USER
MANUAL

MPS
SERIES

MPS series energy storage converter

MPS0030~MPS0500

VER: V2.00

CONTENT

1 About the manual

1.1 Preface

Dear customer:

Thank you very much for using the energy storage converter. We sincerely hope that our products can meet your demands. We look forward valuable comments on the performance and function of our product, we will continue to improve.

1.2 Applicable product

The manual is applicable to energy storage converters. The product models are shown as follows:

Table 1-1 Product model

Model	Power	Split type	Integrated Model
MPS0030	30 kW		√
MPS0050	50 kW		√
MPS0100	100 kW		√
MPS0150	150 kW		√
MPS0250	250 kW	√	
MPS0500	500 kW	√	

1.3 Content abstract

- This manual is exclusive instruction manual for MPS series energy storage converter. The manual details the product information, installation instructions, operations, maintenance and troubleshooting. Before installation and debug, the users are supposed to read all information in the manual and be familiar with relevant safety symbols.
- Readers are required to have a certain degree of electrical theory, electrical wiring and professional mechanical knowledge. Before installation, please read this manual carefully and ensure that the relevant personnel can easily access and use manual.
- The contents, pictures, logos, symbols, etc. used in this manual are owned by us. Non-company personnel are not allowed to publicly reproduce all or part of the contents without written authorization.

1.4 Symbols

For user's personal and property safety and better use of product, the manual provides relevant information and highlights it with appropriate symbols.

The following list of symbolic hints may be used in this manual, please read them carefully.

- "Danger" indicates a high potential hazard which will result in death or serious injury if not avoided.

- "Warning" indicates a medium potential hazard that could result in death or serious injury if not avoided.

- "Caution" indicates a low level of potential hazard 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.

- "Instruction" is additional information to contents or optimized use skills of product.

Please pay attention to the danger warning signs on device which includes:

Table 1-2 Symbols on the Product

Sign	Sign description
	The sign indicates there is a high voltage within the machine, and touch may result in electric shock.
	The sign indicates that the temperature is higher than the acceptable range of human body, touch may result in injuries.
	The sign indicates here is the protective earthing (PE), and solid grounding is needed to ensure the safety of operators.

2 Safety instructions

2.1 Personnel requirements

- 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.

- It is strictly prohibited to perform maintenance or overhaul when the equipment is live.
- Ensure that at least two operators are present during the maintenance or overhaul of equipment. After the device is disconnected, wait for 15mins until the converter complete discharge then operate maintenance or overhaul.

2.2 Safety warning operation

When installing, maintaining, or servicing the energy storage converter, please observe the following to prevent accidents from occurring due to misuse by non-professional personnel:

- Set up a marked sign at the front and rear switches of the energy storage converter to prevent mis-switching.
- Set up warning signs or caution tape near the operation area.
- After the completion of maintenance or overhaul, be sure to pull out the key of the cabinet door and keep it stored safely.

2.3 Device sign protection

- The warning signs on energy storage converter or in the cabinet contain important information about safety operation of converter. It is strictly forbidden to tear or damage!
- A nameplate is fitted inside the front door of the energy storage converter, and the nameplate contains important parameter information related to the product. It is strictly forbidden to tear or damage!

- Once the device sign is damaged or blurred, please contact us.

- Make sure the device sign is legible and readable at all times.
- Once the device sign is damaged or blurred, replace it immediately.

2.4 Safety of using electricity

2.4.1 Electrical safety

Lethal high voltage is present inside the product!

- Do not touch terminals or conductors connected to power grid circuits.
- Pay attention to all safety documentation or instructions regarding connection to the grid, and follow the warning signs on the product.
- Observe the safety precautions listed in the manual and other documents related to the equipment.

Damaged equipment or system malfunctions may cause electric shock or fire!

- Preliminary visual inspection of equipment for damage or other hazards prior to operation.
- Check the safety of other external equipment or circuit connections.
- Confirm the safety of equipment before operation.

2.4.2 ESD

Electrostatic sensitive components on the circuit board or elsewhere may be damaged by improper operation or contact by the operator.

- Please avoid unnecessary contact with the circuit board.
- Please observe electrostatic discharge (ESD) prevention regulations, such as wearing anti-static wrist strap.

2.4.3 Notes for energy storage batteries

- There is a lethal high voltage between the positive and negative terminals of the energy storage battery pack connected with the energy storage converter.
- Ensure disconnection between energy storage converter and battery pack before maintenance to equipment.

2.5 Environmental requirements

2.5.1 Escape way

To ensure prompt evacuation of staff from the scene in case of accidents, please observe the following:

- Do not place flammable and explosive materials around the converter.
- It is strictly forbidden to pile up sundries in the escape way or occupy the escape way in any form.

2.5.2 Moisture protection

Do not use the converter in a humid environment that exceeds the specified limits!

The energy storage converter is likely to be damaged in humid environment.

In order to guarantee the normal use of the energy storage converter, please observe the following:

- Do not open the cabinet door when the air humidity is over 95%.
- Do not open the cabinet door in rainy or humid conditions to maintain or overhaul the energy storage converter.

2.6 Energized test specification

2.6.1 Energized test

High voltage exists in the equipment and accidental touching may result in a risk of lethal electric shock, so please observe the following:

- Take precautions (e.g. wear insulated gloves, insulated shoes, etc).
- At least two personnel must be on site to ensure personal safety.

2.6.2 Measuring equipment

To ensure conformance to requirements of electrical parameters, it is necessary to use relevant electrical measuring equipment when conducting electrical connection and trial operation of energy storage converter.

- The selection of high-quality measuring equipment with measuring range and available conditions in line with site requirements.
- Ensure that the connection and use of the measuring equipment is correct and standardized to avoid arcing and other hazards.

2.7 Touch screen setting

The parameters in the touch screen are closely related to the operation of the energy storage converter. These parameters can be modified and set only after reliable analysis and evaluation of the operating status of the system and energy storage converter.

- Inappropriate parameter settings may affect the normal function of the energy storage converter.
- Only authorized professionals can set the parameters of the energy storage converter.

2.8 Maintenance and overhaul specification

The following should be observed when performing maintenance or overhaul operations on the equipment:

- Set the inspection mark and ensure that the energy storage converter is not accidentally re-powered.
- After the energy storage converter is powered off and disconnected from the AC and DC power supplies, wait at least 15 minutes before open the front door to maintain or overhaul the energy storage converter.
- Use a multimeter to measure inside the energy storage converter and ensure that the discharge is complete.
- Ensure that the device is properly grounded.
- Energized parts must be covered with insulation materials.
- Ensure that the escape ways are completely unblocked during maintenance and overhaul.

2.9 Product obsolescence

- When an energy storage converter is to be discarded, it must not be disposed of as regular scrap.
- Contact local authorized professional recycling agency.

2.10 Other matters needing attention

The following protective or emergency measures should be taken according to the needs of the site:

- When maintaining or inspecting the equipment, operators should take proper protective measures, such as wearing anti-noise earplugs, insulating shoes and insulating gloves.
- The installation sites of energy storage converters are usually far away from urban areas.Therefore first-aid facility should be prepared in case of need.
- Take all necessary auxiliary measures to ensure the safety of personnel and equipment.

- All operations on the energy storage converter must comply with the relevant standards of the country/region.

- All descriptions in this manual apply to standard energy storage converters. If you have special demands, please ask the staff when ordering. Subject to the actual product received.
- The manual cannot take into account all possible situations during operation, maintenance, and overhaul. If you encounter a situation that is not addressed in this manual, please contact us.

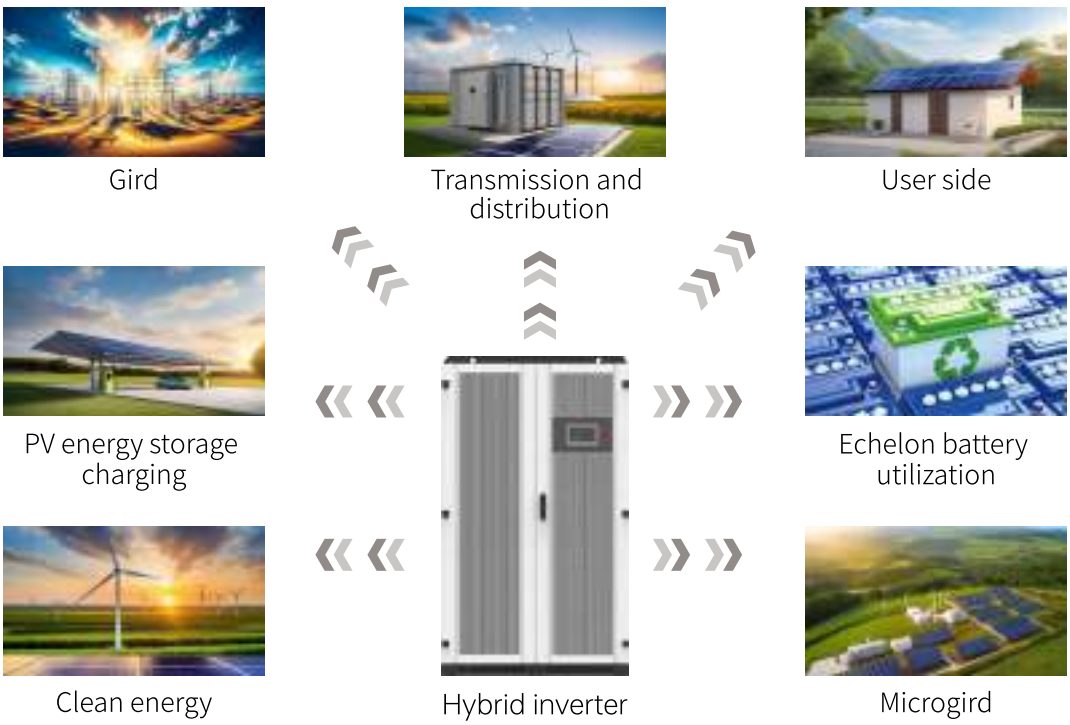
3 Product introduction

3.1 Introduction of energy storage system

- Energy Storage System (ESS) refers to the cycle process of storing the same form of energy or converting it into another form of energy through a medium or device, and releasing it in a specific form of energy based on future applications. Energy storage system is an important part of the power grid link: "power-transmission-convert-distribution-use", is an essential part of the Energy Internet and smart energy.
- Generation: The energy storage system can participate in the rapid response frequency modulation service, improve the reserve capacity of the power grid, provide continuous power supply to the end users with wind energy, solar energy and other renewable energy. Furthermore, it makes use of the advantages of renewable energy, and also effectively overcome its shortcomings such as volatility and intermittency.
- Transmission and distribution: Energy storage system can effectively improve the reliability of transmission system and improve the quality of electric energy.
- User: The distributed energy storage system optimizes electricity consumption, reduces electricity costs and maintains the high quality of electric energy under the coordinated control of the intelligent microgrid energy management system.

Figure 3-1 Application scenarios of energy storage converter in ESS

In the ESS, the energy conversion is mainly realized by the power conversion system (MPS for short), as shown in Figure 3-1:



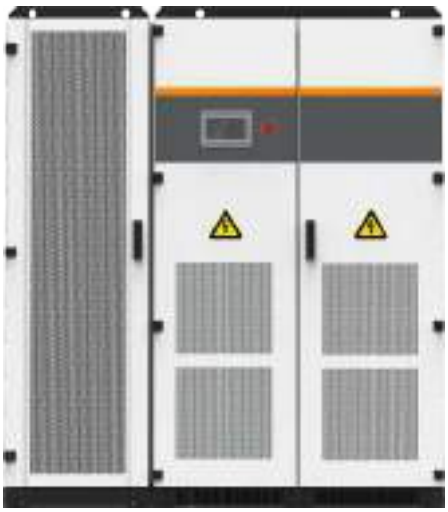
3.2 Product appearance

The appearance and external components of energy storage converter as shown below:

Figure 3-2 Product appearance

MPS0030/MPS0050

MPS0100/MPS0150



MPS0250

MPS0500

Emergency Power Off Button

MPS0250 and MPS0500 are split-type. MPS0250 consists of one photo-voltaic controller and one energy storage converter. MPS0500 consists of two photo-voltaic controller and one energy storage converter.

WARNING

High voltage danger!

- After press EPO button, the AC/DC terminal in the energy storge converter still energized.
- There is lethal high voltage inside the energy storage converter.

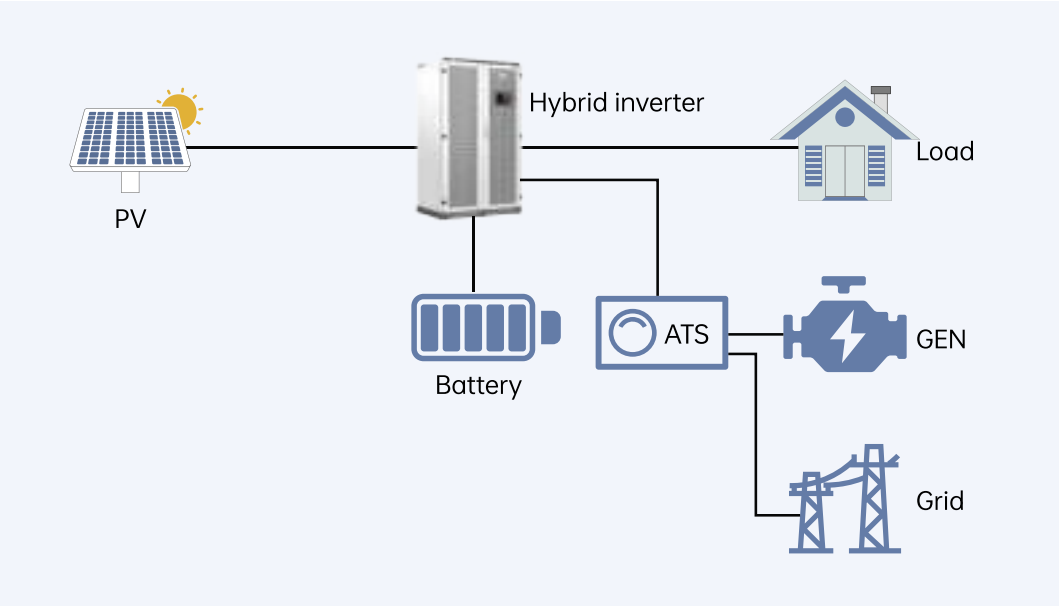
WARNING

- Press EPO button to turn off the energy storage converter only under the emergency.
- Improper use of EPO button will result in the damage of energy storage converter.
- Pressing EPO button when on-load will cause greater stresses exposed to related components of energy storge converter.

3.3 Main circuit topology

MPS series energy storage converter is suitable for mine off-grid, island off-grid, no power (power shortage) area villages and towns, rural off-grid, energy storage converter product application is shown in the following Figure 3-3:

Figure 3-3 Product application



3.4 Product features

MPS series energy storage converter optimize the control performance and improve system reliability adopting advanced digital control technology. It meets the demands of different battery charging and discharging, and its main performance characteristics are as follows:

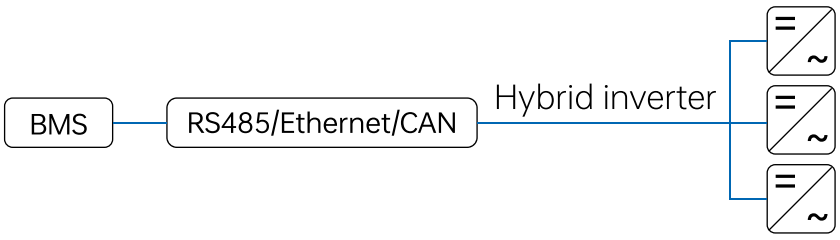
- Integrated solution support simultaneous access of load, battery, grid or diesel generator and photovoltaic.
- Support five operating modes, including self-use, battery priority, optimal mode, mixed mode, manual mode.
- BMS system communication supports RS485/Ethernet/CAN.
- Accept EMS schedule, communication modes include RS485/Ethernet/CAN.
- The integrated EMS function provides safe and stable power supply and maximizes the utilization of new energy.
- Support flexible use of lithium batteries and lead-acid batteries, battery capacity display.
- Photovoltaic controller can be expanded to facilitate flexible configuration of photovoltaic capacity.
- Strong ability to carry three-phase unbalanced loads under off-grid conditions.
- Industrial frequency design scheme with high impact resistance.
- The system uses dual auxiliary power supply, redundant design, improve reliability.
- Independent air duct - excellent heat dissipation design.

3.5 Communication scheme

3.5.1 BMS communication scheme

Through the RS485/Ethernet/CAN communication line, the energy storage converter communicates with the BMS to achieve data transmission.

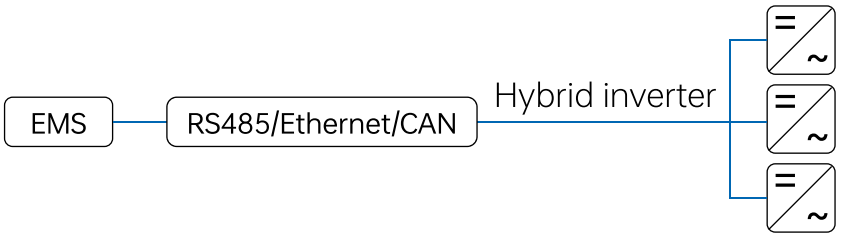
Figure 3-4 BMS transmits data through RS485/Ethernet/CAN



3.5.2 EMS communication scheme

Through the RS485/Ethernet/CAN communication line, the energy storage converter communicates with the BMS and monitor the energy storage converter in real time by self-designed monitoring software.

Figure 3-5 EMS transmits data through RS485/Ethernet/CAN



3.6 Technical parameter

Table 3-1 Technical parameter

AC (on-grid)

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Max output power (kVA)	33	55	110	165	275	550
Rated power(kW)	30	50	100	150	250	500
Rated voltage(V)	400					
Maximum current (A)	48	80	158	238	397	794
Rated current(A)	43	72	144	216	361	722
Voltage range(V)	400 (80%~115%)					
Rated frequency(Hz)	50/60					
Frequency Range(Hz)	45-55/55-65					
THDI	<3%					
Power factor	1.0 (0.8leading-0.8lagging (settable))					
AC connection	3W+N+PE					
Isolation transfomer	100/400	200/400	270/400	270/400	270/400	315/400

AC (off-grid)

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Max output power (kVA)	33	55	110	165	275	550
Rated power(kW))	30	50	100	150	250	500

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Rated voltage(V)	400					
Maximum current (A)	48	80	158	238	397	794
Rated current(A)	43	72	144	216	361	722
THDU	≤ 2% Linear					
Rated frequency(Hz)	50/60					
Overload capacity	110% long-term					

PV input

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Max photovoltaic input voltage(V)	1000					
Max photovoltaic power(kW)	60/120		120/180/240		300/360	600/660/720
MPPT voltage range	250VDC-850VDC					

Battery

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Battery voltage range (V)	250-850	320-850	420-850	420-850	420-850	500-850
Max charging power (kW)	60/120		120/180/240		300/360	600/660/720

System parameter

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Dimension (W/D/H) (mm)	800x800 x1900	800x800 x1900	1200x800 x2050	1200x800 x2050	1800x800 x2050	2800x1050 x2050
Net weight (kg)	620/650	720/750	1120/1150 /1180	1250/1280 /1310	1980/2010	3265/3295 /3325
Ambient temperature (℃)	-30 ~ +60					
Relative humidity	0 ~95% non-condencing					
Protection grade	IP20					
Noise level	<70dB					

Model	MPS0030	MPS0050	MPS0100	MPS0150	MPS0250	MPS0500
Altitude	5000m(> 3000m derating)					
Cooling mode	Air cooling					
Display	LCD touch screen					
BMS communication interface	RS485/Ethernet/CAN					
Local communication	RS485/Ethernet					
Certificate	TUV、CE、EN50549-1、CEI 0-21、EN62109-1/-2、EN62477、EN61000-6-2/-6-4、IEC61727&IEC62116&IEC61683、NRS 097-2-1:2017、NRS 097-2-1:2017 、ASGC、AS/NZS 4417.1、CEI 0-21、CEI 0-16、G99：2022 Type B					

*Postscript:

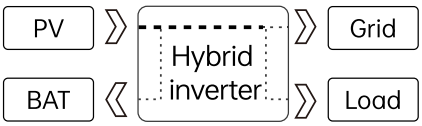
- 1. MPS0250 and MPS0500 are split-type. MPS0250 consists of one photovoltaic controller （600×720×2050mm） and one energy storage converter （1200×800×2050mm). MPS0500 consists of two photovoltaic controller （600×720×2050mm） and one energy storage converter （1600×1050×2050mm).
- 2. Special models require custom development.
- 3. In the absence of the VFD/VSD, the motor power cannot exceed one-eighth of the rated power of MPS; In the case of the VFD, the motor power cannot exceed half of the rated power of MPS (the motor is the most severe inductive load; other inductive loads can refer to the above).
- 4. The MPPT mode can be set “boost mode”or“buck mode” 。The configuration of batteries and photovoltaics needs to meet the following principles. Buck Mode: Under extreme high temperature condition, the MPPT operating point voltage should be ≥ the maximum battery voltage + 20V. Boost Mode: Under extreme low temperature condition, the MPPT open-circuit voltage should be ≤ the minimum battery voltage - 20V. Maximum battery voltage = number of battery cells * 3.65V, Minimum battery voltage = number of battery cells * 2.8V.
- 5. Derating in Parallel:
  For a system consisting of 2 to 4 parallel machines, the machine capacity reduction coefficient is 0.95. 4 parallel machines and more, the machine capacity reduction coefficient is 0.9.
  Parallel System Configuration:
  The specifications and power of PV components must be consistent.
  Storage battery specifications must be consistent.
  Parallel Line Impedance:
  The length error between the grid port and the PCC point of the grid should be within 5%, and the specifications and number of cables must be consistent.
  The length error between the load port and the load PCC point must be within 5%, and the specifications and number of cables must be consistent.
  Parallel System Black Start：
  For a low-voltage microgrid system without Medium Voltage Transformer, the parallel system needs to be started one by one. When the system starts with a load, the load power cannot exceed the capacity of a single device. After the parallel system is fully started, the system's load is gradually increased.
  For the microgrid system with Medium Voltage Transformer, the parallel system needs to be started one by one. The system should be started with the medium voltage transformer, and the load cannot be connected to the parallel system until it is fully started. After the parallel system is fully started, the Medium Voltage Transformer side can be gradually loaded.

4 Mode and function

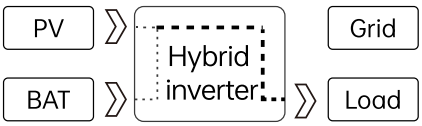
4.1 Work pattern

The work pattern of MPS is set on the touch screen. User select work pattern according to different demands(for reference) by clinking the “Menu”→“System”.

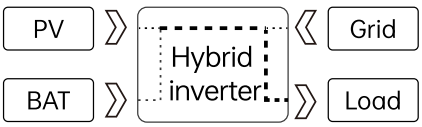
Work pattern：self-use



1.PV power > the load power， the residual power charge the battery. If the battery is fully charged, the residual power will connect to the power grid or the PV controller will limit the power.

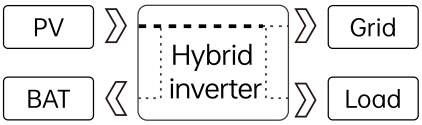


2.Photovoltaics prioritize power to loads. When the PV power < the load power, the photovoltaic and the battery jointly supply power to the load.

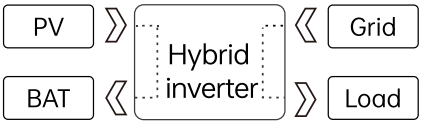


3.Photovoltaics prioritize power to loads. When (PV + battery) power < the load power, the grid, photovoltaic and battery will simultaneously supply power to the load.

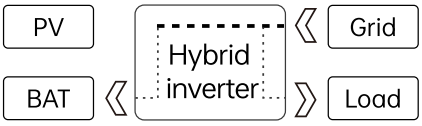
Work pattern：battery priority



1.Photovoltaics prioritize charge the battery, the residual energy supplies power to the load. When there is still energy left, it will be fed to the power grid.

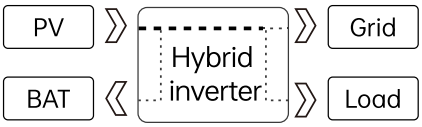


2.In the case of insufficient photovoltaic energy to power the battery and load, the grid provides the rest of the energy required for the load.

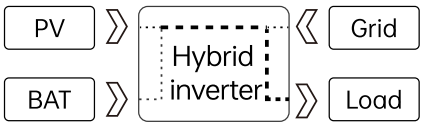


3.In the absence of photovoltaic energy, the grid will supply energy to the load.

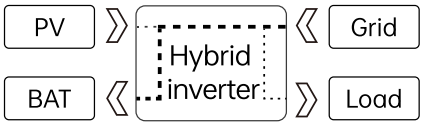
Work pattern：optimal mode



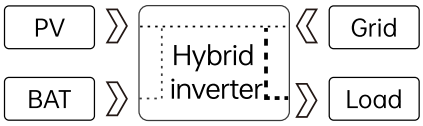
1.If there is enough photovoltaic energy, the photovoltaic will charge the battery and power the load at the same time, and if there is any surplus, it will be sent to the grid.



