

PCS series energy storage converter

PCS0030TS~PCS0630



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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	Built-in isolation transformer	On-grid/Off-grid type	Integrated on-grid and off-grid
PCS0030T	30kW	√	√	
PCS0050T	50kW	√	√	
PCS0100T	100kW	√	√	
PCS0150T	150kW	√	√	
PCS0250T	250kW	√	√	
PCS0500T	500kW	√	√	
PCS0500	500kW		√	
PCS0630	630kW		√	
PCS0030TS	30kW	√		√
PCS0050TS	50kW	√		√
PCS0100TS	100kW	√		√
PCS0150TS	150kW	√		√
PCS0250TS	250kW	√		√
PCS0500TS	500kW	√		√

- In the manual, unless otherwise stated, the reference to "PCS", "converter", "energy storage converter" shall refer to above series products.

1.3 Content abstract

- This manual is exclusive instruction manual for PCS 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 injuries 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 *PCS 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

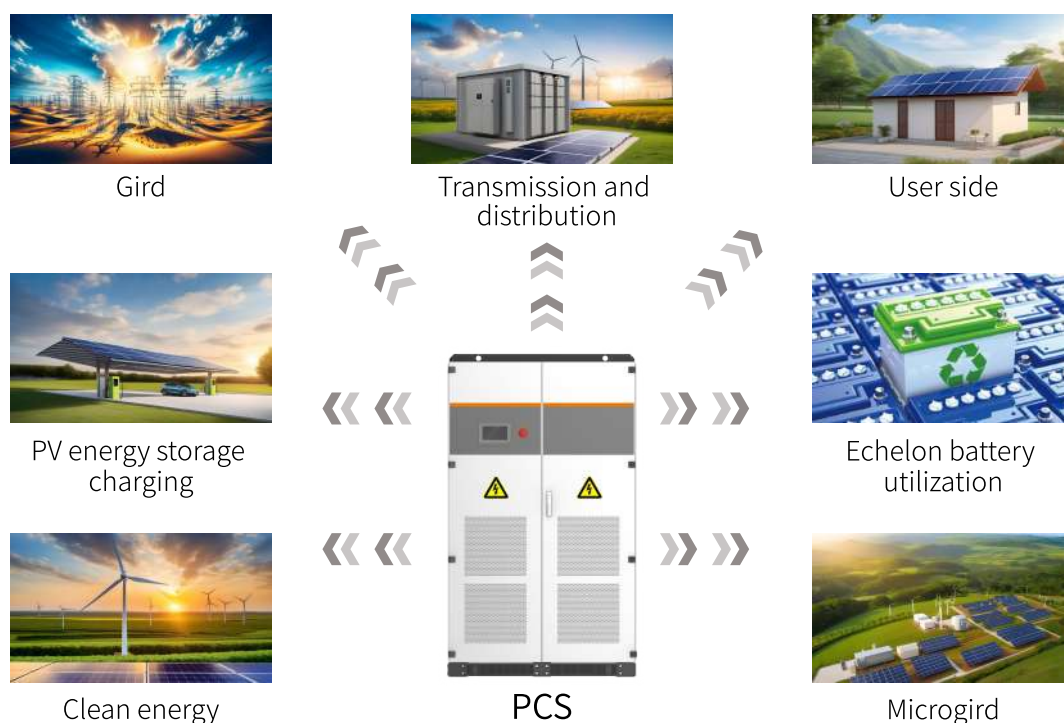
3.1 Introduction of energy storage system

- 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 (PCS for short), as shown in Figure 3-1:

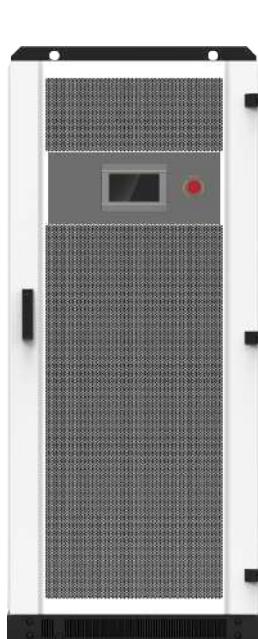


3.2 Product appearance

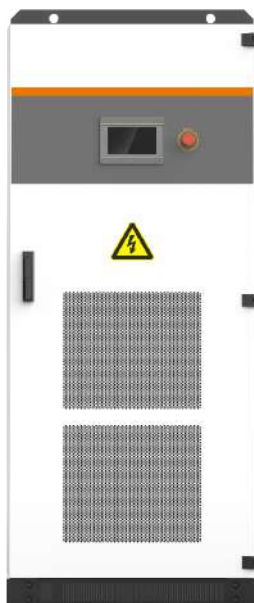
The appearance and external components of energy storage converter as shown below:

Figure 3-2

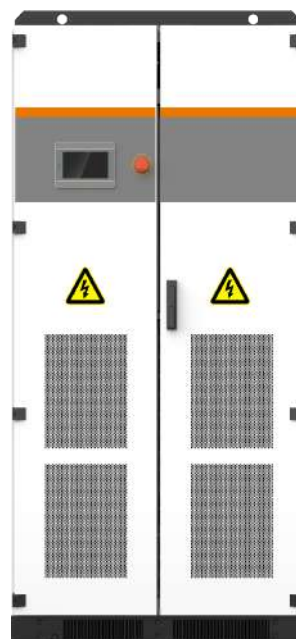
Product appearance



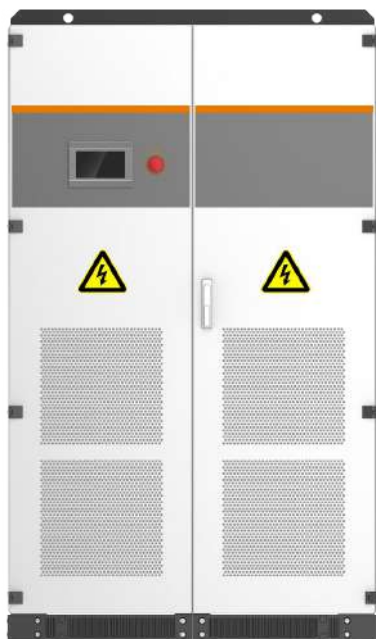
PCS0030TS/PCS0030T
/PCS0050TS/PCS0050T



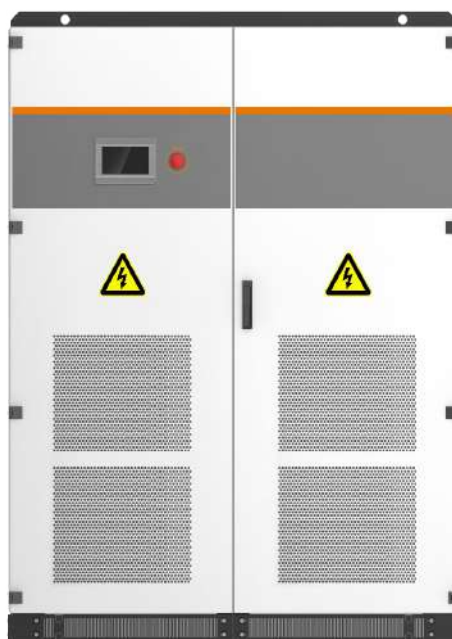
PCS0100TS/PCS0100T
/PCS0150TS/PCS0150T



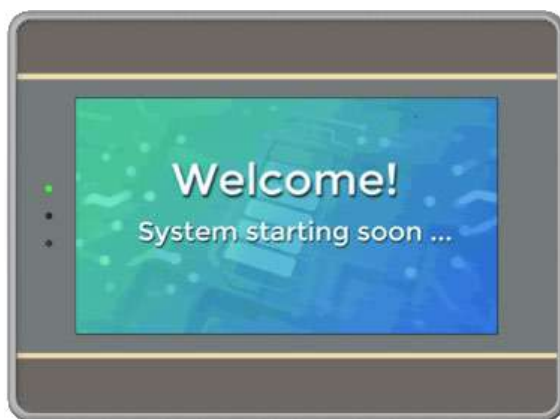
PCS0500/PCS0630



PCS0250T/PCS0250TS



PCS0500TS



LCD screen



Emergency Power Off Button



WARNING

High voltage danger!

- After press EPO button, the AC/DC terminal in the energy storage 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 storage converter.

3.3 Main circuit topology

The converter adopts three-phase full-bridge topology to achieve four-quadrant operation. The filter circuit adopts LCL filter circuit, and the transformer model comes with isolation transformer to realize electrical isolation.

The main circuit principle inside the energy storage converter is shown as follows:

Figure 3-3

PCS series on-grid main circuit topology

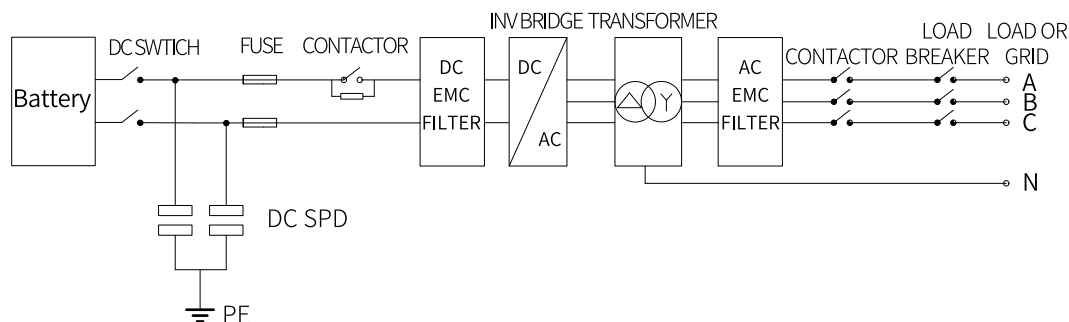
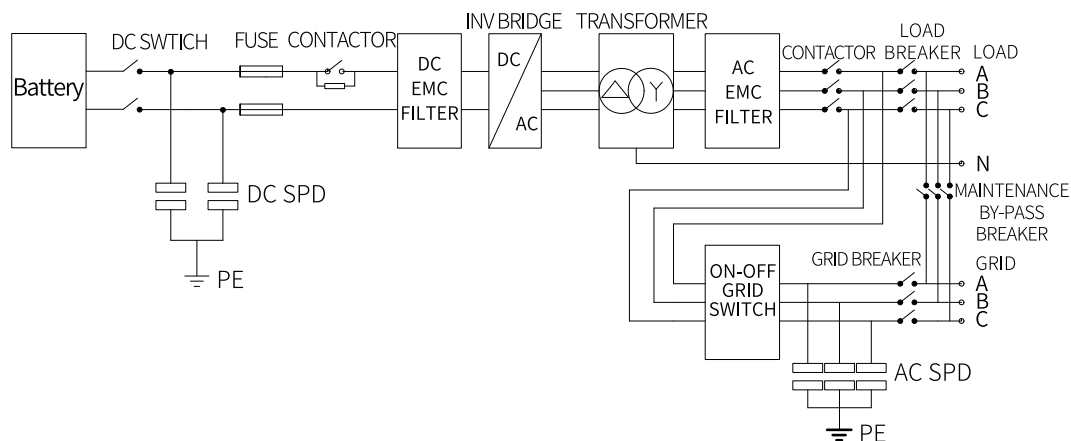


Figure 3-4 PCS series on-grid/off-grid main circuit topology



3.4 Product features

PCS series energy storage converter adopts advanced digital control technology, which optimizes the control performance and improves the reliability of the system. It is suitable for different battery charging and discharging needs. Its main performance characteristics are as follows:

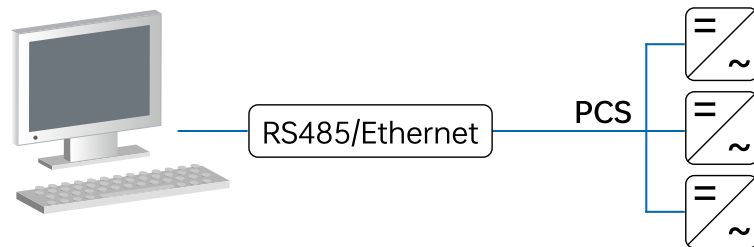
- Support a variety of types of batteries, lead-acid batteries, fuel cells, lithium batteries, BMS support communication methods include RS485, CAN and Ethernet.
- EMS scheduling, communication methods include RS485, CAN and Ethernet.
- It has five working modes: manual, peak load shifting, backup, steady-state expansion of power grid, and transient expansion of power grid.
- AC parallel machine, utmost 4 parallel.
- High voltage ride through capability and low voltage ride through capability
- With automatically frequency modulation and controlled frequency modulation and voltage regulation function.
- With off-grid independent inversion, the micro-grid system is established by the energy storage converter to ensure the power supply of important loads.
- The three-phase unbalanced load capacity at off-grid is strong.
- Industrial frequency design scheme support strong impact resistance.
- Dual auxiliary power supply mode, redundant design to improve reliability.
- Independent air duct design, excellent heat dissipation design.

3.5 Communication scheme

3.5.1 Upper computer communication scheme

The energy storage converter communicates with the upper computer through RS485 / Ethernet, and multiple energy storage converters are connected through RS485 / router, and finally connected to the upper computer terminal.

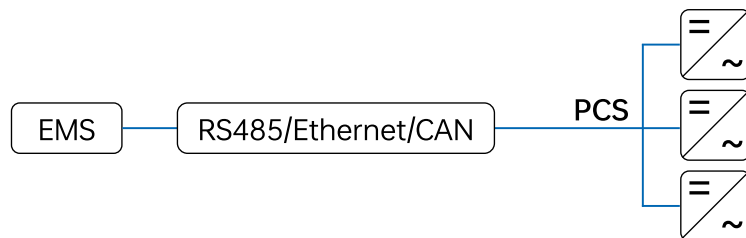
Figure 3-5 Upper computer monitor via RS485 converter/Ethernet



3.5.2 EMS communication scheme

The energy storage converter communicates with EMS through the CAN/ Ethernet / RS485 communication line. The self-designed energy storage system monitoring software monitors the energy storage converter in real time.

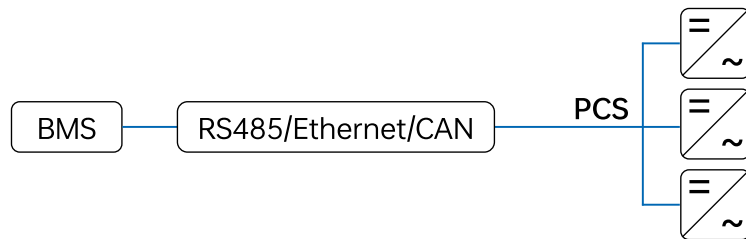
Figure 3-6 EMS monitor via CAN/ Ethernet /RS485



3.5.3 BMS communication scheme

The energy storage converter communicates with BMS through the CAN/ Ethernet / RS485 communication line to realize data transmission.

Figure 3-7 BMS transmits data via CAN/ Ethernet /RS485



4 Work mode and function

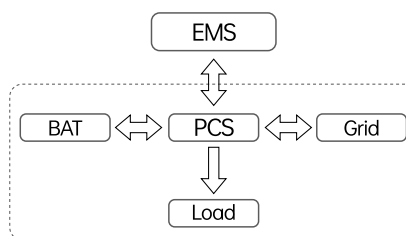
4.1 Work mode

4.1.1 Introduction of work mode

The work mode of PCS can be set on the touch screen. Users click "Menu" → "System" to select the work mode according to different requirements (for reference) :

Manual mode:

Control the working state, charge and discharge power (active power), reactive power, and power factor of the converter through HMI or EMS.



Peak load shifting mode:

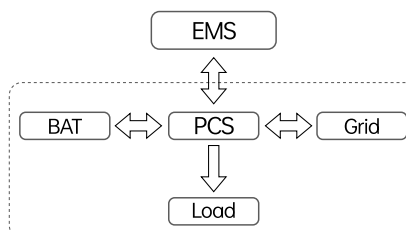
The converter operate according to the local peak-valley electricity price. Set the running period, start time, end time, and power value on the "Run Time" page.

Check	Start Time	End Time	Status	Power (kW)
√	08:00	09:00	charge	10
√	09:00	10:00	discharge	-10
↓	↓	↓	↓	↓
Enable corresponding period	The start time of the automatic run	The time to end the automatic run	Prompt to charge or discharge	The value of the power performed when the automatic runs

Backup battery mode:

When failure occurs on the power grid side, the system switches from zero power to off-grid discharge mode to provide energy for critical loads. Enter the Backup Battery mode to configure this mode.

Note: The mode is only applicable to lithium battery mode and requires normal communication between the converter and the BMS.

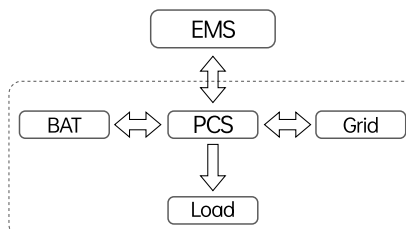


Steady state capacity expansion mode:

PCS limit the input power of the grid (HMI software control).

Charging power: When the PCS load power is less than the set grid capacity, and the current battery SOC is less than the charging SOC, the PCS charge the battery with the value of "charging power = grid capacity - load power". When the battery SOC charge reaches the charge stop SOC or the battery is forbidden to charge, it will stop charging.

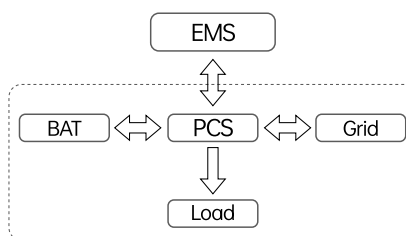
Discharge power: When the PCS load power is greater than the set grid capacity, the PCS will discharge with the value of "discharge power = load power - grid capacity" to make up for the shortage of the grid and realize the steady-state expansion of the grid.



Transient capacity expansion mode:

PCS limits the input power of the grid (DSP software control).

Transient capacity expansion is the power grid dynamic capacity expansion function controlled by "DSP", the capacity of the power grid port is set up to the constant power, positive value is the online capacity attribute, negative value is the load capacity attribute, which can be scheduled by EMS.



4.2 Function of PCS

4.2.1 Basic function

On-grid

- The converter is directly connected to the grid and can either output energy to the grid through the battery or absorb energy from the grid to charge the battery.

Off-grid

- In the absence of grid, the energy storage converter can operate independently to provide load power supply.

On-grid/off-grid switch

- The function is only for models that support on-grid/off-grid switch. In the on-grid mode, the energy storage converter directly switch the charging and discharging state without entering the standby state. The energy storage converter operate independent inversion in the absence of the grid.

Redundant parallel connection

- In large scale applications, the converter can be redundant parallel to improve the redundancy, capacity and reliability of the system.

Charge and discharge control of energy storage battery

- The energy storage converters of all PCS series models are capable of charging and discharging in on-grid mode. The depth of charge and discharge can be set by the user.

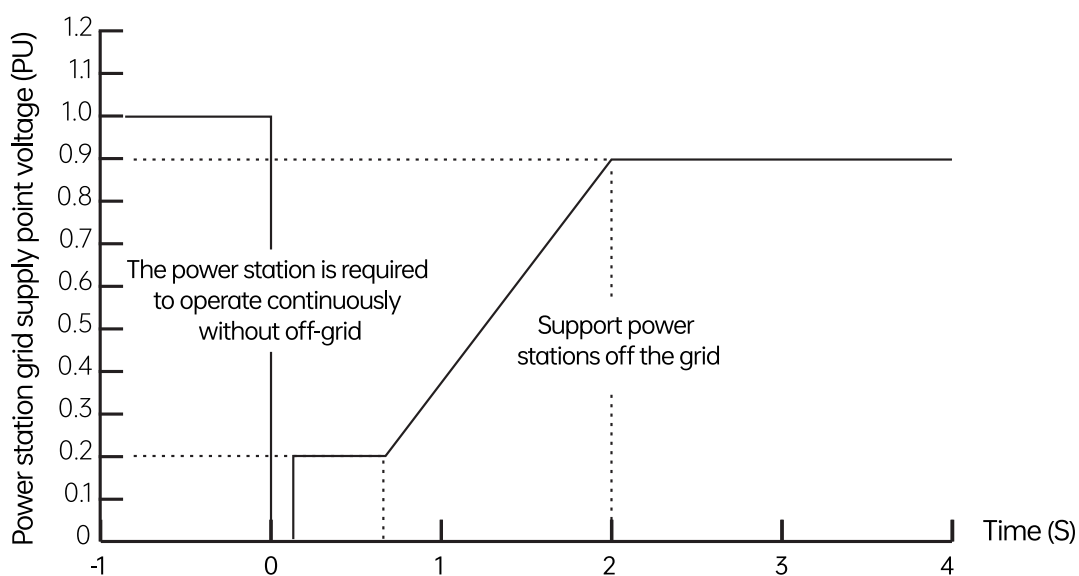
Independent inverter parallel is an additional function, if necessary, please contact with the technician .

4.2.2 Low voltage ride through capability

When the voltage of the power station junction drops to 0, the power station should be able to run continuously for 0.15s without taking off the grid.

Figure 4-1

Low voltage ride through curve



- * This series converter meets the above requirements.

4.2.3 Over temperature derating operation

- The converter operates at the set power when the IGBT junction temperature is less than 105 °C.
- When the IGBT junction temperature is higher than 105°C , the converter will be derated according to the set power percentage.

4.2.4 Start of cooling system

- The air-cooling system will automatically start when the energy storage converter reaches the threshold of temperature or rated power.

4.3 Status of converter

There are four states of energy storage converter, as shown in table 4-1 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.
Emergency 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.	



WARNING

5 Mechanical installation guidance

5.1 Precautions

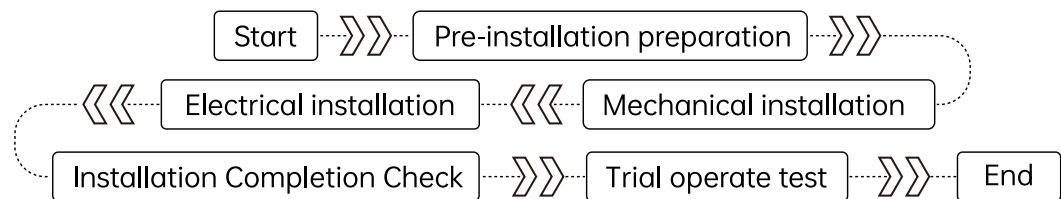
- The installation of PCS series energy storage converter must be operated by at least two qualified persons at the same time, and all electrical installation must comply with local electrical installation standards.
- Do not touch other parts of the cabinet except wiring terminals during installation.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

5.2 Installation procedure

The installation process of PCS series energy storage converter is as follows:

Figure 5-1

Installation process



5.3 Packaging preparation

5.3.1 Packaging inspection

Check equipment before installation. If any transportation damage is found, contact us or transportation company 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°C ~55°C
Humidity	< 95% (non-condensing)
Altitude	5000m (> 3000m derating)

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 table5-4 and table5-5:

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

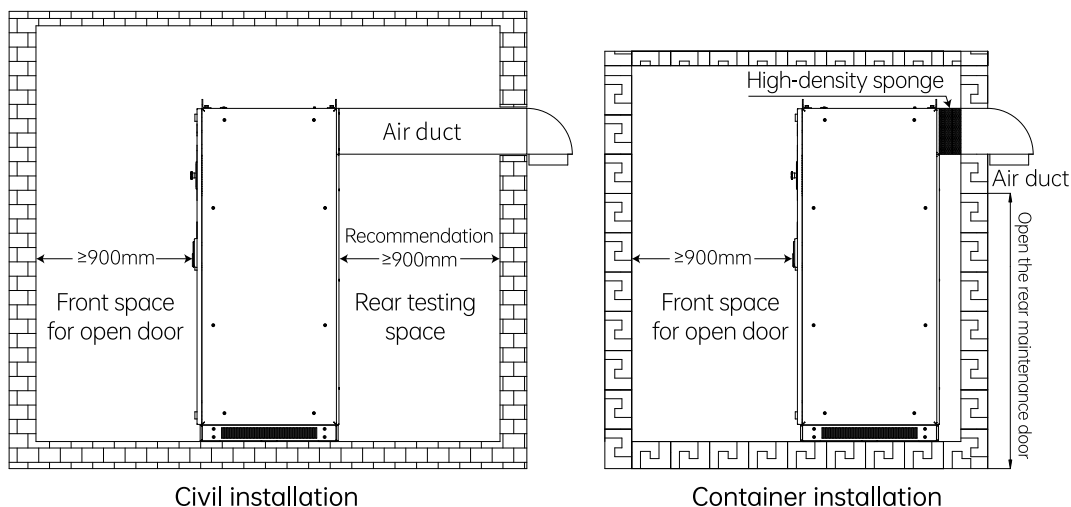
5.5.1 Space requirements

- 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



5.5.2 Dimensions of models

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

Table 5-6

PCS series dimensions

Model	Dimension (W×D×H)
PCS0030T/ PCS0030TS	800×800×1900(mm)
PCS0050T/ PCS0050TS	800×800×1900(mm)
PCS0100T/ PCS0100TS	800×800×1900(mm)
PCS0150T/ PCS0150TS	800×800×1900(mm)
PCS0250T/ PCS0250TS	1200×800×2050(mm)
PCS0500/PCS0630	1000×700×2050(mm)

Model	Dimension (W×D×H)
PCS0500T/ PCS0500TS	1600×1050×2050(mm)

5.5.3 Base mounting

The bottom of the PCS 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.
- Please refer wiring figure for details.

