PWX1-1575KTL-H
Grid-Support Utility-Interactive Energy Storage Inverter

User manual

Energy Freedom
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Sinexcel

PWX1-1575KTL-H Grid-Support Utility-Interactive Energy Storage Inverter

User Manual

Version 1.1

Shenzhen Sinexcel Electric Co.

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Content

1 Overview

1.1 Applicable Models

This document applies to the following product codes:

• PWX1-1575KTL-H

Model Definitions

This section introduces the product model definitions used in this manual, as shown in Figure 1.1：

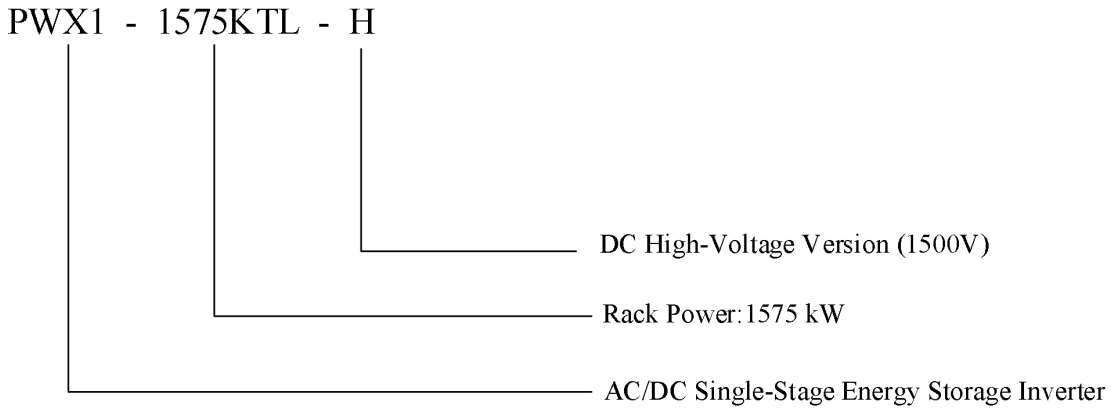


Figure 1.1 Product Model Definition

For example:

PWX1-1575KTL-H: Indicates a bi-directional energy storage inverter with a rack-rated capacity of 1575 kW and a high-voltage rating of 1500 V.

Check the nameplate on the PCS to determine the model.

The illustrations in this document are for reference only. Please refer to the actual product for details.

1.2 Target Group

The contents described in this document can only be operated by professionals.

Professionals are required to have the following skills:

1) Understand how the product works and how to operate it
2) Learn how batteries work and how to operate them
3) Train and understand how to deal with hazards and risks that arise when installing and using electrical equipment
4) Understand the installation and commissioning of electrical equipment and devices
5) Understand all applicable standard operating instructions
6) Understand and follow this manual and all safety information

1.3 Terminology

Name	Definition
STS	Static Transfer Switch
AC	Alternating current
DC	Direct Current
BESS	Battery Energy Storage System
ESS	Energy Storage System
EMS	Energy Storage System
BMS	Battery Management System
PCS	Power Conversion System
SLD	Single Line Diagram
SOH	State of Battery Health, expressed as a percentage
SCR	Silicon Controlled Rectifier
DOD	Depth of Discharge, expressed as a percentage
EOD	End of Discharge Cut-Off
SOC	State of Charge,or Remaining Power, expressed as a percentage
UI	User Interface
EPO	Emergency Power Off
SPD	Surge Protective Devices

2 Safety Information

2.1 Signs

Signs	Explanation
 **Danger**	Indicates a dangerous situation which, if not avoided, will result in death or serious injury.
 **Warning**	Indicates a dangerous situation which, if not avoided, will result in death or serious injury.
 **Caution**	Indicates a dangerous situation which, if not avoided, may result in minor or moderate injury.
 **Attention**	Indicates that property damage will occur if not avoided.
 **Instruction**	Please note important information, best practice and advice. Note the information used to resolve issues not related to personal injury, equipment damage and environmental degradation.

2.2 Important Safety Instructions

This user manual covers the installation and operation of the Sinexcel PWS1 Series 1575kW bi-directional energy storage inverter module.

Please read this user manual carefully before installation.

The bi-directional energy storage inverters must be commissioned and maintained by an engineer appointed by the manufacturer or an authorized service partner. Failure to do so may endanger personal safety and lead to equipment failure. Damage to the equipment caused as a result is not covered by the warranty.

Bi-directional energy storage inverters should not be used in any environment or application associated with life support equipment.

This manual contains important instructions for the PWS1 series models and these instructions should be followed when installing and maintaining the bi-directional energy storage inverter.

 **Danger**

Any touching of the copper strip, contacts and terminals inside the appliance that are connected to the grid circuit may cause a fatal burn or electric shock!

Do not touch any terminals and wires connected to the grid circuit.

Take note of any instructions and safety documents regarding grid connection.

Warning

Contact with the interior of the appliance may present a risk of electric shock!
Any operation in connection with this appliance must be carried out by qualified personnel.
Please note the safety precautions listed in the safety instructions and installation documentation.
Please take note of the safety precautions listed in the operating and installation manuals and other documentation.

Warning

Massive power leakage.
Before connecting the input power, ensure that the earth is securely grounded.
The appliance must be earthed in accordance with local electrical codes.

Warning

When the battery is connected to a bi-directional energy storage inverter, DC voltage may be present at the input port. Please take care during operation or check the battery system user manual.

Warning

Do not touch live parts within 5 minutes of power failure!
Dangerous energy is stored in the internal capacitors, so do not touch the terminals, contacts, copper strip, etc. for 15 minutes after disconnecting the appliance from all power sources.

NOTICE

All internal maintenance and servicing of the equipment should be carried out by trained personnel. Internal components that require the use of tools to open cannot be maintained by the user.
Please read this user manual before operation

2.3 Additional Information

For further detailed information, please click: www.sinexcel.com.

3 Product Introduction

3.1 System Introduction

The energy storage inverter is a conversion device between the grid and the battery, which can charge and discharge the battery. It can invert the DC power from the battery into AC power that can be connected to the grid and rectify the AC power from the grid into DC power that can be charged into the battery. Bi-directional energy storage inverters can be used in grid-connected mode or off-grid mode.

3.2 Bi-directional Energy Storage Inverter Appearance

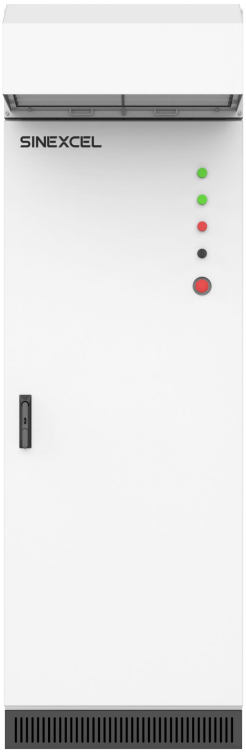


Figure 3.1 Bi-directional Energy Storage Inverter Appearance

Location	Name	Instruction
A	Power Indicator (POWER)	Control circuit power indicator
B	Run Indicator (RUN)	Always on when the inverter is running normally
C	Fault Indicator (FAULT)	Always on when there is a fault, blinking when there is an alarm
D	Start/Stop knob	Turn on or off the inverter
E	Emergency Power off knob	Press in case of emergency to disconnect AC and DC power immediately

3.3 Dimensions and Weight

The external dimensions of the PWX1-1575KTL-H energy storage inverter are shown in Figure 3.2. The product net weight is approximately 1200 kg, with the actual weight subject to the specific nominal value.

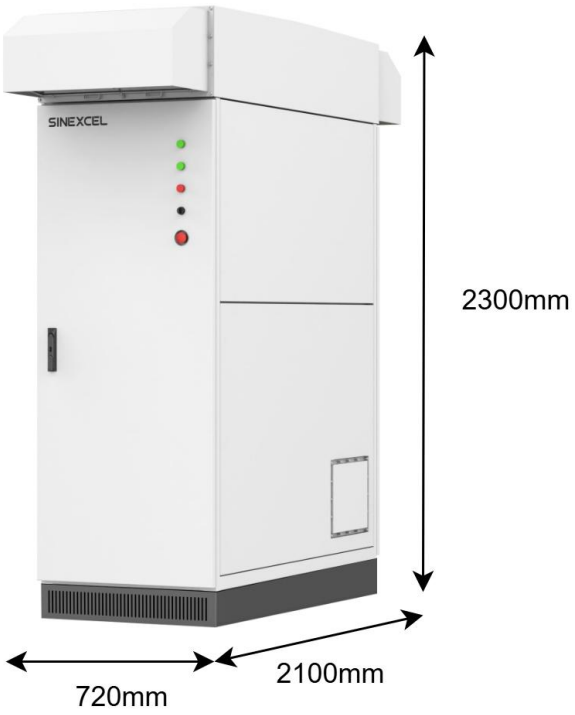


Figure 3.2 PWX1-1575KTL-H Energy Storage Inverter External Dimensions (Including Bend Pipe)

3.4 System Schematic Diagram

The PWX1-1575KTL-H bi-directional energy storage inverter is equipped with SPD protectors, AC/DC filter units, AC/DC switches, auxiliary power distribution units, and so on. The internal main circuit topology of the energy storage inverter is illustrated in Figure 3.3. It employs a three-phase three-level topology for rectification and inversion. The battery pack interface can be directly connected to the battery, while the AC interface can be connected to the grid or AC loads via an isolation transformer or step-up transformer.

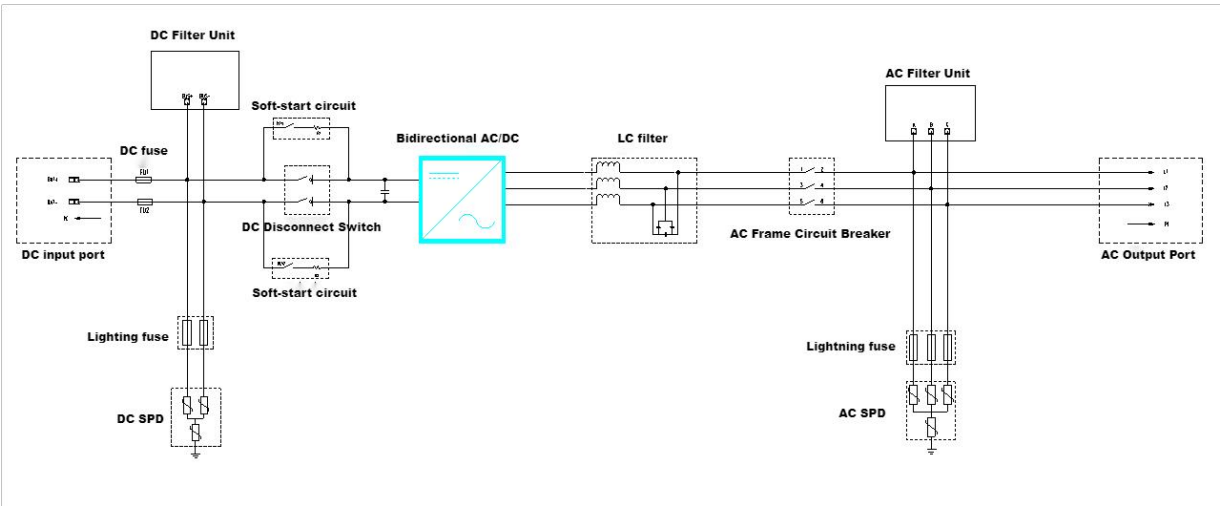


Figure 3.3 Schematic Diagram of Energy Storage Inverter Topology

3.5 Heat Dissipation Design

The PWX1-575KTL-H energy storage inverter is an IP65 outdoor unit, the whole adopts the structure design of air inlet on the top side from rear panel and air outlet on the bottom side. Outdoor air enters through the bend pipe duct at the cabinet's top, while hot air is exhausted through the exhaust port at the bottom of the cabinet. The airflow rate of the fan is 2340m^3 /h. There is an internal circulation heat dissipation system at the front door, with a fan airflow rate of 1300m^3 /h. The ventilation design is showed in Figure 3.4.

Figure 3.4 The Ventilation Design for PWX1-1575KTL-H Energy Storage Inverter

4 Technical Specifications

Table 4-1 The Table of Technical Parameters（PWX1-1575KTL-H）

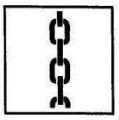
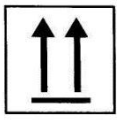
Model	PWX1-1575KTL-H
AC Parameters	
Rated AC Power	1575 kW
AC Connection	3P3W
AC Overload Capacity	1732 kW（30℃）
Utility-interactive Mode	
Allowable Grid Voltage	690（-15%~10%）Vac
Allowable Grid Frequency	50/60（-5~5）Hz
THDi	≤3%
Voltage Ripple Coefficient	≤1%
Power Factor	-1~1
Stand-alone Mode	
Rated Output Voltage	690（-10%~10%）Vac
Output Voltage Distortion	≤1% (Linear load)
Rated Output Frequency	50/60（-5~5）Hz
Dc Parameters	
Maximum DC Power	1732 kW
DC Voltage Range	1000Vdc~1500 Vdc
Dc Voltage Range@Full load	1040Vdc~1500 Vdc
Number Of DC Input Branches	1
Maximum DC Current per Branches	1694 A
Voltage Regulation Accuracy	≤±1%
Current Stability Accuracy	≤±1%
System Parameters	
Maximum Conversion Efficiency	99%
Dimensions (Width * Height * Depth)	720mm*2300mm*2135 mm (including bent pipe)
Weight	1200 kg
Noise	<75 dB
Protection Rating	IP65
Permissible Ambient Temperature	-40℃~+60℃ (> +45°C derating) Optional heater -25℃~+60℃ (>+45°C derating) Without heater
Cooling Method	Air cooling
Relative humidity	0~100% (No condensation)
Altitude	5000m (>3000m derating)
Display and Communication	
Display	Web Backend Interaction
Communication Interface	RS 485，Ethernet，CAN
Communication Protocol	Modbus TCP/RTU，IEC104，IEC61850

5 Storage, Handling and Transportation

5.1 Transportation and Storage

In order to ensure that the energy storage inverter is in a high protection state during transport, please choose to transport with packaging as far as possible, and according to the indication of the markings on the packaging, the illustration of the packaging markings is shown in Table 5-1:

Table 5-1 Explanation of Packaging Markings

Icon	Description
	Center of gravity mark, indicating the center of gravity of the bi-directional storage inverter.
	Lifting mark, indicating the position of the chain or rope when lifting the bi-directional storage inverter
	The upward mark indicates the placement method when carrying and placing the bi-directional storage inverter. It is strictly forbidden to put it upside down, horizontally or tilted.
	Handle the logo with care, and avoid violent friction or collision during transportation and placement.
	During transportation and storage, the bi-directional storage inverter should be protected from rain or moisture.

