

PWS2-30M-EX
Energy Storage Inverter
User's Manual

User's Manual

Sinexcel PWS2-30M-EX Energy Storage Inverter

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Applicable to: PWS2-30M-EX

Shenzhen Sinexcel Electric Co., Ltd. ("Sinexcel") provides its customers with all-around technical support. Users can contact local Sinexcel office or customer service center or directly contact Sinexcel Headquarters.

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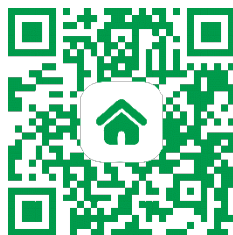
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Chapter 1 Overview

1.1 Model definition

The model definition of PWS2-30M-EX energy storage inverter is shown in Fig. 1-1:

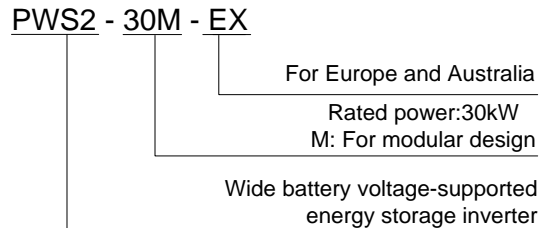


Fig. 1-1 Model definition





1.2 Icon interpretation

This user's manual is about installation and use of Sinexcel PWS2-30M-EX energy storage inverter.

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

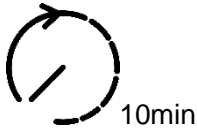



The following are the examples for icons in this user's manual. Please read and understand the definition of each icon.

 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 in a 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 during operation. 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 and a highlight and supplement for the content. It provides skills and tips of product usage and can help you efficiently solve some problems in

	application.
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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.


1.3 Safety instructions

PWS2-30M-EX 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	<p>All installation, debugging and maintenance should be completed by professionals. Professionals should:</p> <ul style="list-style-type: none"> ■ 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.
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Professionals who meet the above conditions can:




- (1) Install the inverter;
- (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.

 <p>CAUTION</p>	<p>Equipment wrong operation might cause injury!</p> <ul style="list-style-type: none"> ■ Removal and placement of the inverter should abide by the description in this manual. ■ Improper equipment operation might cause electric shock, burn or contusion. ■ Any system (equipment) damage caused by modification and disassembly without permission does not fall into the warranty scope.
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1.3.1 Safety instructions for mechanical installation




 <p>DANGER</p>	<p>Before inverter installation, ensure that the inverter does not have any electric connection.</p>
 <p>CAUTION</p>	<p>Poor ventilation for installation will weaken the system performance!</p> <p>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.</p>

1.3.2 Safety instructions for electrical connection


 <p>DANGER</p>	<p>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.</p>
 <p>CAUTION</p>	<p>The cables used in energy storage system must be connected firmly and with good insulation and proper specification.</p>
 <p>CAUTION</p>	<p>All electrical installations should meet national/regional electrical standards;</p> <p>Grid-tied operation can be conducted after permission is obtained from local national/regional electric power department.</p>





	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	<p>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.</p> <ul style="list-style-type: none"> ■ Don't touch any terminal and conductor connected with the power grid. ■ Pay attention to any instruction and safety documents about grid connection.
 WARNING	<p>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.</p> <ul style="list-style-type: none"> ■ Only intact and closed cabinet can protect operator's personal and property 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. <p>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.</p>
 CAUTION	<p>During inverter operation, the ventilation duct must not be blocked.</p>

1.3.4 Safety instructions for maintenance and replacement

 DANGER	<p>Improper equipment maintenance and operation might cause personal injury or equipment damage. Before any operation, users should strictly abide by the following steps:</p> <ul style="list-style-type: none"> ■ Disconnect the AC isolation switch between the power grid and the
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	<p>inverter, and then turn off DC breaker of the battery box.</p> <ul style="list-style-type: none"> ■ 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	<p>Stop irrelevant personnel from entering the maintenance site!</p> <p>During electrical connection and maintenance, temporary warning signs should be pasted and barriers should be set up to prevent irrelevant personnel entering electrical connection or maintenance area.</p>
 CAUTION	<p>The inverter can be restarted only after its malfunction affecting safety performance is removed.</p> <p>Power can be supplied again after the inverter is fully disconnected for 1 minute.</p> <p>There are no serviceable parts in the inverter. If any maintenance is required, please contact our after-sales personnel.</p>
 CAUTION	<p>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.</p>
 CAUTION	<p>Components might be caused by any contact with PCBs or other electrostatic sensitive components or improper operation.</p> <p>Don't touch the circuit boards.</p> <p>Abide by electrostatic protection specifications and wear anti-static wrist strap.</p>

1.3.5 Others

 WARNING	<p>Safety signs, warning label and nameplate on the inverter:</p> <ul style="list-style-type: none"> ■ Must be clearly visible; ■ Should not be removed or covered.
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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 in this manual. Such pictures are only used for description and indication. For detailed information, please refer to the product itself.

Chapter 2 Introduction to energy storage system

2.1 System application

As shown in Fig. 2-1, the energy storage system set up by PWS2-30M-EX is composed of battery (pack), energy storage inverter, intelligent (or manual) 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 (or manual) 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. PWS2-30M-EX energy storage inverter pushes the data to EMS or other host systems in real time.

The Intelligent power distribution unite is a remote controllable disconnecter. A manual switch can also work. This component is used to isolate the grid when the system needs to run in off-grid mode.

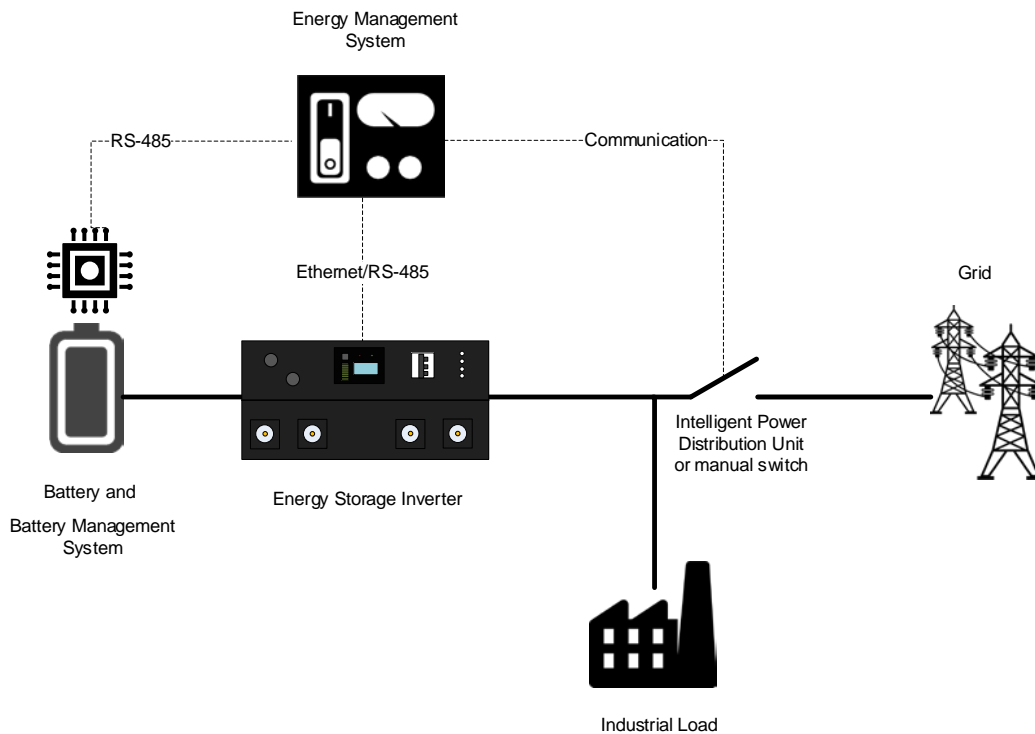


Fig. 2-1 Structure of energy storage system

2.2 Overall dimension

Overall dimension of PWS2-30M-EX is shown in Fig.2-2.

