CEP Series

CVP Emergency Power System

Operation and Maintenance Manual

Version: 1.2

Applicable Models:

CEP30H

CEP30L

CEP60H

CEP60L

IMPORTANT SAFEGUARDS

When using electrical equipment, basic safety precautions should always be followed including the following:

a) **READ AND FOLLOW ALL SAFETY INSTRUCTIONS.**

b) Do not use outdoors

c) Do not let power supply cords touch hot surfaces

d) Do not mount near gas or electric heaters

e) Use caution when servicing batteries. Battery acid can cause burns to skin and eyes. If acid is spilled on skin or in eyes, flush acid with fresh water and contact a physician immediately.

f) Equipment should be mounted in locations and at heights where it will not readily be subjected to tampering by unauthorized personnel.

g) The use of accessory equipment not recommended by the manufacturer may cause an unsafe condition.

h) Do not use this equipment for other than intended.

SAVE THESE INSTRUCTIONS

For Technical Assistance, please contact:
MicroNOC Inc.
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949-398-7430
info@MicroNOCinc.com

The specifications and descriptions in this document were in effect at the time of publication. MicroNOC continuously seeks to improve our product offerings and thus reserves the right to change specifications and product appearance, or to discontinue products at any time. For the latest Installation documentation, please contact your MicroNOC representative.

Table of Contents

1 Overview

1.1 Model definition

The CEP Series CVP Emergency Power System includes the following models:

Model #	Maximum Output Power	Nominal Voltage	Transformer
CEP30H	29 kW	277/480V, 3-phase	NO
CEP30L	29 kW	120/208VAC	YES
CEP60H	58 kW	277/480V, 3-phase	NO
CEP60L	58 kW	120/208VAC	YES

1.2 Icon interpretation

This user's manual is about installation and use of the Power Conversion System (PCS) Inverter along with the associated battery cabinet.

To ensure personal and property safety or use this product efficiently, please read this user's manual carefully before installation and use.

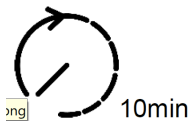
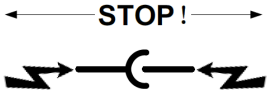
1.2.1 Icons in the manual

The following are the examples for icons in this user's manual. Please read and understand the definition of each icon.

 DANGER	The DANGER icon indicates that there is a safety risk during operation.If this kind of warning information is not followed, it will directly result ina serious human casualty accident.
 WARNING	The WARNING icon indicates that there is a potential risk during operation. If this kind of warning information is not followed, it might result in a serious human casualty accident.
 CAUTION	The CAUTION icon indicates that there is a potential risk duringoperation. If this kind of warning information is not followed, it might result in device damage.
	The NOTE icon indicates the additional information in the manual anda highlight and supplement for the content. It provides skills and tips of product usage and can help you efficiently solve some problems in

1.2.2 Inverter prompt icons

The following are the examples for icons on the inverter. Please read and understand the definition of each icon.

	This icon indicates that internal conductive device can be touched by waiting for 10 minutes after inverter and power grid are disconnected from storage battery.
	This icon indicates that the inverter surface is hot during operation. Keep cautious. Don't touch the inverter surface.
	This icon indicates that before any operation of the inverter, please read this product manual carefully.
	The ELECTRICAL DANGER icon indicates that only professional and qualified personnel can carry out equipment installation and electric operation.
	The STOP icon indicates that when the inverter is running, disconnection is not allowed. Disconnection operation can be conducted after the inverter is shut down.

1.3 Safety Instructions

PCS energy storage inverter is designed and tested in strict accordance with relevant international safety standards. Its installation, trial operation, operation and maintenance should comply with safe operation specifications of electrical and electronic equipment. Incorrect use or wrong operation might endanger operator or a third party and destroy the inverter or other properties. To prevent the above circumstances from happening, the following precautions should be strictly abided by in the process of operation and maintenance. The detailed description will be provided in relevant chapter.

 WARNING	All installation, debugging and maintenance should be completed byprofessionals. Professionals should: • be approved engineer by the factory or its agent; • be professionally trained; • fully read this manual and learn about safe operation matters for electrical and electronic equipment; • be familiar with relevant safety specification of electric system.

Professionals who meet the above conditions can:

(1) Install the inverter onto the wall;

(2) Setup energy storage system as per customer's requirement;

(3) Conduct trial operation of energy storage system;

(4) Operate, debug and maintain energy storage system.

 CAUTION	Equipment wrong operation might cause injury! • Removal and placement of the inverter should abide by thedescription in this manual. • Improper equipment operation might cause electric shock, burn orcontusion. • Any system (equipment) damage caused by modification anddisassembly without permission does not fall into the warranty scope.

1.3.1 Safety instructions for mechanical installation

 DANGER	Before inverter installation, ensure that the inverter does not have any electric connection.
 CAUTION	Poor ventilation for installation will weaken the system performance! During equipment operation, the ventilation should be good. The equipment should be upright, and there should be no strong air current to prevent airflow so as to ensure that the device is cooled well.

1.3.2 Safety instructions for electrical connection

 DANGER	Be careful in electric connection. There is dangerous voltage between the two poles of storage battery. Don't touch the metal terminal when there is no sufficient protection.

 CAUTION	The cables used in energy storage system must be connected firmly and with good insulation and proper specification.
 CAUTION	All electrical installations should meet national/regional electrical standards; Grid-tied operation can be conducted after permission is obtained from local national/regional electric power department. Before power-on, please ensure that it is reliably grounded, and the grounding meets local electrical standards.

1.3.3 Safety instructions for inverter operation

 DANGER	Any contact with copper bar, uncovered contact spot or terminal inside the device that is connected to the loop of power grid might result in burning or fatal electric shock. • Don't touch any terminal and conductor connected with the power grid. • Pay attention to any instruction and safety documents about grid connection.
 WARNING	There might be an electric shock risk inside the device! When the inverter operates or is electrified, don't open the enclosure of the inverter. • Only intact and closed cabinet can protect operator's personal andproperty safety. • Any operation related to this device will be conducted by professionals. • Pay attention to the safety precautions listed in this manual and other documents. When AC of the inverter is loaded, DC disconnection is not allowed. If disconnection is required, shutdown operation should be conducted first. After the AC load isolation switch of the inverter is disconnected and it is confirmed that there is no voltage at the AC terminal of the inverter, DC connection can be turned off.
 CAUTION	During inverter operation, the ventilation duct must not be blocked.

1.3.4 Safety instructions for maintenance and replacement

 DANGER	Improper equipment maintenance and operation might cause personal injury or equipment damage. Before any operation, users should strictly abide by the following steps: • Disconnect the AC isolation switch between the power grid and the inverter, and then turn off DC breaker of the battery box. • Wait for at least 10 minutes until internal energy storage elements are discharged off. During this period, don't touch equipment terminal, contact spot, copper bar and other electric parts with body or conductor. • Use detecting device to check and ensure that there are no voltage and current on the device.
 CAUTION	Stop irrelevant personnel from entering the maintenance site! During electrical connection and maintenance, temporary warning signs should be posted and barriers should be set up to prevent irrelevant personnel entering electrical connection or maintenance area.
 CAUTION	The inverter can be restarted only after its malfunction affecting safety performance is removed. Power can be supplied again after the inverter is fully disconnected for 1 minute. There are no serviceable parts in the inverter. If any maintenance is required, please contact our after-sales personnel.
 CAUTION	Don't replace the internal elements at will. Otherwise, our company will not undertake any quality guarantee and joint liability for any losses caused thereby.
 CAUTION	Components might be caused by any contact with PCBs or other electrostatic sensitive components or improper operation. Don't touch the circuit boards. Abide by electrostatic protection specifications and wear anti-static wrist strap.

1.3.5 Label Warning Symbols

The following symbols or icons are used on various safety information labels secured to the system.

	Warning:	Indicates an electrical shock hazardous situation which, if not actively avoided could result in injury, death, or damage.
	Caution:	Indicates a hazardous situation which, if not actively avoided could result in damage to the equipment or performance degradation.
	Hot surface:	Indicates heat hazard or hot surface. Use caution to prevent burns.
	See Manual:	Indicates a reference to the Installation and Operation & Maintenance Manuals for more information.

1.3.6 Others

 WARNING	Safety signs, warning label and nameplate on the inverter: • Must be clearly visible; • Should not be removed or covered.

1.4 Precautions

1.4.1 Personnel requirements

Energy storage inverter must be debugged and maintained by the engineers designated by the manufacturer or its agent. Otherwise, it might endanger personal safety and result in device fault. Any damage against the device caused thereby will not fall into the warranty scope.

1.4.2 Purposes of usage

Energy storage inverter is only used for commercial/industrial purposes, and it cannot be used as an energy saving device related to life support device.

1.4.3 Label on enclosure

The label on enclosure contains important information for safe operation to the inverter. Don't tear or damage it.

The label on enclosure should be clear and readable. If it is damaged or becomes vague, please replace it.

1.4.4 Notes

To help users read this manual more conveniently, a lot of pictures are provided. Such pictures are only used for description and indication. For detailed information, please refer to the product itself.

2 Chapter 2 Introduction to energy storage system

2.1 System application

As shown in Fig. 2-1, the energy storage system set up by PCS is composed of battery (pack), energy storage inverter, intelligent power distribution unit, EMS and BMS. Battery pack is connected to energy storage inverter. Energy storage inverter is connected with the load and power grid through intelligent power distribution unit. Energy storage inverter communicates with EMS through Ethernet interface (or RS-485 interface) to indirectly control charging and discharging of battery pack. EMS communicates with energy storage inverter, BMS and/or intelligent electric meter through RS-485 interface to dispatch the energy of an energy storage system.

2.1.1 System structure diagram

The structure diagram of energy storage system is shown below. PCS energy storage inverter pushes the data to EMS or other host systems in real time.