5.6 Air duct

5.6.1 Ventilation environment

For ventilated environment of PCS series converter, the installation environment must meet the following requirements:

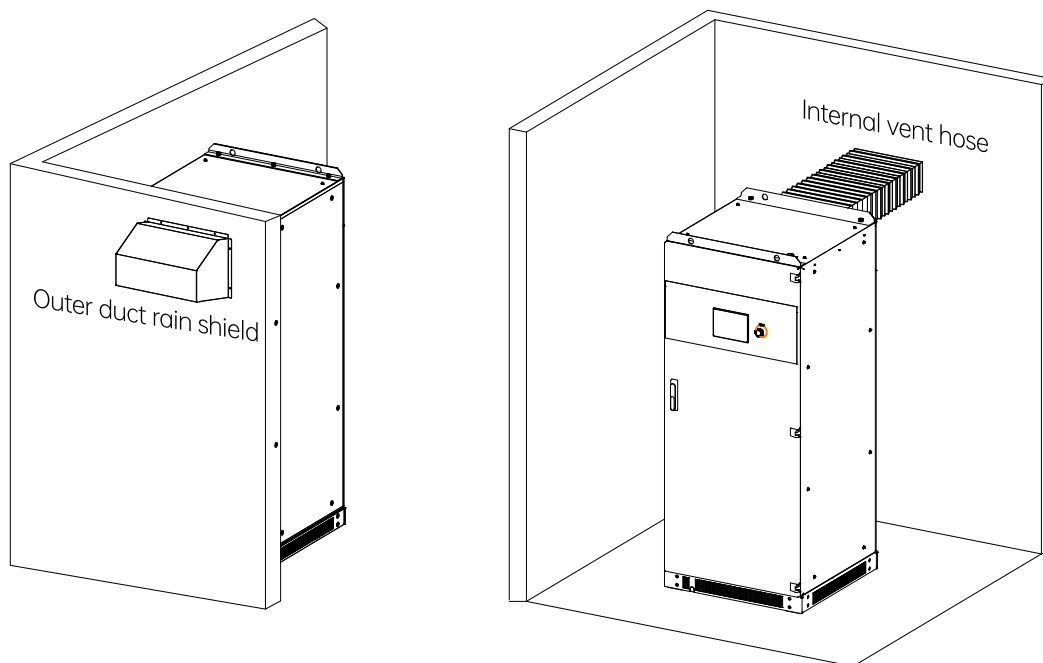
- Avoid installation in the situation of poor ventilation and low air flow. More ventilation can be obtained by adding construction measures such as air supply grid or fan.
- The air inlet should have sufficient air intake volume and ample air intake area.
- Air quality must be guaranteed. If the suspended 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).

5.6.2 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 5-6

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.).

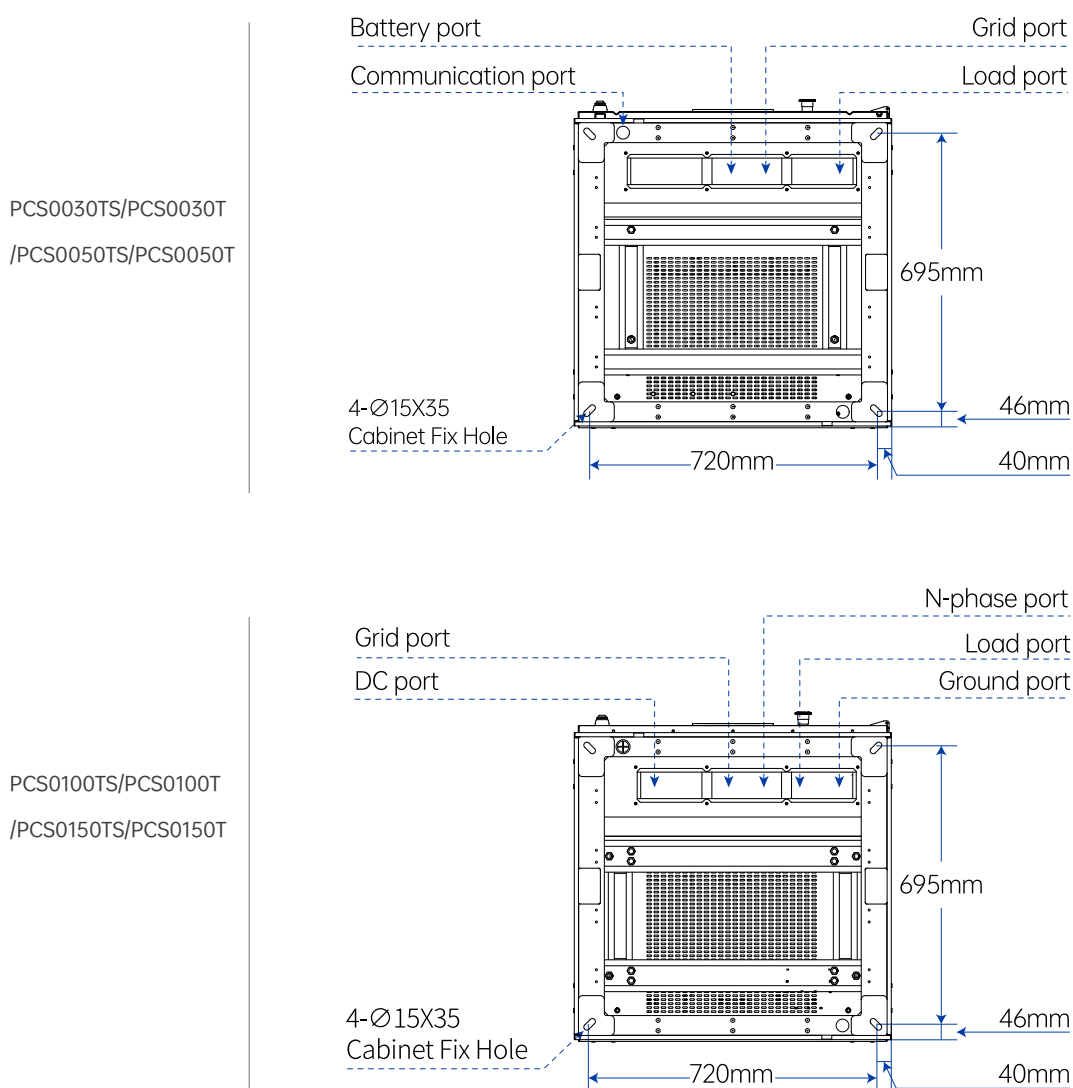
The air required by the converter is inhaled through the vents at the bottom and the dustproof mesh at the front door. The hot air is discharged through the exhaust vents at the top of the converter.

5.7 Base mounting and fixing

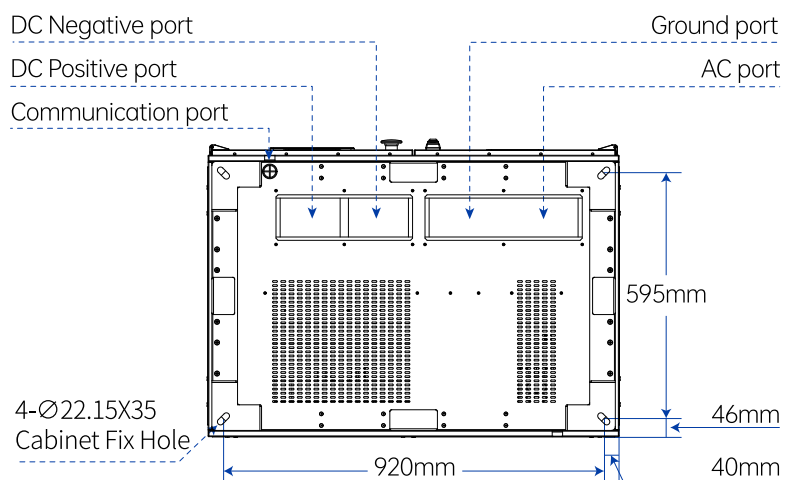
- The channel steel should be designed according to the positioning hole at the bottom of the converter equipped with a base.
- The bottom section of each model is shown in the previous figures (mm). Cooling air enter from the front and bottom, and cables from the bottom. In front of the converter, there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

Figure 5-7

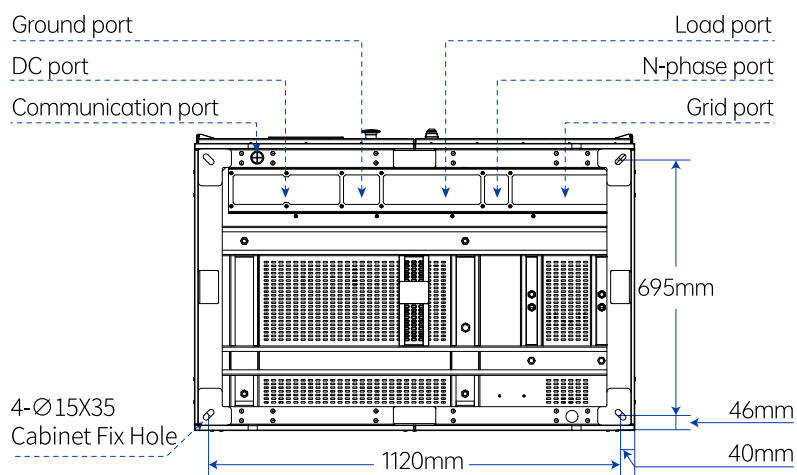
Base mounting and fixing



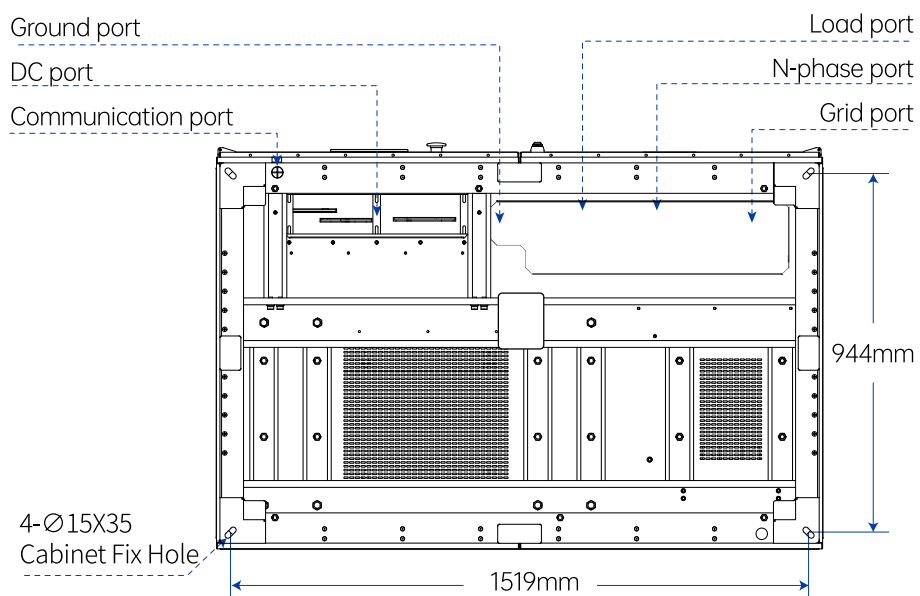
PCS0500/PCS0630



PCS0250T/PCS0250TS



PCS0500TS



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 PCS converters (copper wire)

Capacity	AC output(each phase)	Neutral wire	Ground wire	Battery wire
30 kW	$\geq 25\text{mm}^2$	$\geq 25\text{mm}^2$	$\geq 16\text{mm}^2$	input 50mm ²
50 kW	$\geq 35\text{mm}^2$	$\geq 35\text{mm}^2$	$\geq 16\text{mm}^2$	input 70mm ²
100 kW	$\geq 70\text{mm}^2$	$\geq 70\text{mm}^2$	$\geq 35\text{mm}^2$	input 95mm ²
150 kW	$\geq 50\text{mm}^2 \times 2$	$\geq 50\text{mm}^2 \times 2$	$\geq 50\text{mm}^2$	input 95mm ²
250 kW	$\geq 120\text{mm}^2 \times 2$	$\geq 120\text{mm}^2 \times 2$	$\geq 95\text{mm}^2$	2 Input channel 120mm ² /channel
500 kW	$\geq 120\text{mm}^2 \times 4$	$\geq 120\text{mm}^2 \times 4$	$\geq 95\text{mm}^2 \times 2$	4 Input channel 120mm ² /channel
630kW	$\geq 150\text{mm}^2 \times 4$	$\geq 150\text{mm}^2 \times 4$	$\geq 150\text{mm}^2 \times 2$	4 Input channel 150mm ² /channel



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.



- 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.



- 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 PCS 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

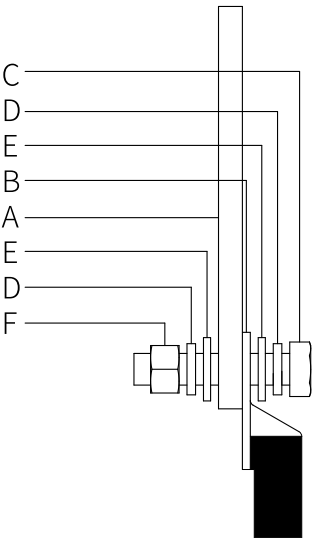


Table 6-2 Names of wiring terminals

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

6.3 Wiring specification

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

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.

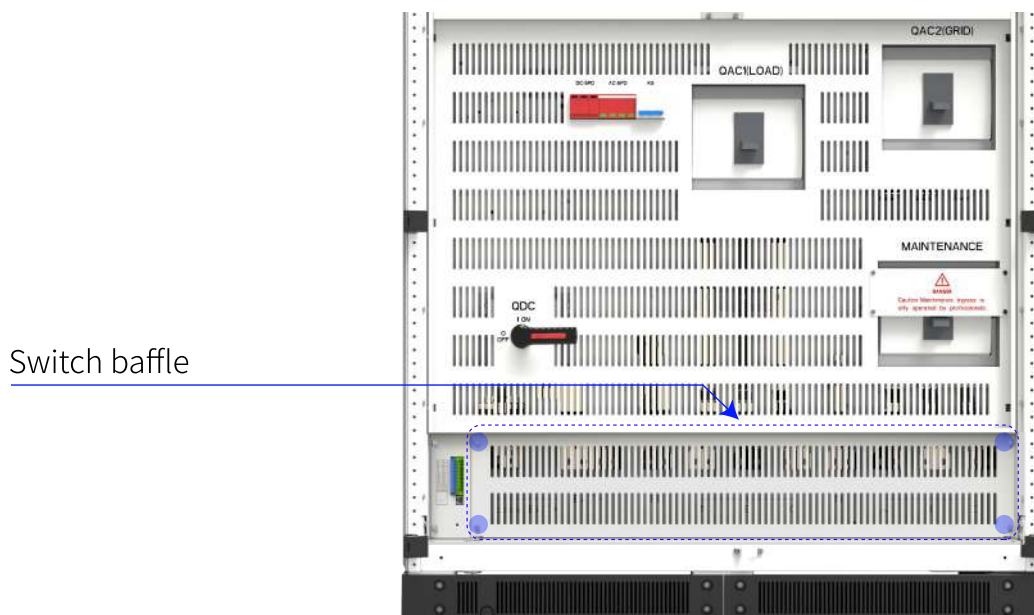
6.5 Remove the switch baffle and lower coaming

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

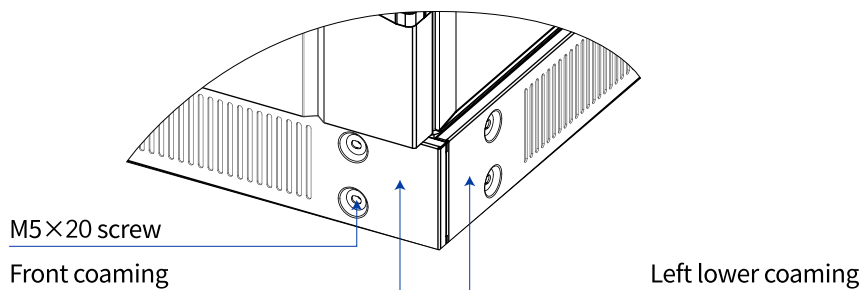
Switch baffle



6.5.2 Installation of lower coaming

The PCS 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 DC wiring

6.6.1 Battery connection

- The DC wiring correspondence between the battery and PCS series converter is shown in table 6-5 below.
- For a single PCS series converter power should not exceed 1.05 times the rated power. When connecting, the user needs to access the corresponding specification input line for each way. The energy storage converter leaves multiple wiring terminals for the user.

Table 6-5 DC wiring correspondence

BAT+	BAT-	GND
Connect to the positive electrode of the battery pack	Connect to the positive electrode of the battery pack	Ground

6.6.2 DC wiring procedure

- Step 1: Verify with the multimeter that all terminals of the converter have been powered off.
- Step 2: Confirm the positive and negative terminals of the cable and make the line mark.
- Step 3: Connect the positive and negative electrodes of the battery pack to the "BAT+" and "BAT-" terminals.

* PCS0250 and PCS0250 split machine DC positive terminal connection screen printed as "BAT+" and "PV+", are used to rent the battery positive terminal.



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!

6.7 AC wiring

6.7.1 AC connection

All models of PCS series energy storage converters have grid connection, and their corresponding relationships are shown in the following table respectively.

Table 6-6

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

Table 6-7

LOAD

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

- * **Note:** If the grid side is diesel generator, the N line should be connected to the PE in the distribution cabinet.

6.7.2 AC wiring procedure

- 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: According to Table 6-6, the phase A,B,C of the grid is correctly connected to the converter.
- Step 4: For the on-grid and off-grid integrated models, connect the cables according to Tables 6-6 and 6-7.

6.8 Communication wiring

6.8.1 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 6-4

Description of skill screen

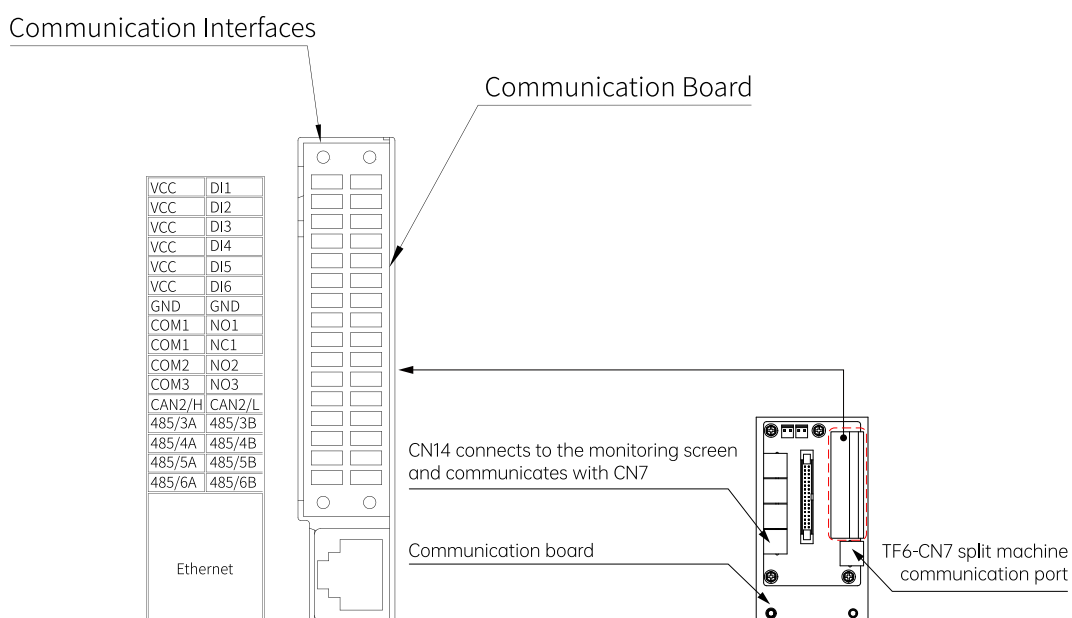


Table 6-8

TF6 definition of interface

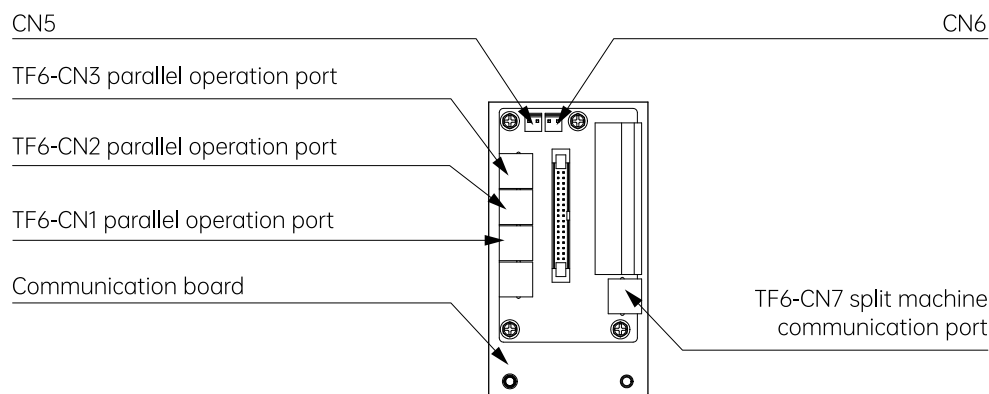
TF6-terminal item	Function
DI1	EPO (default)
	NC
	Access Control
	Full power
	Smoke
	Temperature
	Flooding
	BMS alarm
	ATS signal
DI2	EPO
	NC (default)
	Access Control
	Full power
	Smoke
	Temperature
	Flooding
	BMS alarm
	ATS signal
DI3	EPO
	NC
	Access Control (default)
	Full power
	Smoke
	Temperature
	Flooding
	BMS alarm
	ATS signal
DI4	EPO
	NC
	Access Control
	Full power
	Smoke
	Temperature
	Flooding
	BMS alarm
	ATS signal (default)

TF6-terminal item	Function
DI5	EPO
	NC
	Access Control
	Full power
	Smoke (default)
	Temperature
	Flooding
	BMS alarm
DI6	ATS signal
	EPO
	NC
	Access Control
	Full power
	Smoke
	Temperature (default)
	Flooding
COM1	BMS alarm
	ATS signal
	GND
	NC1
	NO1
	NO2
	COM2
	NO3
COM3	Reserved
	Reserved
	CAN2/H
	CAN2/L
	485/3A
	485/3B
	485/4A
	485/4B
485/5A	Electricity meter
	485/5B
	485/6A
	485/6B
	Ethernet
	PCS to EMS communication
	PCS to EMS communication (default)

- In order to facilitate customers with parallel requirements, all models of PCS series energy storage converters have the function of multi-machine parallel use, up to four devices can be used in parallel. The TF6 communication board and wire crossing hole are arranged on the top of the device. When the number of solders is used in parallel, the network cable is used to connect the parallel port between the devices. See Figure 6-5 for details:

Figure 6-5

The function of external communication board port



- When wiring, attention should be paid to the choice of network port. CN1-3 network port should be used for parallel use of multiple devices. At the same time, the distance between the equipment should not be too long.
- The length of network cable and the type of network head have a vital impact on communication, too long network cable will lead to communication failure.