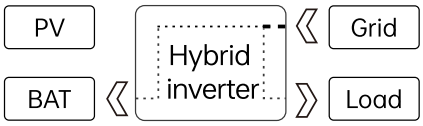
2.When the photovoltaic energy is insufficient, the photovoltaic will charge the battery and power the load at the same time, and the grid will make up the remaining energy required for the load.



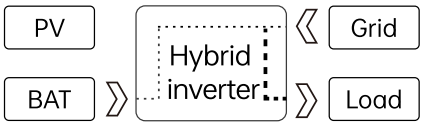
3.When the photovoltaic energy is insufficient, the photovoltaic will charge the battery: if the power of the load is less than the power value set by the AC power, the AC side will provide energy for the load, and the remaining energy will charge the battery.



4.When the energy of photovoltaic is insufficient, and the power of the load is greater than the value set by the AC power, the available power of the AC side will all supply the load, and the photovoltaic will supplement the remaining insufficient energy, If the photovoltaic energy supply is insufficient, the battery will supplement the remaining energy.



5.When the photovoltaic is not available and the load power is less than the power value set by the AC power, the AC side will supply power to the load, and the remaining power will charge the battery.



6.When the photovoltaic is not available and the load power is greater than the power value set by the AC power, the AC side and the battery supply power to the load.

Work pattern: mixed mode

Check	Peak-Flat-Valley	Start Time	End Time	Features	Power (kW)
√	Peak price	9:00	10:00	System for self-use	10
√	Peak price	9:00	10:00	System for self-use	10
↓	↓	↓	↓	↓	↓
Enable	Select the peak segment, flat segment and valley segment when peak-load shifting.	Arrive at this time, the system starts to run automatical.	Arrive at this time, the system stops running automatical.	Functions performed in the current time range.	Operating power of peak-load shifting.

Note: "Mixed mode" has the following functions:

1. Economic mode

a. Peak segment: execute the "self-use" mode, and the battery provides the energy required for the load.

b. Flat segment: the implementation of "self-use" mode, the power grid provides the energy required for the load.

c. Valley segment: the implementation of the "battery priority" mode, the grid charge the battery, while providing the load required energy.

2. Peak-load shifting: according to the set power value of positive and negative (positive discharge negative charge) to control the battery charge. Secondly, the generator can be turned on/off by selecting "generator action".

- Note: If the anti-reverse function is set to enable, the system will not supply power to the grid in all working modes.

4.2 Converter status

There are four states of energy storage converter, as shown in table below:

Table 4-1 Status and description

Status	Description
Operation	Converter works normally.
Fault	When the energy storage system malfunctions, the converter will stop working and automatically disconnect the AC-DC contactor, then the main circuit is separated from the battery, the power grid or the load. In the fault state, the system keeps monitoring whether the fault is rectified. If the fault is not rectified, the system keeps the fault state. If the fault is rectified, the system shuts down after 30 seconds by default.
Halt	When the energy storage converter is in the operation state, the user stops the energy storage converter by issuing a stop command through the upper computer, or shut down the energy storage converter through the shutdown button on the LCD screen switching page.
Energency halt	In case of failure or emergency, press the EPO button to stop the converter.

- When the energy storage converter is faulty or the power module is faulty, do not turn on the power again through the touch screen.
- Confirm the system works normally by power off inspection, and then power on again, otherwise it will cause damage to the machine.

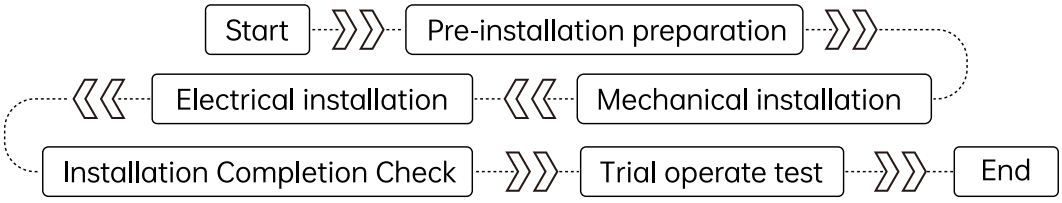
5 Mechanical installation guidance

5.1 Precautions

- The installation of MPS series energy storage converter must be operated by at least two qualified persons at the same time, and all electrical installation must comply with local electrical installation standards.
- Do not touch other parts of the cabinet except wiring terminals during installation.
- Safety signs: “Do Not Close Under Construction” must be set at all upstream switches.

5.2 Installation procedure

Figure 5-1 Installation process



5.3 Installation preparation

5.3.1 Packaging inspection

Check equipment before installation. If any transportation damage is found, please contact us and provide the images of damaged place.

5.3.2 Delivery checklist

According to the checklist in the packing box, check that all the delivered accessories are complete or not:

Table 5-1 Checklist

Item	Number
Converter	1
Key	2
Certificate	1
Warranty Card	1
Product User Manual	1
Factory inspection report	1

5.3.3 Installation tools and parts

The tools and parts needed to install the converter are as follows:

Table 5-2 Tool list

Tool	Number
Forklift or crane	1
Wire stripper	1
Crimping plier	1
Screwdriver	1
Sleeve	1
Multimeter	1
Screws, nuts, gaskets	Some

5.3.4 Installation environmental requirements

Before installing the converter, ensure that the environment meets the following requirements:

Table 5-3 Environmental requirements

Item	Requirements
Temperature	-30℃ ~60℃
Humidity	< 95% (non-condensing)
Altitude	5000m(> 3000m derating)

- Places away from sources of electromagnetic radiation; Places free from oil mist, corrosive gas, flammable gas, etc.; In the place of metal powder, dust, oil, water and other foreign matter will not enter the converter inside (please do not install the converter on wood and other flammable materials); Places free of radioactive and flammable substances; The place free of harmful gases and liquids.

5.4 Machine transportation

5.4.1 Transportation instructions

- In order to make the converter in a better state of protection, as far as possible to use packaging transport.
- When using forklifts or cranes for transportation, it is necessary to pay attention to the weight of the converter, ensure that the transportation equipment has sufficient carrying capacity, and rationally arrange the support or lifting points.

- The converter's outer package is marked with detailed product parameters and transportation requirements. Please transport according to the various marks on the package. The graphic description of the converter's packaging marks is shown in Table 5-4 and Table 5-5:

Table 5-4 Description of parameter

Item	Description
MODEL	Converter model
SIZE	Out packing size
NW	Net weight of converter
GW	Gross weight: converter includes outer packing box

Table 5-5 Graphical description of packing marks

Mark	Description
	Front-up, no transverse, tilt or inversion of converter
	Care should be taken to avoid damage to converter caused by excessive collision and friction in transportation
	Pay attention to damp-proof, avoid the converter being rained or damped

5.4.2 Forklift transportation

The following diagram shows the use of forklift for transport with and without packaging.

- When transporting without packing, be sure to unload the lower coaming for transporting.
- In the course of transportation, the center of gravity of the box device should fall between the two forks of the forklift truck.
- Forklift trucks are forbidden to carry long distances or take sloping roads.
- Take-off and landing should be handled lightly to avoid impact or vibration.
- When transporting, the larger size of the converter may block the operator's sight. Please arrange the assistant personnel.

Figure 5-2 Carry with packaging

Figure 5-3 Carry without packaging

- Note: When handling without packing, remove the bottom enclosure before using forklift!

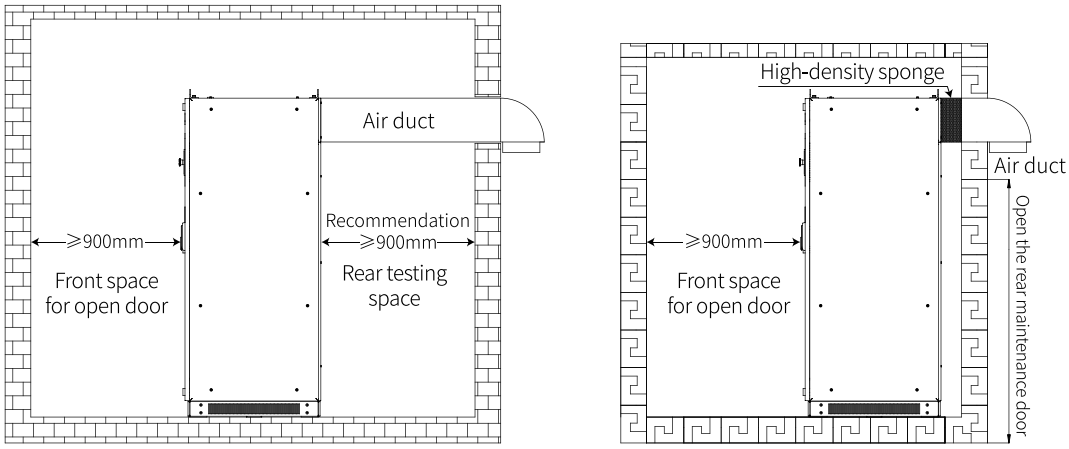
5.5 Location and fixation

5.5.1 Space requirments

- Installed indoors with good ventilation. Not in high humidity and high temperature source, no corrosive gas.
- Avoid direct sunlight or rain.
- Ensure that the grounding cable in the power distribution room is properly grounded, and that the grounding resistance in a dry environment is less than 4 Ω.
- The converter mounting surface must have sufficient bearing capacity.
- Avoid placing together with inflammable and explosive materials, meeting fire protection requirements.

The reserved space size is shown as follows:

Figure 5-4 Installation space requirements



Civil installation　　Container installation

5.5.2 Dimensions of models

The mechanical dimensions of various models of MPS series converters are shown in Table 5-6 below. Users can design and install them according to the data.

Table 5-6 MPS series dimensions

Model	Dimension（W×D×H)
MPS0030	800×800×1900(mm)
MPS0050	800×800×1900(mm)
MPS0100	1200×800×2050(mm)

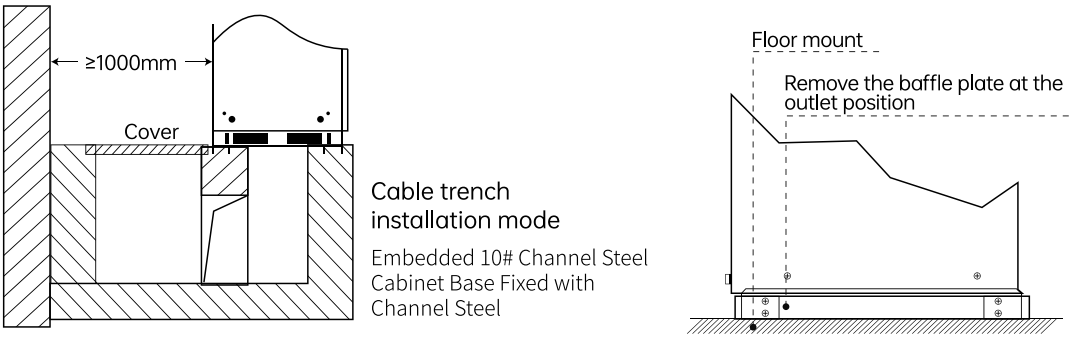
Model	Dimension（W×D×H）
MPS0150	1200×800×2050(mm)
MPS0250	(600×720×2050) ×1+1200×800×2050(mm)
MPS0500	(600×720×2050) ×2+1600×1050×2050(mm)

* **MPS0250 is split-type which consists of one photo-voltaic controller (600×720×2050) and one energy storage converter (1200×800×2050). MPS0500 is split-type which consists of two photo-voltaic controller (600×720×2050) and one energy storage converter (1600×1050×2050).**

5.5.3 Base mounting

The bottom of the MPS series converter must be connected to the base surface. The bottom of the converter has a fixing hole for fixation, which is used to fix the converter on the bottom support channel or the ground. As shown in the following picture:

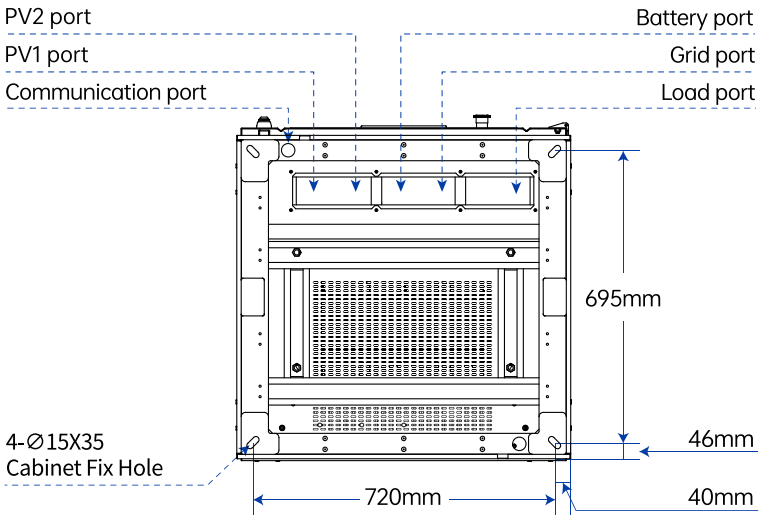
Figure 5-5 Base mounting and fixing



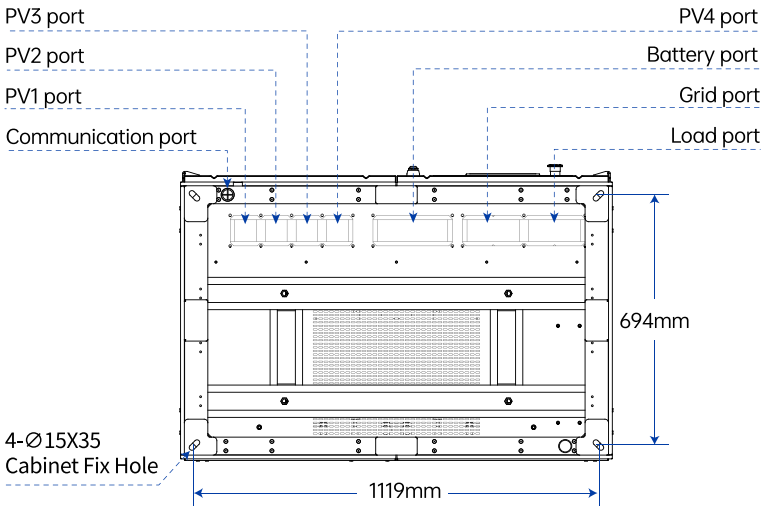
- The channel steel should be designed according to the positioning hole at the bottom of the converter equipped with a base.
- The bottom section of each model is shown in the following figures (mm). Cooling air enter from the front and bottom, and cables from the bottom. In front of the converter, there are DC and AC inlet and outlet holes.

Figure 5-6 Bottom section

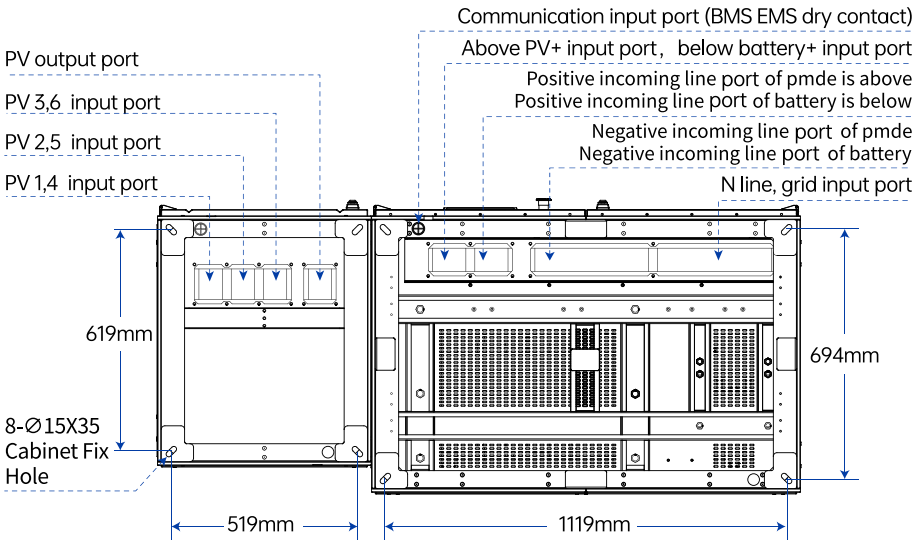
MPS0030/
MPS0050



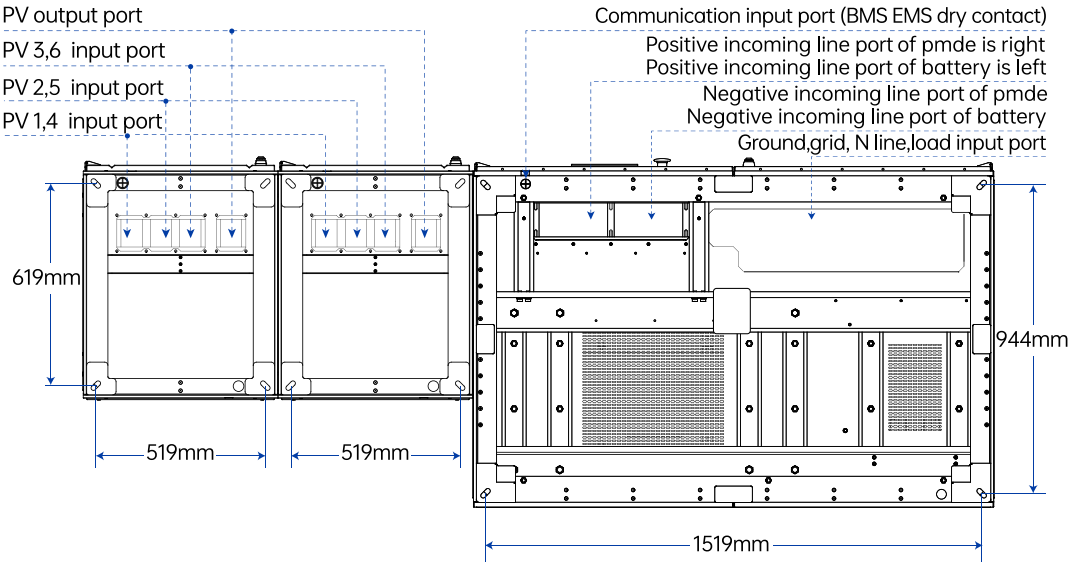
MPS0100/
MPS0150



MPS0250



MPS0500



5.6 Air duct

5.6.1 Forced air cooling system

The MPS series energy storage converters use forced air cooling for heat dissipation and are require to maintain sufficient air intake.

Table 5-7 Forced air cooling system

Model	Min. area of shutters for air intake (m^2)
MPS0030/50	0.543858
MPS0100/150	0.8068668
MPS0250	0.9715392
MPS0500	1.6123272
PMDE0250	0.536526
PMDE0300	0. 536526

5.6.2 Ventilated environment

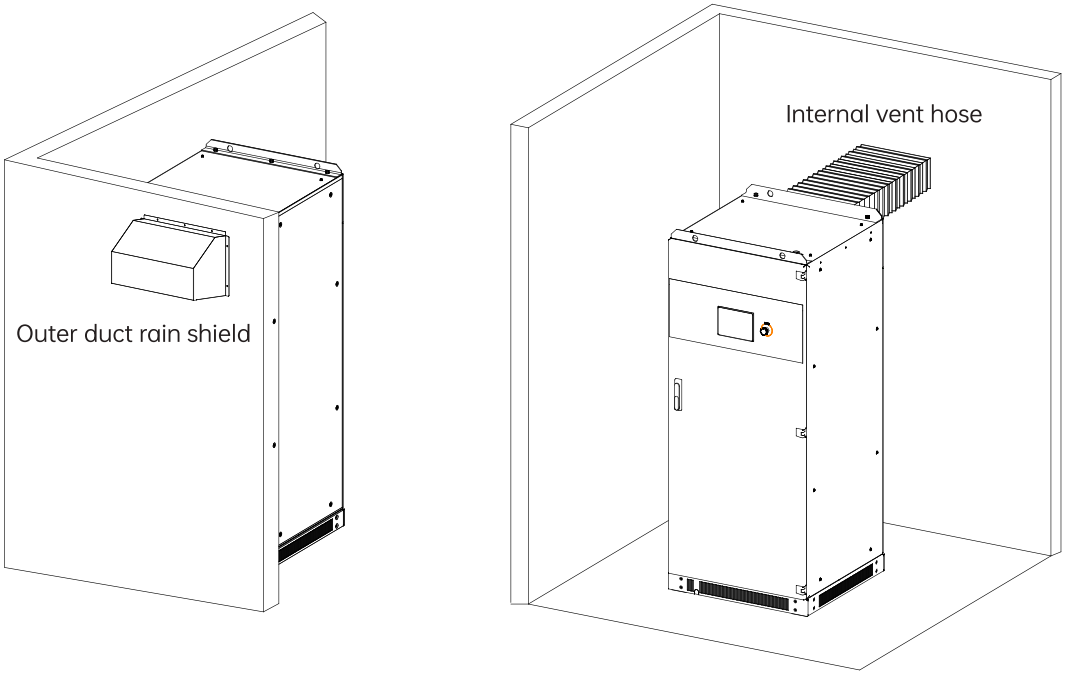
For ventilated environment, the installation environment must meet the following requirements:

- Avoid installation in the situation of poor ventilation and low air flow. More ventilation can be obtained by adding construction measures such as air supply grid or fan.
- The air inlet should have sufficient air intake volume and ample air intake area.
- Air quality must be guaranteed. If the suspended matter concentration (sand wind and dust) is too high, taking some construction measures to realize the air quality requirements (such as installing filters at the air supply grille of the building).

5.6.3 Air duct setup

For pressure balance, add a fan that exhausts air outward on the outlet of the air duct. The size of the air duct depends on the air output volume, designed by professionals. The design and installation of air duct take into consideration preventing the air flow backward of the converter cabinet.

Figure 5-7 External duct of converter



* The air duct should be reasonably designed according to different models and site environment.

Specific requirements for adding air ducts to converters are as follows:

- The increase of air ducts does not reduce the ventilation volume of the cabinet.
- The interface between air duct and converter cabinet is well sealed.
- The air duct outlet should be tilted downward (rain proof).
- Add barbed wire to the air duct outlet (to prevent rodents, birds, etc.).

The air required by the converter is inhaled through the vents at the bottom and the dustproof mesh at the front door. The hot air is discharged through the exhaust vents at the top of the converter.

6 Electrical installation guidance

6.1 Cable requirements

According to the capacity allocation requirement of single energy storage converter, it is suggested that the current passing through 1mm² conductor should be no more than 3A, and the same size and type of conductor should be selected for the connection on the same side. The reference requirements for various types of interface cables are given by us. Users can design relevant cables according to the table below. Cables shall be designed in accordance with the instructions in this section and local wiring regulations, taking into account environmental conditions.

Table 6-1 Specifications of power cables for the MPS converters (copper wire)

Capacity	AC output(each phase)	Neutral wire	Ground wire	Battery wire	Photovoltaic
30 kW	≥ 25mm²	≥ 25mm²	≥ 16mm²	input 50mm²	50mm²/group
50 kW	≥ 35mm²	≥ 35mm²	≥ 16mm²	input 70mm²	50mm²/group
100 kW	≥ 70mm²	≥ 70mm²	≥ 35mm²	input 95mm²	50mm²/group
150 kW	≥ 50mm²×2	≥ 50mm²×2	≥ 50mm²	input 95mm²	50mm²/group
250 kW	≥ 120mm²×2	≥ 120mm²×2	≥ 95mm²	2 Input channel 120mm²/channel	50mm²/group
500 kW	≥ 120mm²×4	≥ 120mm²×4	≥ 95mm²×2	4 Input channel 120mm²/channel	50mm²/group

WARNING

- Before wiring operation, confirm that both the grid input and BAT input switches are disconnected, and affix warning signs to prevent others from operating the switches.

WARNING

- Power cables must be routed through trenches or metal wiring channel to avoid mechanical damage to the cables or RF interference to peripheral devices.

- The cable dimensions provided in this table are for reference only. The actual selection should be based on the working environment temperature, laying method, heat dissipation conditions and so on.

CAUTION

- The equipment does not have external cables. The above cable recommendation table is not provided by converters. Users are requested to provide their own cables according to relevant needs.

CAUTION

- All external cables are connected to the corresponding position after entering the equipment through the bottom entry and exit holes.
- The terminals and fixing screw used in power cable wiring of MPS series converters have been installed at the corresponding wiring terminals when the equipment is delivered.

