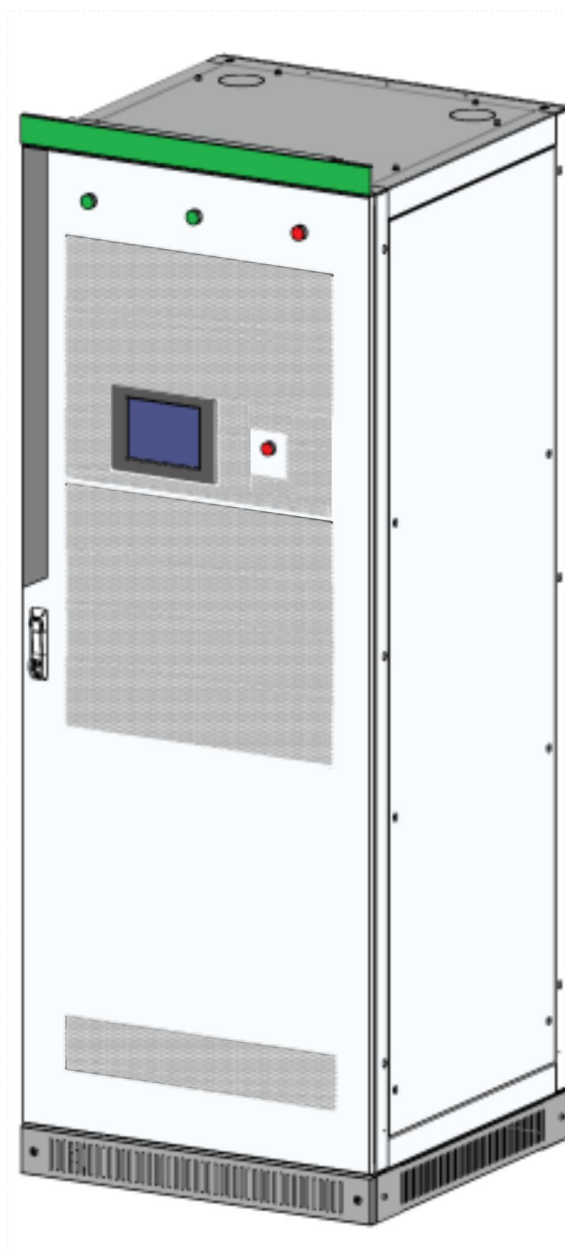


Operation Manual

NKGP Series Power Conversion System



NKGP Series Power Conversion System

User's Manual (Operation Manual)

Version 2.1

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1. Summary

1.1 Applicable models

This document applies to the following inverter models;

•**NKGP-50K**

•**NKGP-100K**

Model definition:

This section introduces the inverter model definition in this manual,
as shown in Figure 1.1:

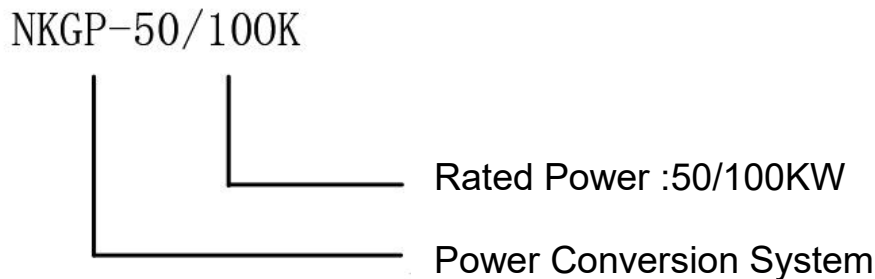


Figure 1.1 Inverter Model Definition

Explanation:

NKGP-100K: represents 100kW PCS

Check the nameplate on the inverter to determine the model.

The illustrations in this document are only schematic diagrams, please refer to actual products for details.

1.2 Target groups

What is described in this document can only be operated by professionals.

Professionals must have the following skills:

Understand how the product works and how to operate it;

Understand how batteries work and how they operate;

Be trained and know how to deal with the hazards and risks in the process of installing and using electrical equipment;

Understand the electrical equipment, installation and commissioning of equipment;

Understand all applicable standard operating instructions;

Understand and observe this manual and all safety information.

1.3 Technical term

Name	Definition
STS	Static transfer switch
AC	Alternating current
DC	Direct current
BESS	Battery energy storage system
ESS	Energy storage system
EMS	Energy management system
BMS	Battery management system
PCS	Power conversion system
SLD	Single line diagram
SOH	State of health(battery), expressed as a percentage
SCR	Silicon-controlled rectifier
DOD	Depth of discharge,expressed as percentage
EOD	End of discharge
SOC	State of charge,expressed as percentage
UI	User interface
EPO	Emergency power off
SPD	Surge protective devices

2. Safety Instructions

2.1 Mark

Mark	Explanation
	Indicates a dangerous situation, which, if not avoided, will result in death or serious injury
	Indicates a dangerous situation, which, if not avoided, will result in death or serious injury
	Indicates a dangerous situation, which, if not avoided, may result in mild or moderate injury
	Indicates that if it is not avoided, it will cause property damage
	Draw attention to important information, best practices and recommendations Attention is used to resolve information that has nothing to do with personal injury, equipment damage, and environmental degradation.

2.2 Important safety instructions

This user's manual is about the installation and operation of NKGP series 50/100kW PCS, Please read this user's manual carefully before installation.

PCS must be debugged and maintained by the engineer or authorized service partner designated by the manufacturer. Otherwise, it may endanger personal safety and cause equipment failure. The resulting damage to the equipment is not covered by the warranty.

PCS cannot be used in any environment or application related to life support equipment.

This manual contains important instructions for the NKGP series models, and these instructions should be followed when installing and maintaining PCS.

Any touching of the copper bars, contacts, and terminals connected to the power grid circuit inside the device may cause burns or fatal electric shocks !

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

Pay attention to any instructions and safety documents related to grid connection.

There may be electric shock hazards within the equipment!

Any operations related to this equipment must be performed by professionals.

Please pay attention to the safety precautions listed in the safety instructions and installation documents.

Please pay attention to the safety precautions listed in the operation and installation manuals and other documents.

Large leakage current

Before connecting the input power, make sure that the grounding is reliable.

The equipment must be grounded and comply with local electrical codes.

When the battery is connected to the PCS, there may be DC voltage at the input port. Please pay attention to or check the battery system user's manual during operation.

Do not touch live parts within 15 minutes of power failure!

The internal capacitors store dangerous energy. It is strictly forbidden to touch the terminals, contacts, copper bars and other live parts of the device within 15 minutes after disconnecting all power to the device.

All internal maintenance and maintenance of the equipment should be performed by trained personnel. Internal devices that need to be opened with tools cannot be maintained by the user. Please read this user's manual before operation.

2.3 Additional Information

For other details, please contact the supplier.

3. Product Introduction

3.1 System introduction

PCS converts DC power supplied by batteries and photovoltaic into AC power that is integrated into the grid, which can be used in grid-connected or off-grid mode. Inverter models with STS modules can quickly switch between grid-connected and off-grid modes.

Adopt two-stage topology and wide voltage input range: 250-520V;

Can be connected to photovoltaic panels;

With MPPT photovoltaic maximum power tracking function;

Photovoltaic can directly charge the battery to ensure the highest system efficiency;

3.2 PCS appearance

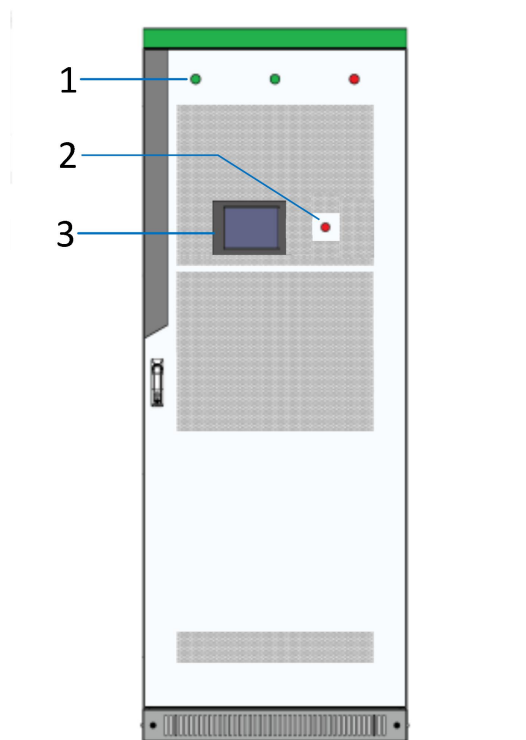


Figure 3.1 PCS Appearance

Location	Describe
1	Indicator light
2	Emergency stop button
3	Touch screen

3.3 System schematic diagram

NKGP -50K / 100K PCS composed of one or more groups of DC modules and AC modules. These modules identify the master-slave system through the dial code of the DIP switch on the panel. One of the modules acts as the master, and the other modules act as slaves to synchronize with the master.

The equipment is equipped with SPD protectors, AC and DC switches and auxiliary power distribution units. If you want to realize the fast on-off and off-grid switching function, you need to configure the STS module separately. Figure 3.2 and 3.3 are the topological diagrams of the two components respectively.

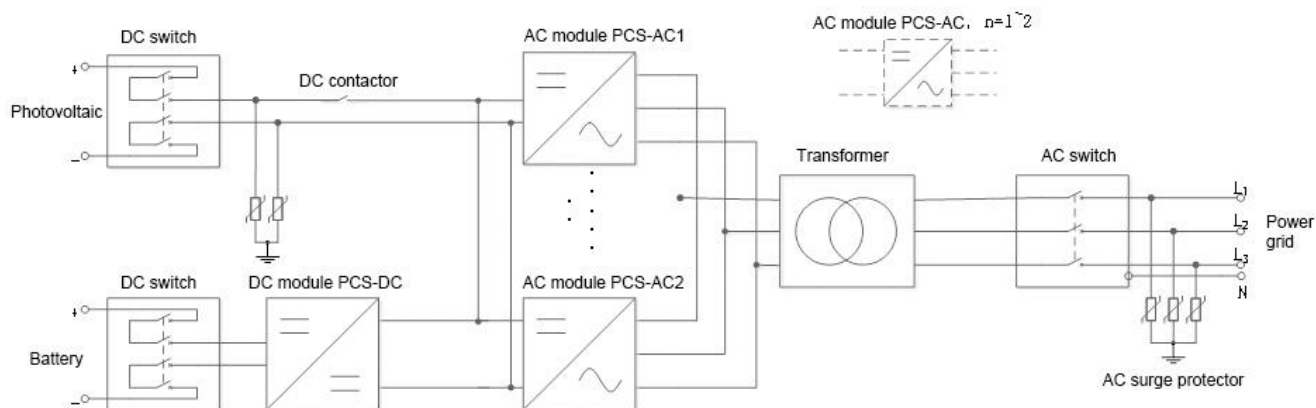


Figure 3.2 Topology diagram of two-way hybrid PCS without STS module

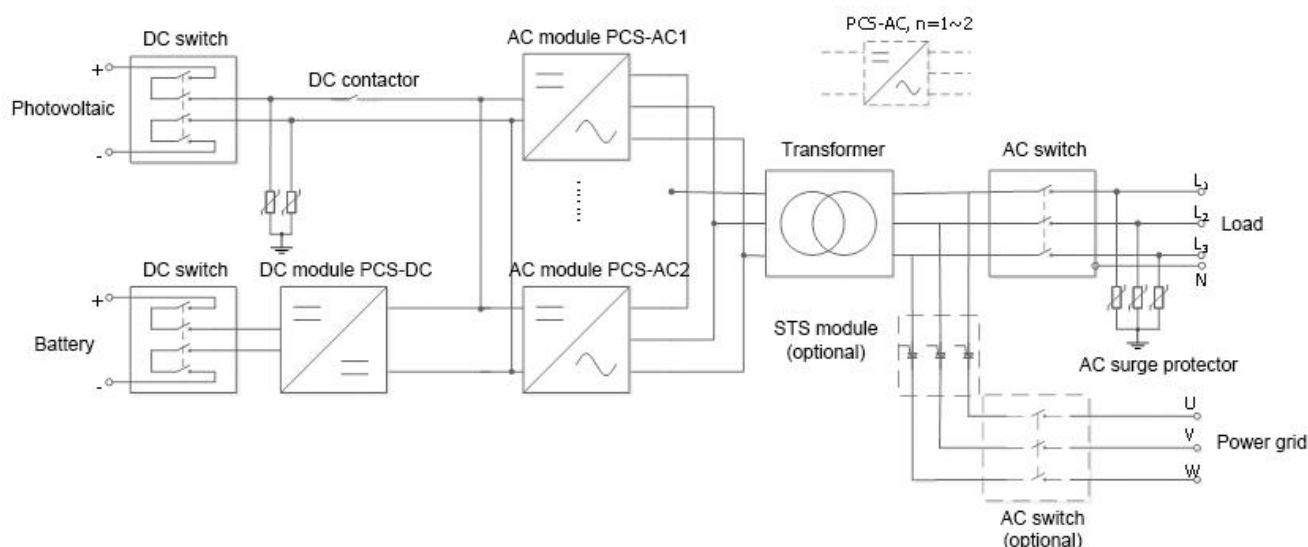


Figure 3.3 Topology diagram of two-way hybrid PCS with STS module

Both models have the same mechanical and electrical structure, except that they are composed of different numbers of AC modules and DC modules:

The NKGP -50K series is composed of 1 set of AC module and 1 set of PCS-DC module. Special models have 1 set of STS module.

The NKGP-100K series consists of 2 sets of AC modules and 2 sets of PCS-DC modules, and special models are equipped with 1 set of STS modules.

NKGP-50K/100K The rack composition structure of PCS is shown in the following table 3-2: Table 3-2 PCS rack composition

Number	Name	Quantity	Mark
1	Cabinet	1	The cabinet is equipped with power distribution components
2	AC Module	1pcs or 2pcs	1pcs of 50kW 2pcs of 100kW
3	DC Module	1pcs or 2pcs	1pcs of 50kW 2pcs of 100kW
4	Isolation transformer	1pcs	
5	Man-machine interface (touch screen)	1pcs	Installed on the cabinet door
6	STS Module	1pcs	The model with STS module is optional.

3.4 Composition of PCS

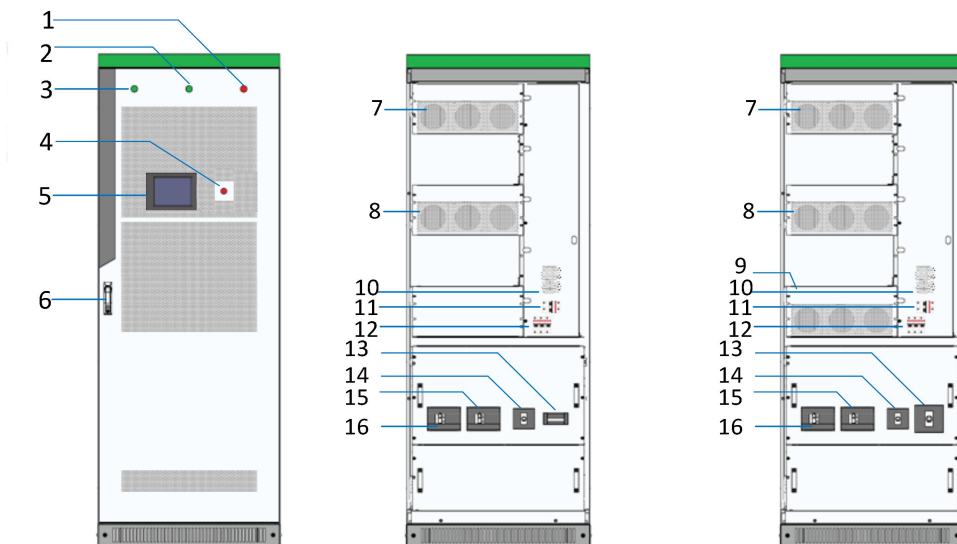


Fig.3.4 PCS Appearance Internal composition of without STS module Internal composition of STS module

Local	Name	Description
1	Fault light	Red when it is faulty, go out when it is normal
2	Running indicator light	Green
3	Power indicator light	Green
4	Emergency stop button	
5	touch screen	
6	door handle	
7	DC Module (1/2pcs)	1pcs of 50kW,2pcs of 100kW
8	AC Module (1/2pcs)	1pcs of 50kW, 2pcs of 100kW
9	STS Module	A switching device;Only applicable to models with STS
10	Terminals	Signal input or signal output
11	Auxiliary power switch	
12	SPD Switch	
13	Manual soft start switch	Only applicable to models without STS

or	AC switch (grid side)	Only applicable to models with STS
14	AC switch (grid side)	Only applicable to models without STS
or	AC switch (load side)	Only applicable to models with STS
15	Battery switch	
16	Photovoltaic DC switch	

No.10 is the wiring terminal, No.11 is the auxiliary power switch and No.12 is the SPD switch, which can be seen after opening the baffle.