NOTICE

Since the center of gravity is not located at the mechanical center of the energy storage inverter, please pay attention to the center of gravity mark on the packaging box during transportation.

NOTICE

Regardless of whether the inverter is packaged or not, it is strictly forbidden to tilt an angle greater than 5° during the movement. Due to its large size and weight, an excessively large inclination angle may cause the equipment to fall upside down, causing casualties or equipment damage.
Please avoid physical shocks to the equipment during the movement, such as suddenly dropping or lifting.

NOTICE

Please avoid transporting the energy storage inverter under rain or bad weather conditions. If it is unavoidable,

please take necessary protective measures.

If on-site installation is not performed immediately after delivery acceptance, the energy storage inverter with its outer packaging must be stored in a well-ventilated, dry, and clean indoor environment. Additionally, the following aspects shall also be noted:

- Restore the packaging to its original condition upon receipt; desiccants inside the packaging must be retained.
- The storage floor is flat and sufficient to carry the weight of the energy storage inverter with the outer packaging.
- Ensure ventilation and moisture prevention during storage. Water accumulation in the storage environment is strictly prohibited.
- The storage environment temperature shall be -40℃~+60℃, and the relative humidity of the storage environment shall be 0~100%, without condensation.
- Pay attention to dealing with harsh surrounding environments, such as sudden cold, sudden heat, collision, etc., to avoid damage to the equipment.
- Conduct regular inspections at least once a week. Verify packaging integrity to prevent insect or rodent damage, and replace damaged outer packaging immediately.
- If the storage time exceeds half a year, the package should be opened for inspection, and the desiccant should be replaced and repackaged.

NOTICE

The energy storage inverter is a whole device, and it must not be disassembled during transportation or storage. Equipment failures caused by modifications not authorized by Sinexcel are not covered by the warranty.

NOTICE

When the equipment is transported and stored, it is strictly forbidden to stack, and no other items are allowed to be stacked on the top of the equipment.

NOTICE

When the equipment is transported and stored, it should be ensured that the environment in which it is located is free of corrosive gas, no high-temperature heat source, not excessively dusty, and meets the fire protection requirements. Storage without packaging is strictly prohibited.

5.2 Movement

It is recommended to use a forklift to move the entire box body in a short distance without removing the shipping box. When moving, pay attention to the center of gravity mark and lifting mark position on the box, and ensure that the transportation tool has sufficient carrying capacity. Lifting is strictly prohibited.

Moving the energy storage inverter without a packaging box is usually used near the installation location of the equipment. It is recommended to use a forklift for operation. When using a forklift, the bottom baffle of the energy storage inverter needs to be removed first.

1) Forklift Movement (Preferred)

Using a forklift to transport the energy storage inverter is a standard way of movement. The center of gravity of the inverter should fall between the two forks of the forklift and be pre-inserted to ensure that it will not tilt after being lifted. As shown in Figure 5.1, the length of forklift forks shall not be less than 1.2m.

In the process of using a forklift to fork, lower and move the energy storage inverter, it is necessary to ensure that it is slow and stable, and the energy storage inverter must be placed on a firm and level ground.

In the entire process of using a forklift to operate, it is necessary to strictly abide by the forklift safety operation specifications. Due to the large volume of the energy storage inverter, it may obstruct the driver's sight, so assistance should be provided for cooperation.

Figure 5.1 Forklift Schematic Diagram

2) Pallet truck movement

The use of a pallet truck to move the energy storage inverter is only suitable for conditions where the transportation route is relatively stable. During transportation, the center of gravity of the inverter should fall between the two forks of the forklift and be pre-inserted to ensure that it will not tilt after being lifted. As shown in Figure 5.2, the length of the forklift forks shall not be less than 1.2m, the inner distance between the two fork arms of the pallet truck shall not be less than 0.2m, the outer distance shall not be greater than 0.8m, and the load-bearing capacity of the pallet truck must be ≥1500kg.

In the process of using a forklift to fork, lower and move the energy storage inverter, it is necessary to ensure that it is slow and stable, and the energy storage inverter must be placed on a firm and level ground.

In the entire process of using a forklift to operate, the relevant safety operation regulations must be strictly observed. Due to the large size of the energy storage inverter, it may obstruct the operator's view, so assistance should be provided for cooperation.

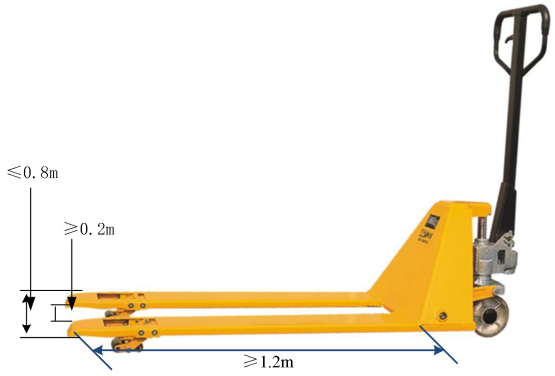


Figure 5.2 Pallet Truck Schematic Diagram

NOTICE

Before moving the energy storage inverter using a forklift or pallet truck, the bottom cover must be removed. Failure to do so may result in damage to the bottom cover.

NOTICE

No matter which way you choose to move the energy storage inverter, you must ensure:

- Must always pay attention to the position of the center of gravity.
- Must be considered the volume and weight at all times.
- Must be ensured the safety of operators at all times.

Take necessary auxiliary measures to ensure that the equipment is transported to the installation site in good condition.

5.3 Unpacking Inspection

5.3.1 Unpacking

When the energy storage inverter is transported to the vicinity of the installation site, the transport box needs to be removed. The removal steps are as follows:

① Remove the top panel of the box.
② Remove the wooden side panel of the packing box.
③ Remove the shielding material from the packing box.
④ Remove the anchor parts that fix the energy storage inverter on the transport wooden bracket.

NOTICE

After removing the anchor parts between the energy storage inverter and the transport wooden bracket, it is strictly forbidden to transport the energy storage inverter through the wooden bracket.

5.3.2 Inspection

Before leaving the factory, the energy storage inverter has been checked by the staff of Sinexcel and packed firmly. Nonetheless, the following items need to be checked after the energy storage inverter shipping packaging has been removed:

- Check whether the quantity of each item on the packing list is consistent with the actual item;
- Check whether the nameplate data of the product is consistent with the order contract, such as product model, rated capacity, voltage level, etc.;
- Check whether the factory documents and accessories are complete;

- Check whether the appearance of the energy storage inverter is consistent with the description in this manual;
- Check the energy storage inverter for deformation, peeling paint and loose parts.

The packing list of the PWX1-1575KTL-H energy storage inverter is shown in Table 5-2.

Table 5-2 Packing List

Serial Number	Name	Quantity
1	PWX1-1575KTL-H energy storage inverter (including cabinet door key and related accessories)	1
2	PWX1-1575KTL-H series user manual	1
3	Equipment wiring diagram	1
4	Certificate of conformity	1
5	Inspection report	1
6	Warranty card	1

NOTICE

Installation and debugging can only be carried out on the energy storage inverter that has been inspected correctly and is complete without damage. During the inspection process, if any problem is found, please contact the transporter or Sinexcel in time.

6 Equipment Installation

6.1 Installation Requirements

6.1.1 Basic Requirements

The protection level of PWX1-575KTL-H energy storage inverter is IP65, allowing for outdoor installation. However, it should not be left in high-humidity environments for extended periods. Due to operational noise, the energy storage inverter should be installed in a location away from residential areas and the installation location should be free from corrosive and combustible gases.

To ensure that the energy storage inverter can operate safely and efficiently, it is important to observe the following when selecting the installation environment.

- The energy storage integrated cabinet must be mounted on a suitable concrete support with a refractory surface, and the inverter inlet and outlet must not be obscured.
- The installation ground is dry and flat, no water accumulation, the ground level does not shake, and it can completely carry the weight of the energy storage inverter.
- Installation site ambient temperature range: -40℃~+60℃; relative humidity range:0~100%, non-condensing.
- Energy storage inverter grounding resistance <4Ω.
- Cabinet should be installed in a location that ensures easy viewing of the LED indicators.
- If the machine is placed directly outdoors, it is recommended to take the necessary shading measures for the machine to avoid the machine temperature rising due to direct sunlight, causing the machine to run at reduced capacity.

6.1.2 Outdoor Requirements

PCS is capable of operating within an ambient temperature of -40℃ to 60℃.

When the ambient temperature is higher than 55℃ the machine will run at a decreased rate. When the temperature is lower than -25℃, it needs to warm up first before high power operation.

The sunlight irradiation intensity should be ≤1200W/m^2, and it is recommended that the inverter installed outdoors should take the necessary shading measures.

6.1.3 Foundation Support Requirements

Since the energy storage inverter is front-lower air outlet, it is recommended to ensure at least 2m of air duct at front side when installing the inverter.

PCS needs to be installed on a concrete foundation or a structure supported by steel channels with a flame retardant material on the surface. It must be ensured that the foundation is flat and solid, safe and reliable, and has sufficient bearing capacity. It is strictly forbidden to install on a foundation with a depressed or inclined surface.

When building the foundation, the cable trench should be pre-designed according to the overall design of the power station and the location of the cable in and out of the bottom of the PCS.

Holes need to be cut in advance on the foundation, and the size of the holes must be exactly the same as the positioning holes of the base of the PCS, so as to connect the energy storage inverter to the foundation firmly.

As shown in Figure 6.1, the energy storage inverter base is equipped with 20 positioning waist holes of⌀ 14. It is recommended to use M12*50 bolts of grade 8.8 to fix the inverter base to the foundation.

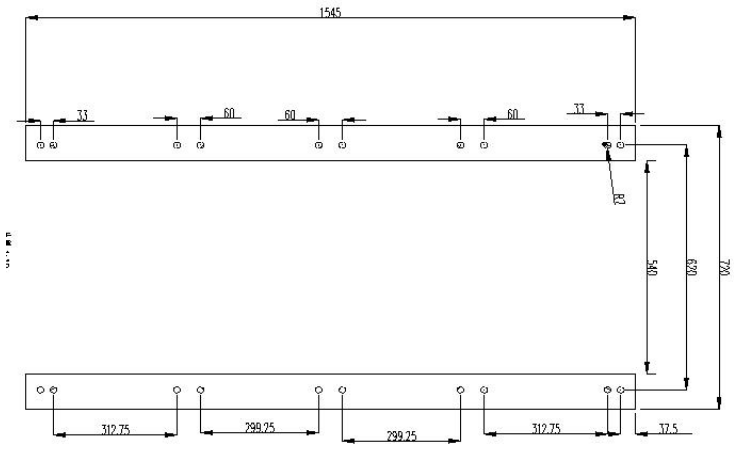


Figure 6-1 Bottom View of Energy Storage Inverter

6.1.4 Space Requirements

The energy storage inverter must be installed with sufficient distance from walls and other equipment to allow for the minimum maintenance access, evacuation routes, and ventilation requirements. This subsection requirement is the minimum space requirement for normal operation of the PCS. If site conditions permit, it is recommended that a larger spacing be selected to ensure reliable and efficient operation of the PCS. Taking the 4 inverter parallel connection scenario as an example: If no other heat sources are present around the energy storage inverter, refer to Figure 6.2 to reserve the space. If there are other heat sources around, please refer to Figure 6.3 to reserve the space.

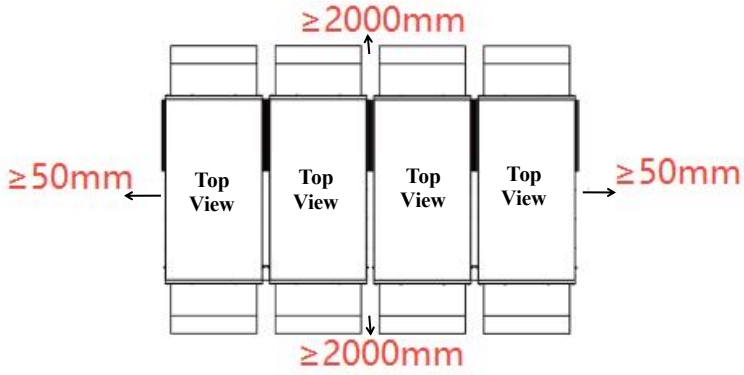


Figure 6.2 Space Requirements for PCS Without Heat Source

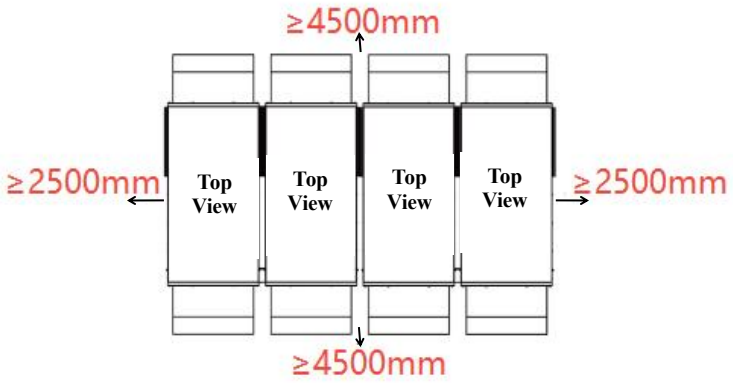


Figure 6.3 Spatial Requirements for PCS With Heat Source

Note: The distance (E) between the air outlet at the bottom of the inverter and the ground represents the minimum space requirement. The space must be guaranteed to ensure the normal air duct heat dissipation function.

