



2500kWh BESS OUTDOOR STORAGE CONTAINER

User Instruction

CONTENES

1. Security Precaution	1
1.1. Security Symbols Explanation	1
1.2. Personnel Safety	1
1.3. General Safety	1
1.4. Electrical Safety	3
1.4.1. Wiring Requirements	3
1.4.2. Grounding Requirements	4
1.4.3. Maintenance Requirements	4
1.5. Mechanical Safety	5
2. Product Introduction	6
2.1. Product Features	6
2.2. System Topology	7
2.3. Product Layout	8
2.4. System Technical Specifications	9
2.5. Key Components	9
3. Installation Wiring	11
3.1. Transportation and Handling	11
3.1.1. Product Transportation	11
3.1.2. Product Handling	11
3.2. Packaging and Storage	12
3.2.1. Product Packaging	12
3.2.2. Product Storage	12
3.3. Installation Environment Requirements	12
3.4. Before Installation	14
3.5. Electrical Cable Installation	15
3.6. Communication Cable Installation	16
3.7. Inverter Side Wiring	17
3.7.1. MPS Series Inverter	17
3.7.2. Remove the Switch Baffle And Lower Coaming	17
3.7.3. Introduction of Inverter Status	18
3.8. DC Side Wiring	18
3.8.1. Battery Pack Specification	18

3.8.2 Battery Module Front Interface	20
3.8.3 High Voltage Control Module	21
3.8.4 Brackets installation	22
3.8.5. Installation and Configuration	23
3.8.6. Battery Connection	24
3.9. AC Side Wiring	25
3.9.1. AC Connection	25
3.9.2. AC Side Line Steps:	26
3.10. System Grounding	26
3.11. Installation Is Complete	26
4. Startup and Debugging	27
4.1. Pre-startup Inspection	27
4.2. Start-Up Operation	28
4.3. Shutdown Operation	30
4.3.1.Normal Shutdown	30
4.4. Emergency Shutdown	31
5. Running and Operation	32
5.1. Operation interface	32
5.2. Alarm Buzzer	33
5.3. Communication Settings	33
5.4. Software Introduction	34
5.4.1. Homepage introduction	34
5.4.2. Introduction to Status Menu	36
5.4.3. Introduction to Record Menu	36
5.4.4. Introduction to System Settings Menu	37
6. Fault Handling and Maintenance	38
6.1. Fault Handling	38
6.1.1. Troubleshooting	38
6.1.2. Non-Alarm Inducing Failure	38
6.1.3. Alarm Failure List	39
6.2. Maintenance	40

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.

 • **Danger:** Indicates a high potential for danger, such as a situation that will result in death or serious injury if not avoided.

 • **Warning:** Indicates a moderate potential for danger, such as a situation that could result in death or serious injury if not avoided.

 • **Caution:** Indicates a low potential for danger, such as a situation that could result in moderate or minor injury if not avoided.

 • **Note:** Indicates a potentially hazardous situation which may result in device failure or a fault if not avoided.

1.2. Personnel Safety

Only professional electricians or qualified personnel are allowed to carry out all operations on this product.

- Operators should be fully familiar with the structure and working principle of the entire energy storage system.
- Operators should be fully familiar with the manual MPS series energy storage converter user manual.
- Operators should be fully familiar with the relevant standards in the country/area where the project located.

1.3. 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.

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.

 Danger:

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.

- 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.



Description:

- 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 container first, and then open the container door to avoid debris falling into the container.

- 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.

1.4. Electrical Safety

1.4.1. 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 container 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.

1.4.2. 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.

1.4.3. 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.



Description:

- 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.

1.5. Mechanical Safety



Attention:

- 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 elected 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.



Warning:

- It is prohibited to open the container door in rain, snow, lightning, sand, dust,

fog, or other weather.

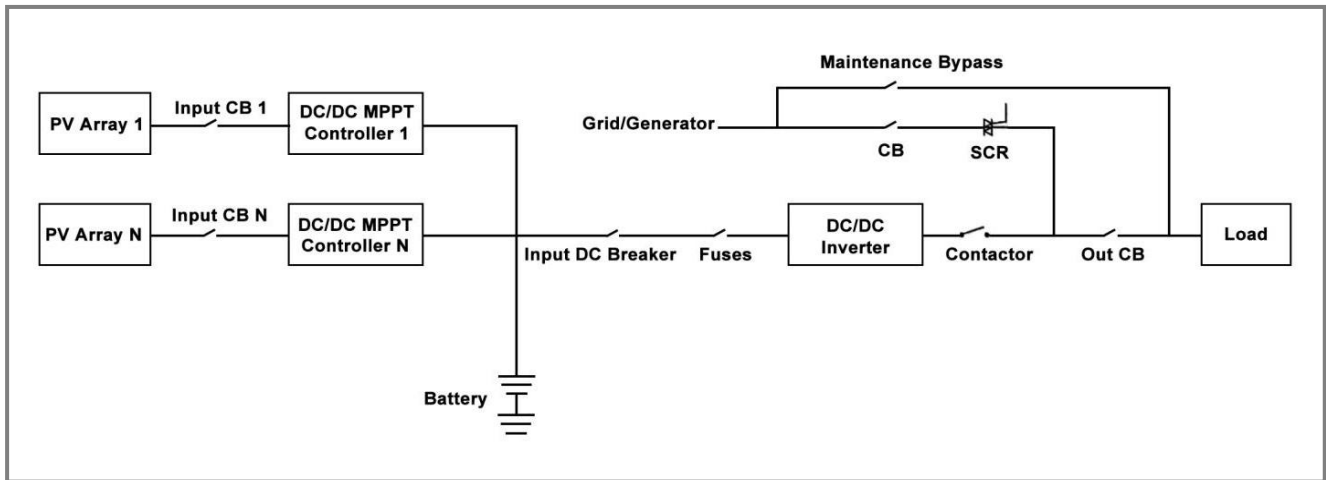
- Before parts are removed from the container, make sure that other parts on the container are not loose.
- During equipment maintenance, cover nearby energized parts with insulating material.
- Prohibit any objects from touching the running fan (e.g., fingers, parts, screws, etc.) until the fan is de-energized 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 container 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 container door should be locked in time and the key should be kept properly.