3.5 Operation part

3.5.1 Switch introduction

3.5.1.1 AC Switch

The AC switch is used to disconnect the PCS from the grid.

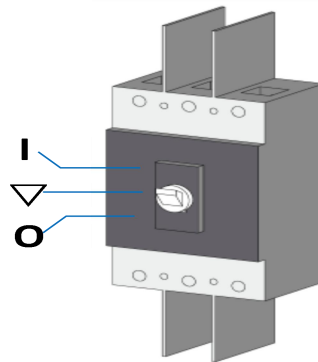


Figure 3.5 Indicating position of AC switch

Location	Name	Explanation
I	Close the gate position	The AC switch is closed
∇	Trip position	AC switch buckled
O	Separating brake	The AC switch is disconnected

Trip recovery: Turn the switch to the close the gate position first, and then to the separating brake again.

3.5.1.2 DC switch

The DC switch is used to disconnect the battery or photovoltaic from the PCS.

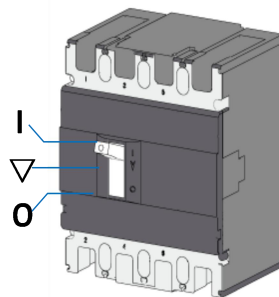


Figure 3.6 Indication position of DC switch

Location	Name	Explanation
I	Close the gate position	The DC switch is closed
▽	Trip position	DC switch buckled
O	Separating brake	The DC switch is disconnected

Trip recovery: Turn the switch to the separating brake first, and then to the close the gate position again.

3.5.1.3 Auxiliary power supply switch

220V redundant power supply can be provided through the AC switch in the cabinet. You can see these switches after opening the bezel.

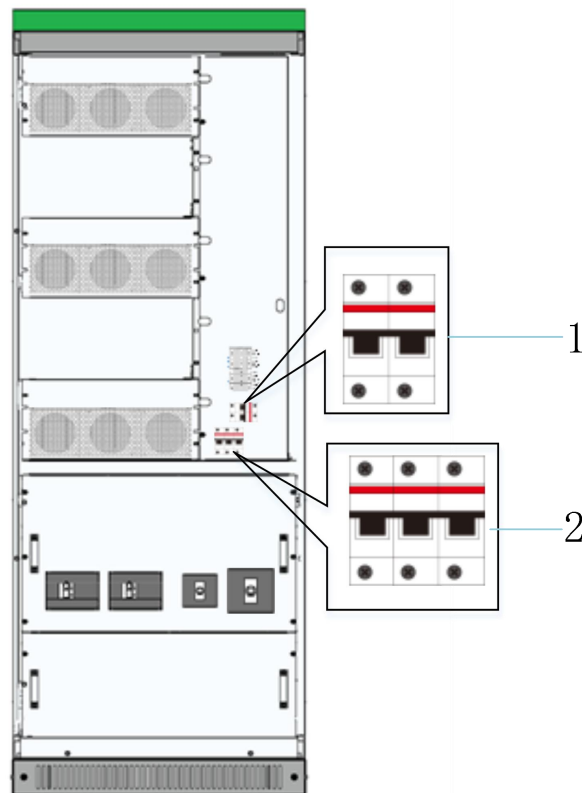


Figure 3.7 Auxiliary power switch and surge protector switch

1	2
Auxiliary power switch	Surge protector switch

3.5.2 Touch screen

3.5.2.1 User interface

Touch screen is used to display real-time values and parameter settings. Click on the options on the touch screen to set the corresponding functions. If the touch screen is not operated for [10] minutes, the display screen will be locked and the logged-in user will be logged out. Unlock the display again by clicking on the screen.

The touch screen is divided into three areas.

A

B

C

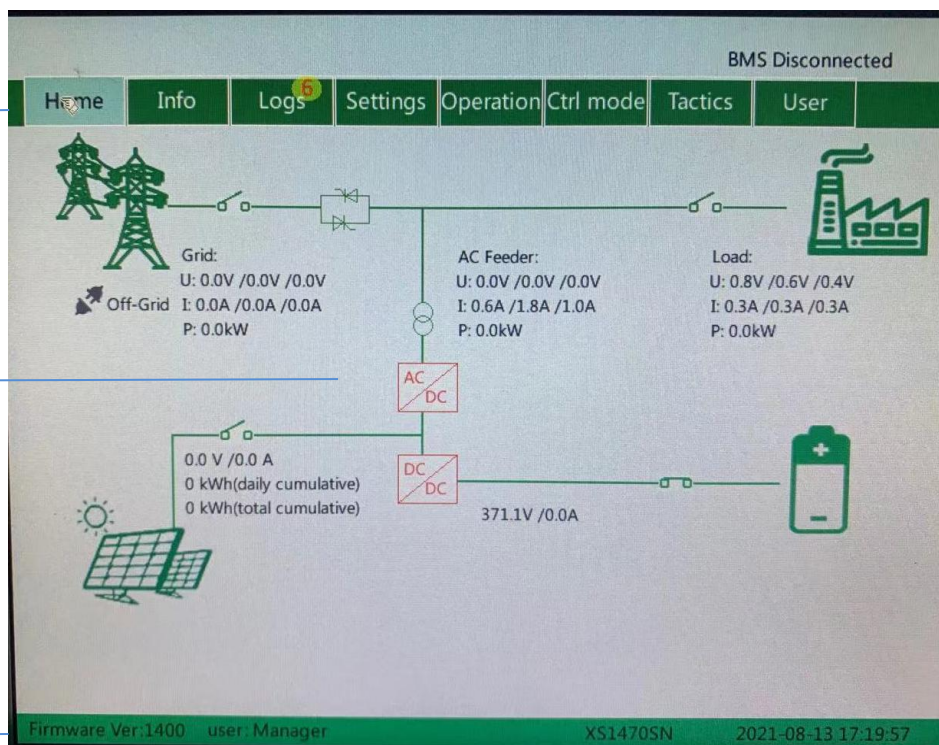


Figure 3.8 Design of Human-machine operation interface

Location	Name	Explain
A	Menu	The menu before login/after login, the options you see are different.
B	System topology	
C	Version and time	

3.5.2.2 Icon explanation

Symbol	Explanation
	Icon explanation
	Photovoltaic
	AC-side load
	Battery side
	The STS module
	Transformer (built-in)
	AC module
	DC module
	The DC side or the AC side switch is disconnected
	The DC side or AC side switch is closed

3.5.3 Module introduction

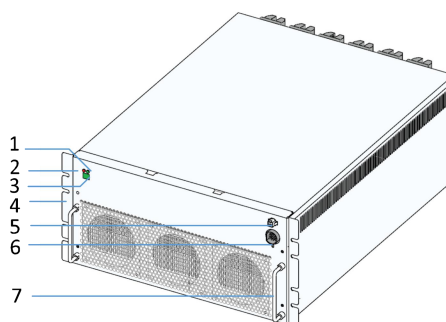


Figure 3.9 Front view of the AC module

Series Number	Name	Description
1	Normal indicator light	Green
2	Fault indicating light	Red
3	Dial-up switch	Address
4	Hangers	
5	Power plug	
6	Communication line plug	
7	Handle	Can't bear weight

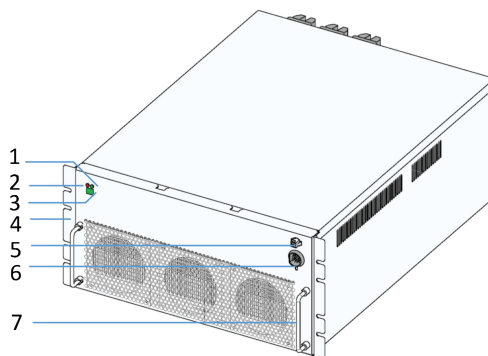


Figure 3.10 Front view of the DC module

Series Number	Name	Explanation
1	Normal indicator light	Green
2	Fault indicating light	Red
3	Dial-up switch	Address
4	Hangers	
5	Power plug	
6	Communication line plug	
7	Handle	Can't bear weight

3.5.4 Label

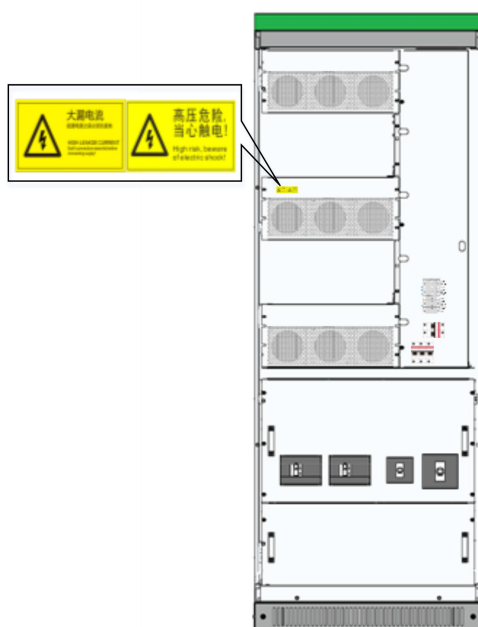











Figure 3.11 Label location

Number	Label	Acceptance
1		A phase label
2		B phase label
3		C phase label
4		Positive bus label
5		Negative bus label
6		N-line label
7		Ground point label
8		High voltage electric shock label
9		High voltage electric shock label

4. Technical Specifications

Technical specifications

Product Model	NKGP -50K	NKGP-100K
Battery side parameters		
DC voltage range	250V-520V(rated 450V)	250V-520V(rated 450V)
DC maximum current	150A (rated 130A)	300A (rated 260A)
Maximum DC power	50kW	100kW
PV side parameters		
PV voltage range	520~900V	520~900V
Maximum PV current	220A	440A
Maximum PV power	100kW	200kW
Grid-connected parameters		
Rated output power	50kW	100kW
Rated grid voltage	400V	400V
Grid voltage range	±15%	±15%
Grid frequency range	50Hz/60Hz	50Hz/60Hz
Grid frequency range	±2.5Hz	±2.5Hz
AC rated current	72A	144A
Output THDi	≤3%	≤3%
On-grid power factor	-1~+1	-1~+1
AC off-grid parameters		
AC off-grid voltage	400V	400V
Adjustable range of AC voltage	±10%	±10%
AC off-grid frequency	50Hz/60Hz	50Hz/60Hz
Off-grid output THDu	≤2%	≤2%
System parameter		
Maximum efficiency of whole PCS	96.1%	96.1%
Connection mode	3-phase3-lines(grid-connected),3-Phase 4-Wire(off-grid)	3-Phase3-Wire(grid-connected),3-Phase 4-Wire
Isolation mode	Power-frequency isolation	Power-frequency isolation
Cooling mode	Forced cooling	Forced cooling
Noise	70dB	70dB
Temperature range	-20℃~50℃	-20℃~50℃
The protection grades	IP20	IP20
Altitude	3000M	3000M
Humidity range	0~95%	0~95%
Size	800*2160*800	800*2160*800
Weight	520kg	750kg
Communication method		
Display	Touch screen	Touch screen

Communication mode of upper computer	ModBusTCP/IP	ModBusTCP/IP
communication interface	Internet access、RS485、CAN	Internet access、RS485、CAN

Application environment restrictions:

When the battery energy storage system works in independent mode (off-grid mode), there are some restrictions on the application environment.

Parallel connection of AC outputs of multiple PCS is a customized function. When the user needs to connect AC output in parallel in off-grid mode, please contact the manufacturer.

Resistance load power < PCS rated power

The load power of RCD (resistor capacitor diode) is less than 80% of PCS apparent power, and the load power of RCD is less than 100KW. When the load of RCD is more than 100KW, please contact the manufacturer and customize PCS.

Motor load with frequency converter, load power < apparent power of PCS single machine * 80%

With motor load without frequency converter, PCS needs to be customized, please contact the manufacturer.

The specific power with motor load should be determined according to the actual load situation on site, and it is necessary to communicate with our technical personnel.

5. Storage, Handling and Transport

For more transportation and installation information, please refer to the user installation manual.

5.1 Transportation safety precautions

If the lifted or suspended goods tip over, fall or shake, there is a danger of damage.

Vibration during transportation or hurried lifting of the goods may cause the goods to tip over or fall, which may result in death or serious injury.

Must comply with all national transportation standards and regulations.

Be sure to transport the goods as close to the floor as possible.

It must be packaged and protected before being transported.

Avoid rapid or uneven movement during transportation.

Always keep a sufficient safe distance from the cargo during transportation.

The frame structure of the PCS will be damaged due to the uneven supporting surface.

Placing the optical storage all-in-one on an uneven surface will cause it to bend, causing the optical storage all-in-one door to fail to close properly.

Prevent moisture and dust from penetrating into the PCS.

Do not place the optical storage all-in-one on an uneven surface, even for a short period of time.

The unevenness of the supporting surface must be less than 0.25%.

5.2 Transport PCS

5.2.1 Transportation and storage

The module is installed in the rack and transported as a whole. When transporting and storing the machine, pay attention to the markings on the packaging box.

The optical storage integrated machine has a modular design, which is convenient for the positioning and transportation of the equipment. The selection of its storage location should ensure:

- No corrosive gas around;
- No excessive humidity and high temperature source;
- Non dusty environment;
- Meet the fire protection requirements;

When the cabinets are transported and stored, they cannot be stacked, and other items are not allowed to be stacked on the top.

The cabinet should be placed upright, not upside down or lying down.

5.3 Open-box inspection

Refer to the user installation manual for multi-unpacking inspection information.

6. Installation

Refer to the user installation manual for more transport and installation information.

6.1 Installation precautions

Live parts have the voltage and the risk of causing electric shock.

High voltage exists on the live parts of the equipment that may cause death or severe electrical shock damage.

Wear the appropriate personal protective equipment for work.

Do not touch any live parts.

Read carefully and meet all the requirements in the warning information appearing in the device and documentation.

Observe all safety precautions provided by the battery manufacturer.

Electric shock hazard caused by the DC cable.

The DC cable connected to the battery is charged and contact with the live cable may cause electrocution or serious damage.

Before connecting the DC cable, make sure that the DC cable is without voltage.

Wear the appropriate personal protective equipment for work.

Open the equipment without permission.

Broken insulation in the energy storage system can cause fatal ground current and cause electrical shock.

Ensure that the insulation resistance of the energy storage system exceeds the minimum value.

Minimum insulation resistance: 14k Ω .

The optical storage unit must be installed in an enclosed electrical operating area.

Fire is caused by the bolted connection and its failure to comply with the torque specifications.

Failure to meet the specified torque reduces the load capacity of the bolted connection, thus reducing the contact resistance value.

May cause components to be overheating and fire.

Avoid tightening the bolts repeatedly, as this can lead to unbearable high torque, causing bolt damage.

6.2 Inverter installation

6.2.1 Installation preparation

The installation position requires drilling and installation holes for fixing, and the overall appearance size of the PCS is shown in the figure below.

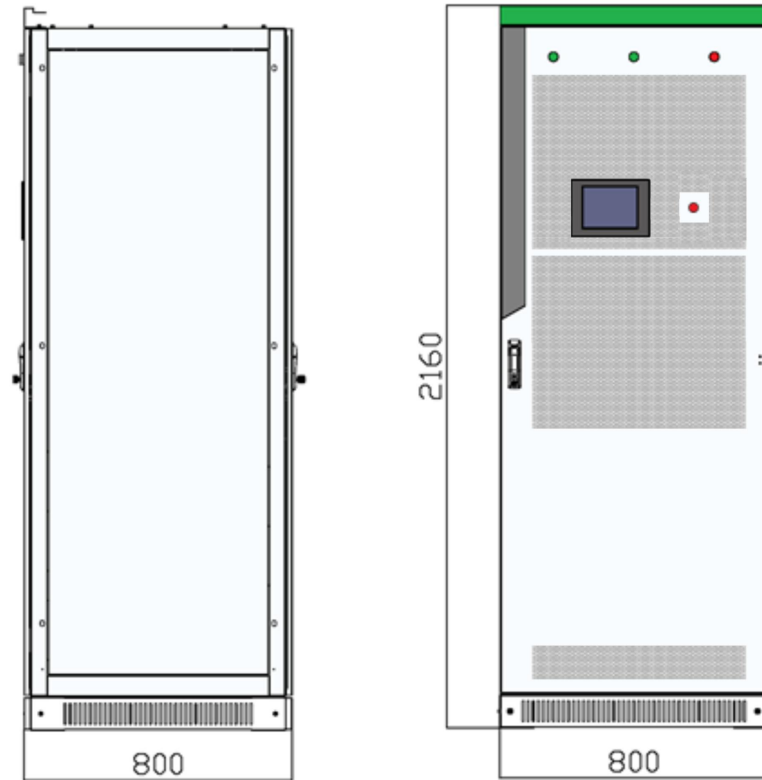


Figure 6.1 PCS dimensions

NNKGP -50K/100K cabinet, width: 800mm, height: 2160mm (without lifting ring); length: 800mm.