6.9 Grounding

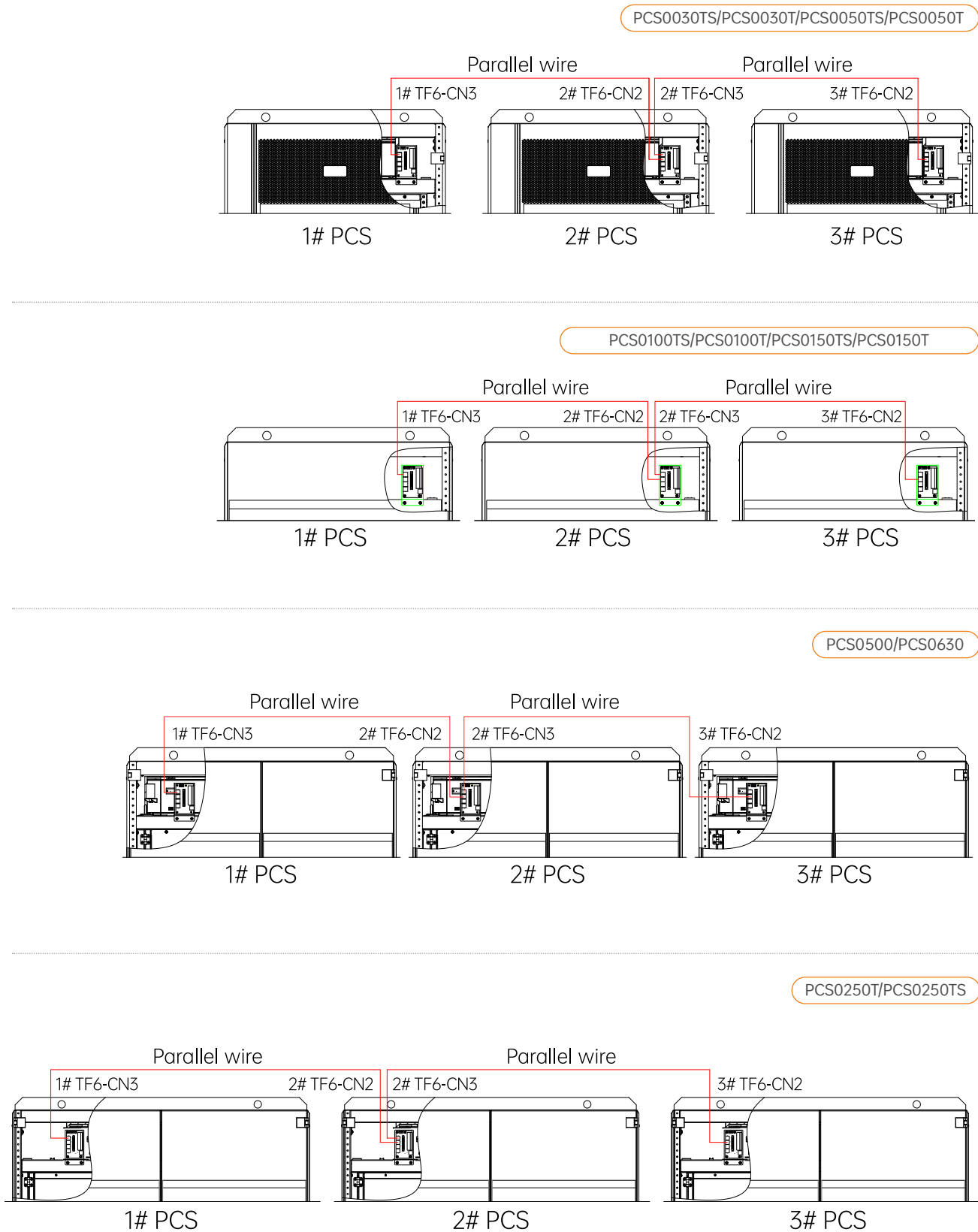
- The grounded copper bar in PCS series energy storage converter should be connected by grounding cable. The grounded copper bar has been connected with the housing of the converter in the cabinet. When connecting, the grounded copper bar should be connected with the equipotential coupling device in the installation site or electrical control room. The resistance should not be higher than 4Ω , and the diameter of the grounding cable should not be less than 16mm^2 .

6.10 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 allowed only after confirmation is correct.

6.11 Parallel wiring

Figure 6-6 Three parallel machine wiring diagram



PCS0500TS

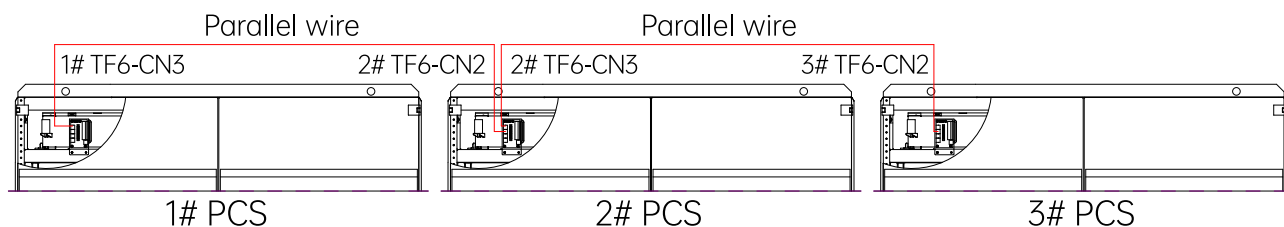
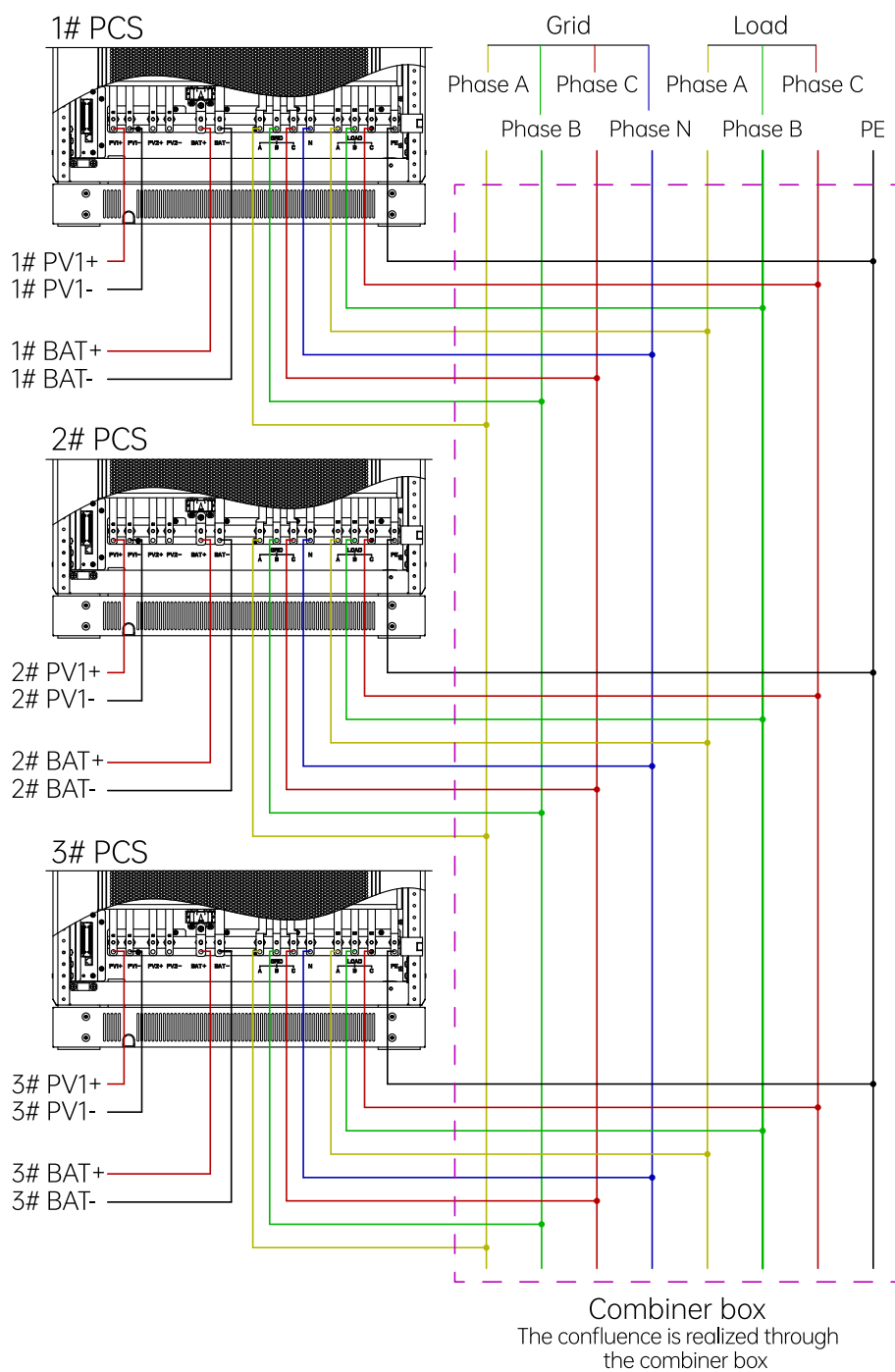


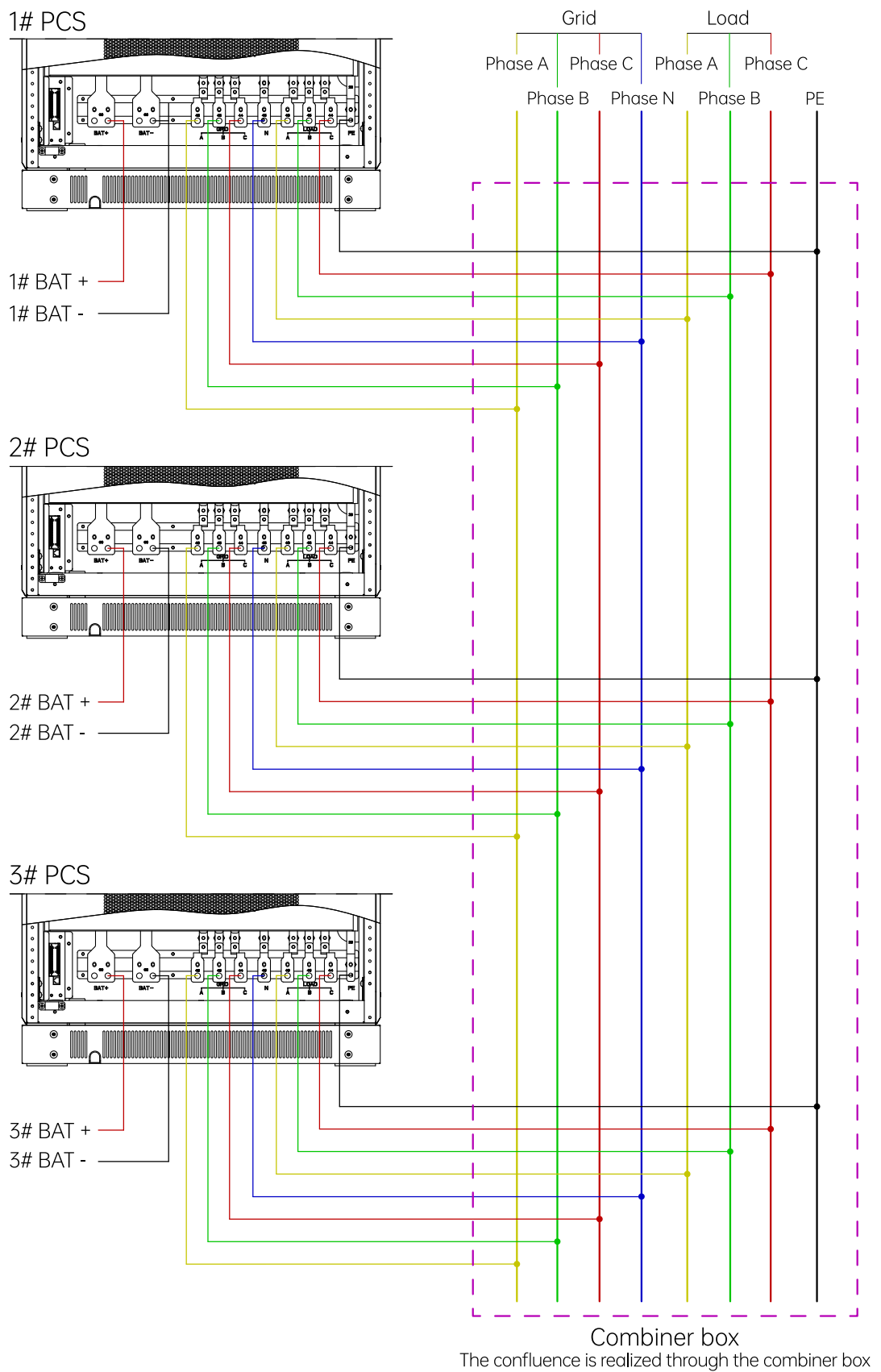
Figure 6-7

Three parallel machine power cable wiring diagram

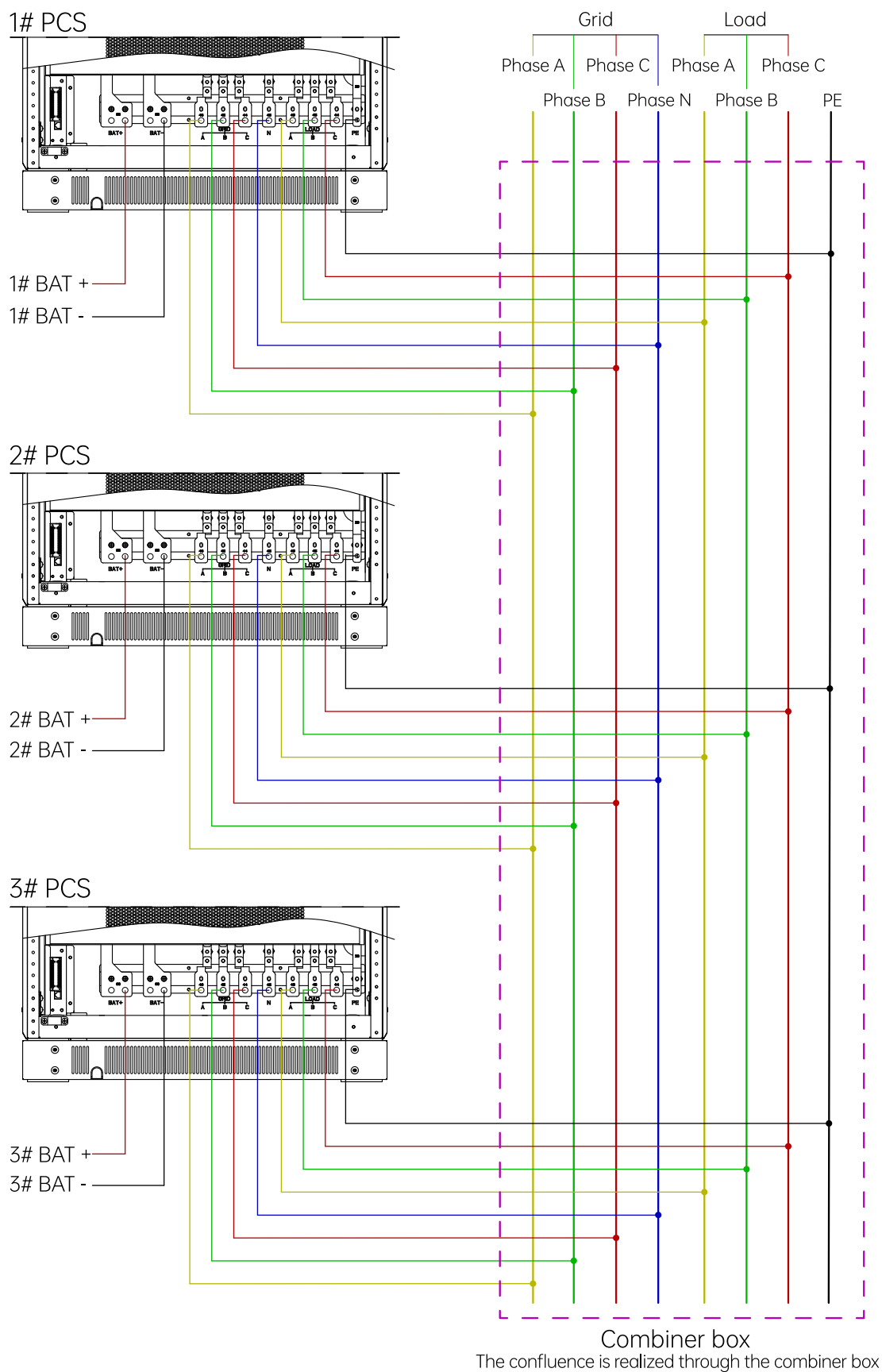
PCS0030TS/PCS0030T/PCS0050TS/PCS0050T



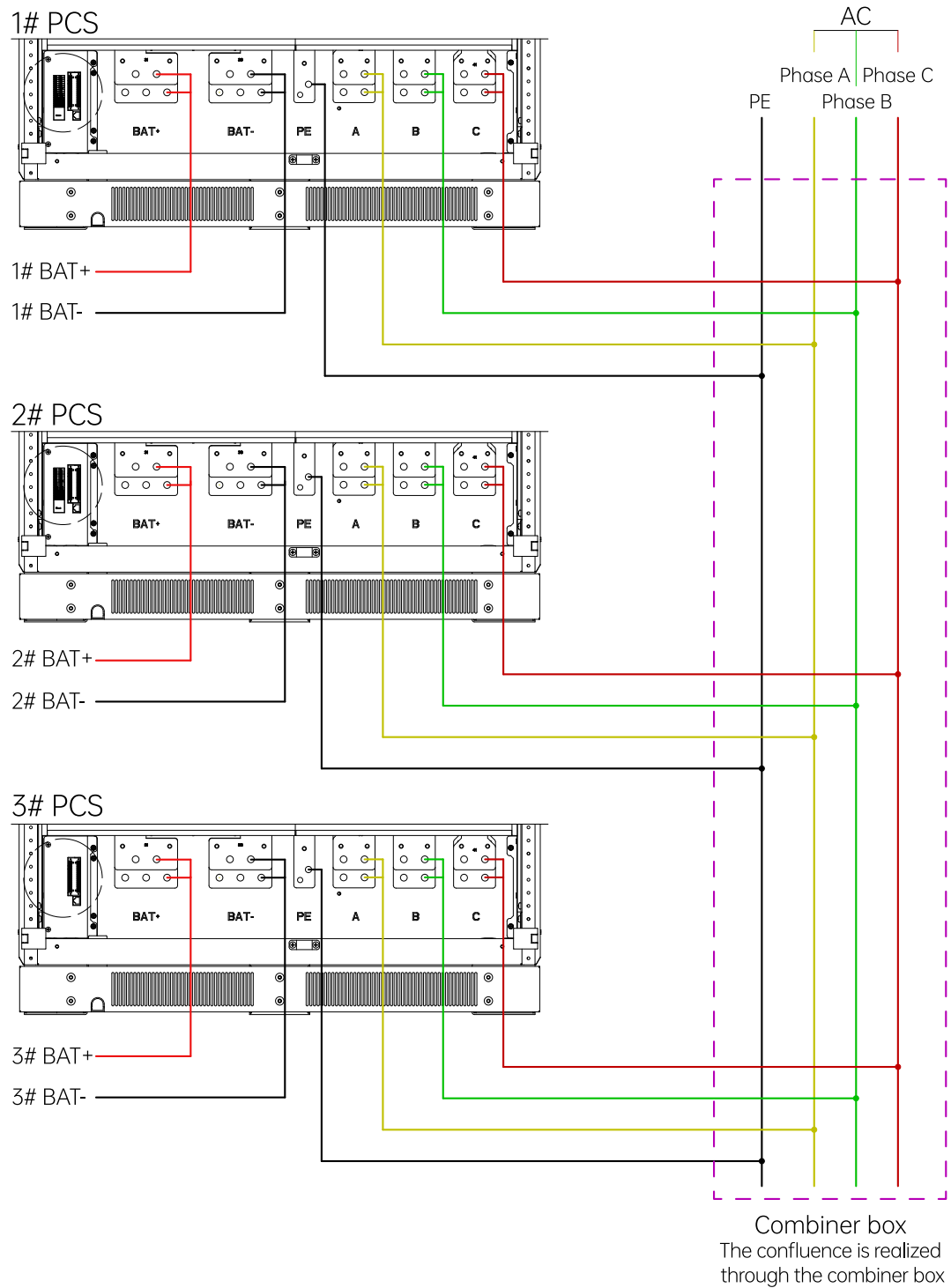
PCS0100TS/PCS0100T



PCS0150TS/PCS0150T

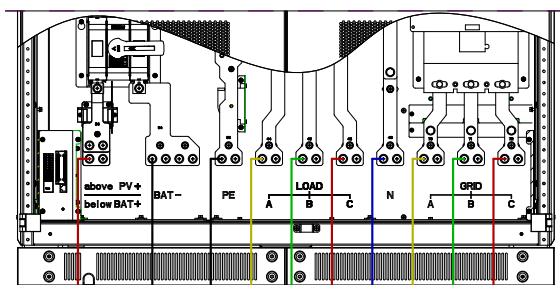


PCS0500/PCS0630



PCS0250T/PCS0250TS

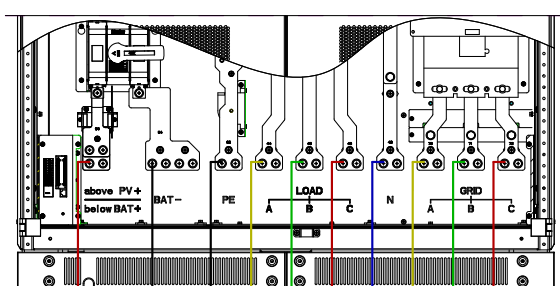
1# PCS



1# BAT +

1# BAT -

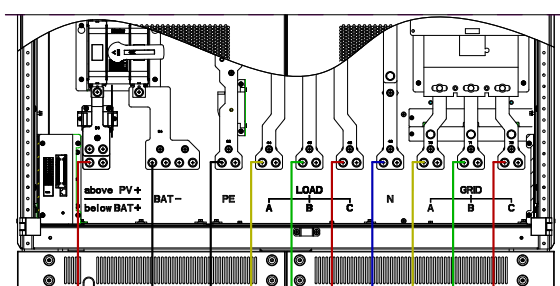
2# PCS



2# BAT +

2# BAT -

3# PCS



3# BAT +

3# BAT -

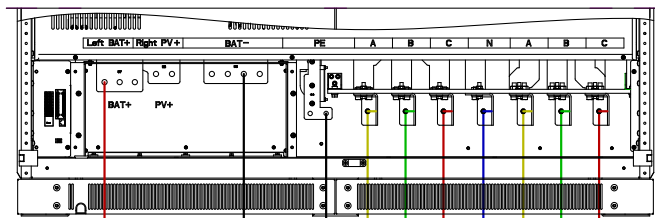
Grid Load
Phase A Phase C Phase A Phase C
Phase B Phase N Phase B PE

Combiner box

The confluence is realized through the combiner box

PCS0500TS

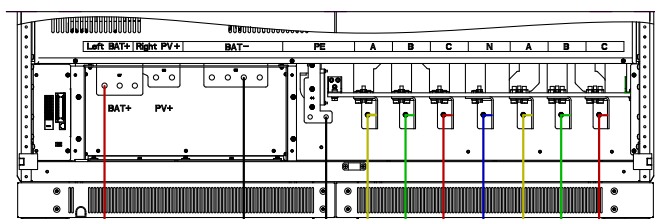
1# PCS



1# BAT + 1# BAT -

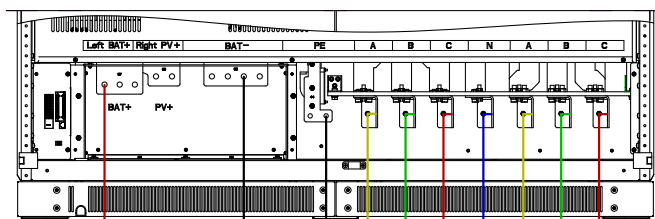
Grid Load
 Phase A Phase C Phase A Phase C
 Phase B Phase N Phase B PE

2# PCS

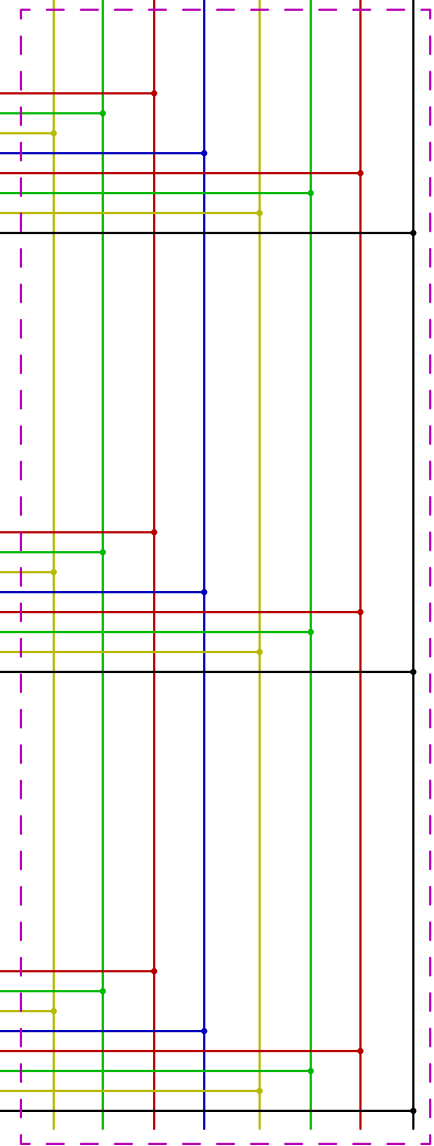


2# BAT + 2# BAT -

3# PCS



3# BAT + 3# BAT -



Combiner box
 The confluence is realized through the combiner box

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.