6.2 Terminal

Installation indication of terminal and fixed screw used in power cable wiring of converter:

Figure 6-1 Connection terminal

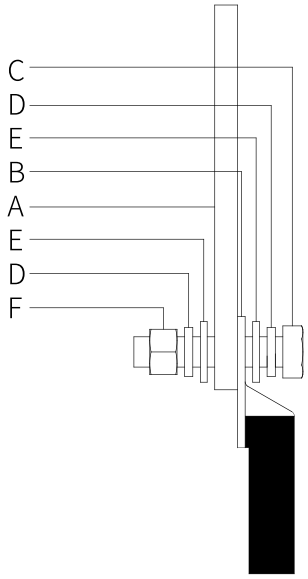


Table 6-2 Names of wiring terminals

Number	Name
A	Copper bar
B	Connection terminal
C	Screw
D	Spring washer
E	Large pad
F	Nut

6.3 Wiring specification

- The recommended minimum space distance between parallel shielded data lines and power cables corresponds to the field.

- When laying cables, communication lines and power lines should be laid separately. DC and AC circuits need to be laid separately, and the distance between different cables should be more than 300 mm. When the control cable must pass through the power cable, the angle between the two cables should be kept as high as 90 degrees.

Table 6-3 Distance between signal lines and power cables

Parallel Line Length (m)	Minimum Spatial Distance (m)
200	0.3
300	0.5
500	1.2

*** The data line should be as close as possible to the supporting line of the surface ring, such as supporting beams, steel troughs, metal guideways, etc.**

6.4 Fixation and protection of cables

6.4.1 Cable fixation

In order to prevent loosening of the copper wiring nose, causing poor contact, or increasing contact resistance leading to fever or even fire, it is necessary to ensure that the screw fastening the terminal meets the torque requirements listed in Table 6-4:

Table 6-4 Screw dimensions and required torques

Screw dimensions	M4	M5	M6	M8	M10	M12	M14	M16
Torques (N·m)	2	3.2	7	16	34	46	58	68

6.4.2 Cable protection

The protection of cables includes communication cables and power cables. The protective methods are as follows:

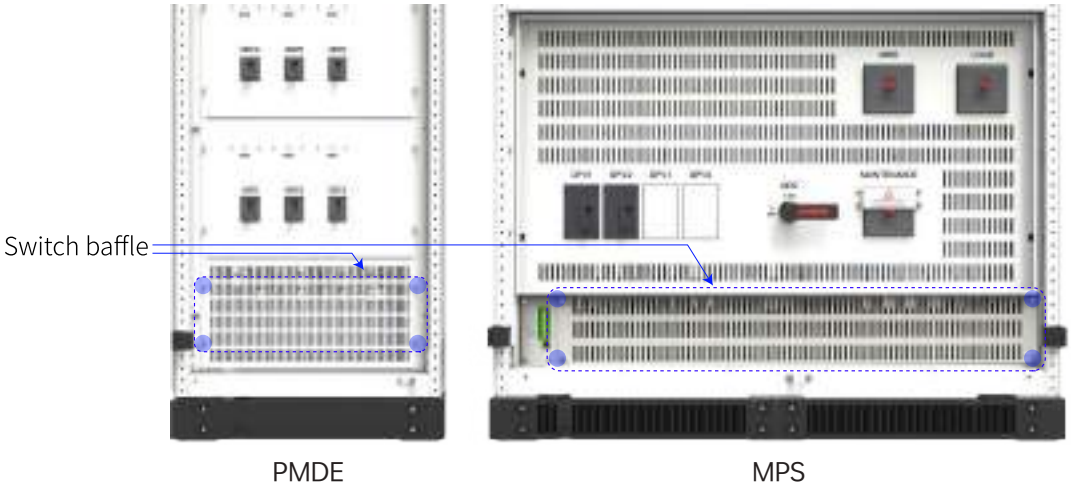
- Protection of communication cable: Because communication cable is thin, it is easy to break or fall off from the terminal during construction. Therefore, it is suggested that the power circuit should be connected first, and then the connection should be made. When connecting, the cable should be grooved as far as possible. Where there is no groove, the cable should be fastened with tie-in belt. When traveling, the development of thermal elements and strong electric field circuit cables should be avoided.
- Protection of power cables: Therefore, the scratch and breakage of cable insulation skin should be avoided when installing connection, because this may lead to short circuit. Power cables must also be properly fixed.

6.5 Remove the switch baffle and lower coaming

6.5.1 Remove baffle

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 in Figure 6-2.

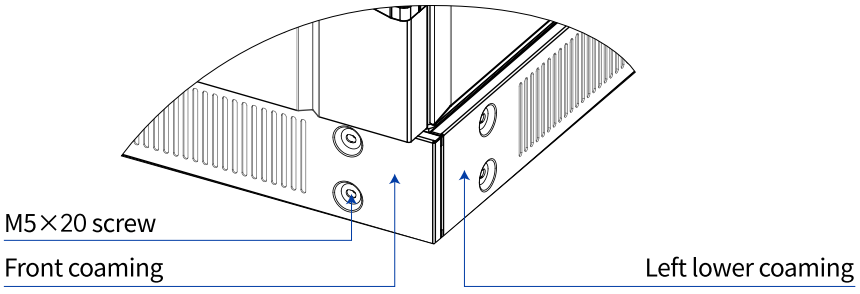
Figure 6-2 Switch baffle



6.5.2 Installation of lower coaming

The MPS series energy storage converters have lower coaming at the bottom of front, back, left and right. They are packaged and placed at the bottom of the packaging box. Before installation, all lower fencing boards of the converter must be removed and put out. After the converter is positioned and the screw is locked, the lower fencing boards shall be installed. Dust-proof cotton is installed in the lower fencing board, which cannot be lost during installation.

Figure 6-3 Installation of lower coaming

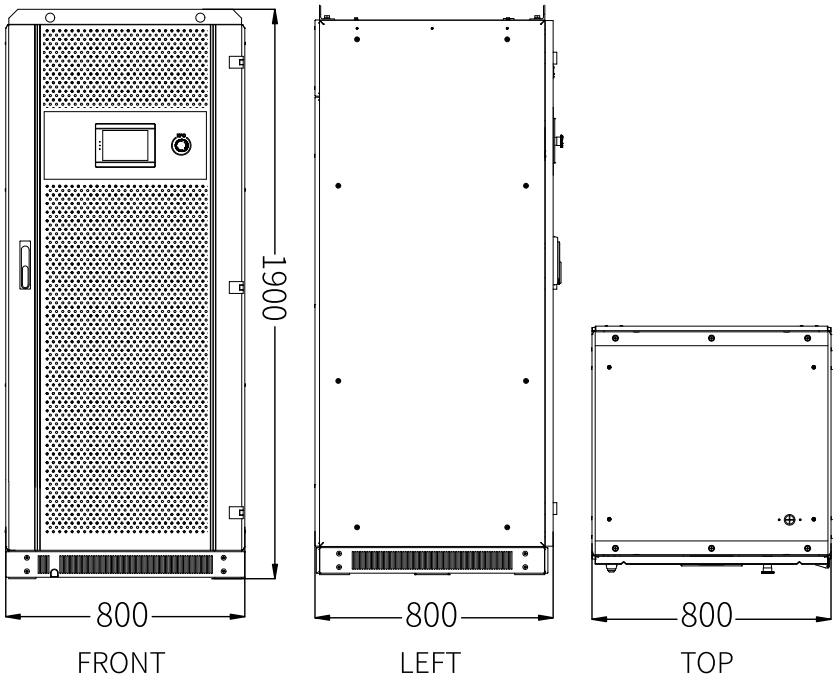


6.6 Dimension figure

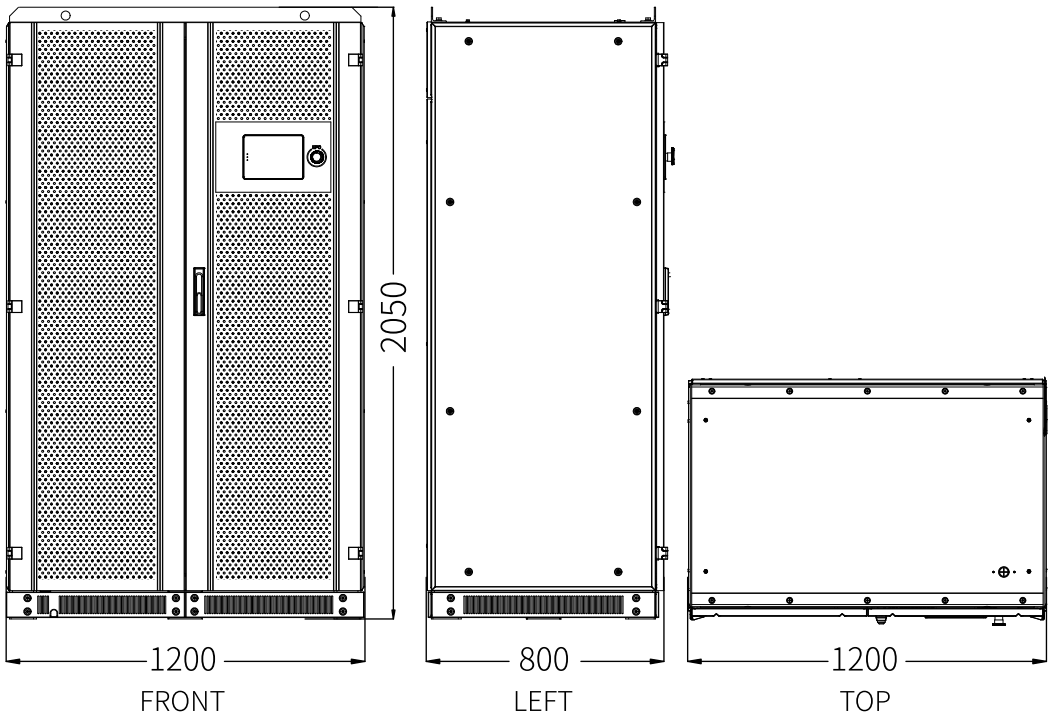
- The energy storage converters are in and out of line mode, the power terminal can be seen after the switch baffle is removed, available in three screw sizes M8/M10/M12,the internal wiring terminals are shown in Figure 6-4.

Figure 6-4 Dimension figure

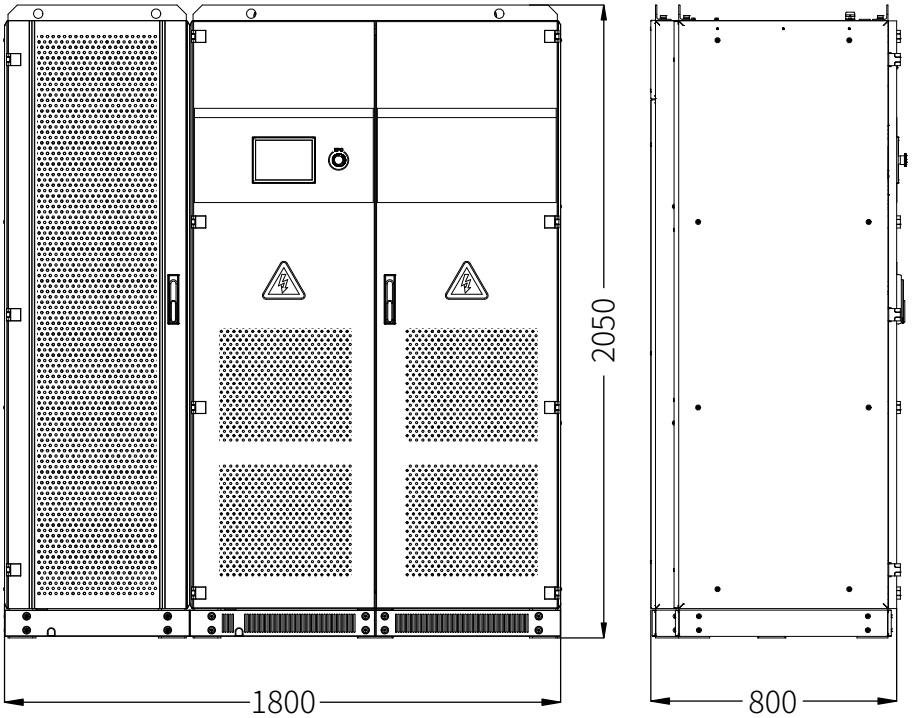
MPS0030/MPS0050



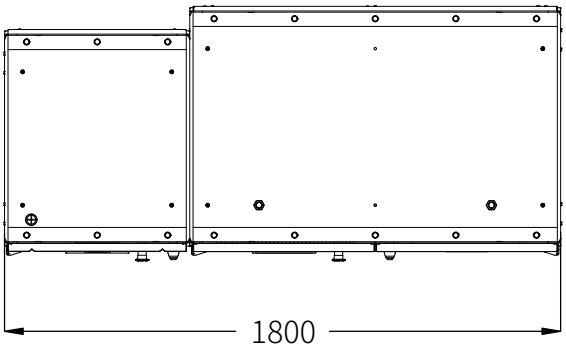
MPS0100/MPS0150



MPS0250

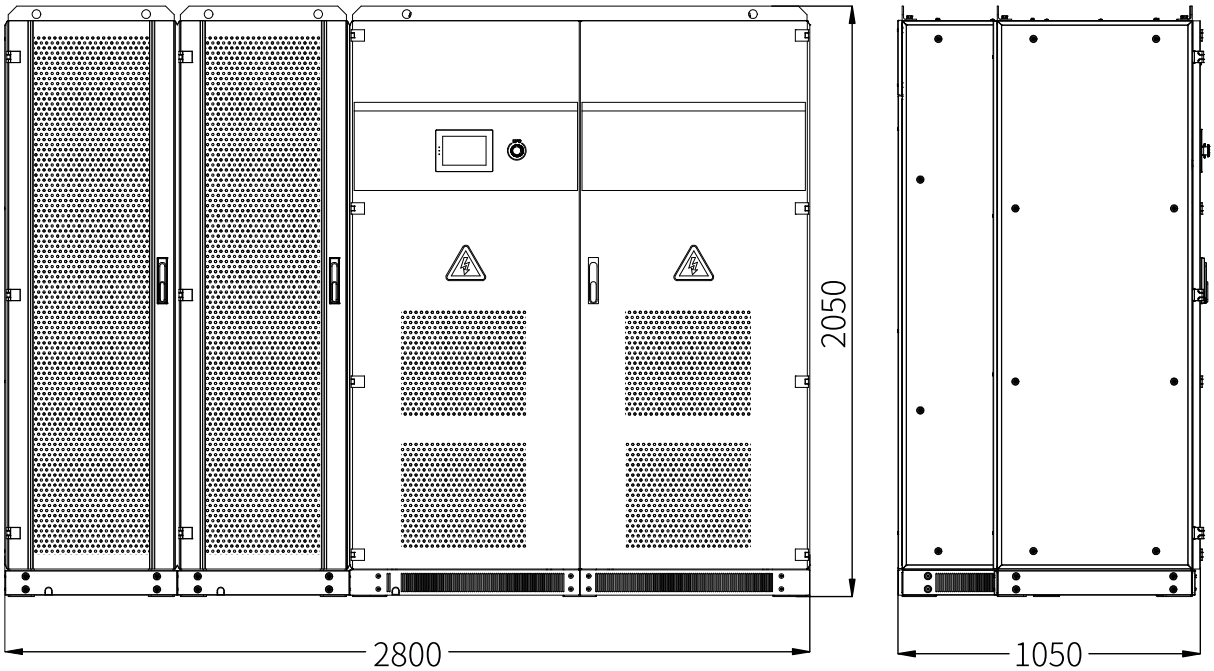


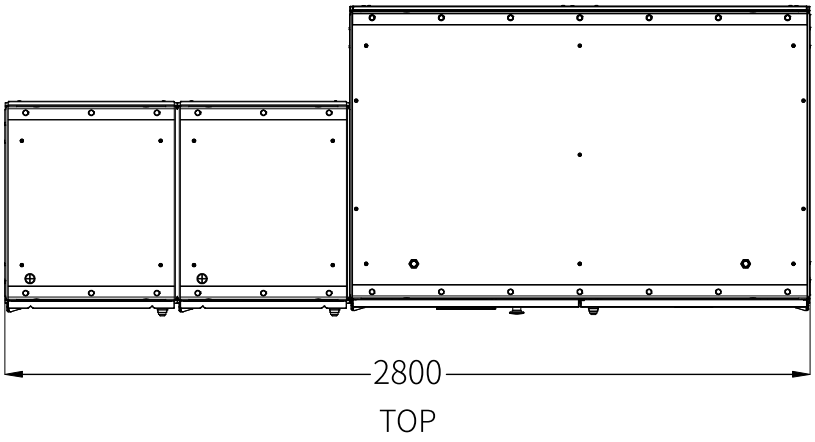
FRONT LEFT



TOP

MPS0500





6.7 DC side wiring

- 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.

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 converter.
- Damage and loss of equipment caused in this case do not fall within the scope of quality.

- 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 aluminum materials are interconnected, special copper and aluminum connectors should be used. Do not connect directly!

6.8 AC side wiring

6.8.1 AC side wiring

- All models of this series energy storage converters have grid connection. Only those with bypass need to consider bypass connection. Their corresponding relations are shown in the table below. Refer to Section 7.2 for the access location of copper bars.

Table 6-5 GRID

GRID	
A	Phase A or U connected to power grid
B	Phase B or V connected to power grid
C	Phase C or W connected to power grid
N	Phase N connecting to power grid

6.8.2 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 A,B,C, 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 6-5. Connect the three phases A, B and C connected to the load to the load correctly according to Table 6-6.

Table 6-6 LOAD

LOAD	
A	Phase A connected to load
B	Phase B connected to load
C	Phase C connected to load

6.9 Communication wiring

6.9.1 External communication wiring

- The communication cable of external interface is reserved at the bottom of the device. Connect the communication cable to the terminal of the device. Figure 6-5 shows the silkscreen description of external communication ports.

* **Communication lines can be fine-tuned according to technical protocols.**

Figure 6-5 TF6 skillscreen

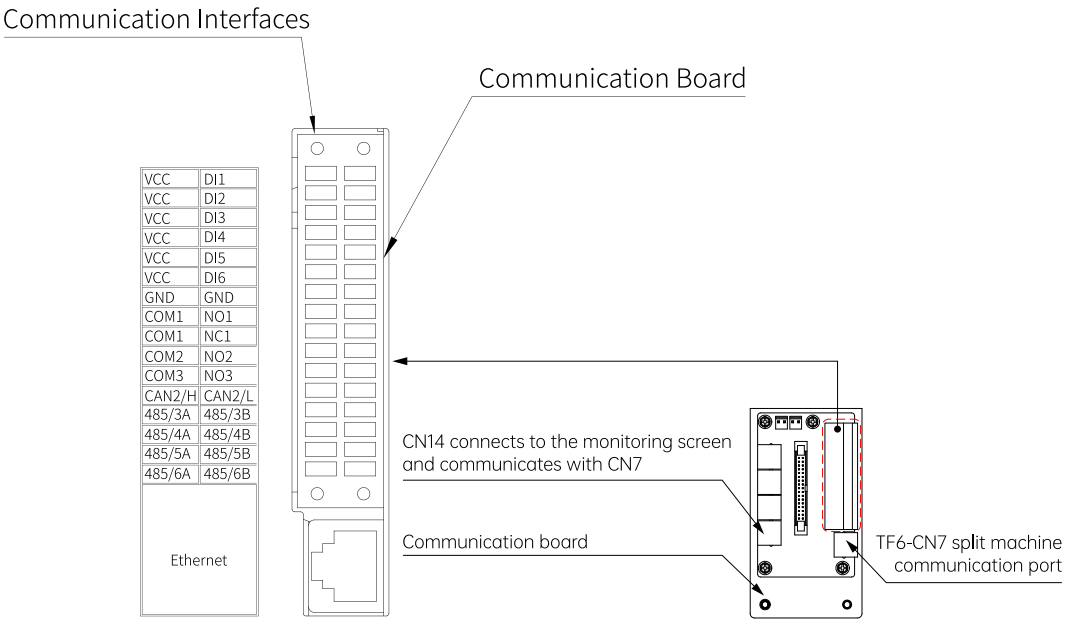


Table 6-7 TF6 definition of interface

TF6-terminal item	Function
DI1	EPO（default）
	Shutdown
	Switch
	ATS signal
	Water logging
	Fire protection
DI2	EPO
	Shutdown（default）
	Switch
	ATS signal
	Water logging
	Fire protection
DI3	EPO
	Shutdown
	Switch（default）
	ATS signal
	Water logging
	Fire protection
	0%active power

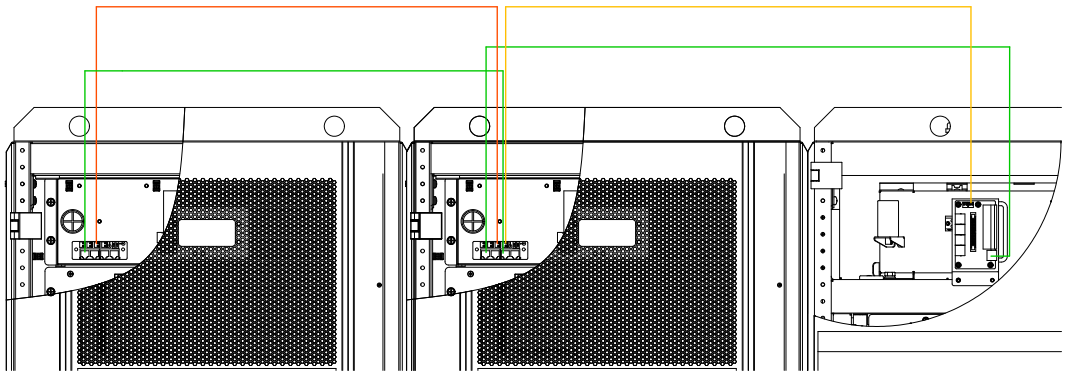
TF6-terminal item	Function
DI4	EPO
	Shutdown
	Switch
	ATS signal（default）
	Water logging
	Fire protection
	30%active power
DI5	EPO
	Shutdown
	Switch
	ATS signal
	Water logging（default）
	Fire protection
	60%active power
DI6	EPO
	Shutdown
	Switch
	ATS signal
	Water logging
	Fire protection（default）
	100%active power
GND	/
NC1	Generator
COM1	
NO1	
NO2	Warning signal
COM2	
NO3	Operation signal
COM3	
CAN2/H	Battery BMS communication（default）
CAN2/L	
485/3A	Battery BMS communication （default）
485/3B	
485/4A	/
485/4B	
485/5A	Electricity meter
485/5B	
485/6A	MPS to EMS communication
485/6B	

TF6-terminal item	Function
Ethernet	MPS to EMS communication （default）

6.9.2 Parallel communication connection

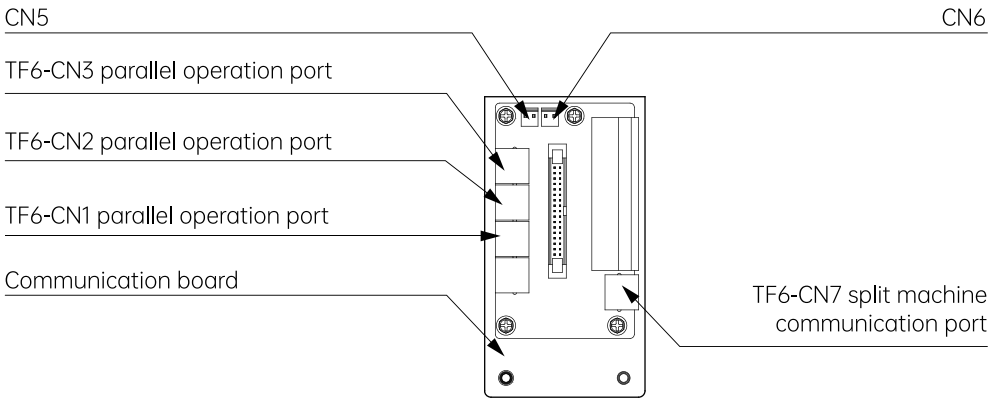
- For the communication problem of MPS0250 and MPS0500 split machine, MPS series energy storage converter is equipped with TF6 communication interface board located at the top of the device. A TF1 communication board is installed on the top of the DCDC multi-module cabinet. Connect the power cord and network cable in parallel between the machines when in use. Details are shown in Figure6-6:

Figure 6-6 Split machine communication wiring



- For the convenience of customers with parallel requirements, all models of MPS series energy storage converters have the function of multi-machine parallel use, supporting up to four devices for parallel operation. The TF6 communication board and wire hole are arranged on the top of the equipment. When multiple devices are used in parallel, connect the parallel ports between the devices using network cables, as illustrated in Figure 6-7.

Figure 6-7 The function of external communication board port



- When connecting cables, pay attention to network port selection. The communication on the split machine is connected to network port CN7. When multiple devices are used in parallel, network ports CN1-CN3 are used.
- At the same time, the distance between devices should not be too long. The length of the network cable is crucial to the communication. If the network cable is too long, the communication fault may occur.