6.1.5 Ventilation Requirements

The inverter will generate a lot of heat when running, and the high temperature will directly affect the electrical performance of the equipment and even damage the equipment, so the ventilation and heat dissipation needs of the equipment should be fully considered when planning the installation environment of the inverter to ensure the normal and efficient operation of the equipment.

To ensure the reliable and efficient operation of the energy storage cabinet, please regularly clean the grille, filter and filter cotton of the air inlet and outlet of the equipment, and regularly check whether the equipment exhaust fan is functional.

In order to meet the ventilation requirements of the integrated energy storage cabinet, its installation environment needs to meet the following requirements.

1) The energy storage cabinet should be avoided to be installed in poor ventilation conditions and low air flow.

2) The air inlet should have sufficient fresh air supply.

3) Air quality must be ensured. If the air contains too much sand, dust and other suspended matter, the air purity can be improved by installing filters at the air supply grille and other measures.

4) The ventilation system of the energy storage cabinet must be independent of the ventilation system of other equipment and do not affect each other.

Cooling ducts should be designed by professionals in advance to avoid placing the cabinet at backflow wind phenomenon. At the same time, each combination must be sealed to prevent air leakage, the choice of sealing materials to withstand the temperature of at least 80℃.After installing the cooling duct, cabinet interior should be checked to prevent screws, gaskets and other debris fall during installation process.

6.2 On-site Installation

6.2.1 Wire Channel Design

The energy storage inverter has the following wiring configurations: DC side: bottom connection; AC side: side connection.For ease of installation and maintenance, it is recommended that the cables connected with the outside are wired from the cable trench. Energy storage cabinet installation foundation should be pre-set under the concrete

cable trench, or at the foundation with installed bracket to raise the installation surface, and cables are laid in the overhead. Alternatively, a rigid support frame may be mounted on the foundation to elevate the installation surface, with cables routed overhead. Foot screw or channel steel could be used to fix the cabinet installed with pre-set cable trench. If a steel bracket is used, the equipment installed directly fixed on the bracket.

The cable trench is usually designed and constructed in accordance with the relevant standards, considering the weight of the required cables and the space.

The cross section of the trench is shown in Figure 6.4. The quantities of cable brackets refers to the user’ s demands. In order to facilitate the installation and maintenance, the DC circuit and AC circuit should be laid separately.

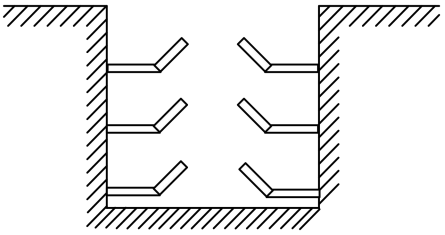


Figure 6.4 Cross-sectional View of the Trench

6.2.2 Fixed the PCS

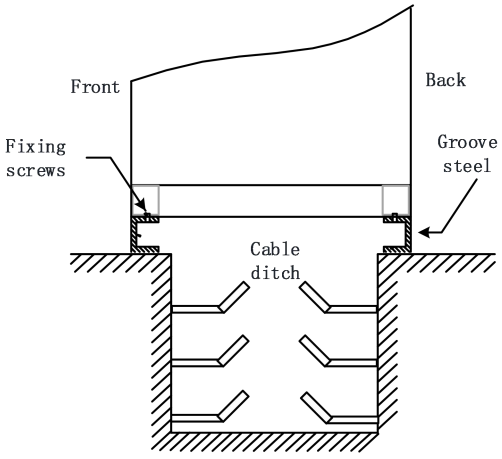
If the final fixing of the energy storage inverter on the channel steel, it is necessary to ensure that the cable trench is laid and the slotted holes meet the installation requirements of the energy storage inverter before the final fixing of the equipment. If the energy storage inverter is finally fixed on the concrete floor, holes need to be punched in the floor and the energy storage inverter needs to be fixed firmly with expansion screws. The fixing method of the energy storage inverter is shown in Figure 6.5.

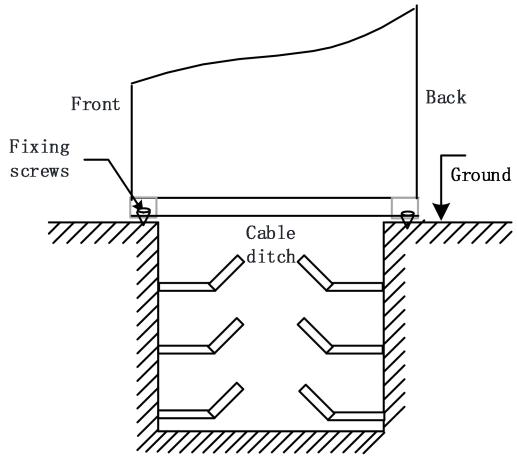
The fixing of the energy storage inverter needs to be done according to the following steps:

1) Select the appropriate tool to transport the energy storage inverter to the installation position and align the installation hole.

2) Use M12*50 bolts to fix the energy storage inverter on the channel steel or foundation through the base.

3) Install the base baffle of the energy storage inverter to complete the fixed installation of the energy storage inverter.





(a) Schematic diagram of the inverter fixed to the channel (b) Schematic diagram of the inverter fixed to the ground

Figure 6.5 Energy Storage Inverter Fixing Method

6.3 Electrical Connections

6.3.1 General Safety Provisions

Danger

Danger of electric shock!

Please make sure that the installation cables and equipment are not charged before installation.

The capacitor inside the energy storage inverter is a hazardous energy storage device, do not place flammable and explosive substances near the energy storage inverter.

Warning

All electrical connections must comply with the electrical connection standards of the country where the project is located.

Energy storage inverters should only be connected to DC with the permission of the local power company and only after installation by a qualified technician.

Warning

Only a qualified electrician or a qualified person should make the electrical connections to this product.

Please strictly follow the wiring signs inside the device.

The following safety rules must be observed throughout the electrical connection of the energy storage inverter and during subsequent maintenance and repair operations.

- Disconnect all external connections to the energy storage inverter and to the internal power supply of the device.
- Ensure that the energy storage inverter is not accidentally re-powered.
- Use a multimeter to make sure that the inside of the energy storage inverter is completely de-energized.
- Apply the necessary ground connections.
- Insulate and cover the adjacent potentially energized parts of the operating section with a fabric made of insulating material.

6.3.2 Installation Tools

The following tools are required prior to installation:

- Torque wrench
- Screwdriver

- Wire stripper
- Terminal crimping machine
- Hot air gun (or hot air blower)
- Multimeter

6.3.3 Wiring Parts

The parts such as fixing screws for the power cable connection of the energy storage inverter have been packed in a uniform bag when the equipment is delivered, so please connect the cables in strict accordance with the screw fastening rules.

Attention

When connecting the cables, make sure that the connectors are tightened.

Inadequate connection or oxidation of the contact surface may cause local heat accumulation, which may lead to fire and combustion.

Attention

When wiring the power line, use copper wire of appropriate size and use copper terminals to fix it tightly before connecting it to the wiring copper strip.

6.3.4 Preparation before Wiring

1) Open the DC side door of the energy storage outdoor cabinet

The user needs to open the DC side door of the energy storage inverter before wiring.

2) Open the inlet hole

The overall design of the outdoor energy storage cabinet adopts a structure with DC side wiring at the bottom and AC side wiring at the side. The water inlet is located at the bottom of the inverter for user use. and the connection lines with the outside are all accessed from the bottom of the machine. In order to prevent foreign objects from entering or leaving the machine during transportation, the delivered equipment has an inlet hole baffle at the bottom, and the inlet hole baffle needs to be removed before wiring.

6.3.5 Cable Requirements

The cable selection requirements are as follows:

- The selected cables must possess sufficient current-carrying capacity. The current-carrying capacity of conductors is related to the environmental conditions, the type of conductor insulation material, the laying method, the conductor material, and the cross-sectional area.
- The wire diameter for all cables must be selected in accordance with maximum current on either side of the energy storage inverter, and a margin must be left.
- The same side of the connection line should choose the same size and type of wire.
- Please use flame retardant cables.

The recommended specifications for the connection cable diameter are shown in Table 6-1. For specific

equipment model cable recommendations, please consult our technical personnel.

Table 6-1 Recommended Specifications for Connecting Cables

Cable	Wire Gauge Requirements	Installation Bolt Specifications
Battery Side DC+	Recommend 6*120mm² cables; other type of cables can be selected, but the total cross-sectional area must not be less than 720mm².	M12*35
Battery Side DC-	Recommend 6*120mm² cables; other type of cables can be selected, but the total cross-sectional area must not be less than 720mm².	M12*35
AC Side Phase A	Recommend 5*120mm² cables per phase. Other type of cables can be selected, but the total cross-sectional area must not be less than 600mm²	M12*35
AC Side Phase B		M12*35
AC Side Phase C		M12*35
Grounding Cable	Recommend 3*75mm² cables	M8*12
Communication Cable	2*0.75mm² , it is recommended to use shielded cable	-

Attention

It is strictly forbidden to overload the cable, and the current distributed on the 1mm² cable is strictly forbidden to exceed 3A.

6.3.6 Wiring Precautions

Attention

Before all electrical wiring is performed, all connecting cables must be insulated and inspected for completeness. Use of poorly insulated, partially exposed or otherwise damaged cables is strictly prohibited.

Attention

Before wiring, make sure that polarity of either side of the cable is correct.

During wiring, do not pull on the cable to avoid damaging its insulation properties.

All cables need to maintain an adequate bend radius.

Take necessary auxiliary measures to reduce stress on cables.

The length of the screws should be selected appropriately; screws that are too long may affect the insulation performance of the equipment.

Installation should prevent part of the heat-shrinkable sleeve from being sandwiched between the copper nose and the copper row, otherwise it may lead to poor contact and even damage the equipment.

After each step of the wiring operation, it should be carefully checked to ensure that the wiring is correct and firm.

Attention

Incorrect wiring may cause fire or combustion. so please pay attention to the connection order of wiring components.

When connecting, make sure that the connections are tight. Inadequate connection or oxidation of the contact surface may cause local heat accumulation and may lead to fire and combustion.

Attention

After all the electrical connections are completed, the wiring should be fully checked to confirm that it is correct, and then use fireproof mud to seal the gap at the entrance of the wire to prevent small animals from entering.

6.3.7 Wiring Area Overview

The input and output terminals of the energy storage inverter are all located at the bottom of the cabinet,and the communication ports are also located at the bottom of the cabinet. The terminals are arranged as shown in the figure. Please connect the wiring correctly according to the marking.

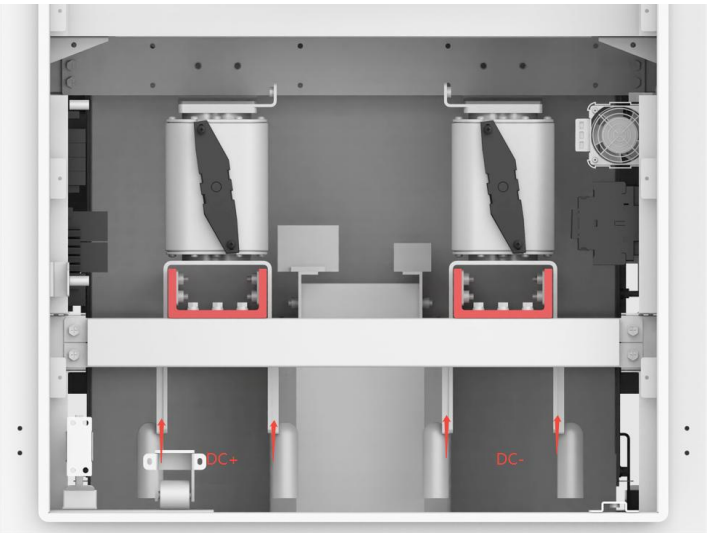


Figure 6.6 DC Terminal Schematic Diagram

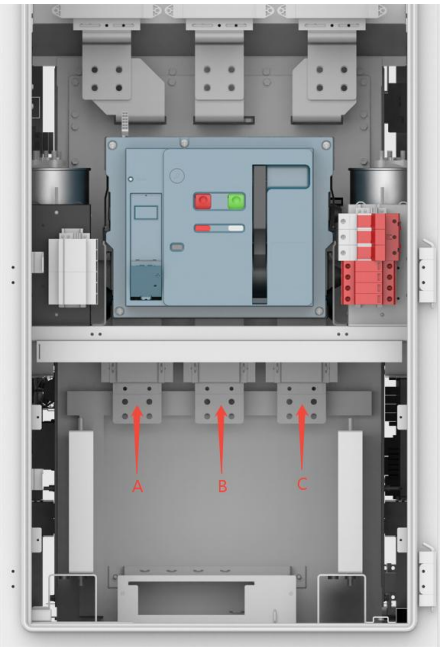


Figure 6.7 AC Terminal Schematic Diagram

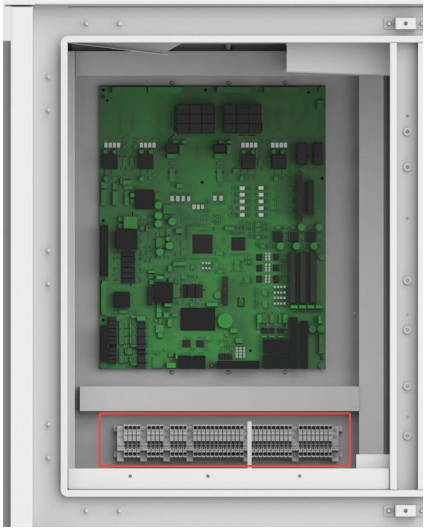


Figure 6.8 Communication Port Wiring Location Diagram (The front door of the cabinet is open)

6.3.8 DC Side Wiring

Before wiring the DC side, the following check should be performed:

- Measure the open-circuit voltage of the battery/busbar set to ensure that the open-circuit voltage is within the normal DC voltage range of the energy storage inverter.
- Confirm the positive and negative polarity of the cable and mark it well.