WARNING

- The Battery side voltage shall not exceed 850V.
- 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.

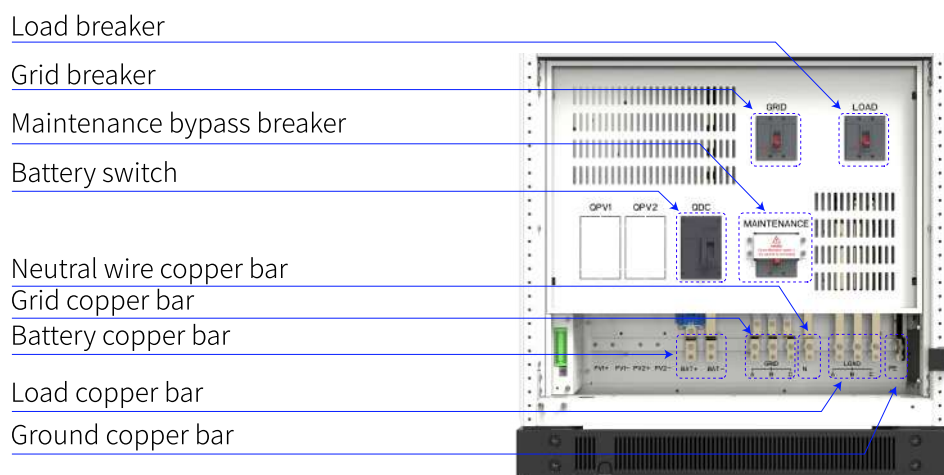
7.2 Start-up operation

After all the above items are satisfied, the energy storage converter can be started up. The operation steps are as follows:

- Step 1: Make sure that the DC side and AC side are connected correctly and the DC side voltage is lower than 850V.
- Step 2: Close AC and DC circuit breaker switches.
- Step 3: Close the lightning protection switch KS, auxiliary power switch KB1, contactor power switch KB2, (and on-grid and off-grid integrated models need to close KB3).
- Step 4: After completing the above steps, click the converter to open through the switch menu on the touch screen. The running status of the machine can be checked through the touch screen after the machine is turned on normally.
- Step 5: After the machine runs normally, close the cabinet door and hand over the key to a special person for safekeeping.

Figure 7-1

PCS input and output



PCS0030TS/PCS0030T/PCS0050TS/PCS0050T

Load breaker

Grid breaker

Maintenance bypass breaker

Battery switch

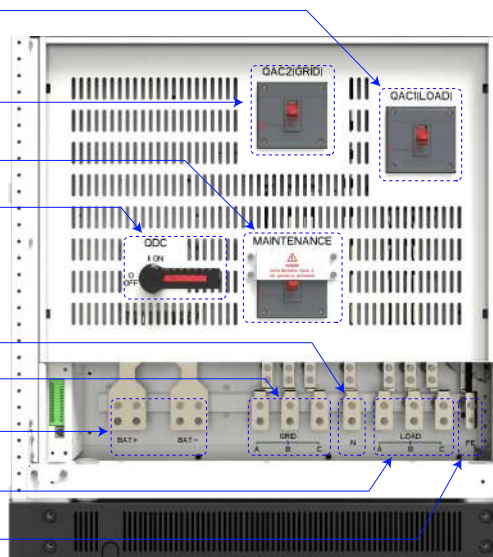
Neutral wire copper bar

Grid copper bar

Battery copper bar

Load copper bar

Ground copper bar



PCS0100TS/ PCS0100T

Load breaker

Grid breaker

Maintenance bypass breaker

Battery switch

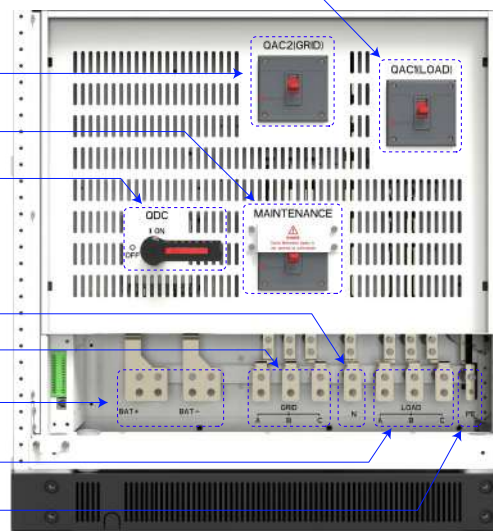
Neutral wire copper bar

Grid copper bar

Battery copper bar

Load copper bar

Ground copper bar



PCS0150TS/PCS0150T

Grid breaker

Load breaker

Lightning arrester switch

Maintenance bypass breaker

Battery switch

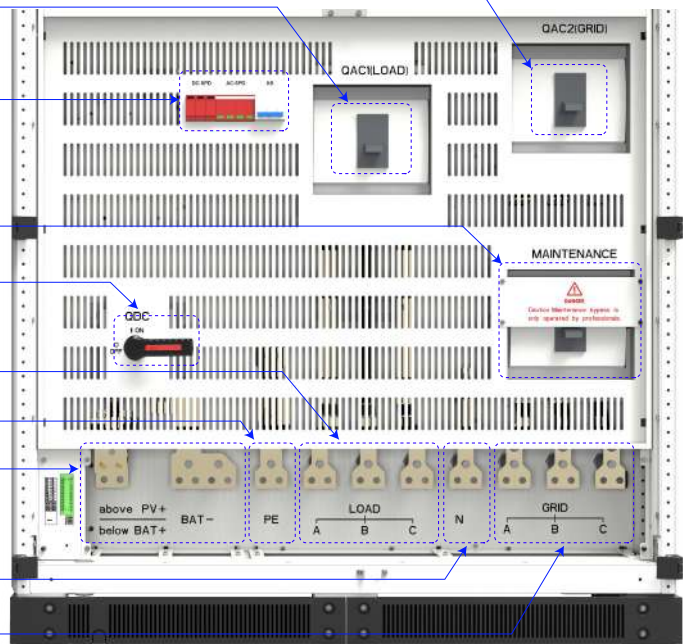
Load copper bar

Ground copper bar

Battery copper bar

Neutral wire copper bar

Grid copper bar



PCS0250T/PCS0250TS

AC breaker

Lightning arrester switch

AC lightning arrester

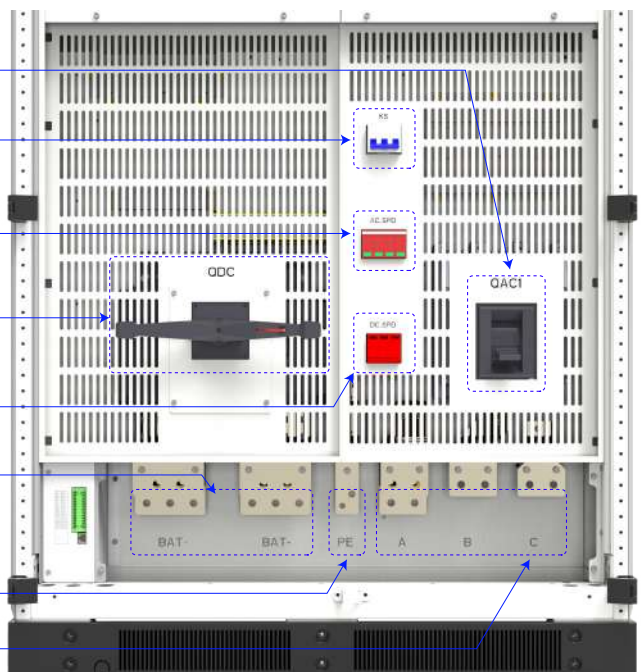
Battery switch

DC lightning arrester

Battery copper bar

Ground copper bar

Grid/Load copper bar



PCS0500/PCS0630

Grid breaker

Maintenance bypass breaker

Lightning arrester switch

Load breaker

Battery switch

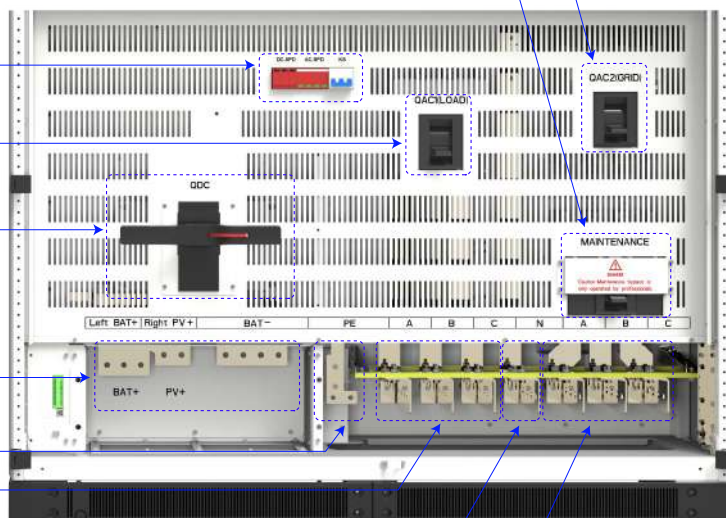
Battery copper bar

Ground copper bar

Load copper bar

Neutral wire copper bar

Grid copper bar



PCS0500TS

- (1) Power on the battery system and close the battery switch.
- (2) Open the cabinet door, close KB1, KB2 and KB3, wait about 30 seconds, the battery voltage data can be displayed on the monitoring interface.

Figure 7-2

Internal micro break

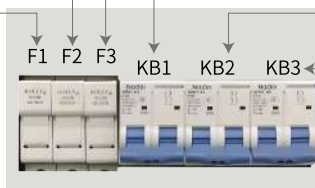
F2 F3: DC Electricity utilization insurance of auxiliary power

F1: Battery soft-start insurance

KB1: T2 Electricity utilization switch of fan

KB2: T3 Electricity utilization switch of AC contactor

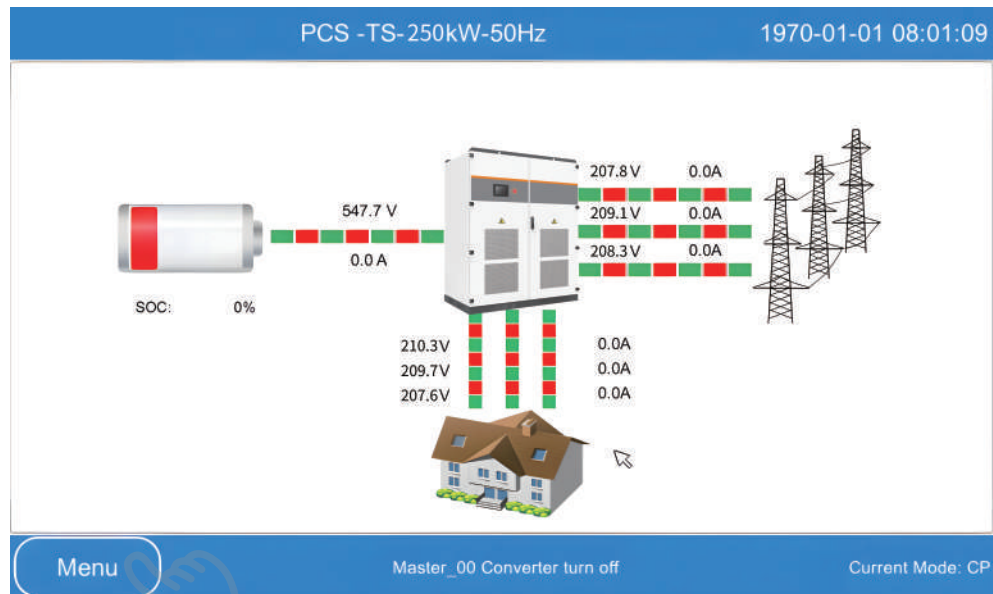
KB3: T4 AC Electricity utilization switch of auxiliary power



- (3) Take PCS0250TS as an example, check whether there is a red alarm signal in the upper right corner of the monitoring, and start the device without a red alarm signal.

Figure 7-3

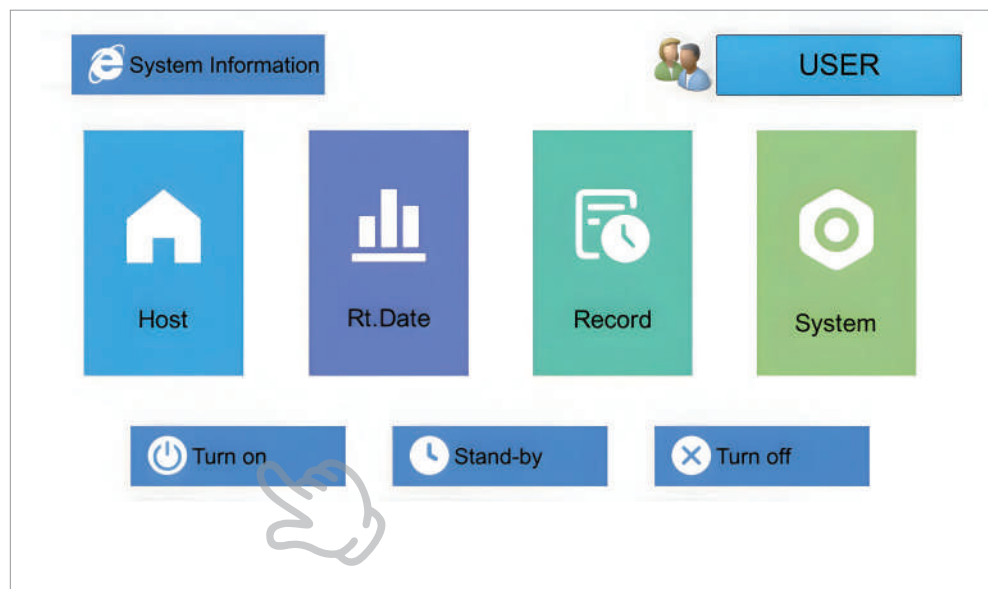
Homepage



- (4) Click the "Menu" → "Turn on" point in the lower left corner of the monitoring (as shown in Figure 7-4), click "Turn on" and you will hear the DC contact sucking sound, and then the converter will start soft, and you will hear the AC contact sucking sound after the soft starting is completed. At this time, the converter state displayed in the positive and lower corner of the main monitoring interface will change to "converter off-grid discharge" or "converter grid-connected charging" or "converter grid-connected discharge". At this time, the converter is switched on.

Figure 7-4

Power on/off interface



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 menu on the touch screen, click "Turn off".
 - Step 2: After the AC contactor is disconnected and the touch screen displays "converter" is closed, manually disconnect the DC side circuit breaker or load switch of the converter to make the switch in the "OFF" status.
 - Step 3: Disconnect the converter fan switch, disconnect the auxiliary power switch and disconnect the lightning protection switch.
 - Step 4: Disconnect the AC side breaker of the converter so that the switch is in the "OFF" status.
 - Step 5: Wait for the bus capacitor to discharge, the touch screen to go off, and the energy storage converter to shut down.
-



-
- 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.
-

Converter shutdown Detailed steps:

- The converter is shut down. Click "Menu" → "Turn off" in the lower left corner of the monitoring, and then you will hear the AC contactor disconnecting sound. At this time, the converter status displayed in the lower and positive corner of the main interface of the monitoring 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.
-

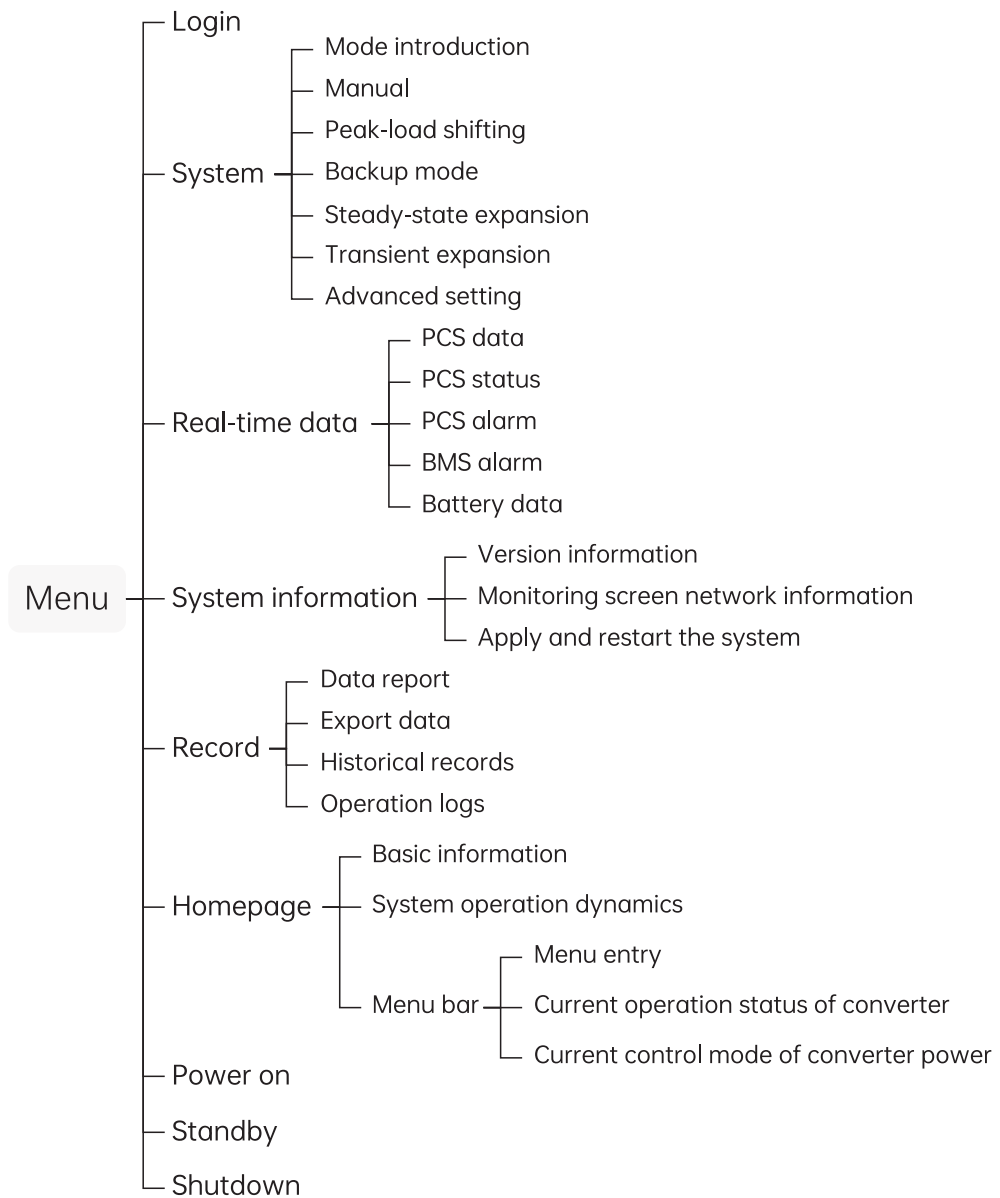
8 Touch screen operation guidance

8.1 Overview

- Based on the system menu, an overview of each interface is shown in figure 8-1.

Figure 8-1

System overview

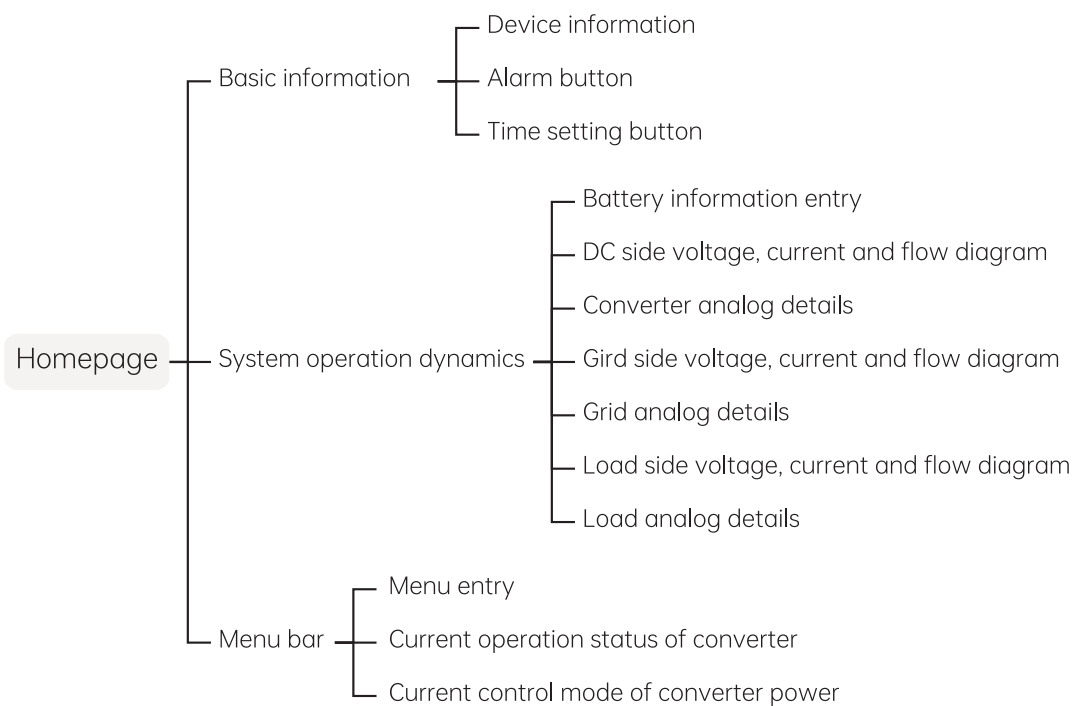


8.2 Homepage introduction

- The information contained on the homepage is shown in figure 8-2.

Figure 8-2

Homepage tree diagram



- The homepage is divided into three main parts: the basic information bar, the system operation dynamic graph, and the menu bar. For details, please refer to table 8-1.