Figure 6-8 MPS0250 dial switch

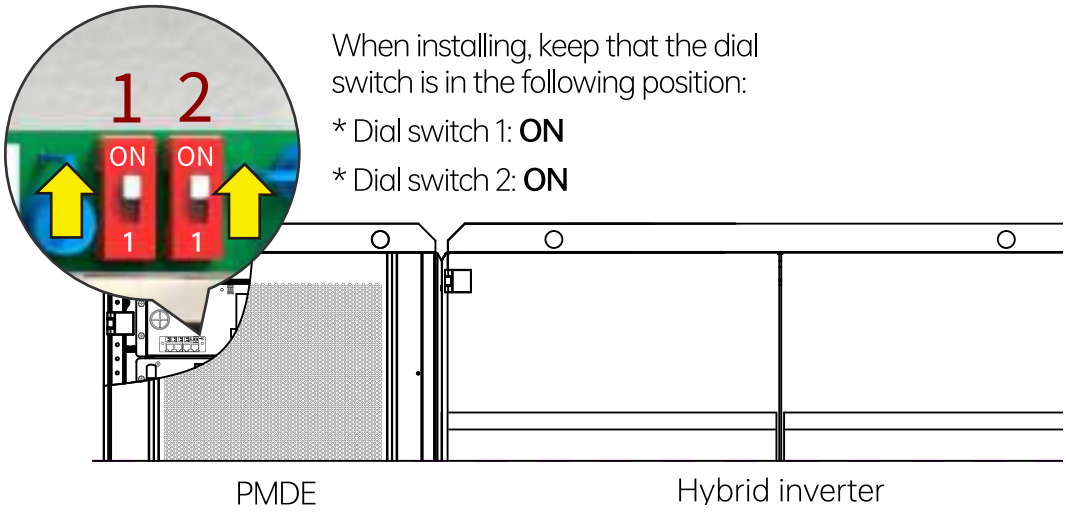
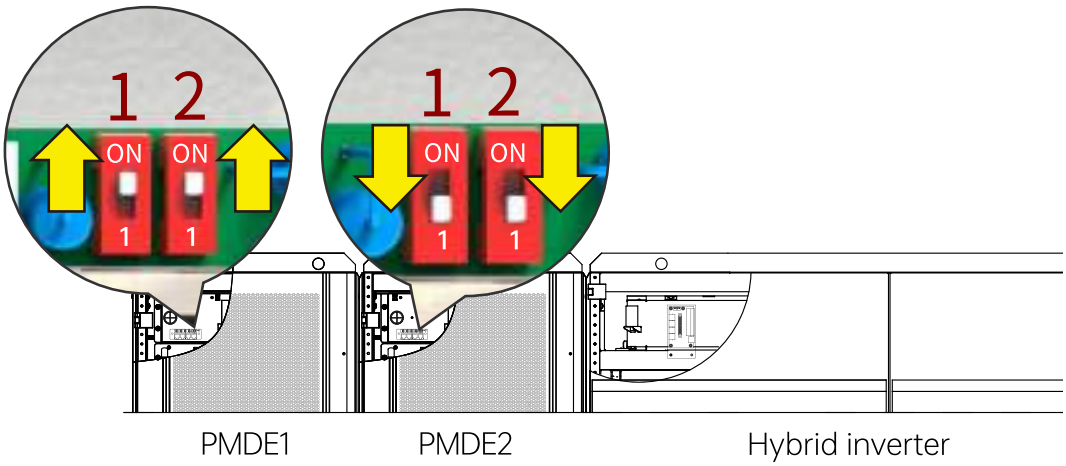


Figure 6-9 MPS0500 dial switch



When installing, keep that the dial switch is in the following position:
PMDE1

- Dial switch 1: “On ”, Dial switch 2:“ On”.

PMDE2

- Dial switch 1: “1 ”, Dial switch 2: “1”.

6.10 Grounding

- The grounding copper bars in this series energy storage converters need to be connected reliably by grounding cables. Grounding copper bars have been reliably connected with the outer shell of the converter 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 4Ω, the diameter of grounding cable shall not be less than 16 mm ², and the position of the copper bars shall refer to the internal terminal of 7.2 section.

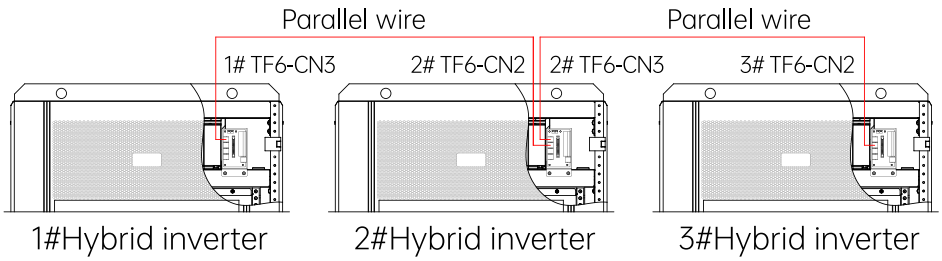
- When connecting ground cables for MPS models, the ground cables of MPS and PMDE are connected to the ground terminal of the power distribution cabinet. Therefore, connect the ground terminal of PMDE1 to the ground terminal of the power distribution cabinetand and connect the ground terminal of PMDE2 to the ground terminal of the power distribution cabinet.

* **The ground terminal of the PMDE is connected to the ground copper bar of the power distribution cabinet, but not to the ground copper bar of the MPS.**

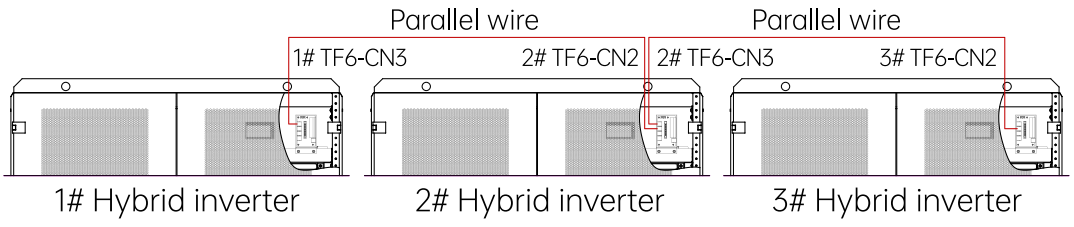
6.11 Parallel wiring

Figure 6-10 Three parallel machine wiring diagram

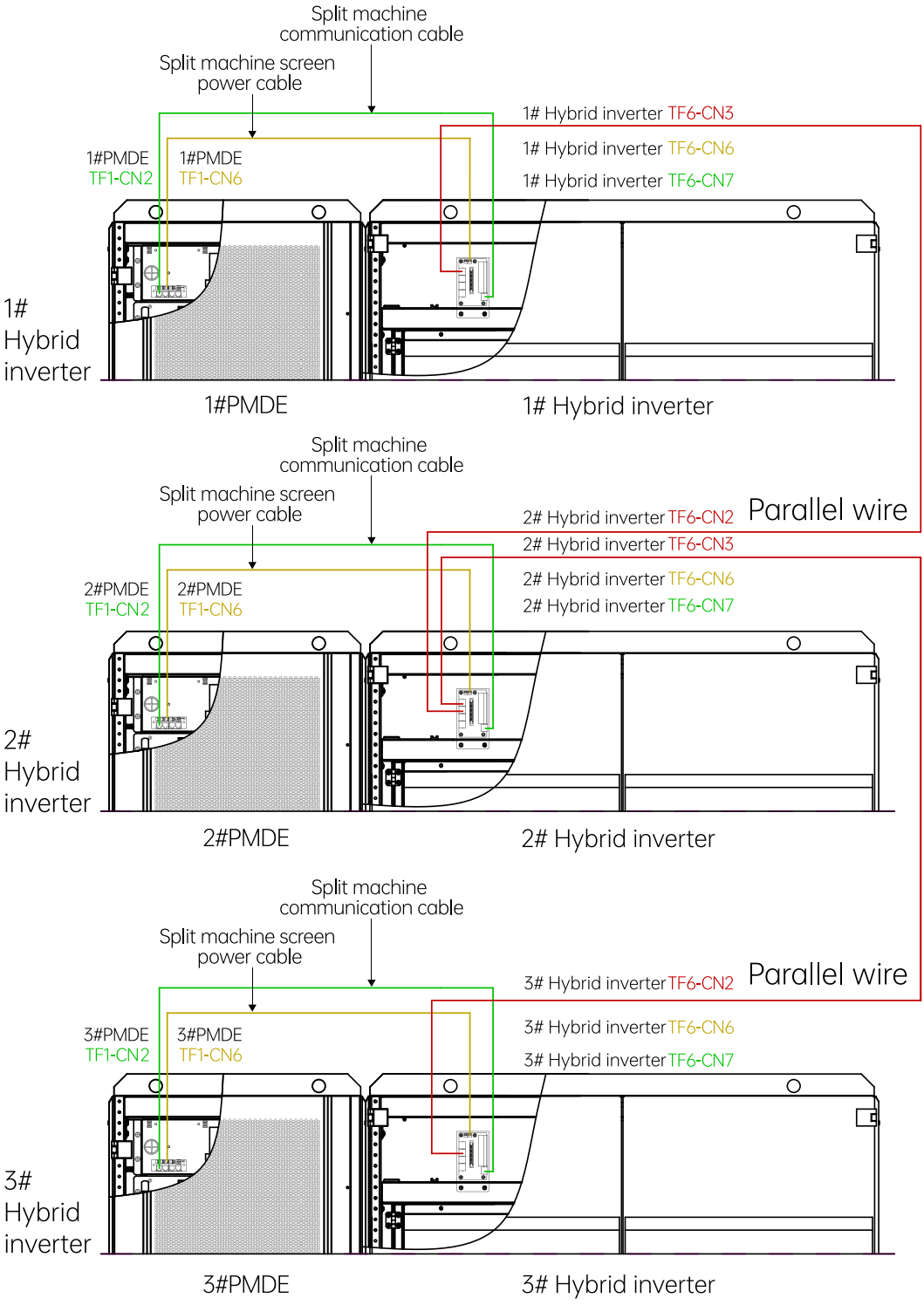
MPS0030/MPS0050



MPS0100/MPS0150



MPS0250


Split machine communication cable
Split machine screen power cable
1#PMDE TF1-CN2
1#PMDE TF1-CN6
1# Hybrid inverter TF6-CN3
1# Hybrid inverter TF6-CN6
1# Hybrid inverter TF6-CN7
1# Hybrid inverter
1#PMDE
1# Hybrid inverter
Split machine communication cable
Split machine screen power cable
2#PMDE TF1-CN2
2#PMDE TF1-CN6
2# Hybrid inverter TF6-CN2
Parallel wire
2# Hybrid inverter TF6-CN3
2# Hybrid inverter TF6-CN6
2# Hybrid inverter TF6-CN7
2# Hybrid inverter
2#PMDE
2# Hybrid inverter
Split machine communication cable
Split machine screen power cable
3#PMDE TF1-CN2
3#PMDE TF1-CN6
3# Hybrid inverter TF6-CN2
Parallel wire
3# Hybrid inverter TF6-CN6
3# Hybrid inverter TF6-CN7
3# Hybrid inverter
3#PMDE
3# Hybrid inverter

MPS0500

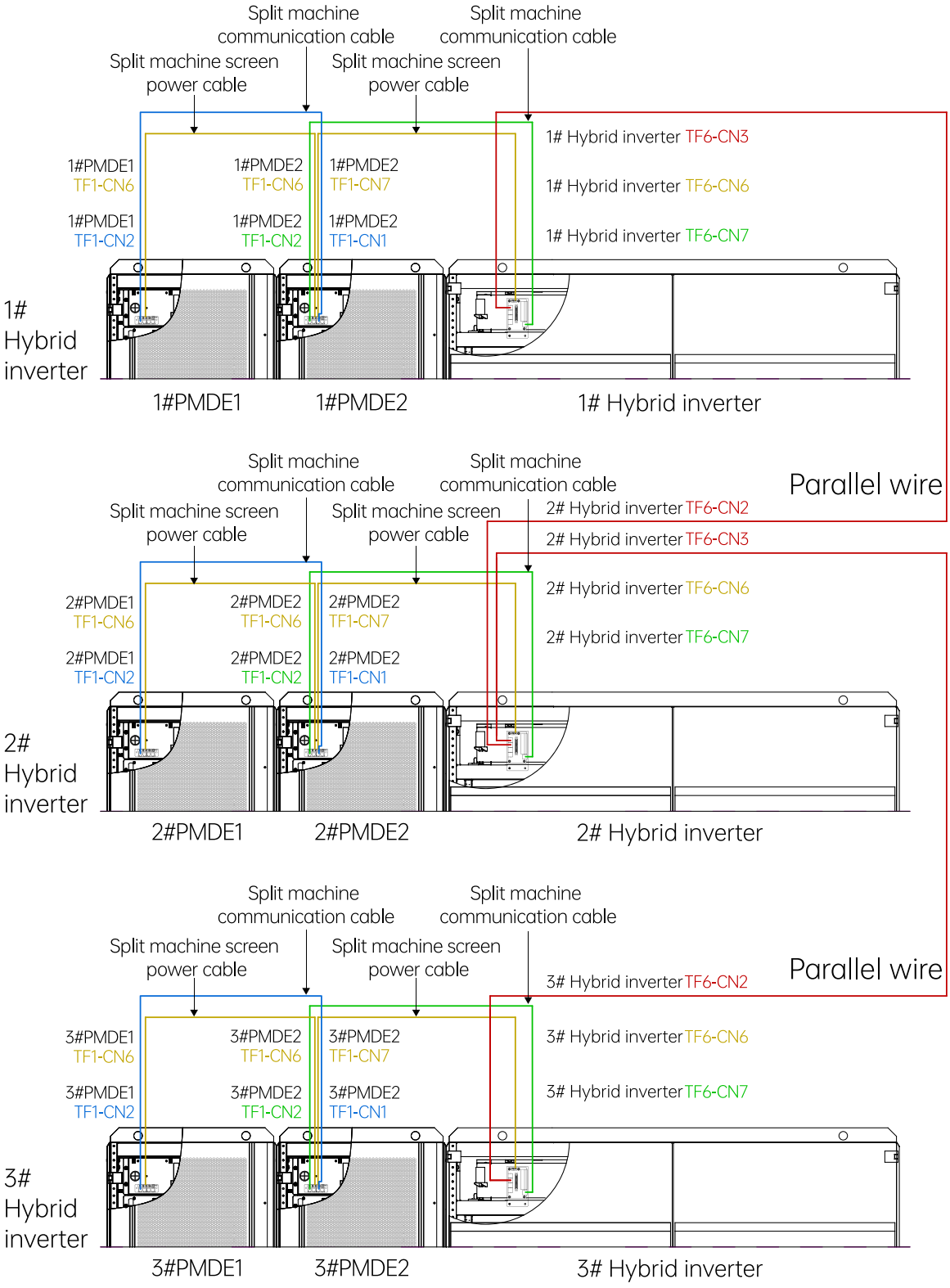
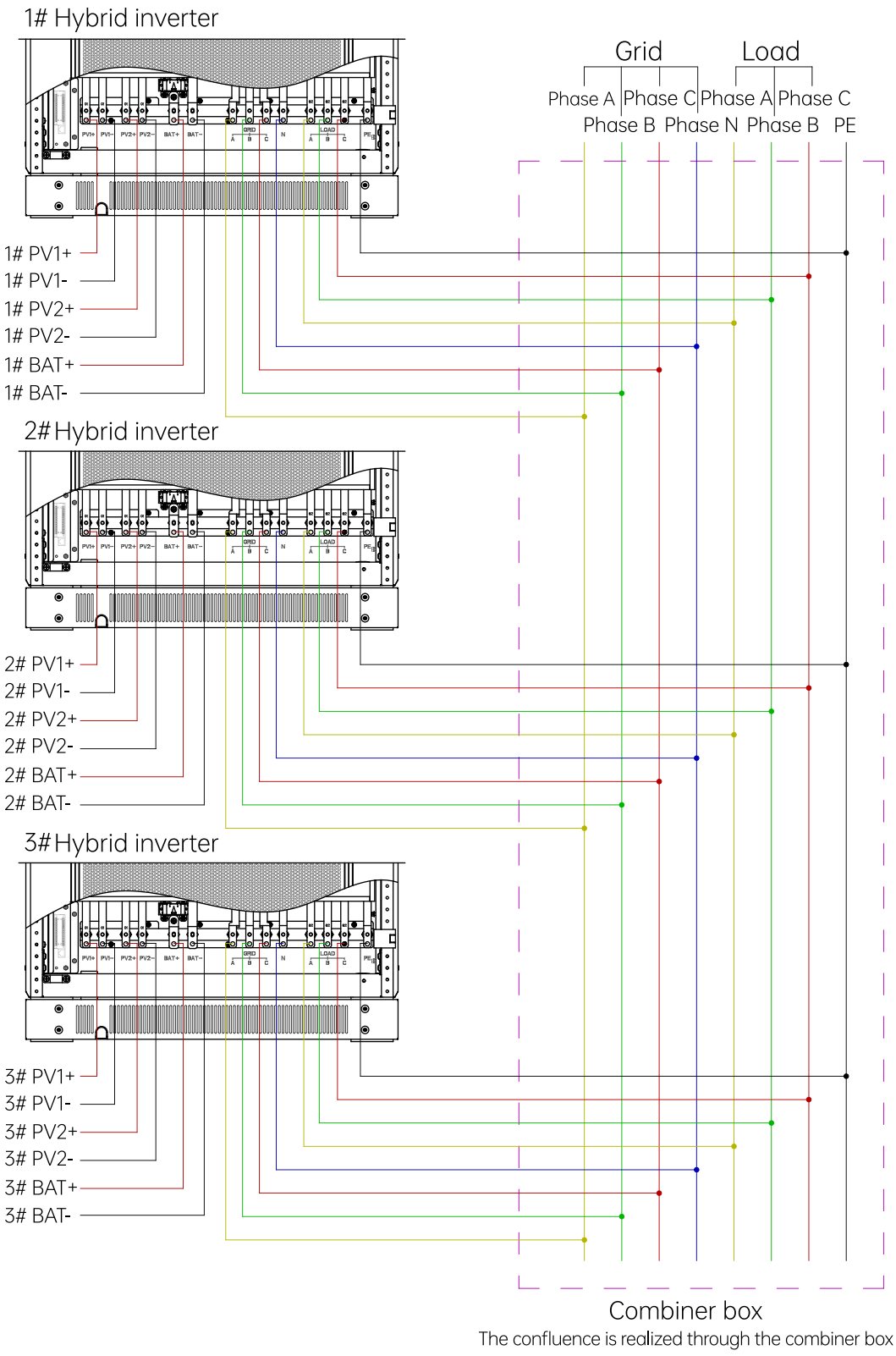
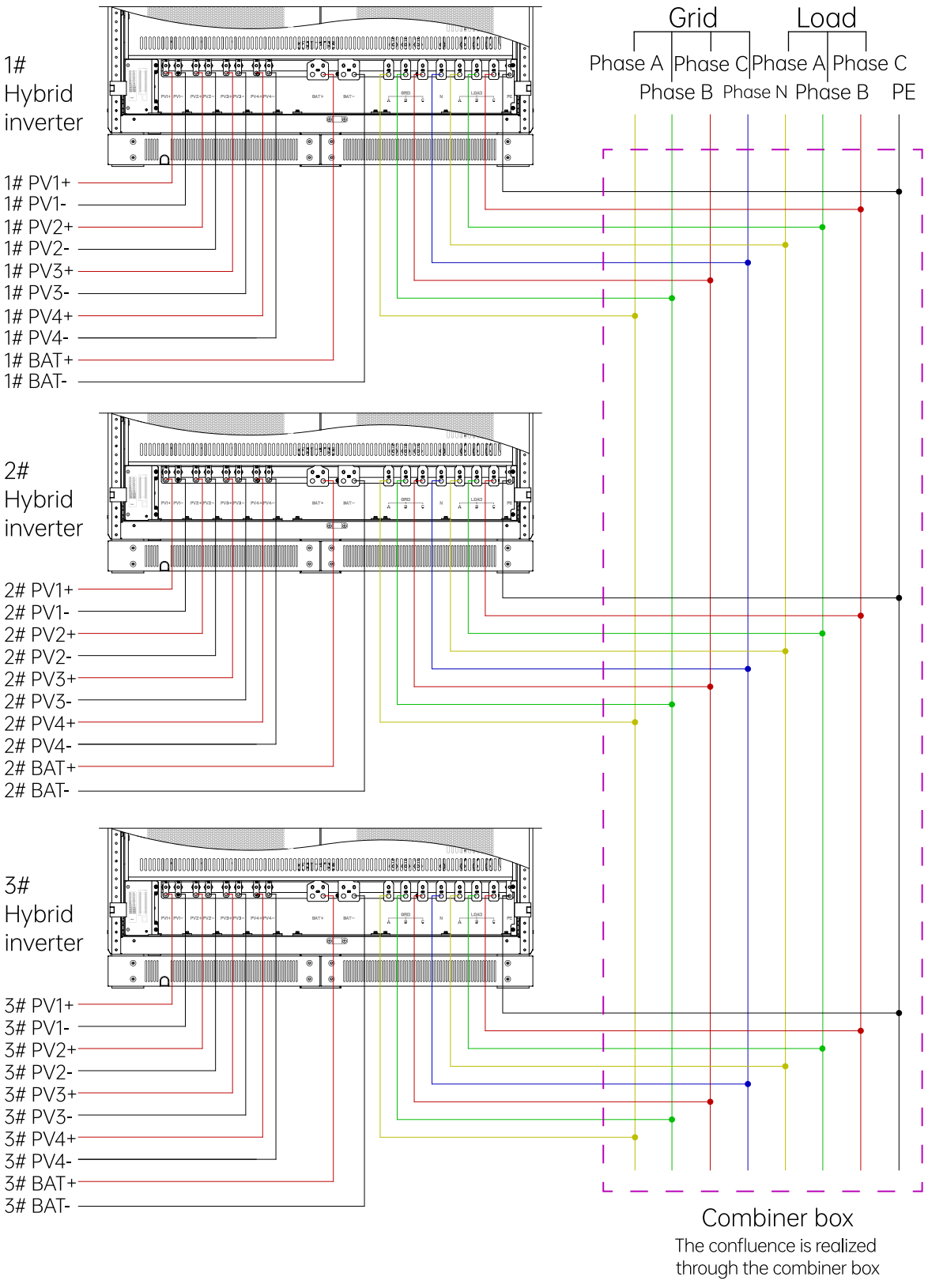

Split machine communication cable
Split machine communication cable
Split machine screen power cable
Split machine screen power cable
1# Hybrid inverter TF6-CN3
1# Hybrid inverter TF6-CN6
1# Hybrid inverter TF6-CN7
1#PMDE1 TF1-CN6
1#PMDE2 TF1-CN6
1#PMDE2 TF1-CN7
1#PMDE1 TF1-CN2
1#PMDE2 TF1-CN2
1#PMDE2 TF1-CN1
1# Hybrid inverter
1#PMDE1
1#PMDE2
1# Hybrid inverter
Parallel wire
Split machine communication cable
Split machine communication cable
Split machine screen power cable
Split machine screen power cable
2# Hybrid inverter TF6-CN2
2# Hybrid inverter TF6-CN3
2# Hybrid inverter TF6-CN6
2# Hybrid inverter TF6-CN7
2#PMDE1 TF1-CN6
2#PMDE2 TF1-CN6
2#PMDE2 TF1-CN7
2#PMDE1 TF1-CN2
2#PMDE2 TF1-CN2
2#PMDE2 TF1-CN1
2# Hybrid inverter
2#PMDE1
2#PMDE2
2# Hybrid inverter
Parallel wire
Split machine communication cable
Split machine communication cable
Split machine screen power cable
Split machine screen power cable
3# Hybrid inverter TF6-CN2
3# Hybrid inverter TF6-CN6
3# Hybrid inverter TF6-CN7
3#PMDE1 TF1-CN6
3#PMDE2 TF1-CN6
3#PMDE2 TF1-CN7
3#PMDE1 TF1-CN2
3#PMDE2 TF1-CN2
3#PMDE2 TF1-CN1
3# Hybrid inverter
3#PMDE1
3#PMDE2
3# Hybrid inverter

