

Monet Series Energy Storage Converter

USER'S MANUAL



Content





1. Security Precaution	1
1.1. Security Symbols Explanation	1
1.2. General Safety	1
1.3. Electrical Safety	3
1.4. Mechanical Safety	5
1.5. Maintenance and Replacement	6
2. Product Introduction	7
2.1. Model Description	7
2.2. Product Features	7
2.3. Electrical wiring diagram	8
2.4. Product Features	9
2.5. Product parameters	10
2.6. Component Introduction	11
2.7. Interface instructions	13
3. Installation and Wiring	14
3.1. Transportation and Handling	14
3.2. Packaging and Storage	15
3.3. Installation environment requirements	15
3.4. Before installation	17
3.5. Mechanical installation	18
3.6. Electrical Cable Installation	18
3.7. Communication Cable Installation	23

4. Startup and Debugging	24
4.1. Pre-startup Inspection	24
4.2. Startup Operation	25
4.3. Trial Run	26
4.4. Shutdown Operation	26
4.5. Emergency Shutdown	27
5. Running and Operation	29
5.1. Introduction to Human Machine Interface	29
5.2. Switching operation	30
5.3. Communication Settings	32
5.4. Operating Mode Settings	33
5.5. Battery Parameter Settings	38
5.6. Data Viewing and Exporting	38
5.7. Software Upgrade	39
6. Warning and Maintenance	43
6.1. Handling of warnings	43
6.2. Routine Maintenance	45
6.3. Warranty Service	46

1. Security Precaution

1.1. Security Symbols Explanation

When installing, operating, and maintaining the equipment, please read this manual first and follow the safety precautions indicated on the equipment and in this manual. To ensure proper use of this product and to protect personal and property safety, please carefully read the following symbols used in this manual.

<i>Symbol</i>	<i>Description</i>
 Danger	<i>Indicates a high potential for danger, such as a situation that will result in death or serious injury if not avoided.</i>
 Warning	<i>Indicates a moderate potential for danger, such as a situation that could result in death or serious injury if not avoided.</i>
 Caution	<i>Indicates a low potential for danger, such as a situation that could result in moderate or minor injury if not avoided.</i>
 Note	<i>Emphasizing and adding content may also provide techniques for optimizing the use of the product.</i>

1.2. General Safety

This equipment shall be used under the environment meeting the design specification requirements. Otherwise, equipment failure may be caused, and the resulting equipment function abnormalities or component damage, personal safety accidents, property losses and other events are not within the scope of equipment quality guarantee. When installing, operating and maintaining the equipment, local laws and regulations and norms shall be observed. The safety precautions in this manual are only supplementary to local laws, regulations and norms. The company shall not be responsible for the following situations.

 **Note**

- Installing and using the equipment in an environment that exceeds the regulations in relevant international, national, and regional standards.
- Not operating within the conditions specified in this manual.
- Unauthorized disassembly, modification of the product or modification of software code.

- Not following the operating instructions and safety warnings in the product and documentation.
- The equipment damage caused by abnormal natural environment (force majeure, such as earthquake, fire, storm, flood, mudslide, etc.) shall not be borne by the company.
- Damage caused by customers not following the transportation and installation requirements.
- Damage caused by storage conditions not meeting the requirements specified in the product documentation.
- Damage to the equipment's hardware or data caused by customer negligence, improper operation, or intentional damage.
- System damage caused by third parties or customer reasons, including relocation and installation of the system not in accordance with the requirements of this manual, as well as damage caused by adjustments, modifications or removal of identification marks not in accordance with the requirements of this manual.
- Defects, failures, or damage caused by acts, events, negligence, or accidents beyond the reasonable control of the seller, including power shutdown or electrical failures, theft, war, riots, civil unrest, terrorism, intentional or malicious damage, etc.

The equipment contains high voltage, and improper operation may result in electric shock or fire, leading to death, severe personal injury, or significant property damage. Please follow the operation sequences and safety precautions provided in this manual and other relevant documents, and operate the equipment in a standard manner.

 **Danger**

- Check if the equipment is damaged, such as holes, dents, or other internal signs of possible damage. Check that the internal components of the equipment are not shifted, and do not alter the structure or installation sequence of the equipment.
- It is prohibited to use water to clean electrical components inside the equipment. If any liquid enters the equipment, do not power it on and notify the site manager.

- It is prohibited to perform installation, wiring, maintenance, and replacement operations while the equipment is powered on. Before contacting any conductor surface or terminal, measure the voltage at the contact point and confirm that the protective ground wire of the equipment or the component to be repaired is reliably grounded to eliminate the risk of electric shock.
- Other than the personnel performing operations on the equipment, please do not approach the equipment. Do not power on the equipment until it is fully installed or confirmed by a professional. When initially powering on or performing main circuit operations with electricity, at least two personnel must be present on site.

 **Note**

- The user's operating behavior and tools during transportation, handling, installation, wiring, and maintenance must comply with the laws and regulations and relevant standards of the country or region where the equipment is used.
- When installing, operating and maintaining, it is necessary to clean the water, snow and other debris on the top of the cabinet first, and then open the cabinet door to avoid debris falling into the cabinet.
- It is prohibited to perform reverse engineering, decompile, disassemble, modify, implant, or other derivative operations on the equipment software. It is not allowed to study the internal implementation of the equipment, obtain the equipment software source code, steal intellectual property rights, or disclose any results of equipment software performance testing.

1.3. Electrical Safety

1.3.1. Wiring requirements

- Please select cables that comply with local laws and regulations. Cables of the same type should be bundled together, while cables of different types should be separated and laid out without intertwining or crossing each other.
- If the wiring is completed or temporarily left during the wiring process, the cable opening should be blocked immediately, and the cabinet door should be closed to avoid animals entering.

- The cables used in the energy storage system must be connected solidly, have good insulation, and meet the specifications. The cables passing through pipes or holes must be protected to avoid being damaged by sharp edges, burrs, etc.
- After the completion of wire connections, reliable fixing should be done with cable supports and clamps. The cables in the back-filled soil area should be closely attached to the ground to prevent deformation or damage caused by wire stress during back-filling.
- The use of cables in high-temperature environments may cause aging and damage to the insulation layer. The distance between the cables and the heat-generating devices or heat source areas should be at least 30mm.
- To ensure construction safety, all cables should be installed at temperatures above 0°C. When handling cables, especially when working in low-temperature environments, they should be handled gently.

1.3.2. Grounding requirements

- It is prohibited to damage the grounding conductor. The grounding body of the equipment shall be connected to the protective grounding grid permanently. Before operating the equipment, the electrical connection of the equipment shall be checked to ensure that the equipment has been reliably grounded.
- .The equipment grounding impedance meets the national standard GB 50054 and local electrical standards.
- It is prohibited to operate the equipment without installing a grounding conductor. For equipment that needs to be grounded, when installing, the protective ground wire shall be installed first; when removing the equipment, the protective ground wire shall be removed last.
- AI must be used for protective earthing.

1.3.3. Maintenance requirements

- Before connecting or disconnecting cables, the protective switch corresponding to the circuit must be disconnected.
- Use a multimeter with the corresponding voltage rating to check if the equipment is charged, to ensure that the equipment is completely shut down.

- If there are nearby live bodies, use insulating boards or insulating wraps to cover or wrap them.
- After using an earthing wire to connect the maintenance circuit with the earthing circuit, proceed with the maintenance operation.

Note

- Before connecting the cables, it is necessary to confirm that the wire labels are correctly identified before connecting them.
- If the equipment has multiple input channels, all inputs should be disconnected and the equipment should be completely powered off before it can be operated.
- After completing the maintenance, disconnect the earthing wire between the maintenance circuit and the earthing circuit.

1.4. Mechanical Safety

Caution

- When lifting and transporting the equipment without wooden boxes, the bottom boards must be removed. The equipment should be handled gently to avoid impact or vibration during lifting and lowering.
- During transportation, the center of gravity of the equipment should be placed in the middle position between the two forks of the forklift. Long-distance handling, inversion, or tilting are prohibited.
- When transporting equipment, it may be necessary to cover the operator's line of sight due to the large size of the equipment. It is recommended to arrange auxiliary personnel to assist in completing the operation.
- To ensure the safety of drilling outside the equipment body, suitable positions should be selected before drilling to avoid short circuits or other impacts. The equipment should be blocked during the drilling process to prevent debris from falling into the equipment. After drilling, clean up the debris promptly.

- When handling equipment by hand, it is necessary to prepare for the weight and wear protective gloves, anti-crash shoes and other safety equipment.
- During the transportation of the equipment, it should be carefully moved to avoid collisions or falls. Avoid scratching the equipment surface, damaging components or cables.

1.5. Maintenance and Replacement

Warning

- It is prohibited to open the cabinet door in rain, snow, lightning, sand, dust, fog, or other weather.
- Before parts are removed from the cabinet, make sure that other parts on the cabinet are not loose.
- During equipment maintenance, cover nearby energized parts with insulating material.
- Prohibit any objects from touching the running fan (e.g., fingers, parts, screws, etc.) until the fan is de-energized and stops rotating.
- Do not energize the unit before troubleshooting.
- When the converter is energized for inspection, pay attention to the hazard warning signs on the equipment and avoid standing at the cabinet door.
- Wait 15 minutes after powering down the equipment to ensure that the equipment is free of power before operating the equipment.
- Manual wiring inspection is required after the replacement of power components or wiring change of the equipment to avoid abnormal operation of the converter.
- After completing the maintenance and replacement related operations, the cabinet door should be locked in time and the key should be kept properly.

2. Product Introduction

2.1. Model Description



Figure 2-1 Model identification



Note

Rated AC power can be flexibly configured according to project requirements.

2.2. Product Features

Monet series energy storage converter integrates modular PCS, local energy management monitoring system, power distribution system and environmental control system. It adopts modular PCS, which is easy for maintenance and capacity expansion; it adopts front maintenance, which can reduce the footprint and maintenance access; it features safety and reliability, rapid deployment, low cost, high energy efficiency and intelligent management.

The common application scenarios run with the following strategies:

Grid-connected mode: Energy storage converter access to batteries, photovoltaic or other DC sources, through the AC / DC power module converted to AC power into the grid, can be achieved: storage battery access to achieve peak shaving, tariff difference arbitrage.

Off-grid mode: The storage converter is connected to a battery, photovoltaic or other DC source, which is converted to AC power to supply local loads via an AC/DC power module with a default three-phase voltage of 400Vac, 50Hz..

2.3. Electrical wiring diagram

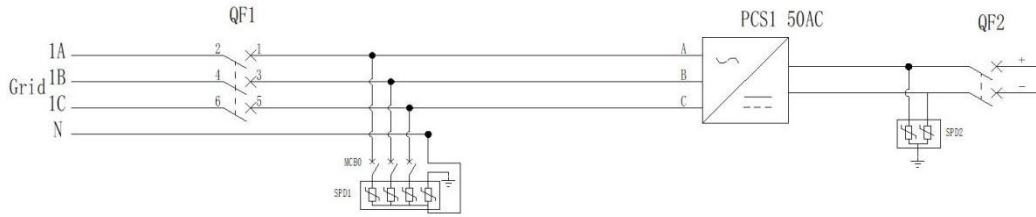


Figure 2-2 Monet-50 Electrical primary diagram

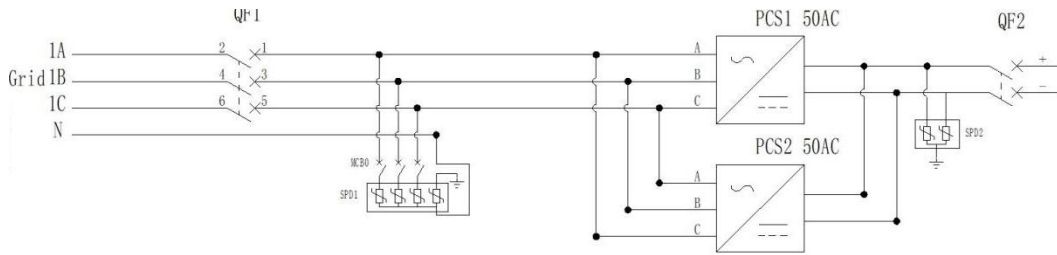


Figure 2-3 Monet-100 Electrical primary diagram

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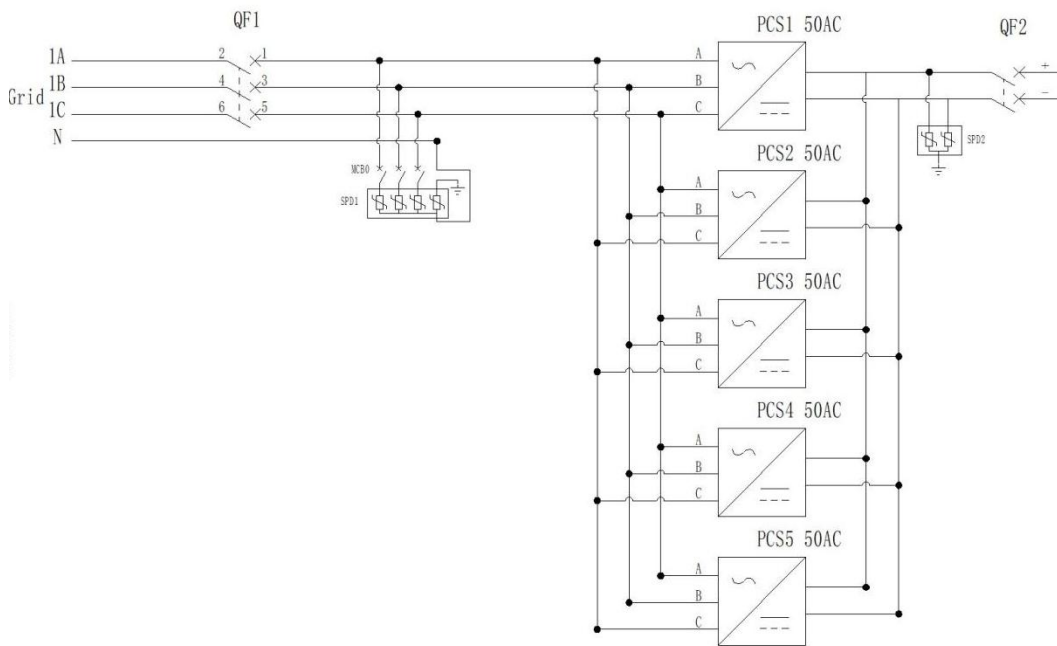