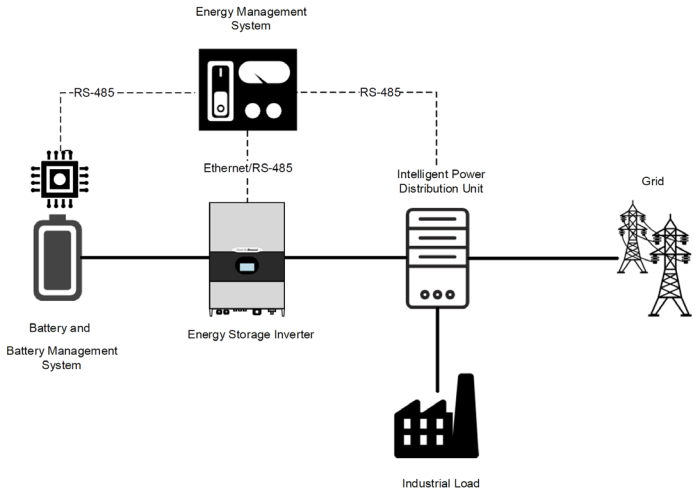


Fig. 2-1 Structure of energy storage system

2.1.2 Adaptive power grid type

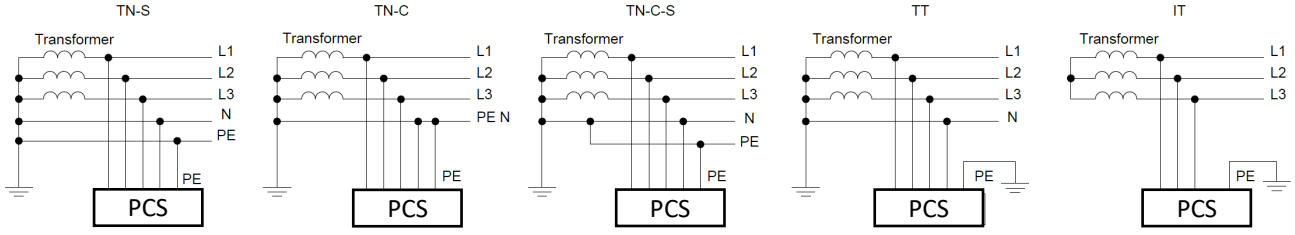


Fig. 2-2 Adaptive power grid type

⚠ CAUTION	**VERY IMPORTANT INFORMATION** THERE IS NO ISOLATION TRANSFORMER IN THE ENERGY STORAGE INVERTER OF THIS MODEL. THE AC PORT OF ENERGY STORAGE INVERTER CANNOT BE DIRECTLY CONNECTED WITH SINGLE PHASE LOAD. IF SINGLE PHASE LOAD IS REQUIRED, IT SHOULD BE CONNECTED THROUGH AN ISOLATION TRANSFORMER. IN GRID INTERACTIVE APPLICATION, IF THE CAPACITY OF ENERGY STORAGE INVERTER DOES NOT MEET THE DEMAND, PARALLEL CONNECTION OF MULTIPLE INVERTERS CAN BE CONDUCTED. SEPARATE STORAGE BATTERIES WITH PROPER CAPACITY SHALL BE EQUIPPED FOR EACH INVERTER IN DC PORT. THE DEVICES CAN BE CONNECTED TO THE POWER GRID IN PARALLEL ON AC PORT. THE DC PORT OF TWO OR MORE ENERGY STORAGE INVERTERS SHOULD NOT BE PARALLELED ON ONE SAME BATTERY PACK/MODULE.

2.2 Overall dimension

Overall dimension of PCS is shown in Fig. 2-3.

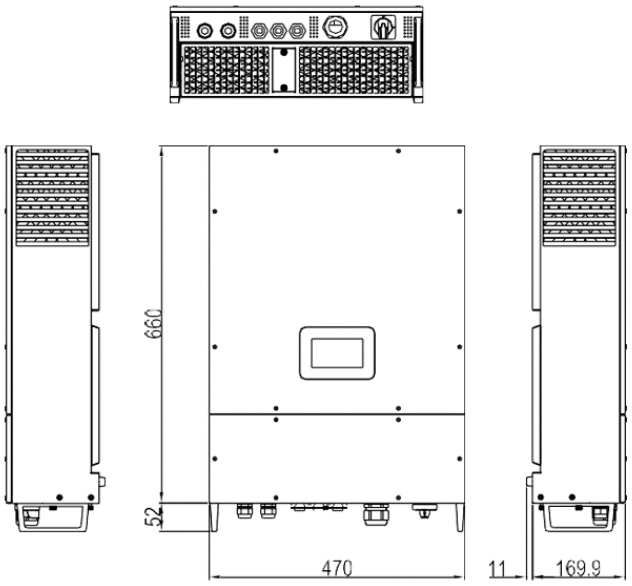


Fig. 2-3 Overall dimension of PCS (unit: mm)

2.3 Appearance

The appearance of PCS is shown in Fig. 2-4.

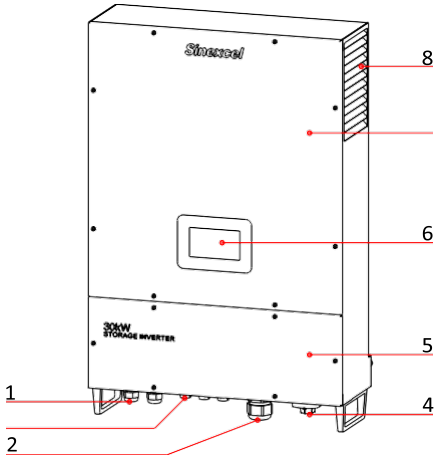


Fig. 2-4 Appearance of front side of PCS

SN	Name	Description
1	DC port	To connect power cables to the battery cabinet
2	Communication interfaces	Including Ethernet, RS-485, R-EPO
3	AC port	AC wiring terminal for gird and AC load
4	AC switch	Safety device to connect or disconnect the current in AC port.
5	Bottom cover	Used to cover the connecting terminals of cables under the case.
6	HMI	Human-machine interface which is used to set parameters of energy storage inverter and read inverter operation information.
7	Upper panel	Case cover
8	Air outlet	Ventilation duct exit for heat dissipation

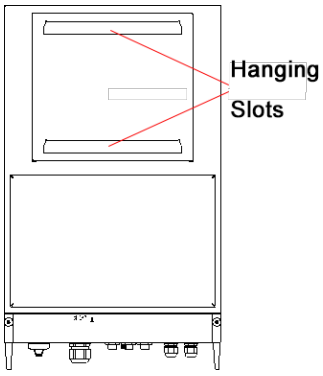


Fig. 2-5 Appearance of back side of PCS

2.4 Technical parameters

Technical parameters of PCS energy storage inverter:

Table 2-1 Technical parameters

DC port	
DC voltage range	200V~750V (350~750V Full Load)
Max. DC current	90A
Max. DC power	33kW
DC voltage accuracy	≤1%
Charge and discharge mode	3-phase charging (constant power→constant voltage→trickle current); constant current discharging, constant power discharging
AC port (grid-tied mode)	
Rated output power	30kW
Rated grid voltage	480V
Grid voltage range	-12%～+10%
Rated grid frequency	60Hz
Range of grid frequency	±2.5Hz
Max. input short circuit current	200A
Max. output fault current and duration	200A(200ms)
Max. output overcurrent protection	300A
Rated AC current	36.1A
Synchronization in-rush current	30A
Trip limit and trip time accuracy	5%
Output THDi	≤3%
Grid-tied power factor	0.8 leading～0.8 lagging (listed) 0 leading～0 lagging (actual)
AC port (off-grid mode)	
Off-grid AC voltage	480V
Off-grid AC voltage range	±5%
Off-grid AC frequency	60Hz
Off-grid output voltage stabilizing accuracy	≤1%
Off-grid output frequency accuracy	±0.1Hz
Off-grid THDu	≤1% (linear load)
	≤5% (nonlinear load)
Output overload capacity	105%~115% 10min

	115%~125% 1min
	125%~150% 200ms
System parameters	
Max. efficiency	97.5%
Protection	System protection: over-temperature, AC overvoltage and under- voltage, AC over frequency and under frequency, AC inverted sequence, fan fault, relay fault, output overload and leakage current protection
	Optional safety protection conditions: upper and lower limit of AC voltage protection, upper and lower limit of frequency protection, upper and lower battery voltage and voltage of battery EOD
Installation mode	Wall-mounted
Wiring mode	3-phase +N+PE
Isolation mode	Non-isolated
Cooling mode	Fan cooling
Standby self-power consumption	<20W
Noise	≤60dB
Temperaturerange	-20℃～60℃ (de-rating in case of exceeding 45°C)
Enclosure	CLASS I/NEMA1(IP32)
Altitude	4,000m (de-rating in case of exceeding 2,000m)
Humidity	0～95%
Dimension	470mm×660mm×170mm
Weight	43kg
Display	LCD touch screen
Standard communication interface	RS-485 on RJ45, Ethernet on RJ45
EMS Communication protocol	Modbus on RS-485, TCP/IP on Ethernet
BMS communicationprotocol	RS-485

Table 2-2 Utility interconnection voltage trip settings

Default Mag trip setpoint (% of Nom)	Default time trip setpoint (Seconds)
V < 45	0.16
45 ≤ V < 60	1
60 ≤ V < 88	2
110 < V < 120	1
V ≥ 120	0.16

Table 2-3 Frequency trip settings

Default Frequency trip Setpoint (Hz)	Default time trip setpoint (Seconds)
<57	0.16
<59.5	2
>60.5	2
>62	0.16

2.5 Technical specification

2.5.1 Principle description

There are three operation modes: grid-tied discharging, charging and off-grid discharging.

When the battery voltage connected to PCS is within the preset normal voltage range, the inverter can operate under grid-tied discharging, charging and off-grid discharging. If the inverter is in discharging state, the DC power supply of the battery can be inverted into 3-phase AC power supply. If the inverter is in charging state, the 3-phaseAC power energy of the power grid can be stored into battery (pack).