2. Product Introduction

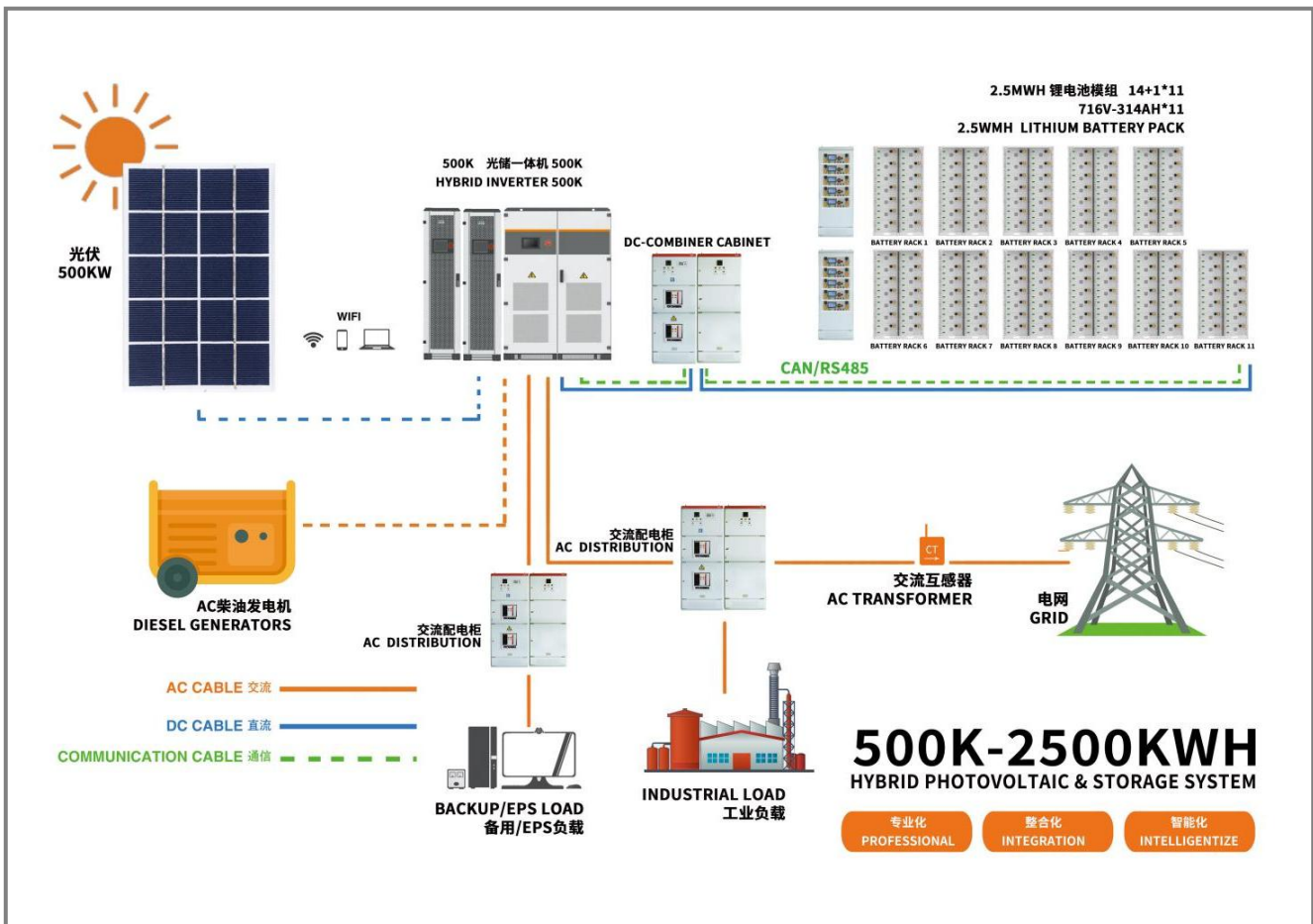
2.1. Product Features

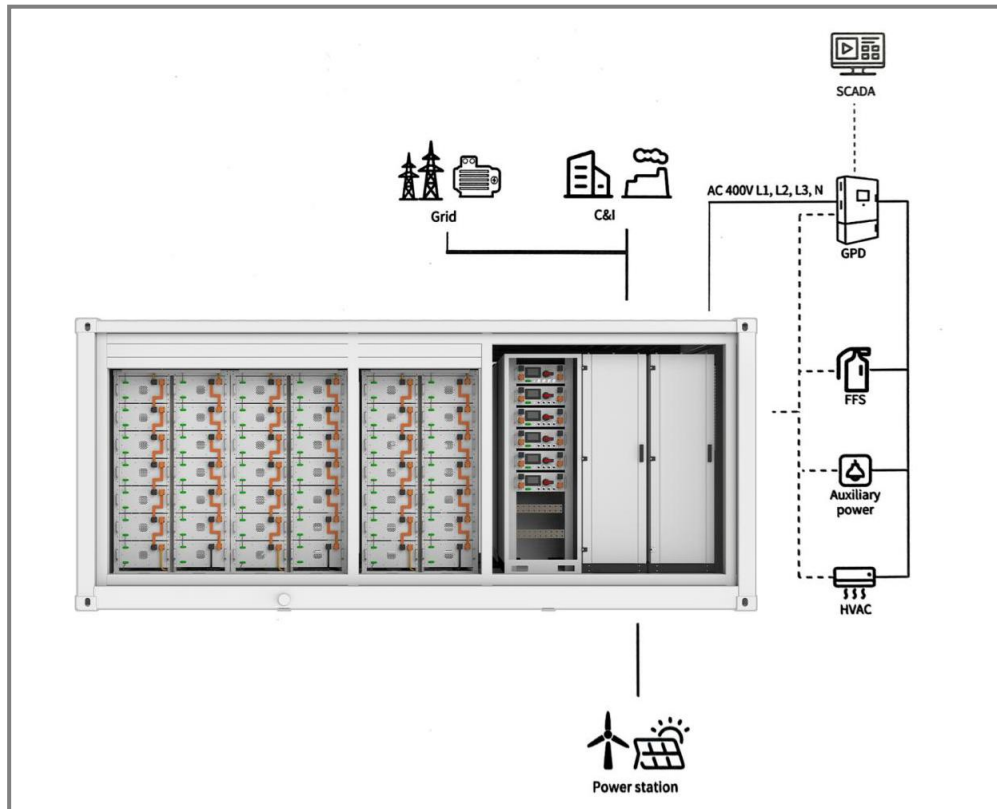
500kW - 2500 kWh BESS outdoor container integrates energy storage battery, modular DCDC/PCS, energy management monitoring system, power distribution system and fire control system. Adopting modularized DC DC/PCS, it is easy to maintain and expand capacity, and the outdoor container adopts front maintenance, which can reduce the footprint and maintenance access, and is characterized by safety and reliability, rapid deployment, low cost, high energy efficiency and intelligent management. It is ideal for mostly utility and C&I applications, such as renewable energy power plant supplement, factories, buildings, etc.

2.2. System Topology

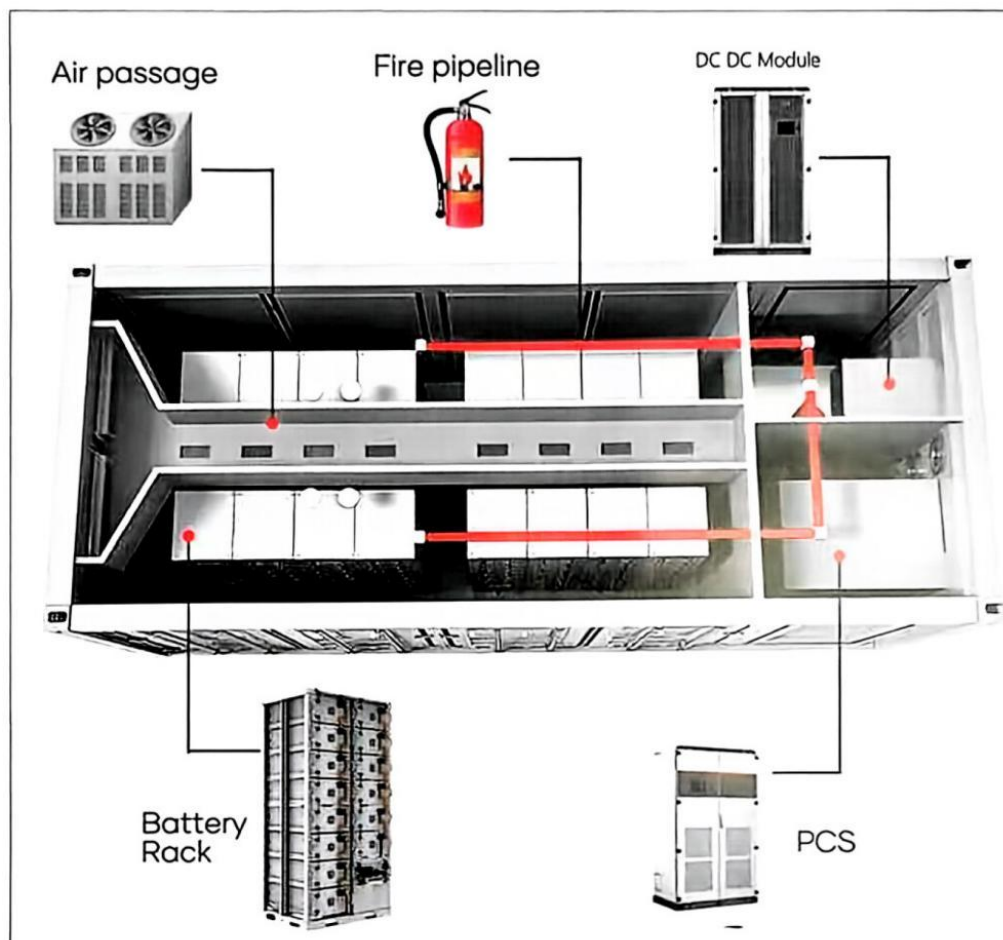


500K-2500KWH HYBRID PHOTOVOLTAIC & STORAGE SYSTEM





2.3. Product Layout



2.4. System Technical Specifications

Item	H-500K/2500kWh
AC Data	
Rated AC power	500kW
Maximum AC power	550kW
Rated voltage	400V
Grid voltage range	342-418V(configurable)
AC rate of current	722A
Output THDi	<3%
AC PF	1leading-1lagging(settable)
AC output	3-Phase+PE
General Data	
Dimension w/o clearances (L*W*H)	12192*2438*2591mm
Weight of the whole system	31t
Degree of protection	IP54
Operating temperature range	-20-40° C
Relative humidity	0-95% (non-condensing)
Max. working altitude	3000m/10000feet (> 2000m/6500feet derating)
Cooling concept of DC hatch	HVAC
Fire fighting system	NOVEC1230/FM-200
Communication interfaces	RS485, Ethemnet, GPRS
Certificates	CE,IEC62933, UN3536, etc

2.5. Key Components



- 0.5C Charge/Discharge;
- Power supply can be single battery string or parallel battery strings;
- Easy configuration and maintenance.