Figure 2-4 Monet-250 Electrical primary diagram

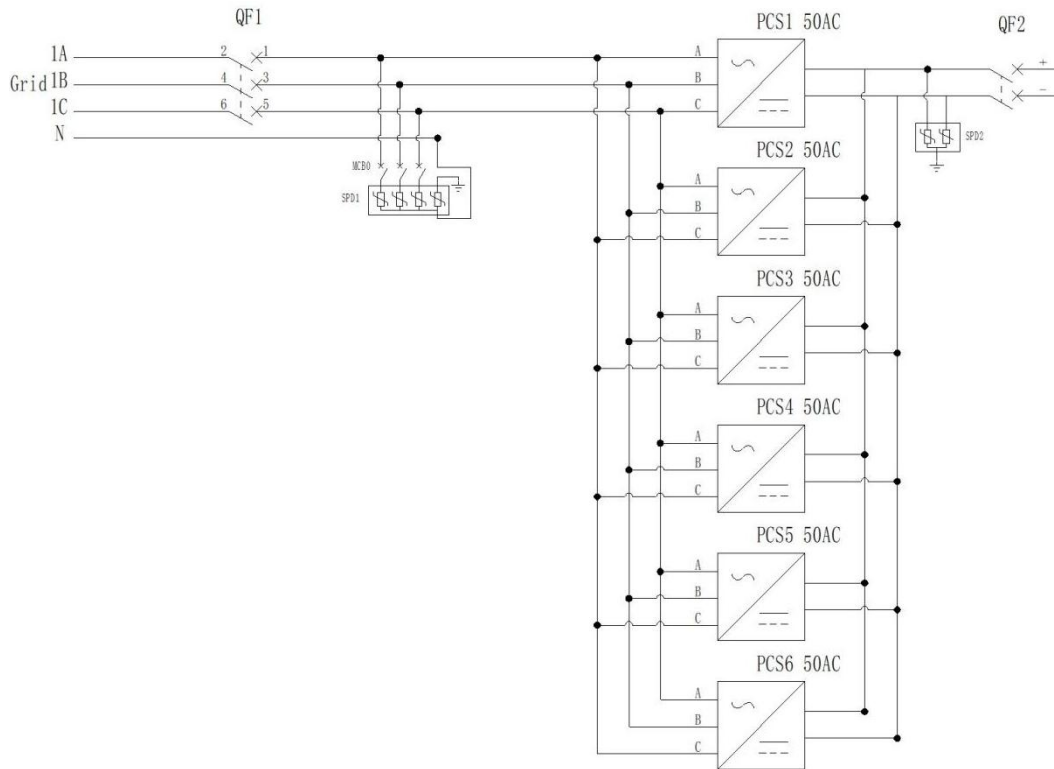


Figure 2-5 Monet-300 Electrical primary diagram



Note Different projects with different configurations, the line is slightly different, the actual shipping attached to the map shall prevail.

2.4. Product Features

Monet series energy storage converter adopts advanced digital control technology, equipped with self-developed Lotus-Pcs microgrid management system to optimize the control performance and improve the reliability of the system, to meet the needs of multi-application scenarios, its performance characteristics are as follows:

- Can accept grid scheduling, with a frequency/voltage regulation, black start and other functions.
- There are two types of cabinets for indoor and outdoor to meet the needs of a variety of installation sites.

Energy Storage Converter

- Modular rack-mounted design, flexible configuration, convenient expansion and maintenance.
- Power module three-level circuit design, high conversion efficiency, improve power utilization.
- The local control panel can realize diversified functions such as converter operation monitoring, energy management strategy formulation and equipment remote upgrade.

2.5. Product parameters

The parameters of the power module of the energy storage converter are as follows:

Table 2-1 Parameters of the Energy Storage Converter

Model	Monet-50	Monet-100	Monet-150	Monet-200	Monet-250	Monet-300
Grid side						
<i>Rated power</i>	50KW	100KW	150KW	200kW	250KW	300KW
<i>Max.power</i>	55KW	110KW	165KW	220kW	275KW	330KW
<i>Rated current</i>	72A	144A	216A	288A	360A	432A
<i>Max.current</i>	79A	158A	237A	316A	396A	475A
<i>Rated Voltage</i>	400Vac, 3W+PE					
<i>Rated frequency</i>	50Hz (±5Hz)					
DC-side parameters						
<i>DC Voltage Range</i>	600~950V					
<i>Maximum current on DC side</i>	92A	184A	276A	368A	460A	552A
<i>Number of DC Inputs</i>	1					
General parameters						
<i>Degree of protection</i>	IP21					
<i>Protection level</i>	I					
<i>Isolation method</i>	No isolation					
<i>Shutdown self-discharge</i>	< 0.1%Rated power (Without transformer)					
<i>Display</i>	LCD					
<i>Relative humidity</i>	0 ~ 95% (no condensation)					
<i>Noise</i>	< 78dB					
<i>Ambient temperature</i>	-25°C to +60°C(derating above 45°C)					
<i>Cooling mode</i>	Intelligent air-cooled					
<i>Altitude</i>	3000m (> 3000m reduction)					
<i>Communication interface</i>	RS485 / CAN/Ethernet					
<i>Dimensions (W * D * H)</i>	800*800*2100mm					
<i>Weight (approx.)</i>	330kg	370kg	410kg	450kg	490kg	530kg
<i>Note: The above dimensions and weights are for indoor models without transformer, outdoor dimensions will be adjusted.</i>						



Actual parameters are set according to customer needs and have been configured before delivery.

2.6. Component Introduction

2.6.1. Electrical system

The energy storage converter adopts modularization scheme, users can configure different number of power modules according to the project requirements. The parameters of the power modules of the energy storage converter are as follows:

Table 2-2 Power Module Parameters

Model	Monet-50AC	Monet-62.5AC
<i>Rated power</i>	50kW	62.5KW
<i>Maximum power</i>	55kW	68.75KW
<i>DC operating voltage range</i>	590V~1000V	600V-900V
<i>DC side full load voltage range</i>	500V~950V	600-900V
<i>Maximum current on low voltage side</i>	92A	110A
<i>Rated AC Voltage</i>	400Vac, 3W+PE, 50/60Hz, (±5Hz)	
<i>Rated AC current</i>	72A	90A
<i>Overload capability</i>	110%, normal operation; 120%, 1 minute	
<i>Current distortion</i>	< 5% (Rated power)	
<i>Power factor adjustment range</i>	-1 leading ~+1 lagging	
<i>Capacity with unbalanced load</i>	100%	
<i>Suitable battery</i>	Lithium-ion/lead-acid/photovoltaic modules	
<i>Maximum efficiency</i>	98.2%	
<i>Dimensions (W * D * H)</i>	483(without mounting lug 440)*600*150mm	
<i>Weight (approx.)</i>	68kg	
<i>Isolation Mode</i>	Non Isolation	
<i>Protection level</i>	IP20	
<i>Operating temperature</i>	-35°C to +60°C(derating above 45°C)	
<i>Relative humidity</i>	0 ~ 95% (no condensation)	
<i>Cooling mode</i>	Intelligent air-cooled	
<i>Altitude</i>	3000m (> 3000m reduction)	
<i>Communication interface</i>	CAN	

2.6.2. Distribution system

Schematic diagram of the power distribution system:

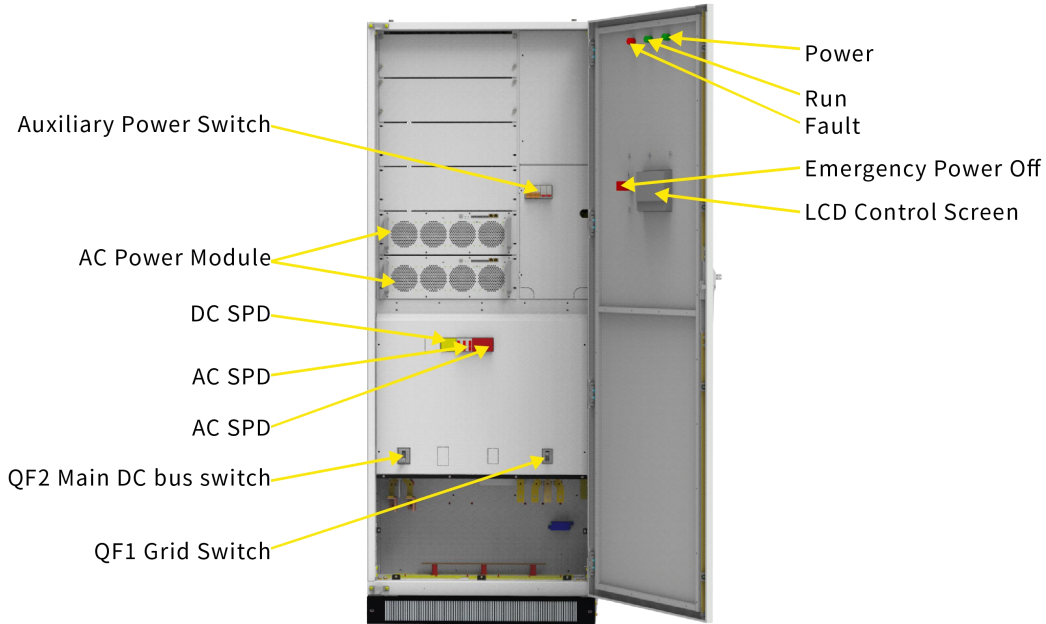


Figure 2-6 Monet-100 Cabinet Internal Structure

Note

- Six module positions are reserved inside the series to support the expansion of Monet-50 to Monet-300.

2.6.3. Local management system

The microgrid management system Lotus-Pcs is an intelligent management system independently developed by our company, which can realize the energy control system of power storage and conversion. On the power generation side, it can effectively connect renewable energy systems such as photovoltaic power generation and wind power generation to the grid; on the input side, it can respond to the grid and realize peak shaving, peak load shifting, and valley filling to cooperate with grid dispatching and stabilize grid frequency; on the power distribution side, it can achieve peak shaving, valley filling, and flexible DC interconnection, alleviating power shortages during peak periods and smoothing out power surpluses during low-demand periods; on the power consumption side, it can be used as an uninterruptible power supply and DC source. The product integrates the human-machine interface (HMI), port

control and communication, system parameter and operation strategy setting functions to realize the monitoring and management of energy storage converters. The hardware resources and parameters of the product are as follows:

Table 2-3 Local controller parameters

Module	Lotus - ESS
<i>Power input</i>	<i>DC 12V</i>
<i>Output control</i>	<i>3 isolated output switching values</i>
<i>Input control</i>	<i>6 isolated input switching values</i>
<i>Serial communication</i>	<i>2 isolated RS232, 4 isolated RS485</i>
<i>Fieldbus</i>	<i>2 CAN bus interfaces</i>
<i>Ethernet port</i>	<i>1 10/100M Ethernet port (RJ45)</i>
<i>Expanded storage</i>	<i>1 USB port, 1 SD card port</i>
<i>Audible alarm</i>	<i>1 controllable buzzer</i>
<i>Program indication</i>	<i>1 operation indicator light, 1 status indicator light, 1 alarm indicator light</i>
<i>Abnormal indication</i>	<i>1 hardware watchdog timer</i>
<i>Real-time clock</i>	<i>1 set of RTC real-time clock</i>

2.7. Interface instructions

In summary, the overall configuration list of the energy storage converter in a typical configuration is as follows:

Table 2-4 Energy storage converter overall configuration list

Name	Module	Unit	Quantity	Note
<i>Cabinet</i>	<i>800*800*2100mm</i>	<i>set</i>	<i>1</i>	
<i>DC Power Module</i>	<i>Monet-50AC</i>	<i>set</i>	<i>1/2/3/4/5/6</i>	<i>modular</i>
<i>Lightning protection</i>	<i>20/40kA</i>	<i>unit</i>	<i>1</i>	
<i>Distribution system</i>	<i>Micro breaks, etc.</i>	<i>set</i>	<i>1</i>	<i>Auxiliary equipment</i>
<i>Management system</i>	<i>Lotus-PCS</i>	<i>set</i>	<i>1</i>	

3. Installation and Wiring

3.1. Transportation and Handling

3.1.1. Product Transportation

- To ensure better protection of the equipment, it is recommended to use packaging for transportation.
- The equipment should be transported according to the requirements indicated on the packaging to prevent personal injury and equipment damage.
- It is not recommended to transport energy storage batteries by rail or air. Land transportation speed limit requirements: the speed limit on flat roads is 80km/h, and on rough roads is 60km/h. In case of any conflict, please comply with local traffic regulations.