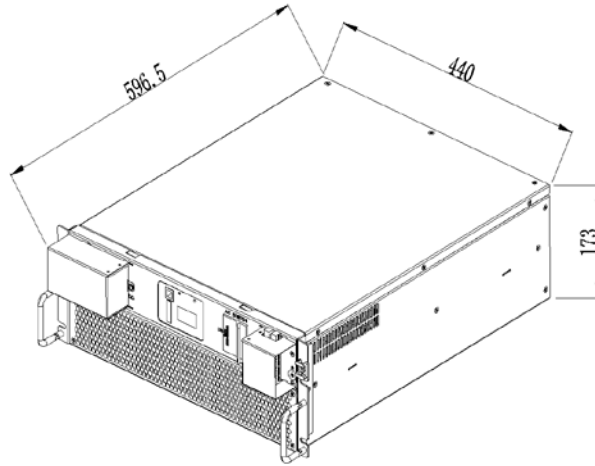


Fig. 2-2 Overall dimension of PWS2-30M-EX (unit: mm)

2.3 Appearance

The appearance of PWS2-30M-EX is shown in Fig.2-3.

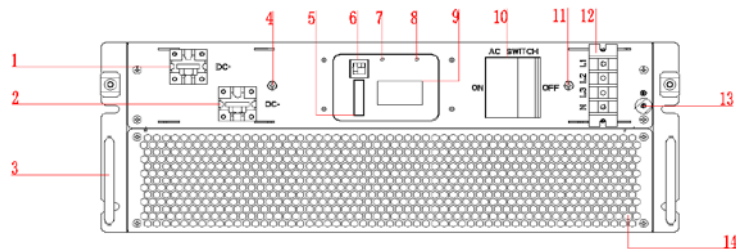


Fig. 2-3 Appearance of front side of PWS2-30M-EX

SN	Name	Description
1	Positive DC port	To connect positive power cables to the battery cabinet
2	Negative DC port	To connect negative power cables to the battery cabinet
3	Knob	Pulling module can't be used for bearing
4	DC protection shell fixing point	For DC terminal protection case fixing

5	Communication interfaces	Including RS-485, EPO
6	Internet port	Ethernet
7	Running lights	Lights on during normal operation
8	Fault indicator	Lights on during abnormal running
9	Monitor screen	Display monitoring content
10	AC breaker	Safety device to connect or disconnect the current in AC port.
11	AC protection shell fixing point	For AC terminal protection case fixing
12	AC port	To connect AC power cables
13	Ground port	To connect ground protection point.
14	Air outlet	Ventilation duct exit for heat dissipation

2.4 Technical parameters

Technical parameters of PWS2-30M-EX energy storage inverter:

Table 2-1 Technical parameters

Product Model		PWS2-30M-EX
DC PORT - BATTERY		
Battery Voltage Range		200~750V
DC.Max Current		90A
DC.Max Power		33kW
AC GRID-TIE PARAMETER		
Rated Output Power		30kW
Rated Voltage		400V
Voltage Range		-20%~+15%
Rated Frequency		50Hz
Frequency Range		-2.5~+1.5Hz
AC.Rated Current		43.3A
Output THDi		≤3%
Power Factor		0 leading~0 lagging
AC OFF-GRID PARAMETER		


Voltage	380/400V
Voltage Adjustable Range	±5%
Frequency	50Hz
Output THDu	≤1%(Linear load)
Output THDu	≤5%(Nonlinear load)
SYSTEM PARAMETER	
Peak Efficiency	97.1%
Wiring Mode	3P3W+PE, 3P4W+PE
Isolation Mode	No-isolation
Cooling	Forced air cooling with replaceable fan module
Noise	60dB
Working Temp.	-20°C~60°C(de-rating in case of exceeding 45°C)
IP Degree	IP20
Max Elevation	4000M(de-rating in case of exceeding 2,000m)
Humidity Range	0~95%
Size (W*D*H)	440*550*173mm
Weight	30kg
Type of battery	Lithium battery, lead-acid battery
COMMUNICATION	
Display	LCD Screen
Communication Protocol	Modbus TCP/IP, MESA
Communication Socket	Ethernet, RS485

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 PWS2-30M-EX 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-phase AC 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.

 <p>CAUTION</p>	<p>Energy storage inverter without built-in isolation transformer.</p> <p>If the capacity of the energy storage device does not meet the demand, multiple parallel connections can be made. Each inverter is equipped with a suitable battery capacity on the DC side and the AC side is</p>
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	connected to the grid in parallel.
--	------------------------------------

2.5.2 Function description

The functions of PWS2-30M-EX 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 charge the 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 for 3-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, BMS.
- 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 configuration is

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 above the Freq/Watt point.
- **PF regulate:** Regulate the PF of the entire storage system.

Protection function:

- 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
- VDE certified redundancy protection

Grid support function:

- Grid over/under frequency drop active power function
- Grid over/under voltage drop active power function
- Grid over/under voltage regulation reactive power function
- Active power regulation power factor curve function
- Power ramping after grid fault recovery

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

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 restored to 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.

	<p>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.</p>
---	--

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 360V. The curvilinear relationship for grid voltage de-rating is as follows:

$$P_{[V_{\min} 360V]} = P_n \times (V_{\text{grid}} / 360V)$$

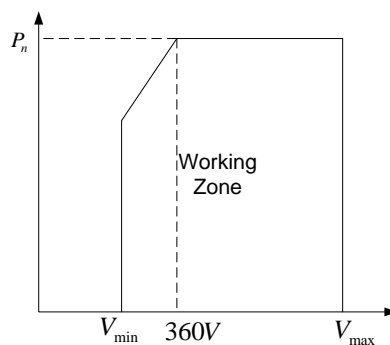


Fig.2-4 Grid under-voltage de-rating

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:

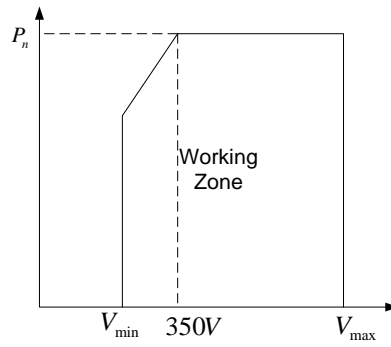


Fig.2-5 Battery under-voltage de-rating

External command de-rating

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

Chapter 3 Equipment transport, storage and installation

3.1 Transport and storage

During transport and storage of inverter module, pay attention to the packing label on enclosure. Transport and storage should meet the following requirements:

- Don't dismantle external package of the inverter.
- Ensure there is no corrosive gas nearby.
- Storage temperature is maintained between -40°C ~ 65°C , and relative humidity is maintained between 0%RH~95%RH.
- Dusty environment is not allowed.
- 3 layers are stacked at most.
- During storage, regular inspection should be conducted. If the packing material is damaged by worms or rats, it should be replaced in time.
- The storage location complies with firefighting requirement.
- After long-term storage, the inverter needs to be checked and tested by professionals before use.