Figure 6-11 Three parallel machine power cable wiring diagram

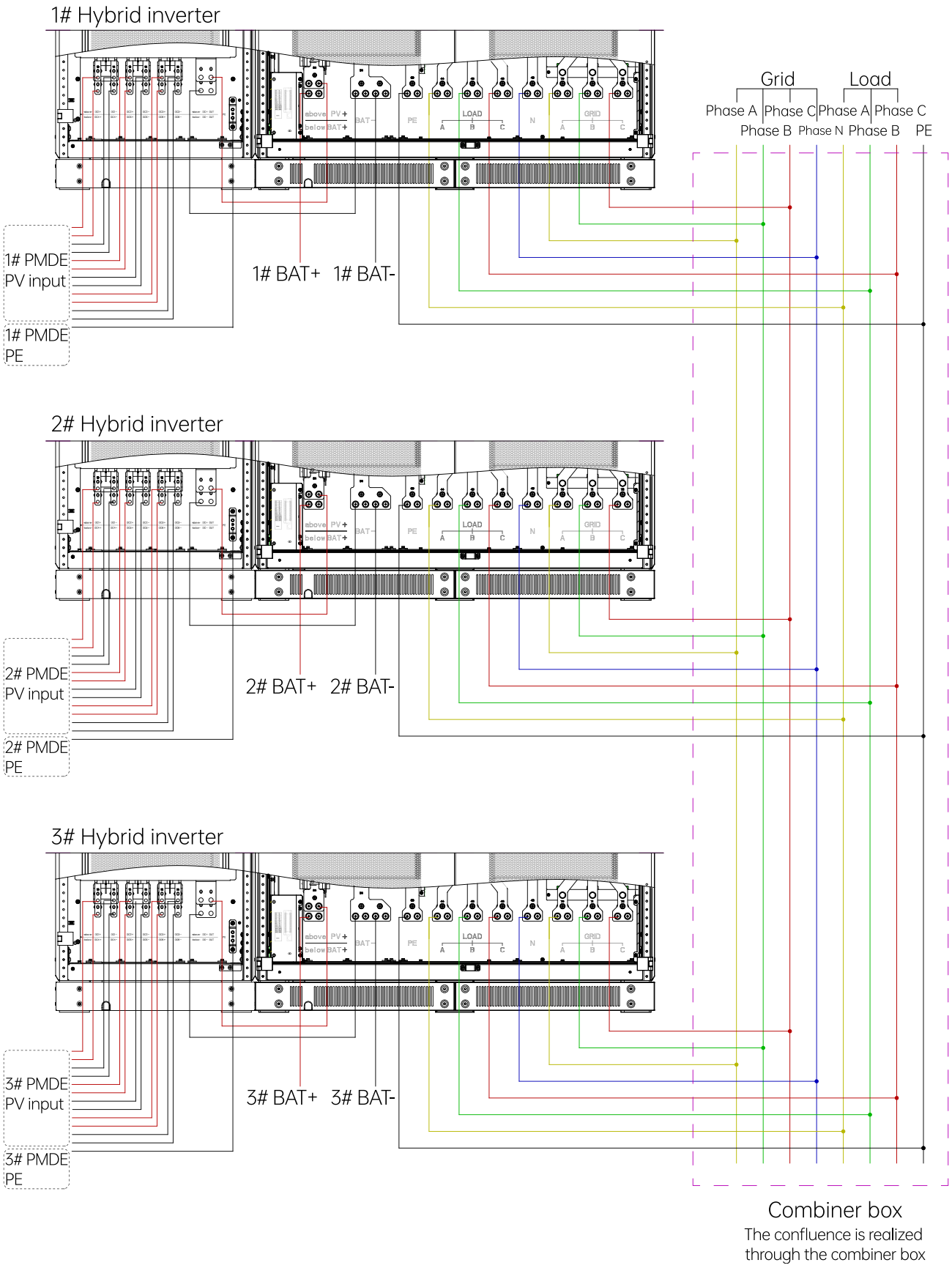
MPS0030/MPS0050



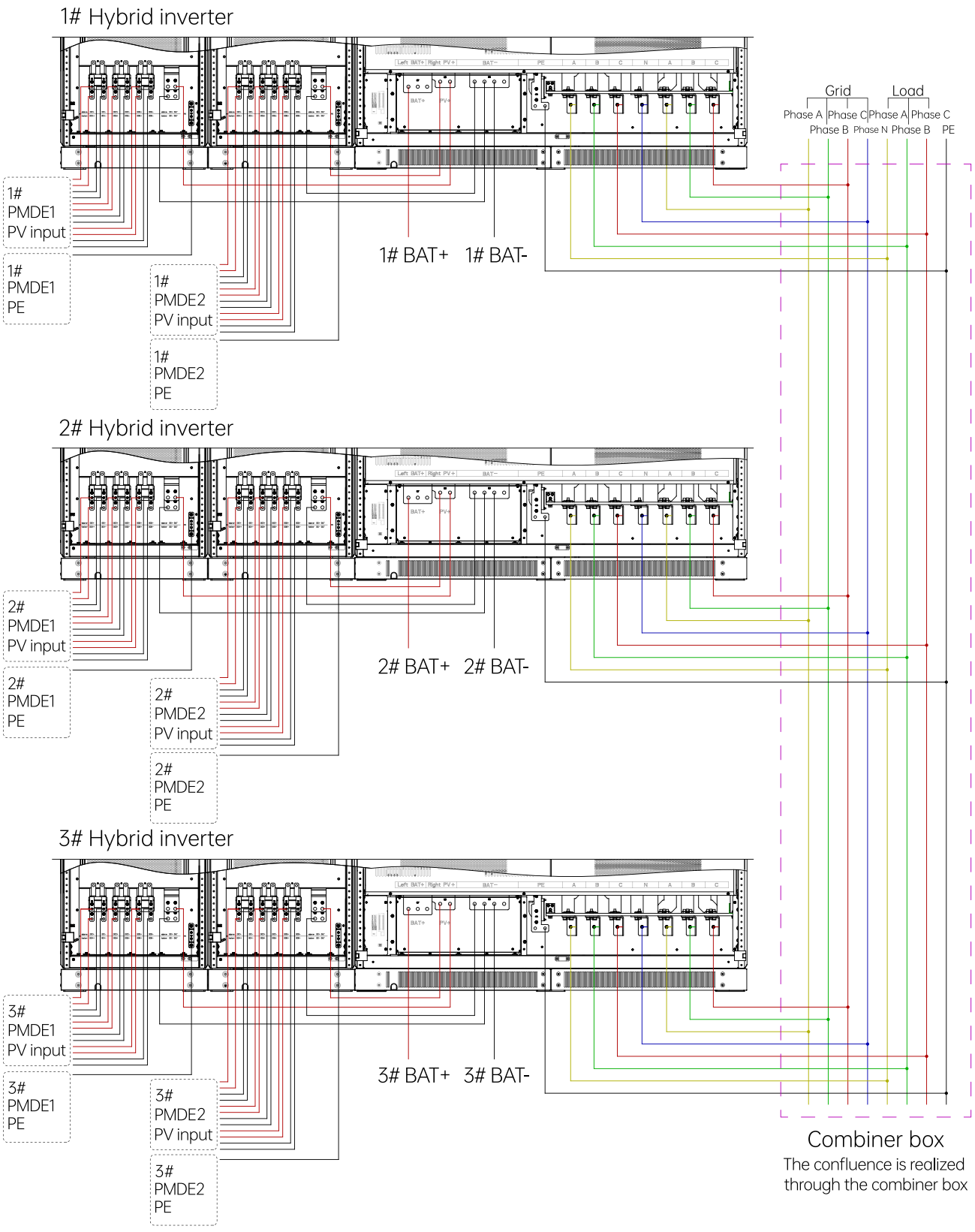
MPS0100/MPS0150



MPS0250


1# Hybrid inverter
Grid
Load
Phase A
Phase C
Phase A
Phase C
Phase B
Phase N
Phase B
PE
1# PMDE
PV input
1# BAT+
1# BAT-
1# PMDE
PE
2# Hybrid inverter
2# PMDE
PV input
2# BAT+
2# BAT-
2# PMDE
PE
3# Hybrid inverter
3# PMDE
PV input
3# BAT+
3# BAT-
3# PMDE
PE
Combiner box
The confluence is realized
through the combiner box

MPS0500


1# Hybrid inverter
Grid
Load
Phase A
Phase C
Phase B
Phase N
Phase A
Phase B
Phase C
PE
1#
PMDE1
PV input
1#
PMDE1
PE
1#
PMDE2
PV input
1#
PMDE2
PE
1# BAT+
1# BAT-
2# Hybrid inverter
2#
PMDE1
PV input
2#
PMDE1
PE
2#
PMDE2
PV input
2#
PMDE2
PE
2# BAT+
2# BAT-
3# Hybrid inverter
3#
PMDE1
PV input
3#
PMDE1
PE
3#
PMDE2
PV input
3#
PMDE2
PE
3# BAT+
3# BAT-
Combiner box
The confluence is realized
through the combiner box

6.12 Installation complete

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

7 Trial operation

7.1 Check before starting

- Before commissioning, a thorough inspection of the installation of the equipment should be carried out, especially to check whether the DC and AC voltages meet the requirements of the converter, as well as whether the polarity and phase sequence are correct.
- Check that all connections have met the requirements of the relevant standards and specifications. And whether the system is well grounded. Grounding resistance is of great importance to the safety of the whole system. It must be determined that the grounding resistance meets the requirements before the first trial operation.


CAUTION

- Before commissioning, it is necessary to ensure that all switches on the AC side are open.

Step 1: Check the converter

The converter needs to be checked before it is turned on.

- Check the installation and wiring of the converter according to Chapters 5 and 6.
- Ensure that all AC and DC circuit breakers are disconnected.

Step 2: Check AC side voltage

- Check whether the three phases of the converter are connected correctly to the three phases of the power grid.
- Check whether the phase voltage and line voltage are within the predetermined range and record the voltage value.
- If possible, measure the total harmonic distortion (THD) and view the curve. If the distortion is serious, the converter may not work.

Step 3: Check DC side voltage

- The DC side should be connected to the converter from the battery pack to ensure that the input polarity of each battery pack is correct.
- The PV side should be connected to the converter from the PV to ensure that the input polarity of each PV group is correct.


WARNING

- The Battery side voltage shall not exceed 850V.
- The PV side- not exceed 1000V.
- If the voltage deviation is greater than 3%, it may be caused by load fluctuation, cable damage or cable loosening on site.

Step 4: Check other content after completing the above check before starting, the following items need to be carefully checked to ensure that they are correct.

- All links are made in accordance with Chapter 6 of this manual.
- The protective shield inside the equipment has been firmly installed.
- The emergency shutdown button is released.
- The AC side and DC side circuit breakers have been disconnected, they are in the "OFF" position.
- The multimeter is used to detect whether the AC and DC side voltages meet the starting conditions of the converter, and there is no danger of overvoltage.
- The door of the cabinet has been closed and the key of the cabinet door has been pulled out and handed over to a special person for safekeeping.

- For the long downtime energy storage converter, before starting, the equipment must be thoroughly and meticulously checked to ensure that all indicators meet the requirements before starting.

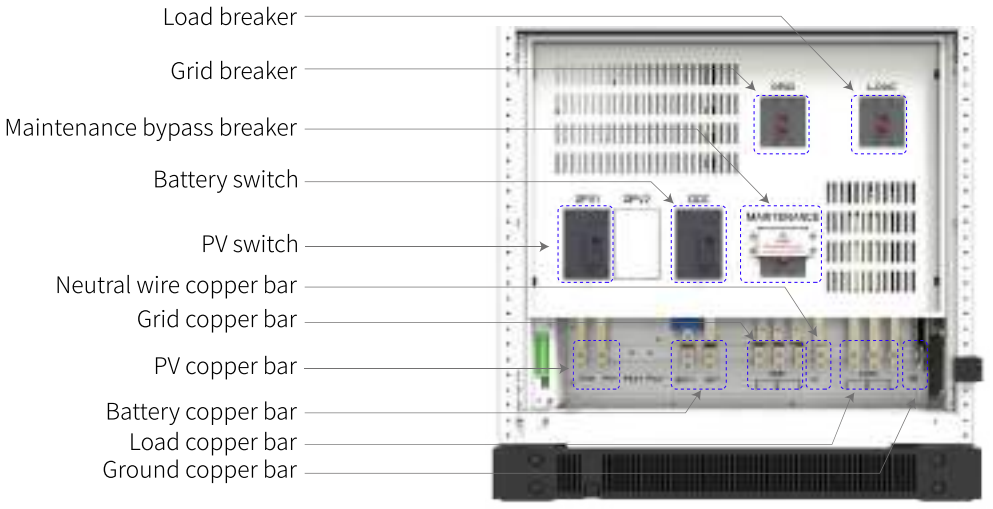
7.2 Start-up operation

After all the above conditions are met, the energy storage converter can be turned on. The operational steps are as follows:

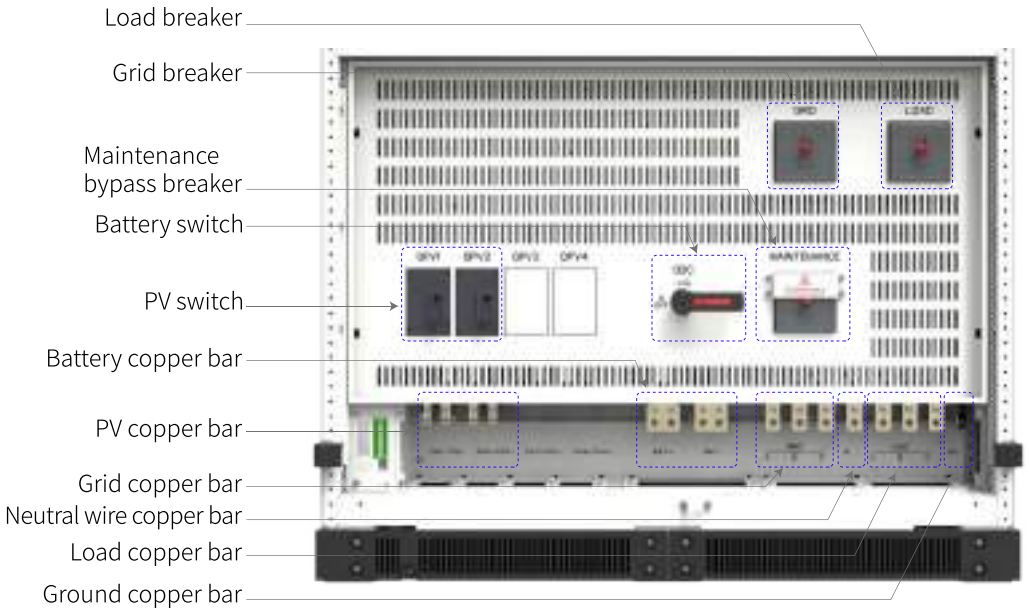
- Step 1: Make sure that the DC side and AC side are connected correctly and the DC side voltage is lower than 850V.
- Step 2: Close AC and DC circuit breaker switches.
- Step 3: Close the lightning protection switch KS (applicable to split models), close KB1, KB2, KB3.
- Step 4: After completing the 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 QPV2 in Figure 7-1. 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.

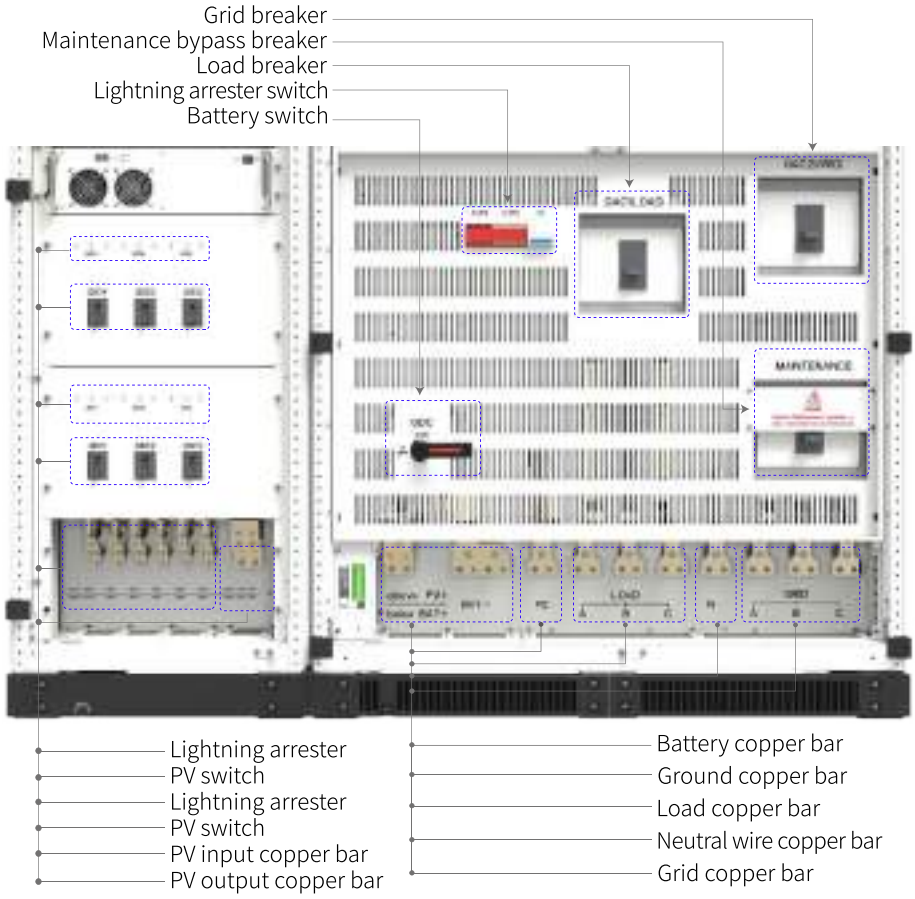
Figure 7-1 MPS input and output



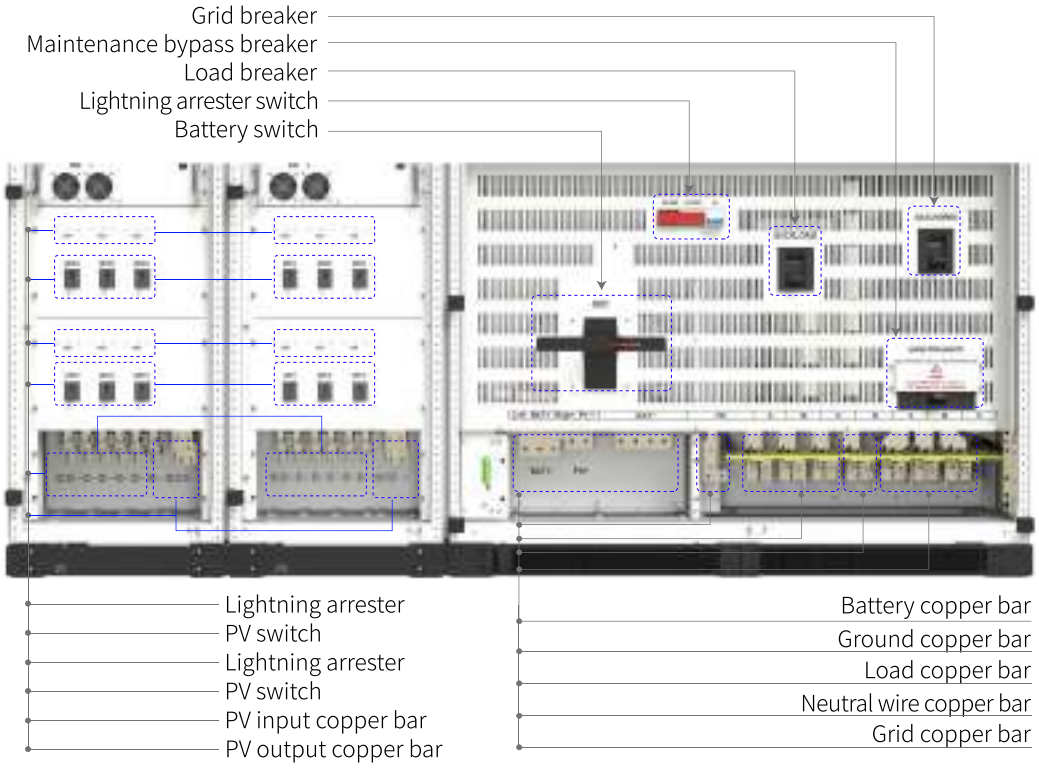
MPS0030/MPS0050



MPS0100/MPS0150

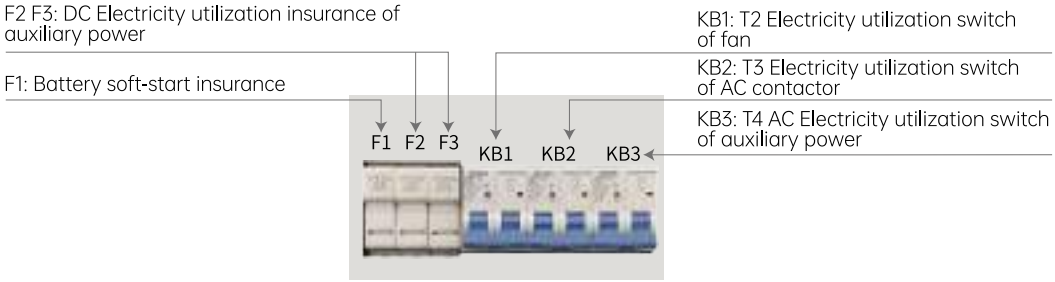


MPS0250



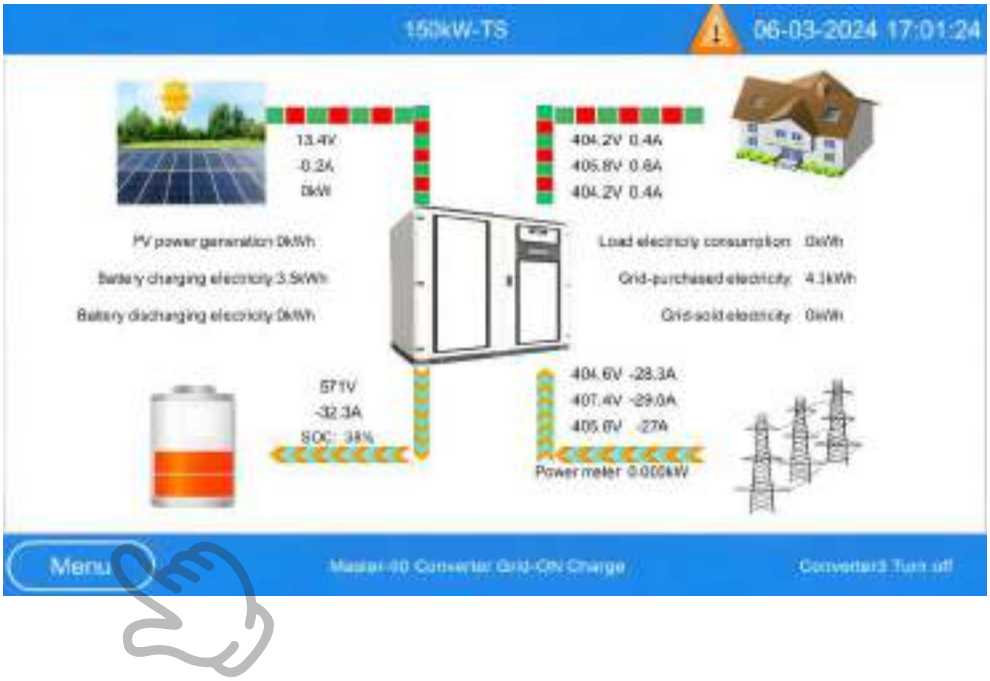
MPS0500

Figure 7-2 Internal MCB



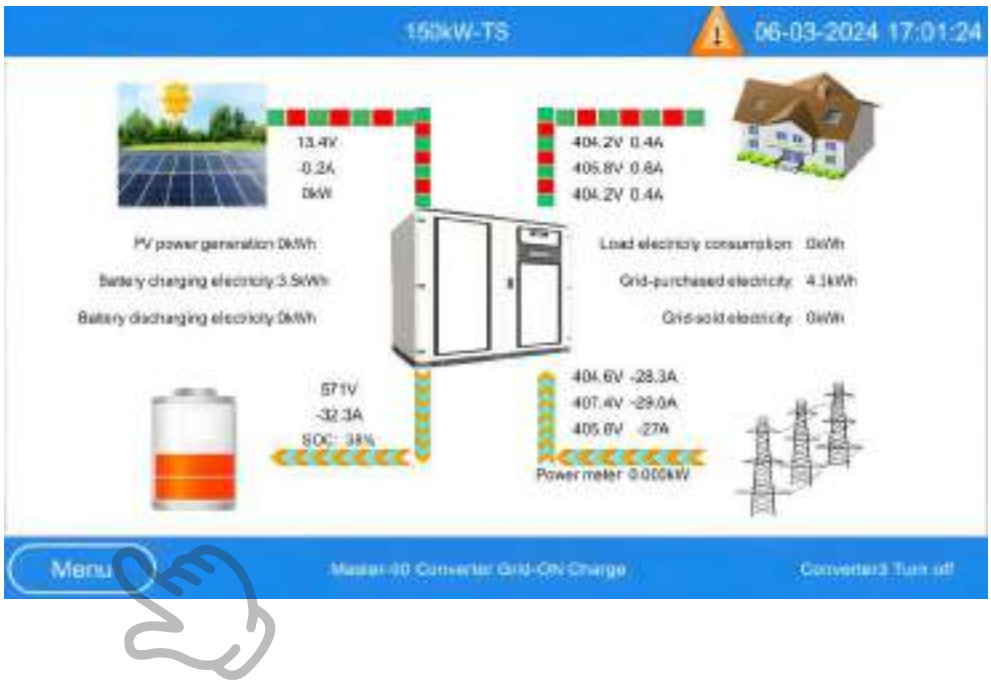
- (5) Take MPS0150 as an example, check whether there is a red alarm signal in the upper right corner of the monitor, and it can be turned on if there is no red alarm signal.