3.1.2. Product handling

- When moving with a forklift, ensure that the forklift has sufficient load capacity and pay attention to the center of gravity of the equipment falling between the forks of the forklift to prevent personal injury and equipment damage.
- When transporting with batteries, the load capacity of the forklift should be $\geq 3t$.
- It is recommended that the fork length should be $\geq 1.5m$, the width should be 80cm~160cm, and the thickness should be 25cm~70cm.

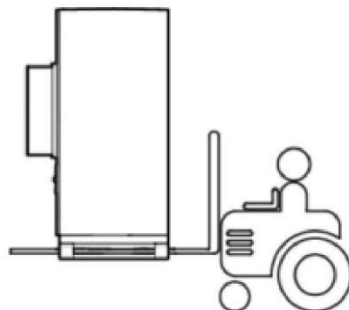


Figure 3-1 Schematic diagram of handling

3.2. Packaging and Storage

3.2.1. Product packaging

To ensure better protection of the product during transportation, specific paper boxes are used for packaging. The equipment packaging includes the following basic parameters (including but not limited to), which need to be carefully checked against project requirements:

Table 3-1 Table of packaging parameters

<i>Parameter</i>	<i>Description</i>
<i>model</i>	<i>Product model</i>
<i>size</i>	<i>Product packaging size</i>
<i>weight</i>	<i>Total weight of product after packaging</i>
<i>Identification</i>	<i>Face up, handle with care, center of gravity position, etc.</i>

3.2.2. Product storage

If the product is not to be transported or installed for use immediately, it must be stored indoors in a place that meets the following conditions:

Table 3-2 Requirements for product storage conditions Parameter Requirement

<i>Parameter</i>	<i>Description</i>
<i>Storage temperature</i>	<i>-25°C~+60°C</i>
<i>Storage relative humidity</i>	<i>< 95%(no condensation)</i>
<i>weight</i>	<i>< 3000m</i>

Note

Long-term storage is not recommended. If stored for more than 6 months, aging test is required before installation, and no problem before installation and use.

3.3. Installation environment requirements

The installation layout of the energy storage system must meet the fire protection distance or firewall requirements specified by local standards, including but not limited to the "GB 51048-2014 Electrochemical Energy Storage Power Station Design Code" and "NFPA 855 Standard for the Installation of Stationary Energy Storage Systems". The siting requirements are generally as follows:

- The installation location should be at a level higher than the historical highest water level of the area. The distance from airports, landfills, river banks, or dams should be $\geq 2\text{km}$.
- Choose a well-ventilated place. Do not block the vents and cooling system during operation to prevent high temperature and fire. Ensure sufficient installation space to prevent surrounding equipment from being affected by the heat generated by the product; and ensure sufficient external wiring space. Have convenient transportation conditions and reliable fire suppression system equipment.
- The installation location should be far away from fire sources, and flammable and explosive materials should not be placed around the equipment. If the equipment is installed in a place with lush vegetation, in addition to routine weeding, hardening treatment should be carried out on the ground below the equipment to prevent weeds from growing.
- Do not install the energy storage system outdoors in salt-affected areas to prevent equipment corrosion and subsequent fires. Salt-affected areas refer to areas within 2km of the coast or affected by sea breeze.
- The energy storage system must be equipped with fences, walls, and other protective measures, and safety warning signs should be erected for isolation to prevent unauthorized personnel from entering during operation, which may lead to personal injury or property damage.
- The equipment should be installed in an area away from liquids, and should not be installed below water pipes, air outlets, or other locations prone to condensation; it should also not be installed below air conditioning vents, exhaust vents, or machine room outlet windows, to prevent liquid from entering and causing equipment short circuits.

 **Note**

When the safety clearance required by relevant national standards cannot be met during the site selection, it is recommended to relocate the site. The site selection should avoid scenarios that are not recommended by industry standards and regulations, including but not limited to the following locations, areas, and sites:

- Strong vibration, strong noise sources, and strong electromagnetic field interference areas.
- Places that generate or have dust, smoke, harmful gases, corrosive gases, etc.
- Places that produce or store corrosive, flammable, and explosive substances. Within the danger zone of blasting.
- Places with existing underground facilities. Dense populated areas, high-rise buildings, and underground structures.
- Places with adverse geological conditions such as rubber soil, weak soil layers, and other ground that is prone to water accumulation and sinking.
- Within the boundaries of collapsed (defective) mining areas. In areas that may be flooded after dam or levee collapse.
- In earthquake fault zones and earthquake-prone areas with a seismic fortification intensity higher than level 9. In areas directly threatened by landslides, mudflows, quicksand, and caves.
- Important water supply source health protection zones.
- Historic and cultural heritage protection zones.

If there is no more suitable site, it is recommended to install a firewall of not less than 3h fire resistance for safety protection, while considering the space requirements for equipment transportation, installation and maintenance. It is recommended to refer to T/CEC 373-2020: the length and height of the fireproof wall should exceed the outer contour of the energy storage cabinet by 1m each.

3.4. Before installation

- (1) Before installing the product, you need to check whether the product is intact or not. If you find any signs of damage, please keep the evidence and contact us.
- (2) If you are sure that there is no abnormality in the product, please check according to the delivery list to see if the accessories are complete.

Table 3-3 Delivery list

<i>Serial number</i>	<i>Name</i>	<i>Quantity</i>	<i>Note</i>
1	Energy storage converter	1	key for cabinet door
2	User manual	1	electronic version
3	Certificate of conformity	1	
4	Factory inspection report	1	

(3) Users need to prepare relevant installation tools before installation.

Table 3-4 List of installation tools

<i>Serial number</i>	<i>Name</i>	<i>Quantity</i>	<i>Note</i>
1	Screwdriver set	1	
2	Socket	1	
3	Multimeter	1	
4	Forklift	1	
5	crews, nuts, washers	Some	

3.5. Mechanical installation

(1) After confirming that the product is free from any abnormalities and all accessories are complete, you can refer to the following suggestions for mechanical installation:

- Select the equipment installation location in advance according to the product dimensions, and ensure proper positioning and fixation. It is recommended to use the foundation as shown in the figure.
- Refer to the product weight, and choose an installation location with sufficient bearing strength.
- Reliable grounding, ensure that the grounding resistance is less than 4Ω.

Energy Storage Converter

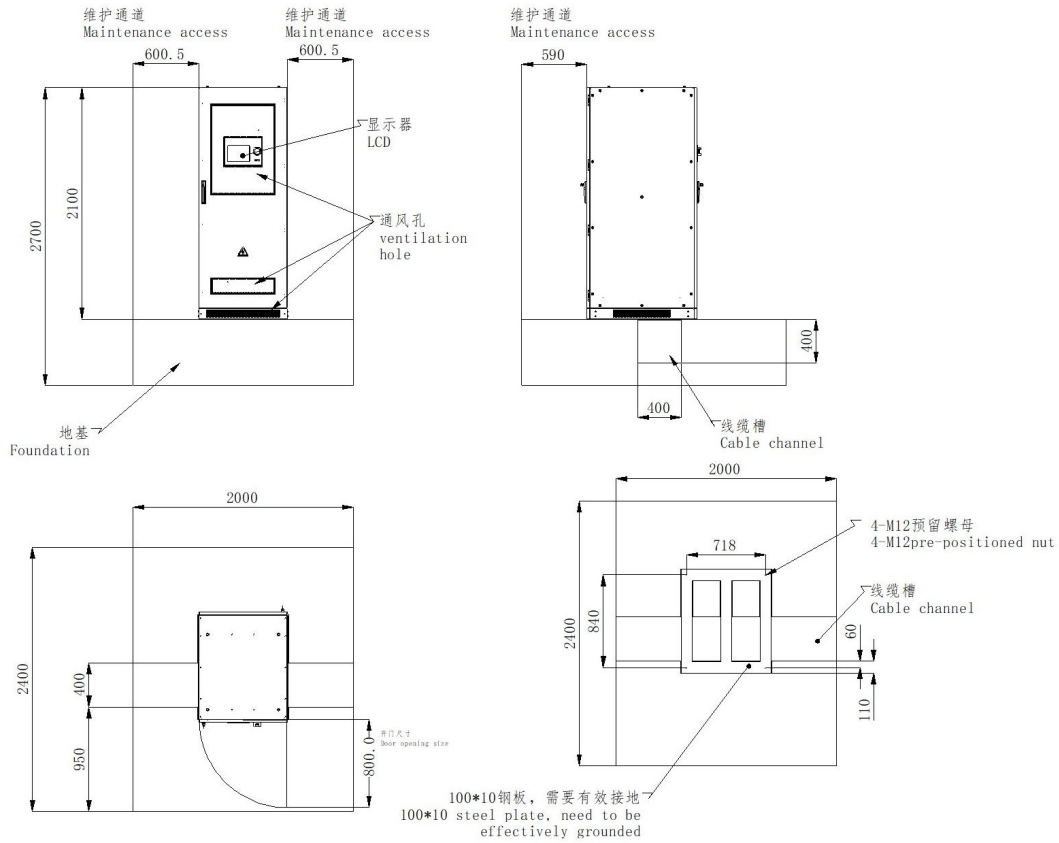


Figure 3-2 Base reference diagram (equipment subject to actual shipment)

- (2) After removing the wooden packaging box, disassemble the side panels at the bottom of the equipment first. Keep the disassembled side panels and screws properly, and reinstall them after the equipment is in place.
- (3) Position the equipment on the foundation with a forklift, align the equipment fixing holes with the pre-embedded nuts of the foundation, and fasten with M12X40 bolts.

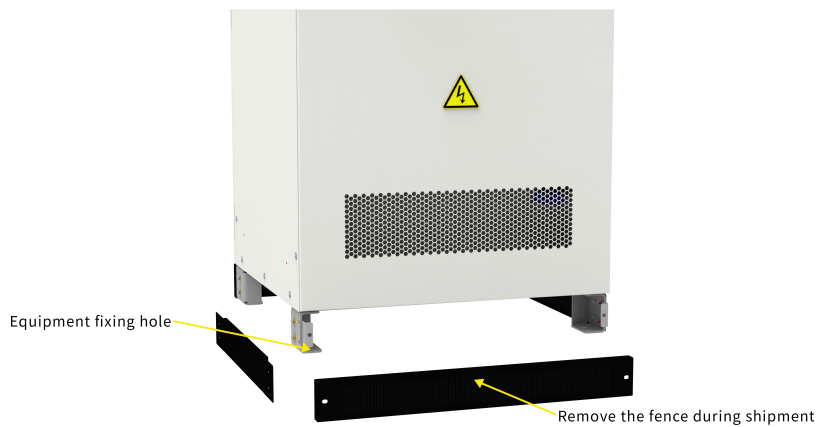


Figure 3-3 Schematic of bolt fastening at the bottom of the unit

3.6. Electrical Cable Installation

This product adopts an all-in-one structure, and the wiring on the DC side has been completed internally. Only electrical cable installation for the AC side and external communication is required on site. Nato provides wiring references as shown in Table 3.5 based on product power and cable specifications. The selection of cable diameters should comply with local cable standards. Factors that affect the selection of cables include rated current, cable type, installation method, ambient temperature, and maximum acceptable line loss.