3.2 Installation flow

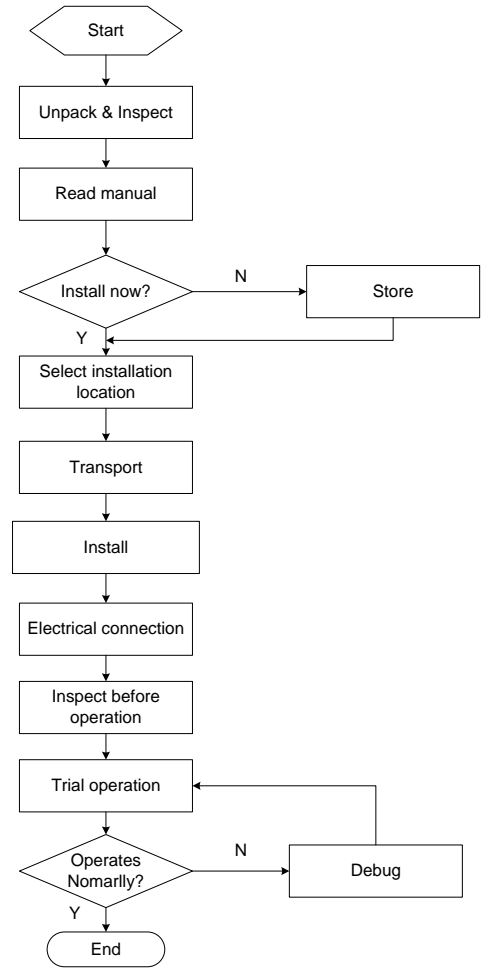


Fig. 3-1 Flow chart for installation

3.3 Open-case inspection

Before delivery, each inverter is strictly checked and tested. To prevent any damage during transport, the case needs to be opened and checked before installation of energy storage inverter. The following should be checked:

- Check whether the items in the packing list are consistent with the real objects.
- Check whether the data (such as product model, rated capacity and voltage) on the product nameplate is consistent with purchase contract.
- Check whether the ex-factory documents and accessories are complete.
- Check whether the energy storage inverter is deformed and falls off paint.

3.4 Model check and preparation

Before installation, please check inverter parameters. The nameplate in the side of PWS2-30M-EX contains inverter model, important technical parameters and certification marks, etc. Prepare operation tools (such as percussion drill, marker and cross screwdriver) in advance so that the energy storage inverter can be installed and wired smoothly. The nameplate label is shown in Fig. 3-2.

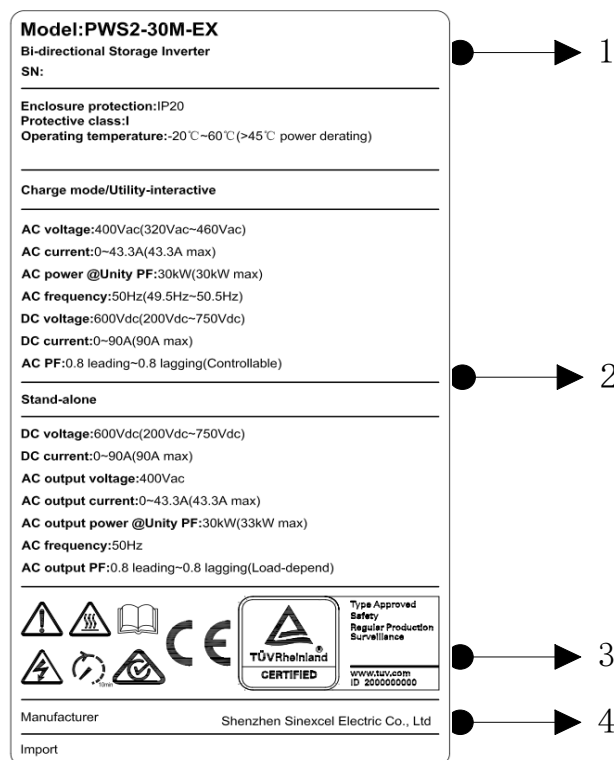


Fig. 3-2 Nameplate

* The above picture is only for reference. Please refer to the real object.

(1) Product model and serial number (2) Technical parameters of inverter

(3) Precaution and Certification label (4) Manufacturer

3.5 Installation requirements

3.5.1 Environment requirements




- The inverter is designed for indoor use. Direct sunshine, rain and ponding should be avoided.
- The installation environment is clean. The air should not contain lots of dust.
- The installation should be conducted in a well-ventilated environment so as to ensure good heat dissipation.
- Air inlet and outlet should not be sheltered so as to make ventilation duct unblocked.
- Environment temperature should be -20~45℃ so as to ensure that the inverter has the best operation state. Over-high and over-low temperature will shorten the service life of inverter.

3.5.2 Carrier requirements

- The installation carrier of inverter should be fireproof.
- Don't install the inverter on the flammable construction materials.
- Please ensure that the installation surface is firm and meets the load bearing requirements for inverter installation.

3.6 Electrical connection

PWS2-30M-EX electrical wiring should strictly follow the following requirements. Please read the following carefully.

 DANGER	Before electrical connection, please ensure that all switches of energy storage 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.)

3.6.1 Recommended system configuration

The configuration of energy storage system is recommended as follows:

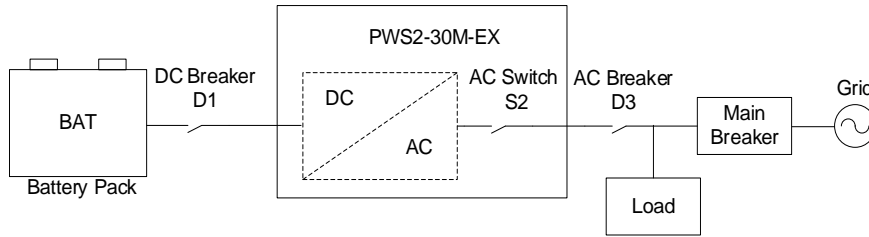





Fig. 3-2 Recommended configuration

 WARNING	<p>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.</p> <p>When 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.</p> <p>PWS2-30M-EX does not include DC GFDI function, and the system needs to configure BMS containing DC GFDI function.</p>
 WARNING	<p>Only qualified professional can conduct wiring work.</p>
 CAUTION	<p style="text-align: center;">Battery Types and Battery Management</p> <p>The Inverter can operate with different types and models of batteries. The battery is monitored and managed by the appropriate BMS, usually specific to the make and model of the battery. For proper operation the BMS must be compatible with the Sinexcel inverter.</p> <p>The BMS passes on the appropriate battery charge-discharge characteristics and settings to the inverter. The inverter in turn controls the charge/discharge voltage and current and ensures that the batteries are operated with the specified parameters and within the appropriate limits.</p> <p>For Lithium batteries the BMS is usually supplied by the battery manufacturer. For Lead-acid batteries, it could be supplied by battery manufacturer or anyone compatible verified by Sinexcel such as:</p> <ul style="list-style-type: none"> ● model OS-EB-P-xxx by Oztron Energy, ● model AL-EB-CIMG_x.xx by Alpha ESS, and so on. <p>These EMS incorporates various features for microgrid and hybrid operation and also includes the BMS suitable for Lead-acid batteries.</p>

	<p>The parameters are factory or site programmed to suit the particular make and model of the batteries. The BMS/EMS also includes a battery temperature sensor for temperature compensation.</p> <p>For details, consult your EMS vendor</p>
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3.6.2 Introduction to port of PCS