Attention

The open circuit voltage of the battery pack is strictly prohibited to exceed the maximum DC input voltage of the energy storage inverter, too high open circuit voltage will cause damage to the energy storage inverter.

The positive and negative terminals of the battery pack are connected to the positive and negative copper row of the energy storage inverter, not to be reversed.

To connect either side of the cable, proceed as follows:

① Make sure that the battery or bus bar of the front stage of the energy storage inverter is disconnected.

② Confirm that the DC disconnect switch or DC circuit breaker of the energy storage inverter is open.

③ Peel off the insulation skin at the end of the cable, the length of the bare cable should be more than the wiring copper nose wire hole depth of about 5 mm.

④ Use terminal crimping machine or crimping pliers to compress the wiring copper nose.

⑤ Select heat shrink tubing that matches the size of the cable and use a hot air blower to shrink the tubing. Before conducting the DC-side wiring, the following inspections shall be carried out:

- Measure the open-circuit voltage of the battery/busbar to ensure that the open-circuit voltage is within the normal DC voltage range of the energy storage inverter.
- Confirm the positive and negative poles of the cables and make clear markings.

⑥ Fasten the DC+ and DC- cables respectively with the appropriate size bolts using a wrench.

In order to prevent the wiring copper nose loosening caused by poor contact, or to increase the contact resistance caused by local overheating or even fire, should ensure that the tightening screw to meet the torque requirements shown in Table 6-2:

Table 6-2 The Table of Screw Size and Torque Comparison

Screw size	M6	M8	M10	M12	M16
Torque (N·m)	7~8	17~20	34~40	60~70	119~140

6.3.9 AC Measurement Wiring

Before wiring the AC side, the following checks should be performed:

- Measure the AC line voltage to ensure that the AC line voltage is within the normal AC voltage range of the energy storage inverter.
- Confirm the phase sequence of the cable and mark it well.

Attention

Incorrect AC side wiring can cause the energy storage inverter to not work properly or even be damaged.

Make sure the grid-side distribution circuit breaker is disconnected and the AC and DC disconnect switches are disconnected before wiring.

If there is an "N" line tap on the machine side of the isolation transformer, the "N" line is suspended and must be well insulated, and it is forbidden to ground the "N" line.

In order to prevent three-phase current imbalance caused by uneven cable routing during transmission, it is recommended to group AC cables for routing, with each group containing one cable for each phase. The distance between groups should be at least twice the diameter of a single cable. Furthermore, the lengths of the phase cables from the AC connection side of the energy storage inverter to the machine-side windings of the isolation transformer should be approximately equal.

The AC side of the energy storage inverter needs to be connected to the grid via an isolation transformer, and the steps to connect the AC cable are as follows:

① Verify that the grid distribution switch on the AC rear stage of the energy storage inverter is off.

② Confirm that the AC and DC disconnect switches of the energy storage inverter are both off.

③ Determine the phase sequence of the AC connection cable and mark it well.

④ Peel off the insulation skin at the end of the cable, the length of the bare cable should be more than the wiring copper nose wire hole depth of about 5 mm.

⑤ Use terminal crimping machine or crimping pliers to compress the wiring copper nose.

⑥ Select heat shrink tubing that matches the size of the cable and use a hot air blower to shrink the tubing.

⑦ Select the right size bolts and use a wrench to tighten the cables in Phase A, Phase B, and Phase C respectively.

6.3.10 Grounding Connection

Attention

The grounding cable must be well grounded, otherwise:

- Possible fatal click hazard to the operator in case of failure in the event of a fault.
- Possible equipment damage in the event of a lightning strike.

May cause the device to fail to operate properly.

Before leaving the factory, the shell of the energy storage inverter and the devices that need to be grounded in the cabinet have been connected reliably with the grounding copper row at the bottom of the machine. When making the grounding connection, a grounding cable with a cross-sectional area of at least 200mm² is needed to connect the PE grounding copper row reliably with the grounding row at the installation site or in the machine room, and then connect it to the earth or ground network through the equipotential connection device, and the grounding resistance shall not be greater than 4Ω.

After the cable connection is completed, the gap around the bottom of the inverter should be sealed with fireproof mud. Tighten the waterproof terminals of communication cables, etc., and plug the unused waterproof terminals with suitable plugs to meet the requirements of waterproof and dustproof.

6.3.11 Communication Interface

The energy storage inverter reserves a customer interface for the EMS, as shown in the figure below. Ports 1-4 of P1 are wiring terminals that can be connected to RS485.

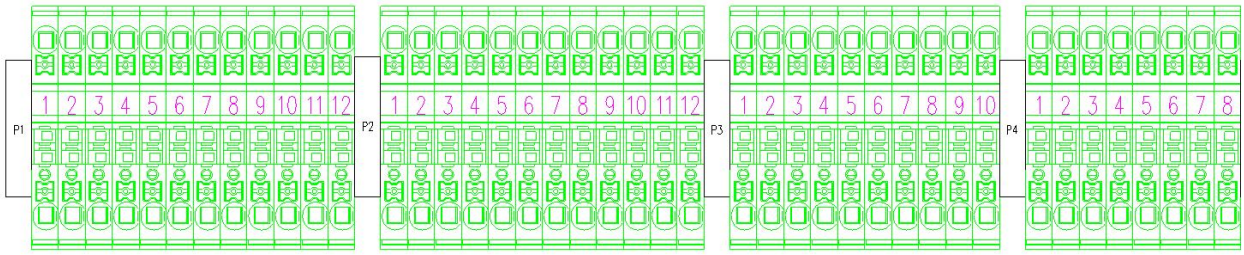


Figure 6.9 External Port Location Diagram

When communicating with a single energy storage inverter, only the signals of the energy storage inverter needs to be connected to the EMS system using shielded cables.

Figure 6.10 Schematic Diagram of Single PCS Ethernet Communication Scheme

When connecting multiple energy storage inverters for communication, the communication network cables of multiple machines are connected to the same switch and then unified to the EMS system.

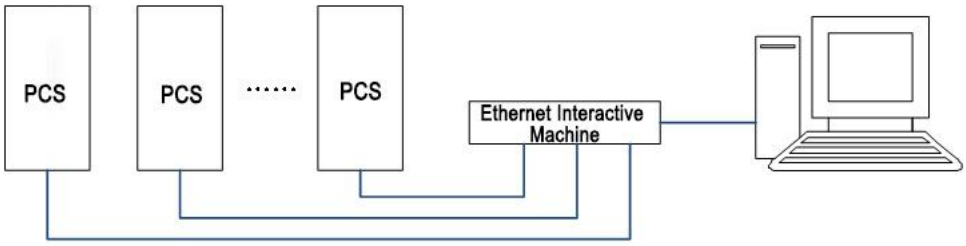


Figure 6.11 Schematic Diagram of Multiple PCS Ethernet Communication Scheme

6.3.12 Installation Checklist

After the PCS is fully installed, at least two staff members are required to conduct a comprehensive inspection of its installation in accordance with the items listed in the table 6-3 below. The inspection process should be recorded, and once the entries that do not meet the requirements are found, they should be rectified immediately.

Table 6-3 Checklist

Equipment Installation Mechanical installation inspection	√
No deformation or damage to PCS	□
PCS bottom fixed, stable and reliable support	□
Sufficient space around PCS	□
The temperature, humidity and ventilation of the environment in which PCS is located meet the requirements	□
Smooth cooling air circulation	
Complete and reliable cabinet sealing protection	
Electrical Installation inspection	√
PCS grounding is complete and solid	□
Grid-side voltage matches PCS AC-side voltage	□
The net side connection phase sequence is consistent, the tightening torque meets the requirements	□
Battery system DC voltage matched to PCS DC side voltage	□
DC positive and negative polarity matched with PCS positive and negative polarity	□
Communication wiring is correct, and keep a certain distance from other cables	□
Correct and clear cable marking	□
Complete and reliable insulation shield, clear and firm hazard warning labels	□
Other Installation inspection	√
All useless conductive parts are tied with insulating ties	□
No tools, parts, iron filings or other foreign objects left inside the cabinet	□
No condensation of moisture or icing inside the cabinet	

7 Product Operation

7.1 Check before Operation

Before the first operation or after completing maintenance and overhaul, the installation of the equipment should be thoroughly checked again.

Warning

All operations during operation must be performed by professional electrical personnel, and no individual is allowed to operate without authorization.

7.1.1 Check Cable Connection

- Check all connecting cables for tears or cracks to make sure that all connection cables are intact.
- Compare the system wiring schematic diagram and carefully check again whether all cable connections are correct.
- Ensure all cables are securely connected.
- Ensure that the PE grounding copper bar of the energy storage inverter is connected to the equipotential bonding point in the equipment room and is properly grounded, with the grounding resistance not exceeding 4Ω.

7.1.2 Check the PCS

- Ensure that the AC and DC isolating switches in the main circuit are all disconnected.
- Ensure that the emergency stop knob has been released and can work normally.
- Check and ensure that various electrical switches and buttons of the energy storage inverter and the front and rear stages are flexible and meet the specification requirements.
- Make sure that the DC power-taking isolating switch QF5 remains closed, and the AC power-taking switch QF2 remains closed.
- Note that the AC internal power supply switch QF2 and the external power supply switch QF3 are strictly prohibited from being closed at the same time!

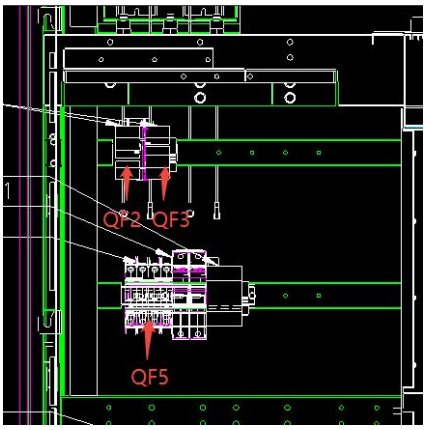


Figure 7.1 Schematic Diagram of AC (Upper) and DC (Lower) Power-taking Isolating Switches Position

7.1.3 Check the Battery/Grid Side Voltage

- Measure the open-circuit voltage of each energy storage battery for compliance and record it accurately.
- Make sure the positive and negative polarity is correct.
- Measure the resistance of the cable between the battery pack junction box and the machine using an ohmmeter with a megohm range, and record it accurately.

Warning

Make sure that the measuring equipment is used correctly; otherwise, there is a risk of electric shock.

Warning

The voltage on either side must not exceed the maximum DC voltage allowed for input by the energy storage inverter.

Excessive DC voltage can damage equipment and even cause safety accidents.

- Accurately measure the three sets of line voltages on the AC grid side. The measured values should not exceed the allowable grid voltage range on the AC side of the energy storage inverter, and the three phases should be balanced.
- Accurately measure the frequency on the AC grid side, and the measured value shall not exceed the allowable grid frequency range on the AC side of the energy storage inverter.
- It is recommended to measure the THD (Total Harmonic Distortion) of the voltage of each phase. If the distortion is severe, the energy storage inverter may not operate.

7.2 Power on/off

7.2.1 Power on

After all the above checks before operation meet the requirements, close the cabinet door of the energy storage inverter, pull out the cabinet door key and hand it over to a designated person for proper storage, and then energy storage inverter can be switched on. The operation steps are as follows:

① Close the output switch of the battery cabinet. Power on the DC port of the device; the green "Power Indicator Light" is always on. After about 10 seconds, the red "Fault Indicator Light" stays on, and turn the knob switch to the "ON" position.

② Set the working mode. The default working mode is "grid-connected" after power on. If off-grid operation is required, please make changes through the background web page.

③ If the setting mode in step②is "off-grid", the "fault indicator light" should turn off after the setting is

completed, and the warning message in "current warnings" should disappear. If the setting mode in step ② is "grid-connected", close the grid-side distribution circuit breaker; the "fault indicator light" should turn off after the circuit breaker is closed, and the warning message in "current warnings" should disappear.

④ The energy storage inverter starts working according to the dispatching instructions.

The default power on mode of the energy storage inverter is "manual". The "automatic" mode needs to be set in the background. After the setting is completed, after AC and DC are powered on, it will automatically and continuously monitor whether various parameters such as voltages on the AC and DC sides meet the operating requirements. If all parameters on the AC and DC sides meet the conditions, the inverter will start automatically and operate in accordance with the dispatch instructions.

7.2.2 Power off

Power off is usually divided into two situations: shutdown during normal maintenance or overhaul, and shutdown in critical moments.

For shut down during normal maintenance or overhaul, operate according to the following steps:

① Control the energy storage inverter to shut down through the "shutdown" operation command on the background webpage.

② Disconnect the output switch of the battery cabinet.

③ Disconnect the AC side distribution circuit breaker.

Warning

The internal capacitors of the energy storage inverter store dangerous energy, and maintenance or overhaul is strictly prohibited within 15 minutes after the end of the execution of the shutdown operation.

Attention

During normal operation of the equipment, manual disconnection of the AC/DC isolating switch is strictly prohibited.

To avoid the danger of arcing damage to the isolating switch, which may also lead to equipment damage in serious cases.

To shut down in case of emergency, operate according to the following procedure.

① Press the emergency stop button.

② Disconnect the output switch of the battery cabinet.

③ Disconnect the bus side distribution circuit breaker.

Attention

The emergency stop knob is only for use in emergency situations. For normal shutdown during regular operations, the shutdown should be performed through the "Shutdown" operation command on the backend webpage.