Table 3-5 Cable Diameter Comparison Table

<i>Model capacity</i>	<i>AC Cable</i>	<i>Zero</i>	<i>Ground</i>	<i>DC Cable</i>
<i>50kW</i>	$\geq 3*35mm^2$	$\geq 35mm^2$	$\geq 35mm^2$	$\geq 2*35mm^2$
<i>100kW</i>	$\geq 3*50mm^2$	$\geq 35mm^2$	$\geq 35mm^2$	$\geq 2*70mm^2$
<i>150kW</i>	$\geq 3*95mm^2$	$\geq 50mm^2$	$\geq 50mm^2$	$\geq 2*95mm^2$
<i>200kW</i>	$\geq 2*(3*70mm^2)$	$\geq 70mm^2$	$\geq 70mm^2$	$\geq 2*(2*70mm^2)$
<i>250kW</i>	$\geq 2*(3*70mm^2)$	$\geq 70mm^2$	$\geq 70mm^2$	$\geq 2*(2*95mm^2)$
<i>300kW</i>	$\geq 2*(3*95mm^2)$	$\geq 95mm^2$	$\geq 95mm^2$	$\geq 2*(2*95mm^2)$

Danger

When performing electrical installation, you can refer to the following suggestions for electrical installation:

- (1) Before wiring, check that all switches inside the equipment are in the off position to ensure that the equipment is not energized.
- (2) Disconnect the power grid switch before wiring to ensure that the cables are not energized.
- (3) Determine the correct phase sequence of the cables, and use different colored insulating sleeves or markings (yellow, green, red, and black) to distinguish them, to prevent phase sequence errors.
- (4) The connection between the cable terminals and the copper busbars needs to be securely tightened. The length of the screws should be moderate to avoid affecting insulation and tightening.

- (5) Communication cables and power cables should be laid separately as much as possible, and care should be taken to ensure that the insulation layers of the cables are not damaged during installation.
- (6) The grounding cables must be reliably connected to the grounding copper busbars, and the cross-sectional area of the cables should meet the design requirements.
- (7) All AC cables should enter the equipment through the bottom access holes and be connected to the corresponding phase sequence.
- (8) After wiring is completed, use fireproof mud to seal the wiring gaps to prevent external pests such as insects and rodents from entering and damaging the equipment or cables.

In order to prevent the terminals from loosening under force and causing poor contact resulting in increased contact resistance and heat generation, etc., make sure that the bolts used to fasten the terminals meet the torque requirements listed in Table 3.6:

Table 3-6 Wiring torque requirements

Screw dimensions	M4	M5	M6	M8	M10	M12	M14	M16
Torque (N * m)	1.8-2.4	4-4.8	7-8	22-29	44-58	76-102	121-162	189-252

The inlet and outlet mode of the energy storage converter is lower inlet and outlet, after removing the switch baffle, as shown in Fig. 3.2, the A/B/C/N and DC positive and negative copper rows at the lower end of the switch are reserved with φ11mm and φ13mm holes for the customer to wire, or according to the customer's requirements for the size of the holes; the protective ground wire is connected to the PE copper row, and the equipment grounding impedance meets the requirements of national standard GB 50054 and the local electrical standards.



Figure 3-4 Switch block and terminals

The installation of the terminals, set screws and other parts used for power cable wiring is shown below:

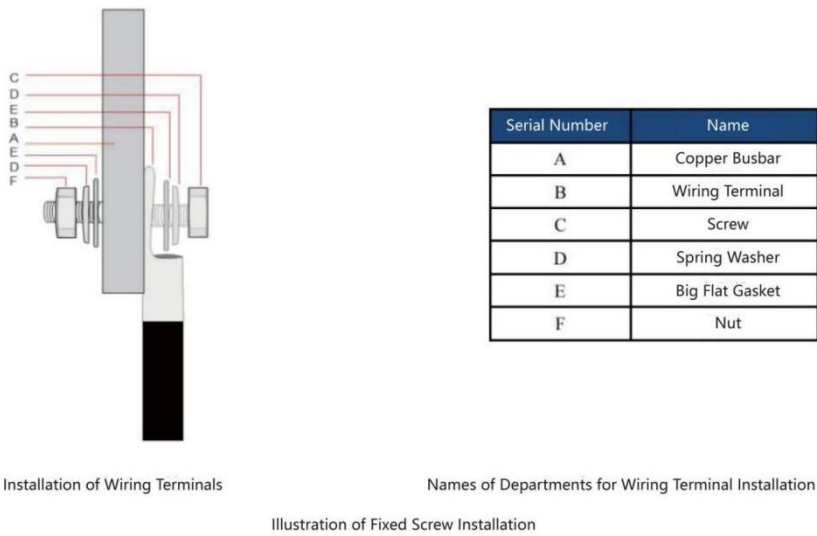


Figure 3-5 Set Screw Installation Schematic

Caution

- When using copper-cored cables or copper-clad aluminum cables, please use copper wiring terminals.

- When using aluminum alloy cables, please use copper-aluminum transition wiring terminals, or aluminum wiring terminals in combination with copper-aluminum transition gaskets.

3.7. Communication Cable Installation

When installing external communication cables, it is important to separate them from power cables. When laying communication cables and power cables in parallel, the recommended distance should be no less than 300mm. When the communication cable must pass through the power cable, it is recommended to ensure that the angle between the two cables is 90° to reduce electromagnetic interference from the power cable to the communication cable. Communication cables should be routed as close to the surface support as possible, such as wire ducts, metal rails, etc. If there is no support, they can be basically fixed with ties.

The system can use RS485 or Ethernet communication methods for backend communication, and the system communication protocol uses Modbus RTU or TCP. Twisted shielded cables or network cables are used to access the position shown in the figure below.

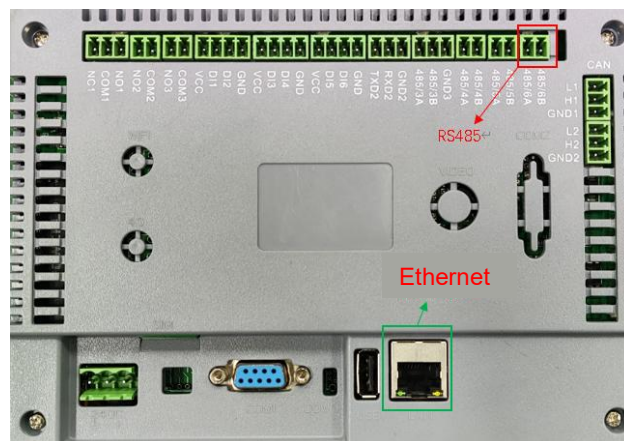


Figure 3-6 Communication cable wiring location diagram

4. Startup and Debugging

4.1. Pre-startup Inspection

Before operating the product, please ensure that the product has been installed according to specifications, and conduct a thorough and detailed inspection of the machine. The product can only be turned on after ensuring that all indicators meet the requirements.

(1) Visual Inspection:

- a、 The exterior of the equipment is intact, with no damage, rust, or paint peeling. If there is paint peeling, please conduct paint repair operations.
- b、 The equipment labels are clearly visible, and damaged labels should be replaced promptly.

(2) Grounding Inspection: The cabinet has a grounding point, and the grounding is secure; the grounding conductor inside the cabinet is reliably connected to the cabinet's grounding copper bar.

(3) Cable Inspection:

- a、 The protective layer of the cables is intact and there is no obvious damage.
- b、 The terminals are made in accordance with specifications, and the connections are solid and reliable.
- c、 The labels at both ends of each cable are clear and unambiguous. The wiring meets the principle of strong and weak power separation, with sufficient slack at the turns and no tightening.
- d、 The cable installation bolts are tightened, and there is no loosening when pulling the cables; the cable pass-through holes have been sealed.

- e、Check that the AC phase sequence and DC positive and negative terminals of the access cable are correct.
- (4) Copper row inspection: no obvious cracks or deformation of copper rows, fastening of screws at the lap joints, no misalignment of scribed markings, and no debris on the copper rows.
- (5) Component inspection: Referring to Figure 4.1, the circuit breakers are all in the open position.

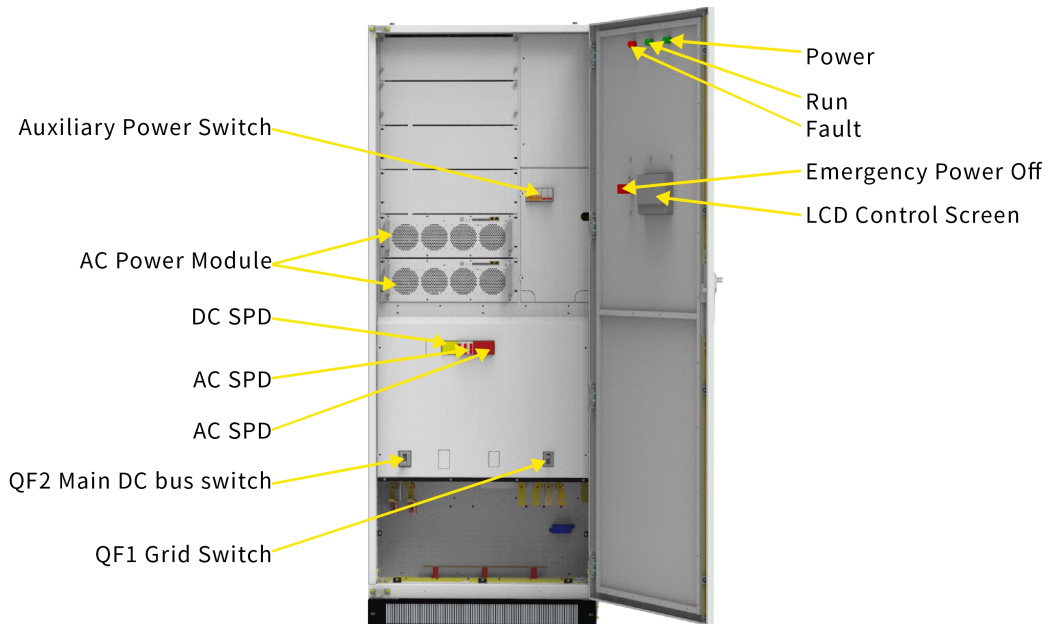


Figure 4-1 Distribution switch location diagram

Note Consistent switching and wiring positions for different series.

4.2. Startup Operation

The operation flow for starting up the product is as follows:

- (1) Use a multimeter to confirm that the grid voltage is within the predetermined range .
- (2) Referring to Figure 4.1, QF1 AC moulded case switch and auxiliary power switch MCB1.
- (3) Close QF2 DC switch.
- (4) Confirmation of normal display and no fault alarms.

- (5) Set the converter parameters in 'System' -> 'Parameter Setting' interface, and select the required operation mode in 'System' -> 'Operation Mode' interface. Select the required operation mode in 'System' -> 'Operation Mode' interface.
- (6) Enable all modules in the "Switch" page of the touch screen, and click "Converter on" to complete the power-on.

4.3. Trial Operation

After the equipment has completed all electrical structure installation to meet the start-up conditions, in order to ensure the reliable and stable operation of the energy storage converter, the initial operation must be powered up by professional electrical engineers and technicians and set the operation mode and related parameters according to the project requirements:

- (1) Set the equipment control mode to 'manual mode' and set the active power to 5%.
- (2) Observe the parameters of PCS on the screen during operation, and stop the machine in time for testing if there is any abnormality.
- (3) Run for 0.5 hours.
- (4) set the active power to -5%, at this time the battery is charged at 5% of the rated power of the system.
- (5) Observe the screen PCS during the running period, if there is any abnormality, stop the machine in time for testing.
- (6) Run for 0.5 hours.
- (7) After completing 1 hour trial run without any abnormality, switch off the system in the 'switch' interface.

- (8) According to the project background and demand, you can choose the local manual power control mode, automatic peak shaving mode or backup mode mode to put into operation formally, and click 'system on' in the system interface.

4.4. Shutdown Operation

When the product needs daily maintenance, the shutdown operation is required. The normal shutdown operation of the product is as follows:

- (1) Click on the 'Switch' interface of the touch screen and click on 'System Shutdown', and wait for the converter to stop running.
- (2) Refer to Fig. 4.1, switch off the converter auxiliary switch MCB1.
- (3) Switch off the main AC circuit breaker QF1 and DC switch QF2.
- (4) Wait for the end of bus discharge, the touch screen goes out, and the equipment completes shutdown.

4.5. Emergency Shutdown

In the event of a product malfunction or emergency situation requiring immediate shutdown, the following emergency shutdown procedure can be performed:

- (1) Press the emergency shutdown button "EPO".
- (2) Referring to Figure 4.1, breakout converter auxiliary switch MCB1.
- (3) Tap main AC circuit breaker QF1, tap DC switch QF2.
- (4) Reset the EPO button after determining that the fault or hazard is cleared and operation is required.



After pressing “EPO” emergency shutdown, it is necessary to turn off the auxiliary power switch and DC molded case switch, and wait for 10min before powering on!

5. Running and Operation

This chapter mainly introduces the LCD touch screen display interface and the corresponding operational control through the human-machine interface. Users can execute various operational commands through the LCD display interface, conveniently browse DC, AC, and system operation-related parameters and data, promptly obtain current equipment status and real-time alarm information, providing a reliable basis for fault diagnosis. Additionally, the LCD touch screen can also display system software version information and upgrade various component software via a USB flash drive.