Battery String-225K-314

Item	Data
Product	314Ah
Nominal Voltage	716.8V
Nominal Capacity	225kWh
Discharge Cut-Off Voltage (V)	616
Charge Cut-Off Voltage (V)	795.2
Recommend Charge/Discharge Current	100A
Max. Charge/Discharge working Current	160A
Cycle Life	(0.5C/0.5C-80% DOD) >6000 times
Dimensions (WxDxH)	1090*780*2190mm
Weight	1804kg
Certifications	UN38.3/MSDS/ROHS



- Integrated MPPT module/ transformer/ STS/ maintenance bypass.
- Support 100% unbalance.
- Support parallel connection of multiple machines.
- Global launch of MPPT step-up/-down adaptive technology, supporting flexible configuration of PV capacity
- Support DG load rate control to improve fuel economy.
- Support flexible configuration of control strategies.

Power Conversion System

Item	Data
Battery voltage range(V)	500~950
AC Rated current(A)	722
Rated AC power(KW)	500
Max output power(kVA)	550
Rated voltage(V)	400
Voltage range(V)	320~460
AC Rated frequency (Hz)	50/60
THDi	<3%
Transformer ratio	315/400

Overload capacity	110% long-term, 120% 1min
THDU	≤1% linear; or ≤5% nonlinear
Dimensions (W*D*H)	(600*720*2,050)*2+1,600*1,050*2,050
Weight(kg)	3,205/3,235/3,265
Operation temperature (° C)	-30~55
Relative humidity	0~95% non-condensing
Ingress protection	IP20
Noise emission (dB)	<70
Operating altitude (m)	>3,000 Derating
Cooling	Air Cooling
BMS communication	RS485, CAN

3. Installation 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 container with a crane, ensure that the crane has sufficient load capacity, rationally arrange the lifting points and pay attention to the center of gravity of the equipment to prevent personal injury and equipment damage.
 - When transporting with batteries, the load capacity of the forklift should be >3t.
 - It is recommended that the fork length should be 1.5m, the width should be 50cm~80cm, and the thickness should be 25cm~70cm.

3.2. Packaging and Storage

3.2.1. Product Packaging

The outer package is marked with detailed product parameters and transportation requirements. Please transport according to the various marks on the package. 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

Parameter	Description
Model	Product model
Size	Product packing size
Weight	Total weight of product after packing
Identification	Face up, handle with care, center of gravity position, etc.

3.2.2. Product Storage

If the batteries are 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

Parameter	Description
Storage temperature	-40°C~ + 70°C
Storage relative humidity	< 95%(no condensation)
Height	<3000m

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 "GB51048-2014 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 >2km.

- 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.

Description:

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.

3.4. Before Installation

- 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.
- 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 3.4 Delivery list

Serial number	Name	Quantity	Note
1	Energy container with PCS/AC cabinet/ DC cabinet	1	Key for cabinet door
2	Battery pack	77	Wooden box
3	User manual	1	
4	Certificate of conformity	1	
5	Warranty card	1	

Users need to prepare relevant installation tools before installation.

Serial number	Name	Quantity	Note
1	Screwdriver set	1	
2	Socket	1	
3	Multimeter	1	
4	Forklift/crane	1	
5	Crews, nuts, gaskets	1	

3.5. Electrical Cable Installation

This product adopts an all-in-one structure, only electrical cable installation for the Solar panels, Battery pack, 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

Capacity	AC cables	Neutral	Ground	Battery	Photovoltaic
250kW	$\geq 2 \times 120\text{mm}^2$	$\geq 2 \times 120\text{mm}^2$	$\geq 95\text{mm}^2$	$\geq 2 \times 120\text{mm}^2$	50mm ² /group
500kW	$\geq 4 \times 120\text{mm}^2$	$\geq 4 \times 120\text{mm}^2$	$\geq 2 \times 95\text{mm}^2$	$\geq (4 \times 120\text{mm}^2)$	50mm ² /group



Danger:

- When performing electrical installation, you can refer to the following suggestions for electrical installation:
 - Before wiring, check that all switches inside the equipment are in the off position to ensure that the equipment is not energized.
 - Disconnect the power grid switch before wiring to ensure that the cables are not energized.
 - 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.
 - 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.
 - 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.
 - 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.
 - All AC cables should enter the equipment through the bottom access holes and be connected to the corresponding phase sequence.
 - 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

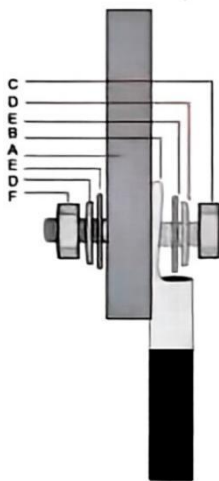
equipment or cables.

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.

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



Serial number	Name
A	Copper Busbar
B	Wiring Terminal
C	Screw
D	Spring Washer
E	Big Flat Gasket
F	Nut

Illustration of Fixed Screw Installation

! Attention:

- 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.

3.6. Communication Cable Installation

When laying communication cables, DC and AC circuits need to be laid separately, 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.

3.7. Inverter Side Wiring

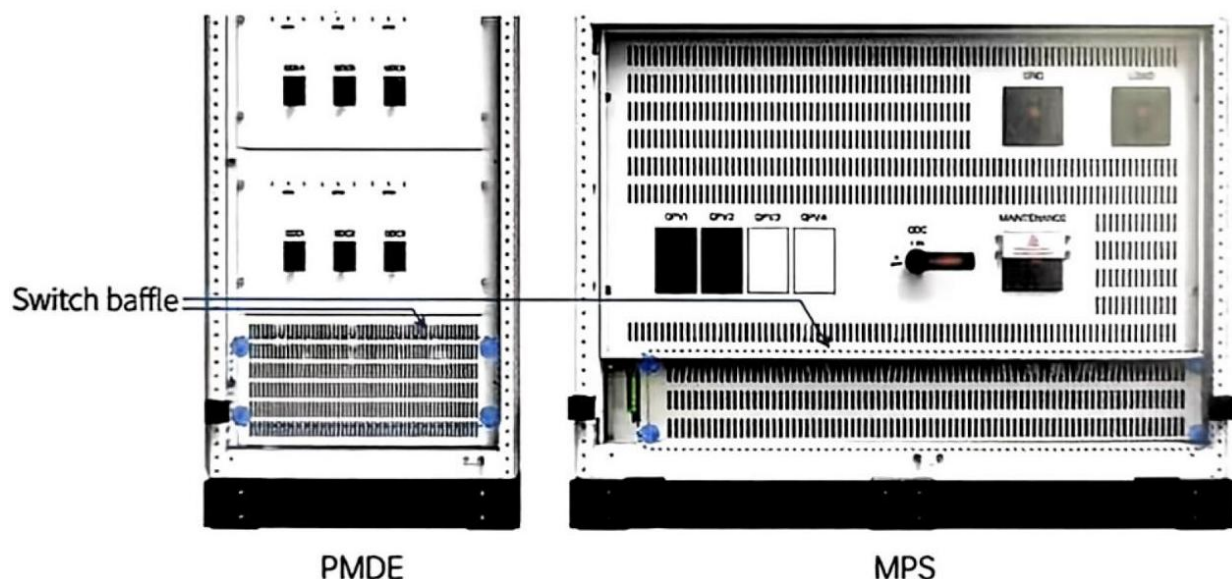
3.7.1. MPS Series Inverter

The inverter achieves the rectification and inversion through a three-phase full-bridge inverter, and the rectified output is injected into the energy storage battery. The inverter output is turned into sine wave voltage via the LC filter, then goes through the isolated boost of three-phase transformer and then is incorporated into the grid power generation or becomes off-grid power supply to the load.

3.7.2. Remove the Switch Baffle And Lower Coaming

With a screwdriver, loosen the four screws of the lower baffle of the switch, remove the screw and the lower baffle of the switch, and the wiring operation can be carried out. Open the front door as shown Table 3.7.2.

Table 3.7.2. Switch baffle



3.7.3. Introduction of Inverter Status

There are six states of energy storage inverter, as shown in Table 3.7.3. below.