In case of an emergency, be sure to press the emergency stop knob directly to ensure a quick shutdown.

7.3 Operating Modes

7.3.1 Main Functions

The PWX1-1575KTL-H energy storage inverter has the following functions:

- **Local manual**

The energy storage inverter is subject to local monitoring or web monitoring for switch-on/off charging and discharging operation, and is subject to local scheduling.

- **Local automatic**

The energy storage inverter is operated by the automatic operation strategy set by the local monitoring or web monitoring, and is scheduled by the local strategy.

- **Remote control**

The energy storage inverter accepts remote dispatching instructions. At this time, there will be no local dispatching or operation authority, and it is required to login to change the control mode.

- **Grid-connected and off-grid control**

The energy storage inverters can work in grid-connected and off-grid modes. In grid-connected mode, the AC side follows the grid voltage. In off-grid mode, PCS output constant frequency and constant voltage AC power.

- **Charge and discharge control**

The energy storage inverter can charge and discharge battery packs. The charging power and discharging power can be selected by the user. The various modes of charging and discharging commands are modified by the background web page or the host computer.

Charging modes include constant current charging and constant power charging.

Discharge modes include constant current discharge and constant power discharge.

- **Reactive power control**

The energy storage inverter can control the power factor and reactive power ratio. This function can be achieved when the energy storage inverter is performing charging and discharging functions. Users can set the reactive power through the background web page.

- **Output voltage and frequency stabilization**

The energy storage inverter can adjust the stability of output voltage and frequency by controlling reactive power and active power in grid-connected systems. To achieve this function, it is necessary to establish large-scale energy storage power stations.

7.3.2 Operating States Introduction

The PWX1-1575KTL-H energy storage inverter has several states such as "Shutdown", "Running", "Standby", "Fault", and "Emergency Shutdown".

- **Shutdown**

When the energy storage inverter does not receive any operation command or dispatch, the system is in shutdown mode.

In the shutdown mode, the energy storage inverter receives operation instructions and dispatching from the host computer. When the operating conditions are met, the equipment is transferred from shutdown mode to operation mode.

During operation, if a "shutdown" command is received, the energy storage inverter is transferred from the running state to the shutdown state.

- **Operation**

The operating mode is divided into charging and discharging. In grid-connected mode, the energy storage inverter can perform power quality adjustment and reactive power control.

- **Standby**

In this state, the AC and DC circuit breakers of the energy storage inverter are closed, and the internal auxiliary power supply of the machine is in working condition, ready to respond to operation commands as the fast as possible.

- **Fault**

The PWX1-1575KTL-H energy storage inverter has comprehensive fault detection functions. Fault types can be divided into two categories: "shutdown faults" and "non-shutdown faults". When a "shutdown fault" occurs, the system enters a shutdown state; when a "non-shutdown fault" occurs, the upper computer sends an alarm message, but does not stop the running state.

- **Emergency shutdown**

When the the emergency stop button is pressed at the critical moment, and the equipment enters the emergency stop state, and when it needs to enter the operation state again, the emergency stop knob must be turned.

7.3.3 Operating States Switching

When the energy storage inverter is powered on and enters the shutdown state, the control system will complete a self-check to verify the integrity of the entire machine's sensor system. The DSP starts normally, and the energy storage inverter enters the shutdown state.

The PWX1-1575KTL-H energy storage inverter can switch between different modes, and the switching conditions that need to be met are shown in Figure 7.3.

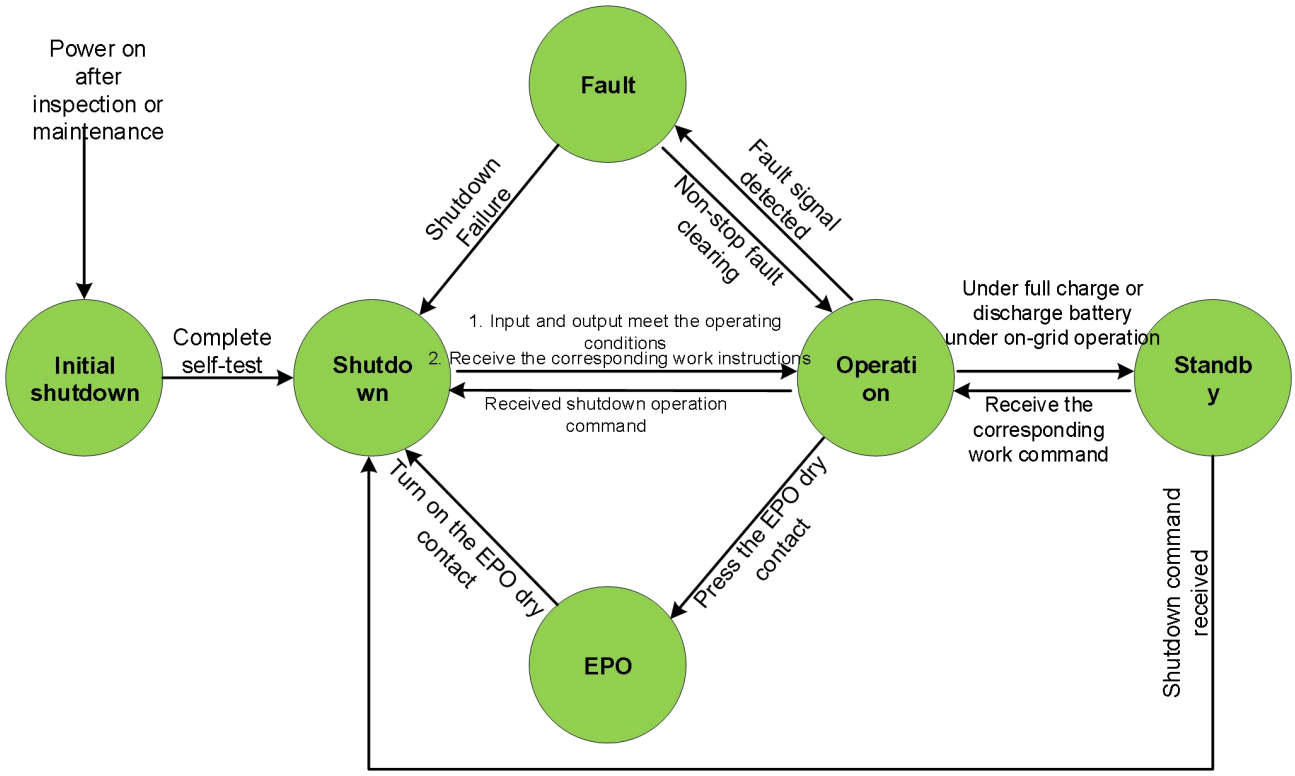


Figure 7.3 Switching between Different Operating States

The working modes of the energy storage inverter can be divided into grid-connected charging, grid-connected discharging, off-grid charging, and off-grid discharging. In the grid-connected mode, the switching between charging and discharging functions can be performed directly without going through a shutdown state.

7.4 Protection Functions

The PWX1-1575KTL energy storage inverter has comprehensive protection functions. When there is an abnormal situation in the battery side voltage or grid side voltage, it can operate effectively to protect the safe operation of the energy storage inverter, and will resume grid-connected power generation after the abnormal situation disappears. The protection items include but are not limited to:

- **DC over/undervoltage protection**

When the DC voltage of the energy storage battery exceeds the allowable voltage range, the energy storage inverter will stop working, at the same time send an alarm signal and display the fault type on the web backend.

- **Grid over/undervoltage protection**

When the grid voltage exceeds the operating voltage range, the energy storage inverter will stop working, send an alarm signal at the same time, and display the fault type on the web backend.

- **Grid over/underfrequency protection**

When the energy storage inverter detects that the grid frequency fluctuation exceeds the allowable range, the energy storage inverter will stop working, and at the same time issue an alarm signal, and display the fault type on the web backend.

- **Island protection**

When the energy storage inverter detects that the effective value of the grid voltage drops below 30% of the

rated value, or that the grid frequency can be disturbed by the inverter, the energy storage inverter will stop working, send an alarm signal at the same time, and display the fault type on the web background.

- **AC short-circuit protection**

When a short-circuit fault occurs on the AC side of the energy storage inverter, the energy storage inverter will stop working, send an alarm signal at the same time, and display the fault type on the web background.

- **IGBT over-temperature protection**

The IGBT module of the energy storage inverter uses a high-precision temperature sensor, which can monitor the module temperature in real time. When the temperature is too high, the DSP will issue a command, the energy storage inverter will stop running, and an alarm signal will be sent at the same time, and the fault type will be displayed on the web backend.

- **Environment over-temperature protection**

High-precision temperature sensors are used inside the energy storage inverter rack, which can monitor the internal temperature of the machine in real time. When the temperature is too high, the DSP will issue a command to stop the operation of the energy storage inverter, send an alarm signal at the same time, and display the fault type on the web backend.

- **Unbalanced AC voltage**

When the energy storage inverter detects that the difference between the three-phase AC voltages exceeds the allowable range, the energy storage inverter will stop working, issue an alarm signal at the same time, and display the fault type on the web backend.

- **Phase abnormality**

When the energy storage inverter detects an error in the phase of the three-phase voltage of the connected power grid during self-inspection in the initial shutdown, shutdown, or fault state, it will issue an alarm signal and display the fault type on the web backend.

- **AD sampling fault**

When the energy storage inverter is performing a self-check, if it detects that the zero offset value of the sampling channel exceeds the allowable range, the energy storage inverter will send an alarm signal and display the fault type on the web backend. After returning to normal, the energy storage inverter should be powered on again for self-check and can work normally only after passing the self-check.

- **Reversal polarity fault**

When the energy storage inverter detects a negative DC voltage during self-check, it will send an alarm signal and display the fault type on the web backend. After restoring to normal, the energy storage inverter should be powered on again for self-check and can work normally only after passing the inspection.

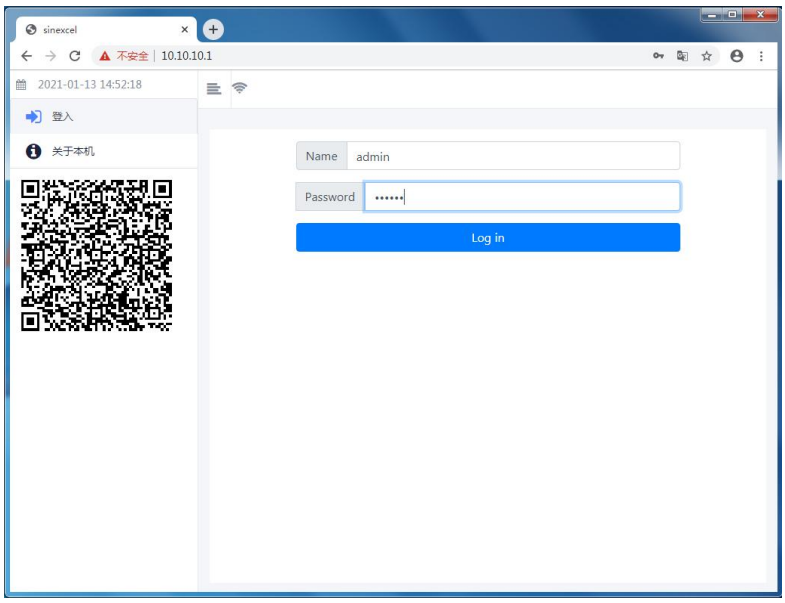
Note: Short-circuiting the device during startup and operation may cause damage to the internal components of the device.

When the above faults occur, the energy storage device will enter protective shutdown. After the fault is resolved, depending on the type of fault, it can be reset automatically, manually (via a fault clearing command), or by powering off.

8 Webpage Monitoring Introduction

8.1 Introduction to Web Backend Functions and Menus

Energy storage inverters feature a web backend interaction method, which is convenient for users to view data and perform related operations. Users can connect a network cable via a computer, then open a web browser, enter the IP address of the energy storage inverter: 10.10.10.1 in the address bar, and access the login interface of the energy storage inverter's web backend, as shown in the following figure:



Web backend login page

The login username is: admin, and the initial password is 123456. It can be modified on the "Login - Change Password" page.

Users can enter the webpage backend after entering the correct user name and password, which is convenient for issuing various operation commands, viewing various operation-related parameters and working status, obtaining the current working condition of energy storage inverter and alarm information in time, and displaying the version information of system control software and internal monitoring software.

8.2 Description of Initial State for Network Monitoring

The monitoring interface of this device adopts a web-based monitoring system, which can realize remote monitoring and control through direct network cable connection or access to the local area network.