5.1. Introduction to Human Machine Interface

After the system is powered on, the LCD touch screen enters the startup interface, and after 30s, the startup interface disappears and the system enters the "home" interface. As shown in Figure 5.1, the homepage interface displays the real-time power, voltage, current, power generation, operation mode, working status and other information of the system.

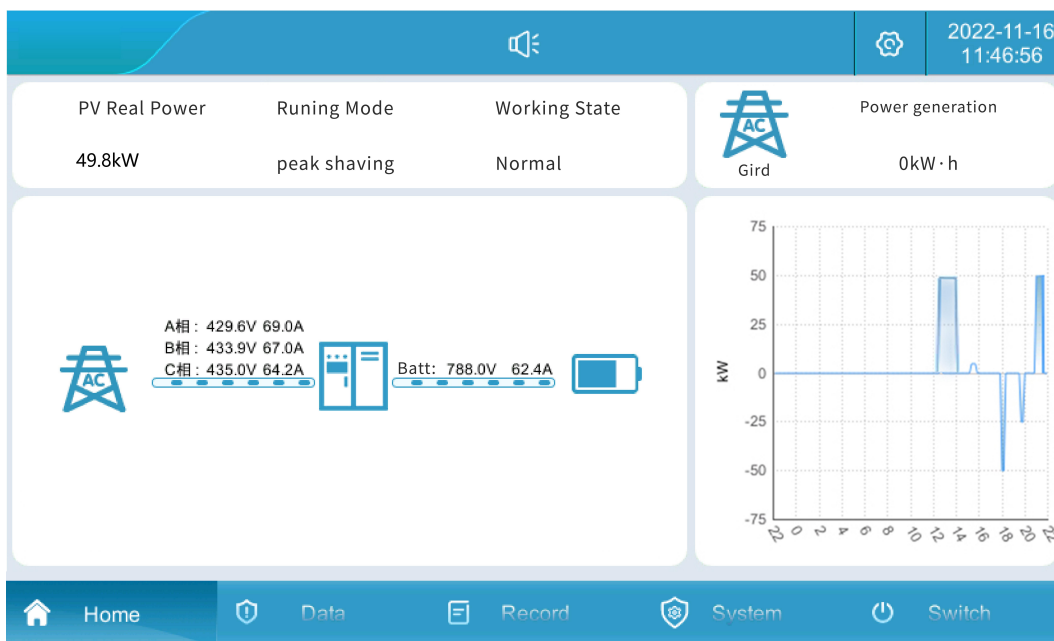


Figure 5-1 Main Page

Each menu expands items :

No.	Menu name	Menu Items	Parameter Function
1	Home page	N/A	Display the operation status of the system and the charging/discharging curve of the day.
2	Data	Real-Time Data	Display all analog data of the converter
		Real-Time Status	Converter operating status and switching status display
		Real-Time Alarm	Current system alarm information
3	Record	History Alarm	Displaying historical alarm records
		Operation Log	Displaying the operation log
		Data Report	Exporting history records
4	System	System information	Displaying system information
		Run Mode	System operation mode setting
		Parameter Set	Converter and battery parameterization
		Manufacturer	Equipment manufacturer settings
		System Update	System software upgrade
		Comm Set	Perform communication settings
5	Switch	Converter on/off	Converter power on and off

5.2. Switching operation

- 1、 Converter on: First of all, check the power-up situation of the whole machine, refer to Fig. 4.1 to close the QF1 AC molded case switch and auxiliary power switch MCB1.
- 2、 Set the converter parameters in 'System' -> 'Parameter Setting' interface, and select the required operation mode in 'System' -> 'Operation Mode' interface. In 'System' -> 'Operation Mode' interface, select the required operation mode, select the grid connection and control mode manually or peak shaving and valley filling, etc.

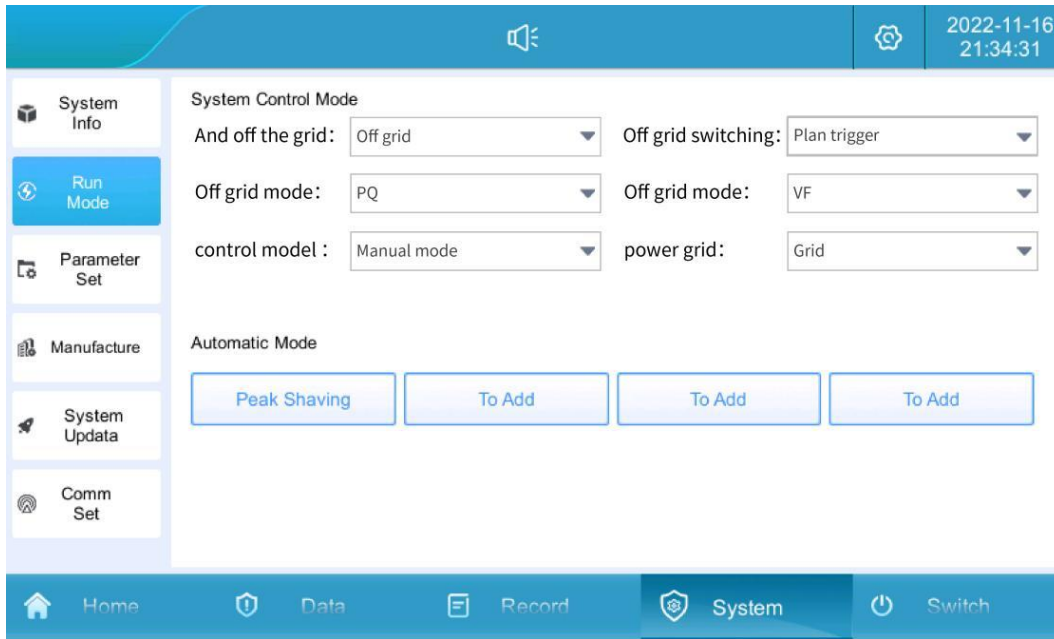


Figure 5-2 Run Mode Interface Diagram

- 3、 In the touch screen “switch” page to enable all the modules (you can also turn on some of the modules according to the actual need, the number of modules to the actual delivery shall prevail, in order to two modules, for example), click on the “system on” , the normal turn on time of about 30 seconds, as shown in Figure 5.3.

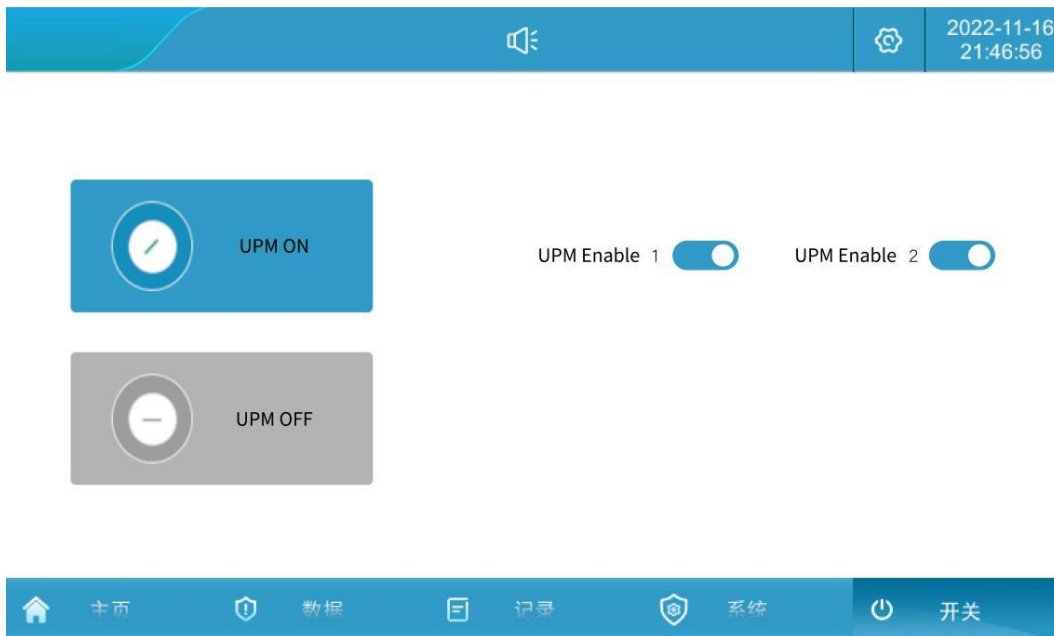


Figure 5-3 Switching Interface

- 4、 Converter shutdown: When the converter is in operation, click "Converter shutdown", as in Figure 5.3.
- 5、 Disconnect the converter auxiliary switch MCB1.

- 6、 Disconnect QF2 DC switch.
- 7、 Disconnect QF1 Grid switch.

5.3. Communication Settings

Note Communication setting refers to the communication protocol setting between LCD touch screen and EMS background.

- 1、 Check that the backstage EMS communication cable has been connected to terminals COM6_A and COM6_B on the back of the touch panel or to the position of the network port.

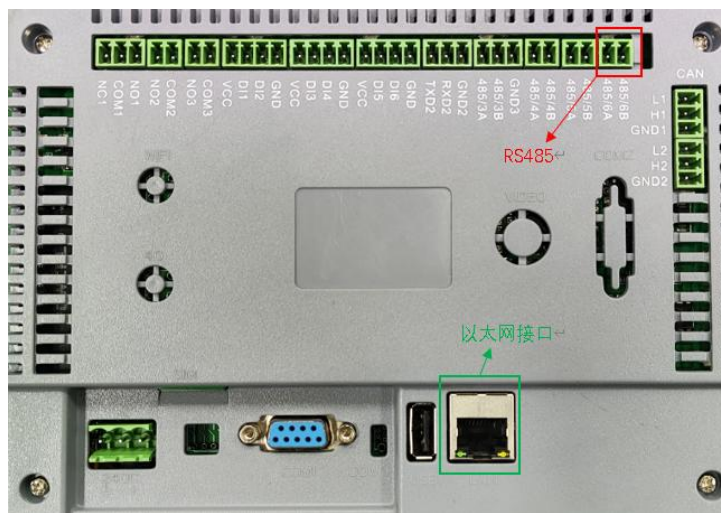


Figure 5-4 Communication wiring check

- 2、 Click on "System" -> "Communication Settings" on the LCD touch screen to enter the communication settings interface.

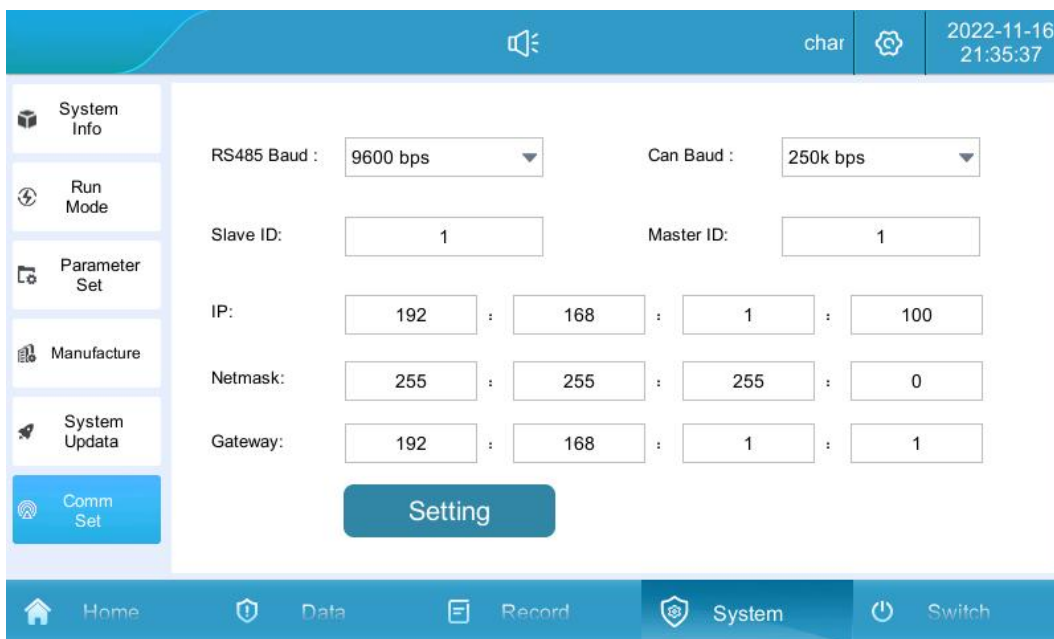


Figure 5-5 Communication Setting Screen

- 3、 Background EMS communication setting 1: If RS485 communication is used, set the local address corresponding to the communication panel to 1, if more than one energy storage converter is connected to the background from the address cannot be repeated.
- 4、 Background EMS communication setting 2: If Ethernet communication is used, the local machine of the energy storage converter is used as the server, the default address of the host is set to 192.168.1.100, and the corresponding local address of the communication panel is set to 1, and the server port is 502, if more than one energy storage converter is accessed to the background IP address can not be duplicated, and the IP address is modified by clicking on the Setup button to configure the IP address.