Table 3.7.3. Status and Description

Status	Description
Operation	Normal operation of energy storage inverter.
Standby	When the inverter receives standby instructions from the LCD screen or the host computer, it turns to standby state in shutdown or operation mode. When the AC and DC contactors of the inverter are closed in standby state, the system is in hot standby state. When the LCD screen or the host computer carries out relevant control, the inverter can respond quickly.
Fault	When the energy storage system fails, the inverter will stop working, automatically disconnect the contactor on the AC and DC side, and the main circuit will be disconnected from the battery, power grid or load. In the fault state, the system always monitors whether the fault is eliminated or not. If the fault is not eliminated, the system maintains the fault state. If the fault is eliminated, it will enter standby state after the default of 30 seconds.
Shutdown	If the energy storage inverter is in the normal "running" state, the user can stop the energy storage inverter by issuing the stop instruction from the host computer, or Turn off the key through the LCD screen switch page.
Emergency shutdown	In case of failure or emergency, press the emergency shutdown button (EPO) to stop the inverter.
Shutdown	Energy Storage Inverter All Circuit Breakers Disconnect and Switch Reset.

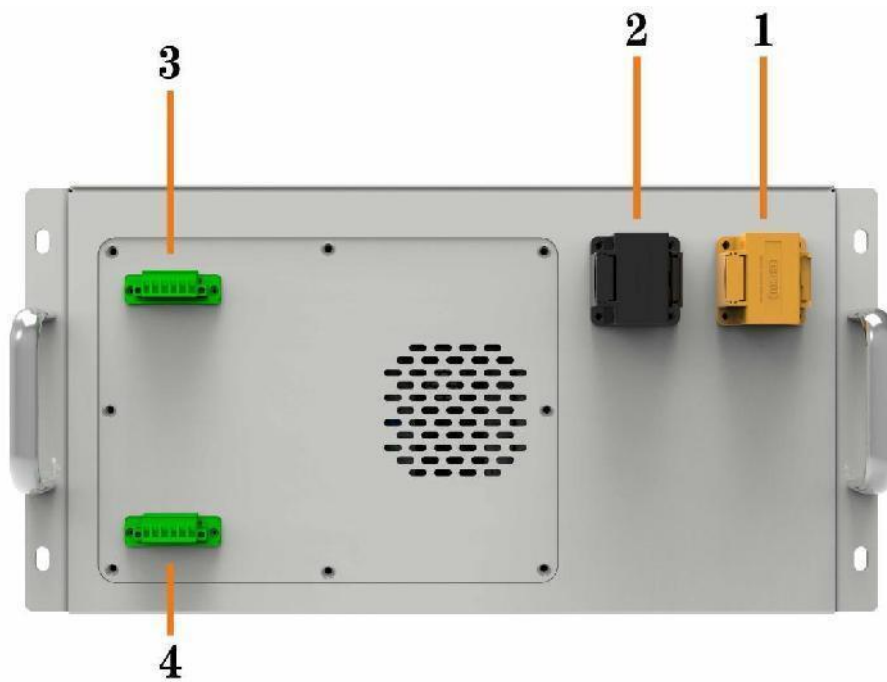
3.8. DC Side Wiring

3.8.1. Battery Pack Specification

Battery positive electrode materials are lithium iron phosphate with safety performance and long cycle life. Battery cells are managed effectively by BMS with better performance, possesses protection function like over-discharge, over-charge, over-current, abnormal temperature. Self-management on charging and discharging, single core balancing function. Battery module is non-toxic, non-polluting and environmentally friendly. Our battery system by connecting parallel to form a larger capacity battery pack to meet the user's long-term power supply needs.

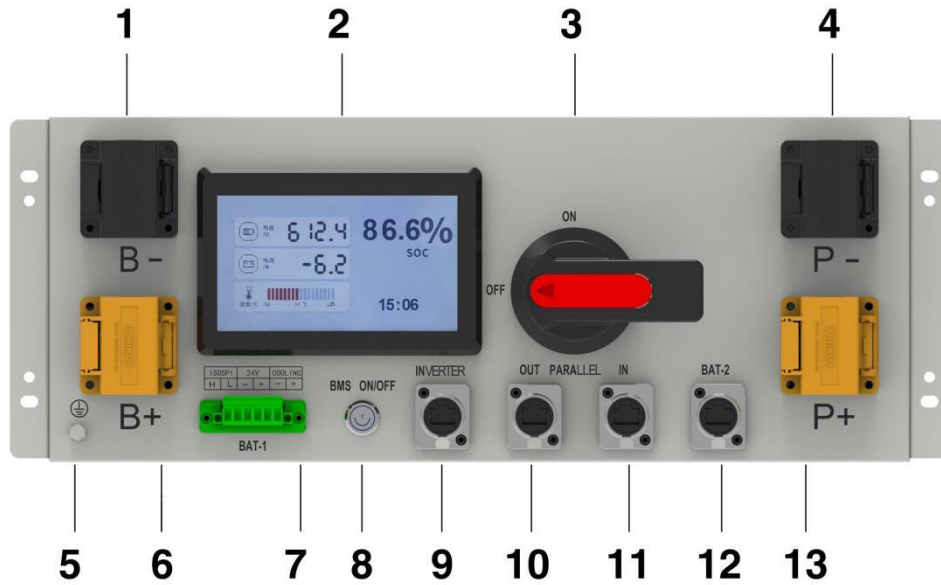
No.	Product Type	HBOWA-51314
1	Cell Technology	Li-ion(LFP)
2	Battery Module Capacity (KWH)	16.1
3	Battery Module Voltage (Vdc)	51.2
4	Battery Cell Voltage (Vdc)	3.2
5	Battery Cell Capacity (AH)	314
6	Battery Module Cell Quantity in Series (pcs)	16
7	Battery Module Charge Voltage (Vdc)	57.6
8	Battery System Charge Current (Standard)	100
9	Battery Module Charge Current (Normal)	140
10	Battery Module Charge Current (Max)	140
11	Battery Module Discharge Lower-Voltage (Vdc)	44.8
12	Battery System Discharge Current (Standard)	100
13	Battery Module Charge Current (Normal)	140
14	Battery Module Charge Current (Max)	140
15	Efficiency	98%
16	Depth of Discharge	90%
17	Dimension(W*D*H, mm)	483*245*792
18	Communication	RS485
19	Protection Class	IP22
20	Weight	98
21	Operation Life	>10years
22	Operation Cycle Life	>6000
23	Operation Temperature	0°C~50°C Charge -10°C ~50°C Discharge
24	Storage Temperature	-20°C~60°C
25	Product Certificate	CE/IEC
26	Transfer Certificate	UN38.3/MSDS