Step 1: The photovoltaic controller is turned on. Click "Menu" → "Turn On/Off" → "DCDC converter ON" in the lower left corner of the monitor.



Step 2: After clicking "DCDC converter ON", the PV controller status displayed in the lower right corner of the monitoring main interface will change from "Standby" to " Converter xMPPT", the PV controller is running normally.

Step 3: The converter starts. Click "Menu" → "Turn On/Off" → "DCAC converter ON" in the lower left corner of the monitoring.



Step 4: After clicking "DCAC converter ON", you will hear the DC contact suction sound, and then the converter will soft up. After soft up, you will hear the AC contactor suction sound. At this time, the converter state displayed at the positive lower Angle of the monitoring main interface will change to "converter off-grid discharge" or "converter grid-connected charging" or "converter grid-connected discharge". At this time, the converter runs normally.

At this point, the MPS converter is powered on.

7.3 Shutdown operation

7.3.1 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 converter.

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 xMPPT" " 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.

7.3.2 Shut down in case of malfunction or emergency

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

- Step 1: Press the EPO button.
- 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 working.

- 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 on touch panel according to the shutdown instruction on touch panel.
- In case of crisis, press the EPO button directly to ensure prompt response.

7.3.3 Use of maintenance bypass

The maintenance bypass circuit breaker (MAINTENANCE) in Figure 7-1 is normally in the off state. The maintenance bypass is to ensure that the load is not powered off when the energy storage converter is overhauled or faulty (provided that the grid is powered). After the maintenance bypass is closed, connect the diesel generator or grid to the load.

The specific operation steps are:

- (1) Confirm that the diesel generator is in normal operation or the grid has electricity.
- (2) MPS Converter shutdown (refer to 7.3.1).
- (3) Disconnect all switches.

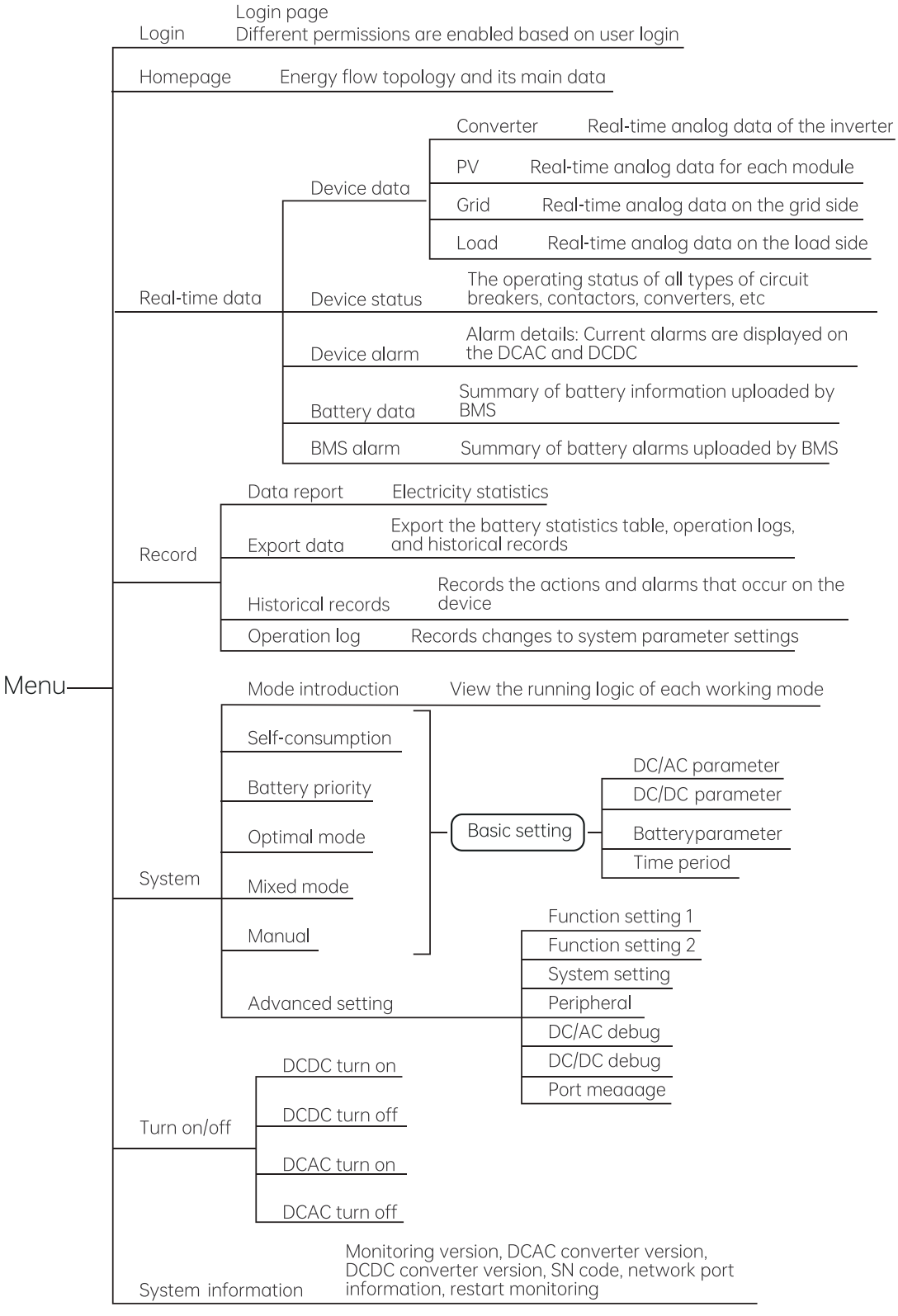
- (4) Remove the baffle on the maintenance bypass circuit breaker.
- (5) Close the maintenance bypass circuit breaker.

After equipment maintenance or fault recovery, the maintenance bypass must be disconnected, and the maintenance bypass baffle must be replaced.

8 Touch screen operation guidance

8.1 Monitoring logic diagram

Figure 8-1 Monitoring menu Logic Diagram



8.2 Homepage

The homepage is divided into three parts:

- Basic Information Bar: Includes machine model, alarm status, and a time setting button. Clicking the time button will open the time setting interface, as shown in Figure 8-4. Users can directly input hours, minutes, and seconds or use buttons to adjust the year, month, and day.
- Homepage Content: Displays real-time data and power data for inverters, photovoltaics, loads, batteries, and the power grid. Users can click on the corresponding icon buttons to view more detailed real-time data information.
- Menu Bar: Includes the menu button, current status information of the DCAC inverter, and the current status of the DCDC module. Clicking the menu button will jump to the system menu interface, with the menu page shown in Figure 8-5.

Figure 8-2 Home logic diagram

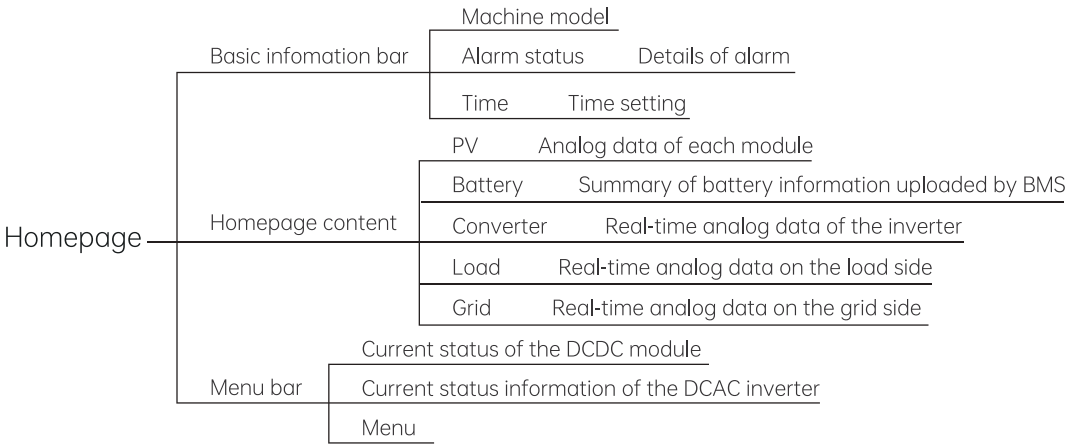
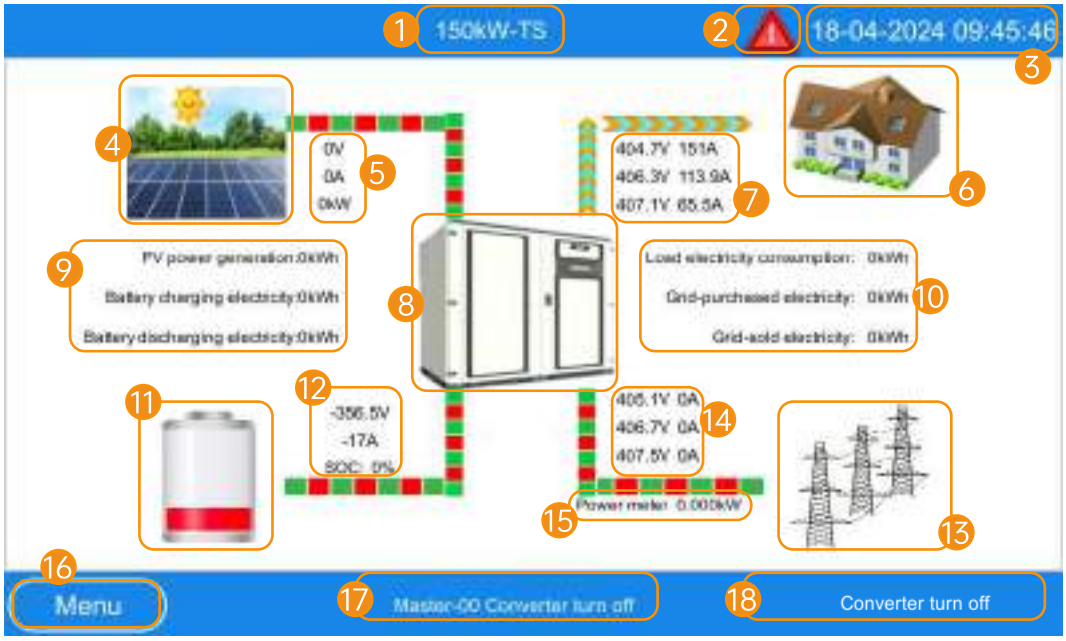


Figure 8-3 Homepage introduction



Homepage introduction
1. Machine model.
2. Alarm status: Click to view current alarms.
3. Time: Click to set the time.(Figure 8-4)
4. Photovoltaics (PV): Click to jump to the real-time data interface, where you can view the real-time analog data of each module.
5. PV voltage value, current value, power value.
6. Load: Click to jump to the real-time data interface, where you can view the real-time analog data of the load.
7. Load voltage value, current value, power value .
8. Converter: Click to jump to the real-time data interface, where you can view the real-time analog data of the converter.
9. PV's daily power generation, battery's daily charge amount, battery's daily discharge amount.
10. Load's daily power consumption, grid's daily power purchase, grid's daily power sale.
11. Battery: Click to jump to the real-time data interface, where you can view the summary of battery data uploaded by the BMS.
12. Battery voltage value, battery current value, state of charge (SOC) value uploaded by BMS.
13. Grid: Click to jump to the real-time data interface, where you can view the real-time analog data of the grid.
14. Grid's phase A/B/C voltage and current values.
15. Power meter wattage.
16. Menu: Click to jump to the menu page.(Figure 8-5)
17. Current status of the DCAC converter.
18. Current status of the DCDC converter.

Figure 8-4 Time setting

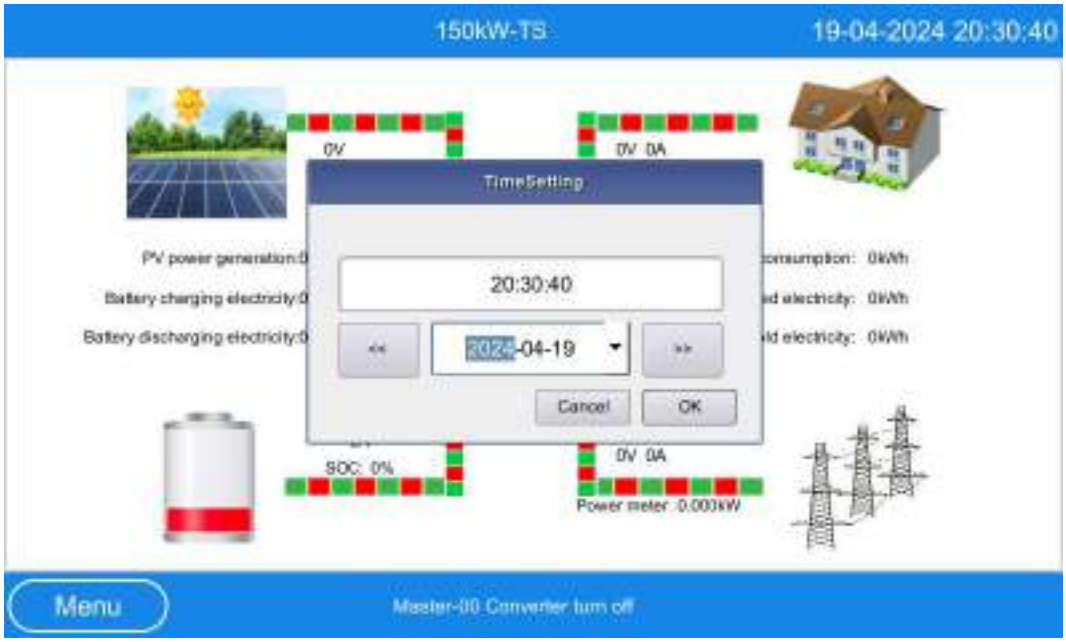
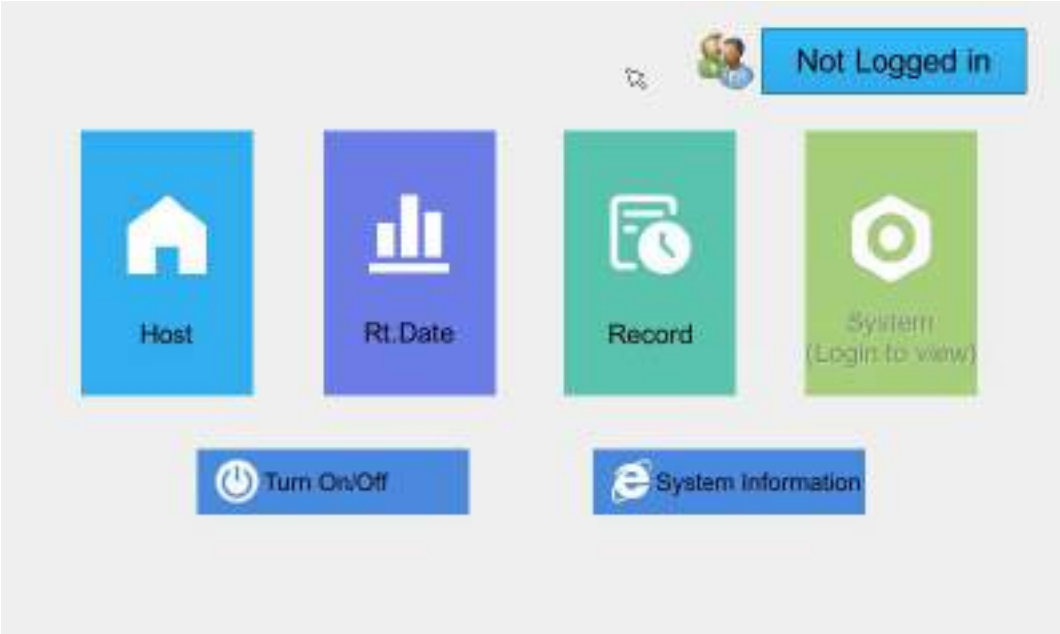


Figure 8-5 Menu



8.3 Menu

- The menu interface consists of seven buttons, which are: Login, Homepage, Real-Time Data, Records, System, Turn On/Off, and System Information. Clicking each button will redirect to the corresponding interface, as shown in Figures 8-6 and 8-7.

Figure 8-6 Menu logic diagram

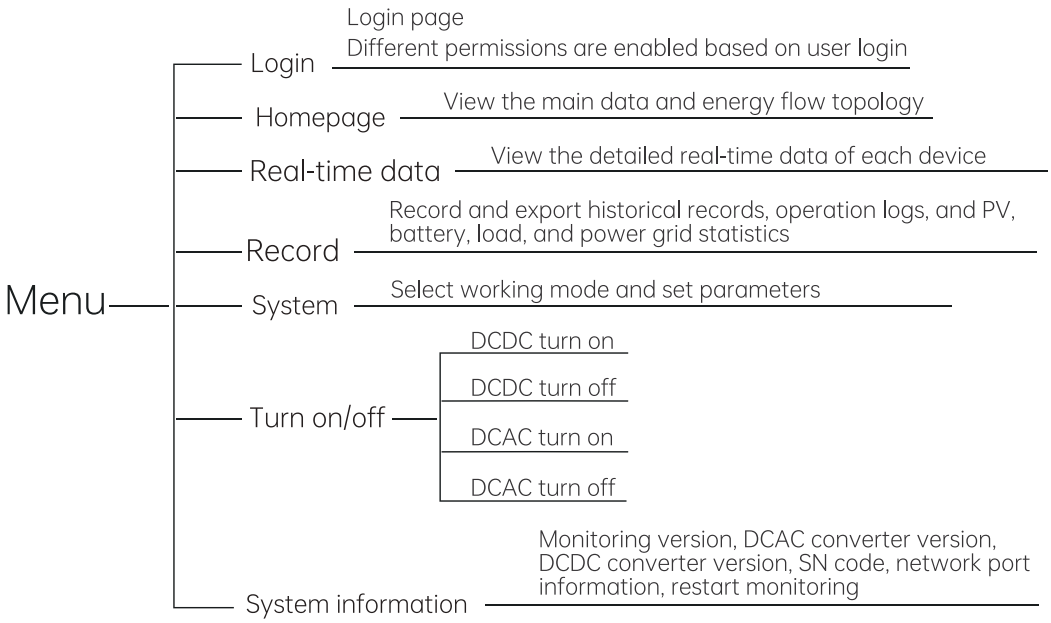


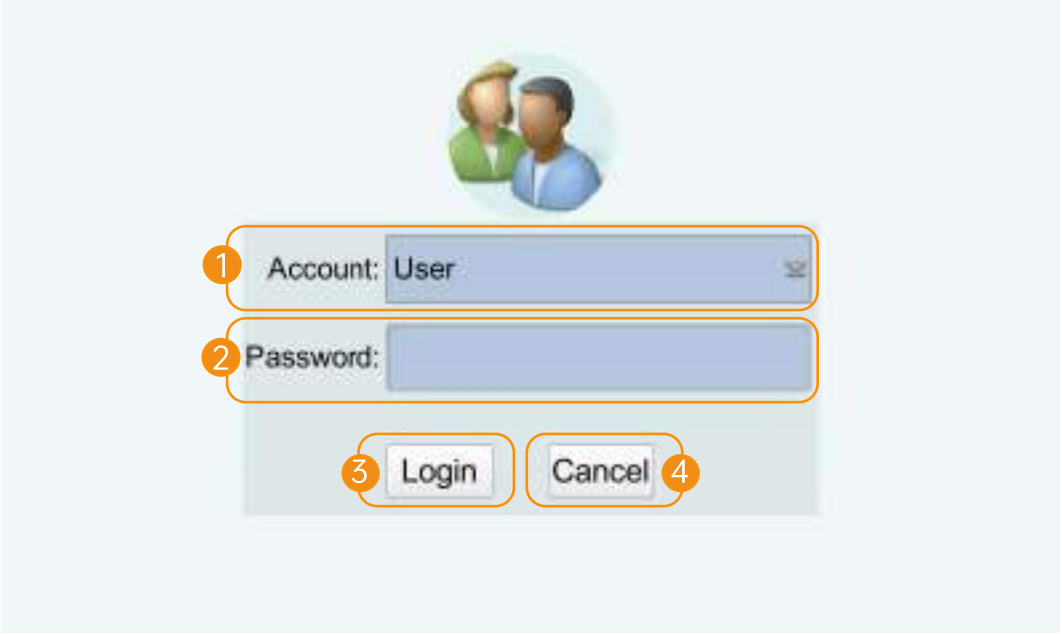
Figure 8-7 Menu page introduction

Menu page introduction
1. Login: Click to navigate to the login page, which offers different permissions based on the user type.
2. Homepage: Click to return to the homepage.
3. Real-Time Data: Navigate to the real-time data page to view analog data for inverters, photovoltaics, the grid, and loads. This includes the operational status of various devices like circuit breakers, contactors, inverters, battery data uploaded by the BMS, and device alarms.
4. Record: Record and export historical records, operation logs, and statistics of electricity for PVs, batteries, loads, and the grid.
5. System: Choose the working mode and set related parameters as needed.
6. Turn On/Off: Access the on/off interface to independently control the operation of the DCAC and DCDC converters.
7. System Information: View monitoring version, DCAC converter version, DCDC converter version, serial number (SN code), and network port information.

8.4 Log in

- When not logged in, access to the system page to change work modes and settings is not available, and the system will automatically log out one hour after logging in; users will need to log in again.
- To log in, select the required account in the "Account" section, enter the password, and click "Login". After a successful login, you will be redirected to the homepage.
- The default password for the "User" account is 123456. In this user mode, you can modify work modes and set basic parameters, but you can only view and not set advanced parameters.

Figure 8-8 Login Interface Introduction

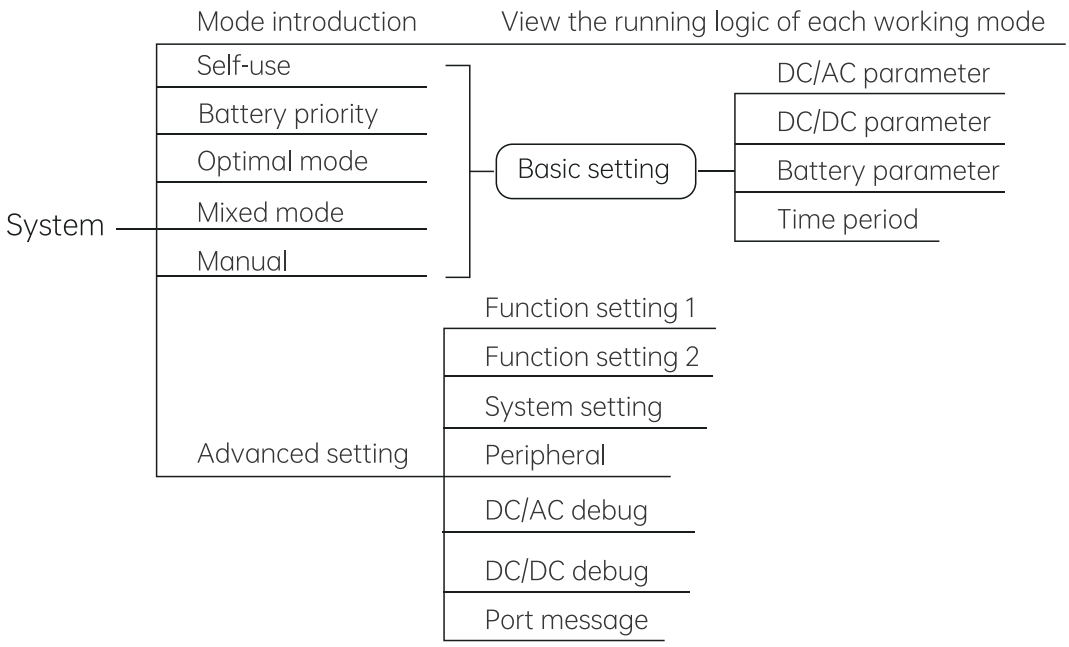


Login Interface Introduction
1. Account: Account login selection, including three account options: User, Maintenance, and Super Permission.
2. Password: Different accounts have different passwords, which can be changed in the advanced settings.
3. Login: Clicking login will proceed based on the selected account and entered password. Successful login will redirect to the homepage.
4. Cancel: Clicking cancel will return to the menu page.