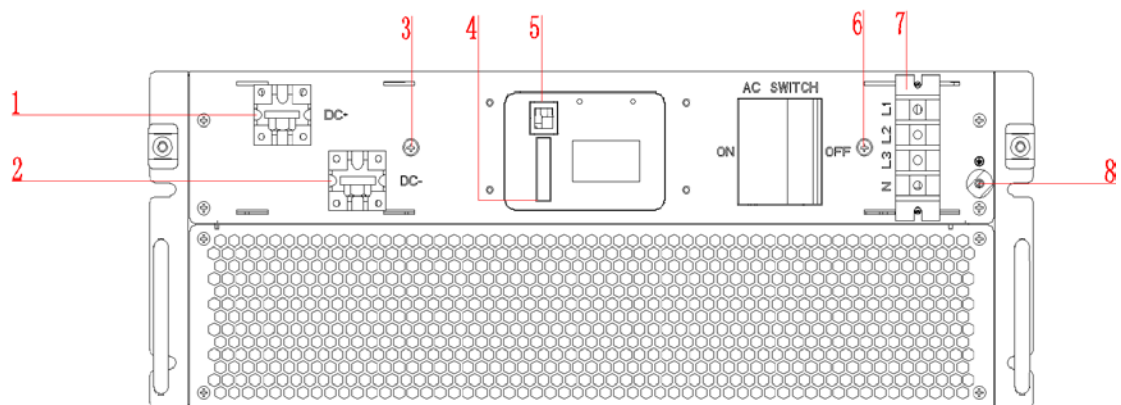


Fig. 3-4 Terminals introduction

No.	Description
1	DC + to connect battery's positive pole. It is recommended to use M8*12 screws.
2	DC - to connect battery's negative pole. It is recommended to use M8*12 screws.
3	DC protection shell fixing point
4	RS-485, R-in+, R-in-, R-out+, R-out-
5	Ethernet port
6	AC protection shell fixing point
7	AC terminal block, M6 crimp terminal are recommended.
8	Ground protection block, M4 crimping terminals are recommended.

Preparation tools:

- Torque wrench
- Screwdriver
- Wire stripper
- Terminal crimping machine
- Multimeter
- Hot air blower


- Heat Shrink Tubing

3.6.3 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: M4

 <p>CAUTION</p>	<p>Good grounding can resist the surge voltage surge and improve EMI performance. Before connection of AC, DC and communication cables, the grounding wire should be connected first.</p> <p>It is recommended that the inverter should be grounded locally. For multiple PWS2-30M-EX 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.</p>
--	--

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

Step 2: 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 3: Cover the terminal on the grounding bolt and screw up the nut.



Fig. 3-5 Wiring stripping

3.6.4 DC wiring

Specifications of cable and terminal:

- Grounding wire: the recommended cross-sectional area=25mm² (3AWG) outdoor copper core cable
- Ring terminal: M8

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: Connect the positive cable of the battery pack to the “DC+” of the DC terminal block so that the angle between the cable and the terminal block is 90 degrees.

Step 5: Connect the negative cable of the battery pack to the “DC-” of the DC terminal block so that the angle between the cable and the terminal block is 90 degrees.

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

Remark: The angle of 90 degrees between the cable and the terminal is for convenient installation of the DC side protective case.

 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.
 WARNING	Only qualified professional can conduct wiring work.

3.6.5 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 16mm² (AWG 5) with copper cord.

Step 5: Connect AC cable to “L1”, “L2”, “L3” and “N” of AC wire terminal block;

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.
 WARNING	Only qualified professional can conduct wiring work.

3.6.6 Connection of communication cables

PWS2-30M-EX has two different communication interfaces: Ethernet and RS-485.

(1) Ethernet cable connection

PWS2-30M-EX can be directly networked through Ethernet and connected to PC for communication. Through networking, users can remote dispatch energy, monitor operation state, and set parameters with background software in PC. The definition of RJ45 connector pin is shown in Fig. 3-6.

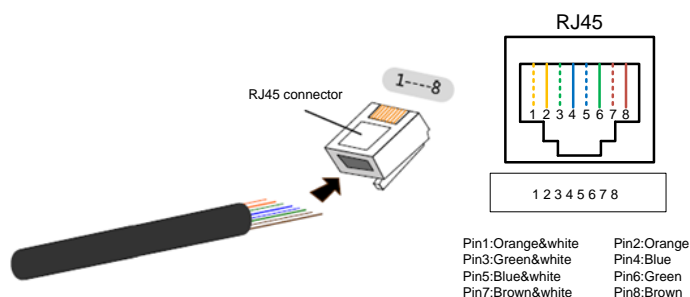


Fig. 3-6 Ethernet interface

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: Insert the finished cable into the "Ethernet" port of the inverter panel.


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

Step 5: Lock the waterproof cap.

(2) RS 485 cable connection

PWS2-30M-EX can be connected to BMS/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. The port is a 3.81MM pitch pluggable terminal block with a spacing of 3.81 8P.

Insert the communication cable into the terminal block, lock the terminal, and access the communication port according to the sequence of the operation panel.

 WARNING	Only qualified professional can conduct wiring work.
--	--

3.6.7 EPO connection

The R-in+ interface and R-in-interface can be used as the EPO interface, which is a 3.81MM pitch pluggable terminal block.

The EPO function can be enabled or disabled by setting the contents of the 0x0148 address register to 1 or 0. When the EPO function is enabled, you need to short the R-in+ interface to the R-in-interface to maintain the normal operation of the PWS2-30M-EX.

If the R-in+ interface is disconnected from the R-in-interface, the device will trigger an EPO alarm to shut down.

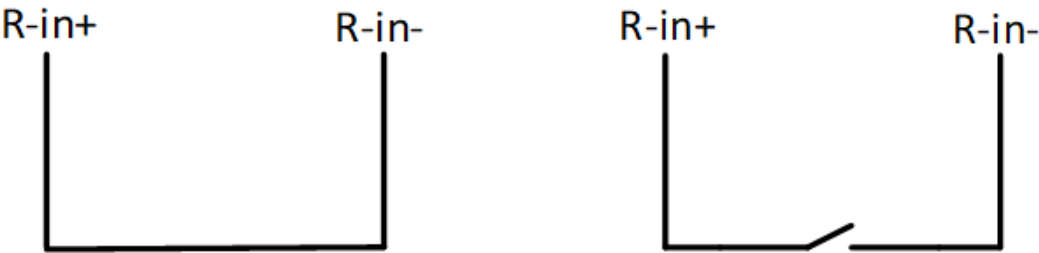



Fig.3-7 Wiring ways

 WARNING	<p>Only qualified professional can use R-in+ and R-in-interface.</p>
---	--

3.6.8 DMR0 port

According to the Australian certification requirements for the Inverter demand response modes (abbreviated as DRM) function, the grid-connected equipment incorporated into the Australian grid must be equipped with a DRM device. Therefore, the PWS2-30M-EX device shipped to Australia must have a built-in DRM device, while shipments to other countries, optional DRM device. At present, the DRM device built into the PWS2-30M-EX can only implement the DRM0 function as shown in the following figure.

DRM 0	<input checked="" type="checkbox"/>	DRM 1	<input type="checkbox"/>	DRM 2	<input type="checkbox"/>
DRM 3	<input type="checkbox"/>	DRM 4	<input type="checkbox"/>	DRM 5	<input type="checkbox"/>
DRM 6	<input type="checkbox"/>	DRM 7	<input type="checkbox"/>	DRM 8	<input type="checkbox"/>

Fig. 3-8 DRM function selection table

When the PWS2-30M-EX has a built-in DRM device, the customer can enable or disable the DRM0 function by setting the contents of the 0x0148 address register to 2 or 0.