3.8.2 Battery Module Front Interface



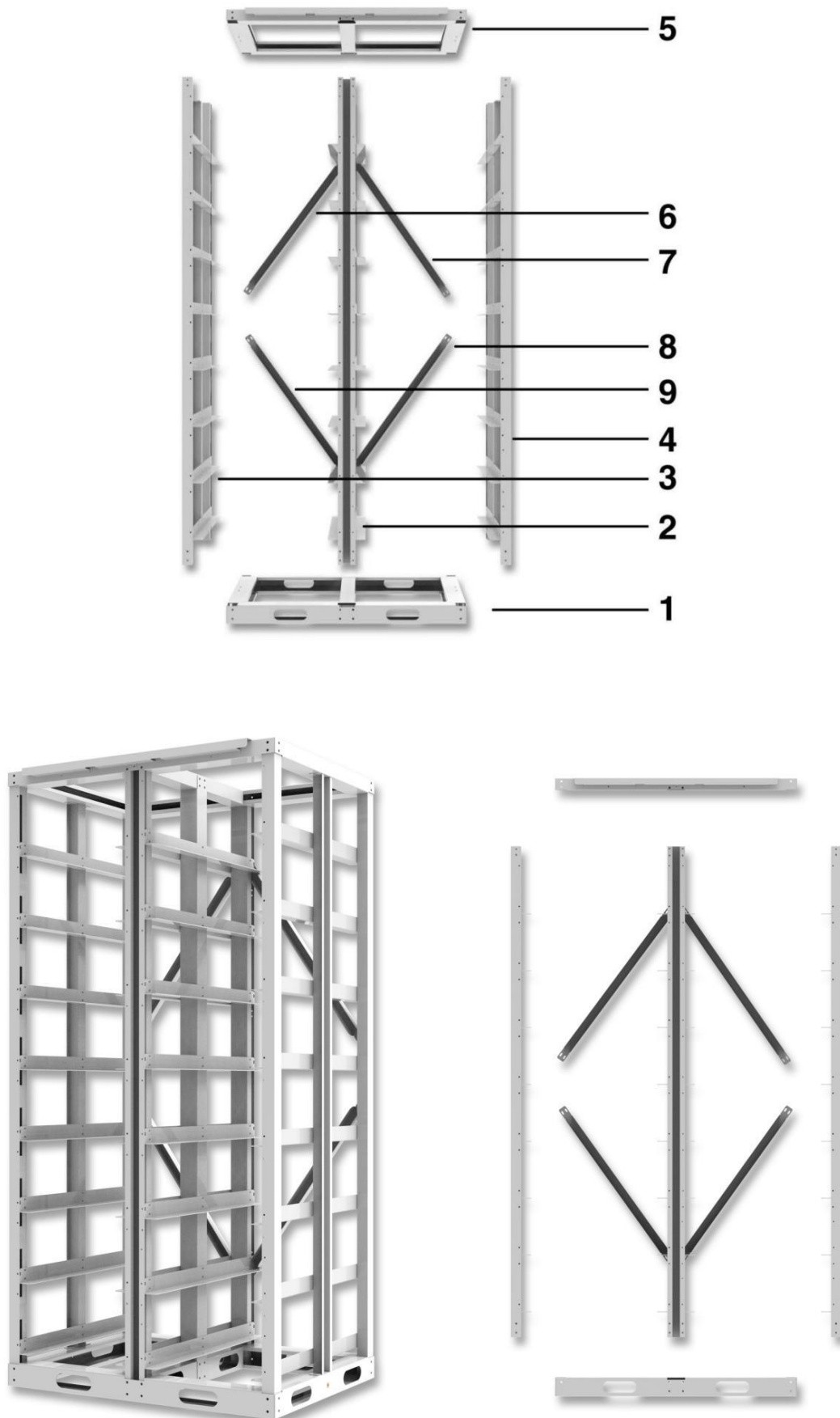
Item	Name	Definition
1	Positive socket	Battery output positive or parallel positive line
2	Negative socket	Battery output positive or parallel positive line
3	Communication Port IN	Support RS485 communication between battery module, and control module
4	Communication Port OUT	Support RS485 communication between battery module, and control module

3.8.3 High Voltage Control Module



Item	Name	Definition
1	Battery Access Negative	Battery Pack Negative Connector
2	Display screen	Display battery pack information
3	Power switch	OFF/ON, must be in the "ON" state when in use
4	DC Output Negative	Connect the inverter DC negative terminal
5	Grounding wire	Ground connection
6	Battery Input Positive	Battery pack positive access
7	Communication interface	Connection to Battery Pack Communication
8	BMS Switch	Switch BMS on/off
9	Communication port	Connect to inverter
10	Parallelism	Battery Cluster Parallel Network Port
11	Parallelism	Battery Cluster Parallel Network Port
12	Communication interface	Connection to Battery Pack Communication
13	DC Output Positive	Connect the DC positive terminal of the inverter

3.8.4 Brackets installation



3.8.5. Installation and Configuration

Safety Requirement

This system can only be installed by personnel who have been trained in the power supply system and have sufficient knowledge of the power system.

The safety regulations and local safety regulations listed below should always be followed during the installation.

- All circuits connected to this power system with an external voltage of less than 51.2V must meet the SELV requirements defined in the IEC60950 standard.
- If operating within the power system cabinet, make sure the power system is not charged. Battery devices should also be switched off.
- Distribution cable wiring should be reasonable and has the protective measures to avoid touching these cables while operating power equipment.
- when installing the battery system, must wear the protective items below:

		
The isolation gloves	Safety goggles	Safety shoes

Environmental requirements

- Working temperature: **-20℃ ~ +55℃**
- Charging temperature range is **0℃~+55℃**,
- Discharging temperature range is **-20℃ ~+55℃**
- Storage temperature: **-10℃~ +35℃**
- Relative humidity: **5% ~ 85%RH**
- Elevation: no more than **4000m**
- Operating environment: **Indoor** installation, sites **avoid the sun** and **no wind**, **no conductive dust** and corrosive gas.
- And the following conditions are met:
 - Installation location should be **away from the sea** to avoid brine and high humidity environment.
 - The ground for product arrangement shall be **flat and level**.

- **Step 1:** Verify that all terminals of the converter have been powered off with a multimeter.
- **Step 2:** Identify the positive and negative poles of the cable and mark them well.
- **Step 3:** Connect the positive and negative poles of the battery pack to the "BAT+" and "BAT-" terminals. Connect the positive and negative poles of the PV to "PV+" and "PV-" terminals. Connect the positive and negative photovoltaic input terminals to the PV+ and PV on the PMDE cabinet, and connect the DC+OUT and DC-OUT of the PMDE cabinet to the PV+ and BAT- on the MPS respectively.

 Danger:

In order to avoid personal and equipment injury, wiring must be carried out without electricity.

- DC switch is off.
- Multimeter is used to measure that the DC side wiring row is not live.
- DC input voltage limit. Confirm that the DC input voltage should **not exceed 850VDC!**
- Any DC input voltage exceeding this limit may cause damage to the inverter.
- Damage and loss of equipment caused in this case do not fall within the scope of quality assurance.

 Note:

- Fixed screw and other parts used for wiring have been installed at the corresponding wiring terminals when the equipment is delivered.
- Need to check the material of the external terminal connection point. If copper and aluminium materials are interconnected, special copper and aluminium connectors should be used. Do not connect directly!

3.9. AC Side Wiring

3.9.1. AC Connection

All models of this series energy storage inverters have grid connection. Only those with bypass need to consider bypass connection.

Table 3.9.1. Grid connection

A	Phase A or U connected to power grid
B	Phase B or V connected to power grid
C	Connecting to C or W phase of power grid
N	N Phase Connecting to Power Grid

Table 3.9.1. Load connection

A	Phase A or U connected to load
B	Phase B or V connected to load
C	Phase C or W connected to load

3.9.2. AC Side Line Steps:

- **Step 1:** Measure with a multimeter to confirm that all terminals have been powered off.
- **Step 2:** Confirm the phase sequence of the cables and mark them well. Three-phase AC output cable L1, L2, L3, N should be added yellow, green, red and black insulating bushing respectively in order to distinguish the phase sequence.
- **Step 3:** Connect three phases A, B, and C connected to the grid to the grid according to Table Table 3.9.1. Grid connection.
- **Step 4:** Connect the three phases A, B and C connected to the load to the load correctly according to Table 3.9.1. Load connection.

3.10. System Grounding

The grounding copper bars in this series energy storage inverters need to be connected reliably by grounding cables. Grounding copper bars have been reliably connected with the outer shell of the inverter in the cabinet. When connecting, it is necessary to connect the grounding copper bars with equipotential connection devices of the installation site or the electrical control room. The resistance shall not be higher than 40, the diameter of grounding cable shall not be less than 16 mm³, and the position of the copper bars shall refer to the internal terminal of 3.7. sections.

3.11. Installation Is Complete

After all mechanical and electrical installations have been completed, the removed switch baffles and lower fences need to be reinstalled on the inverter. After installation, power-on operation is allowed only after confirmation is correct.

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:

The exterior of the equipment is intact, with no damage, rust, or paint peeling. If there is paint peeling, please conduct paint repair operations.

The equipment labels are clearly visible, and damaged labels should be replaced promptly.

(2) Grounding Inspection

The container has a grounding point, and the grounding is secure; the grounding conductor inside the container is reliably connected to the container's grounding copper bar.

(3) Cable Inspection:

The protective layer of the cables is intact and there is no obvious damage.

The terminals are made in accordance with specifications, and the connections are solid and reliable.

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.

The cable installation bolts are tightened, and there is no loosening when pulling the cables; the cable pass-through holes have been sealed.

Check that the AC phase sequence and DC positive and negative polarity of the AC and DC access cables are correct.

(4) Copper row inspection

No obvious cracks or deformation of the copper row, tight screws at the lap joints, no misalignment of the scribe marking, and no debris on the copper row.

(5) Component inspection

The circuit breakers are all in the open position.

4.2. Start-Up Operation

After all of the above are satisfied, the energy storage inverter can be turned on. The operation steps are as follows:

- **Step 1:** Make sure that the DC side and AC side are connected correctly and the DC side voltage is lower than 850V.
- **Step 2:** Close PV,Battery, AC,and Load circuit breaker switches;
- **Step 3:** Close switch KB1, KB2,KB3 ;
- **Step 4:** After completing the above steps, go through the switch menu on the touch screen,click "DC/DC converter on" until the bottom right of the screen displays from standby to MPPT,click "DC/AC converter on" until the screen displays right below the switch from the converter Turn off the converter to charge or discharge the converter. After the machine is turned on normally, you can check the running status of the machine through the touch screen.
- **Step 5:** After the machine is running normally, close the cabinet door and hand over the key to a special person for safekeeping.