System network port communication address default state:

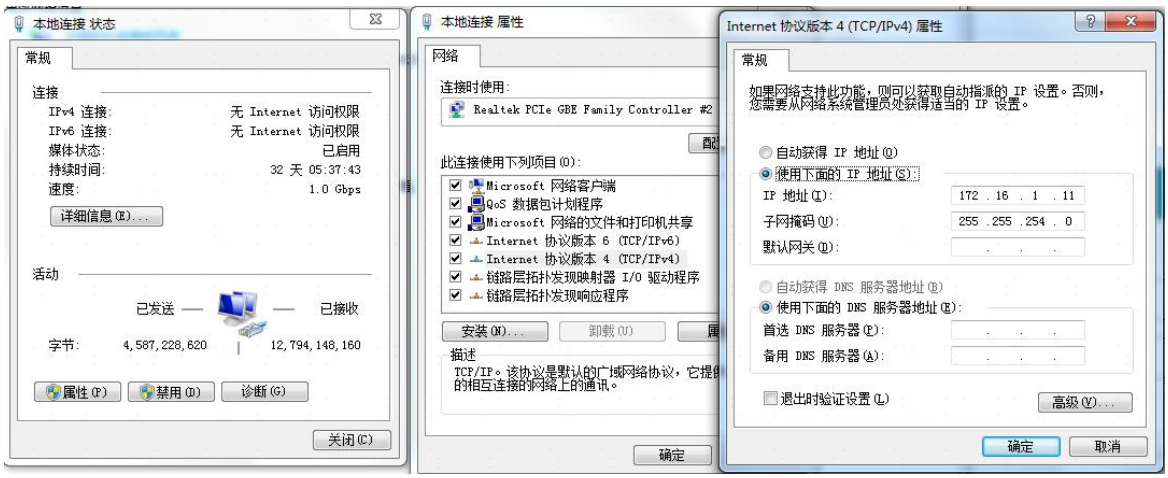
LAN 1：192.168.1.10

LAN 2：172.16.1.10

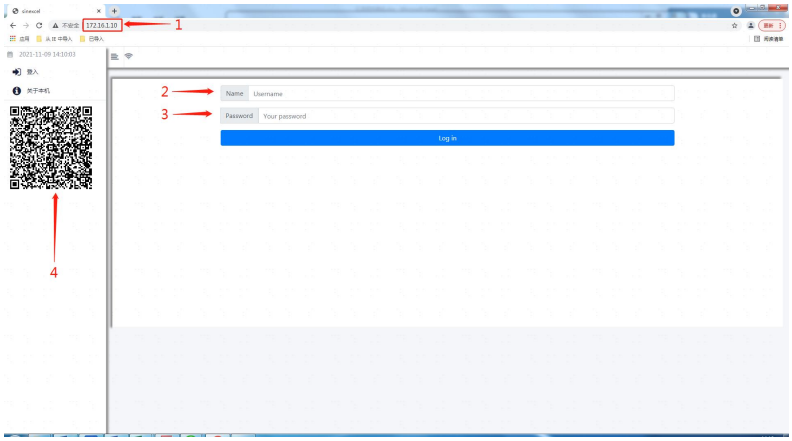
8.3 LAN Port Local Area Network Connection

Take using the control box's LAN2 as an example:

a. The PC is directly connected to the LAN port of the control box, and the PC port is configured with manual IPv4 settings so that the PC and the control box are in the same network segment:



b. The browser enters the web monitoring panel



1.Use a browser to enter the device's IP address at the link;

2.Type username;

3.Type 123456;

(4.QR code for local machine information）

Find the monitoring setting in the setting item, IP address can be set as the IP in the LAN segment that the current device can access, note not to conflict with the existing IP; the current web communication will be lost after typing, and the control box can transfer the network cable to the LAN, and the computer can access the LAN for remote connection (Note: type newly set IP).

8.4 Introduction to the Operation Information Menu

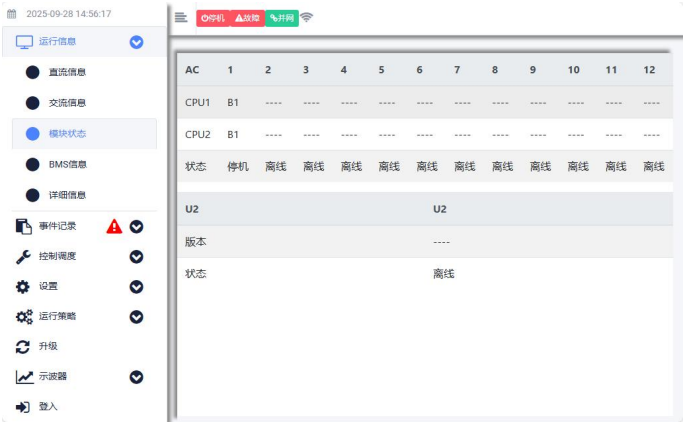
After the user enters the correct username and password to access the backend of the web page, they can click on "Operation Information" to enter the secondary menu display interface of Operation Information. When the secondary menu interface contains content across multiple pages, only the first page is displayed in this section, and the content of other pages is listed in full in the description part.

DC Information Secondary Submenu

Display equipment the DC voltage, DC current, DC power, operating status, alarm status, and air switch status of the equipment.

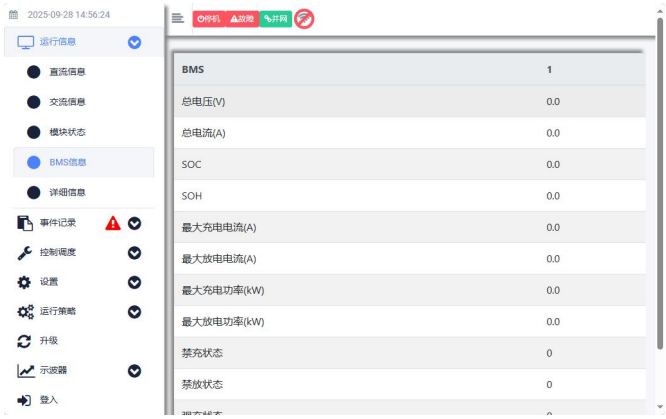
AC Information Secondary Submenu

Display instantaneous three-phase voltage, instantaneous three-phase current, instantaneous active power, instantaneous reactive power, instantaneous apparent power, instantaneous power factor, instantaneous frequency, as well as the accumulated active charging power capacity and active discharging power capacity so far.



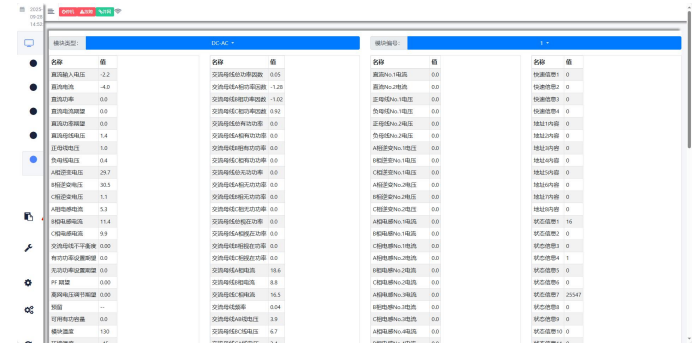
Module Information Secondary Submenu

Display CPU software version information and CRC check code



BMS Information Secondary Submenu

Display battery-related information such as voltage, current, SOC, and charging/discharging status.

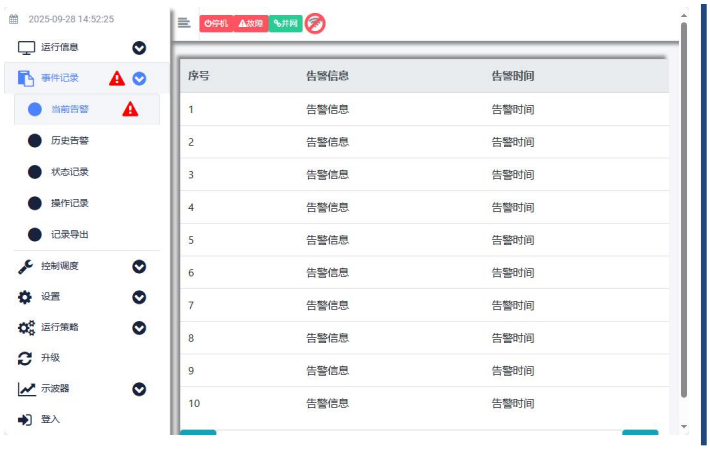


Detailed Information Secondary Submenu

Display detailed information such as voltage, current, and power on the AC and DC sides of the PCS.

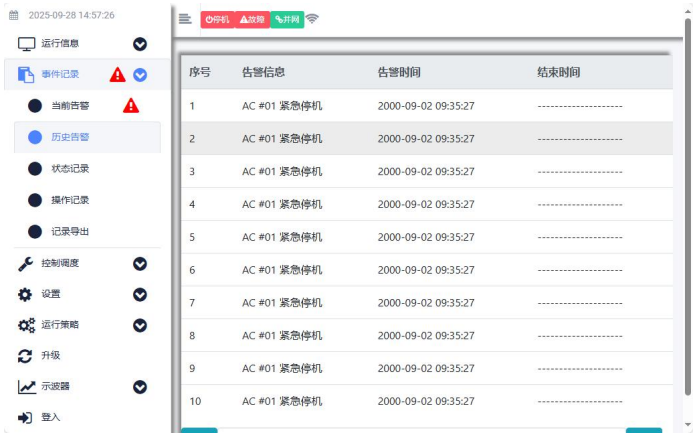
8.5 Introduction to Event Record Menu

Click the Event Logging menu to enter the secondary menu display screen for event logging. When there are multiple pages in the secondary menu screen, only the first page screen is displayed in this subsection, and the contents of other pages are listed in full in the description section.



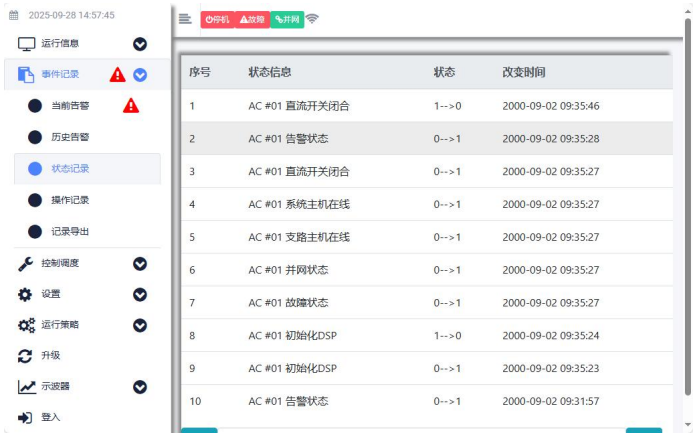
Current Alarm Secondary Submenu

Display various alarm information existing under the current situation.



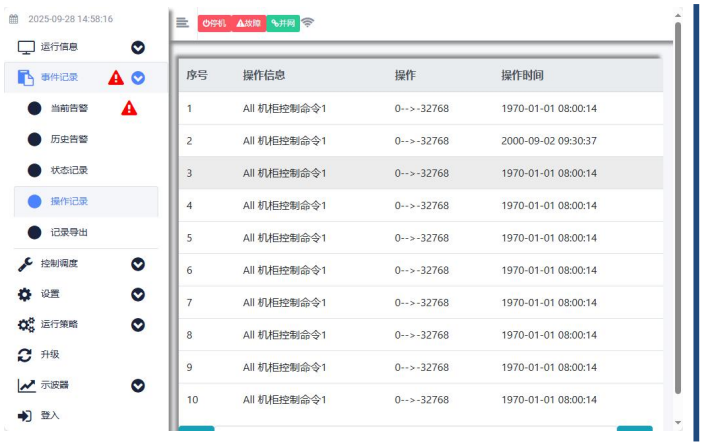
History Alarm Secondary Submenu

Display various alarm had appeared before, but have been cleared in the current case.



Status Record Secondary Submenu

Display the records of status changes of PCS.



Operation Record Secondary Submenu

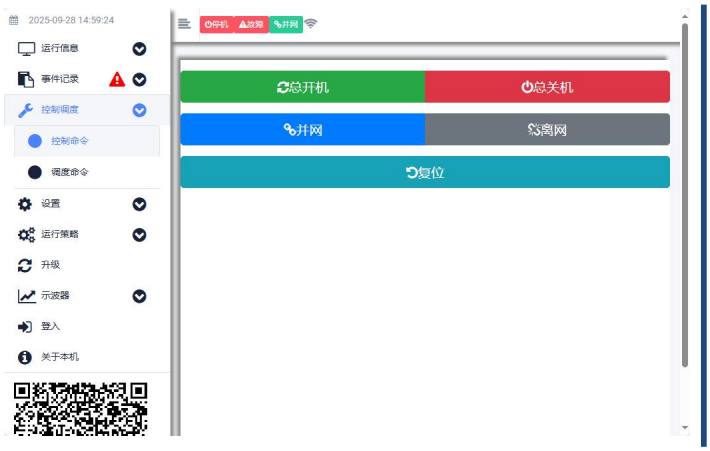
Display the instruction records issued to the PCS.

Record Export Secondary Submenu

Provide the download of all record files to the local browser's download directory.

8.6 Introduction to Control & Dispatching Menu

Click the control & dispatching menu to enter the secondary submenu to set control and dispatching commands.



Secondary Submenu of Control Command

It can control the PCS's power on, power off, grid-connected, off-grid and fault reset functions (note that the fault reset function should not be used arbitrarily).

Dispatch Commands Secondary Submenu

Users can set the energy dispatching mode, active power control mode, reactive power control mode, active power regulation, reactive power regulation, and power factor setting of the PCS.

Energy scheduling: AC dispatching or DC dispatching can be selected

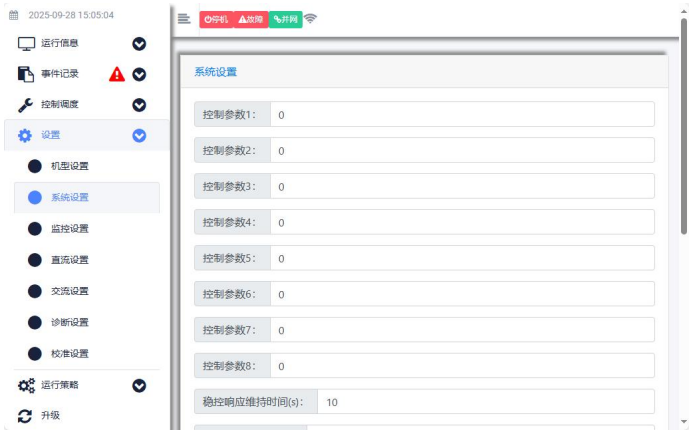
AC dispatching: active power control mode, reactive power control mode, active power regulation, reactive power regulation, and power factor setting can be set.

DC dispatching: DC control mode, DC power regulation, and DC current regulation can be set.