If the DRM0 function is enabled, a resistor with a resistance of 15kΩ and power greater than 0.1W must be connected between the R-in+ interface and the R-in-interface. If the resistor is short-circuited or open circuited, the PWS2-30M-EX device will report a fault within 2 seconds and shut down.

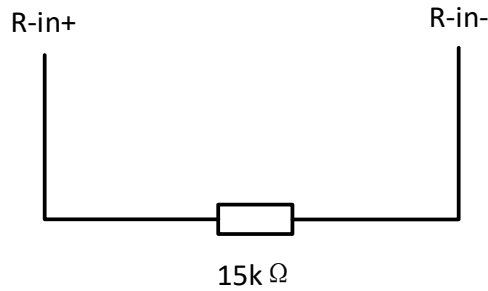




Fig.3-9 DRM0 interface

 WARNING	Since both the EPO function and the DRM0 function need to use the R-in+ and R-in-interface, only one of the two functions can be selected.
 WARNING	Only qualified professional can use R-in+ and R-in-interface.

3.7 Check after installation

3.7.1 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 grid 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.

3.7.2 Electric and communication check

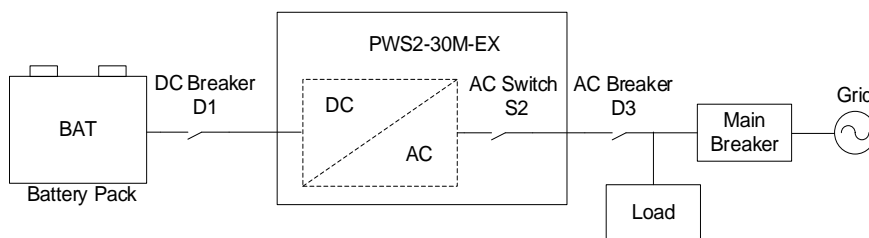





Fig. 3-10 Electric diagram

- (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 normal voltage range. 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 400/380V. If it is 3-phase and 4-wire connection, the voltage among A-N, B-N and C-N should be 230/220V. If the measurement deviation is higher than tolerance, turn off AC breaker D3 and recheck the wiring in AC port.

 <p>CAUTION</p>	<p>The neutral line of the load MUST be connected to the grid's neutral line even if the PWS2-30M-EX is implemented as backup power.</p>
--	--

 <p>DANGER</p>	<p>Electrical connection inspection needs to be completed by qualified operator.</p> <p>After the switch is closed, the system has been loaded with high voltage, so contact with any bared electrical part in the inverter is prohibited.</p>
 <p>WARNING</p>	<p>Only qualified professional can operate.</p>

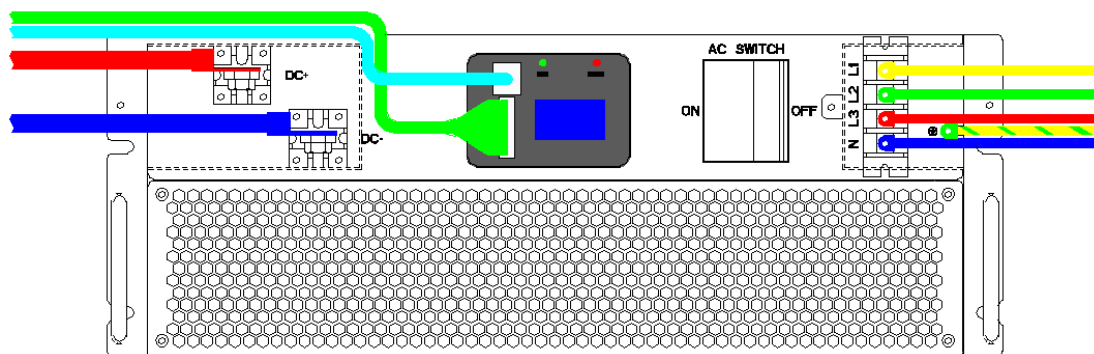


Fig. 3-11 Display after completing wiring

The modular machine can use multi-branch or cabinet multi-machine operation mode, please refer to the following picture.

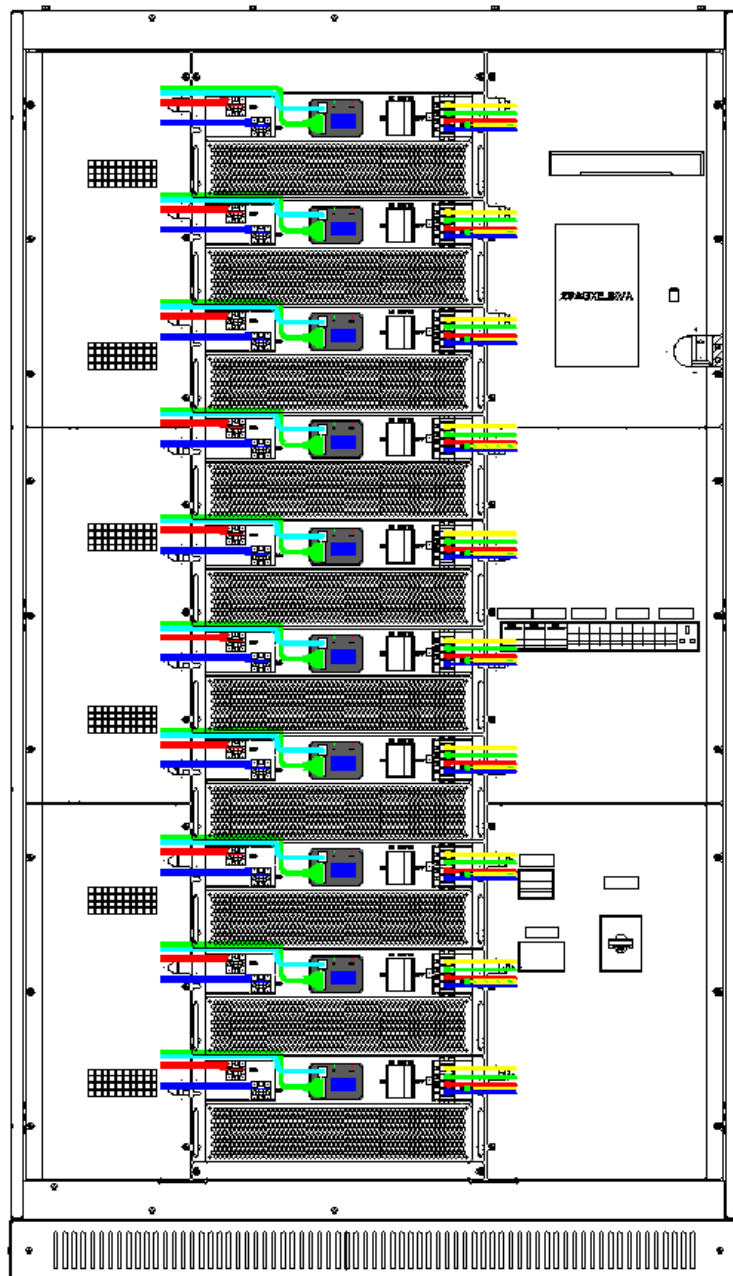


Fig. 3-12 Renderings show

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) According to the inspection items in the third chapter after installation, check the DC input wiring of the energy storage device, whether the AC output wiring is normal and the grounding is good.
- (3) Check whether battery voltage is within normal voltage range.
- (4) Check whether the phase voltage and line voltage of the grid side are within the normal range and record the voltage value.