The detailed startup steps are as follows:

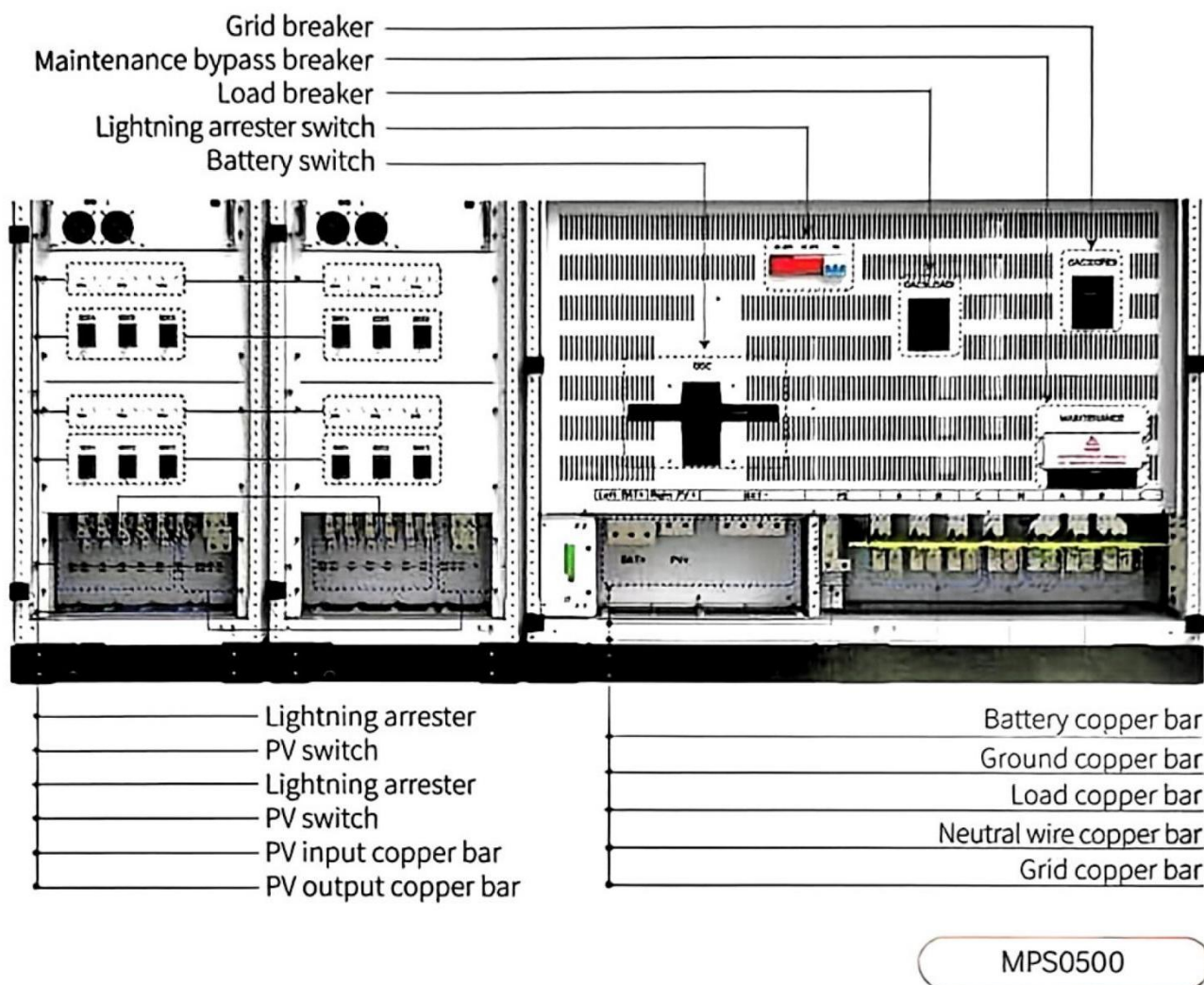
(1) Confirm the photovoltaic input, and close the photovoltaic input switches QPV1 and QPV2in Figure Table 4.2. After closing the PV input switch, if the monitor screen was black before, the monitor screen will start running at this time. (When photovoltaic power is transmitted, each photovoltaic channel must be measured to prevent short circuit).

(2) The battery system is powered on.

(3) After the photovoltaic input and the battery are turned on, you will hear the sound of the DC contactor closing inside the photovoltaic controller (the closing sound of the DC contactor after the bus is softly lifted), and then the photovoltaic controller displayed in the lower right corner of the monitoring main interface will be heard. The status will change from "off" to"converter x standby".

(4) Open the cabinet door, close KB1, KB2 and KB3, wait about 30 seconds, and the battery voltage data can be displayed on the monitoring interface.

Table 4.2. MPS input and output



Internal MCB

F2 F3: DC Electricity utilization insurance of auxillary power

F1: Battery soft-start insurance

KB1: T2 Electricity utilization switch of fan

KB2: T3 Electricity utilization switch of AC contactor

KB3: T4 AC Electricity utilization switch of auxillary power

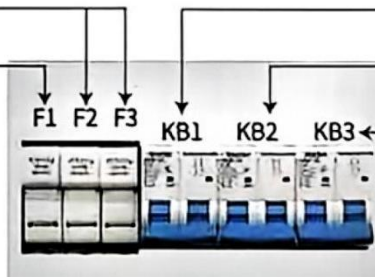
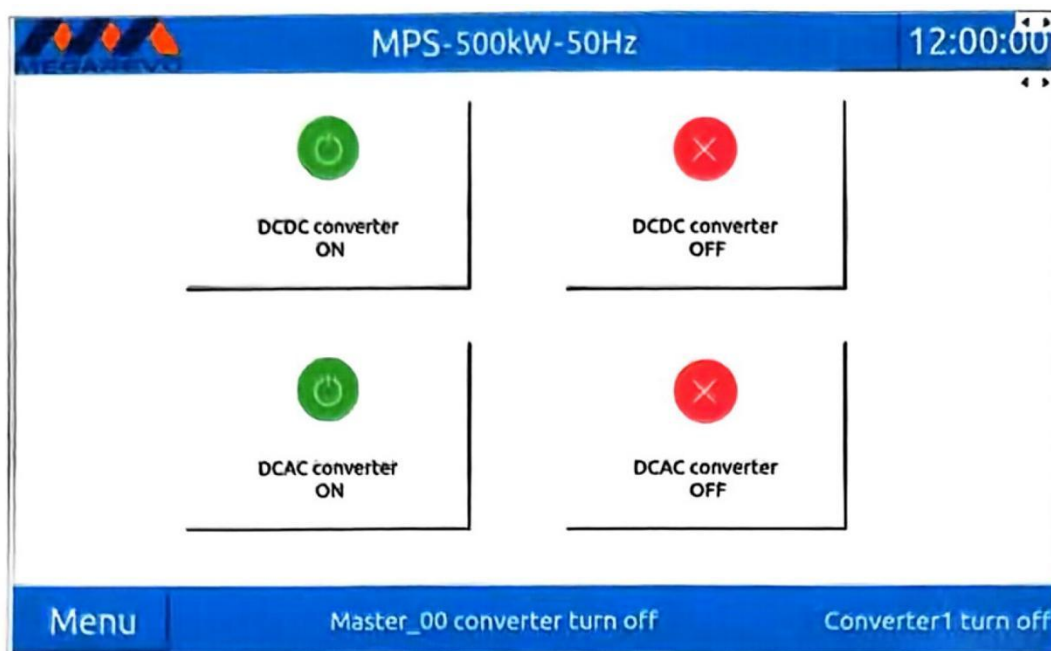


Table 4.2. Touch Screen Inverter Open Button Interface



 Note: When you need to boot through the DC side, you need to press the "cold start" button (red).

Table 4.2. "Cold Start" Switch



4.3. Shutdown Operation

4.3.1. Normal Shutdown

During normal maintenance or overhaul, shutdown operation should be carried out according to the following procedures:

- **Step 1:** Through the switch menu on the touch screen, click "DCDC converter off", and then click "DCAC converter off" after the DCDC converter is off.
- **Step 2:** After the AC contactor is disconnected and the touch screen displays

"host-00 converter OFF" and "converter x Off", manually disconnect the DC circuit breaker or load switch and make the switch "off".