8.7 Introduction to Settings Menu

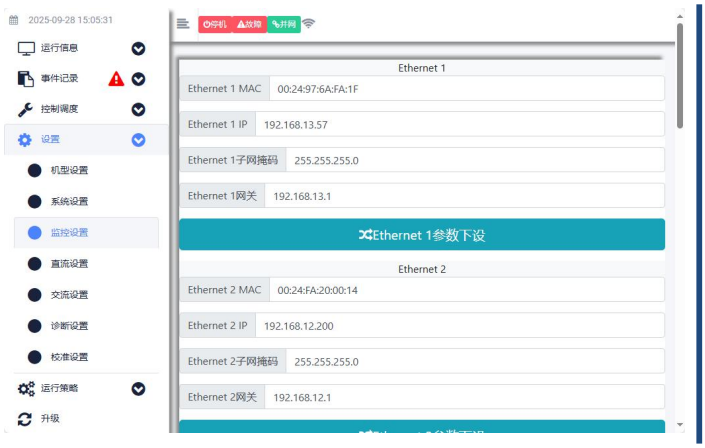
Clicking on the system settings menu will lead to the secondary submenu of system settings, which includes model settings, system settings, monitoring settings, DC settings, AC settings, diagnostic settings, and calibration settings.

This interface is for setting the working mode, rated voltage level, rated frequency level, AC incoming line mode, certification region and standards of the PCS. After changing the above settings, you need to click to restart the entire machine to activate them. If you need to make changes, please contact the engineers of our company for relevant subordinate settings.



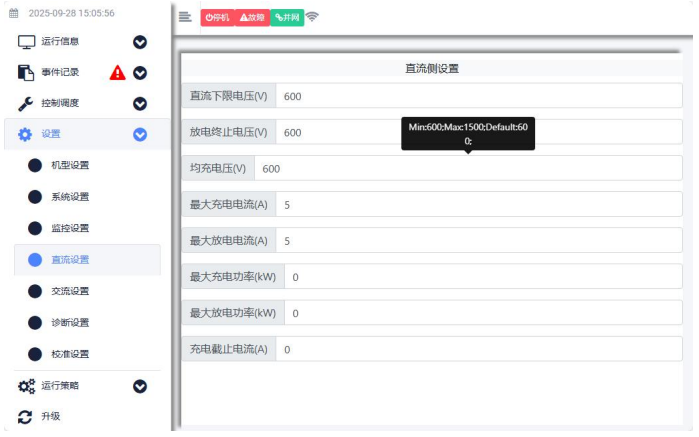
System Settings Secondary Submenu

This interface is a customized one. If needed, please contact the engineers of our company for relevant settings.



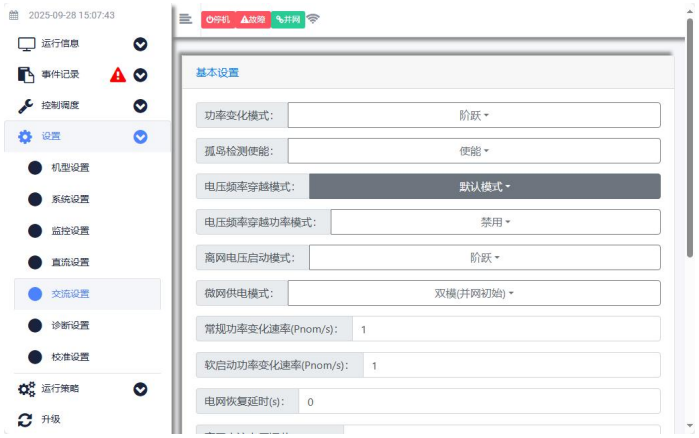
Monitoring Settings Secondary Submenu

Users can set the local IP, subnet mask, gateway, server IP, communication baud rate, language, and restore factory settings, among other things.



DC Setting Secondary Submenu

Users can set the DC lower limit voltage, discharge termination voltage, maximum charging current, maximum discharging current, maximum charging power, maximum discharging power, and charging cut-off current for the inverter operation.

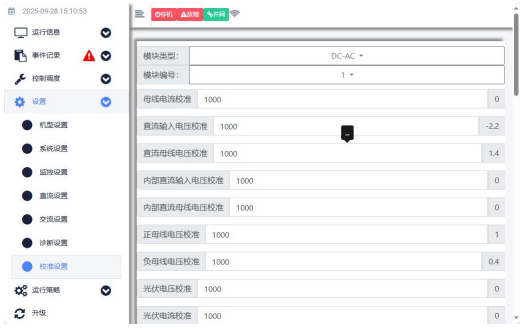


AC Settings Secondary Submenu

It is used to set the inverter power change mode, whether islanding detection is enabled or not, voltage and frequency ride-through mode, and voltage and frequency ride-through power mode, etc.

Diagnostic Settings Secondary Submenu

This interface is a customized interface. If needed, please contact the engineers of our company for relevant settings.

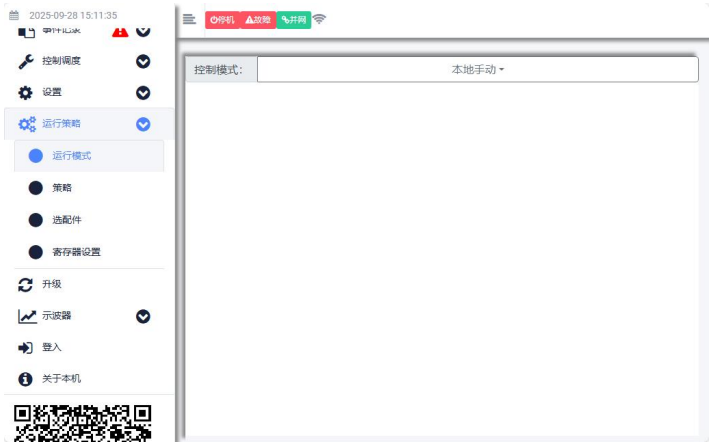


Calibration Settings Secondary Submenu

This interface is a calibration page, which can calibrate the voltage, current, etc. of the PCS.

8.8 Introduction to Operation Strategy Menu

Clicking on the run mode menu will lead to the secondary submenu of the run mode, which includes run mode and register settings.



Secondary Submenu of Operating Mode

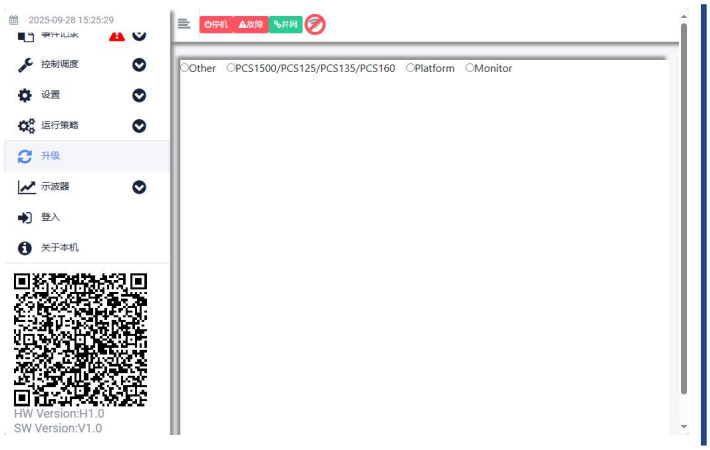
Users can set the operating modes of the PCS: local manual, local automatic, and remote control.

Register Settings Secondary Submenu

This page utilizes Modbus communication.Input the address to be checked in the register address field, and the stored register value will be displayed in the register value field.

8.9 Introduction to the Upgrade Menu

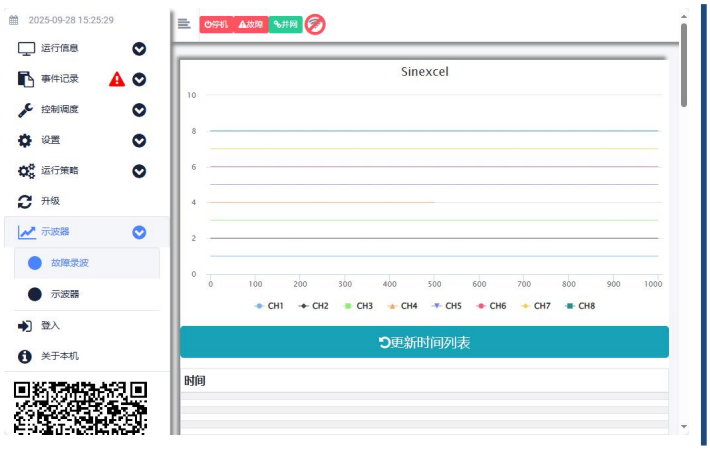
Click Upgrade to enter the upgrade menu interface.



This page allows for online upgrades of the PCS monitoring page and DSP. For specific operations, please refer to the online upgrade instruction manual.

8.10 Introduction to Oscilloscope Menu

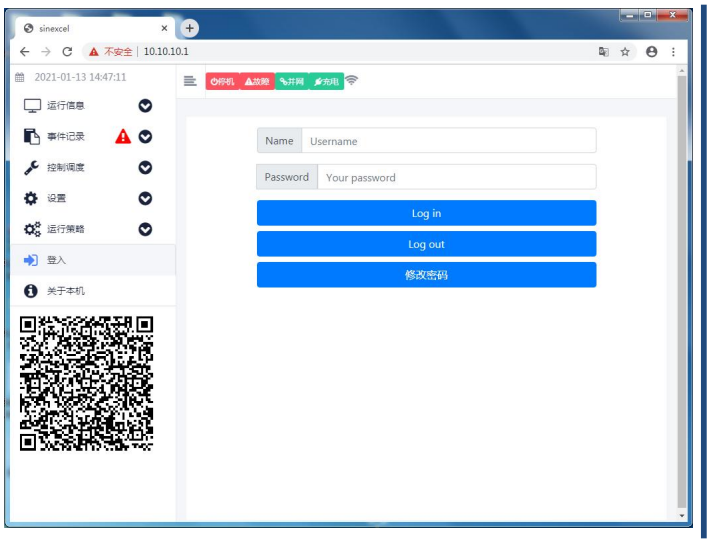
Click on the oscilloscope to enter the secondary submenu interface, which includes the fault waveform recording interface.



This page can record the AC side voltage and current waveforms corresponding to the moment when an AC side voltage abnormality fault occurs.

8.11 Introduction to the Login Menu

Click login to enter the login menu interface



User interface after successful login

Users can log in and log out with more advanced privileges, and change their passwords on this interface.

8.12 Introduction to About this Machine Menu

Click "About this Machine" to enter the menu interface.

About this machine Submenu

Displays: model name, model number, rated voltage, rated frequency, rack ID, serial number,etc.

9 Troubleshooting

Warning

Only qualified technicians are allowed to perform the operations described in this chapter.
"Qualified" means that the operator has attended professional training on the troubleshooting operations of the equipment.
Perform only the troubleshooting procedures described in this manual.
Follow all safety procedures during operation.

- If, with the help of this manual, you still cannot solve the problem or still have questions, please contact us Sinexcel. In order to provide you with better and faster service, we usually need the following information.
- PCS Model
- PCS Serial Number
- Information on the manufacturer and model of the relevant components connected to the equipment, as well as the configuration of the energy storage batteries.
- Communication Connection Scheme for PCS
- Fault information and brief description
- Photos of the fault on site (if site conditions permit)

9.1 Preliminary Troubleshooting

When the PCS does not work as expected or exhibits abnormal charge/discharge levels, please pay attention to the following items before consulting the company's maintenance personnel:

- Verify that the battery open-circuit voltage complies with the inverter's requirements.
- Check if the EPO is in the pressed state.
- Verify whether the grid and DC side are properly connected and energized.
- Check whether communication cable connection is loose

9.2 LED Indicator Light Display and Troubleshooting Methods

Please refer to the following table for device status descriptions:

Table 9-1 Troubleshooting Methods

LED status	Method
The POWER indicator light is off	This indicates that neither the AC nor the DC sides of the energy storage inverter are powered. 1. Check whether the power supply and connection of the power grid and battery are normal. 2. Check whether the AC/DC power-taking circuit breaker is switched to the closed state. 3. If the indicator light is still not on, please contact the after-sales service personnel of our company.

The RUN indicator light is off	This indicate that the PCS is not in operating state. 1. Check whether the AC and DC wiring are correct, use a multimeter to measure the DC input voltage, and ensure that the voltage value exceeds the starting voltage of the energy storage inverter. 2. Ensure that the grid power supply and various parameters meet the operating requirements of the energy storage inverter. 3. If the indicator light is still off, please contact the after-sales service personnel of our company.
The FAULT indicator is always on	This indicates that the energy storage inverter has failed and the failure has not been eliminated. 1. Please check the detailed fault information on the web monitor and take corresponding corrective actions. 2. If the indicator light stays on, please contact the after-sales service personnel of our company.