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 10s, LCD will indicate such warning information as “Alarm: 0103”. (It represents AC undervoltage and AC underfrequency.)
- (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 5s, such warning information as “Alarm:0103” will be cleared automatically.
- (4) Set up the system startup and on-grid operation mode.
- (5) If the inverter is required to operate in off-grid mode, set monitoring parameter to control the operation mode after Step (1). If it is set as off-grid mode, such information as “Alarm:0103” will be cleared automatically.
- (6) After the AC voltage on LCD screen of the inverter is 400V, close AC isolator S2 of the inverter to power a load.



CAUTION


If the inverter is required to operate in off-grid mode, please confirm that the breaker to the grid has been disconnected. Otherwise, it might damage the inverter, or cause personnel injury to the grid maintainers.

4.1.3 Shutdown steps

During normal operation of energy storage inverter, the following steps shall be conducted

if shutdown is required:

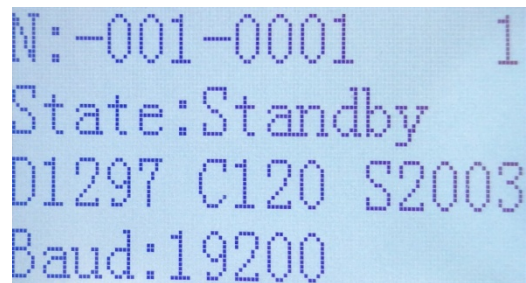
- (1) To find the location of the shutdown register in the accessory protocol table protocol, then send shutdown instructions to inverter.
- (2) To confirm whether the inverter is in standby state.
- (3) Turn off AC isolator S2 and AC breaker D3.
- (4) Turn off DC breaker D1 of battery pack.

 WARNING	<p>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.</p> <p>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!</p>
--	---

4.2 Monitoring interface information

After the module is powered on, the monitor screen is illuminated, and the monitor screen scrolls to display information about PWS2-30M-EX. Please refer to the following specification (The information shown in the following pictures is for reference only, and the actual information is mainly displayed):

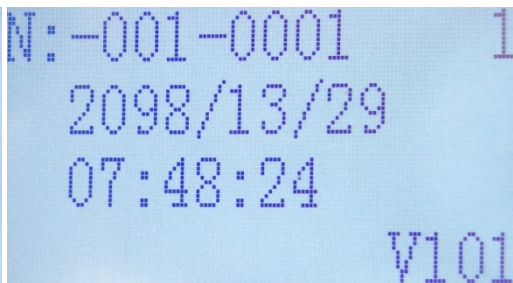
(1) System information



```

N:-001-0001      1
State:Standby
D1297 C120 S2003
Baud:19200
  
```

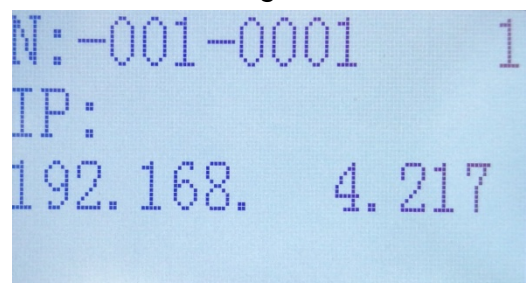
Figure a.



```

N:-001-0001      1
2098/13/29
07:48:24
V101
  
```

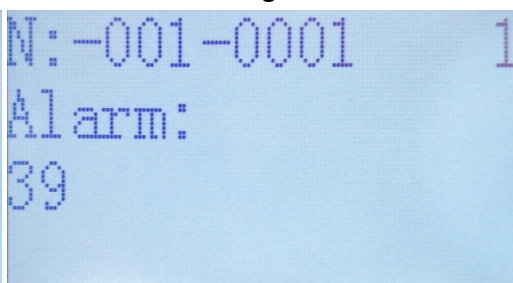
Figure b.



```

N:-001-0001      1
IP:
192.168.  4.217
  
```

Figure c.



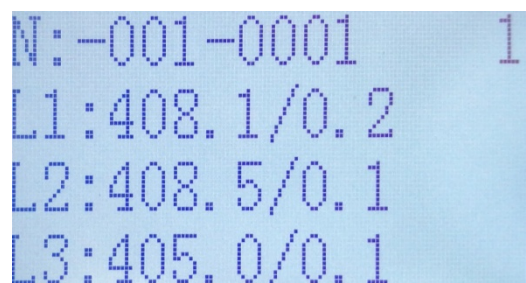
```

N:-001-0001      1
Alarm:
39
  
```

Figure d.

- Figure a. shows the system status and version information.
- Figure b. shows the system time.
- Figure c. shows the system IP information.
- Figure d. shows the system alarm information.

(2) AC information



```

N:-001-0001      1
L1:408.1/0.2
L2:408.5/0.1
L3:405.0/0.1
  
```

Figure a.



```

N:-001-0001      1
Pac(kW):0.01
F(Hz):49.95
Tac(°C):26
  
```

Figure b.

- Figure a. shows AC voltage and current of the system.
- Figure b. shows AC power, frequency and temperature of system.

(3) DC information

N:-001-0001 1
 Udc(V):0.1
 Idc(A):0.0
 Tdc(°C):26

Table 5-1 Information list

Item	Identifier	Description	Unit
Serial NO.	N	Display serial number information of inverter	/
Status	state	system status	/
version information	D***,C***,S***	DSP version, CPLD version, STM32 version	/
Baud rate	Baud	Baud rate value of inverter	
Voltage	L1, L2, L3	Line voltage/current of AC port of inverter	V
Active power	P	Active power of AC of inverter	kW
Frequency	f	Voltage frequency of AC port of inverter	Hz
Temperature	T	AC power module temperature of inverter	°C
System time	/	Screen display system time and software version	/
IP address	IP	Internet Protocol address in the network	/
Alarm information	Alarm	Alarm code	/
Machine NO.	1,2,...,N	The machine corresponds to the machine number (the Arabic number in the upper right corner of the page)	/

4.3 Control method

After the PWS2-30M-EX module is installed and powered on, make sure that the Ethernet/RS485 port is connected. According to communication protocol in the appendix, the PWS2-30M-EX instruction can be used to set parameters and obtain status information via Ethernet or RS485.

In order to the user to understand frame of instruction and frame of state acquisition, we provide the PWS2-30M-EX control plug to provide an example of instruction frame data structure, as shown in the following figure.

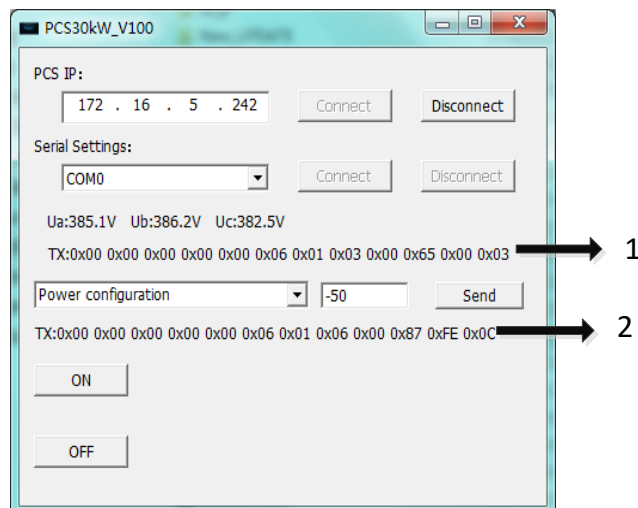


Fig.4.1 Control plug screenshot

(1) Frame of state acquisition (2) Frame of parameter setting

When using an Ethernet connection, fill in the PCS IP column with the local IP address displayed on the monitor screen. When using RS485 connection, the plug-in baud rate is PWS2-30M-EX default baud rate 19200 and the optional serial port number only supports COM8.