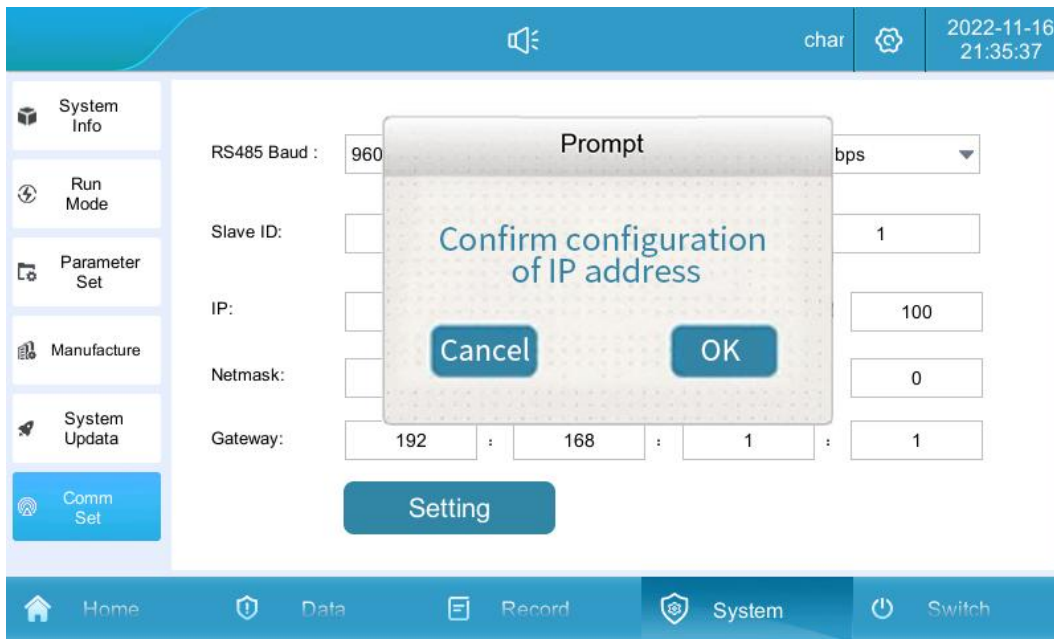


Figure 5-6 IP Address Configuration Screen

5.4. Operating Mode Settings

5.4.1. Introduction of Modes

The operation modes of the energy storage system are categorized into: grid-connected manual mode, and grid-connected automatic mode.

- 1、 **Grid-connected manual mode:** The energy storage system runs in grid-connected mode, but the system startup or shutdown must be manually operated by the user LCD touch screen. The charging and discharging active power, reactive power and power factor of the energy storage system can be set in "Parameter Settings".

2、 **Grid-connected automatic mode:** For peak shaving and valley filling application scenarios, the energy storage system is automatically connected to the grid according to the pre-set time-charging and discharging power.

5.4.2. Grid-connected manual mode

1、 Click “System” -> “Run Mode” mode to enter Figure 5.7.

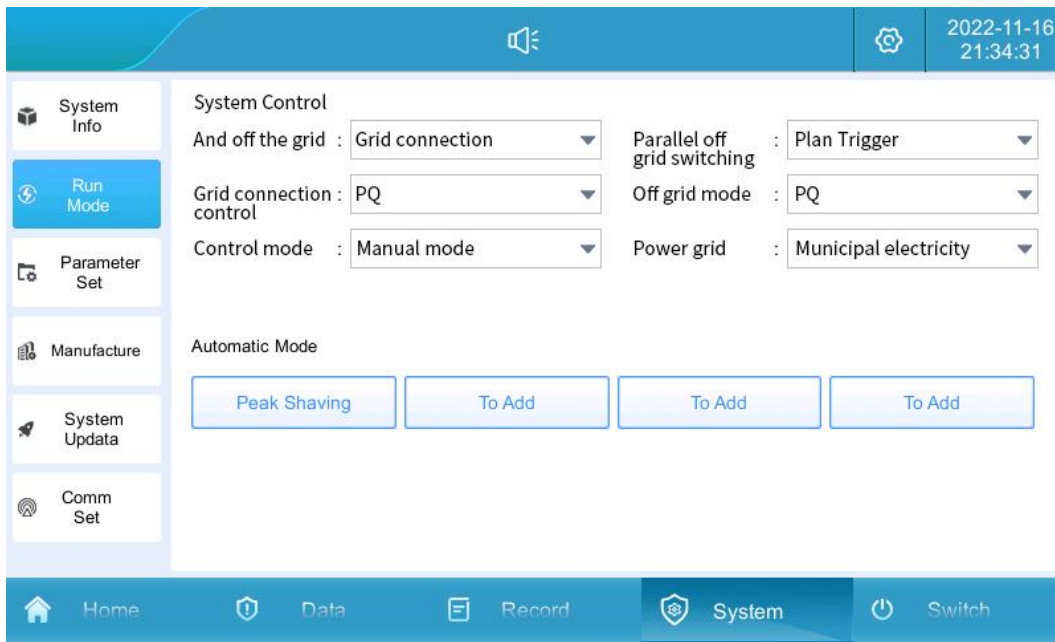


Figure 5-7 Grid-connected manual mode setting

2、 Set the control mode to “Manual Mode” , set the corresponding active power, power factor, reactive power size in the “Parameter Setting” page, and the machine will run according to the set value (positive value for discharging, negative value for charging). The power setting interface is shown in Figure 5.8.

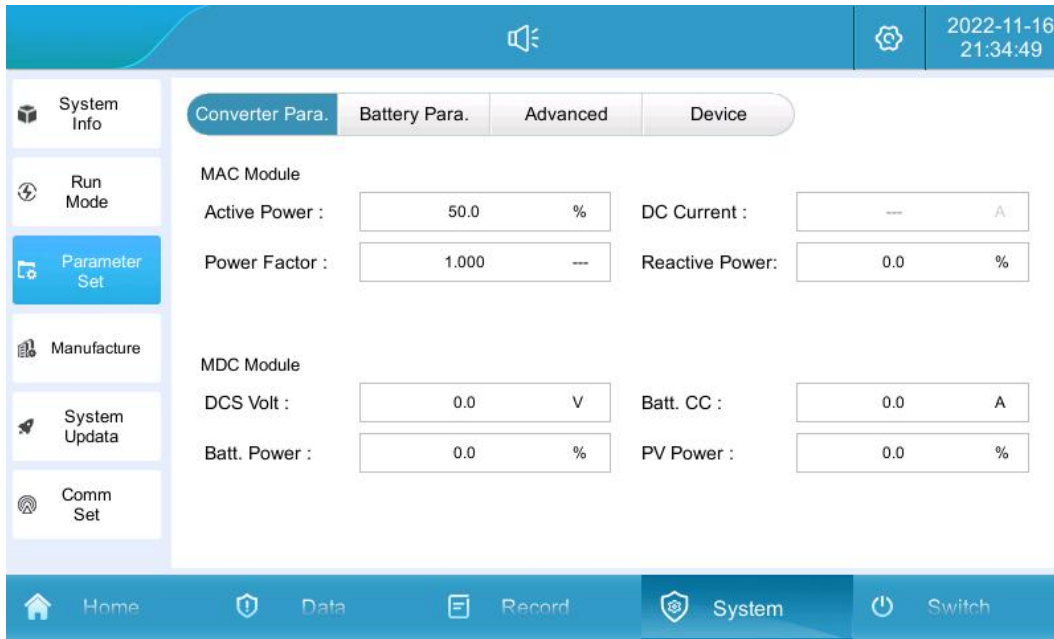


Figure 5-8 Power limit settings

5.4.3. Grid-connected automatic mode

Peak-shaving and valley-filling mode:

- 1、Click "System" -> "Operation Mode" , and then click "Peak Shaving" button to enter the setting page.

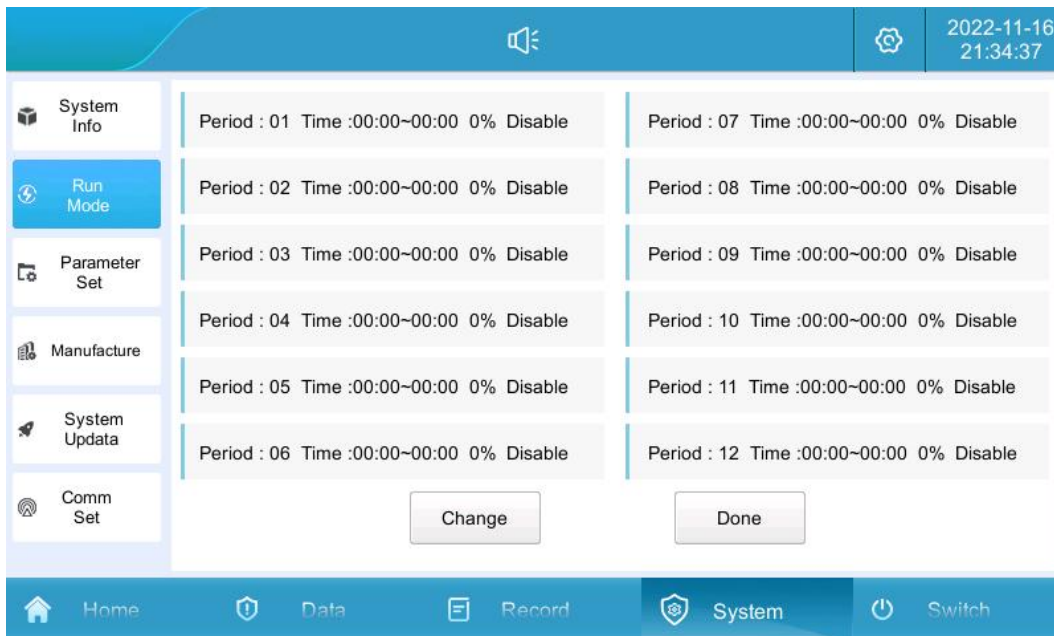


Figure 5-9 Peak Shaving Operation Setup Screen

- 2、Click "System" -> "Operation Mode" , and then click "Peak Shaving" button to enter the setting page.

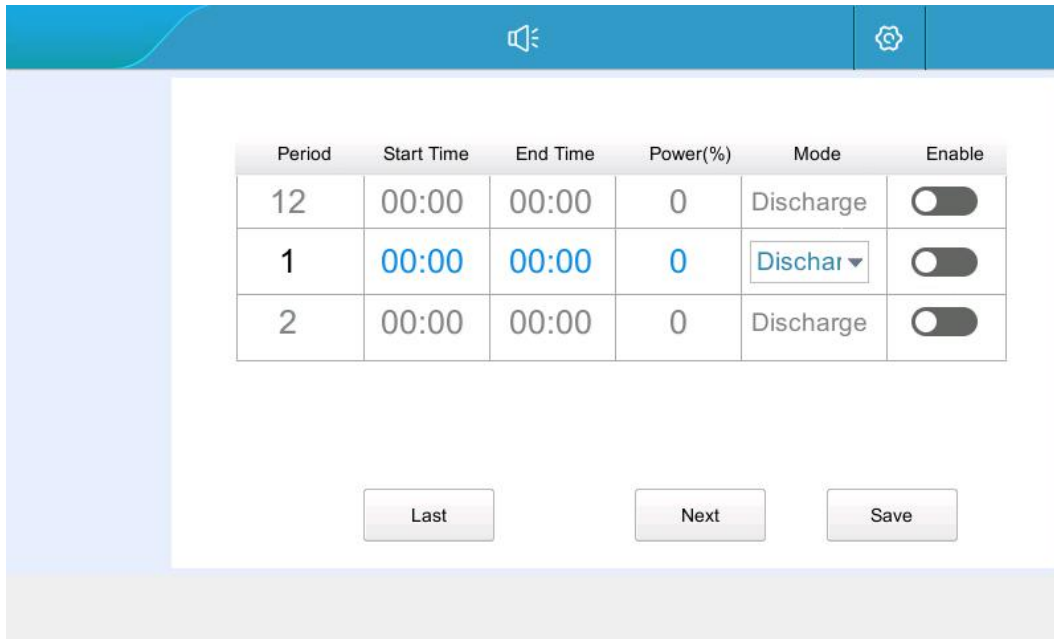


Figure 5-10 Charge and Discharge Time Setting Interface for Peak Shaving

3、Automatically jump to the following screen, click the Finish button.