The protection circuit of the inverter is used to ensure safe operation of the inverter and operators' safety.

2.5.2 Function description

The functions of PCS are as follows:

Grid-tied discharging: The inverter is in inverting state, converts DC into AC that meets the requirement of power grid department in installation region, and feeds the energy back to the power grid.

Grid-tied charging: The inverter is in rectification state and transmits 3-phase AC to chargethe battery (pack) by the set charging mode.

Off-grid discharging: The inverter is in inverting state, converts DC into AC that meets the requirement of power grid department in installation region, and provides power supply for3-phase load in the micro-grid.

Data storage and display: Storage and operation information, operation record and failure record are displayed on the LCD screen.

Communication function:

- Standard RS-485 interface can be connected with monitoring device such as EMS.
- Standard Ethernet interface is used to communicate with upper computer to realize such functions as remote control and remote software upgrading.
- **Reactive power configuration:** Regulate the reactive power of the storage system.
- **FVRT**: frequency/voltage ride-through, this function can be enabled or disabled, for more information, please refer to UL1741 Supplement A or other similar rules about Utility-Interactive Distribute Generators.

- **Soft-Start/Reconnection ramp rate**: This function will apply when system suspend happens caused by utility voltage abnormal, and reconnect after utility restore normal. The default value is 2, twice of rated power per second, which means within 0.5 seconds the system restores to full output.
- **Anti-Islanding**: enable or disable anti-islanding function. For more information, please refer to UL1741 Supplement A or other similar rules about Utility-Interactive Distribute Generators.
- **Volt/Watt:** Available when activated and operating in discharge mode. When the actual voltage is above the point, the active power will be regulated with the ramp rate. The ramp rate is defined as multiple of set active power per 1% of rated voltage that above the Volt/Watt point.
- **Volt/VAR:** Available when activated and operating in discharge mode. In this mode, Reactive power as a function of grid voltage. In Volt/VAR mode, the Q configurationis disabled.
- **Freq/Watt:** Available when activated and operating in discharge mode. When the actual frequency is above the point, the active power will be regulated with the ramp rate. The ramp rate is defined as multiple of set active power per hertz that above the Freq/Watt point.
- **PF regulate:** Regulate the PF of the entire storage system.
- Protections
- Overcurrent protection
- Overload protection
- Short circuit protection
- Environment over-temperature protection
- Over-temperature protection of power module
- Ground leakage current monitoring
- Grid voltage monitoring
- Grid frequency monitoring
- Anti-islanding protection
- Monitoring of AC output current and DC component
- Battery overcharge protection
- Battery over-discharge protection

2.5.3 De-rating

The de-rating of inverter is to avoid inverter overload or restrain potential faults. The inverter might conduct de-rating operation in the following operating conditions:

- Internal over-temperature (including environment temperature and module temperature)
- Grid under-voltage
- Battery under-voltage
- Remote power dispatching
- Grid over- voltage
- Grid over-frequency

Over-temperature de-rating

Over-high environment temperature and ventilation duct blocking will cause de-rating of inverter. Over-temperature de-rating regulation is as follows:

- If power device temperature reaches the upper limit, the inverter will automatically decrease the input and output power. After the power device temperature is restoredto the normal range, the inverter will gradually increase the set value.
- When the environment temperature in the inverter exceeds the upper limit, the inverter will automatically power off so as to protect the inverter.

	The lower limit of over-temperature de-rating is about 66% of rated power. If the de-rating reaches the lower limit but the temperature is not improved, the inverter will shut down automatically.

Grid under-voltage de-rating

If the grid voltage is too low, the inverter will limit the grid current to a specified range through de-rating. The de-rating of grid under-voltage will be activated when 3-phase grid voltage reaches 440V. The curvilinear relationship for grid voltage de-rating is as follows:

$$P_{[V_{\min}\ldots 480V]} = P_n \times (V_{grid} \mid 480V)$$

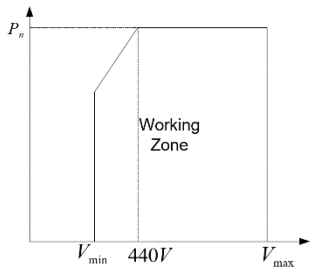


Fig.2-6 Grid under-voltage de-rating

Battery under-voltage de-rating

If the battery voltage is too low, the inverter will limit the battery discharge current to a specified range through de-rating. The de-rating of battery under-voltage will be activated when the battery voltage reaches 350V. The curvilinear relationship for battery voltage de-rating is as follows:

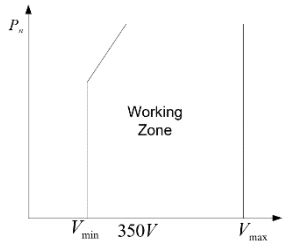


Fig.2-7 Battery under-voltage de-rating

External command de-rating

The inverter can regulate the de-rating of output active and reactive power by LCD touch screen or remote grid dispatching command. The operation state of the inverter will be displayed on the LCD touch screen.

Grid over-voltage de-rating

If the grid voltage is too high, the inverter will limit the active power to a specified range through de-rating. The de-rating of grid over-voltage will be activated when 3-phase grid voltage reaches V1（V1 could be set by RS485 or Ethernet, Range: $1.03V_N$ to $1.10V_N$）. The curvilinear relationship for grid voltage de-rating is as follows:

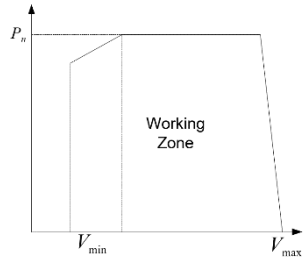


Fig.2-8 Grid over-voltage de-rating

Grid over-frequency de-rating

If the grid frequency is too high, the inverter will limit the active power to a specified range through de-rating. The de-rating of grid over-frequency will be activated when grid frequency reaches f1 (f1 could be set by RS485 or Ethernet）. The curvilinear relationship for grid frequency de-rating is as follows:

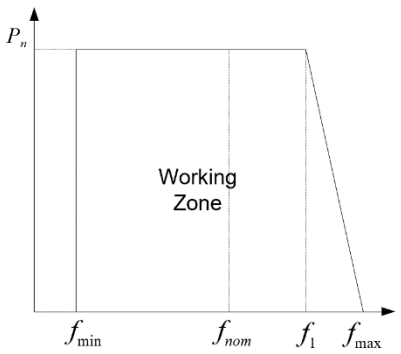


Fig.2-9 Grid over-frequency de-rating

3 Chapter 3 PCS Setup (if required)

3.1 Electrical Connection

The PCS (Power Conversion System) electrical wiring should strictly following the following requirements. Please read the following carefully.

DANGER	Before electrical connection, please ensure that all switches of energystorage system are in “OFF” state. Otherwise, the high voltage of the inverter might cause an electric shock risk.
WARNING	Incorrect wiring operation might cause operator casualties or permanent equipment damage. Only qualified professional can conduct wiring work. Before electrical connection, remember that the inverter has 2 supplies. Electrical operator should wear protective devices such as helmet, insulated shoes and protective gloves.
CAUTION	The cable colors mentioned in all electrical connection diagrams in this chapter are for reference only. Cable selection should comply with local cable standard. (Yellow and green cables can only be used for protective grounding.)

3.1.1 Recommended system configuration

The configuration of energy storage system is recommended as follows:

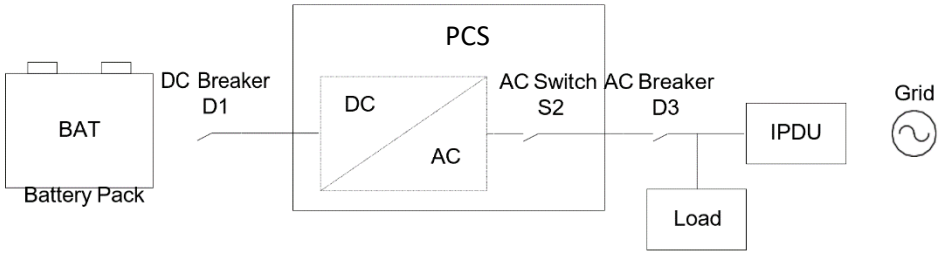


Fig. 3-13 Recommended configuration

WARNING	The input of DC voltage in the battery side of energy storage inverter should be within the required range. Otherwise, the energy storage inverter will not be able to operate. When users configure the quantity of battery series and parallel quantities, the highest charging voltage and the lowest discharging voltage need to be considered. For detailed information, consult qualified technical service personnel. PCS does not include GFDI function, and the system needs to configure BMS containing DC GFDI function.

3.1.2 Introduction to bottom of PCS

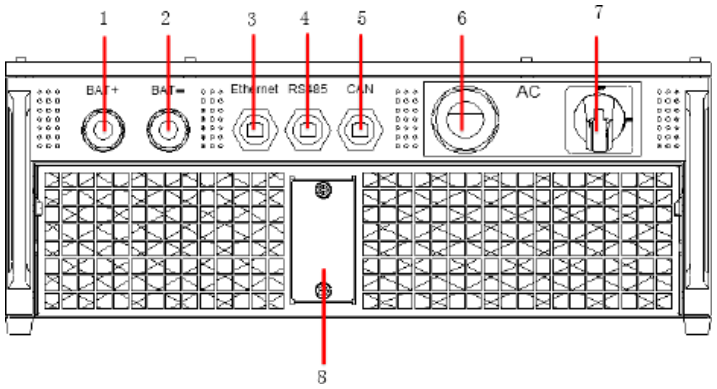


Fig. 3-14 Terminals

No.	Description	No.	Description
1	DC waterproof tube +	5	CAN waterproof terminal
2	DC waterproof tube -	6	AC waterproof tube
3	Ethernet waterproof terminal	7	AC isolator
4	RS-485 waterproof terminal	8	Fan box

3.1.3 Bottom cover removal

To ensure electric safety, the electric wiring terminal of the case is closely blocked by the bottom cover. Before wiring, remove the bottom cover.