8.5 System

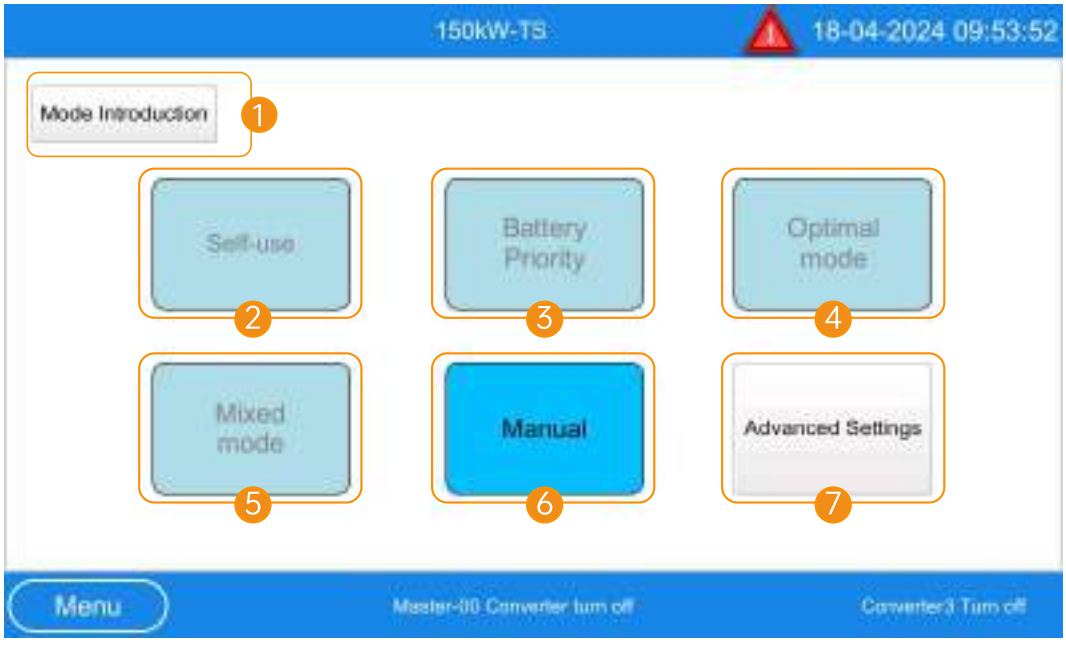
- When not logged in, access to the system is restricted. Within the system, you can view introductions to various work modes, switch work modes, and view/set basic and advanced setting.
- Basic Settings includes DC/AC parameter, DC/DC parameters, Battery setting parameters, Time period.
- Advanced Settings consists of Function settings, System settings, Peripherals, DC/AC debug, DC/DC debug, Port message.

Figure 8-9 System logic diagram



- In the system interface, the button for the currently active and effective work mode is colored sky blue, while the buttons for the inactive work modes are light blue. As shown in Figure 8-10, Manual Mode is the work mode currently in effect.

Figure 8-10 Introduction of system interface



Introduction of system interface

1. Mode introduction: Click to enter the Mode Introduction page to view the operational logic of each work mode.

2. Self-use: Click to enter the basic settings interface for the Self-use mode, where you can switch the current work mode to Self-use and set related basic parameters.

3. Battery priority: Click to enter the basic settings interface for Battery Priority mode, where you can switch the current work mode to Battery Priority and set related basic parameters.

4. Optimal mode: Click to enter the basic settings interface for Optimal Mode, where you can switch the current work mode to Optimal Mode and set related basic parameters.

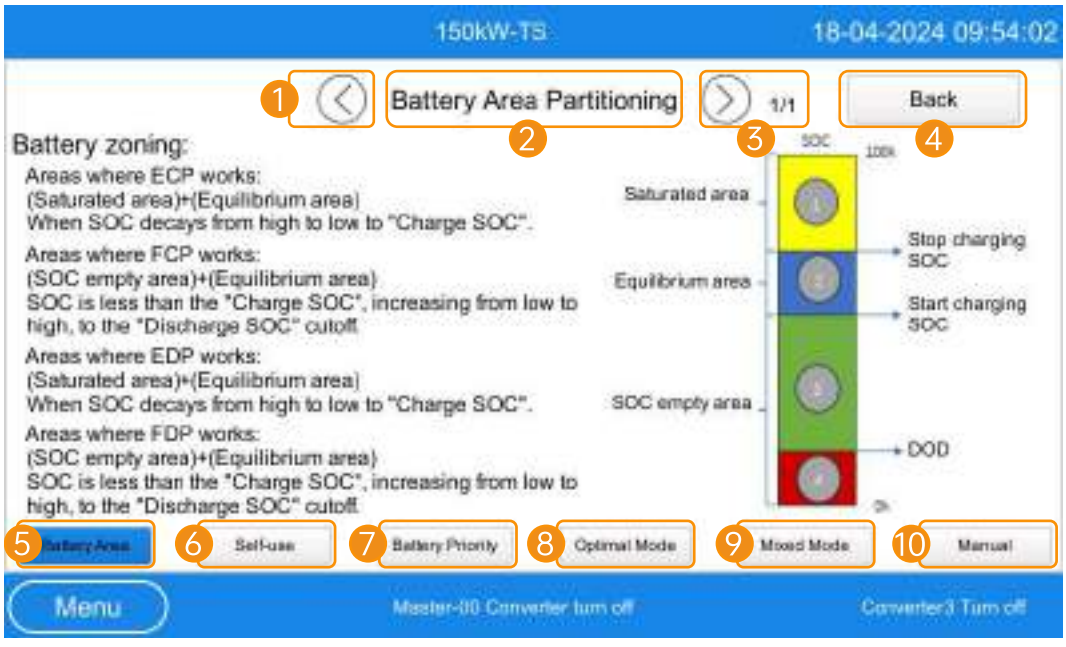
5. Mixed mode: Click to enter the basic settings interface for Mixed mode, where you can switch the current work mode to Mixed mode and set related basic parameters.

6. Manual: Click to enter the basic settings interface for Manual Mode, where you can switch the current work mode to Manual and set related basic parameters.

7. Advanced settings: Click to enter the Advanced Settings interface.

(1) Mode Introduction

Figure 8-11 Mode introduction interface introduction



Mode introduction interface introduction
1. Previous page.
2. The currently selected introduction module.
3. The next page.
4. Return to the system page.
5. Click to view the introduction of battery area division.
6. Click to view the operation logic of the self-use mode.
7. Click to view the operation logic of battery priority mode.
8. Click to view the operation logic of the optimal mode.
9. Click to view the operation logic of the mixed mode.
10. See the manual mode logic.

(2) Basic setting

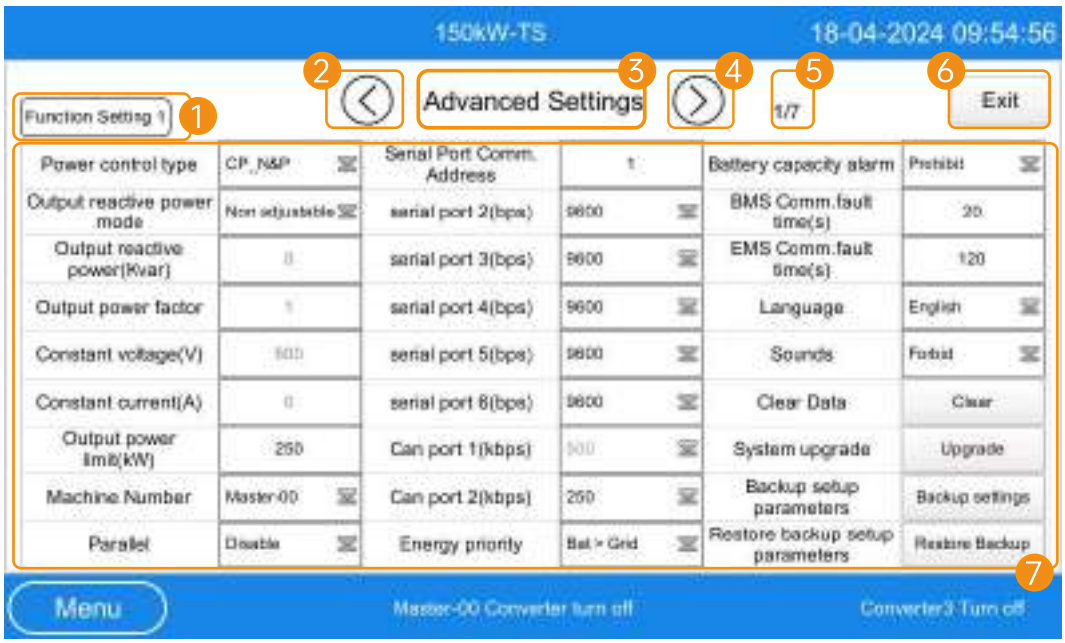
- In the basic Settings interface, you can switch the previous page or the next page through the page turning button, click "Mode Effect" to effect the currently selected mode, and exit the basic Settings interface to return to the system interface.
- The basic Settings include four pages: DC/AC parameters, DC/DC parameters, battery Settings parameters and time period Settings. The parameters that are partially grayed out and cannot be set in the basic Settings interface are invalid parameters set in the currently selected working mode.

Figure 8-12 Introduction to the basic settings interface

Introduction to the basic settings interface
1. The title name of the page you are currently on.
2. The previous page.
3. The name of the currently selected working mode.
4. The next page.
5. The current page number and the total page number.
6. Enable mode: Click to apply and effect the currently selected working mode.
7. Exit: return to the system interface.
8. Display the settings of the current page in this table.

(3) Advanced setting

Figure 8-13 Introduction to the advanced settings interface

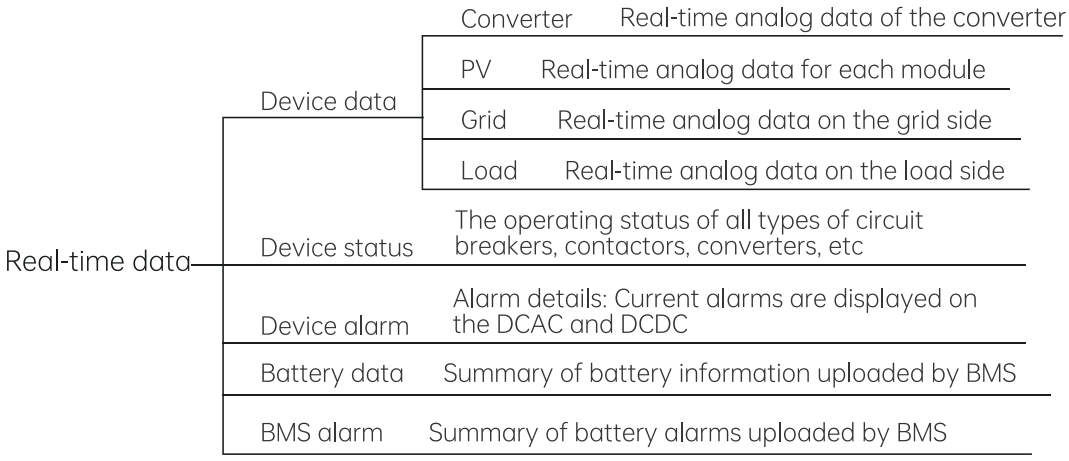


Introduction to the advanced settings interface
1. The title name of the page you are currently on.
2. The previous page.
3. The name of the interface you are currently on.
4. The next page.
5. The current page number and the total page number.
6. Exit: return to the system interface.
7. This table displays the Settings for the current page.

8.6 Real-time data

- Real-time data is divided into five sections: Device Data, Device Status, Device Alarms, Battery Data, and BMS Alarms. Each of these sections displays real-time status data of the machine.

Figure 8-14 Real-time data logic diagram



(1) Device data

- This interface displays real-time data of the machine's operation, including the inverter, PV (photovoltaics), the grid, and load. By clicking the four buttons on the right, detailed data for each functional unit of the MPS device is shown. After clicking the inverter button, the interface appears as shown in the diagram.

Figure 8-15 Introduction to the real-time data Interface

Introduction to the real-time data Interface

1. Device Data: View detailed real-time analog data for the inverter, PV (photovoltaics), grid, and load.

2. Device Status: View the operational status of various devices such as circuit breakers, contactors, and inverters.

3. Device Alarms: View current DCAC and DCDC alarms.

4. Battery Data: View a summary of battery data uploaded by the BMS (Battery Management System).

5. BMS Alarms: View BMS alarms uploaded by the BMS.

6. Inverter Button: Click to view analog data related to the inverter.

7. PV Button: Click to view analog data related to PV.

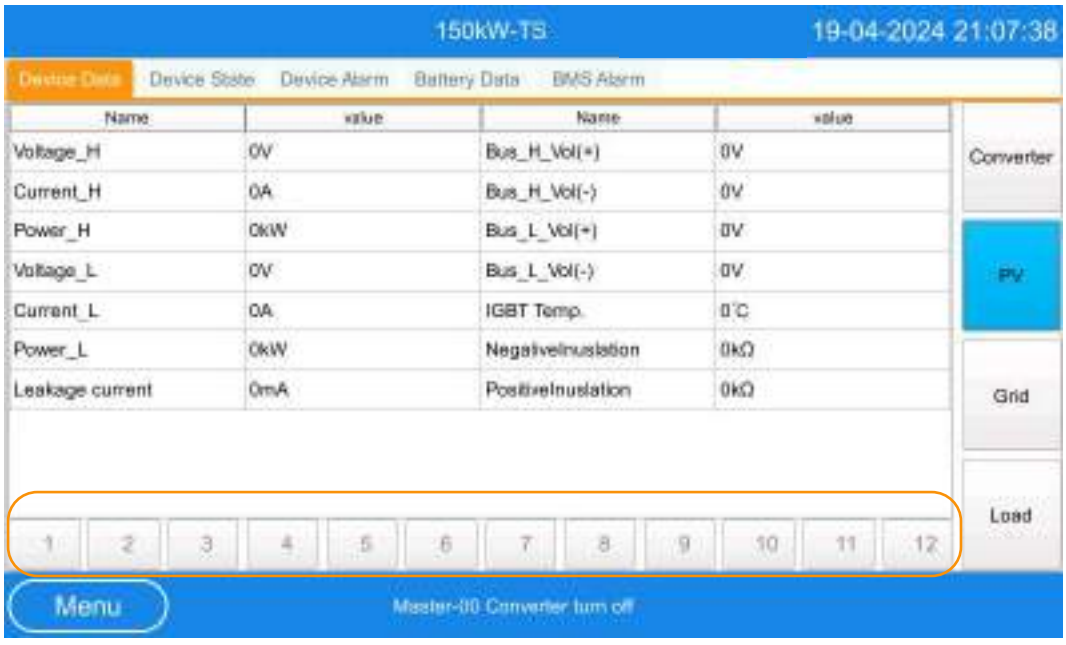
8. Grid Button: Click to view analog data related to the grid.

9. Load Button: Click to view analog data related to the load.

10. Real-Time Analog Data Display: This data is displayed in the table on this interface.

- After clicking the PV button, the interface will switch to the PV data interface. The data list on this interface includes 12 buttons representing the number of modules. Modules that are not online will appear dimmed. The interface is shown as in Figure 8-16.

Figure 8-16 PV data



- After clicking the grid button, the interface appears as shown in Figure 8-17.

Figure 8-17 Grid data

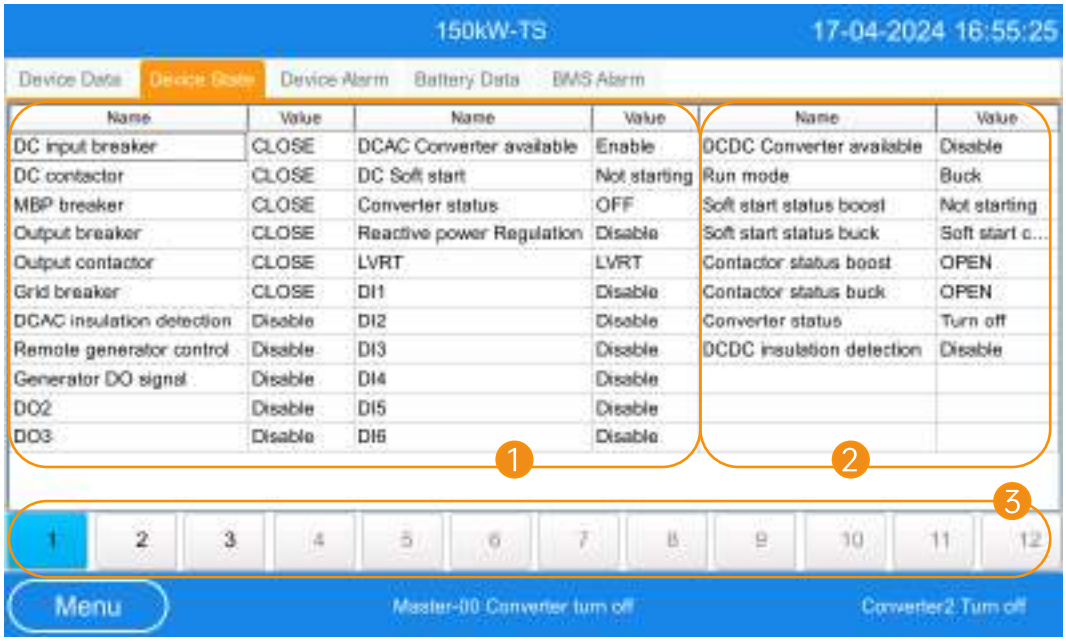
- After clicking the load button, the interface appears as shown in Figure 8-18.

Figure 8-18 Load data

(2) Device status

- This interface primarily displays the operational status of various components within the MPS, such as circuit breakers, contactors, and inverters. Its purpose is to provide a more convenient and intuitive way to understand the operational status of the MPS.
- The data on this interface is organized into three columns, each entry corresponding to a specific status. The first two columns represent the real-time status of the DCAC module, and the third column represents the status of the DCDC module.
- Below the data list, there are 12 buttons representing the number of modules. Buttons for modules that are not online will appear dimmed. Clicking on a module number will update and display the real-time status for that specific module.

Figure 8-19 Device status interface introduction



Device Status interface introduction
1. Display DCAC Status: Shows the status of the DCAC module.
2. Display DCDC Status: Shows the status of the DCDC module.
3. Select Module Number: Selecting a module number will update the corresponding module's PV status in section 2.

(3) Device alarm

- This interface is designed to display faults and alarms that occur during the operation of the machine, including descriptions of alarms related to DCAC and DCDC components.

- Users can view the total number of alarm pages as well as the current page number. By clicking on the page number box, users can select a specific page, or they can navigate through the pages using the "<" and ">" buttons for previous and next pages, respectively. The "|<" and ">|" symbols represent the first and last pages. When faults occur during machine operation, this interface allows users to understand the causes of these faults, facilitating effective troubleshooting.

Figure 8-20 Device alarm interface introduction

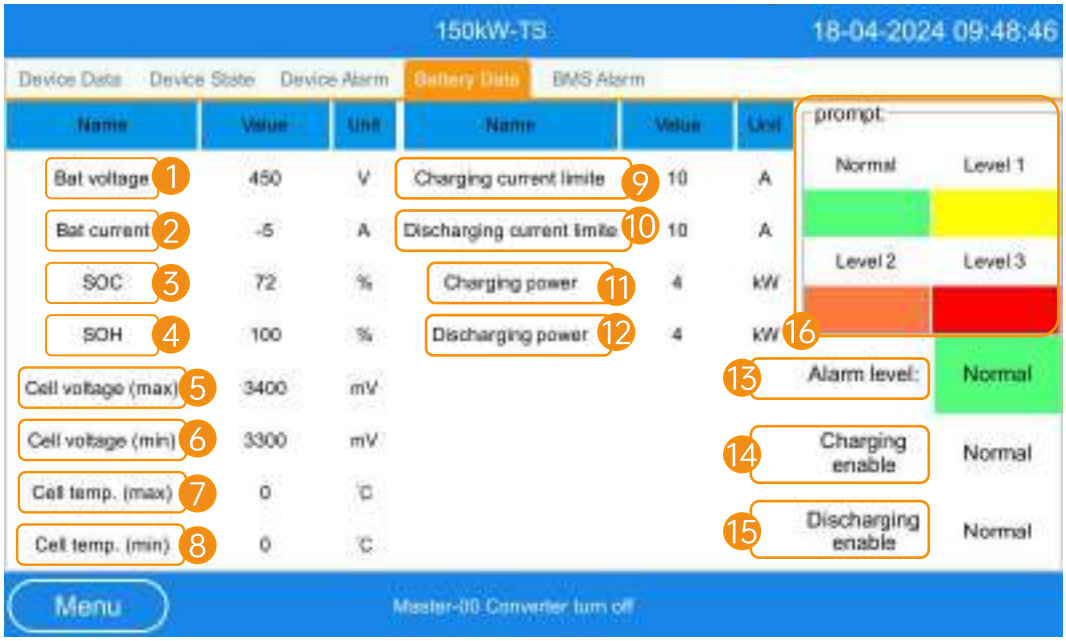
Device alarm interface introduction

1. |<: Clicking this button on the alarm description page will jump to the first page.
2. <: Previous page.
3. >: Next page.
4. >|: Clicking this button on the alarm description page will jump to the last page.
5. DCAC alarm description: Displays the current DCAC alarm that has been triggered.
6. DCDC alarm description: Displays the current DCDC alarm that has been triggered.

(4) Battery data (Lithium Battery)

- This interface displays battery data uploaded by the Battery Management System (BMS).

Figure 8-21 Lithium battery data interface introduction

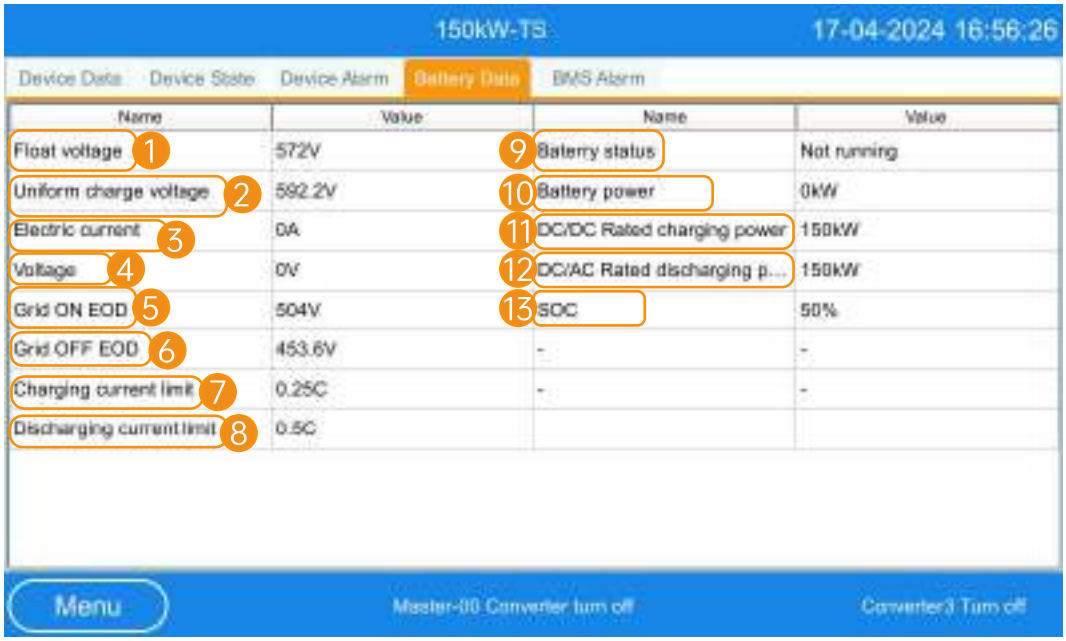


Lithium battery data interface introduction
1. Battery voltage: Total voltage of the battery pack uploaded by the BMS.
2. Battery current: Total current of the battery pack uploaded by the BMS.
3. SOC (state of charge): Percentage of the remaining charge in the battery pack uploaded by the BMS.
4. SOH (state of health): Percentage of the battery pack's usable capacity after full charge compared to its original capacity uploaded by the BMS.
5. Highest single cell voltage: Highest voltage of a single cell uploaded by the BMS.
6. Lowest single cell voltage: Lowest voltage of a single cell uploaded by the BMS.
7. Highest single cell temperature: Highest temperature of a single cell uploaded by the BMS.
8. Lowest Single Cell Temperature: Lowest temperature of a single cell uploaded by the BMS.
9. Charge current limit: Maximum charging current limit uploaded by the BMS.
10. Discharge current limit: Minimum discharge current limit uploaded by the BMS.
11. Charging power: Allowed charging power uploaded by the BMS.
12. Discharging power: Allowed discharging power uploaded by the BMS.
13. Alarm level: Alarm level uploaded by the BMS, where level one is yellow, level two is orange, and level three is red. By default, the inverter does not respond to level one and two alarms, and shuts down for level three alarms.
14. Charge enable: Battery status for charging uploaded by the BMS, where "enabled" means the battery can be charged and "disabled" means it cannot be charged.
15. Discharge enable: Battery status for discharging uploaded by the BMS, where "enabled" means the battery can discharge and "disabled" means it cannot discharge.
16. Alarm level color indication: Color indication for the current alarm level.

(5) Battery data (lead-acid battery)

- This interface is for lead-acid battery data.