Figure 8-3

Homepage

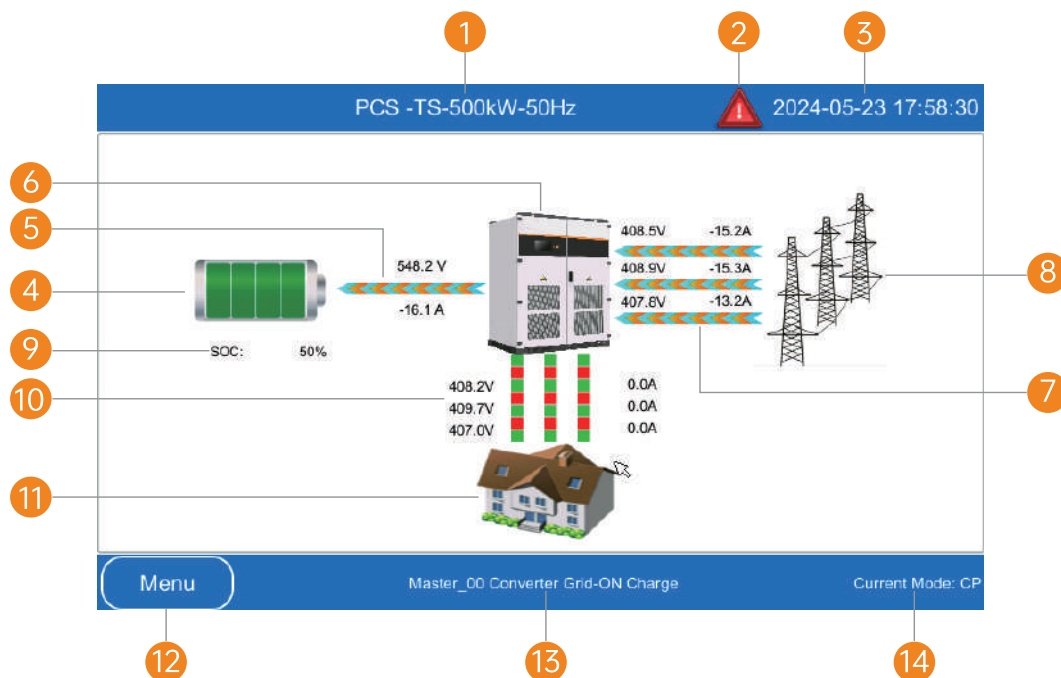


Table 8-1

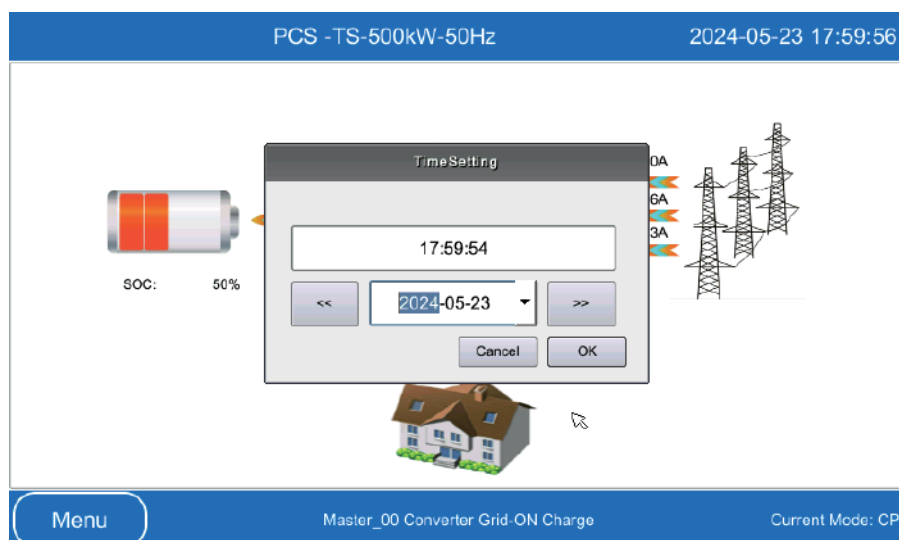
Detailed introduction of the homepage

Detailed introduction of the homepage

1. Current device information, including PCS model, rated capacity, and operating frequency.
2. Alarm icon, click to enter the PCS alarm page to view current alarm information.
3. Current system time, click to set the time, as shown in figure 8-4.
4. Battery icon, click to enter the battery data page to view battery information.
5. Current DC side voltage and DC side current, where negative current values indicate charging and positive values indicate discharging.
6. Converter icon, click to enter the PCS data page to view current PCS analog data.
7. Current grid side three-phase voltage and grid side three-phase current, where negative current values indicate buying electricity from the grid, and positive values indicate selling electricity to the grid.
8. Grid icon, click to enter the PCS data page to view current grid analog data.
9. Remaining battery capacity (SOC).
10. Current load side three-phase voltage and load side three-phase current.
11. Load icon, click to enter the PCS data page to view current load analog data.
12. Menu button, click to enter the menu.
13. Current converter status information.
14. Current converter power control mode information.

Figure 8-4

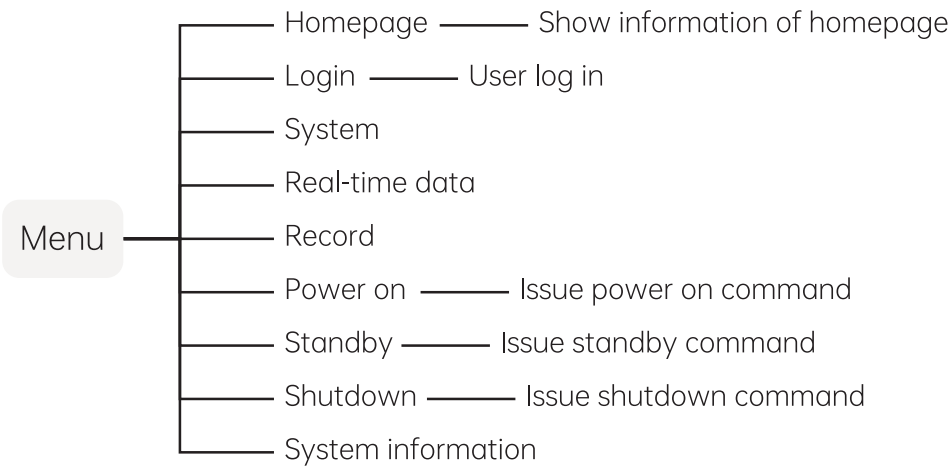
Time setting



8.3 Menu

- The menu page includes buttons for system information, login portal, homepage, real-time data, records, system settings, start, standby, and shutdown functions. An overview of the menu interface is shown in figure 8-5.

Figure 8-5 Overview of the menu interface



- The menu page is as shown in figure 8-6. For details, please refer to table 8-2.

Figure 8-6 Menu

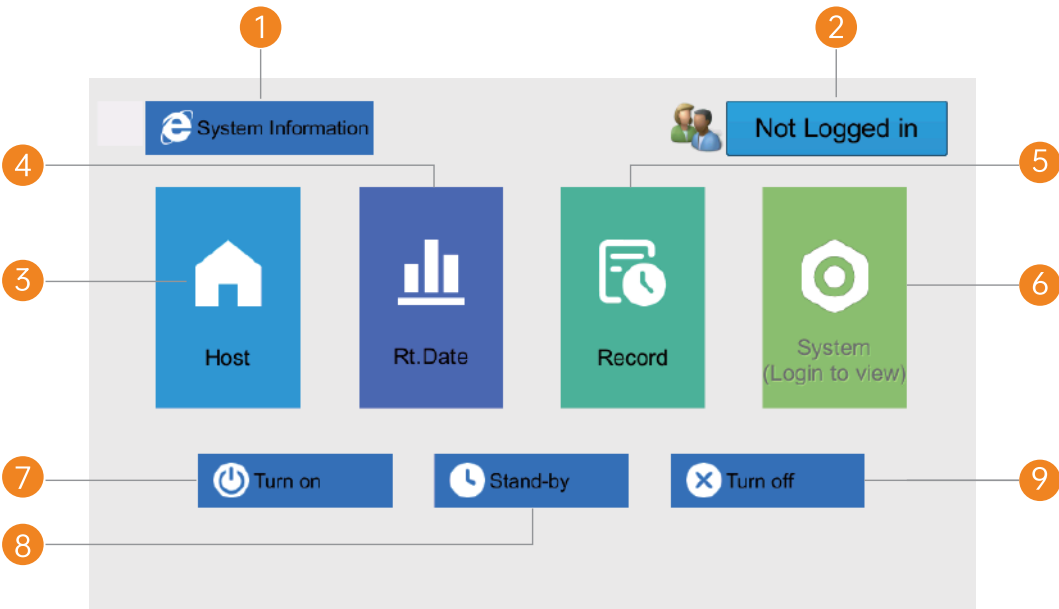


Table 8-2 Menu

Menu
1. System information.
2. Login portal.
3. Display homepage.
4. Real-time data access.
5. Records access.
6. System settings access (login required for viewing and modification).
7. Turn on.
8. Stand-by.
9. Turn off.

8.3.1 Login

- Click the login button to enter the login interface, as shown in figure 8-7. For details, please refer to table 8-3.

Figure 8-7 Login interface

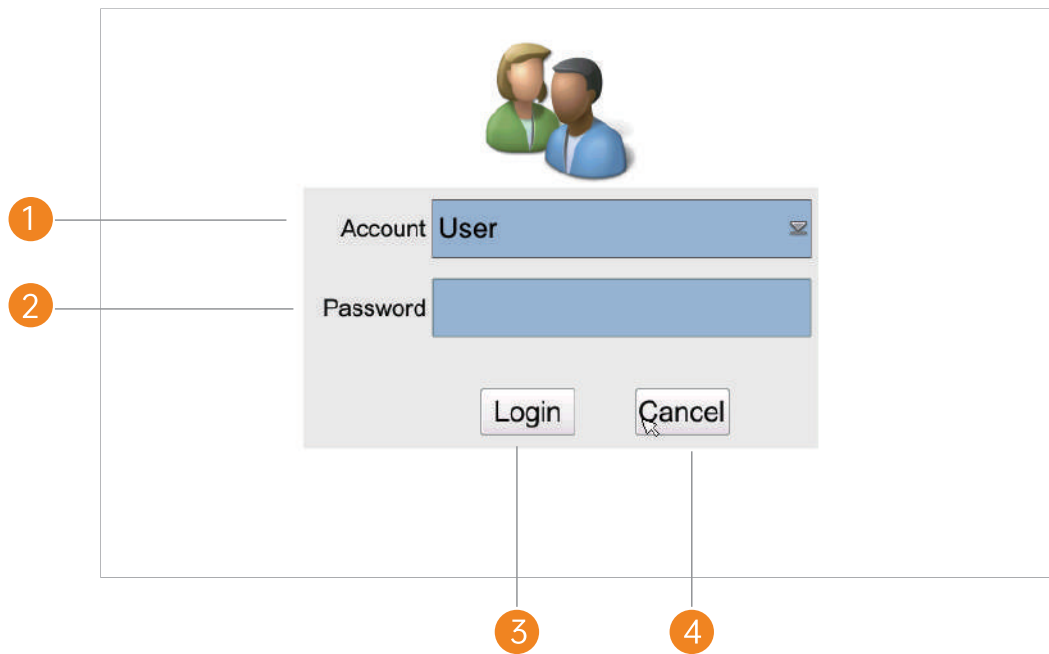


Table 8-3 Login

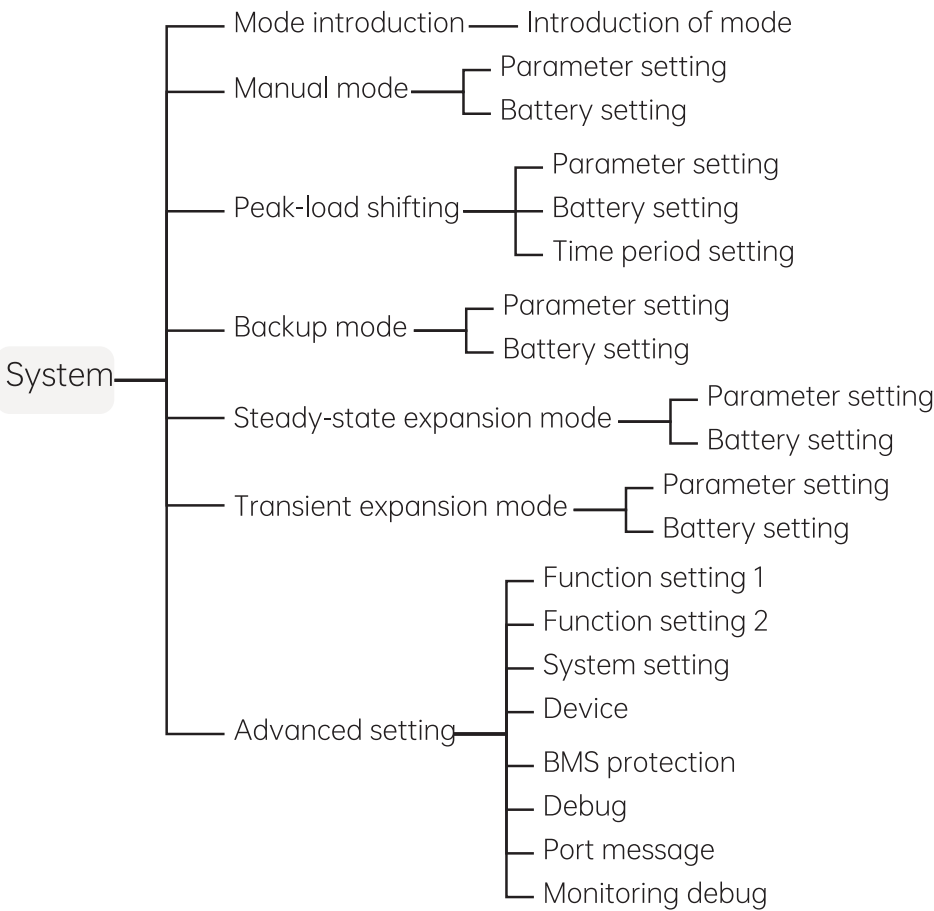
Login

- 1. Login, select user.
- 2. Password, initial password is "123456".
- 3. Login, log into the account and exit the login interface.
- 4. Cancel, cancel login and exit the login interface.

8.3.2 System

- Clicking the system button will skip the interface to the system page, the overview of system is shown in figure 8-8.

Figure 8-8 Overview of system



- Shifting, backup power, transient expansion and steady-state expansion, as shown in figure 8-9. For details, please refer to table 8-4.

Figure 8-9 System

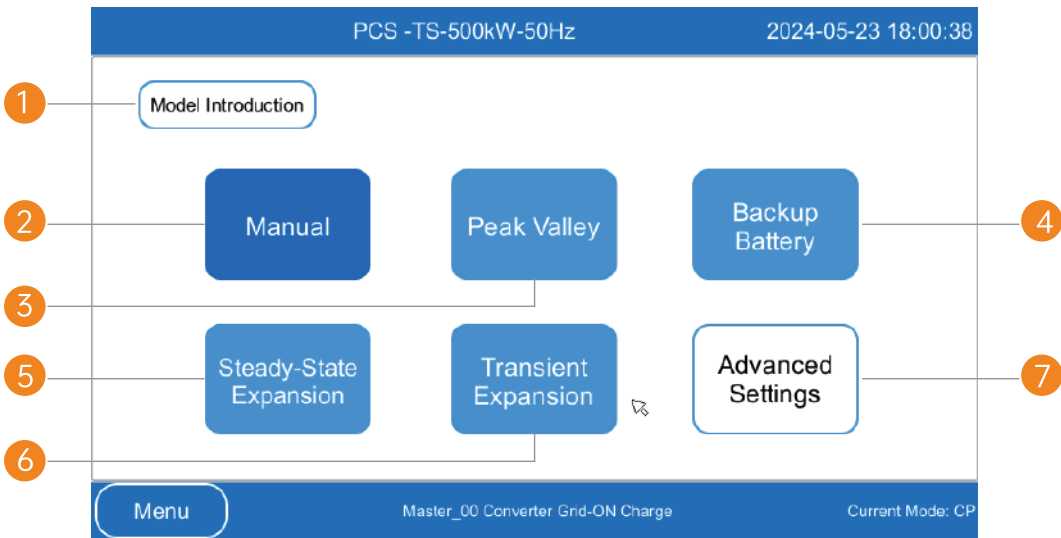


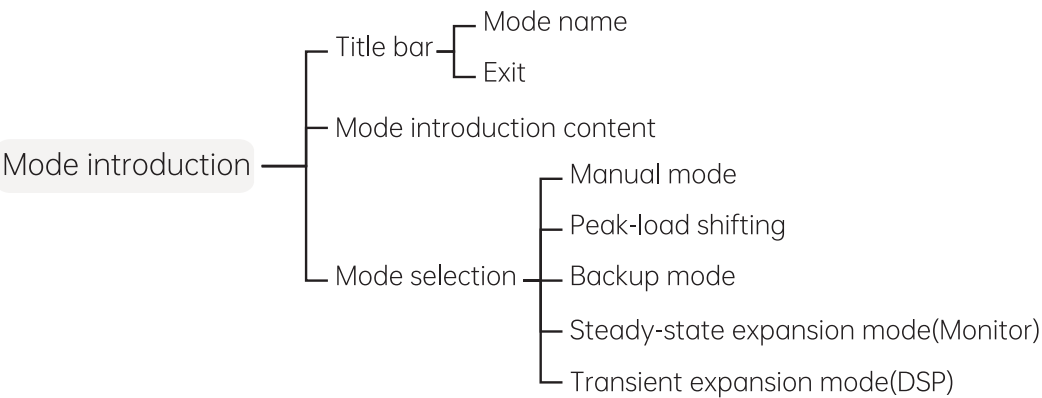
Table 8-4 System

System
1. Mode Introduction entry.
2. Manual mode.
3. Peak-load shifting.
4. Backup power mode.
5. Steady-state expansion mode.
6. Transient expansion mode.
7. Advanced settings entry.

8.3.2.1 Mode introduction

- Clicking the mode introduction button will skip the interface to the mode introduction page, an overview of which is shown in figure 8-10.

Figure 8-10 Overview of mode introduction



- The mode introduction consists of three parts: the title bar, mode introduction content, and mode selection, as described in figure 8-11. For details, please refer to table 8-5

Figure 8-11 Introduction of manual

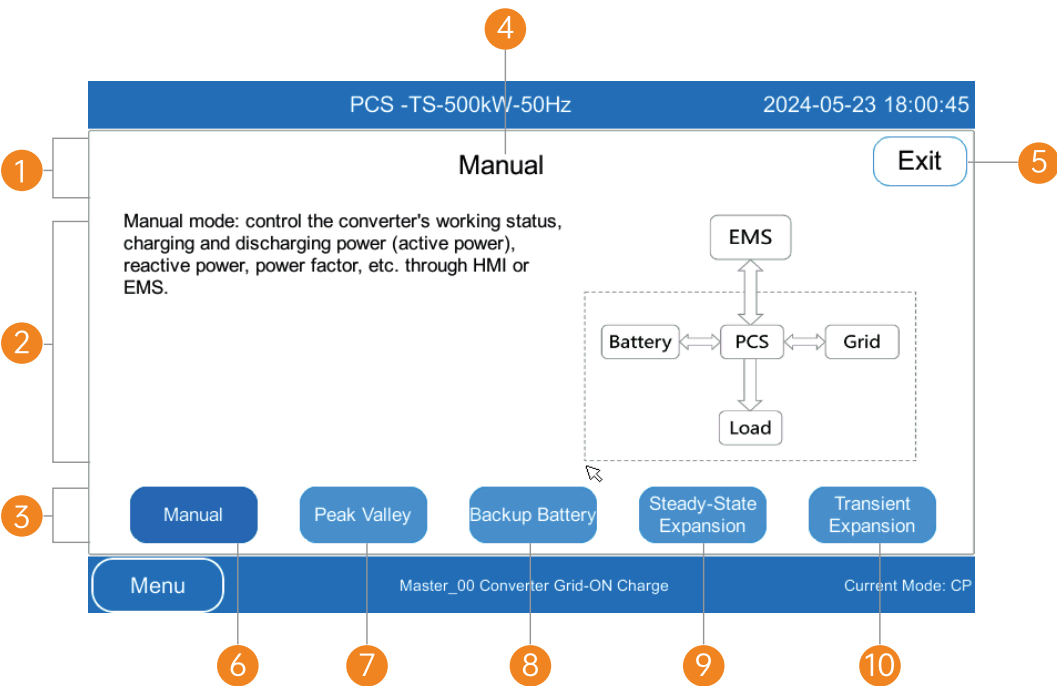


Table 8-5 Mode introduction

Mode introduction
1. Title bar.
2. Mode introduction content.
3. Mode selection.

4. Mode name.
5. Exit mode introduction.
6. Enter the mode introduction for manual mode, as shown in figure 8-11.
7. Enter the mode introduction for peak-load shifting mode, as shown in figure 8-12.
8. Enter the mode introduction for backup power mode, as shown in figure 8-13.
9. Enter the mode introduction for steady-state expansion mode, as shown in figure 8-14.
10. Enter the mode introduction for transient expansion mode, as shown in figure 8-15.

Figure 8-12 Peak-load shifting introduction

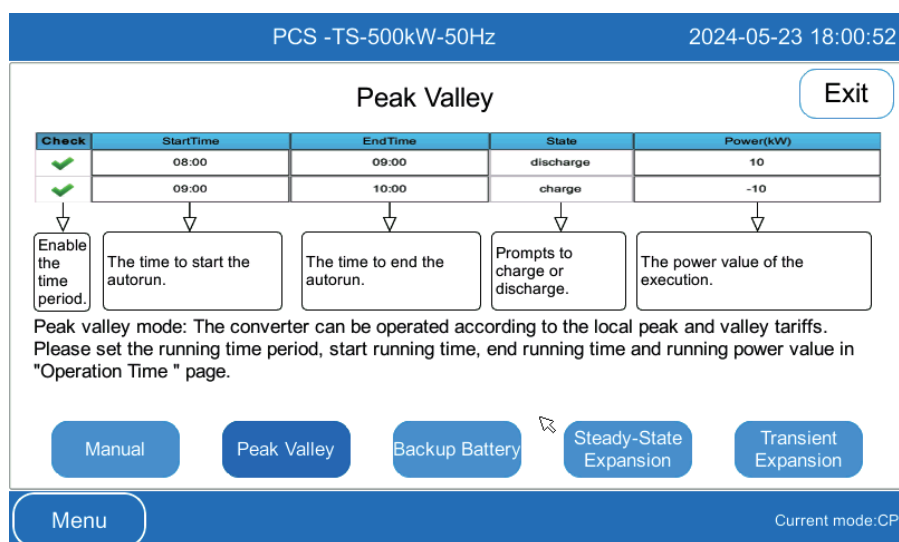


Figure 8-13 Introduction of backup mode

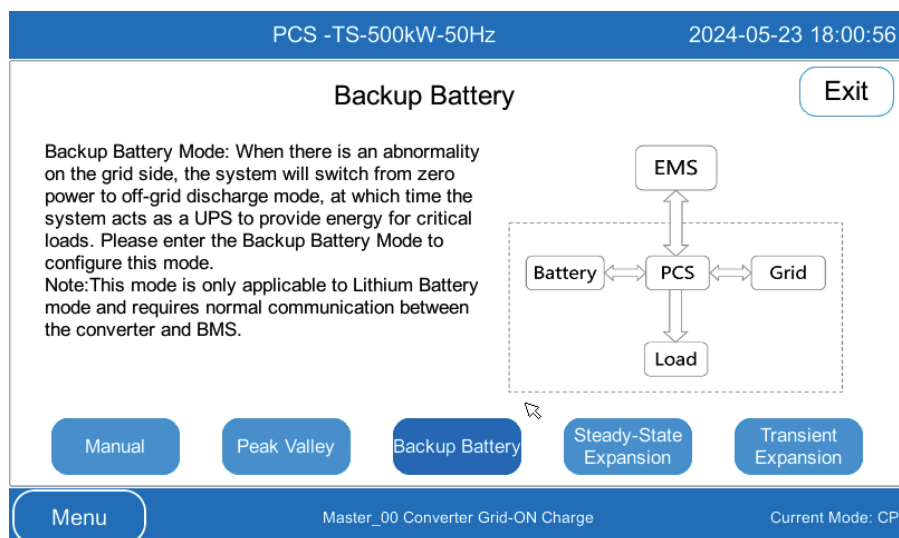


Figure 8-14 Introduction of steady-state expansion mode

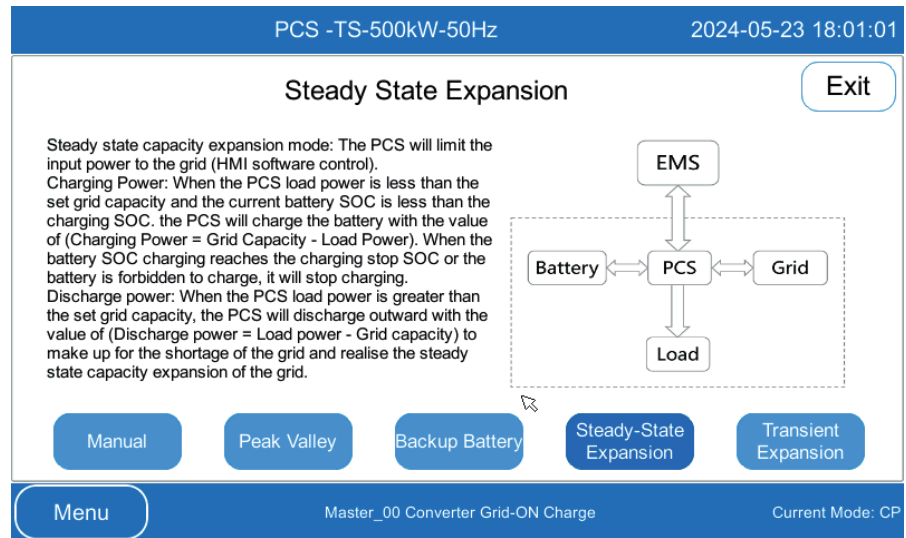
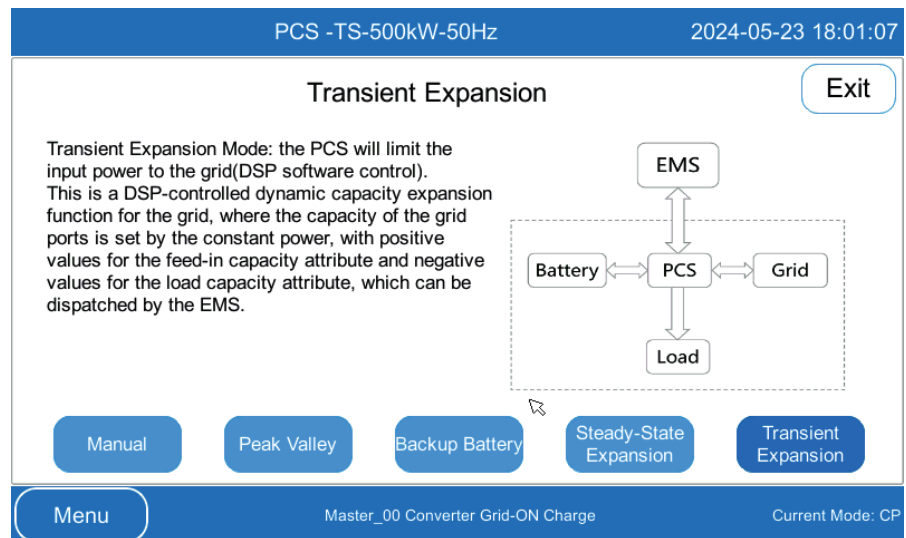


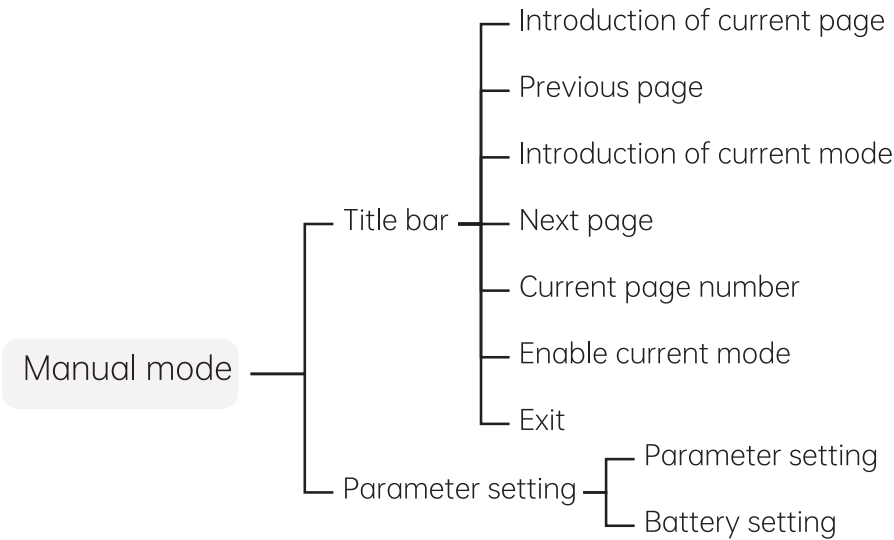
Figure 8-15 Introduction of transient expansion mode



8.3.2.2 Manual mode

- Clicking the manual button will skip to the manual mode parameter setting interface, with the overview of the manual mode as shown in figure 8-16.