After connection, the real-time sampling value of the line voltage can be obtained. The active power (unit kw), the battery float voltage (unit V), the battery equal charge voltage (unit V), the equal charge-to-float charge current (unit A), the maximum charge current (unit A), the maximum discharge current (unit A), the battery voltage protection lower limit (unit V) and the battery voltage protection upper limit (potential V) parameters can be set. The corresponding command frame is automatically displayed below.

Chapter 5 Communication mode

5.1 Communication interface

PWS2-30M-EX 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.

5.1.1 RS-485 interface

RS-485 interface is reserved at the bottom of PWS2-30M-EX 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.

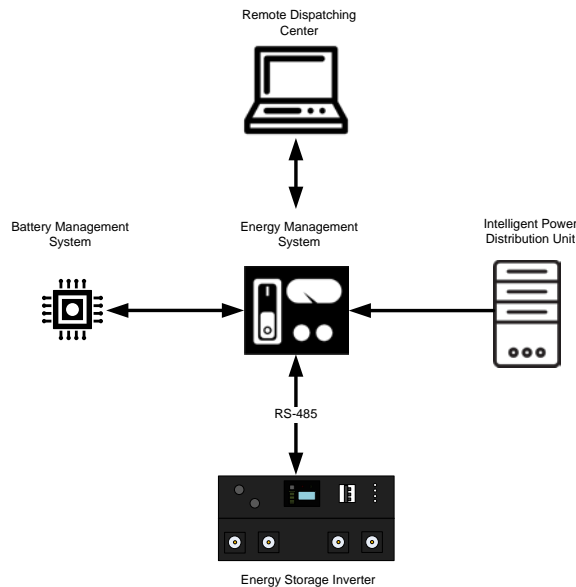


Fig. 5-1 Inverter connecting with EMS through RS-485

5.1.2 Ethernet interface

PWS2-30M-EX 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 switch is connected to remote control computer or EMS. Thus, the state of energy storage inverter can be monitored and controlled in real time.

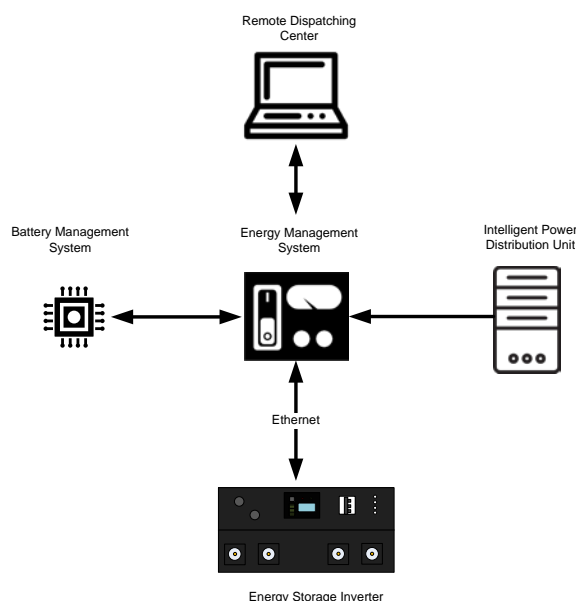


Fig. 5-2 Inverter connecting with EMS through Ethernet

5.2 BMS communication

PWS2-30M-EX supports communication with BMS. It can obtain and detect basic state and protection 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.

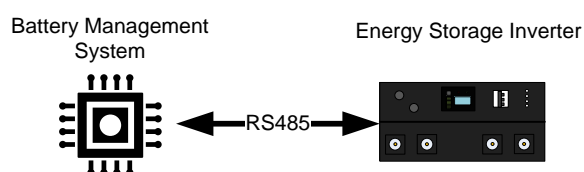



Fig. 5-3 Communication between PWS2-30M-EX and BMS

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

5.3 Monitoring system structure

Multiple PWS2-30M-EX 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 system networking is shown in Fig. 5-4.

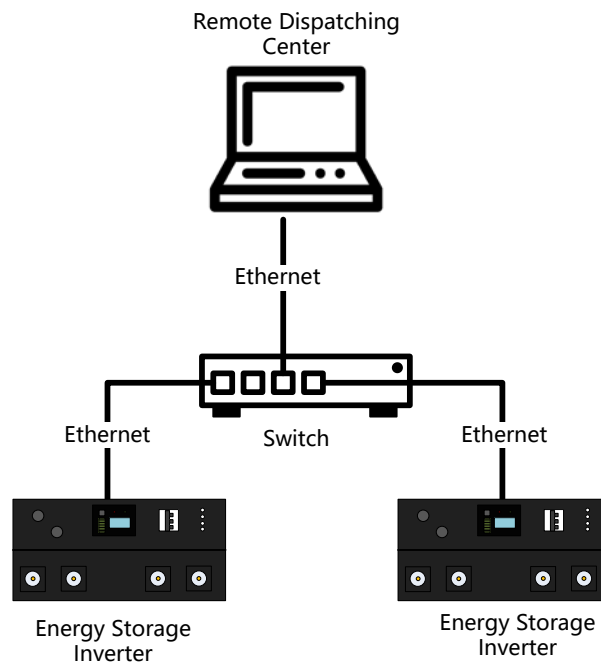



Fig. 5-4 Structure diagram for background monitoring system

Chapter 6 Maintenance

6.1 Operation environment requirements

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

	<p>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.</p> <p>If the altitude exceeds 2,000 meters, the energy storage inverter will de-rate.</p>
---	---

6.2 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.

6.3 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	<p>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.</p>
--	--

Appendixes

Appendix I: Fault list of energy storage inverter

Table 1 shows the types of faults that can be seen in the modular energy storage device. From this table, you can easily and quickly locate the system fault type from the fault code displayed on the monitoring screen.

Table 1 Fault list

Fault codes	Fault type	Description	Advice
0	AC O/V	The voltage of power grid is higher than the set upper limit. After faults are recovered, the inverter will restart automatically.	This fault is caused by the instantaneous condition of the power grid. Waiting for a while, the inverter can return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
1	AC U/V	The voltage of power grid is lower than the set lower limit. After faults are recovered, the inverter will restart automatically.	This fault is caused by the instantaneous condition of the power grid. Waiting for a while, the inverter can return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
2	AC O/F	The frequency of power grid is higher than the set range. After faults are recovered, the inverter will restart automatically.	This fault is caused by the instantaneous condition of the power grid. Waiting for a while, the inverter can return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
3	AC U/F	The frequency of power grid is lower than the set range. After faults are recovered, the inverter will restart automatically.	This fault is caused by the instantaneous condition of the power grid. Waiting for a while, the inverter can return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
4	Ugrid unbalance	The voltage of 3-phase power grid is imbalanced.	Waiting for a while, the inverter can return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
5	Grid Reverse	The phase sequence of AC power grid is inverse.	Check the grid phase sequence wiring, correct it and restart it.
6	Islanding	There is islanding in energy storage inverter.	1. Check whether the grid is reliable 2. Check that the circuit breaker is closed properly If the fault persists, contact Sinexcel Electric Customer Service Center.
7	Grid Switch F	Grid-tied and off-grid shifting is abnormal.	Confirm that the AC grid is disconnected