Figure 8-22 Lead-acid battery interface introduction



Lead-acid battery interface introduction
1. Float charge voltage: Calculated by multiplying the set float charge voltage of a single battery cell by the number of battery cells.
2. Uniform charge voltage: Calculated by multiplying the set equalization charge voltage of a single battery cell by the number of battery cells.
3. Current: Current on the DC side of the inverter.
4. Voltage: Voltage on the DC side of the inverter.
5. Grid ON EOD: Cut-off voltage for discharging when connected to the grid.
6. Grid OFF EOD: Cut-off voltage for discharging when not connected to the grid.
7. Charge current limit: The maximum allowable current on the battery side to prevent overcurrent during charging. (Upper limit of 0.25C)
8. Discharge current limit: The maximum allowable current on the battery side to prevent overcurrent during discharging. (Upper limit of 0.5C)
9. Battery status: Monitors the operational state of the battery.
10. Battery power: Current power of the battery during charging and discharging.
11. DC/DC rated charging power: Total rated power of the DC/DC module on the DC side.
12. DC/AC rated charging power: Rated power on the AC side for DC/AC, similar to the machine model.
13. SOC (state of charge): Calculated based on the total voltage of the battery, representing the percentage of remaining battery power.

(6) BMS alarm

- This interface is designed to display fault and alarm information uploaded by the Battery Management System (BMS).
- Users can view the total number of alarm pages as well as the current page number. By clicking the page number box, users can select a specific page, or they can navigate through the pages using the "<" and ">" buttons for moving backward and forward, respectively. The "|<" and ">|" symbols represent the first and last pages respectively. When the BMS detects and uploads an alarm or fault, users can view this interface to understand the cause of the fault, facilitating effective troubleshooting.

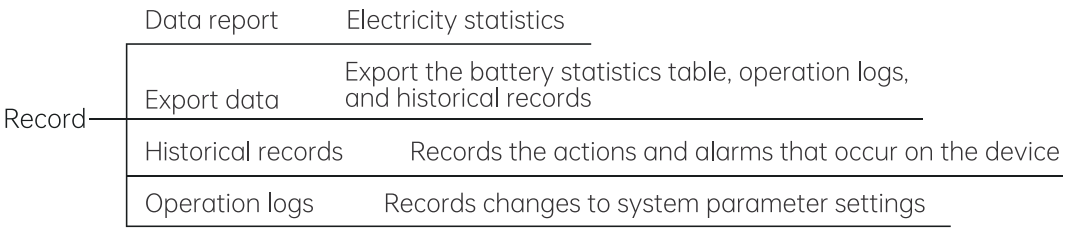
Figure 8-23 BMS alarm interface introduction

BMS alarm interface introduction
1. |<: Clicking this button on the alarm description page will jump to the first page.
2. <: Previous page.
3. >: Next page.
4. >|: Clicking this button on the alarm description page will jump to the last page.
5. BMS Alarm Description: Displays the current BMS alarm that has been triggered.

8.7 Record

- This section includes four functional areas: Data Reports, Export Data, Historical Records, and Operation Logs. These features are designed to track the charging and discharging amounts of the equipment, record the system's operational history and logs, facilitating easy querying and tracing.

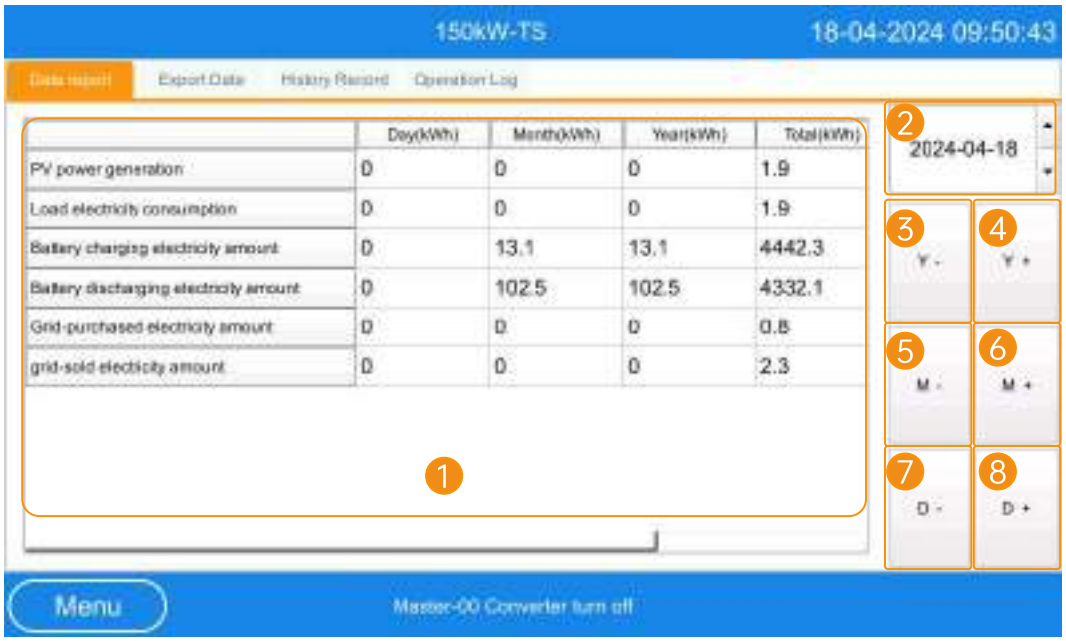
Figure 8-24 Record logic diagram



(1)Data reports

- This section logs the charging and discharging data for PV (photovoltaics), load, battery, and the grid, including daily, monthly, yearly, and total electricity amounts. There is a time query button on the right side, which allows users to search for electricity data on specific dates. Users can set the year by clicking the "Year+" or "Year-" buttons, with each click increasing or decreasing the year by one. The month and day can also be adjusted in a similar manner to view reports for specific dates.

Figure 8-25 Data reports interface introduction



Data reports interface introduction
1. Data reports: Displays the recorded charging and discharging amounts for PV, load, battery, and the grid for the currently selected date in a table format.
2. Current data report date: Shows the date of the data report currently being viewed.
3. Year-: View the data from the previous year.
4. Year+: View the data from the next year.
5. Month-: View the data from the previous month.
6. Month+: View the data from the next month.

Data reports interface introduction
7. Day-: View the data from the previous day.
8. Day+: View the data from the following day.

(2)Export data

- This interface is used for data export. Initially, it requires that the USB drive be formatted in FAT32. Users should check the status bar to see if the USB drive is inserted. If the interface indicates that the USB drive is inserted, users can select the type of data they wish to export and click on the export data button. Once the data export is complete, clicking the 'eject USB drive' button will finalize the data export process.

Figure 8-26 Data export interface introduction

Data export interface introduction
1. Export history to USB: The filename for history records exported to a USB drive is "Record.csv".
2. Export operation log to USB: The filename for operation logs exported to a USB drive is "Log.csv".
3. Export electricity statistics to USB: The filename for electricity statistics exported to a USB drive is "Report.csv".
4. USB status display: Here you can check the connection status of the USB drive.
5. History records export button: This button exports the history records to a USB drive. The file, "Record.csv", needs to be opened with Excel.
6. Operation log export button: Click here to export the operation log to a USB drive.

Data export interface introduction

7. Electricity statistics export button: Click here to export the electricity statistics report to a USB drive.

8. Eject USB drive: This option safely removes the USB drive after the export operations are complete.

(3) Historical Records

- This interface is designed to log the start and end times of status records and fault records that occur during the operation of the equipment.

Figure 8-27 Historical records interface introduction

Historical records interface introduction

1. Level: 0 indicates an alarm event and will be highlighted in red; 1 indicates a status event.

2. Event start time

3. Event end time

4. Event description

(4)Operation Logs

- This interface is used to record the modifications made to some of the system's important parameters.

Figure 8-28 Operation log interface introduction

Operation log interface introduction

1. Modification time: The time when the system settings were modified.

2. System settings operation record: A log of the operations performed on the system settings.

8.8 Turn on/off

- The opening and closing of DCAC converter and DCDC converter can be controlled by the interface.

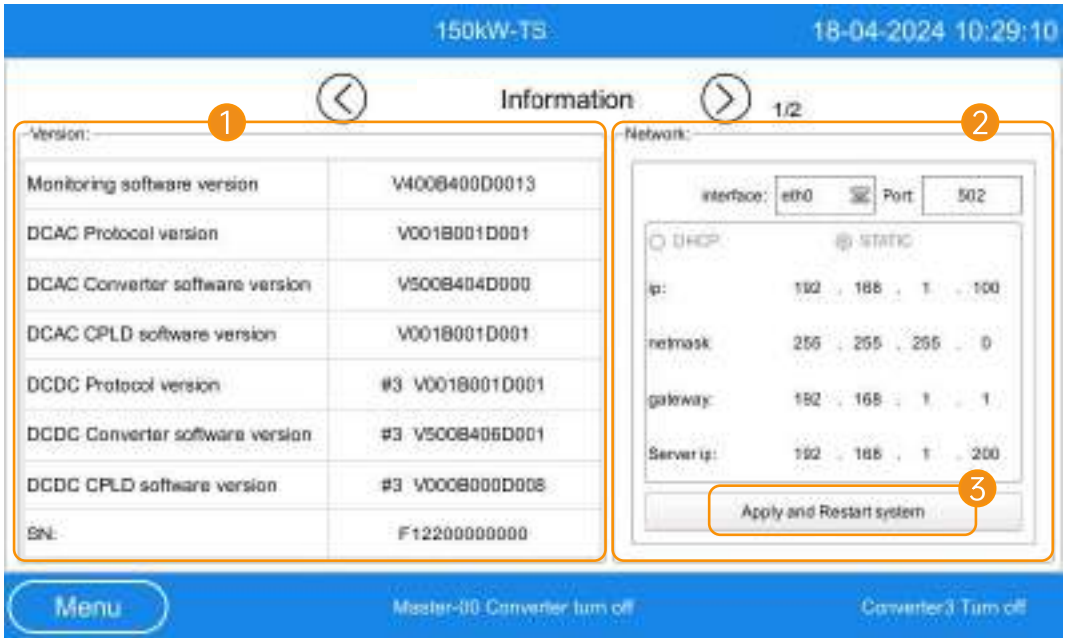
Figure 8-29 Turn on/off interface introduction

Turn on/off interface introduction
1. Click to open the DCDC converter.
2. Click to close the DCDC converter.
3. Click to open the DCAC converter.
4. Click to close the DCAC converter.

8.9 System information

- The system information interface displays the version information of the current running system, such as the monitoring version, the DCAC converter version, the DCDC converter version and the network port information.

Figure 8-30 System information interface introduction



System information interface introduction
1. Display the current system version information.
2. Display the current monitored network port information.
3. The monitoring device will be restarted after clicking.

9 Maintenance and troubleshooting

9.1 Description

Due to the influence of ambient temperature, humidity, dust and vibration, the internal devices of energy storage converter will be aging, which will affect the performance of converter and can even lead to failure.

Therefore, it is necessary to carry out routine and regular maintenance of energy storage converter to ensure its normal operation and service life. All measures and methods to help the energy storage converter in good working condition belong to the scope of maintenance work.

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 converter.
- Information on components connected to energy storage converters, configuration of energy storage batteries and network parameters.
- Energy storage batteries and network parameters.
- Communication connection scheme of energy storage converter.
- Fault information and brief description.

9.2 Matters needing attention

9.2.1 General safety rules

In order to ensure the safety of the operators, the following five safety rules must be observed when maintaining or overhauling the energy storage converter:

- Disconnect all external connections of the energy storage converter and the internal power supply of the equipment.
- Ensure that the energy storage converter is not accidentally re-energized.
- Use the multimeter to ensure that the internal of the energy storage converter is completely uncharged.
- Ensure that the energy storage converter is well grounded.
- The operating part is close to the parts that may be electrified. It needs to be covered with insulation material.

- Only qualified and authorized personnel can maintain the energy storage converter and other operations. In the maintenance work, do not leave screw, washer and other metal parts in the energy storage converter to avoid damage to the converter!

- If only the circuit breaker is disconnected, the cable connection terminals in the AC/DC cabinet of the energy storage converter are still live!
- Before opening the cabinet door and starting the formal maintenance work, it is necessary to disconnect not only the circuit breaker, but also the front and back stage circuit breakers of the energy storage converter.

- After the energy storage converter is out of operation, please wait at least 15 minutes before operating it.

9.2.2 Maintenance work

Table 9-1 Maintenance work item sheet

Maintenance item	Description	Recommended time
Save record	Export data with USB and save backup.	1 month
Converter inspection	Observe whether the appearance of energy storage converter is damaged, deformed or rusted. Listen to the abnormal sound of the energy storage converter. LCD was used to observe the running parameters. Use thermal imager and other detection systems to detect the heating status. Check whether the ventilation, ambient temperature, humidity and dust around the converter meet the requirements.	Half a year
Duct cleaning	Check duct dust. Listen to if there is any abnormal vibration when the fan is running. Use compressed air and turn on the fan for cleaning. Clean or replace the air filter.	Half a year (If the environment is harsh, shorten the time as appropriate)
Security function	Check whether the EPO button is invalid. Check whether the LCD closed converter function is invalid.	Half a year
Circuit connection	Check all electrical connections for loose or poor contact. Check the surface of all cables and metal surfaces for damage or scratch. Check that the insulation bandage of all terminals is off. Check screw position for signs of overheating. Check the color change of the copper bars and bolts.	1 year
Breaker maintenance	Check all circuit breakers for failure. Check whether the circuit breaker or load switch is damaged.	1 year
Signs check	Check device warning signs and other equipment labels. If signs are blurred or damaged, please replace it in time.	1 year

- Due to the capacitance of DC bus, it will take at least 15 minutes to wait until the energy storage converter is completely cut off. Before removing the dust, please use the multimeter measurement to confirm that there is no electricity in the machine, so as to avoid electric shock.

- The majority of maintenance work can only be carried out by removing the protective net cover inside the machine. At the end of all maintenance work, it is necessary to restore all dismantled maintenance covers to their original state. Make sure all screws are tightened in place.

- Only the recommended product routine maintenance cycle is included in the table. The actual maintenance cycle should be determined according to the specific installation environment of the product. The maintenance cycle of the product will be affected by factors such as the scale of the power plant, the location of the plant and the on-site environment. It is necessary to shorten the maintenance cycle and increase the maintenance frequency if the wind and sand in the operation environment are larger or the dust is thicker.

9.2.3 Check and replace the air filter

- Read the safety instructions carefully.
- Open the cabinet door.
- Check the air filter and remove it with a screwdriver if necessary.
- Check the cleanliness of cabinet. If necessary, use a soft cloth or vacuum cleaner for cleaning.
- Close the cabinet door.

9.2.4 Replacement of electronic components

- When replacing the electronic and electrical components in the energy storage converter, be sure to replace the same type of components from the same manufacturer! The type of components can be obtained by identifying the energy storage converter or the product itself. If not, please contact us.
- If it is necessary to replace the products of other manufacturers or different models of the same manufacturer, it must be confirmed by our engineers in advance. Otherwise, we will not be liable for casualties or property losses that may result from this.

9.3 Fault handling

9.3.1 Troubleshooting

When the energy storage converter 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 the state off ailure .
- Whether the power grid is connected correctly and powered on.
- Check whether the communication of measuring equipment is normal.

- 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.

9.3.2 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 upper computer.

LCD screen cannot be switched on and off:

- Check the communication connection between LCD screen and DSP board.

9.3.3 Alarm malfunction and handling method

LCD can display alarms, and the corresponding solutions are shown in Table 9-2 below.

Table 9-2 DCAC Alarm Fault Handling Method

Fault type	Handling method
Converter overcurrent	Shutdown to check whether the input and output of the converter are short-circuited or overloaded.
The converter limits current wave by wave	Shutdown, troubleshoot the fault, and turn on the machine after the fault is rectified.
Converter fault	Shutdown, repeat the converter before starting the check operation.
Low battery voltage	Disconnect DC load switch and check DC side voltage and battery configuration.
Battery charging is not allowed	Shutdown, check battery parameters, and start the battery.
Parallel communication fault	Check parallel wire connection and screen parallel Settings.
Bus overvoltage fault	Shutdown Check the DC voltage.
DC bus short circuit fault	Shutdown Checks the DC bus cables.
Open output contactor	Shutdown to check whether the AC contactor is damaged.
Output contactor short circuit	Shutdown to check whether the AC contactor is damaged.
Converter is overheated	Shutdown: Check whether the converter fan is faulty and whether the air duct is unobstructed.
Overload	Shutdown， check the load size.

Fault type	Handling method
Battery connection is reversed	Shutdown: Switches the DC input bus.
DC contactor fault	Shutdown，check whether the DC contactor is damaged.
Battery overcurrent	Shutdown，check BMS data and battery current.
Converter phase fault	Shutdown: Check the AC line.
Leakage current alarm	Shutdown，check cables and devices for electrical leakage.
Low battery capacity	Shutdown，check BMS data and battery current.
Network overvoltage	Shutdown: Check the voltage of the node.
Grid undervoltage	Shutdown: Check the voltage of the node.
Power grid voltage reverse sequence	Turn off the power supply switch and shut down the power grid to check the three-phase cables.
Power grid frequency anomaly	Shutdown Check the power grid voltage and frequency.
Island protection	Shutdown.
Drive line fault	Shutdown，check whether the internal drive cable is loose.
Arrester fault	Shutdown，check the lightning protection of the converter.
Insulation impedance anomaly	Shutdown，check whether the converter is grounded and whether the cables are aged or damaged.
Battery discharge is not allowed	Shutdown, check battery parameters, and start the battery.
Inversion overvoltage fault	Shutdown: Check whether the input and output voltage of the converter is overloaded.
15V power supply fault	Shutdown，check the AC and DC auxiliary power modules.
Ac fan fault	Shutdown，check the AC fan.
Battery failure	Shutdown，check the battery.
Emergency shutdown	Shutdown.
Output short circuit	Shutdown，check the converter Settings.
CT or Hall open circuit fault	Shutdown，check the CT or Hall cables.

Table 9-3 DCDC Alarm Fault Handling Method

Fault type	Handling method
DC converter overcurrent	Shutdown，check whether the input and output of the converter are short-circuited or overloaded.
DC converter limits current by wave	Shutdown，troubleshoot the fault, and turn on the machine after the fault is rectified.
DC converter fault	Shutdown，troubleshoot the fault, and turn on the machine after the fault is rectified.
DC converter overtemperature	Shutdown，troubleshoot the fault, and turn on the machine after the fault is rectified.
DC converter overload	Shutdown，detects the load size.
Low voltage on the high voltage side	Shutdown，Check the voltage on the high voltage side and start the system after the fault is rectified.
The midpoint of the high-pressure side is unbalanced	Shutdown，check the bus voltage.
The busbar on the high voltage side is overvoltage	Shutdown，turn off the input/output switch, check the voltage on the high voltage side, and start the power after the fault is rectified.
The busbar on the high voltage side is short-circuited	Shutdown，turn off the input/output switch, check the voltage on the high voltage side, and start the power after the fault is rectified.
The input on the high voltage side is faulty	Shutdown，turn off the input/output switch, check the voltage on the high voltage side, and start the power after the fault is rectified.
The voltage on the low voltage side is too low	Shutdown: Check the voltage on the low voltage side and start the system after the fault is rectified.
The low voltage side bus overvoltage fault	Shutdown: turn off the input/output switch, check the voltage at the low voltage side, and start the power after the fault is rectified.
The bus on the low voltage side is short-circuited	Shutdown，turn off the input/output switch, check the voltage at the low voltage side, and start the power after the fault is rectified.
Low voltage side connection reverse fault	Shutdown，turn off the input/output switch, check the voltage at the low voltage side, and start the power after the fault is rectified.
The midpoint of the low-pressure side is unbalanced	Shutdown，check the bus voltage.

Fault type	Handling method
Driver cable fault	Shutdown，check IGBT driver cables.
Lightning protection fault	Shutdown，turn off the input and output switches, and replace the surge protection module in the cabinet.
Insulation impedance anomaly	Shutdown，turns off the input/output switch.
DC auxiliary power supply fault	Shutdown，replace the auxiliary power module.
15V power supply fault	Shutdown，check the low and high voltage auxiliary power supply boards.
DC fan fault	Shutdown，check fan ducts and power supplies.
Emergency shutdown	shutdown，turn off the input/output switch and check the fault.
DC converter is out of sync	Shutdown，Turn off the input/output switch, check the parallel network cable, and restart the DC module.
The high voltage side contactor is open	Shutdown，Turn off the input/output switch and replace the DC contactor.
The high voltage contactor is short-circuited	Shutdown，Turn off the input/output switch and replace the DC contactor.
The low voltage side contactor is open	Shutdown，Turn off the input/output switch and replace the DC contactor.
The low voltage contactor is short-circuited	Shutdown，Turn off the input/output switch and replace the DC contactor.

9.3.4 Alarm malfunction and handling method

- Energy storage converter has perfect protection function and warning function. When the input voltage or abnormal situation of power grid occurs, it can operate effectively to protect the safe operation of energy storage converter and continue to operate the set mode until the abnormal situation disappears.

Table 9-4 Converter Warning and Protection Functions

Function	Description
DC over/under voltage protection	When the DC voltage of the energy storage battery exceeds the allowable voltage range, the energy storage converter will stop working and send out warning signals, and display the fault type on the LCD screen. Energy storage converter can detect abnormal voltage quickly and react.

Function	Description
Overvoltage/undervoltage protection of power grid	When the energy storage converter detects that the grid voltage exceeds the allowable voltage range, the energy storage converter will stop working and send out warning signals, and display the fault type on the LCD screen. Energy storage converter can detect abnormal voltage quickly and react.
Over/Under Frequency Protection of Power Grid	When the energy storage converter detects that the frequency fluctuation of the power grid exceeds the allowable range, the energy storage converter will stop working and send out warning signals. The fault type is displayed on the LCD screen. Energy storage converter can detect abnormal frequency quickly and respond to it.
Isolated island protection	When the energy storage converter detects that the grid voltage is 0, the energy storage converter will stop working and send out warning signals, and display the fault type on the LCD screen. Energy storage converter can detect abnormal voltage quickly and react.
AC Overcurrent Protection	When the output power of the energy storage battery exceeds the maximum DC input power allowed by the energy storage converter, the energy storage converter will work at the allowable maximum AC output power. When the AC current is detected to be greater than 1.2 times the rated current, the energy storage converter will stop working. After restoring to normal, the energy storage converter should be able to work normally.
AC leakage current protection	The energy storage converter has the function of grounding protection. A leakage current sensor is installed in the grounding cable. When the leakage current exceeds 2A, the machine will stop immediately. When the current is less than 1.5A, the protection can be eliminated. The fault is displayed on the LCD screen.
IGBT Overtemperature Protection	IGBT module of energy storage converter uses high precision temperature sensor, which can monitor module temperature in real time. When the temperature is too high, the DSP will issue instructions to stop the operation of energy storage converter to protect the stable operation of equipment.
IGBT Fault Protection	The IGBT module of the energy storage converter has self-protection function. When the module detects that the module has over-current, it can send fault information to the DSP quickly. The DSP will issue instructions to stop the energy storage converter running, and send warning signals, and display the fault type on the LCD.

Function	Description
Polarity Reverse Connection Fault Protection	When the energy storage converter detects that the DC voltage is negative, the energy storage converter will send a warning signal and display the fault type on the liquid crystal.
Environmental Overtemperature Protection	High precision temperature sensor is used in the energy storage converter, which can monitor the temperature inside the machine in real time. When the temperature is too high, the DSP will issue instructions to stop the operation of the energy storage converter to protect the stable operation of the equipment.
DC Overcurrent Protection	When the energy storage converter detects that the DC current is greater than 1.2 times the rated current, the energy storage converter will stop working and send out warning signals, and display the fault type on the LCD. After restoring to normal, the energy storage converter should be able to work normally.
Independent converter Overvoltage Protection	When the energy storage converter operates in the independent converting mode and detects that the three-phase output voltage exceeds the allowable voltage range, the energy storage converter will stop working and send out warning signals, and display the fault type on the liquid crystal.
Phase Sequence Reverse Connection Protection	When the energy storage converter self-checks and finds that the three-phase voltage phase of the connected power grid is wrong, the converter will send out warning signals and display the fault type on the LCD. After returning to normal, the energy storage converter should be re-energized and self-checked to work normally.
AC voltage unbalance protection	When the energy storage converter detects that the difference of three-phase AC voltage exceeds the allowable range, the energy storage converter will stop working and send out warning signals, and display the fault type on the LCD. Energy storage converter can detect abnormal voltage quickly and react.
AC current unbalance protection	When the energy storage converter detects that the difference of three-phase AC voltage exceeds the allowable range, the energy storage converter will stop working and send out warning signals, and display the fault type on the LCD. Energy storage converter can detect abnormal voltage quickly and react.

Function	Description
Transformer Overtemperature Protection	The transformer of energy storage converter uses high precision temperature sensor, which can monitor module temperature in real time. When the temperature is too high, the DSP will issue instructions to stop the operation of energy storage converter to protect the stable operation of equipment.
Fan Fault Protection	The fan of the energy storage converter has the function of automatic detection. When the fan is not turned, it can send fault information to the DSP quickly. The DSP will issue instructions to stop the energy storage converter, and send warning signals, and display the fault type on the LCD.
AC/DC contactor fault protection	When the operating state of the energy storage converter is standby, on-grid or off-grid operation, once the status of the main AC-DC contactor is detected to be disconnected, the energy storage converter will stop working, send a warning signal, and display the fault type on the liquid crystal.

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