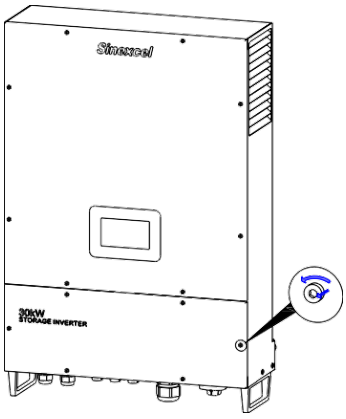


Fig. 3-15 Bottom cover removal

3.1.4 System grounding

Connect the inverter to the grounding bar through the protective grounding wire to protect grounding protection.

Specifications of cable and terminal:

- Grounding wire: the recommended cross sectional area=6mm2 (10AWG) outdoor copper core cable
- Ring terminal: M5

CAUTION	Good grounding can resist the surge voltage surge and improve EMI performance. Before connection of AC, DC and communication cables, grounding wire should be connected first. It is recommended that the inverter should be grounded locally. For multiple PCS parallel connection system, the grounding points of all inverters should be connected with each other so as to ensure equal potential connection of grounding wires.

Step 1: Use a wire stripper to strip the insulating layer of the grounding wire in a proper length;

Step 2: Pass the cable through DC waterproof tube;

Step 3: Penetrate the wire core whose insulating layer is stripped into the conductor crimping area of ring terminal. Press the ring terminal with a hydraulic clamp.

Step 4: Cover the terminal on the grounding bolt and screw up the nut.

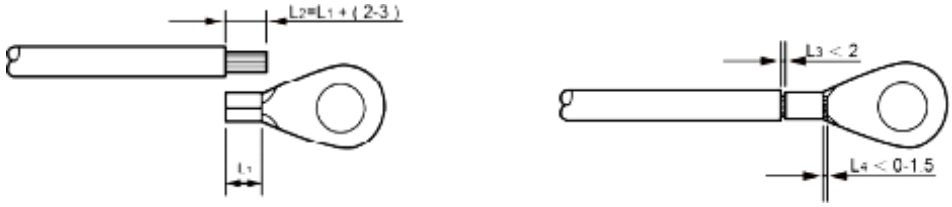


Fig. 3-16 Wiring stripping

3.1.5 DC wiring

Step 1: Use a multi-meter to measure the voltage of battery, and ensure that the voltage is within input voltage range of energy storage inverter.

Step 2: Turn off the DC breaker. Wiring operation can be conducted after using a multi- meter to measure and confirm that there is no voltage between positive and negative poles of DC input.

Step 3: Use a wire stripper to strip the DC cable in a proper length, cover a cord end terminal and use wire crimpers to compress it. Recommended DC cable 25mm2 (AWG 3) with copper cord.

Step 4: Pass the positive pole cable of battery pack through the waterproof tube, and connect it to “BATT+” of DC wire terminal;

Step 5: Pass the negative pole cable of battery pack through the waterproof tube, and connect it to “BATT-” of DC wire terminal;

Step 6: Confirm wiring firmness and lock the waterproof tube of DC cable.

DANGER	Turn off AC and DC distribution switches and ensure that there is no dangerous voltage in the system during wiring.
CAUTION	The positive and negative poles of batteries cannot be connected inversely. Before wiring, a multi-meter needs to be used for measurement.

3.1.6 AC wiring

Step 1: Use a phase-sequence meter for measurement and ensure that the phase consequence of wires should be correct.

Step 2: Turn off the AC breaker connected to energy storage inverter.

Step 3: Use a multi-meter to measure and confirm that the cables connected to the terminals are electrically neutral.

Step 4: Use a wire stripper to strip the AC cable in a proper length, cover a cord end terminal and use wire crimpers to compress it. Recommended AC cable 6mm2 (AWG 8) with copper cord.

Step 5: Pass the AC cable through the waterproof tube and connect it to “L1”, “L2”, “L3”, “PE” and “N” of AC wire terminal;

Step 6: Confirm wiring firmness and lock the waterproof tube of AC cable.

WARNING	Ensure that there is no dangerous voltage at connection points during wiring.

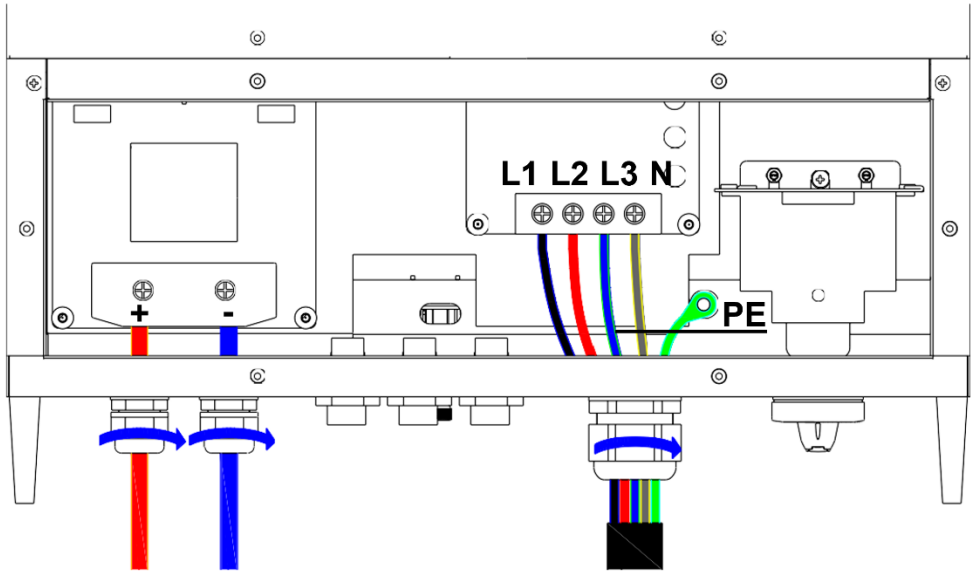


Fig. 3-17 Connection of power cables

3.1.7 Connection of communication cables

PCS has three different communication interfaces: Ethernet, RS-485 and CAN.

(1) Ethernet cable connection

PCS can be directly networked through Ethernet and connected to PC for communication. Through networking, users can remote dispatch energy, monitor operationstate, and set parameters with background software in PC. The definition of RJ45 connector pin is shown in Fig. 3-18.

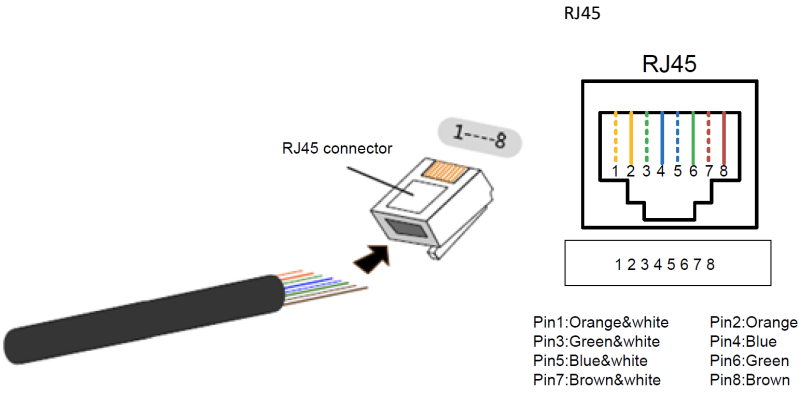


Fig. 3-18 Ethernet interface

Step 1: Penetrate network cable whose insulating layer is stripped into the waterproof cap and insert it into RJ45 connector after being arranged in order;

Step 2: Use wire crimpers to compress the connector;

Step 3: Screw out the cap on the waterproof Ethernet terminal at the bottom of the inverter;

Step 4: Insert the ready-made cable into Ethernet terminal.

Step 5: Lock the waterproof cap.

(2) RS 485 cable connection

PCS can be connected to EMS through RS-485 to obtain battery information and energy dispatching command and complete automatic charging and discharging control and protection of energy storage system. RS-485 is connected through RJ45 connector. The definition of the pin of RJ45 connector is shown in Fig. 3-19. The connection steps are the same as Ethernet cable.

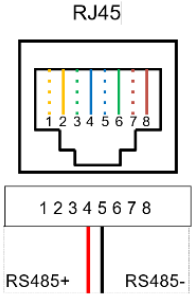


Fig. 3-19 RS-485 wiring

	The wiring making of RS-485 is the same as Ethernet cable. RJ45 terminal should inserted into RS-485 port and cap shall be locked.

(3) Remote EPO connection (if applicable)

A remote EPO switch can be connected to the R-EPO RJ45 port.

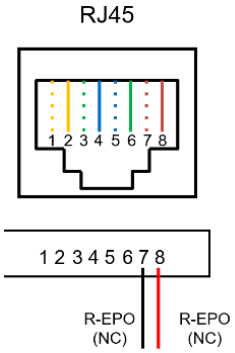


Fig. 3-20 R-EPO wiring

	The wiring making of R-EPO is the same as Ethernet cable. RJ45 terminal should be inserted into the port and cap shall be locked. THE R-EPO IS A **NORMAL CLOSED** CONTACT. IT SHOULD BE CONNECTED TO AN "NC" SWITCH OR BUTTON. IF NO REMOTE EPO IS NEEDED, PLEASE DISABLE THE EPO FUNCTION IN HMI.

3.2 Check after installation

3.2.1 Cable connection check

After installation of energy storage inverter, inspection shall be conducted:

1. The device should be placed and installed properly and meeting safe distance requirements.
2. Power cable is connected correctly. Ground wire and ground screen are in good connection. The constructor is required to inspect the grounding resistance.
3. Compare main wiring diagram and site wiring. Check whether there is any difference and judge whether such difference will affect the safe operation of energy storage system.
4. Confirm that the communication cables of Ethernet and RS-485 have been connected correctly without open circuit and short circuit.
5. Confirm that the caps of Ethernet, RS-485, CAN and power cable have been screwed up.