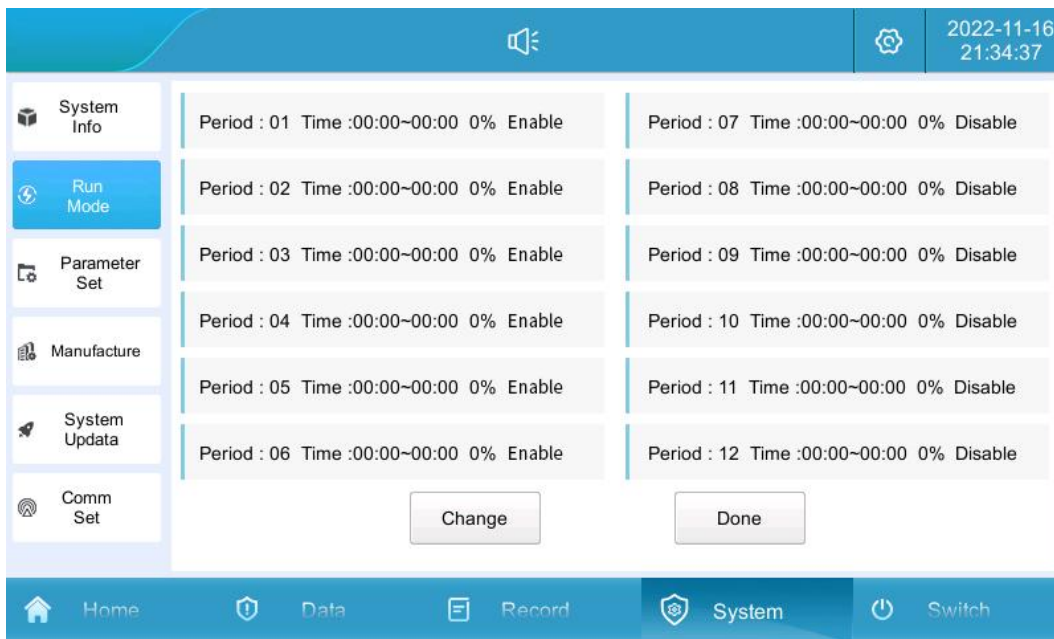


Figure 5-11 Charge and Discharge Time Setting Interface for Peak Shaving

4、"Control mode" changed to " Peak reduction and valley filling" .



Figure 5-12 Peak Shaving control mode

- 5、 This is the automatic mode: pause, click "switch"->"system on" to complete the local automatic control mode setting.

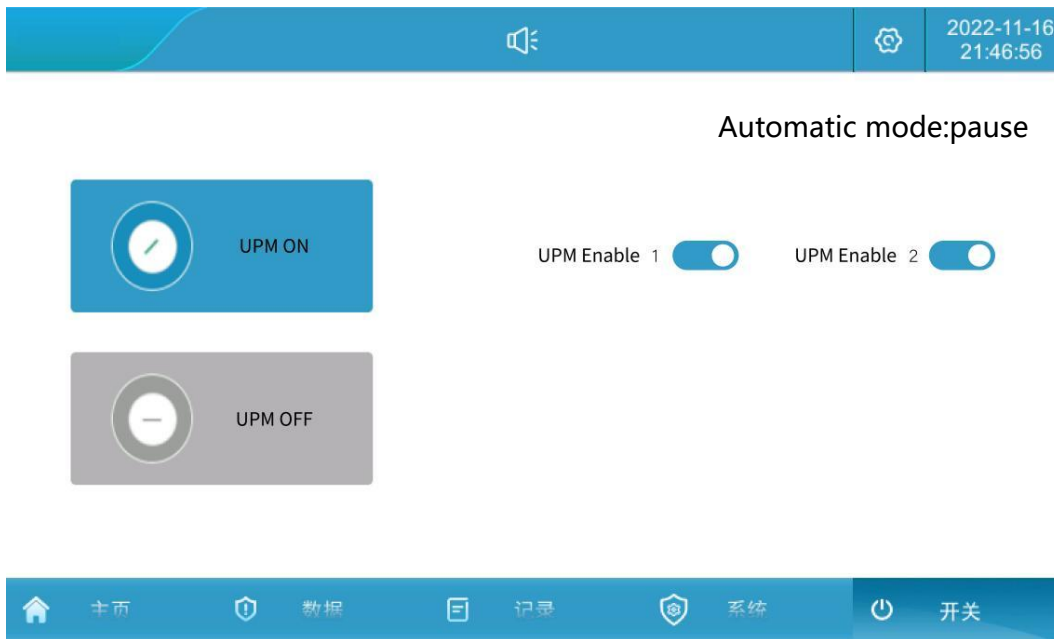


Figure 5-13 Automatic control operation mode on

5.5. Battery Parameter Settings

- 1、 Click 'System' -> 'Parameter Setting' to enter the current page; customers set the upper and lower limits of SOC according to their own needs; it is recommended that the lower limit of SOC is set at a value of not less than 5%.



Figure 5-14 Battery parameter setting interface

5.6. Data Viewing and Exporting

2、Click on "Records" -> "Data Reports" to enter the current page.

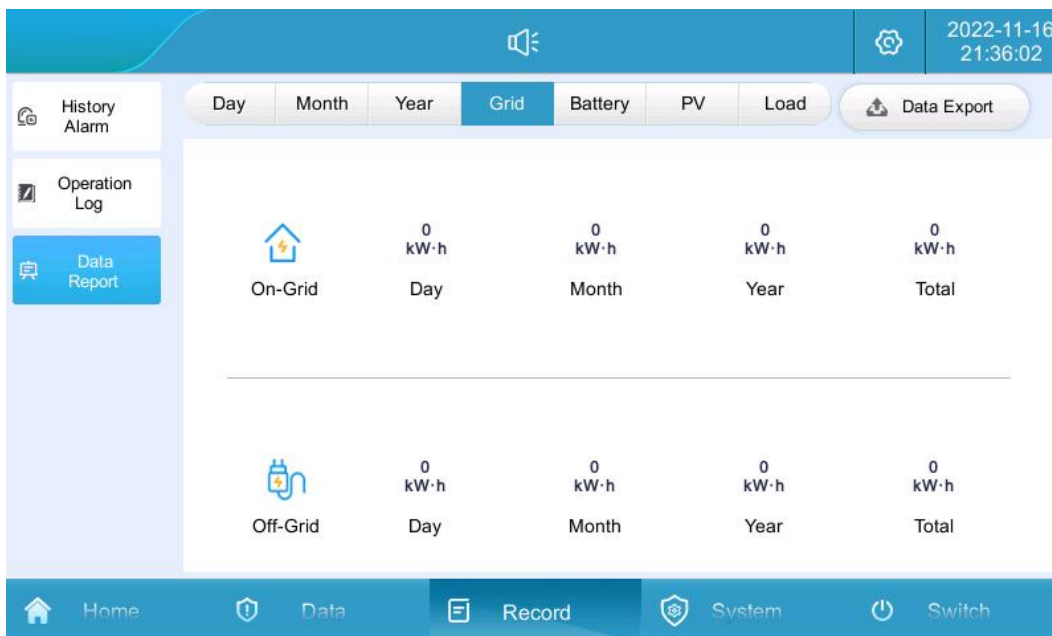


Figure 5-15 Data report screen

- 3、View the total amount of charge and discharge for the day, month, year, and overall.
- 4、Insert a USB flash drive, wait for the USB flash drive to connect, click on "Data Export", and wait for the export to complete.

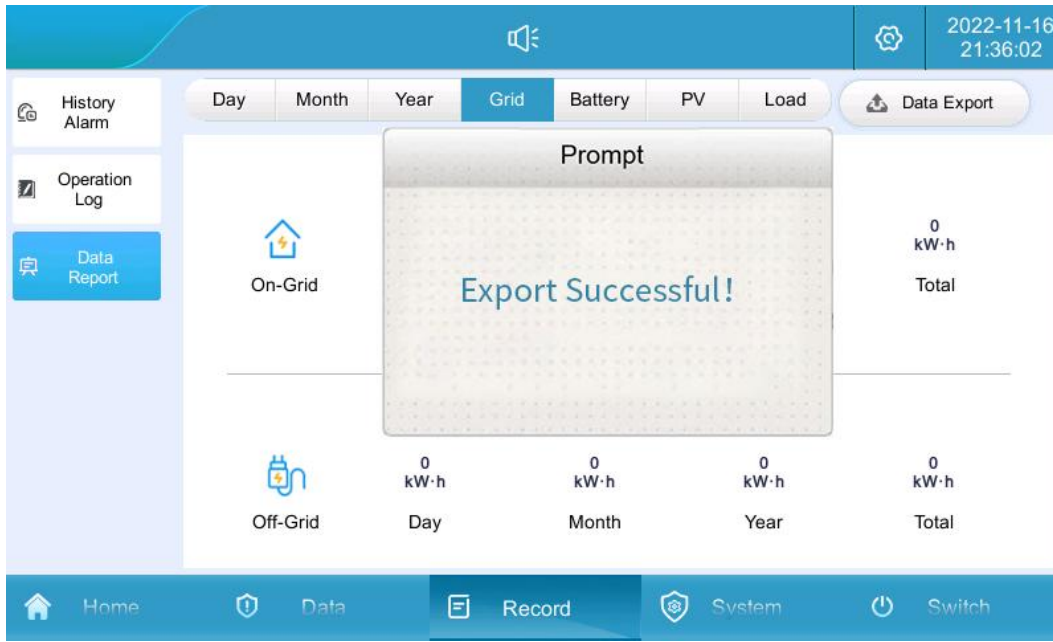


Figure 5-16 Data Export Interface

5.7. Software Upgrade

Software upgrades include the upgrading of three types of software: LCD touch screen software, power module DSP software, and power module ARM software. Before upgrading, turn off the system on the "Switch" page of the touch screen, meaning that the software must be upgraded while the system is not running.

- 1、 First, prepare a USB flash drive and a computer. Create a new folder named "UPDATE" on the USB flash drive to store the burning files.



Figure 5-17 Creating an upgrade software folder

- 2、 Copy the required DSP, LCD, and ARM firmware for system upgrading into the "UPDATE" folder.

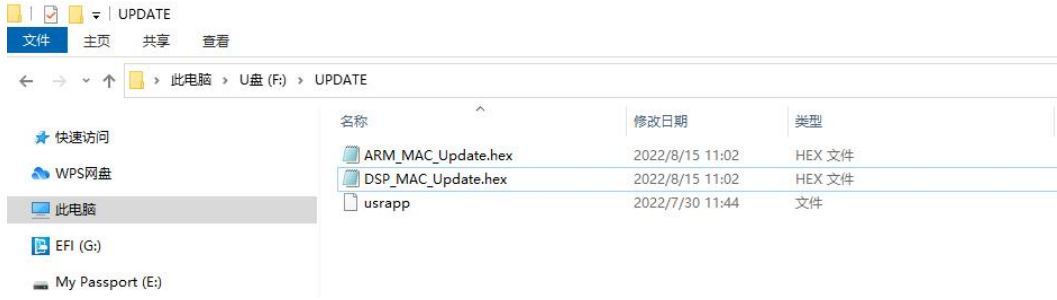


Figure 5-18 Storing the upgrade software

- 3. Click on "System" -> "System Upgrade", enter the password "888888" to access the upgrade page.



Figure 5-19 Upgrade Software Password Verification

- 4. Insert the USB flash drive into the back of the touch screen, and the interface will display that the USB flash drive is connected and the upgrade file is detected.
- 5. To upgrade the LCD touch screen software, click on "LCD Upgrade" and wait for approximately 15 seconds until a prompt appears indicating that the upgrade was successful.

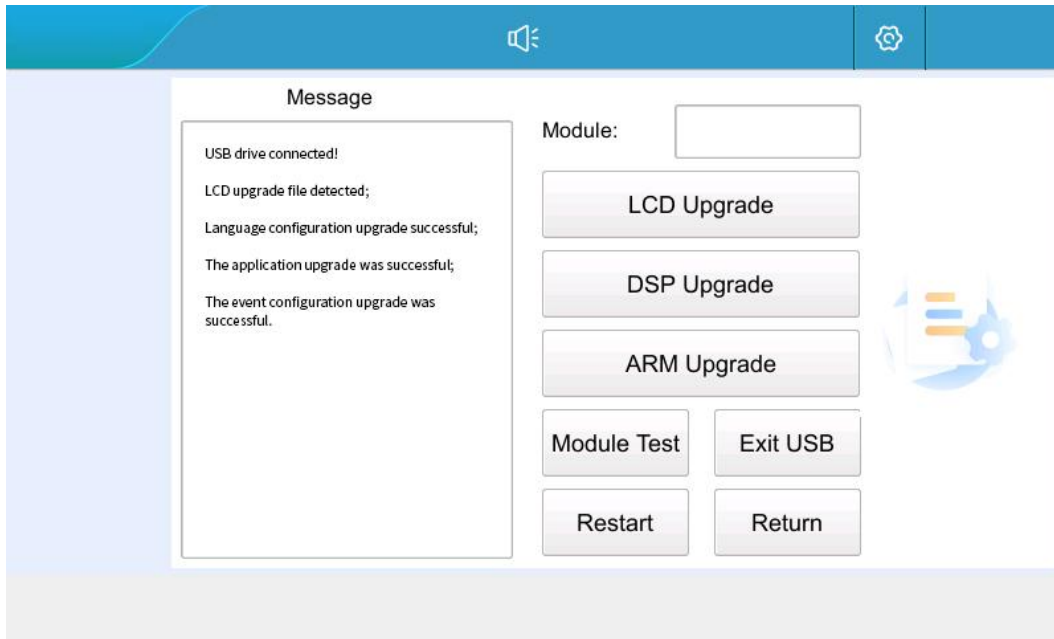


Figure 5-20 LCD Upgrade Software and Reboot Interface

- 6、 After upgrading the LCD touch screen software, click on the "Restart" button to make the version refresh effective, as shown in Figure 5.24. Customers can choose to upgrade the DSP and ARM software after completing the upgrade of the LCD touch screen software, and then click on "Restart" when ready.
- 7、 To upgrade the power module DSP/ARM, select the module to be upgraded in the module box on the "System Upgrade" interface (when there are multiple modules in the system, it is recommended to start with upgrading Module 1, then set and upgrade Module 2, and continue until all modules are upgraded).
- 8、 Click on "DSP/ARM Upgrade" and wait for approximately 5 minutes until a prompt appears indicating that the upgrade was successful. The system upgrade is now complete.