- **Step 3:** Switch off the converter fan switch, switch off KB1, KB2, KB3 and KS switches.

- **Step 4:** Disconnect the AC side circuit breaker of the converter so that the switch is in the "OFF" position.

- **Step 5:** Wait until the bus capacitor discharge is finished, the touch screen is off, and the energy storage converter is off.



Warning:

When the machine is working normally, it is strictly forbidden to disconnect the circuit breaker directly, so as to avoid dangerous arc damage to the circuit breaker.

In severe cases, it may also lead to damage of energy storage inverter.

The detailed steps for shutting down the MPS energy storage converter:

(1) Shutdown of the photovoltaic controller. Click "Menu" - "Turn On/Off" -- "DCDC Converter Off" in the lower left corner of the monitor. After click "DCDC Converter Off", the PV controller status displayed in the lower right corner of the monitoring interface will have "Converter x MPPT" " becomes "standby". At this time, the PV controller stops working.

(2) The converter is turned off. Click "Menu" - "Turn On/Off" - "DCAC Converter Off" in the lower left corner of the monitor. After clicking "DCAC Converter Off", you will hear the AC contactor disconnecting sound. At this time, the converter status displayed at the bottom of the main monitoring interface will change to "Host-00 converter off". At this point the converter stops working.

4.4. Emergency Shutdown

In case of emergency or failure, follow the following procedure:

- **Step 1:** Press the emergency shutdown button "EPO";
- **Step 2:** Disconnect the machine DC side circuit breaker or load switch, AC side circuit breaker;
- **Step 3:** Reset the EPO button after confirming that the danger or fault has been removed and needs to be operated.

Warning:

EPO button is only used in case of machine failure or emergency. When shutdown is normal, shutdown operation should be carried out through the button shutdown instruction on touch panel.

In case of crisis, press the emergency shutdown button directly to ensure prompt response.

5. Running and Operation

5.1. Operation interface

The LCD touch screen is installed on the front of the inverter cabinet door. Users can monitor the inverter through the LCD screen, read the data of the inverter, and set the parameters of the inverter. The touch screen interface is shown in the following figure:

Table 5.1. LCD Appearance

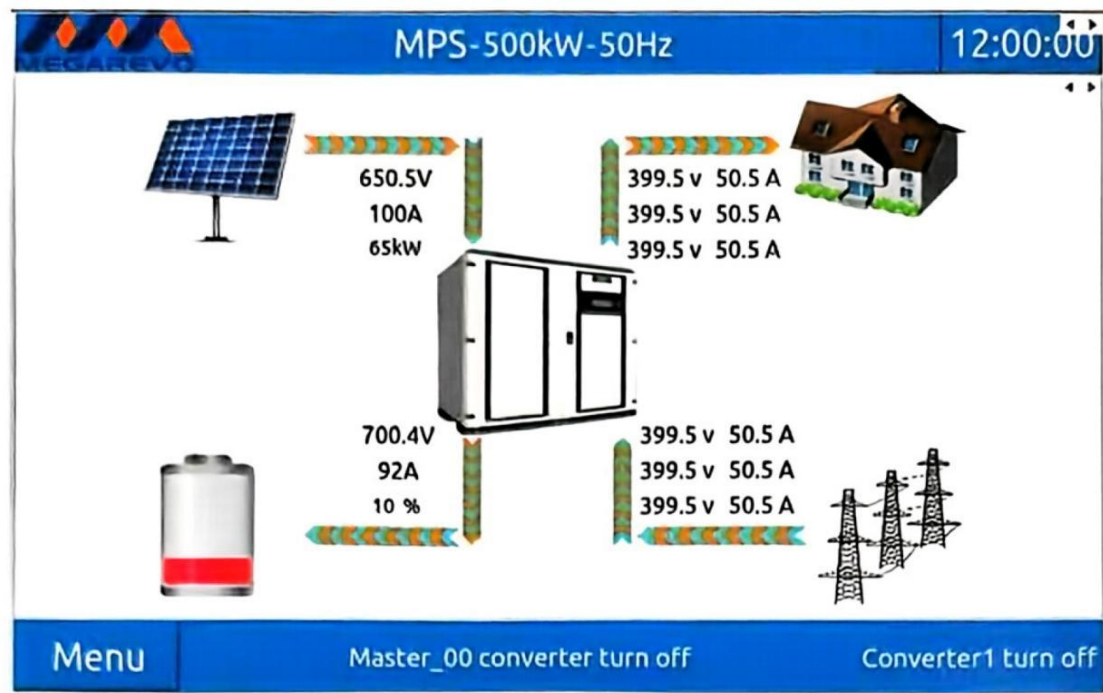


Table 5.1.1. Regional Function Description

Functional Area	Explain
Basic Information Bar	Display company LOGO, machine model, network address, time
Function Bar	Choose the menu of each function
Homepage	Display current and voltage of AC and DC sides of inverter
Running Status Bbar	Communication state, current state of inverter, alarm, state quantity

Table 5.1.2. Indicator Status

Indicator light	Function	State	Significance
Indicator 1	System Operating Indicator	Green always shines/fades	Abnormal monitoring system
		Green scintillation	Normal monitoring system
Indicator 2	Inverter Indicator	Green is always bright	Inverter Normal work
		Green scintillation	Inverter Soft start
		Indicator turn off	Inverter does not work
Indicator 2	Alarm Light	Inverter does not work	Inverter alarm
		Indicator turn off	Inverter no alarm

Indicator lamp 1, indicator lamp 2, indicator lamp 3, refers to the working status indicator lamp, the order is from top to bottom.

5.2. Alarm Buzzer

Table 5.2. Buzzer Warning Mode

Short-lived single-beep alert	When pressing any function operation key, issue this alarm sound
Whisper every 1 second	When an alarm occurs in the inverters, the alarm sounds are emitted

5.3. Communication Settings

Communication parameters can set device address (modbus address) and RS485 baud rate to communicate with the host computer. The communication mode

between equipment and BMS can be chosen: no communication, CAN, serial port. The communication between the equipment and the host computer supports RS485 serial communication and network communication.

The settings are as follows:

RS485 Serial Communication

- The Modbus address of the device ranges from 1 to 247, and each device has a unique address.
- The default baud rate of serial communication is 9600 bps.

Network communication.

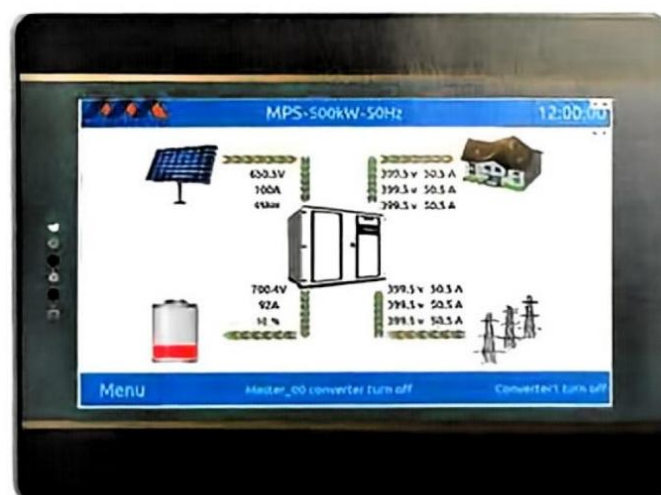
- IP address default 192.168.1.250
- Subnet mask default 255.255.255.0
- Gateway default 192.168.1.1
- CAN port communication
- The default baud rate of CAN port communication is 250 kbps.

5.4. Software Introduction

5.4.1. Homepage introduction

The main interface mainly displays machine model, network address, time, menu bar, battery information, inverter information, communication information, operation status, alarm information, switch status information. As shown in Table 5.4.1. below:

Table 5.4.1. Main Interface



1. Click on the "**Battery**" icon on the main page to view battery properties.
2. Click on the "**PV**" icon on the main page to view PV
3. Click on the "**load**" icon on the main page to view load properties.
4. Click on the "**grid**" icon on the main page to view grid/DG properties.
5. Click on the "**inverter**" icon to view "real-time data"alerts.
6. Click on the triangular "**Warning**" sign in the lower right corner of the screen to view all alerts.