3.2.2 Electric and communication check

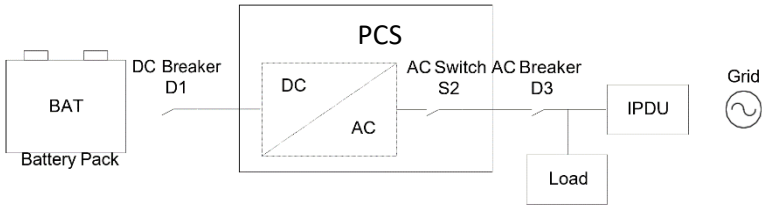


Fig. 3-21

1. Turn off AC switch S2 and breaker D3, turn on DC breaker D1, measure the voltage between “DC+” and “DC-” of DC wiring terminals of the inverter and ensure that it is within 200 ~ 750V. Otherwise, turn off DC breaker D1 and recheck the wiring in DC port.
2. Turn off DC breaker D1, turn on AC breaker D3, measure the voltage among “A”, “B”, “C” and “N” of AC wiring terminals of the inverter. If it is 3-phase and 3-wire connection, the voltage between A-B, B-C and C-A should be 480V. If it is 3-phase and 4-wire connection, the voltage among A-N, B-N and C-N should be 277V. If the measurement deviation is higher than tolerance, turn off AC breaker D3 and recheck the wiring in AC port.

DANGER	Electrical connection inspection needs to be completed by a qualified operator. After the switch is closed, the system has been loaded with high voltage, so contact with any part in the inverter is prohibited.

3.3 Installation of bottom cover

After electric power cable is connected, reinstall the bottom cover in order to ensure electrical safety.

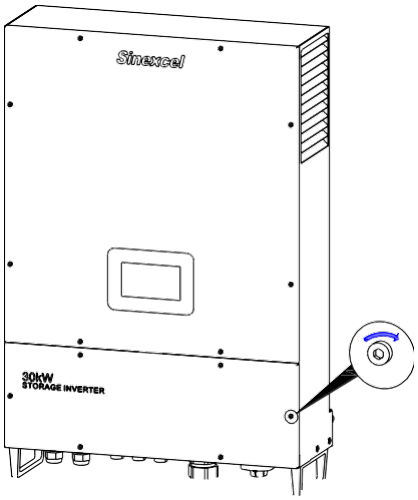


Fig. 3-22 Bottom cover installation

4 Chapter 4 Debug and operation

4.1 Startup and shutdown

Startup steps can be conducted after energy storage inverter is installed and debugged by engineers, with the power switch closed.

4.1.1 Check before startup

Before startup, check the device according to the following steps:

(1) Visually inspect and ensure that there is no damage outside the module, and DC breaker D1 and AC breakers S2 and D3 are in “OFF” state.

(2) Complete installation according to Chapter III, and check whether DC input wiring and AC output wiring in energy storage inverter are normal, and the grounding is good.

(3) Check battery voltage is within the range.

(4) Check AC phase voltage and wire voltage is within the range and record it.

4.1.2 Startup steps

These startup steps are applicable to the circumstance that the energy storage inverter system is in outage state and can be started. Operation steps are as follows:

(1) Close DC breaker “D1” of battery cabinet, the inverter will be powered-on. And the LCD is on and initializing. After about 10 seconds, LCD will indicate such warning information as “grid under-voltage” and “grid frequency abnormal”.

(2) The inverter is defaulted to operate in grid-tied mode. Close AC breaker D3.

(3) Close AC isolator “S2” in the inverter. After about 5 seconds, such warning information as “grid under-voltage” and “grid frequency abnormal” will be cleared automatically.

(4) Click [***ON***] to make the inverter operate under grid connection.

(5) If the inverter is required to operate in off-grid mode, set monitoring parameter to control the operation mode after Step (1). Refer to 5.6 for control parameter setting. If it is set as off-grid mode, such information as “grid under-voltage” and “grid frequency abnormal” will be cleared automatically.

(6) 6) Click [***ON***]. After the AC voltage on LCD screen of the inverter is 480V, close AC isolator “S2” of the inverter to power a load.

 CAUTION	If the inverter is required to operate in off-grid and loaded mode, please confirm that the breaker of intelligent power distribution unit has been disconnected. Otherwise, it might damage the inverter.

4.1.3 Shutdown steps

During normal operation of energy storage inverter, the following steps shall be conducted if shutdown is required:

(1) Click **CONTROL** in the interface of main menu of LCD touch screen and click the round button **OFF**.

(2) Click **HOME** to confirm whether the inverter is in standby state.

(3) Turn off AC isolator S2 and AC breaker D3.

(4) Turn off DC breaker D1 of battery pack.

 WARNING	After the electric circuits connected with the inverter are turned off, the upper cover plate cannot be opened before DC capacitor in the module fully discharged after 10 minutes. To prevent personal injury, please use a multi-meter to measure the voltage at wiring terminal if case maintenance or opening is conducted. Only after ensuring that all the parts in the inverter is not electrified, relevant operation can be conducted!

4.2 Power regulation

When the inverter on in grid-tied state, active and reactive power can be regulated throughLCD screen. Refer to active and reactive settings in 5.6 for specific operation methods.

5 Chapter 5 HMI and operations

5.1 Description

This section introduces HMI (Human-Machine Interface) content and settable parameters. Relevant settings can be conducted via HMI.

The HMI can display real time warning information, provide historical warning records for user's query and offer a reliable basis for fault diagnosis. Through HMI, users can conduct various operations, quickly browse input, output, operation parameters and waveform displaying and timely obtain current energy storage inverter state and warning information. The HMI can also display the version information of system control software and internal monitoring software. The menu tree for HMI content is shown in Fig. 5-1

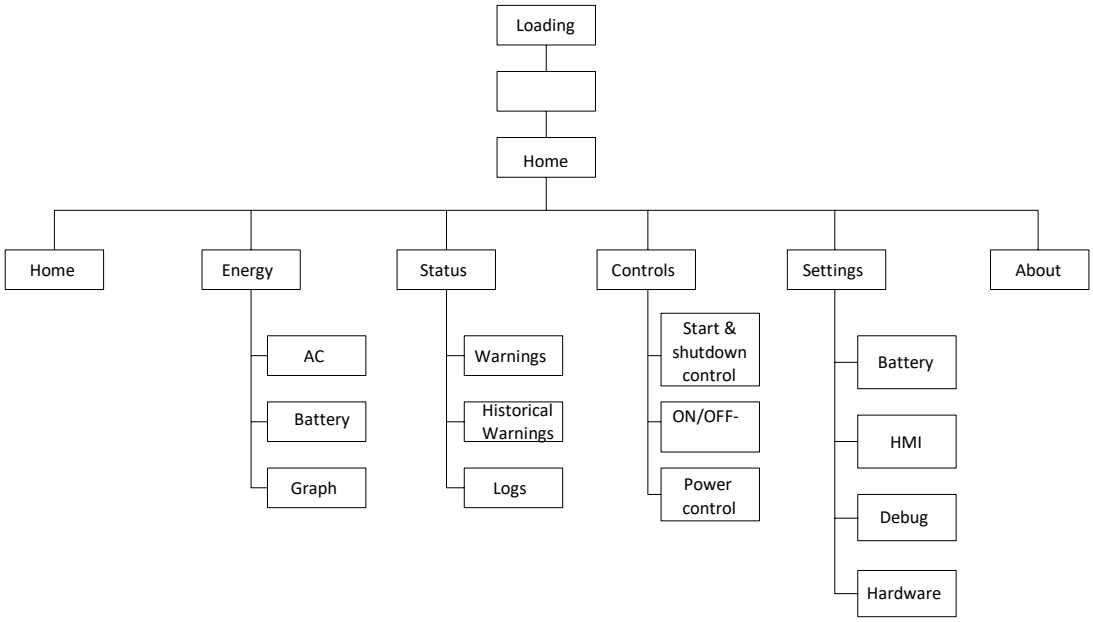


Fig. 5-1 HMI menu tree

5.2 Welcome interface for startup

After system startup, it will automatically jump to home page.

Fig. 5-2 Welcome interface for startup

5.3 Home page

After HMI initialization, it enters Home page, as shown in Fig. 5-3. Users can review system AC and DC voltage, AC and DC current, system charging and discharging and operation state. In this page, the arrow direction for power grid, inverter and battery connecting cable is a reference direction of electric energy flowing. The default direction of the system is that the power grid charges battery through inverter. Click any icon of power grid, inverter and battery to enter main menu interface.

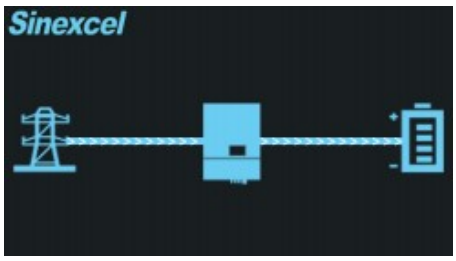


Fig. 5-3 Home page

	If a red dot appears at the top right corner of the icon of the inverter, itindicates that there is warning or fault at present.

5.3.1 Main Menu

The main menu of the system has 6 icons: **“Home”, “Energy”, “Status”**, “**Controls”**, “**Settings”** and “**About”**, as shown in Fig. 5-4.

“**Home”** is used to return to the home page

“**Energy”** is used to read power and temperature in the inverter

“**Status”** is used to read fault information

“**Controls”** is used to control grid-tied or off-grid of inverter, startup, shutdown and output setting;

“**Setting”** is used to set various system parameters and debugging;

“**About**” is the information of the inverter.