Figure 8-16 Overview of manual mode



- The manual mode is divided into two main parts: the title bar and related parameter settings, as shown in figure 8-17. For details, please refer to table 8-6.

Figure 8-17 Manual

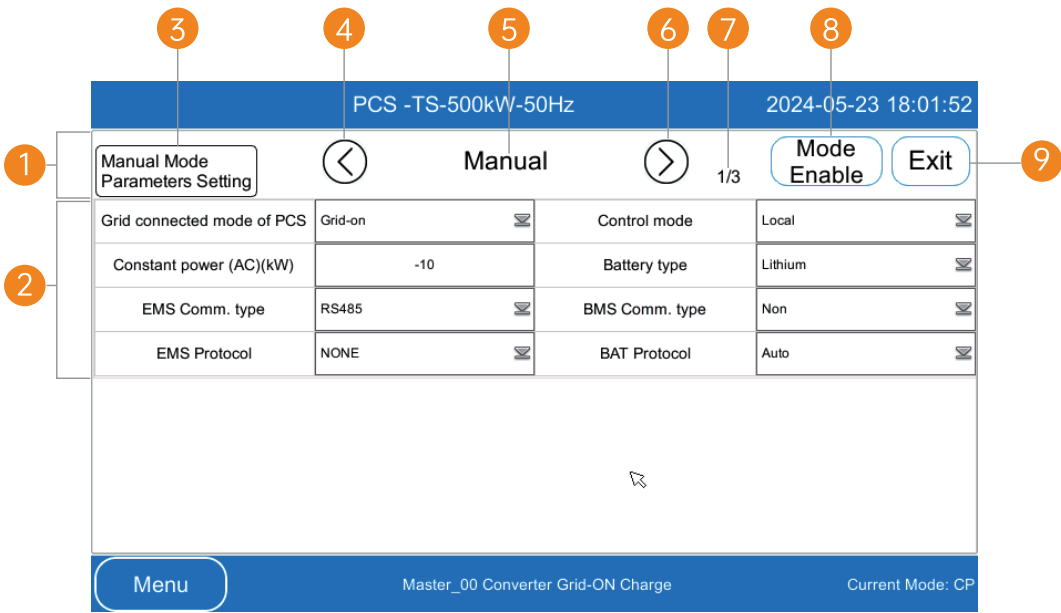


Table 8-6 Manual

Manual

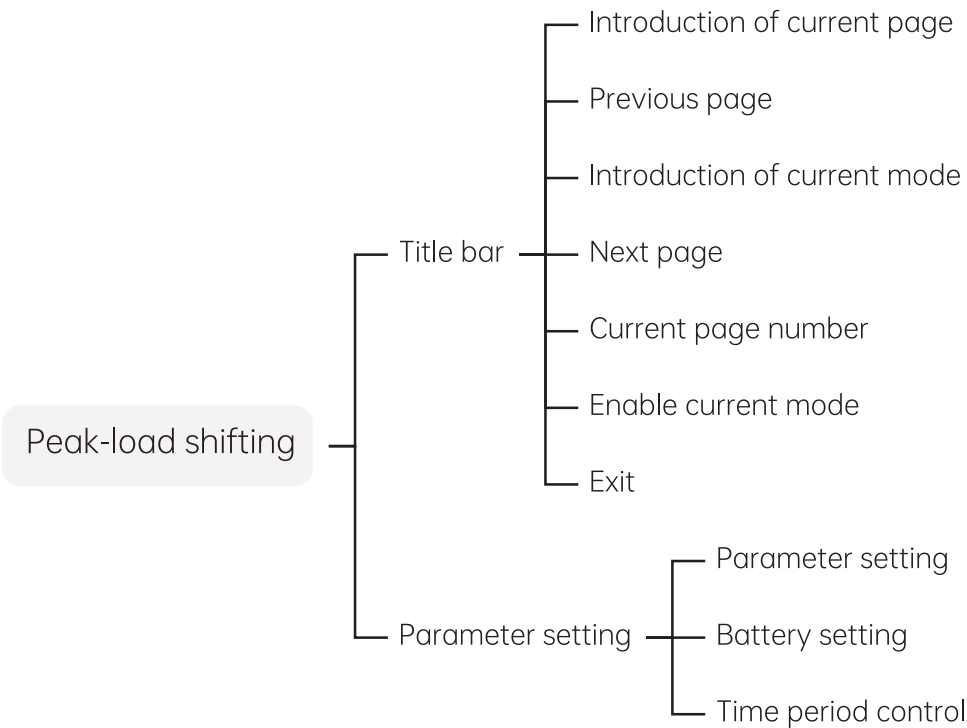
1. Title bar.

- 2. Manual mode related parameter settings, which can be navigated by using “4” or “6” to switch pages and view other settings.
- 3. Subtitle of the current page.
- 4. Previous page.
- 5. Current mode.
- 6. Next page.
- 7. Ratio of the current page to the total number of pages.
- 8. Apply the current mode.
- 9. Exit the current page.

8.3.2.3 Peak-load shifting mode

- Clicking the peak-load shifting button will skip to the parameter settings interface for the peak-load shifting mode. The overview of this mode is shown in figure 8-18.

Figure 8-18 Overview of peak-load shifting mode



- The peak-load shifting mode is divided into two main parts: the title bar and parameter settings, as shown in figure 8-19. For details, please refer to table 8-7.

Figure 8-19 Peak-load shifting mode

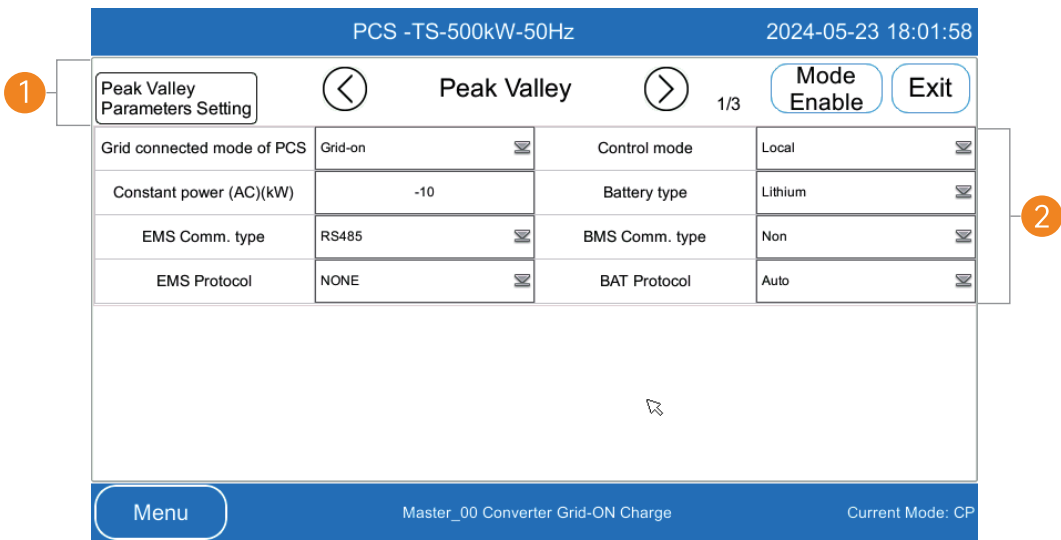


Table 8-7 Peak-load shifting mode

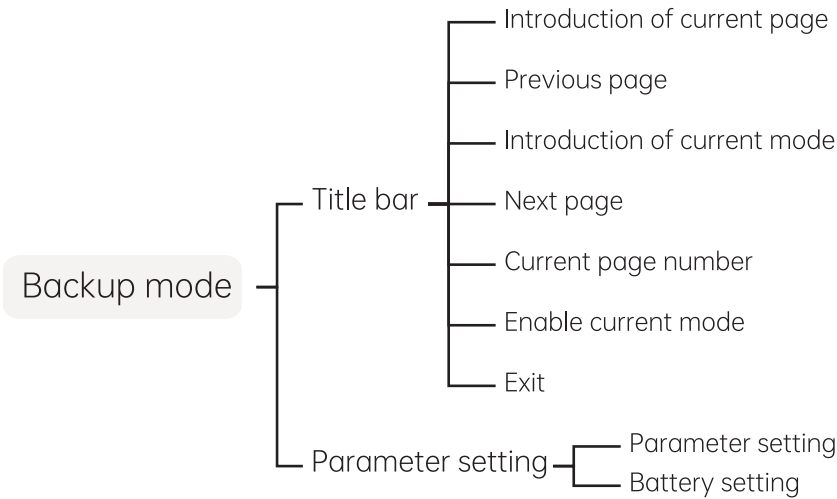
Peak-load shifting mode

1. Title bar, for more details please refer to table 8-6.
2. Parameter settings related to the peak-load shifting mode.

8.3.2.4 Backup battery mode

- Click the backup battery button. The backup battery mode parameter setting screen is displayed, as shown in figure 8-20.

Figure 8-20 Overview of backup mode



- The backup battery mode consists of two parts: title bar and parameter settings, as shown in figure 8-21. For details, see table 8-8.

Figure 8-21 Backup battery mode

1

PCS -TS-500kW-50Hz				2024-05-23 18:02:12	
Backup Battery Parameters Setting		⏪	Backup Battery	⏩	1/3
				Mode Enable	Exit
Grid connected mode of PCS	Grid-on		Control mode	Local	
Constant power (AC)(kW)	-10		Battery type	Lithium	
EMS Comm. type	RS485		BMS Comm. type	Non	
EMS Protocol	NONE		BAT Protocol	Auto	
Turn on SOC(%)	80		Turn on total vol.(V)	400	
Turn off SOC(%)	95		Turn off total vol.(V)	650	
Turn on cell vol.(mV)	3100		UPS charge power(kW)	-10	
Turn off cell vol.(mV)	3500		Monthly cycle time	0	
Menu		Master_00 Converter Grid-ON Charge		Current Mode: CP	

2

Table 8-8 Backup battery mode

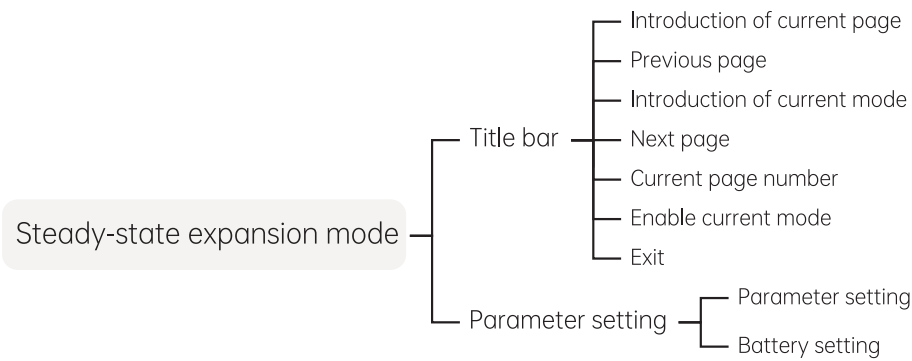
Backup battery mode

1. Title bar, for more details please refer to table 8-6.
2. Parameter settings related to the backup mode.

8.3.2.5 Steady-state expansion mode

- Click the steady-state expansion button. The screen for setting parameters for the steady-state expansion mode is displayed. Figure 8-22 shows the overview of the steady-state expansion mode.

Figure 8-22 Overview of steady-state expansion mode



- The steady-state expansion mode is divided into two main parts: the title bar and parameter settings, as shown in figure 8-23. For details, please refer to table 8-9.

Figure 8-23 Steady-state expansion mode

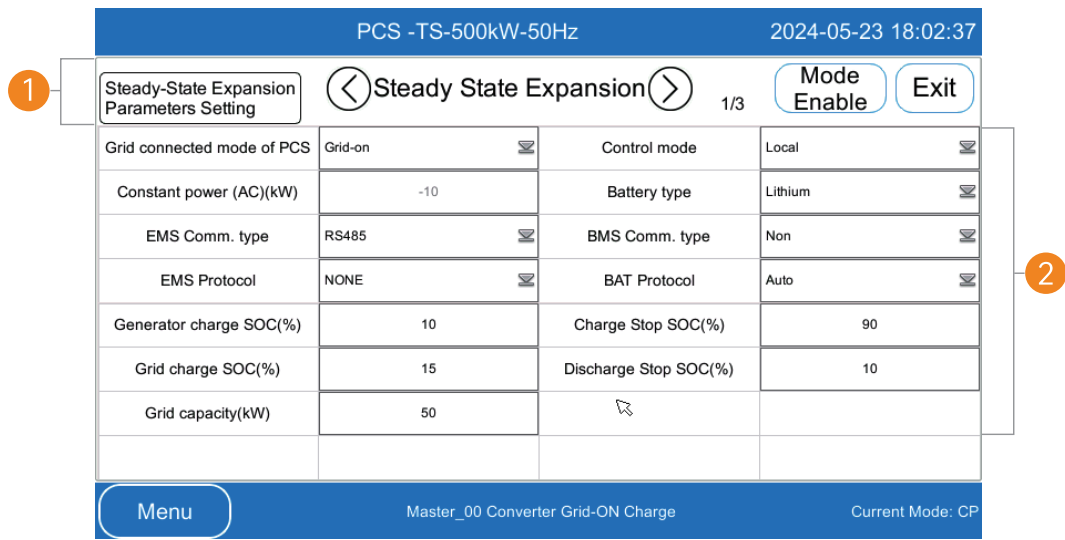


Table 8-9 Steady-state expansion mode

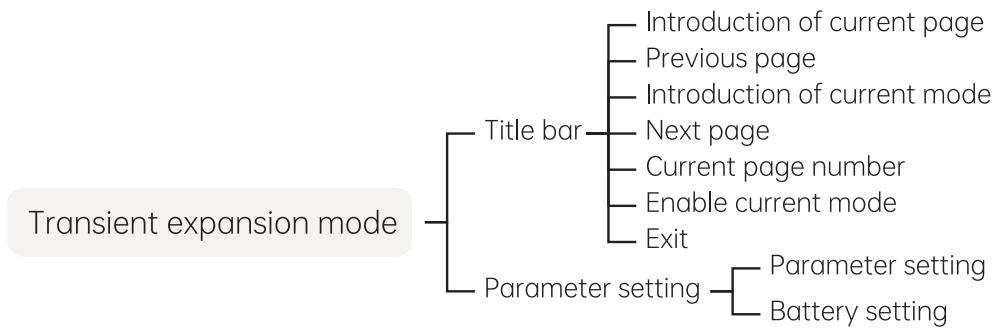
Steady-state expansion mode

1. Title bar, for more details please refer to table 8-6.
2. Parameter setting related to steady-state expansion mode.

8.3.2.6 Transient expansion mode

- Clicking the transient expansion button will redirect the interface to the transient expansion mode parameter settings interface. The overview of the transient expansion mode is shown in figure 8-24.

Figure 8-24 Overview of transient expansion mode



- The transient expansion mode is divided into two main parts: the title bar and parameter settings, as shown in figure 8-25. For details, please refer to table 8-10.

Figure 8-25 Transient expansion mode

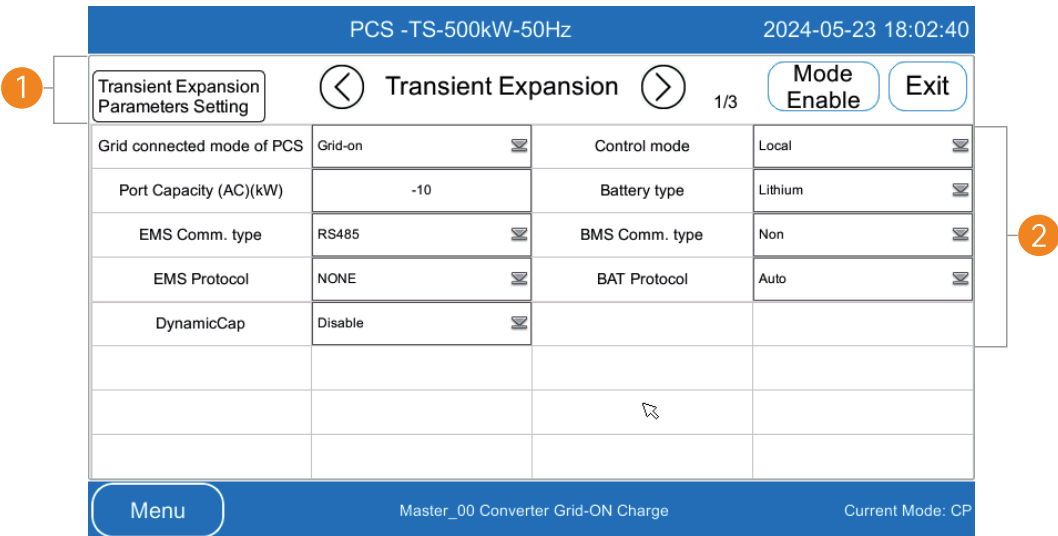


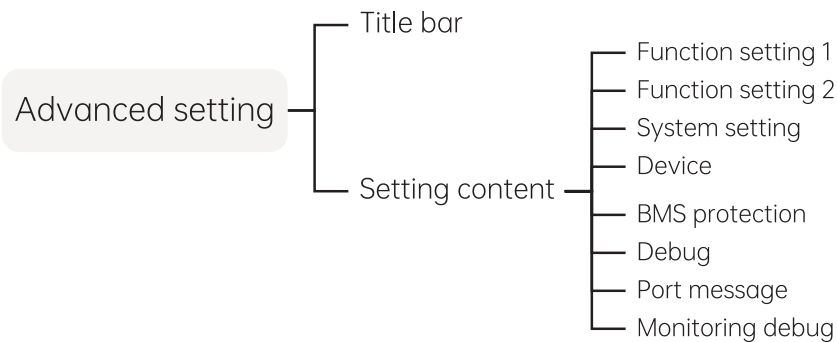
Table 8-10 Transient expansion mode

Transient expansion mode
1. Title bar, for more details please refer to table 8-6.
2. Parameter settings related to the backup mode.

8.3.2.7 Advanced setting

- Clicking the advanced setting button will skip the to the advanced setting interface. The overview of the advanced setting page is shown in figure 8-26.

Figure 8-26 Overview of advanced setting

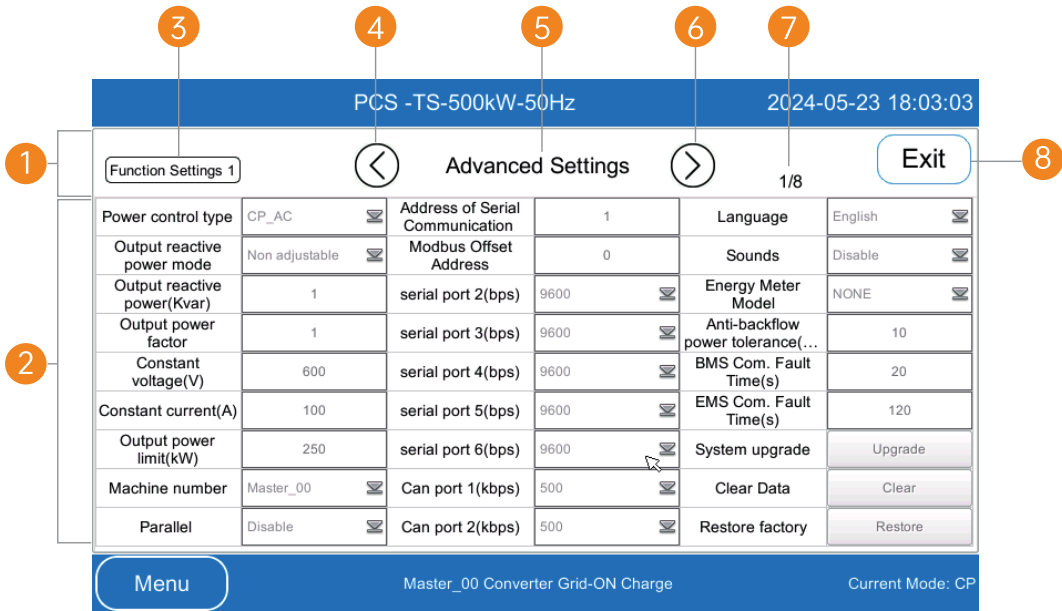


- The advanced setting consists of two parts: the title bar and the setting content. For details, please refer to table 8-11.

Table 8-11 Advanced setting

Advanced setting	
1. Title bar.	
2. Settings content.	
3. Subtitle of the current page.	
4. Previous page.	
5. Main title of the current page.	
6. Next page.	
7. Ratio of the current page number to the total number of pages.	
8. Exit advanced settings.	