The height of the green door lintel is 60mm, if there is not enough height to enter the room, it can be removed.

The NKGP-50K/100K series PCS has no rings and cannot be hoisted.

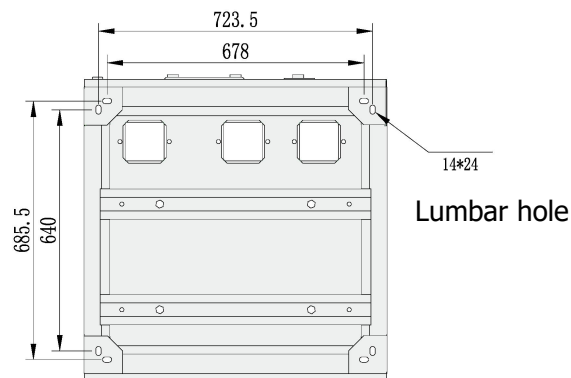


Figure 6.2 Schematic diagram of NKGP-50K cabinet base

There are two holes in each corner, only need bolts on one and the other as backup.

6.2.2 Preparation for installation on the base

Use a forklift or other tools to move the rack to the installation position of the battery energy storage system, fine-tune the rack and move it to the installation position, open the inner door of the rack, and fix the rack with M10 or M12 screws.

When the cabinet needs to be fixed on the channel steel, a $\Phi 14$ hole is opened on the channel steel, and the cabinet is fixed on the channel steel by screws.

Drill holes on the ground and fix the cabinet on the ground with screws.

For detailed installation of the base, please refer to the installation manual.

6.3 Electrical connection

6.3.1 Enter the requirements

The DC voltage of the battery of the PCS must be within its required input range, otherwise it will not work. When configuring the number of batteries in series, the user must fully consider the highest charging voltage and the lowest discharging voltage. For details, you can consult our company's technical service personnel.

The battery system used with the optical storage integrated machine should be equipped with a DC switch, and the charging/discharging voltage should be within the input voltage range. When connecting an external battery pack, make sure to disconnect the DC and AC switches.

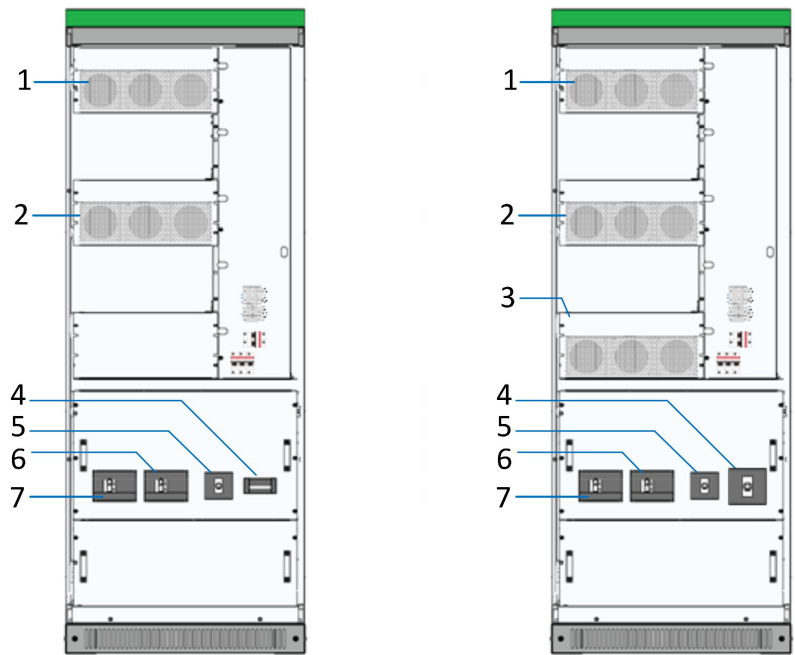
Each DC input branch of multiple PCS works independently, and the DC side of multiple devices is not supported in parallel. It is necessary to connect a single set of batteries to the DC port of a single device.

6.3.2 Output requirements

The output of the PCS is three-phase four-wire. When designing the energy storage system, since the PCS has a built-in isolation transformer, its output side is 400V, which can be directly integrated into the low-voltage power grid.

6.3.3 Wiring

PCS adopt bottom-in-bottom-out wiring mode, the cable hangs into the cable trench through the cable hole on the base. Open the front door and remove the inner door baffle, you can see the wiring copper bar. For the requirements of connecting cables, single or multiple cables with appropriate wire diameters should be selected. It is recommended that the current on the 1mm² wire is $\leq 3A$.



Without STS module

With STS module

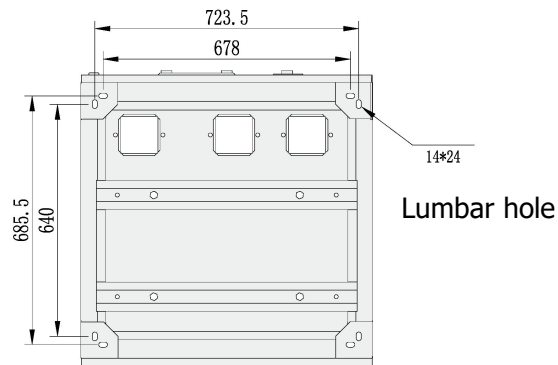


Figure 6.3 The NKGP Series cabinet connection base

Table 6-2 Description of wiring parts of NKGP series cabinet

Location	Name	Description
1	PCS-DC (1~2 pcs of module)	
2	PCS-AC (1~2 pcs of module)	
3	STS module	Realize fast on-off and off-grid switching
4	Manual soft start switch	Model without STS
	AC switch (connected to the grid)	Model with STS
5	AC switch (access to AC)	Model without STS
	AC switch (connected to load)	Model with STS
6	Battery switch	
7	PV DC switch	

Open the baffle next to the switch, you can see the wiring copper bar as shown in the figure below.

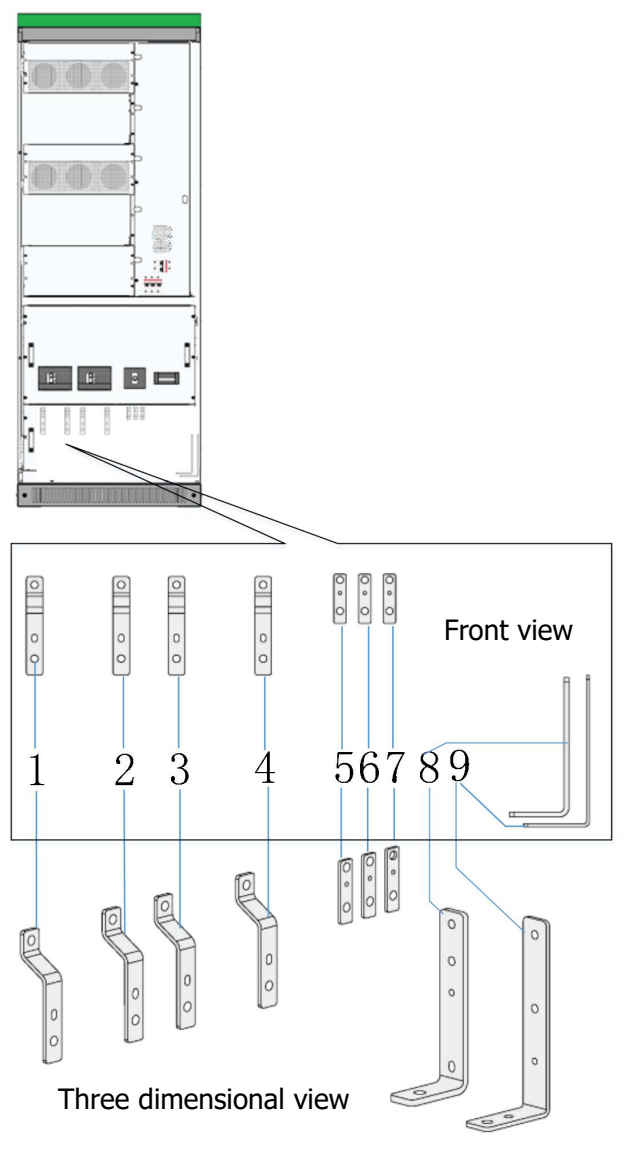


Figure 6.4 NKGP Series without STS Series wiring copper row name

Table 6-3 Description of NKGP series wiring copper row

Location	Name	Description
1	PV+	PV DC input positive
2	PV -	PV DC input negative
3	Battery+	Battery DC input positive
4	Battery-	Battery DC input negative
5	A phase (grid side)	AC output phase A (grid side)
6	B phase (grid side)	AC output B phase (grid side)
7	C phase (grid side)	AC output phase C (grid side)
8	N phase	N phase
9	Grounded	

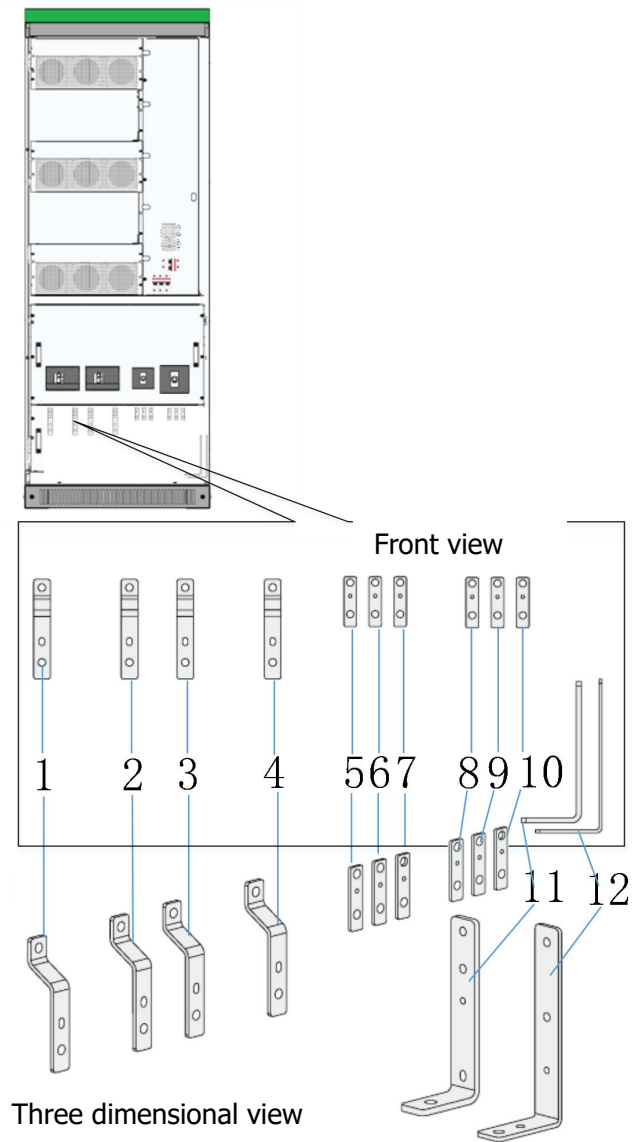


Figure 6.5 NKGP series with STS series wiring copper bar name

Table 6-4 NKGP-50K wiring copper bar description

Location	Name	Description
1	PV +	PV DC input positive
2	PV -	PV DC input negative
3	Battery+	Battery DC input positive
4	Battery -	Battery DC input negative
5	A phase (load side)	AC output phase A (load side)
6	Phase B (load side)	AC output B phase (load side)
7	C phase (load side)	AC output phase C (load side)
8	A phase (grid side)	AC output phase A (grid side)
9	B phase (grid side)	AC output B phase (grid side)
10	C phase (grid side)	AC output phase C (grid side)
11	N phase	N phase
12	Grounded	

Figure 6.6 Size of NKGP-50K series DC wiring

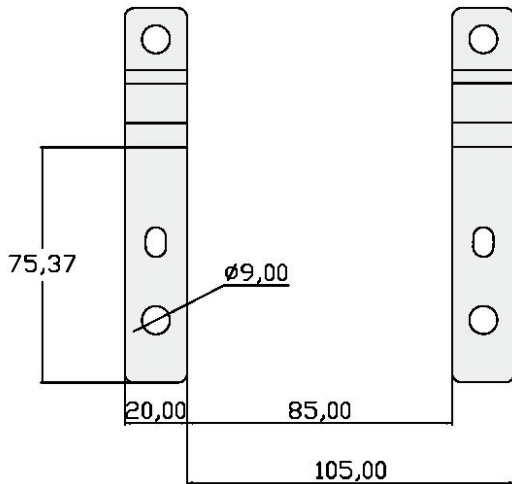
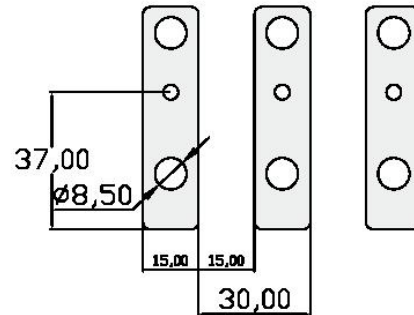


Figure 6.7-NKGP 50K Size of copper row for series AC wiring



6.3.4 System ground

For AC/DC modules in the PCS unit, ground connection to the cabinet through its hanging ear. For the grounding of the cabinet, a grounding copper row is installed at the bottom of the cabinet. Please refer to the cable diameter in the table below. The grounding resistance shall be less than 4 Ω .

The AC output neutral point is not grounded.

Table 6-5 Description of grounding PE cable

Rated power	PE Copper Line Type Selection Recommendation (mm ²)
50kW	≥ 16
100kW	≥ 25

The cabinet and modules shall be reliably grounded! Earthing resistance shall be less than 4 Ω .

6.3.5 DC side wiring

The DC side wiring shall be completed before starting up. See the installation manual for specific DC side wiring.

Disconnect the DC distribution isolation switch to ensure that there is no dangerous voltage in the system during the wiring.

The voltage of the battery is positive and negative and shall be measured with a multi meter before wiring.

6.3.6 AC-side wiring

AC side wiring shall be completed before starting on. See the installation manual.

When wiring, ensure that there is no dangerous voltage at the connection point.

All wiring is connected to the terminal from the outside through the over-line hole at the bottom of the optical storage machine. After the wiring, please seal the wiring hole with fire mud at the crossing hole.

6.3.7 Terminal row wiring

In addition to the connection of the power cable, the entire inverter of the PCS also has the connection of the auxiliary power supply and the input and output of some node signals, which are led to the terminal block in the form of clustered cables inside the cabinet. The definition of the ports that need to be externally connected to the terminal block is shown in the figure below.