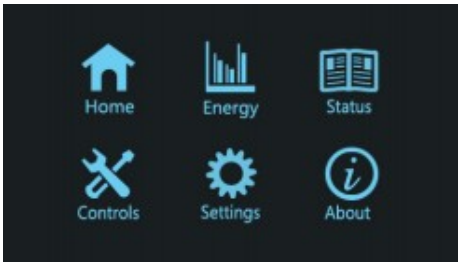


Fig. 5-4 Main Menu

5.4 Energy

Select "**Energy"** in the main interface to enter the display of energy. Users can read AC, Battery, PV, Switches and Graph information, as shown in Fig. 5-5.

5.4.1 AC information

Select "**Energy"** to enter the display of **[AC]** information (or Select AC in the left side to enter) **[_<_]** and **[_>_]** under the interface to turn page up or down, select ⮌ to return the main menu. AC information is shown in Table 5-1.

Table 5-1 AC information

Item	Identifier	Description	Unit
Voltage	Uab, Ubc and Uca	Line voltage of AC output port of inverter	V
Current	Ia, Ib and Ic	Line current of AC output port of inverter	A
Active power	P	Active power of AC of inverter	kW
Reactive power	Q	Reactive power of AC of inverter	kVar
Apparent power	S	Apparent power of AC of inverter	kVA
Frequency	f	Voltage frequency of AC output port of inverter	Hz
Power factor	PF	Voltage and current power factor of AC output port of inverter	1
Temperature	T	AC power module temperature of inverter	℃

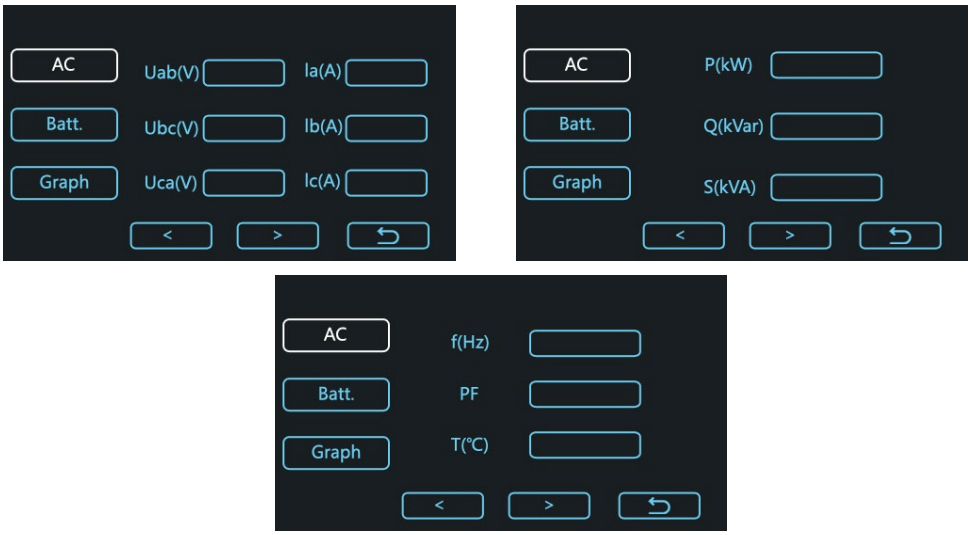


Fig. 5-5 AC information

5.4.2 Battery information

Select **[Batt.]** in the left side to enter, use **[_<_]** and **[_>_]** under the interface to turn page up or down, use ⮌ to return the main menu. DC information is shown in Table 5 2.

Table 5-2 Battery information

Item	Identifier	Description	Unit
Power	P	Real-time power of battery charging and discharging	kW
Voltage	U	Voltage of DC output port of inverter	V
Current	I	Charging and discharging current of inverter	A
Charging quantity	CHGD	Accumulated charging quantity of battery	kW*h
Discharging quantity	DCHGD	Accumulated discharging quantity of battery	kW*h
Temperature	T	DC power module temperature of inverter	℃

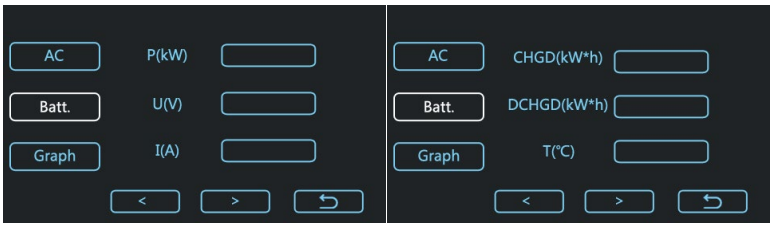


Fig. 5-6 DC information

5.4.3 Graph display

Select **[Graph]** in the left side to enter the graph display. This interface can display the curve for charging and discharging power of inverter in current day. Select ⮌ to return the main menu.

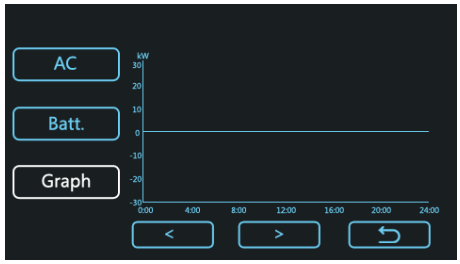


Fig. 5-7 Graph display

5.5 Records

Select **[Status]** in the main interface to search current warning, historical warning, and logs.

Select **[Status]** to enter the current warning interface. As for other interfaces in this function, select **[Warnings]** to enter. This interface includes three columns: “number”, “message” and “time”. Select **[_<_]** and **[_>_]** under the interface to turn page up or down, select ⮌ to return the main menu, as shown in Fig. 5 8.

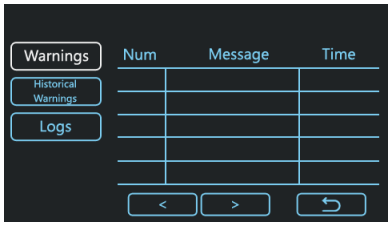


Fig. 5-8 Warnings interface

Select **[Historical Warnings]** to enter the historical warning interface. This interface includes three columns: “Num”, “Message” and “Time End of Warning”. Select **[_<_]** and **[_>_]** under the interface to turn page up or down, click ⮌ to return the main menu, as shown in Fig. 5-9.

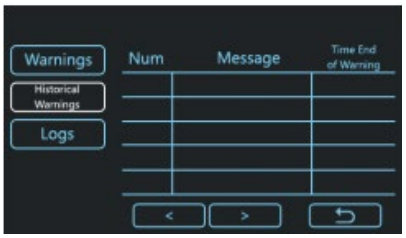


Fig. 5-9 Historical warnings

ⓘ	If the inverter is restarted or shut down due to power failure, the warning will still exist. After being powered on, the end time of warning will be expressed as “--/--/--”.

Select **[Logs]** to enter the operation logs interface. This interface includes three columns: Num”, “Message” and “Time Before-After”. Select **[_<_]** and **[_>_]** under the interface to turn page up or down, click ⮌ to return the main menu, as shown in Fig. 5-10.

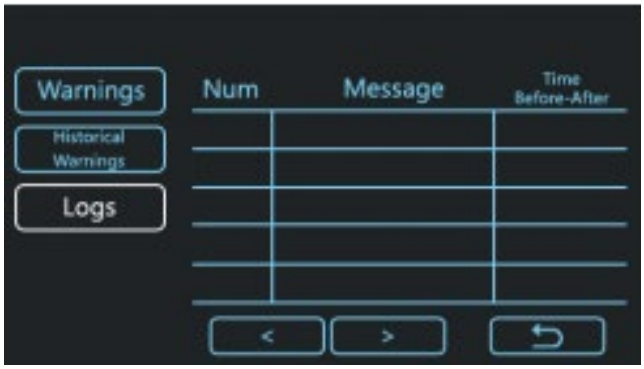


Fig. 5-10 Operation records

5.6 Control parameter

Select "**Controls"** on the Main Menu to enter the control interface of convert operation state. This interface includes grid-tied and off grid-control, startup and shutdown control and output power setting. Select "**Controls"** to enter "startup and shutdown" operation interface to manually start and shut down the inverter, as shown in Fig. 5-11. This interface includes "**[Clear Faults]**" button which used to clear some fault signals which must be cleared manually. After parameter setting is completed and startup conditions are met, the inverter can be started and shut down by **"[ON]"** and **"[OFF]"** buttons.

Fig. 5-11 Startup and shutdown control

Select **[_>_]** under the interface to turn page up to enter the inverter grid-tied and off-grid control interface. The PCS energy storage inverter can operate in grid-tied mode and off-grid mode. During grid-tied operation, close the isolator S2 in AC and the breaker D3 (the breaker between the inverter and the power grid.), and set the energy storage inverter in grid-tied mode through the operation interface. During off-grid operation, close the isolator S2 in AC and the AC breaker D3, turn off the AC breaker of intelligent power distribution cabinet, and set the energy storage inverter into off-grid mode. The system operation interface is shown in Fig. 5-12.

Fig. 5-12 Grid-tied and off-grid setting

Select **[_>_]** under the interface to turn page down (or select **[_<_]** in "startup and shutdown" interface) to return the operation interface of "output power". Output power can be controlled manually, as shown in Fig. 5-13. The content of this page is shown in Table 5-3.

Fig. 5-13 Operation parameter setting

Table 5-3 Control page of electric power parameters

Item	Identifier	Application scenarios	Description
Output voltage amplitude regulation	Vol. Regulation	Off-grid mode	Regulate the output voltage amplitude in off- grid mode. Regulated range±10%
Output voltage frequency regulation	Freq. Regulation		Regulate the output voltage frequency in off-grid mode. Regulated range ±1Hz
Active Power Regulation	Active Power	Grid-tied mode	Regulate the active power of AC grid-tied mode. Regulated Range ±30kW
Reactive Power Regulation	Reactive Power		Regulate the reactive power of AC in grid-tied mode. Regulated Range ±30kW

	When the dispatched apparent power exceeds 30kVA, the output of active power will be restricted by reactive power, and the system will give priority to reactive output.
	When the parameter Active Power is set as a POSITIVE value, the PCS functions as battery charger. When the parameter Active Power is set as a NEGATIVE value, the PCS functions as an inverter, discharges battery.