			when switching off-grid mode. If the fault persists, please contact Sinexcel Electric Customer Service Center.
8	GND fault	Leakage current detection is out of limits.	Check for ground faults, if the fault persists, please contact Sinexcel Electric Customer Service Center. If the fault persists, please contact Sinexcel Electric Customer Service Center.
9	Grid lock fault	Grid voltage harmonic is too large, which cause fault of phase phasing.	1. Check if the power supply is normal 2. Wait for the inverter to return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
A	Over-temp 1	The temperature of internal environment of inverter is too high.	1. Check if the fan is working 2. Check if the output power exceeds the rated value too much If the fault persists, please contact Sinexcel Electric Customer Service Center.
B	ON_GRID Timeout	The grid detection time does not meet the grid connection requirements.	1. Check whether the grid voltage and frequency are within the permitted grid connection conditions 2. Check if the quantity of the parameters under the conditions of grid-connected permission is reasonable If the fault persists, please contact Sinexcel Electric Customer Service Center.
10	EPO	Emergency shutdown	Wait 20s after resetting the emergency stop button, the fault can be cleared automatically. If the fault persists, please contact Sinexcel Electric Customer Service Center.
11	Init fault	The monitoring parameter is set incorrectly.	If this fault occurs, please restart the inverter. If the fault persists, please contact Sinexcel Electric Customer Service Center.
12	DSP Ver A/N	DSP version error	If the fault occurs, please contact Sinexcel Electric Customer Service Center.
13	CPLD Ver A/N	CPLD version error	If the fault occurs, please contact Sinexcel Electric Customer Service Center.
14	M3 fault	Hardware version error	If the fault occurs, please contact Sinexcel Electric Customer Service Center.
15	CAN A fault	Internal communication failure	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.

16	AuxiliaryPower F	15V Auxiliary power voltage is too low.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
17	Fan fault	Inverter internal fan failure	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
18	Ubus O/V	The DC bus voltage in the inverter is too high.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
19	Ubus U/V	During normal operation, DC bus voltage is too low.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
1A	Ubus unbalance	Voltage difference is too large between bus in the inverter.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
1C	AC relay OFF F	AC relay has a short circuit.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
1D	Uout A/N	Output voltage may be syntonc	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
1E	Igrid unbalance	During grid connection, the difference of 3-phase current is relatively large.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
1F	Over-temp 2	The radiator temperature in inverter power module is too high.	1. Check if the fan is working 2. Clean the vents If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
20	Inv Output O/L/T	The output overload and timeout of the inverter exceed the limit.	Reduce the load. If the fault persists, please contact Sinexcel Electric Customer Service Center.
21	AC continuous OV	Grid voltage abnormal oscillation	1. Check whether the grid voltage amplitude is stable within the limit value 2. Check if the continuous overvoltage limit value setting is reasonable

			If the fault persists, please contact Sinexcel Electric Customer Service Center.
22	AC soft start F	AC relay does not close properly	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
23	UI soft start F	Fail in the process of inverter soft start.	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
24	AC switch ON F	AC relay cannot be closed normally.	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
25	U2 fault	U2 board with U1 board communication is disconnected.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
26	DC Component F	DC component in the AC output current value exceeds 1A.	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
27	Sampling fault	Inconsistent sampling values of master controller and slave controller	Wait for the inverter to return to normal. If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
28	EEPROM1 read E	U1 board EEPROM read error during initialization	If this fault occurs, please re-power and restart the inverter. If the fault persists after repeated operation several times, please contact Sinexcel Electric Customer Service Center.
29	EEPROM2 read E	U1 board EEPROM read error during initialization.	If this fault occurs, please re-power and restart the inverter. If the fault persists after repeated operation several times, please contact Sinexcel Electric Customer Service Center.
2A	EEPROM3 read E	U1 board EEPROM read error during initialization	If this fault occurs, please re-power and restart the inverter. If the fault persists after repeated operation several times, please contact Sinexcel Electric Customer Service Center.
2B	Over-load	There is an overload in the AC of inverter. Load needs to be reduced. Otherwise, shutdown will occur due to timeout.	Reduce the load. If the fault persists, please contact Sinexcel Electric Customer Service Center. If the fault persists, please contact Sinexcel Electric Customer Service Center.

38	DC input O/V	DC input voltage is higher than the upper limit. After faults are recovered, the inverter will restart automatically.	<p>1. Set the inverter power to discharge power to discharge the battery and decrease the battery voltage</p> <p>2. Check if the charging voltage, float voltage and battery voltage upper limit are reasonable</p> <p>If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.</p>
39	DC L/V	DC input voltage is lower than the lower limit. After faults are recovered, the inverter will restart automatically.	<p>1. Check whether the battery is normally connected to the inverter</p> <p>2. Set the inverter power to charge direction, charge the battery and increase the battery voltage</p> <p>3. Check if the EOD voltage setting is reasonable</p> <p>If the fault persists, please contact Sinexcel Electric Customer Service Center.</p>
3B	BMS fault	BMS sets fault flag and requires inverter shutdown	Check the BMS fault flag to find out the cause of the BMS alarm. After the BMS clears the fault flag, the fault is cleared automatically.
3C	BMS TimeOut	Inverter loses communication with BMS	<p>1. Check whether the communication cable between the inverter and BMS is firmly connected</p> <p>2. If the inverter does not need to communicate with the BMS, set the BMS timeout to 0</p>
3D	EMS TimeOut	Inverter loses communication with EMS	<p>1. Check whether the communication cable between the inverter and EMS is firmly connected</p> <p>2. If the inverter does not need to communicate with the EMS, set the BMS timeout to 0</p>
40	DC soft start F	Fail in the process of DC soft start.	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
41	DC switch OFF F	Short circuit in DC relay.	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
42	DC switch ON F	DC relay does not close properly.	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.

43	Bat Output O/L/T	Power overload time in DC exceeds the limit.	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
44	Bus soft start F	Fail in the establishment of DC busbar.	Restart inverter, wait for the inverter to return to normal. If the fault persists, please contact Sinexcel Electric Customer Service Center.
45	DC fast O/A	/	If the fault occurs repeatedly, please contact Sinexcel Electric Customer Service Center.
48	DC O/A	DC battery has overcurrent. Load needs to be reduced. Otherwise, shutdown will occur due to overload.	Reduce load power. If the fault persists, please contact Sinexcel Electric Customer Service Center.
90	Setting fault	Unreasonable hardware parameter settings	Reconfigure reasonable hardware parameters. After the setting is complete, you need to power on again to clear the fault. If the fault persists, please contact Sinexcel Electric Customer Service Center.
91	OFF Grid U/V	Battery voltage is lower than EOD voltage in off-grid mode.	1. Set the inverter to grid mode and charge the battery 2. Check if the EOD voltage setting is reasonable
92	N Pha Lost	Inverter AC side N line is not connected.	1. Check whether the N wire on the AC side of the inverter is firmly connected 2. If the inverter does not need to connect N lines, please disable the N detection function.
93	SM Ubus O/V	During the standby process, if the grid voltage amplitude is too high will cause the internal bus voltage of the inverter is too high.	Check if the grid voltage amplitude is abnormal and wait for the inverter to return to normal.
95	F SudChange Flt	The frequency change rate of the grid exceeds the limit value.	Check if the grid frequency is abnormal and wait for the inverter to return to normal.
96	A SudChange Flt	The phase angle mutation of the grid exceeds the limit value	Check if the grid phase angle is abnormal and wait for the inverter to return to normal.

Appendix II: Quality assurance and after-sales service

(1) Quality assurance

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

(2) Disposal of claim products

The replaced nonconforming products will be disposed by Sinexcel. 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, Sinexcel 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.

Installation records

Feedback