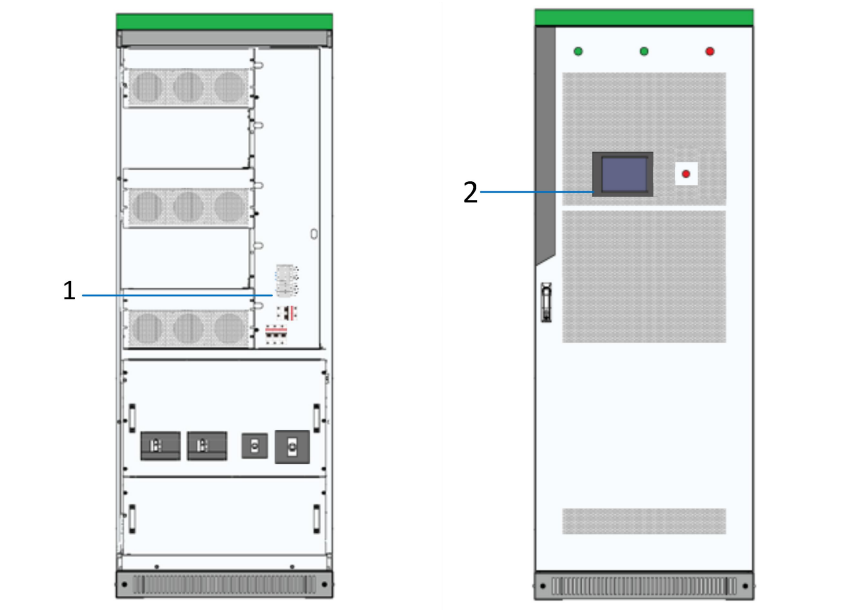


Figure 6.8 Location of the wiring and communication interface

Table 6-6 Description of the communication interface

Interface location	Description	Explanation
1	Terminal block	RS485,CAN,DI,DO, auxiliary power supply Terminal row as shown below
2	Touch screen	The Ethernet port Communication interface is shown in the figure below

Input signal circuit		
	1	DI 1
	2	DI1_GND
	3	DI 4
	4	DI4_GND
	5	DI 5
	6	DI5_GND
External communication circuit		
	7	CAN_H
	8	CAN_L
	9	485_A
	10	485_B
	11	EPO-C
	12	EPO-NO
External fan and output reserved		
Short circuit	13	L
	14	L
Short circuit	15	N
	16	N
	17	CAB_FAN1
	18	CAB_FAN1
	19	
	20	OUT5_NO
	21	OUT5_C
	22	OUT5_NC
	23	
	24	CAB_FAN2
	25	CAB_FAN2

Figure 6.9 Each port definition of the terminal row

Input signal circuit		
BMS fault signal	1	DI 1
	2	DI1_GND
External EPO normally closed	3	DI 4
	4	DI4_GND
Reserved	5	DI 5
	6	DI5_GND
External communication circuit		
From external CAN	7	CAN_H
	8	CAN_L
RS485 from outside	9	485_A
	10	485_B
External EPO normally open	11	EPO-C
	12	EPO-NO
External fan and output reserved		
Power supply to external auxiliary power supply	13	L
	14	L
Power supply to external auxiliary power supply	15	N
	16	N
To container fan 1	17	CAB_FAN1
	18	CAB_FAN1
	19	
Output reserved dry joint	20	OUT5_NO
	21	OUT5_C
	22	OUT5_NC
	23	
To container fan 2	24	CAB_FAN2
	25	CAB_FAN2

Figure 6.10 Port row for each port definition

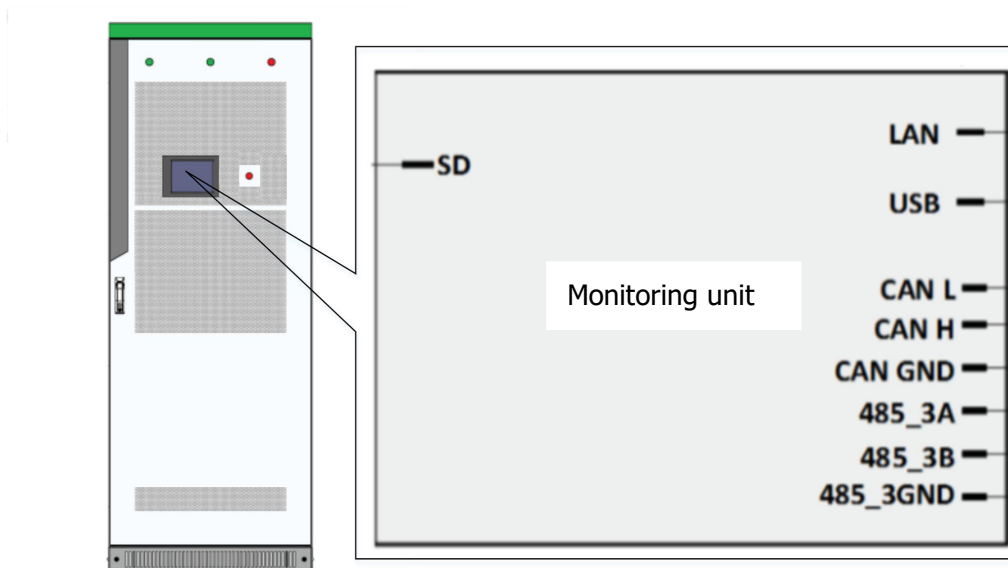


Figure 6.11 Definition of each communication port of the touch screen

The LAN (Ethernet) port is used for communication. The USB ports are used for a system upgrade or information export. Other communication ports on the back of the touch screen are connected to the port in the terminal row.

6.4 Communication interface connection

The PCS supports Modbus protocol and adopts RS485 and Ethernet communication interface to facilitate user background monitoring and realize remote communication, telemetry, telemetry and telemetry and remote control of the inverter all-in-one storage machine. The energy storage inverter has several different communication interfaces: Ethernet, RS485, and CAN.

PCS has only one set of RS485, CAN, Ethernet respectively, for example: RS485 is connected to EMS without BMS.

Table 6-7 Communication interface with other equipment

Device	Connection mode
EMS	RS485 or Ethernet (protocol is based on MODBUS TCP/IP and compatible with MODBUS RTU)
BMS	RS485 (protocol based on MODBUS RTU) or CAN(CAN2.0 protocol specification)
Other PCS	CAN
Photovoltaic inverter	With external EMS
Smart meter	With external EMS
Air conditioner	With external EMS
Fire fighting system	With external EMS
Level	With external EMS
Diesel engine	With external EMS

6.4.1 Connect to the EMS via the RS485 or Ethernet

EMS can be connected with RS485 or Ethernet, depending on the user's specific application, as shown in the figure below.

RS485 serial port

The touch screen on the front door of the PCS shows the user interface on the back. The bit number of RS485 communication interface on the monitoring board is J23, leading the user external terminal row 9 and 10. The user can convert the serial port signal to the signal processed by PC function (such as RS485 to RS232) through the interface converter, debug independently through the background software optical storage machine, read the operation information, alarm information, perform corresponding setting and switching operation.

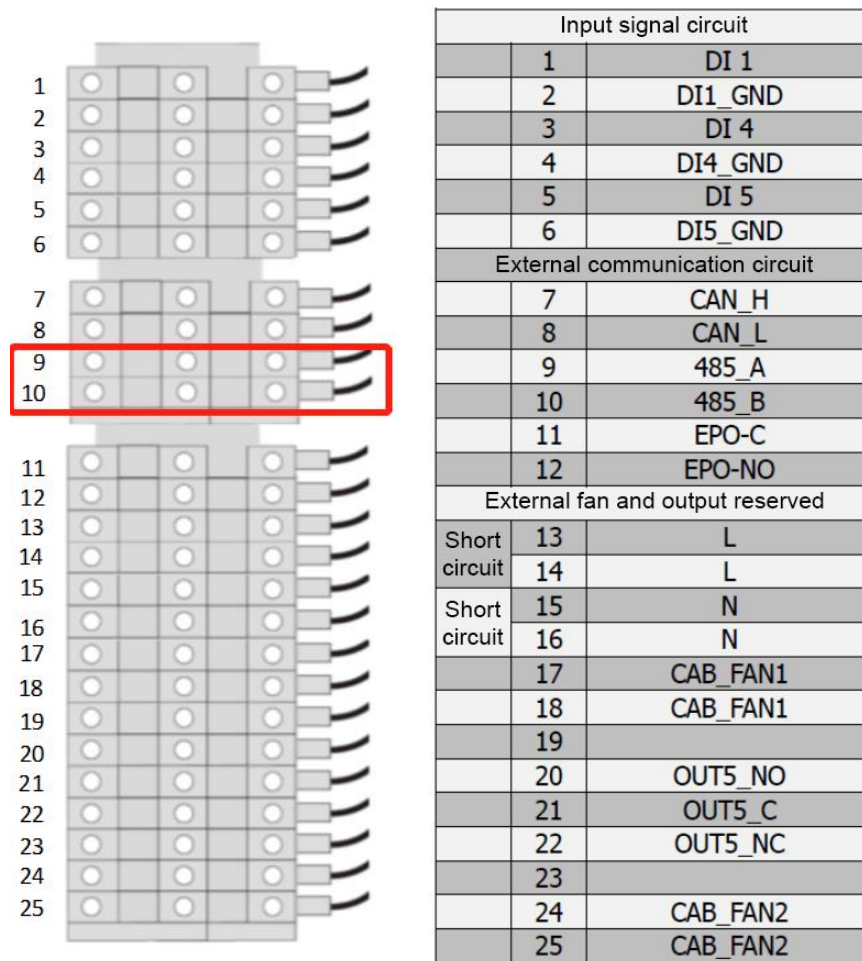


Figure 6.12 PCS RS485 communication terminal

The Ethernet port

The monitoring screen integrates Ethernet interface with RJ25, supporting Modbus TCP/IP protocol and its own IP address. An Ethernet connection requires a switch and a fixed IP. The connection cable is a network cable or twisted pair cable. Connect multiple PCS network outlets to the switch, and connect the switch to the remote monitoring computer. Set corresponding IP address and port number in the monitoring computer can realize real-time monitoring and control of the status of the PCS. Please refer to the figure above.

6.4.2 Connect to the BMS communication via RS485 or CAN

When the PCS is directly connected to the BMS, RS485 or CAN communication can be selected, as shown in the figure below.

If the BMS uses an Ethernet communication port, an Ethernet-CAN protocol converter is required. Ethernet-CAN protocol converter is beyond its scope and must be purchased by the customer. The PCS communicates with the Battery Management Unit (BMS) to monitor the battery status information, issue alarms according to the battery status and provide fault protection for the battery, improving the battery safety. It supports CAN communication and sees the location number of the CAN communication interface on the back of the touchscreen. It is led to the 7 and 8 of the

terminal row ports.

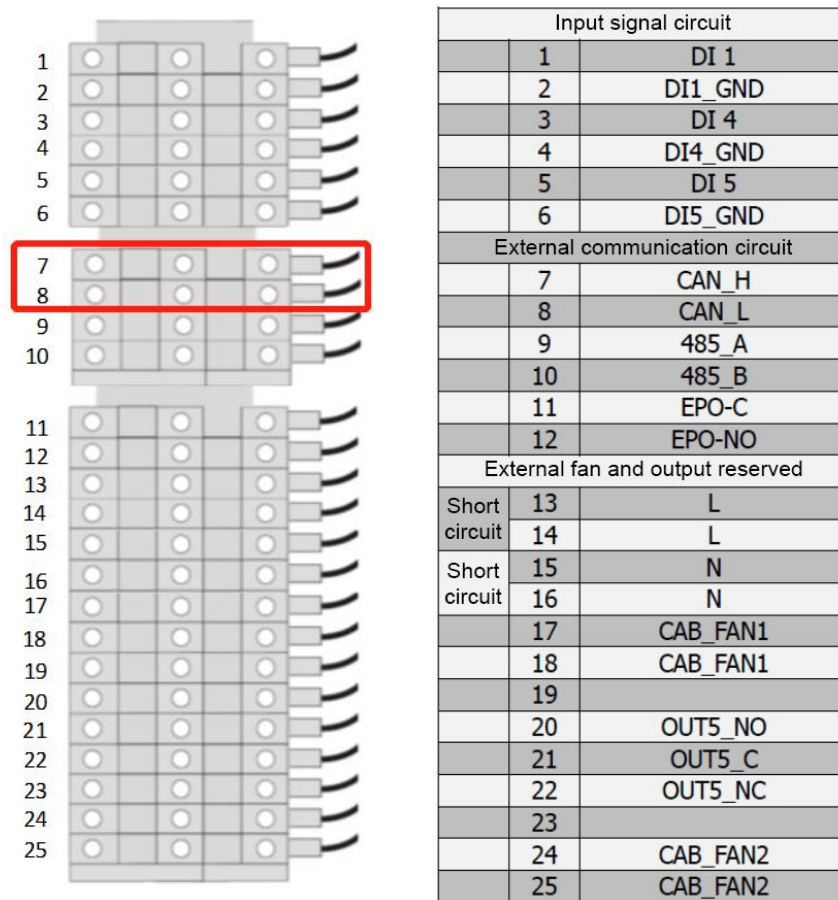


Figure 6.13 CAN communication terminal of optical storage

6.5 Check after the installation

After the installation of the PCS, please follow the inspection list in the installation manual.

Failure to meet the requirements in the inspection list may fail the warranty after installation.

7. Functional description

7.1 Operating status

7.1.1 Overview of the operating status

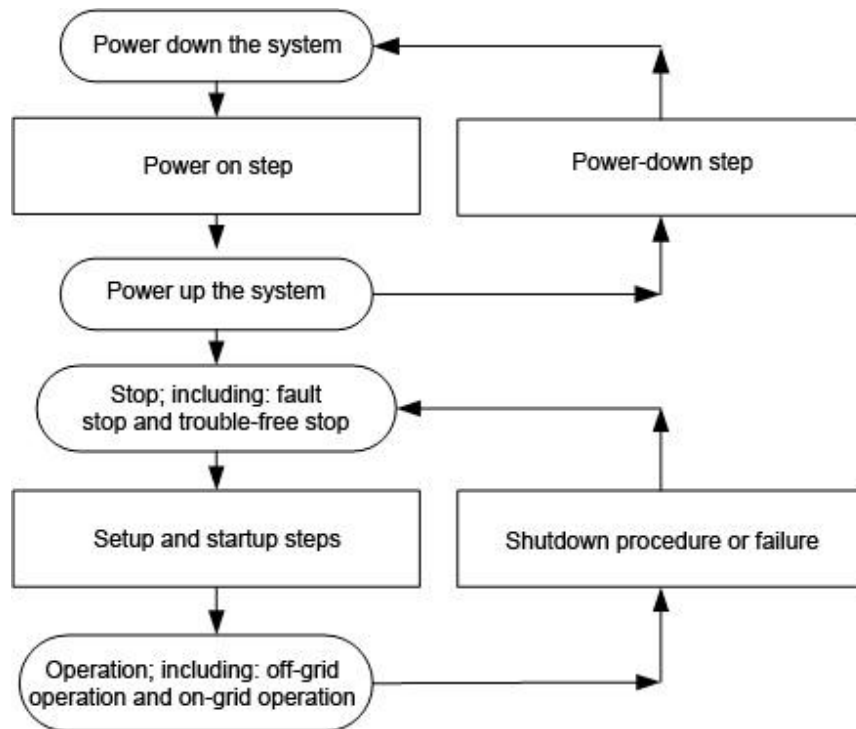


Figure 7.1 State flow chart

See the device status description in the table below:

Table 7-1 Status of PCS

Status	Condition	Running state
Power down	Disconnect AC and DC switch	The lights on the device are all off
Power on/up	Close the AC or DC switch	The power light on the device is on
Stop	The AC switch is closed, the DC switch is closed, and the device is not running	The power green light is always on, the running light is off, and the fault light is off
Running	The equipment is in on-grid operation and off-grid operation	Power green light is on, running light is on
Grid-connected	The current device has no alarm and is set to grid-connected mode, at this time the device can accept the start command	The green light of the power supply is always on, and the green light of the module is always on.
Off-grid	The current device has no alarm and is set to off-grid mode, at this time the device can accept the start command	The green light of the power supply is always on, and the green light of the module is always on.
Boot up	Send the boot command to the equipment	The power green light is always on, and the equipment operation light is on
Fault	There is currently an alarm	The fault light is always on, the red light of the module flashes quickly, and the buzzer

		sends out an alarm
Shut down	Send a shutdown command to the device	The running light is off, and the green light of the module flashes slowly.

7.1.2 Operating status of models without STS module

After all the wiring of the equipment is completed and checked, close the AC and DC switch on the cabinet with no alarm, and the PCS can accept different mode settings.