5.7 Settings

Select **"Settings"** to enter the system operation parameter setting which includes Battery, HMI, Debug and Hardware parameter setting.

	Password is required when entering parameter setting.The initial password is 123456

5.7.1 Interface of battery parameters

Select **[Battery]** to enter battery charging and discharging parameter setting, as shown in Fig. 5-14. Select **[_<_]** and **[_>_]** under the interface to turn page down and select to return the main menu. The settable content of this interface is as shown in Table 5-4.

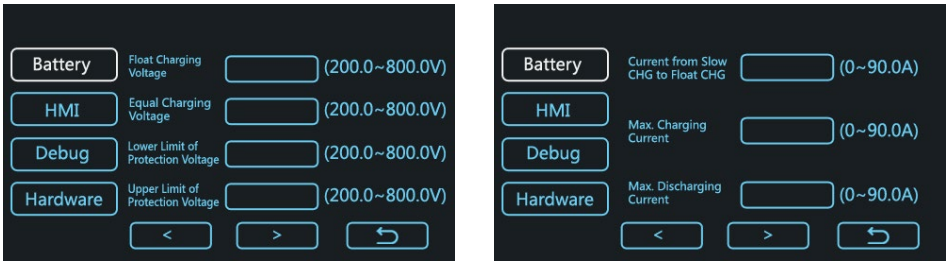


Fig. 5-14 Battery parameters setting

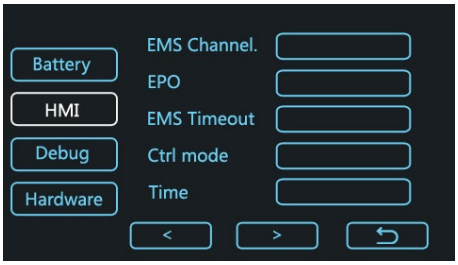
Table 5-4 Content of battery parameters setting

Item	Identifier	Description
Trickle charging voltage	Float Charging Voltage	Set as per to battery manufacturer's recommendation.
Constantvoltage charging voltage	Equal Charging Voltage	Set as per to battery manufacturer's recommendation.
Lower limit of discharging voltage protection	Lower Limit of Protection Voltage	It is final discharging voltage. When the battery discharging is up to this limit, the system modulewill stop operating and the battery stops discharging.
Upper limit of discharging voltage protection	Upper Limit of Protection Voltage	It is final charging voltage. When the battery charging is up to this limit, the system module willstop operating and the battery stops charging.
Current fromslow CHG to float CHG	Current From Slow CHG to Float CHG	Set as per to battery manufacturer's recommendation.
Max. charging current	Max Charging Current	Set as per to manufacturer's recommendation. The maximum current shall not exceed 90A.
Max. discharging current	Max Discharging Current	Set as per to manufacturer's recommendation.The maximum current shall not exceed 90A.

	The values shall be set to the following inequations Lower Limit of Protection Voltage ≤ Float Charging Voltage ≤ EqualCharging Voltage ≤ Upper Limit of Protection Voltage Current From Slow CHG to Float CHG ≤ Max Charging Current

5.7.2 HMI parameters

Select **[HMI]** to enter monitoring parameter setting, as shown in Fig. 5-15. Select **[_<_]** and **[_>_]** under the interface to turn page down and select  to return the main menu. The settable content of this interface is as shown in Table 5-5.



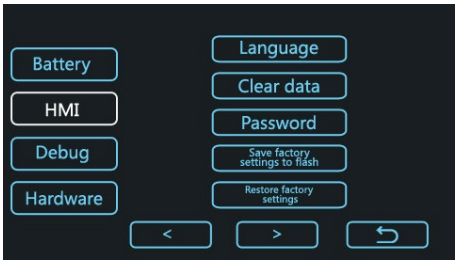


Fig. 5-15 HMI parameter setting

Table 5-2 Content of HMI parameters setting

Item	Identifier	Description
IP address	IP Address	Internet protocol address for PCS in networking
Subnet mask	Subnet Mask	Default: 255.255.255.0
Default gateway	Gateway	Default: 192.168.1.1
Modbus address	Modbus Ad	ID address of PCS in Modbus communication; range: 1~255
Baud rate	Baud Rate	Set communication baud rate, set as 9600 and 19200, system default: 9600
EMS communication	EMS Channel	Set EMS communication as Ethernet or RS-485. Default: RS-485.
EMS comm timeout	EMS Timeout	If PCS receives no communication frames withinsuch period, it will shut down. Can be set as 0~32767s, 0 stands for infinity.
Remote EPO	EPO	Enable/Disable remote EPO function. Default Disabled.
Controlling mode	CtrMode	Remote control or manual control

Modify password	Password	Users modify password as per their own requirements.
System time	Time	Set display time of inverter panel
Change language	Language	Change the language type of HMI
Clear data	Clear data	Clear fault data and operation records
Save factory settings	Save factory settings to flash memory	Users' operation is prohibited.
Restore factory settings	Restore factory settings	Restore parameter setting to initial state.

CAUTION	When password is modified, the password length of the inverter is limited to be 8 digits. If users cannot retrieve or forget their passwords after modification, please contact our service personnel to retrieve theirpasswords. Before clicking "clear data", please consult Sinexcel service. After clicking "restore factory settings", the inverter should be manuallyreboot again. Think twice before do. When control mode is set as remote, all manual controls are disabled. When control mode is set as manual, all remote controls are disabled.

5.7.3 Debug interface

Select **[Debug]** to enter debugging interface and Select **[_<_]** and **[_>_]** under the interface to turn page down and select ⮌ to return the main menu.

WARNING	This debugging interface is used by Sinexcel electrical maintenance engineer when checking machine operation state or fault. Users cannot conduce any operation. Any loss arising from customers' modifying the parameters in this interface will be undertaken by customers.

5.7.4 Hardware parameters

Select **[Hardware]** to enter hardware parameter setting and select ⮌ to return the main menu. This interface includes output voltage grade, output frequency grade, output voltage system, and module power rating.

WARNING	Users can review hardware information in this interface, but they cannot set the parameters. Any loss arising from customers' modifying the parameters in this interface will be undertaken by customers.

5.8 Inverter information

Select **[About]** to enter the inverter information interface, as shown in Fig. 5-16. Click  to return the main menu. This interface includes inverter serial number, MAC address, software build number, grid status and the rated power of the inverter.

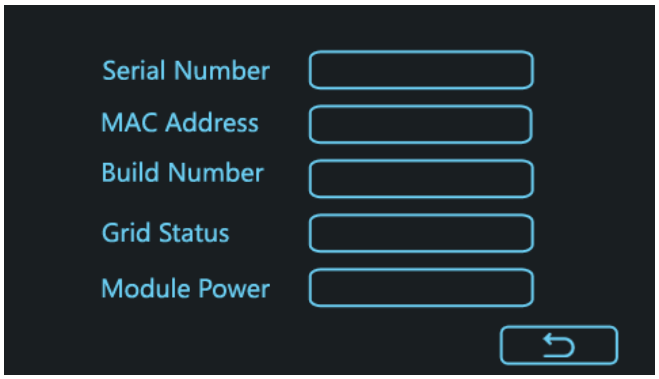


Fig. 5-16 Inverter information interface

6 Chapter 6 Communication mode

6.1 Communication interface

PCS supports Modbus protocol, adopts RS-485 and Ethernet communication interface and facilitates users to conduct background monitoring for energy storage inverter and realize remote signaling, remote metering and remote regulating of energy storage inverter.

6.1.1 RS-485 interface

RS-485 interface is reserved at the bottom of PCS and used to communicate with EMS. As an energy dispatching unit for energy storage system, EMS accepts remote dispatching, receives BMS information and realizes control and protection of automatic charging and discharging of energy storage system.

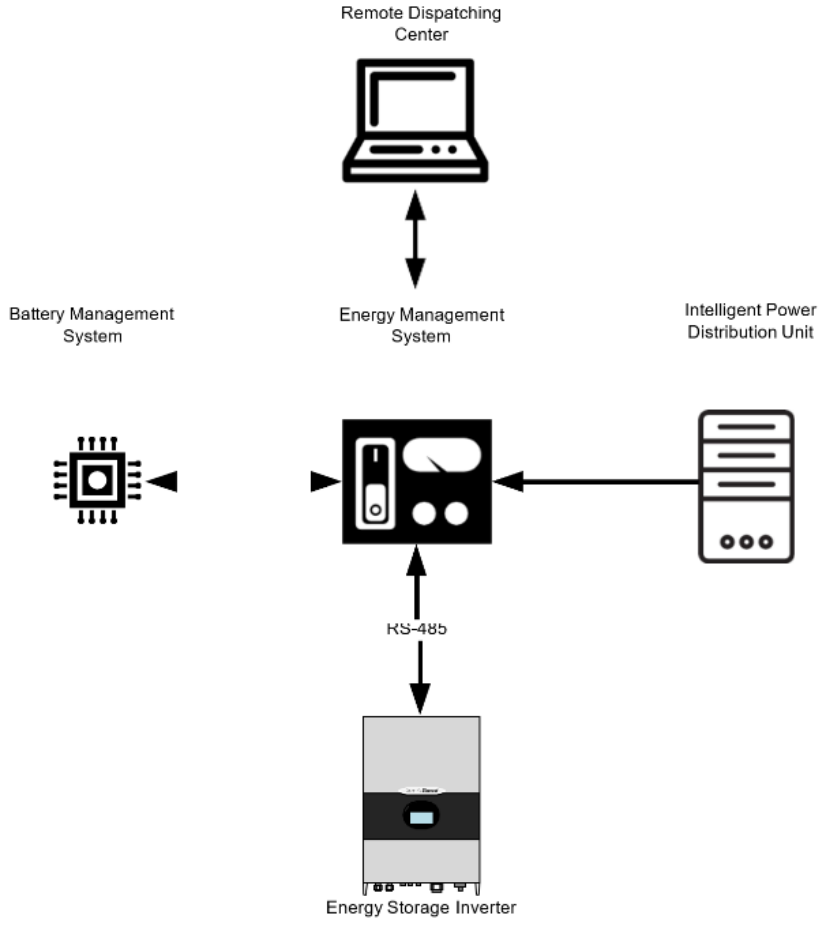


Fig. 6-1 Inverter connecting with EMS through RS-485

6.1.2 Ethernet interface

MicroNOC PCS supports Modbus TCP/IP protocol and has its own IP address. It can connect the Ethernet ports of multiple energy storage inverters to the switch, and the switchis connected to remote control computer or EMS. Thus, the state of energy storage invertercan be monitored and controlled in real time.