Table 5.4.1. Menu expansion items

Serial Number	Menu Name	Menu Item	Parameter Function
1	Homepage	Menu	Main Menu
		PCS Data	Display Real-time Data
		Parameter	Parameter Setting
		PCS State	The state of each switch in the current inverter
		PCS Data	All analog data of the inverter are displayed
2	State	PCS State	Display of Inverter Operation State and Switching State
		PCS Alarm	Current system operation information and alarm
3	Record	Data Report	Charge and discharge statistics
		Export Data	Export history and operation records
		History Record	Display historical alarm records
		Operation Log	Records generated by system settings
4	Parameter Setting	General setup	User-level parameter setting
		Parameter Setting	Factory parameter setting
		Battery Setup	Battery parameter setting
		other	Summary of current main parameter settings Setting up System Language (Chinese/English) System autorun time segment settings Restore system factory settings Display PCS version number
5	Switch	Inverter switch	Inverter Start-up and Inverter Shut-down

5.4.2. Introduction to Status Menu

The state interface is shown in Table 5.4.2.

Table 5.4.2. Status Menu Interface

MPS-500kW-50Hz												12:00:00
MPS Ddata			MPS State			MPS Alarm			Battery Data			
	Name	Value		Name	Value		Name	Value		Name	Value	
New Row	DC input brea...	Close		DCAC converter	Enable		Break1 status	Close				
New Row	DC contactor	Close		DC soft start	Not starting		Break2 status	Close				
New Row	Maintenance ...	Close		Converter sta...	Turn off		Contacto sta...	Close				
New Row	Output breaker	Close		Reactive pow...	Non		Break1 status	Close				
New Row	Output breaker	Close		Sleep mode	Dromant		Break2 status	Close				
New Row	Grid contactor	Close		LVRT	LVRT		Contacto sta...	Close				
New Row	DO1	Enable		DI1	Enable		Run mode	Buck				
New Row	DO2	Enable		DI2	Enable		DCDC converter	Disable				
New Row	DO3	Enable		DI3	Enable		Soft start status	Not starting				
1	2	3	4	5	6	7	8	9	10	11	12	
Menu			Master_00 converter turn off						Converter1 turn off			

5.4.3. Introduction to Record Menu

Click on the status button to enter the record menu interface. In this interface, you can click "Data Report", "Export Data", "History Record" and "Operating Diary".

Table 5.4.3. Recording menu interface

MPS-500kW-50Hz

12:00:00

Data report

Export Data

History Record

Operation Log

PV power generation

0kw

0kw

Day

Month

Load eletricity consumption

0kw

0kw

Day

Month

Battery power generation

0kw

0kw

Day

Month

2000-01-01

Y -

Y +

M -

M +

D -

D +

Menu

Master_00 converter turn off

Converter1 turn off

1. In the record menu, click the "Export Data" button.
2. After entering the interface, you need to access the U disk.
3. You can select in the interface whether you need to export "History" or "Operation Log".
4. After the guide is finished, click "Eject U disk".

Table 5.4.3. Record_Export Data

MPS-500kW-50Hz 12:00:00

Data report Export Data History Record Operation Log

Note:
Out put file:
HistoryRecord.csv Log.csv
Report.csv

Data To Export

static: Udisk disconnect

HistoryRecord.csv OperationLog
Report.csv Udisk disconnect

Menu Master_00 converter turn off Converter1 turn off

5.4.4. Introduction to System Settings Menu

MPS-500kW-50Hz 12:00:00

DC/AC Parameter DC/DC Parameter Battery setup Automatic operation SystemInformation

DOD_OnGrid:		%
DOD_OffGrid:		%
Charge Vol. upper Limit		V
Discharge Vol. lower Limit		V
Charge Cur. Limit		A

Menu Master_00 converter turn off Converter1 turn off



Note: For more detailed information about inverters and battery, please refer to the separate user manual.

6. Fault Handling and Maintenance

6.1. Fault Handling

6.1.1. Troubleshooting

When the energy storage inverter can't output as expected or the charge and discharge quantity changes abnormally, please pay attention to the following items:

- Open-circuit voltage of energy storage battery.
- Whether the machine is in a state of failure.
- Whether the power grid is connected correctly and powered on.
- Check whether the communication of measuring equipment is normal.



WARNING:

Under the condition of failure, there may still be fatal high voltage inside the energy storage converter! Only technicians who meet the requirements can perform the operations described in this chapter. "Compliance with requirements" means that operators have participated in professional training on equipment troubleshooting operations in the early stage. Please perform only the troubleshooting operations described in this manual. When operating, please observe all safety operation specifications.

6.1.2. Non-Alarm Inducing Failure

Machine Working Noise Is High

Check whether the power is in the normal range; Measure whether the grid-connected current and voltage waveforms are normal; Check the replacement of cooling fans.

Network Communication Mode:

- Please check whether the IP address, subnet mask and gateway are set correctly.
- Check whether the communication line is through and whether it is well connected.
- If all the above tests are normal and correct, try to replace the LCD monitoring board.

Serial Communication Mode:

- Check the wiring, check all wiring is good, A/B has no connection.
- Communication adapter does not match. Replace communication adapter and try again.
- Check whether the local address and baud rate are consistent with the host computer. LCD screen cannot be switched on and off.
- Check the communication connection between LCD screen and DSP board.

6.1.3. Alarm Failure List

LCD can display 32 alarms, and the corresponding solutions are shown in Table 6.1.3. below.

Table 6.1.3. Alarm Fault Handling Method

Fault Type	Processing Method
Low battery voltage	Disconnect DC load switch and check DC side voltage and battery configuration.
Battery Voltage Low Auxiliary Power Supply	Disconnect DC load switch and check DC side voltage and battery configuration.
Low battery power	Disconnect DC circuit breaker load switch and check energy storage battery status.
Battery Back Connection Failure	Switch-off DC-side input bus.
Busbar Overvoltage Fault	Turn off to check DC side voltage.
Bus Short Circuit Fault	Turn off and check DC bus connection.
Overvoltage of power network	Check the voltage of grid connection point by shutdown.
Low grid voltage	Check the voltage of grid connection point by shutdown.
Inverse Voltage Sequence of Power Grid	Disconnect the power supply switch and Turn off to check the three phase wiring.

Abnormal Frequency of Power Grid	Turn off and check grid voltage.
DC Contactor Fault	Turn off and check whether the DC contactor is damaged.
Output contactor open circuit	Turn off and check if AC contactor is damaged.
Output Contactor Short Circuit	Turn off and check if AC contactor is damaged.
AC Fan.Fault	Turn off and check AC fans.
AC auxiliary power failure	Turn off and check the AC auxiliary power supply board.
DC auxiliary power supply failure	Turn off and check DC auxiliary power supply board.
15V power failure	Turn off, check AC and DC auxiliary power supply board.
Inverter overcurrent	Turn off, check whether the input and output of the inverter are short circuit or whether the inverter is overloaded.
Wave by Wave Current Limitation of Inverter	Turn off, check whether the input and output of the inverter are short circuit or whether the inverter is overloaded.
Inverter Fault	Check operation before switching off repetitive inverter
Inverter overheating	Turn off, check whether the inverter fan is out of order and whether the air duct is unobstructed.
Inverter Phase Shortage Fault	Turn off and check AC side line.
Inverter asynchronization	Turn off and check the inverter settings.
Lightning protection failure	Turn off and check the lightning protection of the inverter.
BMS Communication Fault	Turn off and check if the communication cable between inverter and battery system is loose.
Overload	Turn off and check load size.
Isolated island protection	Turn off.
Drive Line Fault	Turn off, check whether the internal drive line is loose.
Insulation impedance anomaly	Turn off, check inverter grounding and cable aging.
EPO	Turn off.
CT or Hall Opening	Turn off, check CT wiring.

6.2. 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.

If there is a malfunction, with the help of this manual, you still can't solve the problem. Please contact us. At the same time, provide some information in order to provide you with better service:

- Photographs of Fault Site.
- Type and serial number of energy storage inverter.
- Information on components connected to energy storage inverters, configuration of energy storage batteries and network parameters.
- Communication connection scheme of energy storage inverter.
- Fault information and brief description.

Table 6.2. Routine maintenance tasks

Maintenance objects	Movements	Reference standard
Container/cabinet	• Check the appearance of the whole machine. • Checking the vents. • Check door lock condition.	• No obvious coating peeling, scratches or rusting. • No obvious signs of water leakage. • No accumulation of dust in vents. • No damage to door locks.
Hybrid Inverter	• Check for noise and vibration. • Check front panel vents. • Check the rear copper contact surface.	• 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.
Electricity	• Check the lightning Protector. • Check cable copper contact surface.	• Lightning protector is normal • No loose screws and sockets connecting wires. • No corrosion and discoloration of copper rows and contact surfaces, no dust accumulation.



This manual is for reference only, if the technology is better, please contact the distributor or our company.



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