9.3 Common Faults and Handling Methods

Fault Type	Possible Causes	Simple Processing	Remarks
DC Input Overvoltage	The DC voltage is higher than the maximum allowable DC voltage	Check the configuration of the battery cluster and reduce the open circuit voltage of the battery cluster	Please contact the energy storage battery supplier
DC Input Undervoltage	The DC voltage is lower than the minimum allowable DC voltage	Check the battery cluster configuration	Please contact the energy storage battery supplier
AC bus overvoltage	The grid voltage is higher than the maximum allowable grid voltage	Check the power grid	The grid voltage returns to the permissible range, it can be allowed again
AC bus undervoltage	Grid voltage below maximum allowable grid voltage	Check the power grid	The grid voltage returns to the permissible range, it can be allowed again
AC bus overfrequency	The grid frequency is greater than the maximum allowable grid frequency	Check the power grid	The grid frequency returns to the permissible range, it can be allowed again by manual method
AC bus underfrequency	Grid Frequency Below Maximum Allowable Grid Frequency	Check the power grid	The grid frequency returns to the permissible range, it can be allowed again by manual method
Island protection	The PCS has detected the occurrence of islanding phenomenon	Check the power grid	Grid connection can be restored after the grid returns to normal.
AC bus overload	There is a short circuit on the AC	Check the cable connections	Please contact our

timeout	side of the energy storage inverter or the internal electronic components are damaged.	on the AC side circuit of the PCS and whether there are any problems with the control circuit board.	company for details.
Environment Over-temperature fault	The PCS internal temperature above allowable value.	Inspect and repair the cooling fan after the internal power is fully off.	If the fault occurs more than 10 times per day, please contact our company
Module over-temperature fault x (x=1~2)	IGBT module heat sink temperature is higher than the allowable value.	Inspect and repair the cooling fan after the internal power is fully off.	If the fault occurs more than 10 times per day, please contact our company
AC Power Electrical Control Switch Hardware Fault	The contactor connecting the internal part of the equipment to the power grid is faulty.	Inspect and repair the contactor after the internal power is fully off.	If the fault occurs more than 5 times per day, please contact our company
DC input electrical control switch open circuit	The DC isolation switch connecting the internal part of the equipment to the battery is faulty.	Inspect the DC isolation switch after the internal power is fully off.	If the fault occurs more than 5 times per day, please contact our company
DC input soft start fault	The soft-start contactor connecting the internal part of the equipment to the battery is faulty.	Inspect the contactor after the internal power is fully off.	If the fault occurs more than 5 times per day, please contact our company
DC fuse fault	DC-Side fuse fault	Inspect and repair the fuse or replace the fuse after ensuring the internal power is fully off.	Please contact our company for details
SPD fault	AC side surge protective device (SPD) fault	Inspect and repair the fuse or replace the fuse after ensuring the internal power is fully off.	Please contact our company for details
Auxiliary power supply fault	DC auxiliary power board fault	After the internal power is fully off, check all terminals on the DC auxiliary power board for any looseness.	Please contact our company for details

Attention

Alarm Classification:

Fault - Hardware shutdown fault;

Alarm - Shutdown alarm;

Warning - Alarm but not shut down.

Alarm clearing method:

Auto - The alarm is automatically cleared after the alarm cause disappears.

Manual - After the alarm cause disappears, the alarm is cleared by sending a reset command;

PowerOff - After the alarm cause disappears, the alarm is cleared by powering off and restarting

The Following Simplifies to:

Fault shutdown + Automatic FA

Fault shutdown + Manual FM

Fault shutdown + Power off FP

Warning shutdown + Automatic WA

Warning + Automatic WA

Warning + Manual WM

9.4 Other Faults

- The machine is too noisy

  Possible causes: abnormal operation of the PCS, abnormal operation of the inductor; failure of the cooling fan.

  Solution: Check whether the power is within the normal range, and measure whether the grid-connected current and voltage waveforms are normal. Abnormal waveforms will generate a lot of noise and the inductor will heat up. Repair or replace the cooling fan.

- The host computer cannot communicate.

  Ethernet communication method:

  1. Check whether the IP address, subnet mask, and gateway are set correctly.
  2. Check whether the communication cable is a straight-through cable and whether it is connected properly.

10 Maintenance

Due to the influence of environmental temperature, humidity, dust, vibration, etc., the internal components of the PCS will experience aging and wear, which may lead to potential internal faults of the PCS. Therefore, it is necessary to carry out daily and regular maintenance on the PCS to ensure its normal operation and service life.

10.1 Safety Precautions

Warning

Only qualified and authorized personnel are allowed to perform maintenance and other operations on PCS.

During maintenance work, do not leave metal parts such as screws and washers inside the PCS, as this may damage the equipment.

Warning

Before starting formal maintenance, not only should the AC/DC disconnect switch be disconnected, but also the battery cabinet switch and the grid side distribution switch should be off.

If only the DC disconnector is disconnected, the copper bars connected to the DC cables at the bottom of the PCS will still be live.

Warning

After disconnecting the DC disconnector/circuit breaker, please wait for at least 15 minutes before performing maintenance operations.

Warning

Please refer to the precautions mentioned in section 6.3 when electrical connections are involved in the maintenance process.

10.2 Maintenance Work and Cycles

The recommended routine maintenance intervals and work contents are shown in Table 10-1.

Table 10-1 Maintenance Worksheet

Inspection content	Inspection method	Maintenance cycle
Save software data	● Read data from the backend of the webpage ● Save the running data, parameters, and logs to relevant files ● Check the various parameter settings	Once a month
Operating	● Observe whether the PCS is damaged or deformed	Once every 6

status/ambience of the system	● Check if there is any abnormal sound during the operation of the PCS ● During system operation, check whether all variables are abnormal. ● Check if the main components are normal ● Use a thermal imager to check if the system's heat generation is normal ● Check if the air intake and exhaust are normal. ● Check whether the humidity and dust in the equipment operating environment meet the requirements, and whether all air inlet filters are normal. Attention! Must check the ventilation of the inlet and outlet	months
System cleaning	● Check the cleanliness of the circuit board and components ● Check the heat sink temperature and dust. If necessary, use compressed air and turn on the fan to clean the module. ● Replace the air filter mesh	Once every 6 to 12 months (depending on the dust content in the operating environment)
Power circuit connection	● Check if the power cable connection is loose ● Check for any damage to the power cables and control cables, especially the cover in contact with the metal surfaces. ● Check if the insulation tape on the terminals of the power cable has come off.	Six months after the first debugging, and after that, once every 6 to 12 months
Terminal and cable connection	● Check if the screws of the control terminals are loose. ● Check whether the main circuit terminals have poor contact and whether the screw positions have signs of overheating. ● Check if there is any color change in the wiring copper strip or screws ● Visually inspect the connections of equipment terminals, etc., and the distribution of cable harnesses	Once every 12 months
Cooling fan maintenance and replacement	● Check if there are cracks in the fan blades ● Check for any abnormal vibration sounds when the fan is running. ● If the fan is abnormal, please replace it in time.	Once every 12 months
Disconnector/circuit breaker maintenance	● Conduct a routine inspection of the rust condition of all metal components. ● Annual inspection of disconnectors (auxiliary switches and micro switches) ensures their good mechanical operation. ● Check the operating parameters (especially voltage and insulation)	Once every 6 to 12 months
Security features	● Check the shutdown function of the EPO ● Simulating shutdown and check the shutdown signal communication ● Check the warning signs on the machine body and other	Once every 6 to 12 months

	equipment signs. If any are found to be blurred or damaged, please replace them in a timely manner.	
Software maintenance	● Optimize software ● Check the settings of various parameters	Once every 6 to 12 months

Warning

Regularly check whether the fan of the cabinet module is running properly, and also observe whether there is friction sound when running, if so, it may be caused by dust and you need to stop the inverter to clean the dust.

Due to the dangerous electrical energy stored in the DC bus capacitor, you need to wait at least 15 minutes after the storage inverter is completely disconnected. Before removing the dust, please use a multimeter to measure and confirm that the machine is completely discharged internally to prevent electric shock.

Attention

The majority of maintenance work can only be performed by removing the protective grille inside the machine. At the end of all maintenance work, be sure to restore all the covers to their original position and ensure that all screws are tightened.

10.3 Replace Electronic and Electrical Components

Attention

When replacing electronic components in the PCS, always use identical parts from the same manufacturer. The model number is usually found on the component itself. If not, please contact Sinexcel.

Attention

If the components need to be replaced within other manufacturers or different models of the same manufacturer, it must be confirmed by Sinexcel in advance. Otherwise, we will not be responsible for any casualties or property damage that may be caused.

11 Appendix

11.1 Quality Assurance

Sinexcel (hereinafter referred to as the Company) will repair or replace the product with a new one free of charge if the product fails during the warranty period.

- **Evidence**

Our company requires the customer to present the invoice and date of purchase of the product during the warranty period. Also the trademark on the product should be clearly visible, otherwise it has the right not to be quality assured.

- **Conditions**

The replaced non-conforming products shall be disposed of by our company.

The customer shall allow reasonable time for the Company to repair the faulty products.

- **Liability Exemption**

The Company shall have the right not to guarantee the warranty if the following conditions occur.

1. The whole machine or parts have exceeded the free warranty period
2. Transportation damage.
3. Incorrect installation, modification, or use.
4. Operation in very harsh environments beyond those described in this manual.
5. Equipment failure or damage caused by installation, repair, alteration or disassembly by non-service personnel of our company.
6. Equipment failure or damage caused by the use of non-standard or non-Sinexcel components or software.
7. Any installation or use beyond the scope specified in the relevant international standards.
8. Damage caused by abnormal natural environment.

Product failure caused by the above circumstances, the customer requests for repair service. After the determination of our service department, we can provide paid repair service.

In order to continuously improve customer satisfaction, our products and user manuals are under continuous improvement and upgrading. If there is a difference between the user manual and the product in your hands, it may be due to the version, please refer to the specific product. If you still have questions, please contact our company.

11.2 HMI Protection Parameter Setting Introduction

Table 11-1 DC Protection Parameters

DC control mode	Can be selected between "constant current mode" and "constant power mode".
Charge and discharge current	It can be set from -3200.0A to 3200.0A, negative value means discharge, positive value means charge, and the default value is 0.0.
Charging and discharging power	Can be set between -3200.0kW~3200.0kW, negative value means discharge, positive value means charge, default value is 0.0.
Maximum charging current	Can be set between 0~3200.0A, the default value is 5.0.
Maximum discharge current	Can be set between 0~3200.0A, the default value is 5.0.
Battery lower limit voltage	Can be set between 600.0~1500.0V, the default value is 600.0.

End-of-discharge voltage	Can be set between 600.0~1500.0V, the default value is 600.0.
End-of-charge current	Can be set between 0.0~3200.0A, the default value is 0.0.

Table 11-2 AC Protection Parameters

Active control mode	"Set Active Power Mode", "Voltage-Active Power Regulation", "Frequency-Active Power Regulation", and "Voltage and Frequency-Active Power Regulation".
Reactive power control mode	"Disabled", "Constant Power Factor", "Constant Reactive Power", "Voltage-Regulated Reactive Power", "Power Factor Curve", and "Active and Reactive Power".
Power Factor	Can be set between -1.00~1.00, default is 1.00.
Active power (kW)	Can be set between -3200.0kW~3200.0kW, negative value means battery discharging, positive value means battery charging, the default value is 0.0.
Reactive power(KVar)	Can be set between -3200.0KVar~3200.0KVar, positive value means inductive reactive power, negative value means capacitive reactive power, default value is 0.0.
Normal Power change rate	Can be set from 0.0001 to 3, indicating that the rate is (x * 1500) KW/s, where x is the set value, and the default value is 1.00.
Power change mode	The power change mode can be selected between "Step0" and "Ramp1", and the default value is 0.
Off-grid volt startup mode	Can be chosen between "Step0" and "Ramp1", with a default value of 0.
Soft start ramp rate	Can be set from 0.001 to 3, indicating that the rate is (x * 1500) KW/s, where x is the set value, and the default value is 1.00.
Anti-islanding enable	Can be chosen between "Enable 1" and "Disable 0".
FVRT enable	choose between "Default Mode" and "Mode 1".
Overvoltage stageI protection range	Can be set between 1.00 and 1.35, with a default value of 1.1.
Overvoltage stageII protection range	Can be set between 1.00 and 1.35, with a default value of 1.2.
Undervoltage stageI protection range	Can be set between 0.05 and 1.00, with a default value of 0.9.
Undervoltage stageII protection range	Can be set between 0.05 and 1.00, with a default value of 0.5.
Overvoltage stage I protection time	Can be set between 0 and 180s, with a default value of 1.
Overvoltage stage II protection time	Can be set between 0 and 180s, with a default value of 0.1.
Undervoltage stage I protection time	Can be set between 0 and 180s, with a default value of 1.
Undervoltage stage II protection time	Can be set between 0 and 180s, with a default value of 0.1.
Overfrequency stage I protection	Can be set between 0.01 and 6 Hz, with a default value of 0.5.

range	
Overfrequency stage II protection range	Can be set between 0.01 and 6 Hz, with a default value of 1.5.
Underfrequency stage I protection range	Can be set between -10 and -0.01 Hz, with a default value of -1.5.
Underfrequency stage II protection range	Can be set between -10 and -0.01 Hz, with a default value of -3.5.
Overfrequency stage I protection time	Can be set between 0 and 650s, with a default value of 0.2.
Overfrequency stage II protection time	Can be set between 0 and 650s, with a default value of 0.2.
Underfrequency stage I protection time	Can be set between 0 and 650s, with a default value of 0.2.
Underfrequency stage II protection time	Can be set between 0 and 650s, with a default value of 0.2.
Grid recovery delay	Can be set between 0 and 1800s, with a default value of 60.
Volt-Var V1	Can be set between 0.5 and 1.35, with a default value of 0.92.
Volt-Var V2	Can be set between 0.5 and 1.35, with a default value of 0.98.
Volt-Var V3	Can be set between 0.5 and 1.35, with a default value of 1.02.
Volt-Var V4	Can be set between 0.5 and 1.35, with a default value of 1.08.
Maximum capacitive reactive Q1	Can be set between -1 and 0, with a default value of -0.3.
Initial capacitive reactive Q2	Can be set between -1 and 1, with a default value of 0.
Initial inductive reactive Q3	Can be set between -1 and 1, with a default value of 0.
Maximum inductive reactive Q4	Can be set between 0 and 1, with a default value of 0.3.
Vott-Watt start V1(high volt)	Can be set between 1.0 and 1.2, with a default value of 1.1.
Vott-Watt end V2(high volt)	Can be set between 1.0 and 1.2, with a default value of 1.15.
Vott-Watt start P1(high volt)	Can be set between 0 and 1, with a default value of 1.
Vott-Watt end P2(high volt)	Can be set between 0 and 1, with a default value of 0.
Freq-Watt freq point(high freq)	Can be set between 0.001 and 5 Hz, with a default value of 0.2.
Freq-Watt ramp rate(high freq)	Can be set between 0.0001 and 2, with a default value of 0.4.

12 Contact

If you have technical questions about our products, please call our service hotline. Please provide the following information in order to give you helpful assistance

- Model number of the equipment
- Serial number of the device
- Specification of the battery
- Information about the PV module
- Current alarm information of the device
- Current AC and DC information of the device
- Software version of the device

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Installation Record