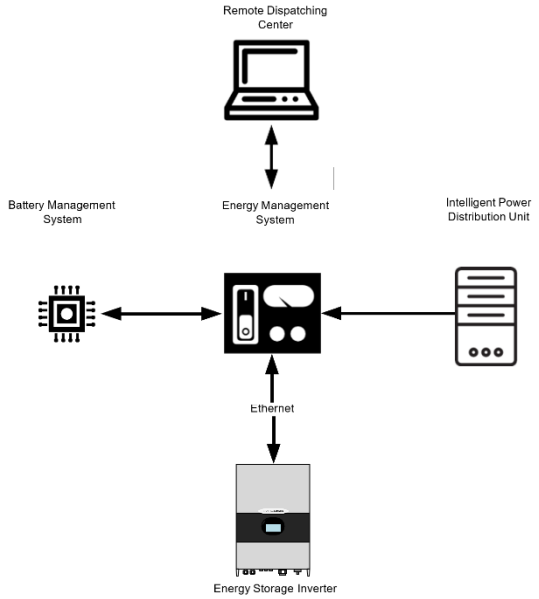


Fig. 6-2 Inverter connecting with EMS through Ethernet

6.2 BMS communication

PCS supports communication with BMS. It can obtain and detect basic state andprotection information from BMS, close the energy storage inverter according to the protection state of storage battery fault and improve the safety of battery pack. RS-485 is adopted for communication between energy storage inverter and BMS, as shown in the following diagram.

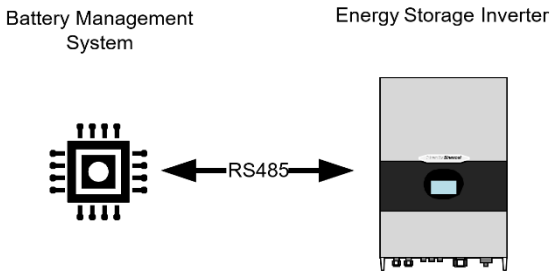


Fig. 6-3 Communication between and BMS

	Energy storage inverter communicates with BMS through RS-485. Ifthe inverter communicates with BMS directly, the communication interface of inverter and EMS can only be configured as Ethernet.

6.3 Monitoring system structure

Multiple PCS energy storage inverters can be connected to a local area network. The connection of background monitoring dispatching system can operate and control the energy storage inverters. This has provided great convenience for detecting and controlling the operation of energy storage inverters. The overall structure diagram for systemnetworking is shown in Fig. 6-4.

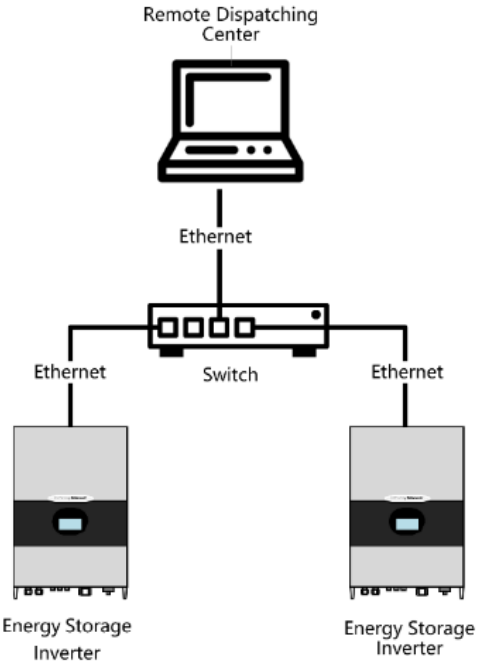


Fig. 6-4 Structure diagram for background monitoring system

7 Chapter 7 Maintenance

7.1 Operation environment requirements

- Temperature: -20~60℃
- Humidity: 0~95% (non-condensing)
- Max. elevation: 4,000m

	It is recommended that the operating temperature should be maintained between -20~45℃ so as to ensure the best performance of the convert. If the temperature is too high or low, it will shorten the service life of inverter. If the altitude exceeds 2,000 meters, the energy storage inverter will de-rate.

7.2 Electrical and fixed connection inspection

After installation and commissioning, routine inspection on follow items is recommended every three months. Record for each inspection should be made.

- All-in-one grounding connection;
- Electrical connection for DC input;
- Electrical connection for AC input;
- Connection for communication cables;
- AC/DC switches and fans;
- Read monitoring fault information.

7.3 Clearing and cleaning

Before installation and commissioning, regularly clean the dust and sundries in the terminals and mesh openings of the inverter.

After installation and commissioning, regularly clean the dust in machine room, check ventilation and air exhaust facilities. Cleaning once every three months is recommended. After installation and commissioning, regularly clean dust in inverter fan and insect prevention mask. Cleaning once every three months is recommended.

 CAUTION	The dust on the fan can block the ventilation duct, and the inverter shuts down due to over-temperature, which will severely affect the normal operation of the inverter.

Appendixes

Appendix I: Fault list of energy storage inverter

Table 1 presents the visible fault types of energy storage inverter. From this table, users can simply and quickly identify the system faults based on the fault types displayed on HMI.

Table 1 Fault list

Fault codes	Fault type	Description
AC O/V	Overvoltage of power grid	The voltage of power grid is higher than the set upper limit. After faults are recovered, the inverter will restart automatically.
AC U/V	Undervoltage of power grid	The voltage of power grid is lower than the set lower limit. After faults are recovered, the inverter will restart automatically.
Grid Reverse	Inverted sequence of power grid	The phase sequence of AC power grid is inverse.
AC O/F	Overfrequency of power grid	The frequency of power grid is higher than the set range. After faults are recovered, the inverter will restart automatically.
AC U/F	Underfrequency of power grid	The frequency of power grid is lower than the set range. After faults are recovered, the inverter will restart automatically.
Ugrid unbalance	Imbalance of power grid	The voltage of 3-phase power grid is imbalanced.
Islanding	Islanding of energy storage inverter	There is islanding in energy storage inverter.
Grid Switch F	Abnormality of grid-tied and off-grid shifting	Grid-tied and off-grid shifting is abnormal.
GND fault	Output ground fault	Leakage current detection is out of limits.
Iout A/N	Abnormality of output current	3-phase output current might be lack-phase.
Grid lock fault	Fault of grid phase locking	Grid voltage harmonic is too large, which cause fault of phase phasing.
Over-temp 1	Overtemperature of internal environment	The temperature of internal environment of inverter is too high.
15V power F	15V power fault	15V power voltage is too low.
Ubus O/V	DC bus overvoltage	The DC bus voltage in the inverter is too high.

Ubus U/V	DC bus under-voltage	During normal operation, DC bus voltage is too low.
Ubus unbalance	Imbalance of DC bus voltage	Voltage difference is too large between bus in the inverter.
AC relay OFF F	Short circuit of AC replay	AC relay has a short circuit.
Uout A/N	Abnormality of output voltage	Output voltage may be syntonic
Igrid unbalance	Imbalance of output current	During grid connection, the difference of 3-phase current is relatively large.
Over-temp 2	Overtemperature of radiator	The radiator temperature in inverter power module is too high.
Inv Output O/L /T	Output overload and timeout	The output overload and timeout of the inverter exceed the limit.
UI soft start F	Failure of inverter soft start	Fail in the process of inverter soft start.
AC relay ON F	Open circuit of AC relay	AC relay cannot be closed normally.
Over-load	Overload of inverter	There is an overload in the AC of inverter. Load needs to be reduced. Otherwise, shutdown will occur due to timeout.
DC input O/V	Overvoltage of DC input	DC input voltage is higher than the upper limit. After faults are recovered, the inverter will restart automatically.
DC L/V	Undervoltage of DC input	DC input voltage is lower than the lower limit. After faults are recovered, the inverter will restart automatically.
DC softstart F	Failure of DC soft start	Fail in the process of DC soft start.
DC relay OFF F	Short circuit of DC replay	DC relay has a short circuit.
DC relay ON F	Open circuit of DC relay	DC relay cannot be closed normally.
Bat Output O/L /T	Overload and timeout of battery power	Power overload time in DC exceeds the limit.
Bus soft start F	Failure of busbar soft start	Fail in the establishment of DC busbar.
DC O/A	DC overcurrent	DC battery has overcurrent. Load needs to be reduced. Otherwise, shutdown will occur due to overload.
DCH disabled	Discharging disabled	DC voltage is lower than threshold, charge the battery, or manually clear the fault

Appendix II: Quality assurance and after-sales service

(1) Quality assurance

Within warranty period, MicroNOC will provide free maintenance or replacement for products without.

(2) Disposal of claim products

The replaced nonconforming products will be disposed by MicroNOC. Users should properly store the claim products. As for the products requiring repair, users should give reasonable and sufficient time. We apologize for any inconvenience caused to you.

(3) In case of any of the following circumstances, MicroNOC will not offer any quality assurance:

- Transport damage;
- The device is operated under the environment conditions beyond this user's manual or in severe condition;
- The device is incorrectly installed, refitted or used;
- Users dismantle or assemble the device or system parts at will;
- It is beyond the warranty period;
- Product damage is caused by emergencies or natural disasters.

If customers require maintenance for the product faults above, our company will offer paid maintenance services after being judged by customer service department.