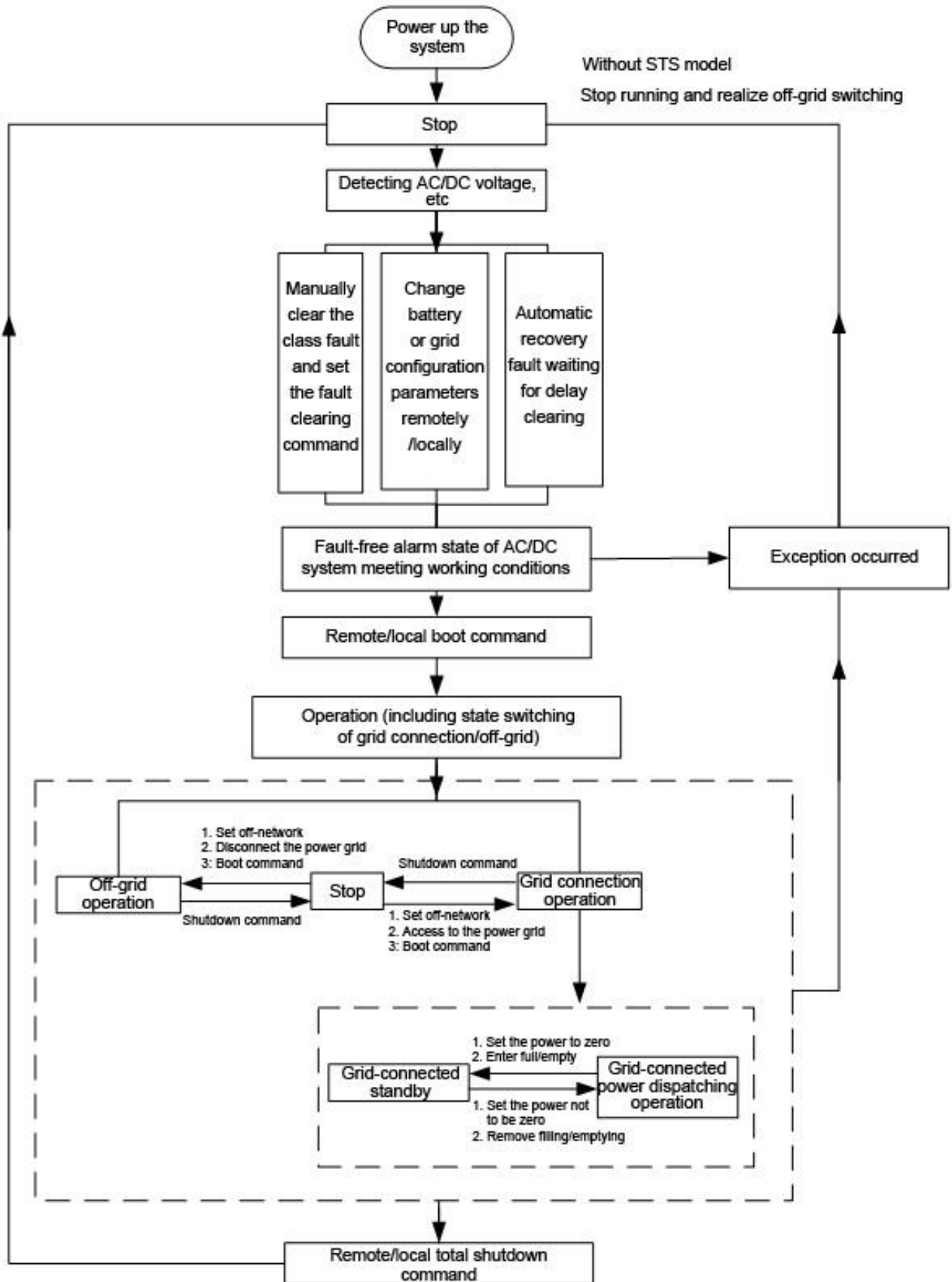


Figure 7.2 State flow chart of PCS without STS module

7.1.3 Model status with STS module

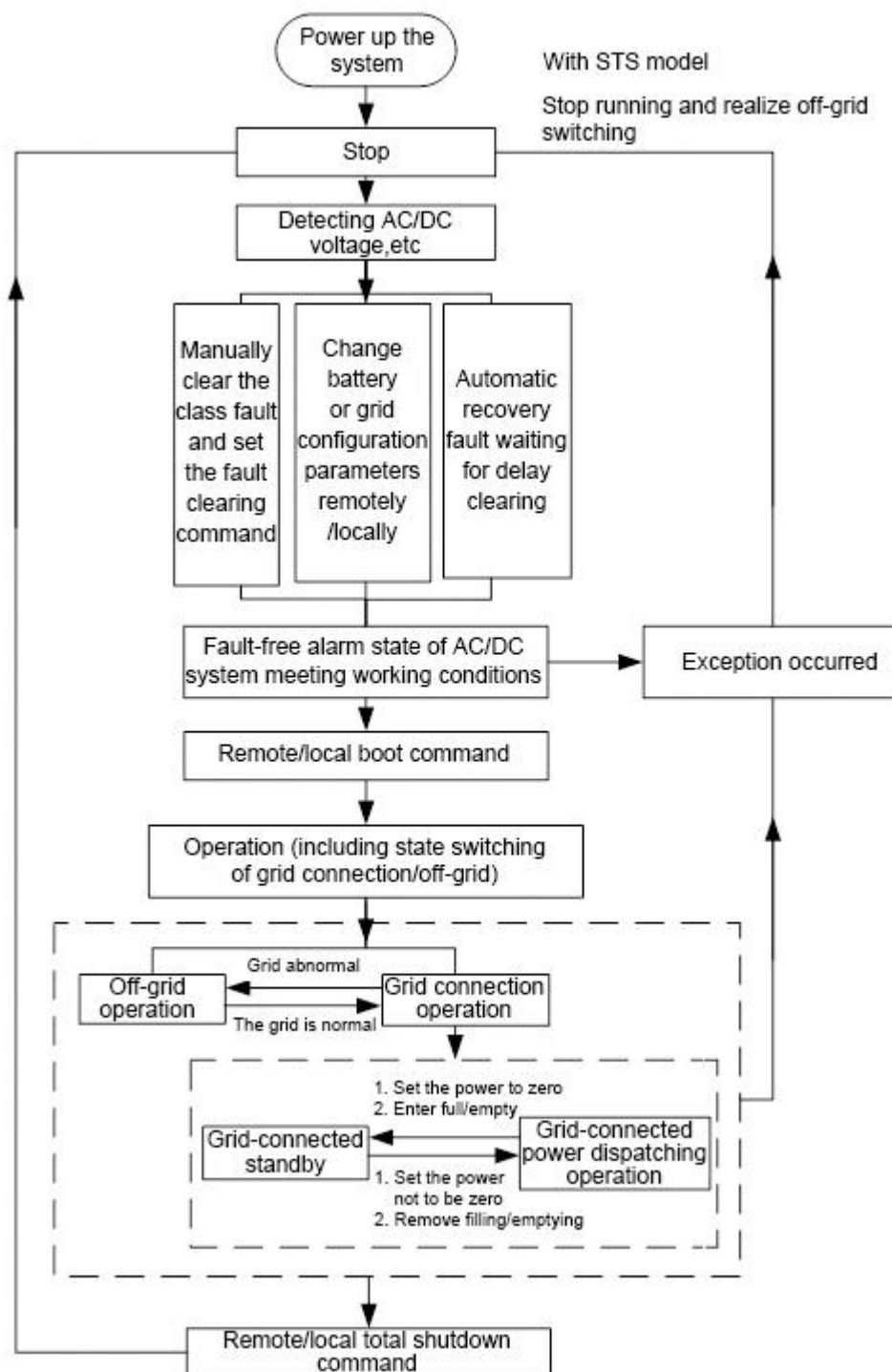


Figure 7.3 State flow chart of PCS with STS module

8. Operation Instructions

8.1 Safety instructions

Incorrect battery parameter setting will interfere with the normal operation of the device, so it needs to be set according to actual parameters;

It is necessary to ensure that the voltage level of the connected AC complies with the current allowable access range of the equipment;

It is necessary to ensure that professionals operate, otherwise it may be dangerous

8.2 Power-on operation steps

Initial power-on operation:

- 1) According to the inspection steps in the installation manual, confirm whether the AC and DC cables are tightly connected;
- 2) Test the insulation withstand voltage according to international or local standards. The following are the parts that need to be measured: positive pole to ground, negative pole to ground;
- 3) Measure and confirm the AC side voltage of the power grid, the DC voltage of the battery, and the DC voltage of the photovoltaic;
- 4) Please make sure that the AC voltage, battery DC voltage, and photovoltaic DC voltage are within the normal range of the equipment specification, and then close the switches in sequence;

Each power-on operation:

- 1) Check whether the EPO button is in the reset state; if not, please turn the button clockwise to reset;
- 2) Close the AC and DC switches in sequence;

First close the AC switch, and then close the DC switch. Please refer to the figure below for the power-on sequence:

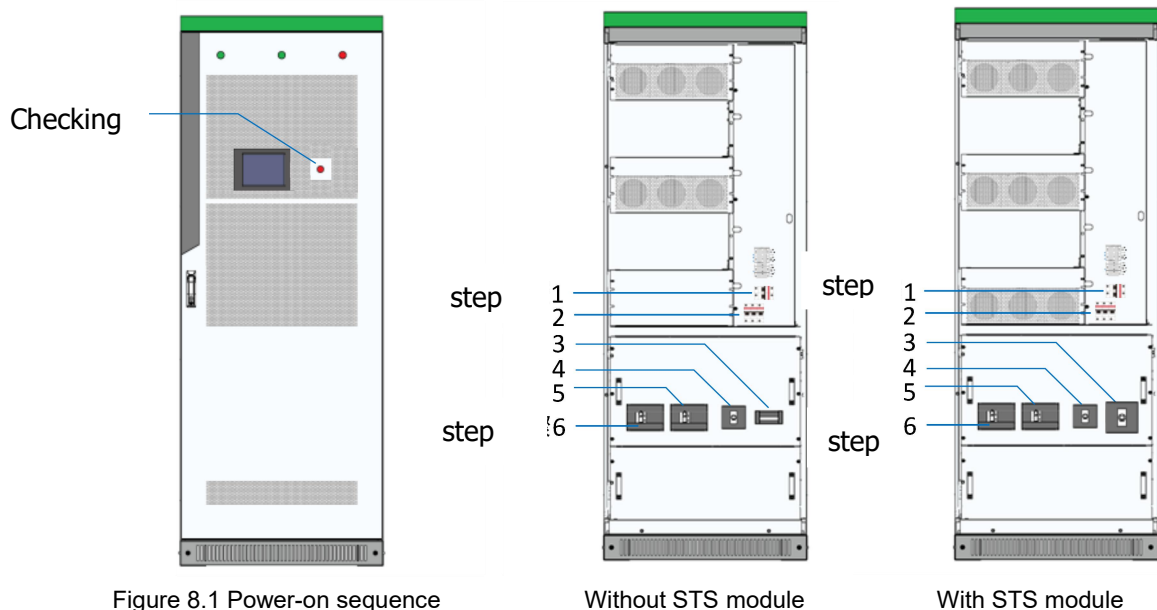


Figure 8.1 Power-on sequence

Without STS module

With STS module

Step	without STS module	with STS module
1	Auxiliary power switch	Auxiliary power switch
2	Surge protector switch	Surge protector switch
3	AC soft start switch	AC switch on the grid side
4	AC switch	Load side AC switch
5	Battery DC switch	Battery DC switch
6	Photovoltaic DC switch	Photovoltaic DC switch

Fig.8.2 Power-on sequence for inverter models without STS module:

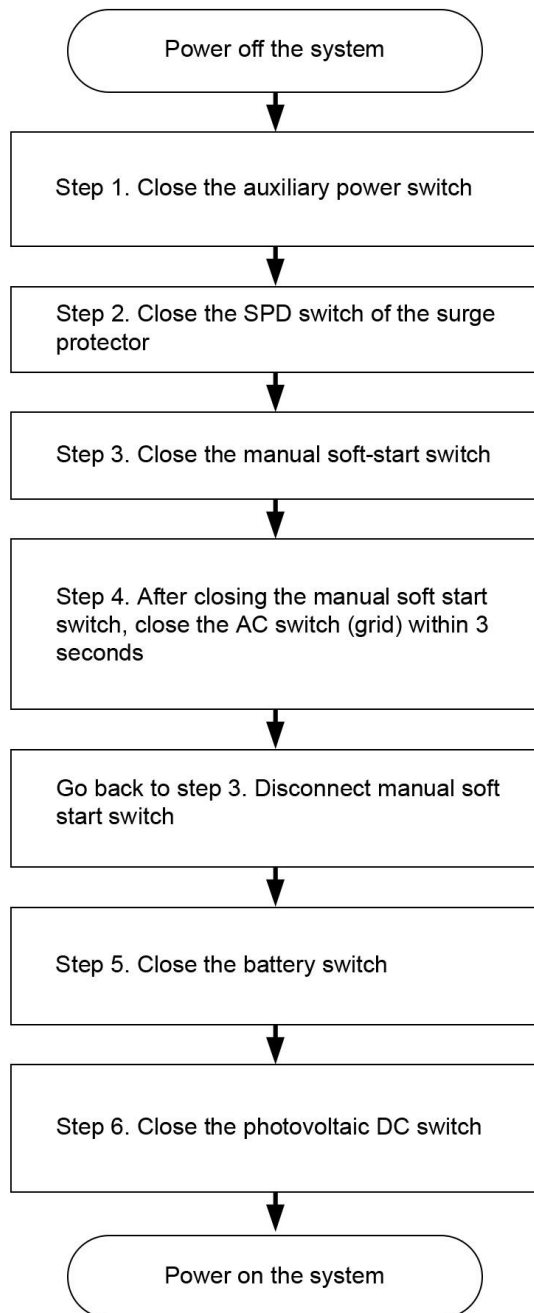
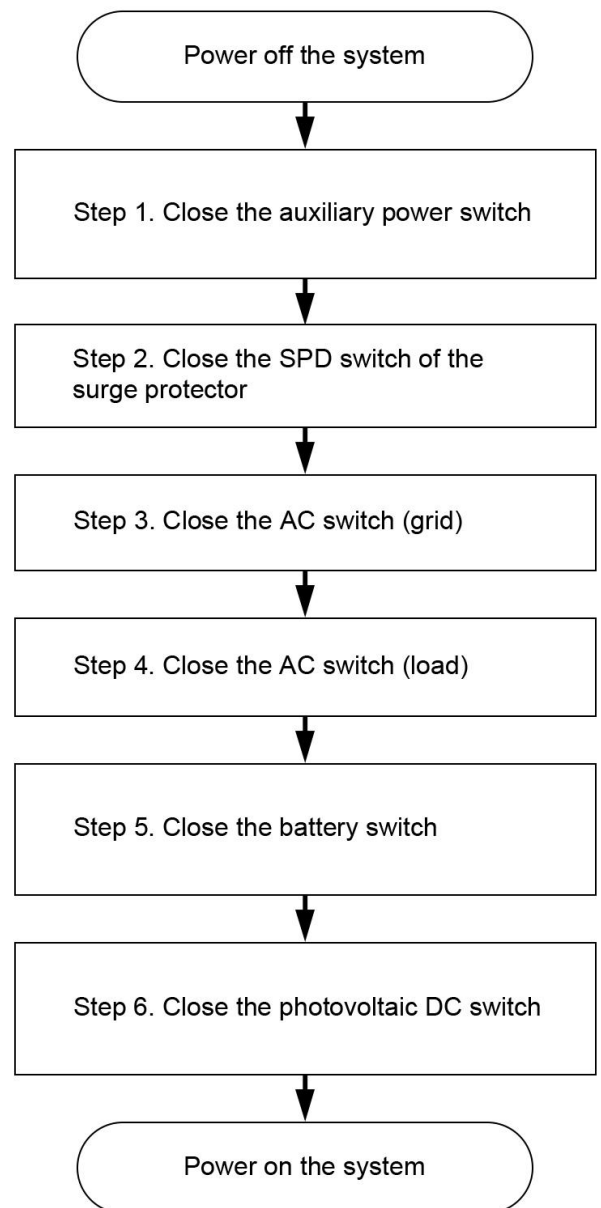


Fig.8.3 Power-on sequence for inverter models with STS module:



8.3 Setup steps before start up

8.3.1 Touch screen

When the device is powered on, the monitoring screen on the cabinet door will display the following interface:

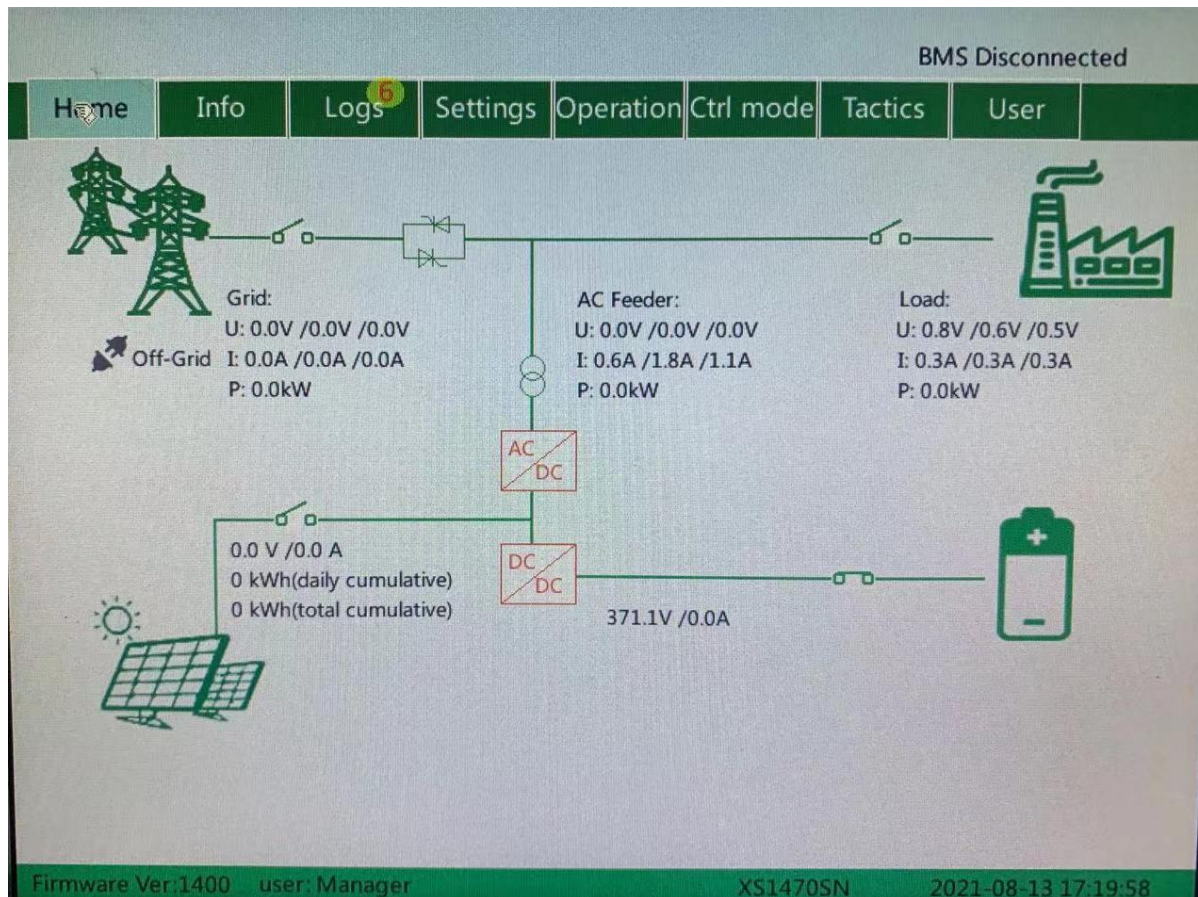


Figure 8.4 Example of Main Interface

Please refer to the attachment file "12.1 Touch Screen Activation" for detailed menu information

8.3.2 Login control interface

1. Click "User" to enter the login interface
2. Enter the password "123456789", and then click Login;

8.3.3 Select the Control mode

The structure of the main menu is different under different "Control mode".

Select the control mode:

1. select "User" and enter the password to log in on the interface;
2. select Control mode > Local manual;

At this time, the setting selection interface will become visible.

8.3.4 Settings

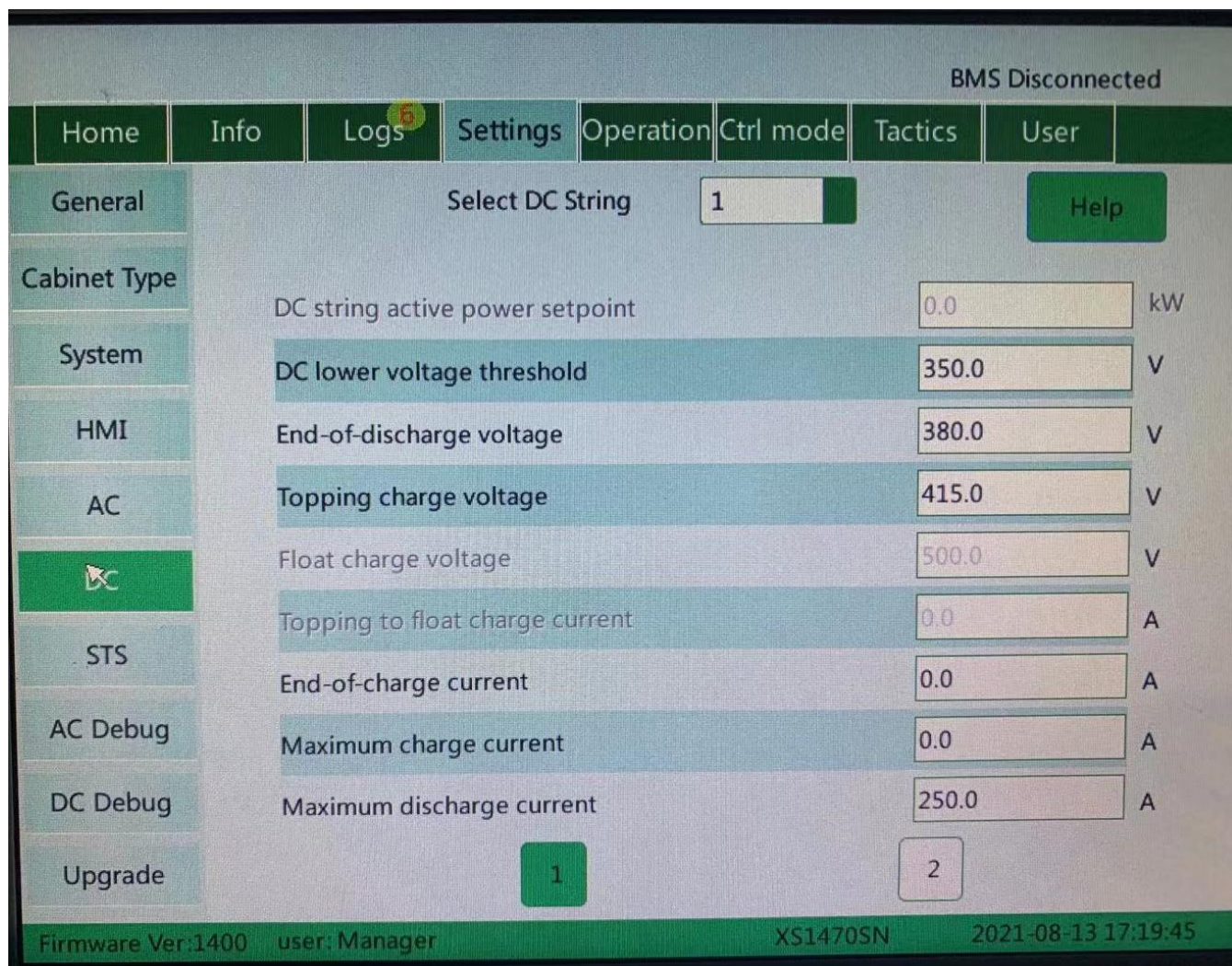


Figure 8.5 Example of the setup interface

There are general settings and advanced settings, which are commonly set in the "Settings" option. Users should set the "DC Configuration" according to the voltage and current requirements recommended by battery manufacturers.

See Appendix 1 12.4 Parameter Settings for detailed advanced settings.

8.3.5 Communication settings

1. Operating steps:
2. If you don't see the setting options, please do the following first:
3. select User > enter password > login
4. select Control mode > Local manual;
5. select Settings > Advanced settings > Monitoring parameters
6. You can set IP address, gateway, subnet mask, baud rate, etc. as needed;
7. If there are multiple devices on site, it is necessary to set different modbus device addresses to distinguish them.

8.4 Manually start the step

Check before startup:

1. select "User" and log in to the control interface on the touch screen with your password.
2. select Control mode > Local manual
3. select "Settings" > "General settings" > Power scheduling, and set the active power of the equipment as required, with positive value for charging and negative value for discharging.
4. select "Operation " > "Total power on"

See Appendix 1 12.7 Manual Start for detailed menu description.

8.5 Start up step

1. select "User" and log in to the control interface on the touch screen with your password.
2. select Control mode > Local manual
3. select Settings > System parameters > Startup mode > Automatic startup
4. select Control mode > Local automatic

See appendix 1 12.8 automatic start for detailed menu description.

8.6 Remote Start Step

1. select "User" and log in to the control interface on the touch screen with your password.
2. select Control mode > Remote control
3. After remote control is selected, the control of PCS is controlled by background software.

See appendix 1 12.9 automatic start for detailed menu description.

8.7 Shutdown step

During the normal operation of the PCS, if it needs to be turned off, the following steps can be performed.

Remote shutdown procedure

1. PCS is working in remote control mode, and the background software sends the shutdown command to PCS;

Manual shutdown procedure

1. after logging in, select local manual mode from Control mode > Local manual
2. select "Operation " > "Total shutdown" to stop PCS manually.

See Appendix 1 12.10 Shutdown Procedure for detailed menu description.

8.8 Power off the system

When the PCS is in a stopped state, disconnect the AC and DC connections.

- 1) Manually or remotely send the "Total Shutdown" command to the PCS to stop the PCS from running;
- 2) Turn the AC switch to the off position;
- 3) Turn the battery switch and photovoltaic switch to the off position;

For detailed operation, please refer to Appendix 1. 12.11 Power off the system

8.9 Emergency shutdown

When the device is running abnormally, please press the red "EPO" emergency stop button on the cabinet door, and the device will stop running immediately.

To prevent personal injury, if the equipment is maintained or the cover plate is opened, use a multimeter to measure the voltage of the input terminal of the equipment. Make sure that there is no AC or DC side and there is no electricity before carrying out relevant operations!

It must be 15 minutes later, when the internal capacitance of the equipment is completely discharged, before touching the live metal part.

9. Trouble Shooting

9.1 Safety precautions

There may be a risk of electric shock due to high voltage

Under fault conditions, the product may have high voltages. Touching live parts of the device may cause danger or death

May cause serious injury due to electric shock.

When operating the product, please observe all safety information.

When performing product maintenance, wear appropriate personal protective equipment.

If you still cannot solve the problem through this document, please contact the manufacturer.

9.2 Export equipment operating data

When the log needs to be sent to the manufacturer for analysis, the device operation record needs to be downloaded.

Insert the FAST 32 format U disk into the USB port on the back of the touch screen.

1. Select "User" and use the password to log in to the control interface on the touch screen.
2. Select "Control mode"> "Local Manual";
3. Select "Event Records"> "Download Records"> "Download All Records". When the download is complete, you can unplug the U disk.

9.3 Common fault description

The following table shows the failure caused by the incorrect parameter settings.

The user can reset the parameters as described in the appendix, and the fault can be resolved automatically.

Alarm classification:

Fault: Shut down.

Warning: alarm but not shut down;

Alarm clearing method:

Auto: After the cause of the alarm disappears, the alarm is automatically cleared.

Manual: After the cause of the alarm disappears, you need to manually send the alarm clear command.

Power off: After the alarm disappears, you need to turn off the power and restart.

Alarm classification + clearing method (abbreviated as A.C. (automatic clearing) + C.M. (manual clearing)):

Fault + automatic

Fault + manual

Fault + power failure

Warning + automatic

Warning + shutdown

Table 9-1

Fault name	A.C.+C.M	Reason
AC bus over-voltage	A.C.	AC bus voltage is higher than the set value of over-voltage protection
AC bus under-voltage	A.C.	AC bus voltage is lower than the set value of over-voltage protection
AC bus over frequency	A.C.	AC bus frequency is higher than the set value of over-frequency protection
AC bus under frequency	A.C.	AC bus frequency is lower than the under-frequency protection setting value
AC over-voltage	A.C.	The current grid voltage is higher than the set value of over-voltage protection
Grid under-voltage	A.C.	The current grid voltage is lower than the set value of under-voltage protection
Grid over frequency	A.C.	The current grid frequency is higher than the over-frequency protection setting value
Grid under-frequency	A.C.	The current grid frequency is lower than the under-frequency protection setting value
DC input over-voltage	A.C.	The current DC voltage of the device is higher than the upper limit of the DC voltage
DC input under-voltage	A.C.	The current DC voltage of the device is lower than the lower limit of the DC voltage or the DC voltage is not connected
DC bus over-voltage	A.C.	When the module is running, the voltage on the DC bus capacitor is too high
DC bus under-voltage	A.C.	When the module is running, the capacitor voltage on the DC bus is too low
Low battery energy	A.C.	1. Receive the battery empty signal transmitted by the BMS in the off-grid state;
The parameters do not match	A.C.	2. In the off-grid state, the DC voltage is lower than the discharge termination voltage;

9.4 Detailed troubleshooting

Please refer to Annex 1 for detailed troubleshooting

10. Maintenance

10.1 Safety during maintenance

There is high voltage in the live parts of the product. Touching electrification may result in death or serious electric shock damage.

Wear appropriate personal protective equipment during maintenance.

Do not touch any live parts.

View all warning messages in products and documents.

Please observe all safety information provided by the battery manufacturer.

Before performing any work, be sure to disconnect the external power equipment from the optical storage machine:

- grid voltage fed by the grid

- Internal power supply

- DC voltage of battery

Additional external voltages, such as control signals from the control room

Ensure that disconnected devices cannot be automatically connected.

After turning off the equipment, wait at least 15 minutes before turning it on, so that the capacitor can be completely discharged.

Before operating, make sure that all components are completely free of voltage.

Cover or isolate any adjacent live components.

Avoid product damage caused by dust intrusion and moisture penetration

The intrusion of dust or moisture will damage the product and affect its function.

Only perform maintenance work when the environment is dry and dust-free.

Product maintenance is allowed only when the product is closed.

Reconnect the external power supply after installing the product.

If the installation or debugging process is interrupted, please install all baffles. Close and lock the chassis.

Store the product in a dry area.

10.2 Maintenance plan and spare parts

10.2.1 Operating environment requirements

The equipment installation environment must meet the requirements of the operating environment

required by the equipment:

Permissible ambient temperature: -20~55°C (if the temperature exceeds 45°C, the power will be derated)

Permissible relative humidity: 0 ~ 95% (non-condensing)

Maximum allowable height: 3,000 meters

Note: When the maximum height is exceeded, the PCS will derate the output.

For specific derating factors, please consult the customer service center.

10.2.2 Electrical and fixed connection inspection

After it is put into operation, the electrical and fixed parts of the equipment are regularly inspected. This inspection is best performed every three months. A record of each inspection shall be carried out.

- Ground connection;
- The module grounding connection;
- Electrical connection of the DC input;
- Electrical connection for AC input;
- Electrical connection of the auxiliary power supply;
- Connection of the communication cable
- The AC/ DC Switches, the SPD, and the fan.

Access the fault information recorded by the monitoring screen.

10.2.3 Clean it up and clean it up

Clean their copper strips, dust and debris in their terminals and mesh before the equipment is put into operation.

After the equipment is put into operation, the dust in the machine room shall be cleaned regularly. Check whether the ventilation and exhaust facilities of the machine room are normal. Cleaning is recommended once every three months.

10.3 Maintenance work

- Maintenance intervals shall be shortened in severe environmental conditions
- Site location and environmental conditions can affect the maintenance intervals. Pay attention to the cleaning and corrosion prevention.
- More frequent maintenance may be required, with specific frequency depending on the conditions on site.

- If DC distribution components are susceptible to harsh environmental conditions, it is recommended to shorten maintenance intervals.
- We recommend regular appearance inspections to determine if maintenance is required.

Consumables and maintenance materials;

Consumables and maintenance materials are not included in the standard equipment list;

Only professionals or qualified electrical personnel can conduct the operation;

Live-line maintenance work;

View history;

Read error messages and warnings;

Check the DC switchgear;

Check the AC switchgear;

Check the fan;

Un-live maintenance;

View the history;

Conduct the appearance inspection;

Clean the ventilation baffle;

Clean the air pipes and ventilation pipes;

Check the interior;

Check the bolt connection of the power cord;

Check the label;

Check the latches, door guards, and hinges;

Check the SPD(surge protection device);

11. Contact

If you have technical problems with our product, please call the service hotline. Please provide the following information to provide you with the necessary assistance.