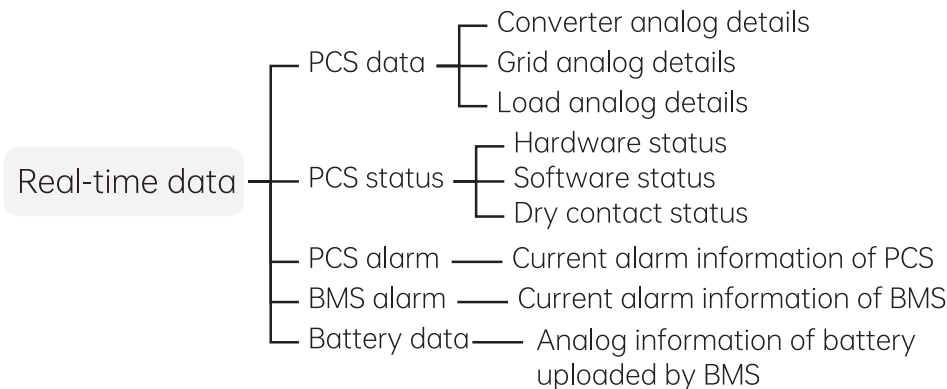
Figure 8-27 Advanced setting



8.3.3 Real-time data

- The overview of real-time data is shown in figure 8-28.

Figure 8-28 Content of real-data data



- Clicking the real-time data button will skip the to the real-time data interface, which includes five sections: PCS data, PCS status, PCS alarms, BMS alarms, and battery data, as shown in figure 8-29. For details, please refer to table 8-12.

Figure 8-29 Real-time data

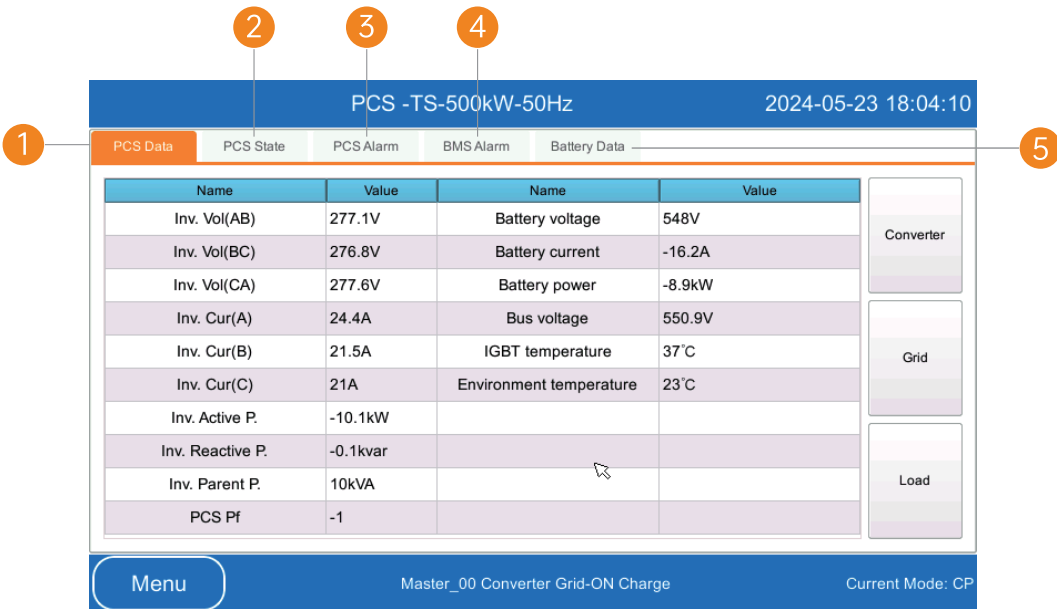


Table 8-12 Real-time

Real-time data	
1.	View real-time data.
2.	View PCS status.
3.	View PCS alarms.
4.	View BMS alarms.
5.	View battery data.

8.3.3.1 PCS data

- PCS data includes analog data of the inverter, power grid, and load. By clicking the three buttons on the right side of the interface, detailed data of each functional unit of the PCS will be displayed. Clicking the inverter button will show the data of the inverter as shown in figure 8-30. For more details, please refer to table 8-13.

Figure 8-30 PCS data

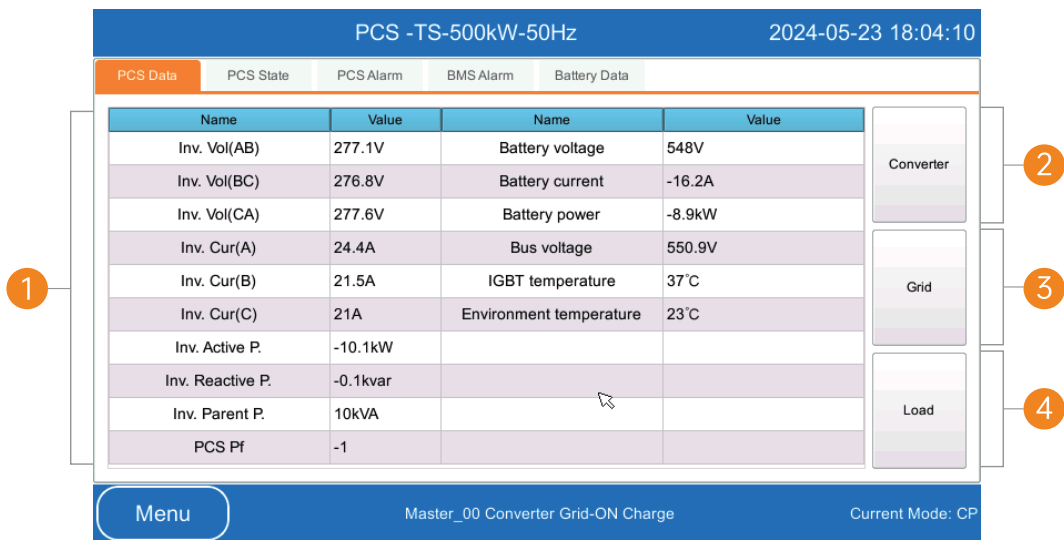


Table 8-13 PCS data

PCS data

1. Inverter analog data, as shown in figure 8-30.
2. View inverter analog data, as shown in figure 8-30.
3. View power grid analog data, as shown in figure 8-31.
4. View load analog data, as shown in figure 8-32.

Figure 8-31 Grid data

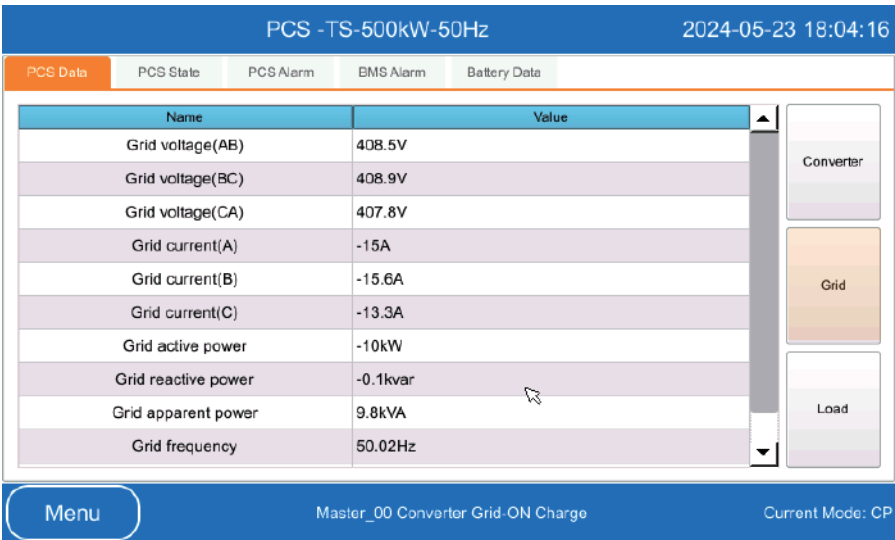
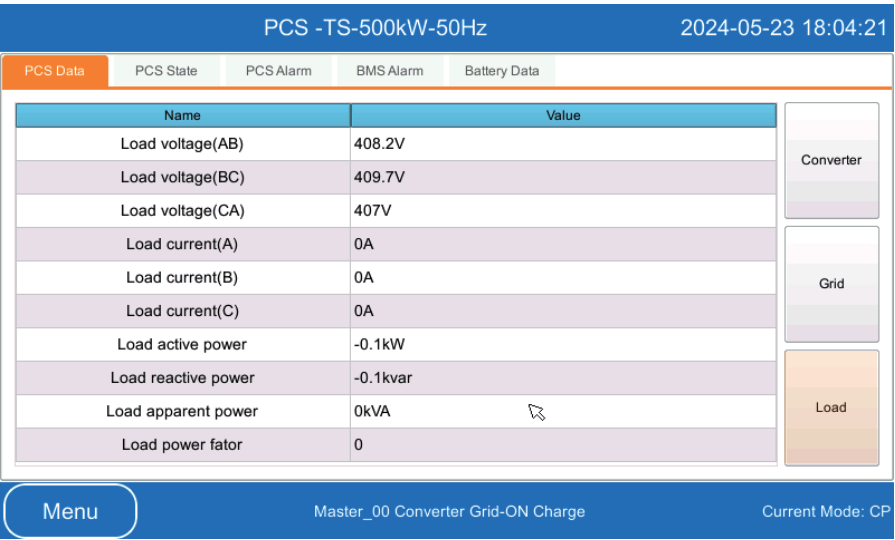


Figure 8-32 Load data



8.3.3.2 PCS status

- This interface primarily displays the real-time operating status of various PCS components such as circuit breakers, contactors, and inverters, allowing users to easily understand the operating condition of the PCS, as illustrated in figure 8-33. For more details, please refer to table 8-14.

Figure 8-33 PCS status

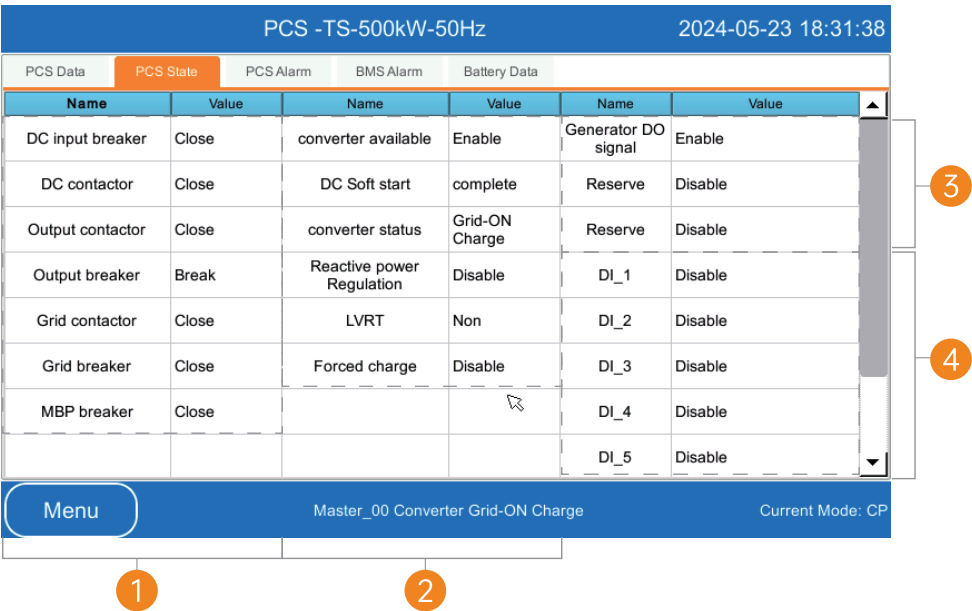


Table 8-14 PCS status

PCS status
1. Hardware circuit breaker, contactor status.
2. Software status.
3. Output dry contact status.
4. Input dry contact status.

8.3.3.3 PCS alarm

- The PCS alarm interface displays the current alarms of the PCS. The BMS alarm interface is shown in figure 8-34. For more details, please refer to table 8-15.

Figure 8-34 PCS alarm

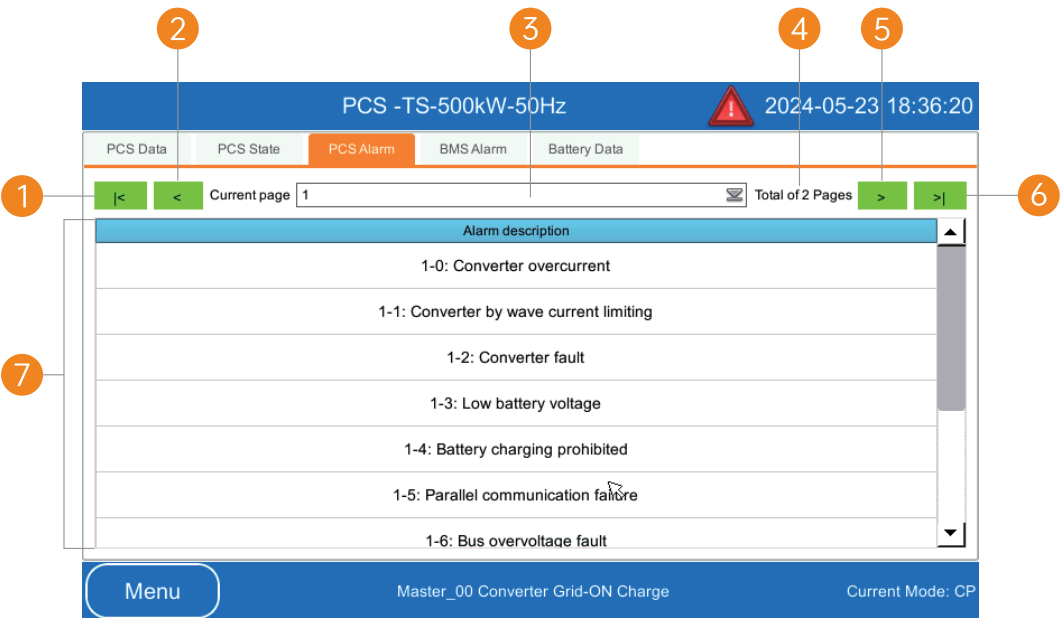


Table 8-15 PCS alarm

PCS alarm
1. Home.
2. Previous page.
3. Current page number, click to select the page number.
4. Total pages.
5. Next page.
6. Last page.
7. PCS alarm description.

8.3.3.4 BMS alarm

- The BMS alarm page displays the alarms uploaded by the BMS. The BMS alarm interface is shown in figure 8-35. For more details, please refer to table 8-16.

Figure 8-34 BMS alarm

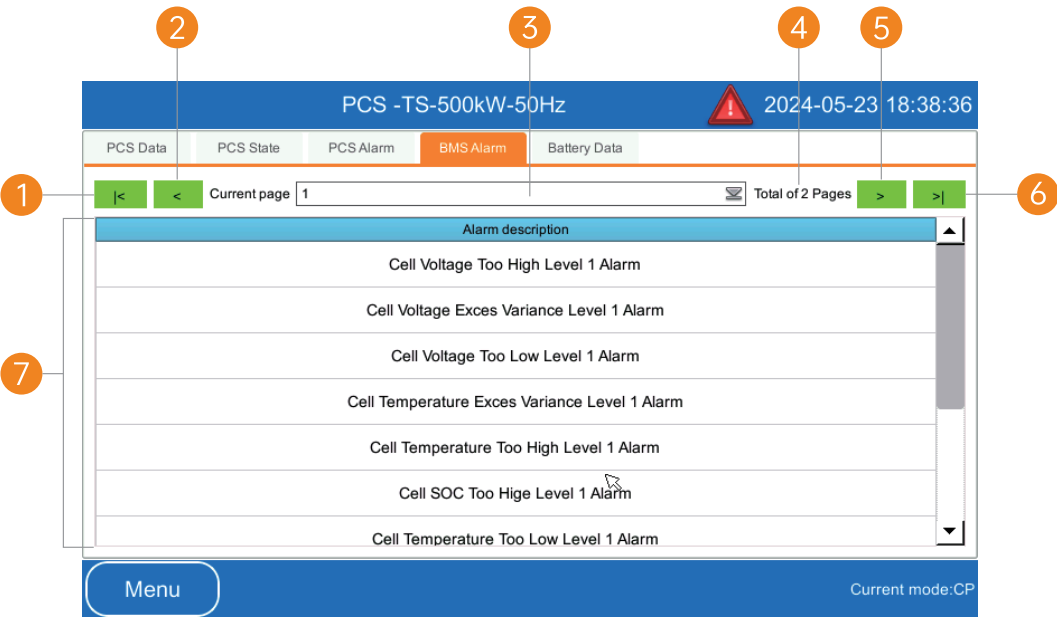


Table 8-16 BMS alarm

BMS alarm
1. Home.
2. Previous page.
3. Current page number, click to select the page number.
4. Total pages.
5. Next page.
6. Last page.
7. BMS alarm description.

8.3.3.5 Battery data(Lithium battery)

- This interface indicates that Battery Management System (BMS) communicates with Power Conversion System (PCS) through CAN, Ethernet, or RS485 communication. Also, it is supported that EMS communicates with PCS through CAN, Ethernet, or RS485 communication. The data for the lithium battery is presented in Figure 8-36, with further details provided in Table 8-17.

Figure 8-36 Lithium battery data

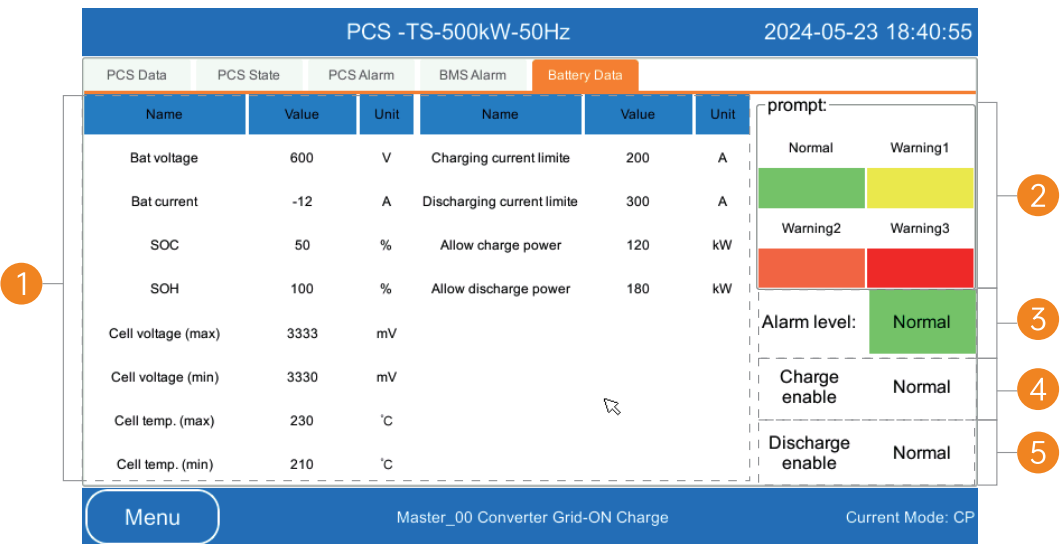


Table 8-17 BMS data

BMS data

1. Battery information uploaded by BMS.
2. Alarm level indicator.
3. Current alarm level: The current status of the battery system; in case of an alarm, level 1 (yellow), level 2 (orange), level 3 (red) alarms are indicated, whereas green signifies normal conditions.
4. Charging enable status: Enabled (current battery is permitted to charge), Disabled (current battery is prohibited from charging).
5. Discharging enable status: Enabled (current battery is permitted to discharge), Disabled (current battery is prohibited from discharging).

8.3.3.6 Battery data(lead-acid battery)

- This interface displays the data for lead-acid batteries, as shown in figure 8-37.

Figure 8-37 Lead-acid battery data

PCS -TS-500kW-50Hz2024-05-23 18:41:17

PCS Data	PCS State	PCS Alarm	BMS Alarm	Battery Data
Name	Value	Name	Value	
Float voltage	572V	Battery status	Charging	
Uniform charge voltage	592.2V	Battery power	-8.9kW	
Electric current	-16.2A	SOC	100%	
Voltage	548V			
Grid ON EOD	441V			
Grid OFF EOD	410.7V			
Charging current limit	0.25C			
Discharging current limit	0.5C			

Menu

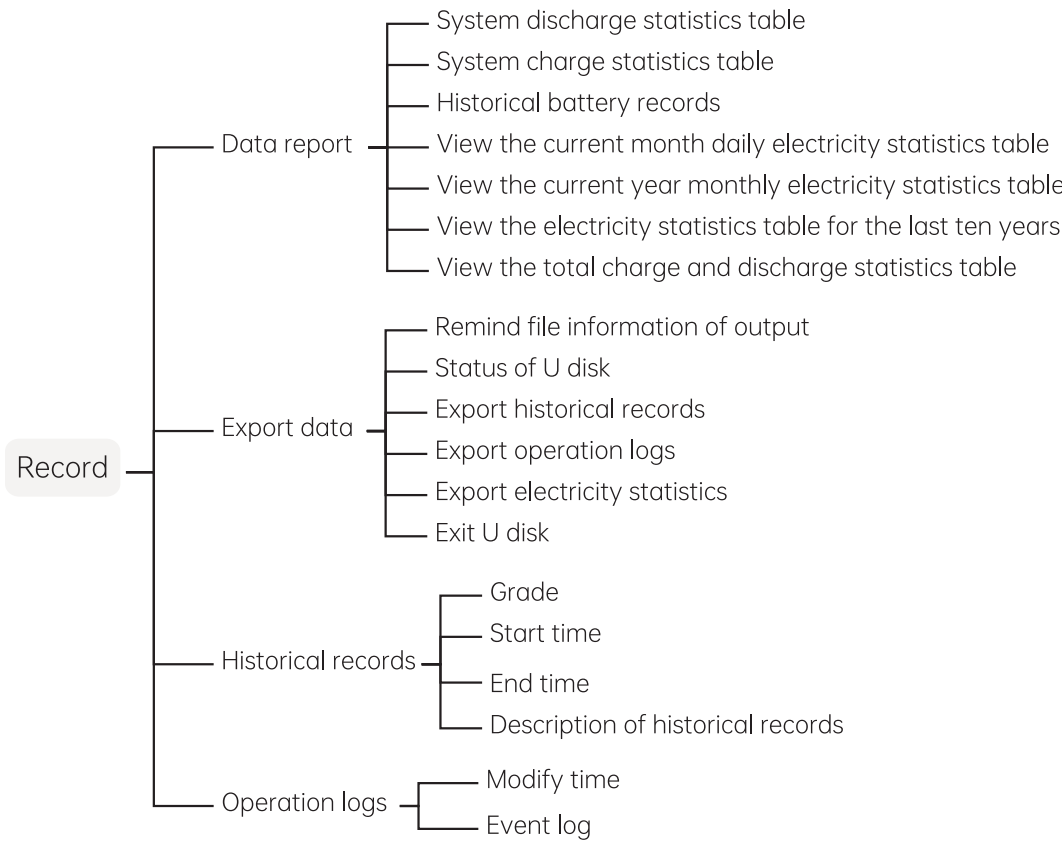
Master_00 Converter Grid-ON Charge

Current Mode: CP

8.3.4 Record

- Click the record button, and the overview of the record page is as shown in figure 8-38.

Figure 8-38 Overview of record page



- The record consists of four parts: data reports, export data, historical records, and operation logs. The recording interface is shown in figure 8-39. For more details, please refer to table 8-18.

Figure 8-39 Record page

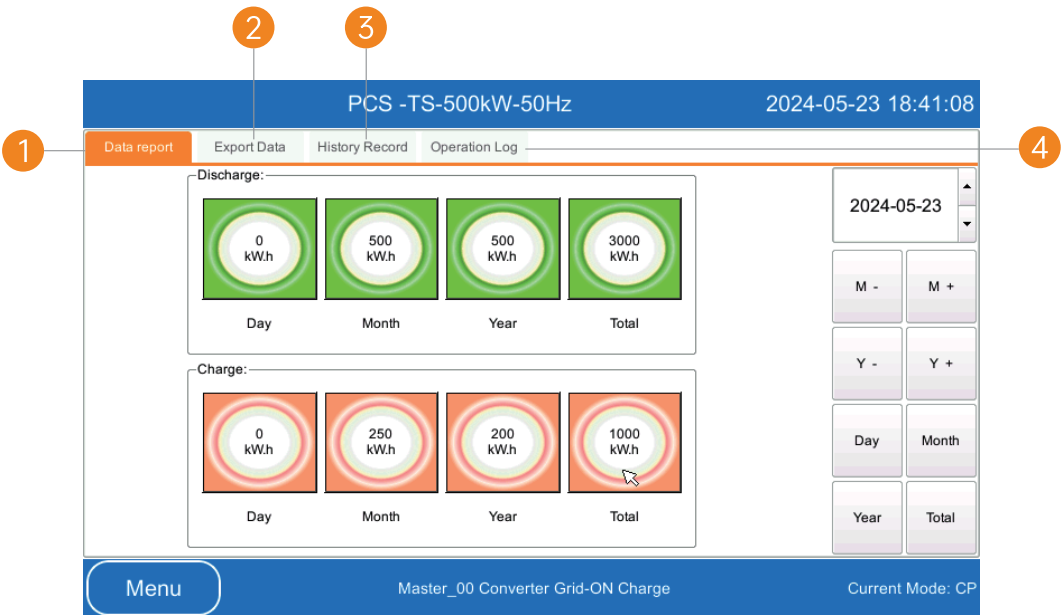


Table 8-18 Record

Record
1. View data reports.
2. View exported data.
3. View historical records.
4. View operation logs.