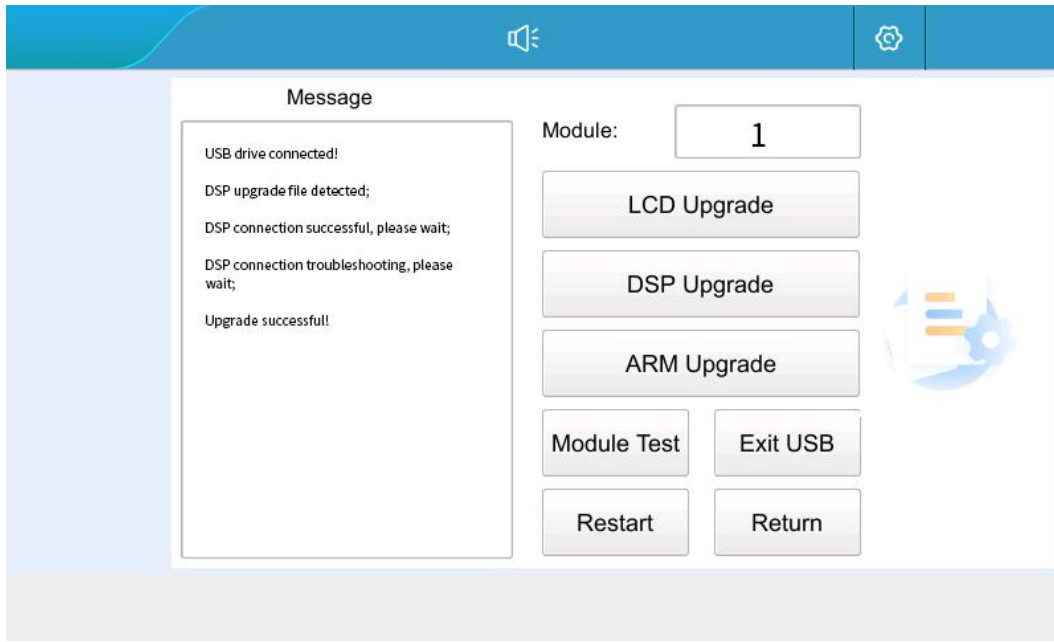


Figure 5-21 DSP/ARM Upgrade Interface

6. Warning and Maintenance

Warning levels are defined as follows:

- The equipment has failed, and the system has stopped operating (charging/discharging).
- Warning: The equipment's output power has decreased or some functions have failed due to external factors, but this does not affect the system's charging and discharging functions.

6.1. Handling of warnings

Table 6-1 Fault Alarm Handling Methods

Warning/Failure	Problem Cause	Handling
<i>Lightning arrester alarm</i>	<i>lightning arrester failure</i>	<ol style="list-style-type: none"> 1. Check whether the lightning arrester signal line connection is loose; 2. Check whether the lightning protector indicator is discolored; 3. Replace the AC lightning protector.
<i>Over-voltage / under-voltage fault of power grid</i>	<i>Abnormal voltage on the grid-connected side</i>	<i>Check whether the voltage at the grid side is abnormal</i>
<i>Over-frequency/under-frequency fault of power grid</i>	<i>Abnormal frequency at grid side</i>	<i>Check whether the frequency at the grid side is abnormal</i>
<i>Island protection fault</i>	<i>Abnormal voltage on the grid-connected side</i>	<i>Check whether the voltage at the grid side is abnormal</i>
<i>High/low voltage ride-through alarm</i>	<i>Abnormal voltage on the grid-connected side</i>	<i>Check whether the voltage at the grid side is abnormal</i>
<i>Grid voltage imbalance fault</i>	<i>abnormal voltage on the grid side</i>	<i>Check whether the voltage at the grid side is abnormal</i>
<i>Phase fault of power grid</i>	<i>Phase sequence at grid side is connected wrongly</i>	<i>Exchange any two cables among the three lines of ABC</i>
<i>Low DC voltage Alarm</i>	<i>Insufficient voltage on DC side</i>	<ol style="list-style-type: none"> 1. Check if DC wiring is loose or abnormal; 2. Check whether the battery is turned on.
<i>DC voltage reverse fault</i>	<i>DC external wiring error</i>	<i>Adjust DC positive and negative cables</i>
<i>DC voltage high/low fault</i>	<i>Battery voltage abnormal</i>	<i>Check the DC input voltage is abnormal</i>
<i>Over-voltage fault of busbar</i>	<ol style="list-style-type: none"> 1. Load imbalance 2. Software exception 	<ol style="list-style-type: none"> 1. Check whether the DC wiring is loose or abnormal 2. Contact the manufacturer
<i>Busbar half-voltage imbalance fault</i>	<ol style="list-style-type: none"> 1. Load imbalance 2. Software exception 	<ol style="list-style-type: none"> 1. Check whether the load is abnormal 2. Contact the manufacturer
<i>Over-temperature derating alarm</i>	<i>Internal temperature is too high</i>	<ol style="list-style-type: none"> 1. Check whether the air inlet and outlet of the electrical compartment are blocked 2. Check whether the internal fan is working properly 3. Contact the manufacturer

Energy Storage Converter

<i>Transformer high temperature</i>	<i>Failure Transformer heat dissipation abnormality</i>	<ol style="list-style-type: none"> 1. Check whether the ambient fan is operating normally; 2. Check whether the temperature switch wiring is loose; 3. Check whether the air inlet and outlet of the electrical warehouse are blocked.
<i>Over-temperature fault of power tube</i>	<i>Internal temperature is too high</i>	<ol style="list-style-type: none"> 1. Check whether the air inlet and outlet of the electrical compartment are blocked 2. Check whether the internal fan is working properly 3. Contact the manufacturer
<i>Over-temperature alarm of balance bridge</i>	<i>Internal temperature is too high</i>	<ol style="list-style-type: none"> 1. Check whether the air inlet and outlet of the electrical compartment are blocked 2. Check whether the internal fan is working properly 3. Contact the manufacturer
<i>DC over-current Fault</i>	<i>DC current overrun</i>	<ol style="list-style-type: none"> 1. Check for short circuits or broken wiring on the DC side; 2. Replace the storage converter module or contact the manufacturer.
<i>Balance bridge over-current fault</i>	<i>Internal current overrun</i>	<ol style="list-style-type: none"> 1. Check whether the inlet and outlet of the electrical compartment are blocked; 2. Check whether the internal fan operates normally; 3. Contact the manufacturer.
<i>Output overload/over-current fault</i>	<i>AC side power/current overrun</i>	<ol style="list-style-type: none"> 1. Check whether the grid voltage is normal 2. Check whether there is a short circuit or line damage on the DC side 3. Check whether the off-grid load exceeds the limit 4. Replace the energy storage converter module or contact the manufacturer
<i>Wave-by-wave current limiting fault</i>	<i>AC side current overrun DC side voltage oscillation</i>	<ol style="list-style-type: none"> 1. Check whether the grid voltage is normal; 2. Check whether the off-grid load is overrun; 3. Check whether DC side voltage is normal; 4. Replace the energy storage converter module or contact the manufacturer.
<i>Communication interruption fault</i>	<i>Communication interruption</i>	<ol style="list-style-type: none"> 1. Check whether the communication network cable between the modules is loose and abnormal; 2. Check whether the communication network cable of the local controller is loose and abnormal.
<i>Parallel operation/synchronization failure</i>	<i>Parallel/synchronization signal interruption</i>	<ol style="list-style-type: none"> 1. Check whether the parallel cable is loose or abnormal 2. Check whether the parallel setting is abnormal 3. Hardware circuit damage
<i>Relay open/short circuit fault</i>	<ol style="list-style-type: none"> 1. Internal relay is abnormal 2. Software exception 	<ol style="list-style-type: none"> 1. Replace the energy storage converter module 2. Contact the manufacturer to replace the internal parts
<i>Pre-charge fault</i>	<i>Internal soft start circuit abnormal</i>	<ol style="list-style-type: none"> 1. Replace the energy storage converter module 2. Contact manufacturer to replace internal board
<i>Battery type misconfiguration</i>	<i>External DC wiring error</i>	Check whether the corresponding PV, battery or DC source is connected to the correct DC switch
<i>Fan 1/2/3 alarm</i>	<i>Internal fan abnormality</i>	<ol style="list-style-type: none"> 1. Replace the energy storage converter module 2. Contact the manufacturer to replace the internal fan
<i>Leakage current fault</i>	<ol style="list-style-type: none"> 1. Excessive leakage current 2. Software exception 	<ol style="list-style-type: none"> 1. Check whether the leakage current Hall is loose or abnormal 2. Check whether the ground wire is disconnected
<i>Abnormal insulation impedance fault</i>	<ol style="list-style-type: none"> 1. Low insulation to ground 2. Software exception 	<ol style="list-style-type: none"> 1. Check whether the AC and DC cables are damaged or short-circuited to the ground 2. Check whether the battery line is damaged or short-circuited to the ground
<i>Module Loss Alarm</i>	<i>Module-to-screen communication is interrupted</i>	Check whether the communication network cable between modules is loose and abnormal



The above alarms and faults are common alarms or faults. If any faults other than those listed in Table 6.1 occur, please contact the manufacturer directly.

6.2. Routine Maintenance

Due to the influence of ambient temperature, humidity, dust, vibration, and aging of internal components of the inverter, the system may encounter some potential issues during operation. To ensure the long-term and stable operation of the energy storage system, it is necessary to arrange maintenance personnel to conduct regular inspections according to Table 6.2, and promptly discover and address any issues. Systems installed in areas with severe dust and sand, high salt fog, or heavy industrial parks are recommended to be maintained once every quarter, while energy storage systems in areas with good climatic conditions are recommended to be maintained once every six months.

Table 6-2 Routine maintenance tasks

Maintenance objects	Movements	Reference standard
<i>cabinet</i>	<ul style="list-style-type: none"> • Check the appearance of the whole machine • Checking the vents • Check door lock condition 	<ul style="list-style-type: none"> • No obvious coating peeling, scratches or rusting • No obvious signs of water leakage • No accumulation of dust in vents • No damage to door locks
<i>Energy storage converter</i>	<ul style="list-style-type: none"> • Check for noise and vibration • Check front panel vents • Check the rear copper contact surface 	<ul style="list-style-type: none"> • The front panel fan rotates normally, without stuttering or rattling • The surface of the front panel vent is clean and not blocked. • No corrosion and discoloration of copper rows and contact surfaces, and no accumulation of dust.
<i>Electricity</i>	<ul style="list-style-type: none"> • Check the lightning protector • Check cable copper contact surface 	<ul style="list-style-type: none"> • Lightning protector is normal • No loose screws and sockets connecting wires. • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation

6.3. Warranty Service

6.3.1. Warranty Period

Under the condition of correct product usage, the warranty period shall be subject to the commercial contract.

6.3.2. Warranty Scope

During the warranty period, if any fault occurs due to the product's inherent quality issues, Jiangsu Natong Energy Technology Co., Ltd. will provide free maintenance or product replacement to the customer. Customers should reserve a reasonable response time for our company's maintenance, and the replaced product will be disposed of by our company. Customers are required to present relevant proof of product purchase and ensure that the product trademark is clearly visible. Otherwise, our company reserves the right to refuse warranty coverage.

6.3.3. Disclaimer

Our company is not obligated to provide warranty coverage in the following situations, but we can still offer paid maintenance services:

- The warranty period has expired.
- Relevant proof of product purchase cannot be provided.
- Damages caused during transportation, loading, or unloading.
- Damages caused by incorrect installation, modification, or dismantling by unauthorized personnel.
- Damages caused by operation under abnormal usage conditions or environments.
- Machine malfunctions or damages caused by the use of non-Natong components or software.
- Faults caused by irresistible factors such as fire, earthquake, flood, etc.

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