- Model number of the equipment
- Device serial number
- Specification parameters of the battery
- Information on the PV modules
- Current alarm information for the device
- Current communication and DC information for the device
- Software version of the device

12. Software Version of The Device

12.1 The Touch screen is activated

Operation control can be performed through HMI (Human Machine Interface). This section introduces HMI display contents and settable parameters.

Before logging in with password, you can always see **"Home"**, **" Information"**, **"Logs"** and **"User"**. The detailed menu structure is shown in the following sections.

12.1.1 Main menu structure before logging in

After the system starts up and the touch screen can display normally, all these information can be seen.

Before logging in, you can see **"Home"**, **" Information"**, **"Logs"** and **"User"** menus in the main menu structure.

12.1.1.1 Home

After initialization, the Home is displayed. The AC/DC voltage and current of the system can be seen in the system topology of the main wiring diagram, and the general system state can be seen.

1. start the PCS user interface
2. Select **"Home"**

12.1.1.2 Information

1. start the PCS user interface.
2. select Home > system information

On the **"System Information"** page, the user can get an overview of the operating parameters of the whole system.

Under the **"System information"** menu, you can see the branch menus **"DC information"**, **"AC information"**, **"Power grid information"**, **"Load information"**, **"Module status"** and **"BMS"**

Users can view detailed information under each menu

"DC Information" shows the status of the DC bus to which the battery or photovoltaic is connected.

"DC voltage (v)", **"DC current (a)"**, **"DC power (kW)"**, **"Running state"**, **"Alarm state"**, **"Empty open state"** and **"Bus voltage (v)"** can be seen under the **"DC information"** menu..

"AC information" shows the status of AC output. When there is no STS or other grid-connected/off-grid switching equipment, **"grid-connected information"** is **"communication information"** in the grid-connected state; **"Load information"** is **"communication information"** in the off-grid state.

The **"Voltage (v)"**, **"Current (a)"**, **"Active power (kW)"**, **"Reactive power (kVar)"**, **"Apparent power (KVa)"** and **"Power factor"** information of each live wire in three-phase **"L1"**, **"L2"** and **"L3"** are listed in the **"AC information"**.

"Total active power (kW)", **"Total reactive power (kVar)"**, **"Total apparent power (KVa)"**, **"Frequency (Hz)"**, **"Active charging capacity (kWh)"** and **"Active discharging capacity (kWh)"**

can also be displayed under the menu **"Communication information"**.

"Active charging capacity (kWh)" and **"Active discharging capacity energy (kWh)"** are special information related to PCS charging/discharging. These two information will not be displayed in **"Grid Connection Information"** and **"Load Information"**.

When the system is a system without STS or other on-grid/off-grid switching equipment, the **"Grid Information"** and **"Load Information"** menus are not visible.

When the system is a system with STS or other switching equipment, the **"Communication Information"** parameter is different from the **"Grid Information"** in the process of switching from the grid-connected state to the off-grid state. In the process of switching from off-grid to grid-connected, the **"Aommunication information"** parameter is different from the **"Load information"**.

The **"Voltage (V)"**, **"Current (A)"**, **"Active power (kW)"**, **"Reactive power (kVar)"** and **"Apparent power (KVa) of each live wire in the three-phase "L1", "L2" and "L3")"** **"Power factor"** information is also described in the list of **"Grid Information"** and **"Load Information"**.

However, **"active charge power (kWh)"** and **"active discharge power (kWh)"** are only displayed in **"AC information"**.

"Module status" displays the **"Version"** and **"Status"** of different AC modules and DC modules.

According to different BMS supplier brands, **"BMS"** information is different

12.1.1.3 Logs

In the **"Logs"** page, users can view **"Current Alarm"**, **"History Alarm"**, **"Operation Record"**, **"Status Record"** and **"Download Record"**.

Incident record				Remark
Current alarm	Serial number	Alarm name	Starting time	End Time
Historical alarm	Serial number	Alarm name	Starting time	End Time
Operation record	Serial number	name	time	Operate
Status record	Serial number	name	time	Status
Download record	Download Status: Download all records			Not visible before the landing

12.1.2 Log in to the control interface

1. Select **"User"** and use the password to log in to the control interface on the touch screen.
2. Users can obtain passwords from authorized persons/groups/agents, etc.

The login password 123456789 can obtain the administrator authority.

12.2 Main Menu Structure After Being Logged In

Main menu			Remark
Home	/		System topology diagram
Information	Dc information		
	Exchange information		
	Grid information		When the system does not have STS or other on-grid/off switching equipment, this menu is not visible
	Load information		When the system does not have STS or other on-grid/off switching equipment, this menu is not visible
	Module status		
	BMS		
Logs	Current alarm		
	Historical alarm		
	Operation record		
	Status record		
	Download record		The menu is not visible before you log in
Settings	General settings		You can only see the "System Settings" menu when you select "Local Remote"> "Local Manual" mode
	Advanced setup	Model selection	
		system parameter	
		Monitoring parameters	
		Ac parameters	
		Dc parameters	
		STS STS	When the system does not have STS or other on-grid/off switching equipment, this menu is not visible
Operation	Total power on		You can see the "Operation Command" menu only when you select "Local Remote"> "Local Manual" mode
	Total shutdown		
	Grid-connected		
	Off-grid		
	Clear fault		
Ctrl mode	Local manual		"System Settings" is visible in this mode "Operation commands" are visible in this mode "Control Strategy" is visible in this mode
	Local automatic		"System Settings" is not visible in this mode "Operation Commands" are not visible in this

			mode "Control Strategy" is visible in this mode
	remote control		"System Settings" is not visible in this mode "Operation Commands" are not visible in this mode "Control Strategy" is not visible in this mode
Tactics	Strategy description		
	Grid-connected strategy		
	48-segment configuration		
	Optional accessories		
User	Please enter the password		

12.3 Control mode

The main menu structure can be different in different "Control mode" settings.

Configure "Control mode"

1. Select "User" and use the password to log in to the control interface on the touch screen.
2. Select "Control mode"> "Local Manual"
3. Select "Control mode"> "Local Automatic"
4. Select "Control mode"> "Remote Control"

12.4 Settings

You can see "Settings" only when you select "Control mode"> "Local Manual" mode

When the system is in "Local Auto" or "Remote Control" mode, "System Settings" is invisible and no configuration is required.

12.4.1 System Settings menu

The "System Settings" menu includes "General Settings" and "Advanced Settings"

The branch menu of "General Settings" is as follows

General settings	Setting parameters	Remark
Active power setpoint	-770.0~+770.0KW;Default 0.0	
Reactive power setpoint	+:Lag;-:lead;-770.0~+770.0kVar;Default 0.0	
DC lower voltage threshold	30.0~800.0V;Default 300.0V for NKGP series models 500.0~850.0 V ; Default 630.0V for NKGP series models	
End-of-discharge voltage	30.00~900.00V; Default 300.0	
Topping charge voltage	30.0~800.0V; Default 300.0V for NKGP series	

	models 500.0~850.0 V ; Default 750.0V for NKGP series models
Float charge voltage	30.0~800.0V; Default 300.0V for NKGP series models 500.0~850.0 V ; Default 750.0V for NKGP series models
Topping to float charge current	0.0~250.0A; Default 0.0
End-of-charge current	0.0~250.0A; Default 0.0
Maximum charge current	0.0~1500.0A; Default 50.0
maximum discharge current	0.0~1500.0A; Default 50.0
Help	Volt-ampere curve and other guidance
The "Advanced Settings" menu includes "Model Selection", "System Parameters", "Monitoring Parameters", "AC Parameters", "DC Parameters" and "STS".	

Only when the system has STS modules or other switching devices can you see the STS menu.

The branch menu is as follows:

Advanced settings	Setting parameters	
Model selection	Model setting	Factory default settings
	Certification standards	Factory default settings
	DC connection type	Factory default settings
	Inverter type	Factory default settings
	Rated frequency level	Factory default settings
	Rated voltage level	Factory default settings
	Rack ID	Factory default settings
	Operating mode	Factory default settings
	Soft start mode	Factory default settings
	Control parameter 3 application	Factory default settings /See interface notes for details
System parameters		
1	Start method	Manual boot/auto boot
	Energy scheduling mode	AC dispatch/DC dispatch
	DC parameter setting method	Unified setting / separate setting
	Off-grid neutral point grounding function	Disable/enable
	Control parameter 1	/
	Control parameter 2	/
2	Control parameter 4	/
	Control parameters 5	/
	Control parameters 6	/
	Control parameters 7	/

	Charging power error	/
	Discharge power error	/
	product type	Default standard model
Monitoring parameters		
1	System time setting	Yyyy-mm-dd-hh-mm-ss
	IP settings	/
	Gateway	/
	Subnet mask	/
	Modbus device address	1~247
	Communication baud rate	19200/9600
	The BMS limit takes effect	Disable/enable
	BMS protocol type	Juwei/Nandu/GCL/Xinwangda/Wotai/Pineng /Gote/Others
	Language	English/Simplified Chinese
	Restore factory settings	/
	Screen calibration	/
	Modify MAC	/
2	Backlight delay setting (min)	0~120 (min)
	BMS timeout time (s)	0~600(s)
	485 remote timeout time (s)	0~600(s)
	TCP remote timeout (s)	0~600(s)
	Recording interval (min)	/
	104 Device address	/
AC parameters		
1	Power factor setpoint	+:Lag,-:Lead,m-1.00~+1.00;default 1.00
	Active power setpoint	-770.0~+770.-.kW, default 0.0
	Reactive power setpoint	+:Lag,-:Lead,-770.0~770.0kVar, default 0.0
	Grid restoration delay	0.00~600.00s,default 20s
	Power change rate	0.01~2.00/s, default 1.00
	Grid reconnection power change rate	
	Off-grid AC voltage regulation	-0.10~+0.10,default 0.00
2	Reactive power control mode	Constant power factor control/constant reactive power control/voltage regulation reactive power
	Active power control mode	Set active mode/voltage active adjustment/frequency active adjustment/voltage and frequency active adjustment
	Island monitoring enable	Do not enable/enable
	Power change mode	Step/slope
	Voltage frequency crossing enable	Do not enable/enable
	Voltage frequency cross current limit	Not enabled

enable		
	Off-grid voltage start mode	Step/soft start
3	Over-voltage protection I section voltage ratio	USA: 1.05~1.25; CHN: 1.05~1.35; Australia: 1.05~1.20; UK: 1.05~1.35; default 1.15
	Over-voltage protection I protection time	USA: 0.01~13.00; CHN: 0.01~13.00; Australia: 0.01~2.00; UK: 0.01~13.00; default 1.00
	Over-voltage protection stage II voltage ratio	USA: 1.05~1.25; CHN: 1.05~1.35; Australia: 1.05~1.25; UK: 1.05~1.35; default 1.20
	Over-voltage protection stage II protection time	USA: 0.01~2.00; CHN: 0.01~1.00; Australia: 0.01~0.50; UK: 0.01~1.00; default 0.10
	Voltage ratio of under-voltage protection section I	USA: 0.45~0.95; CHN: 0.50~0.85; Australia: 0.50~0.85; UK: 0.45~0.95; " Default 0.80
	Under-voltage protection I protection time	USA: 0~21.00; CHN: 0.01~5.00; Australia: 0~5.00; UK: 0.01~5.00; Default 2.00
	Under-voltage protection II voltage ratio	USA: 0.45~0.95; CHN: 0.20~0.50; Australia: /; UK: 0.45~0.95; Default 0.60
	Under-voltage protection stage II protection time	USA: 0.01~11.00; CHN: 0.01~1.00; Australia: /; UK: 0.01~1.00; Default 1.00
	Under-voltage protection III voltage ratio	USA: 0.45~0.95; CHN: /; Australia: /; UK: /; Default 0.45
	Under-voltage protection III protection time	USA: 0~1.00; CHN: /; Australia: /; UK: /; Default 0.16
4	Over-frequency protection section I protection frequency	USA: 0.10~4.50; CHN: 0.10~3.00; Australia: 0.10~3.00; UK: 0.10~3.00; Default 0.50
	Over-frequency protection section I protection time	USA: 0.01~300.00; CHN: 0.01~300.00; Australia: 0.01~5.00; UK: 0.01~300.00; Default 2.00
	Section II protection frequency of over-frequency protection	USA: 0.10~4.50; CHN: 0.10~3.00; Australia: /; UK: /; Default 2.00
	Over-frequency protection section II protection time	USA: 0.00~10.00; CHN: 0.00~10.00; Australia: /; UK: 0.00~10.00; Default 0.16

	Under-frequency protection section I protection frequency	USA: - 4.50~-0.10; CHN: - 4.50~-0.10; Australia: - 5.00~-0.10; UK: - 4.50~-0.10; default-0.50
	Section I protection time of under-frequency protection	USA: 0.00~600.00; CHN: 0.00~600.00; Australia: 0.01~5.00; UK: 0.00~600.00; default 2.00
	Under-frequency protection section II protection frequency	USA: - 4.50~-0.10; CHN: - 4.50~-0.10; Australia: /; UK: - 4.50~-0.10; default-3.00
	Section II protection time of under-frequency protection	USA: 0.00~10.00; CHN: 0.00~10.00; Australia: /; UK: 0.00~10.00; Default 0.16
5	Over-voltage crossing section I voltage ratio	USA: 1.10~1.20; CHN: /; Australia: /; UK: /; default 1.10
	Over-pressure crosses I period of time	USA: 0.00~13.00; CHN: /; Australia: /; UK: /; Default 12.00
	Over-voltage crossing section II voltage ratio	USA: 1.10~1.20; CHN: /; Australia: /; UK: /; Default 1.20
	Over-pressure crossing period II	USA: 0.00~0.16; CHN: /; Australia: /; UK: /; default 0.10
	Under-voltage ride-through voltage ratio of section I	USA: 0.50~0.88; CHN: /; Australia: /; UK: /; default 0.80
	Under-voltage crossing I period of time	USA: 20.00~50.00; CHN: /; Australia: /; UK: /; default 20.00
	Under-voltage ride-through II voltage ratio	USA: 0.50~0.88; CHN: /; Australia: /; UK: /; default 0.60
	Under-voltage crossing period II	USA: 10.00~50.00; CHN: /; Australia: /; UK: /; default 10.00
	Under-voltage ride through section III voltage ratio	USA: 0.40~0.50; CHN: /; Australia: /; UK: /; default 0.50
	Under-voltage crossing period III	USA: 0.1~21.00; CHN: /; Australia: /; UK: /; default 1.00
6	Over-frequency crossing section I frequency	USA: 0.1~6.00; CHN: /; Australia: /; UK: /; default 3.00Hz
	Over-frequency crossing I section crossing time	USA: 20.0~1000.0; CHN: /; Australia: /; UK: /; default 299.0
	Over-frequency crossing section II frequency	USA: 0.1~6.00; CHN: /; Australia: /; UK: /; default 5.00Hz
	Over-frequency crossing section II crossing time	USA: 0.0~1000.0; CHN: /; Australia: /; UK: /; default 0.1
	Under-frequency crossing I frequency	USA: - 10~ - 0.10; CHN: /; Australia: /; UK: /; default-3.00Hz