8.3.4.1 Data report

- The data report records daily, monthly, yearly, and total electricity consumption for charging and discharging. There are eight buttons on the right side of the interface, which users can click to view historical electricity data or statistical tables. The data report interface is shown in figure 8-40. For more details, please refer to table 8-19.

Figure 8-40 Data report

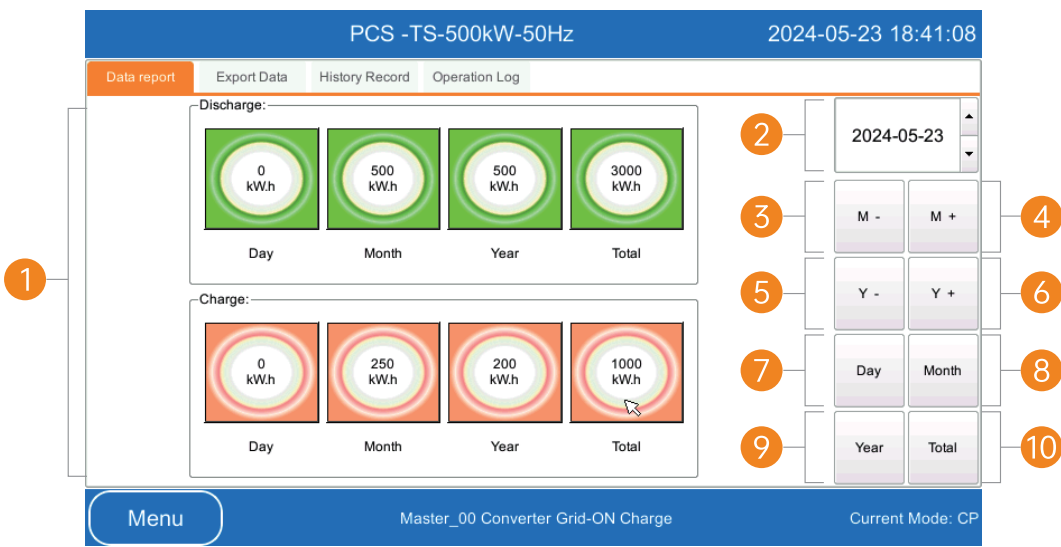


Table 8-19 Data report

Data report
1. System discharge volume statistics table and system charge volume statistics table.
2. Select year, month, or day with the cursor; you can switch to view the electricity volume using the up and down buttons on the left.
3. Switch to view the electricity volume for the previous month.
4. Switch to view the electricity volume for the next month.
5. Switch to view the electricity volume for the previous year.
6. Switch to view the electricity volume for the next year.
7. View the daily electricity statistics for the current month, as shown in figure 8-41.
8. View the monthly electricity statistics for the current year, as shown in figure 8-42.
9. View the yearly electricity statistics for the past ten years, as shown in figure 8-43.
10. View the overall system discharge and charge volumes, as shown in figure 8-40.

Figure 8-41 Daily electricity consumption statistics

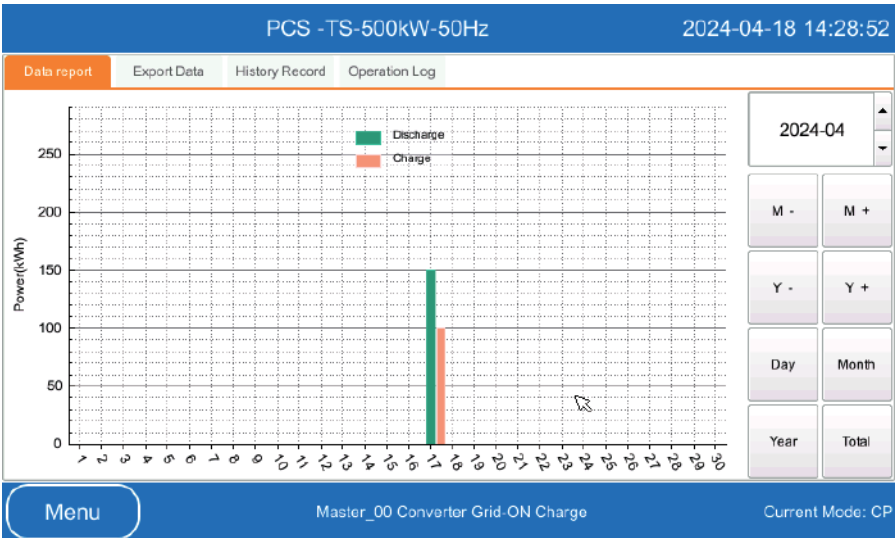


Figure 8-42 Daily electricity consumption statistics

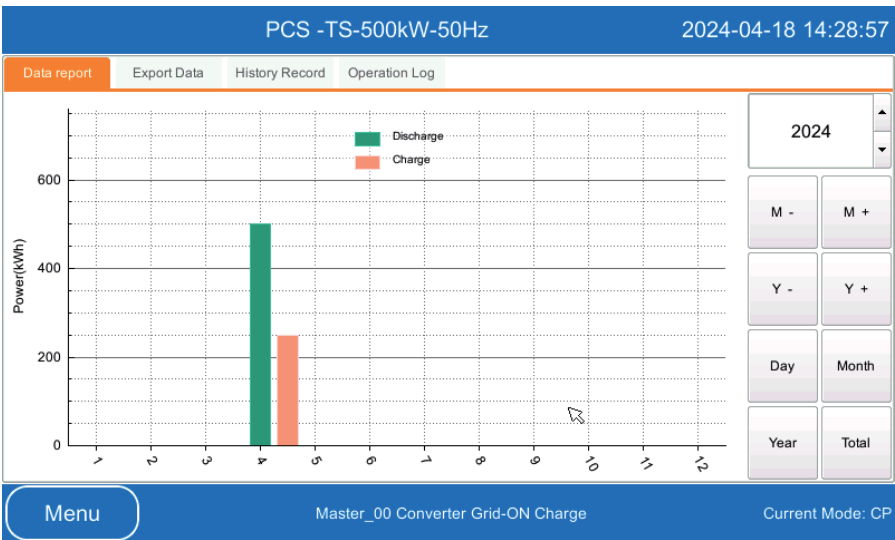
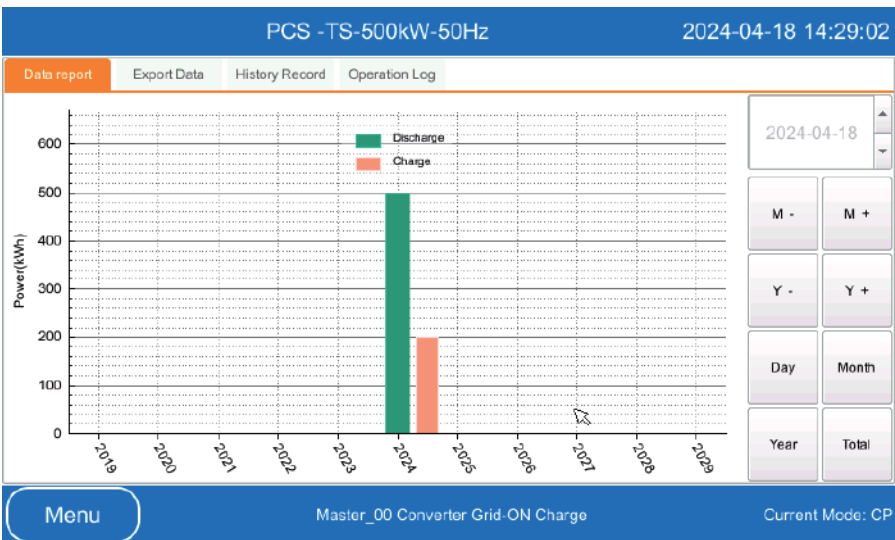


Figure 8-43 Monthly electricity consumption statistics



8.3.4.2 Export data

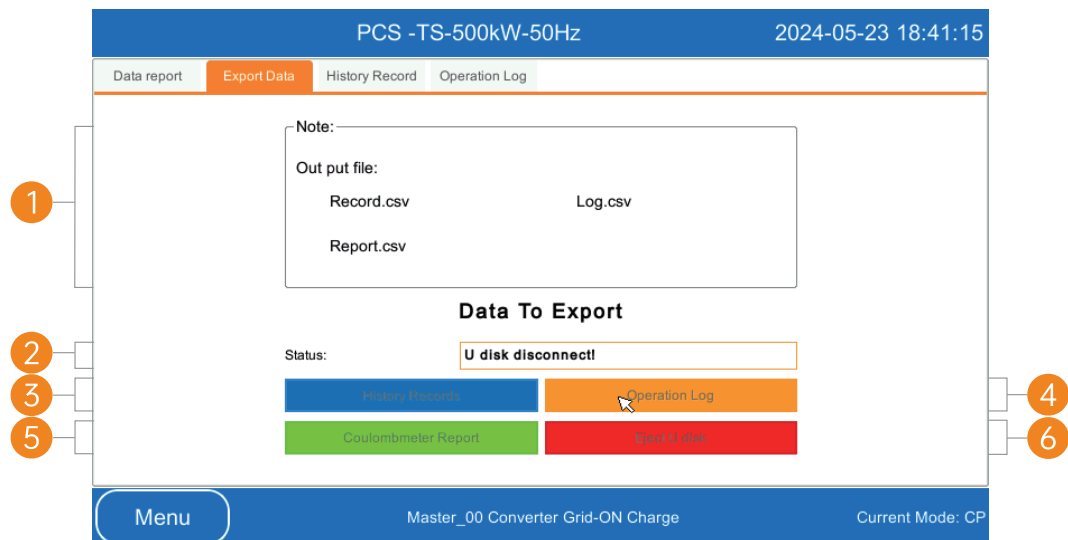
- This interface is used for data export. First, ensure the USB drive is formatted to FAT32. Then, check the status bar to see if the USB drive is indicated as inserted. If the USB drive is confirmed as inserted, you can select the type of data you wish to export and click the 'Export Data' button. Once the data export is complete, clicking the 'Eject USB Drive' button will finalize the data export process. The data export interface is shown in figure 8-44. For more details, please refer to table 8-20.

Table 8-20 Export data

Export data

- Prompt output file information.
- USB drive connection status.
- Export historical records.
- Export operation logs.
- Export electricity statistics table.
- Eject USB drive.

Figure 8-44 Export data



8.3.4.3 Historical data

- This interface is used to record the specific times of status logs and fault logs generated during the operation of the PCS. The interface displays the start and end times of the PCS. The historical records interface is shown in figure 8-45. For more details, please refer to table 8-21.

Figure 8-45 Historical data

PCS -TS-500kW-50Hz

2024-05-23 18:41:26

Data report

Export Data

History Record

Operation Log

	Level	Start Time	End Time	Description
1	0	2024-5-23 18:40:16	...	BMS unusual
2	2	2024-5-23 18:38:28	...	Cell SOC Too Low Level 1 Alarm
3	2	2024-5-23 18:38:28	...	Cell SOC Too Hige Level 1 Alarm
4	2	2024-5-23 18:38:28	...	Insulation Fault Level 1 Alarm
5	2	2024-5-23 18:38:28	...	Cell Temperature Exces Variance Level 1 Alarm
6	2	2024-5-23 18:38:28	...	Cell Voltage Exces Variance Level 1 Alarm
7	2	2024-5-23 18:38:28	...	Discharge Over Current Level 1 Alarm
8	2	2024-5-23 18:38:28	...	Charge Over Current Level 1 Alarm
9	2	2024-5-23 18:38:28	...	Total Voltage Too Low Level 1 Alarm
10	2	2024-5-23 18:38:28	...	Total Voltage Too High Level 1 Alarm
11	2	2024-5-23 18:38:28	...	Cell Temperature Too Low Level 1 Alarm

Menu

Master_00 Converter Grid-ON Charge

Current Mode: CP

1

2

3

4

Table 8-21 Historical data

Historical data	
1. Event level.	
2. Start time.	
3. End time.	
4. Description of historical records.	

8.3.4.4 Operation logs

- This interface is used to record the modification history of some important system parameters. The operation log interface is shown in figure 8-46. For more details, please refer to table 8-22.

Figure 8-46 Operation logs

	Modification Time	Record Event
1	2024-05-23 18:40:49	Control mode: Local -> Remote
2	2024-05-23 18:40:46	EMS Communication Mode: RS485 -> Ethernet
3	2024-05-23 18:40:36	BMS communication Type: CAN -> Non
4	2024-05-23 18:36:35	BMS communication Type: Non -> CAN
5	2024-05-23 18:01:45	Grid active power percent: 10 -> -10
6	2024-05-23 17:59:49	EMS Communication Mode: Ethernet -> RS485
7	2024-05-23 17:59:44	BMS communication Type: CAN -> Non
8	2024-05-23 17:59:42	Control mode: Remote -> Local
9	2024-05-23 17:48:21	Control mode: Local -> Remote
10	2024-05-23 17:48:14	EMS Communication Mode: RS485 -> Ethernet
11	2024-05-23 17:48:02	Control mode: Remote -> Local

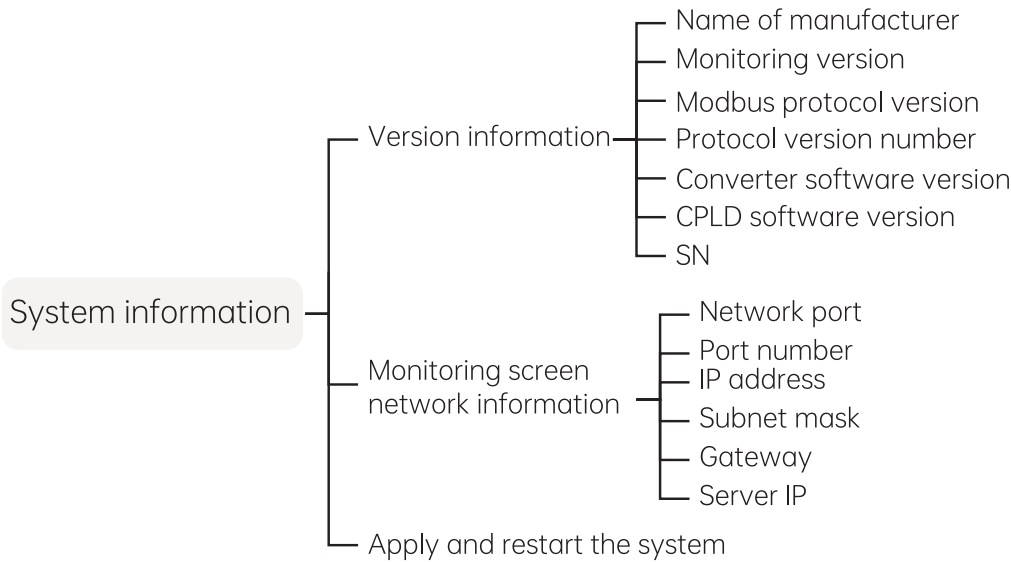
Table 8-22 Operation logs

Operation logs
1. Modification time.
2. Event record.

8.3.5 System data

- The structure of the system information is shown in figure 8-47.

Figure 8-47 Structure of the system information



- Click the "System Information" button to skip to the system information page, as shown in figure 8-48. The system information page includes version number information and network information. For more details, please refer to table 8-23.

Figure 8-48 System information

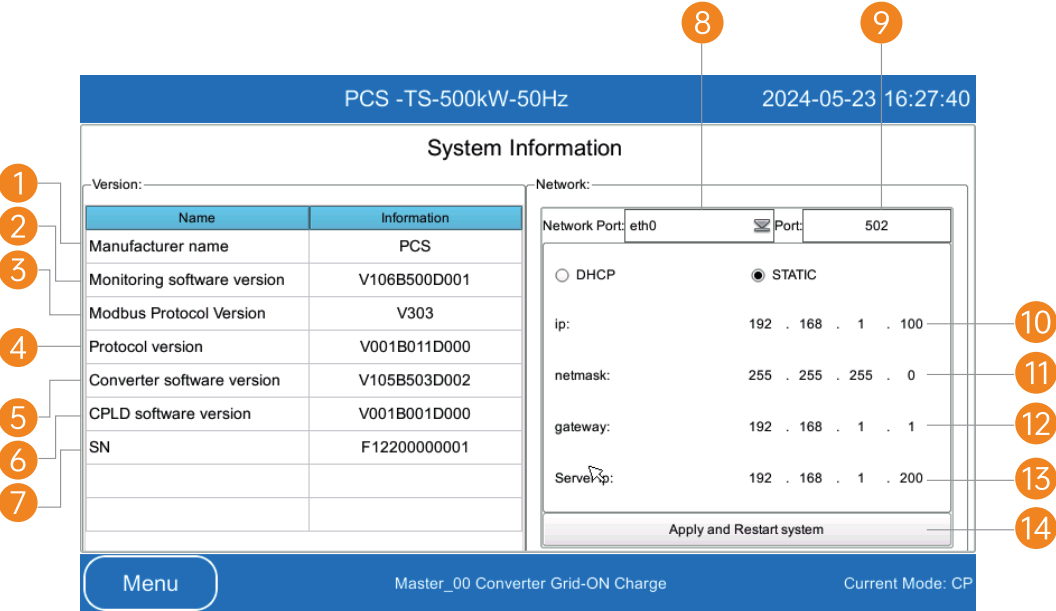


Table 8-23 System information

System information	
1. Manufacturer name.	
2. Monitoring software version number.	
3. Modbus protocol version number.	
4. Protocol version number.	
5. Converter software version number.	
6. CPLD software version.	
7. SN code.	
8. Network Port.	
9. Port.	
10. IP address.	
11. Netmask.	
12. Gateway.	
13. Server IP address.	
14. Apply and reboot button; software updates or IP address changes require a system reboot.	

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

The LCD displays 32 alarms, and the corresponding solutions are listed in table 9-2:

Table 9-2

Alarm failure handling methods

Fault type	Handling method
Low battery voltage	Disconnect the DC load switch and check the DC side voltage and storage battery configuration
Low battery voltage auxiliary power supply	Disconnect the DC load switch and check the DC side voltage and storage battery configuration
Low battery power	Disconnect the DC breaker load switch and check the energy storage battery status
Battery reverse connection failure	Switch off the DC side input bus
Bus overvoltage fault	Shut down and check DC voltage
Bus short circuit fault	Shut down and check DC bus connection
Power grid overvoltage	Shutdown, check the connection point voltage
Low grid voltage	Shutdown, check the connection point voltage
Grid voltage reverse sequence	Disconnect the grid transmission switch and shut down to check the three-phase wiring
Power grid frequency anomaly	Shut down and check the grid voltage
DC contactor fault	Shut down and check if the DC contactor is damaged
The output contactor is open circuit	Shut down and check AC contactor for damage
Output contactor short circuit	Shut down and check AC contactor for damage
AC fan fault	Shut down and check the AC fan
AC auxiliary power failure	Power off, check AC auxiliary power board
DC auxiliary power failure	Shut down and check the DC auxiliary power board

Fault type	Handling method
15V power failure	Shut down, check AC and DC auxiliary power board
Converter overcurrent	Shut down and check whether the converter input and output are short circuit or whether the converter is overloaded
The converter is wave by wave current limited	Shut down and check whether the converter input and output are short circuit or whether the converter is overloaded
Converter failure	Shut down and repeat the check operation before starting the converter
Converter over temperature	Shut down, check whether the converter fan is faulty and whether the air duct is free
Converter out of phase fault	Shut down and check the AC side line
The converter is out of sync	Shut down and check converter Settings
Lightning protection fault	Shut down and check the lightning protection of the converter
BMS communication failure	Shut down and check whether the communication cable between the converter and the battery system is loose
Overload	Shut down and check the load size
Isolated island protection	Shut down
Drive line fault	Shut down the machine and check whether the internal drive wire is loose
Abnormal insulation impedance	Shut down, check converter grounding and cable aging damage
EPO	Shut down
CT or Hall open circuit	Shut down and check the CT wiring

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 9-3 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.
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.
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.

Function	Description
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.
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, and the AC/DC main contactor is detected to be disconnected, the energy storage converter will stop working, and a warning signal will be issued, and the fault type will be displayed on the LCD.

Appendix: Technical parameter

Table 9-4

Technical parameter (Table 1)

AC (on-grid)

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Maximum 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	160	240	400	800
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))					
Fault ride-through capability	ZVRT、HVRT					
Alternating current system	3W+N+PE					

AC (off-grid)

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Maximum power (kVA)	33	55	110	165	275	550
Rated power (kW)	30	50	100	150	250	500
Rated voltage (V)	400					

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Maximum current (A)	48	80	160	240	400	800
Rated current (A)	43	72	144	216	361	722
THDU	< 1% linear < 5% non-linear					
Rated frequency (Hz)	50/60					
Overload capacity	110% long-term					

Battery

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Battery voltage range (V)	250-850	320-850	420-850	420-850	420-850	500-850
Maximum DC current (A)	137	178	270	405	673	1128

System parameter

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Maximum efficiency	0.963	0.965	0.971	0.971	0.973	0.975
Dimensions (W/D/H) (mm)	800×800×1900				1200×800×2050	1600×1050×2050
Weight (kg)	621	712	917	1057	1582	2665
Isolation transformer	100/400	200/400	270/400	270/400	270/400	315/400
Power consumption during shutdown (W)	<100					
Working environment temperature (°C)	-30 ~ +55					
Humidity	0 ~95% non-condensing					
IP Grade	IP21					

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Noise (dB)	<70					
Altitude	5000m(> 3000m derating)					
Mode of cooling	Air cooling					

Display and communication

Model	PCS0030TS PCS0030T	PCS0050TS PCS0050T	PCS0100TS PCS0100T	PCS0150TS PCS0150T	PCS0250TS PCS0250T	PCS0500TS PCS0500T
Display	Touch LCD screen					
BMS communication Interface	RS485/Ethernet/CAN					
Local communication	RS485/Ethernet					

Table 9-5 Technical parameter (Table 2)

AC (on-grid)

Model	PCS0500	PCS0630
Maximum power (kVA)	550	693
Rated power (kW)	500	630
Rated voltage (V)	400	
Maximum current (A)	800	1001
Rated current (A)	722	910
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))	
Fault ride-through capability	ZVRT、HVRT	
Alternating current system	3W+N+PE	

AC (off-grid)

Model	PCS0500	PCS0630
Maximum power (kVA)	550	693
Rated power (kW))	500	630
Rated voltage (V)	400	
Maximum current (A)	800	1001
Rated current (A)	722	910
THDU	< 1% linear < 5% non-linear	
Voltage range (V)	400(80%~115%)	
Rated frequency (Hz)	50/60	
Overload capacity	110% long-term	

Battery

Model	PCS0500	PCS0630
Battery voltage range (V)	600-900	600-900
Maximum DC current (A)	928	1170

System parameter

Model	PCS0500	PCS0630
Maximum efficiency	0.987	0.987
Dimensions (W/D/H) (mm)	1000*700*2050	1000*700*2050
Weight (kg)	925	925
Isolation transformer	/	
Power consumption during shutdown (W)	<100	
Working environment temperature (°C)	-30 ~ +55	
Humidity	0 ~95% non-condensing	
IP Grade	IP21	
Noise (dB)	<70	
Altitude	5000m(> 3000m derating)	
Mode of cooling	Air cooling	

Display and communication

Model	PCS0500	PCS0630
Display	Touch LCD screen	
BMS communication Interface	RS485/Ethernet/CAN	
Local communication	RS485/Ethernet	
Certificate	IEC/EN62109-1/-2 、 EN62477-1 、 IEC/EN61000-6-2/-6-4 、 EN50549-1 、 NRS 097-2-1:2017 、 ASGC 、 GB/T 34120-2017 、 GB/T 34133-2017 、 CGC-R46103:2018A	

*: Postscript

In the absence of the VFD/VSD, the motor power cannot exceed one-eighth of the rated power of PCS; In the case of the VFD, the motor power cannot exceed half of the rated power of PCS (the motor is the most severe inductive load; other inductive loads can refer to the above).

PCS SERIES