7	Under-frequency crossing I section crossing time	USA: 20.0~1000.0; CHN: /; Australia: /; UK: /; default 299.0
	Under-frequency crossing section II frequency	USA: - 10~-0.10; CHN: /; Australia: /; UK: /; default-10.00Hz
	Cross-over Time of Under-frequency Cross-over Section II	USA: 0.0~1000.0; CHN: /; Australia: /; UK: /; default 0.1
	Voltage reactive power adjustment point V1	USA: 0.82~1.03; CHN: /; Australia: 0.82~1.03; UK: /; default 0.92
	Voltage reactive power adjustment point V2	USA: 0.90~1.05; CHN: /; Australia: 0.90~1.05; UK: /; default 0.97
	Voltage reactive power adjustment point V3	USA: 0.95~1.15; CHN: /; Australia: 0.95~1.15; UK: /; default 1.03
	Voltage reactive power adjustment point V4	USA: 0.97~1.18; CHN: /; Australia: 0.97~1.18; UK: /; default 1.07
	Reactive power regulation Q1	USA: 0.00~0.60; CHN: /; Australia: 0.00~0.60; UK: /; default 0.3
	Reactive power regulation Q2	0~0.6*Q, default 0
	Reactive power adjustment Q3	0~0.6*Q, default 0
	Reactive power regulation Q4	USA: 0.00~0.60; CHN: /; Australia: 0.00~0.60; UK: /; default 0.3
	Reaction time of voltage reactive power regulation	1~90s, default 10s
	Voltage reactive power regulation reference voltage	0.95~1.05, default 1.00
	Over-voltage drop active power initial adjustment point	USA: 1.03~1.10; CHN: /; Australia: 1.02~1.11; UK: /; default 1.06
8	Over-voltage drop active power termination adjustment point	1.04~1.10, default 1.10
	Over-voltage drop active starting power	0.00~1.00*P, default 1.00
	Over-voltage drop active termination power	0.00~1.00*P, default 0.00
	Over-voltage drop active response time	0.50~60.00s, default 10.00s
	Over-voltage drop active power recovery delay	3.00~90.00s, default 60.00s
	Over-frequency reduction active power initial adjustment point	USA: 0.01~1.00; CHN: /; Australia: 0.01~1.00; UK: /; default 0.05
	Over-frequency reduction active power adjustment slope	USA: 0.02~0.07; CHN: /; Australia: /; UK: /; default 0.05
	Over-frequency reduction active power response time	0.05~3.00s, default 0.50s
	DC parameters	
	1 Branch	1
	DC lower voltage threshold	30.0~800.0V, default 300.0

	End-of-discharge voltage	30.0~800.0V, default300.0
	Topping charge voltage	30.0~800.0V, default 500.0
	Float charge voltage	30.0~800.0V, default500.0
	Topping to float charge current	0.0~250.0A, default 0.0
	End-of-charge current	0.0~1500.0A, default 50.0
	Maximum charge current	0.0~1500.0A, default 50.0
	maximum discharge current	0.0~1500.0A, default50.0
	Help	
2	Branch	1
	DC control mode	Constant current/constant power
	DC current setting	-1500.0~1500.0A, default 0.1
	DC power setting	-1000.0~1000.0kW, default 0.1
	Discharge starting voltage	30.0~900.0V,default 30.0
	Maximum precharge current	0.0~1500.0A, default 0.0
	Precharge voltage	30.0~900.0V, default 30.0
	Pre-charging to fast charging voltage	1.0~900.0V, default1.0
	Pre-charge time	0~30000min, default 0
STS	Control parameter word 1	-32768~32767, default 0
	Control parameter word 2	-32768~32767, default 0
	Control parameter word 3	-32768~32767, default 0
	On-grid to off-grid mode	On-grid priority, off-grid can be set/On-grid priority, off-grid cannot be set

12.5 Common settings

12.5.1 Language settings

Step :

1. Select **"User"**>Please enter the password>**"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"**> **"Local Manual"**.
3. Select **"Settings"**> **"Advanced Settings"**> **"Monitoring Parameters"**> **"Language"**> **"English"** or **"Simplified Chinese"**.
4. Then a window will pop up to remind you that the system will restart, click **"Yes"** or **"OK"**.

12.5.2 Date and time settings

Step

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"**> **"Local Manual"**.
3. Select **"Settings"**> **"Advanced Settings"**> **"Monitoring Parameters"**> **"System Time Settings"**> **"Yyyy-mm-dd-hh-mm-ss"**
4. Then click **"OK"** to save or click **"Cancel"** to discard the changes.

12.5.3 Communication settings

Step:

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"**> **"Local Manual"**.
3. Select **"System Settings"**> **"Advanced Settings"**> **"Monitoring Parameters"**> **"IP Settings"** to set the PCS IP. Enter the static IP address you want to use to access the PCS.
4. Then click **"OK"** to save or click **"Cancel"** to discard the changes.
5. To change the gateway IP address of the network, please enter the IP address in **"Gateway"**.
6. To change the subnet mask of the network in the subnet mask field, enter **"Subnet Mask"**.
7. To change the Modbus address of PCS, please enter **"Modbus Device Address"**.
8. To change the baud rate of MODBUS communication, please enter **"communication baud rate"**

12.5.4 AC parameter setting

Step:

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)
2. Select **Control mode"**> **"Local Manual"**.
3. Select **"Settings"**> **"Advanced Settings"**> **"Communication Parameters"**

"Power factor setting": This setting is used to adjust the power factor of the energy storage system

"Active Power Setpoint": This setting is used to adjust the active power of the energy storage system

"Reactive Power Setpoint": This setting is used to adjust the reactive power of the energy storage system

"Grid recovery delay": Please keep the factory settings

"Power change rate": Please keep the factory setting. Use this function when setting the power change rate. The default value is 2 rated power per second, which means that the system can run to full output within 0.5 seconds.

"Off-grid AC voltage adjustment": This setting is used to adjust the off-grid AC voltage of the energy storage system

"Grid re-connection power change rate": Please keep the default configuration. The function is suitable for the situation when the system is suspended due to the abnormal voltage of the utility grid, and it is reconnected after the utility grid returns to normal. The default value is 2, which is twice the rated power per second, which means that the system recovers to full output within 0.5 seconds.

"Reactive power control mode": This setting is used to set the operating mode, constant power factor control or constant reactive power control or voltage regulation reactive power.

"Active Power Control Mode": Enable or disable active power adjustment.

"Islanding Detection Enable": Enable or disable the Anti-islanding function. For more information, please refer to UL1741 Supplement A or other similar rules on the access of distributed generation grids.

"Power change mode": Set the power change mode, step or slope. .

"Off-grid voltage start mode": Can be set to start from step or soft start.

12.5.4.1 Frequency / voltage crossing

"Frequency/voltage ride-through": frequency/voltage ride-through, which can be enabled or disabled. for details, please refer to supplementary note a of UL1741 or other similar rules concerning

access to distributed generation grid.

"Over/under-voltage ride-through I/II/III section voltage ratio": this setting is used to adjust the protection voltage of over/under-voltage ride-through

"Over-voltage/Under-voltage Crossing I/II/III Period Time": This setting is used to adjust the protection time of over-voltage/under-voltage crossing

"Over/under frequency crossing I/II/III frequency": this setting is used to adjust the protection frequency of over/under frequency crossing

"Over/under-frequency crossing I/II/III section crossing time": this setting is used to adjust the protection time of over/under-frequency crossing

12.5.4.2 Voltage regulation reactive power

Voltage regulation reactive power is only available when it is enabled. In the voltage regulation reactive power mode, the reactive power configuration is disabled.

"Voltage and reactive power regulation point V 1/2/3/4": This setting is used to set the switching point of voltage regulation and reactive power.

When the actual voltage is **between the voltage reactive power adjustment points V1 and V2**, the capacitive reactive power will increase.

When the actual voltage is **between the voltage reactive power adjustment points V3 and V4**, the induced reactive power will increase.

For more information, please refer to UL1741 Supplement A or other similar rules on the access of distributed generation grids.

"Reactive power regulation Q1/Q2/Q3/Q4": This setting is used to set the maximum inductive reactive power regulation and the maximum capacitive reactive power regulation.

12.5.4.3 Voltage regulation active

Voltage modulation is only available when enabled and in discharge mode. When the actual voltage is higher than this point, the active power will be adjusted with slope. Slope is defined as every 1% multiple of rated voltage of each point in the volt/watt chart when the set active power is higher.

"Over-voltage drop active start/end adjustment point": this setting is used to set the trigger point of over-voltage drop active power

"Over-voltage drop active start/end power" this setting is used to set the trigger power of over-voltage drop active power

"Over-voltage drop active reaction time": This setting is used to set the setting slope after the trigger voltage is adjusted to active power.

"Over-voltage drop active power recovery delay": This setting is used to set the delay time of output power recovery after the voltage of public power grid returns to normal.

12.5.4.4 Frequency modulation active

Frequency adjustment active power is only available when it is enabled and in discharge mode. When the actual frequency is higher than this point, the active power will be adjusted with a slope. The slope is defined as the number of times per Hz that the set active power is higher than each point in the frequency/watt chart.

"Over-frequency reduction active power initial adjustment point": This setting is used to set the trigger threshold of frequency adjustment active power

"Over-frequency reduction active power adjustment slope": This setting is used to set the slope of

the frequency adjustment active power

"Over-frequency reduction active power response time" This setting is used to set the frequency adjustment active power response time

12.5.5 DC parameter settings

Step:

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"**> **"Local Manual"**.
3. Select **"Settings"**> **"Advanced Settings"**> **"DC Parameters"**

"DC lower voltage threshold": Prioritize the setting according to the battery manufacturer's recommendation. If the battery manufacturer's data is not available, please set according to the following data: Set 2V lead-acid batteries according to 1.67~1.80V *number of batteries in series; set 3.2V lithium ion batteries according to 2.70~2.75V *number of batteries in series.

"End-of-discharge voltage": When there is no special requirement, it is set according to the EOD voltage.

"Topping charge voltage": Prioritize the setting according to the battery manufacturer's recommendations. When the data recommended by the battery manufacturer cannot be obtained, set according to the following data: set 2V lead-acid batteries according to 2.20~2.27V *number of batteries in series; set 3.2V lithium ion batteries according to 3.60~3.70V *number of batteries in series.

"Float charge voltage": Prioritize the setting according to the battery manufacturer's recommendations. When the data recommended by the battery manufacturer cannot be obtained, set according to the following data: set 2V lead-acid batteries according to 2.20~2.27V *number of batteries in series; set 3.2V lithium ion batteries according to 3.60~3.70V *number of batteries in series.

"Topping to float charge current": Prioritize the setting according to the battery manufacturer's recommendation. When the data recommended by the battery manufacturer cannot be obtained, set the 2V lead-acid battery according to 0.02C~0.05C. Other connection types can be set to 1A.

"End-of-charge current": keep the factory default value

"Maximum charge current": Set 50K to 100A, 100K to 200A, and 150K to 300A.

"Maximum discharge current": Set 50K to 100A, 100K to 200A, and 150K to 300A.

"DC Control Mode": Please set it to the default factory setting of "Constant Current" or **"Constant Power"**. .

"DC current setpoint": Set the charging or discharging current within the rated power range according to actual needs. (Only available when the "Energy Dispatching Mode" in the "System Parameters" is set to "DC Dispatch", and the DC operation mode is set to "Constant Current".

"DC power setpoint": Set the charge and discharge power within the rated power range according to actual needs. (Only when the "Energy Dispatching Mode" in the "System Parameters" is set to "DC Dispatch", and the DC operation mode is set to "Constant Power".

"Discharge initial voltage": When there is no special requirement, set according to EOD voltage.

"Pre-charge maximum current": Set 50K to 100A, 100K to 200A, and 150K to 300A. Set according to customer requirements. When the client does not need the pre-charging function, set it to 10A.

"Precharge voltage": When there is no special requirement, set according to EOD voltage.

"Pre-charge to fast charge voltage": Set according to EOD voltage when there is no special requirement.

"Pre-charge time": Set according to customer requirements. When the client does not need the pre-charge function, set it to 1minute .

12.6 System parameter settings

Step:

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"**> **"Local Manual"**.
3. Select **"Settings"**> **"Advanced Settings"**> **"System Parameters"**

"Startup Method": The default setting is **"Manual Startup"**.

"Energy Dispatching Mode": Please set it to **"AC Dispatch"**. If it is set to **"DC scheduling"** according to actual needs, you need to set **"DC current setting"** and **"DC power setting"** on the second page of "system settings >" **DC parameters "**

"DC parameter setting mode": a function reserved for specific models, no need to set by default.

12.6.1 General settings

Step:

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"**> **"Local Manual"**.
3. Select **"Settings"**> **"General Settings"**

Power scheduling includes **"active power setpoint"** and **"reactive power setpoint"**

DC configuration includes:

"DC lower voltage threshold", **"End-of-discharge voltage"**, **"Topping charge voltage"**, **"Float charge voltage"**, **"Topping to float charge current"**

"End-of-charge current" **"Maximum charge current"** **"Maximum discharge current"**

12.7 Local manual start

Check before starting

Before starting, please check the device according to the following steps:

- 1) Check and make sure that there is no damage to the outside of the module, and that the DC switch and AC switch are in the **"OFF"** position.
- 2) Complete the installation according to the above chapters, and check whether the DC input wiring and AC output wiring in the PCS are normal and well grounded.
- 3) Check whether the battery voltage is normal.
- 4) Check whether the phase voltage and line voltage on the utility grid side are within the normal range, and record the voltage.

Select **"Control mode"**> **"Local Manual"** and **"Operation Commands"** to be visible.

When the system is in **"Local Remote"**> **"Local Auto"** or **"Remote Control"**, the **"Operation "** is not visible and no configuration is required.

1. Select **"User"**>Please enter the password>**"OK"**>**"Login"**. (Log in to the PCS user interface)

2. Select **"Control mode"> "Local Manual"**. **"Operation"** is visible

"Total power-on", **"Total power-off"**, **"On-grid"**, **"Off-grid"**, and **"Clear fault"** are displayed in the **"Operation Command"** interface.

The system status will always be only one of the **"on-grid"** and **"off-grid"** modes.

The system status will always be only one of the **"total power-on"** and **"total power-off"** modes.

"Clear fault" is used to clear faults that can be manually cleared, such as **"EPO (Emergency Power Off)"**. **"Clear fault"** does not apply to all faults.

After the parameter setting is completed and the system meets the startup conditions, the PCS can be started and shut down through the "Total power-on" and "Total power-off" operations.

After the system starts, check the **"System Information"** to understand the working status of the system.

12.8 Automatic start

1. Select **"User">Please enter the password>"OK">"Login"**. (Log in to the PCS user interface)
2. Select **"Control mode"> "Local Automatic"**

In the local automatic start mode, PCS will automatically check and judge the start conditions. If the system functions normally and meets the system setting conditions, it will start automatically. If the utility grid voltage is too low or too high, the frequency is abnormal, and the DC voltage is too low or too high, the PCS will issue an alarm, automatically shut down and stop external power supply.

After the following conditions are met, the optical storage all-in-one will automatically restart and the output power will be restored.

1. The DC voltage is normal.
2. The voltage of the utility grid is normal in the grid-connected mode, or there is no voltage of the utility grid in the off-grid mode.
3. The operating mode is set correctly.
4. There are no other alarm failures.

If the optical storage integrated machine is not set to automatically start, the user can manually start the device through the touch panel.

12.9 Remote control start

The remote control startup procedure is applicable to the situation where the optical storage integrated machine system is in a stopped state and can be started.

The operation steps are as follows:

- 1) Close the output switch of the battery cluster and confirm that the DC port of the PCS has power.
- 2) Close the DC switch. The green indicator light flashes in green. After about 10 seconds, the red indicator light is always red. At this time, the display will show warning messages such as **"Grid under-voltage"** and **"Abnormal grid frequency"**. If step 2 and step 3 are performed before the red light is always on, there will be no red flashing.
- 3) Set the monitoring parameters and control operation mode according to the above chapters
- 4) Choose **"Control mode"> "Remote Control"**, and then select other control devices to start PCS remotely.
- 5) PCS will start the DC/AC module. After performing step 4, return to the **"Home"** on the display to

check the system status.

12.10 Shutdown step

During the normal working period of the optical storage integrated machine, if you need to shut down, you can perform the following steps.

1) Select "**Control mode**"> "**Remote Control**", and then select other control devices to remotely stop the PCS.

Or select "**Local Remote**"> "**Local Manual**"; "**Operation Command**"> "**Total Shutdown**" to manually stop the PCS.

12.11 System power down

When the PCS is in the "**Total shutdown**" mode, you can cut off the DC and AC power and turn off the system power

- 1) Manual or remote control system stops.
- 2) Turn off the AC switch.
- 3) Disconnect the battery DC switch, and then disconnect the photovoltaic DC switch.

In the above operation process, the system has stopped after step 1. The live components of the system have stopped running, and the busbar copper bars and auxiliary power supply in the system have been energized for a long time. Therefore, the relevant control system is still on standby. In this state, equipment setup and maintenance are not allowed.

When the system is powered off, the internal contactor copper bar is out of power. After the internal capacitance of the module is completely discharged, relevant maintenance and settings can be carried out.

12.12 Emergency shutdown

When the PCS system is abnormal, press the emergency shutdown button "EPO" on the rack door, and the PCS will immediately stop running.

To prevent personal injury, please use a multimeter to measure the voltage of the input terminal if you perform maintenance or open the case. After making sure that there is no power, you can perform related operations!

After about 15 minutes, the upper cover can be opened after the DC bus capacitor is completely discharged (see the warning label on the surface of the module housing).
