



SG500MX

PV Grid-Connected Inverter

Operation Manual

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1 About this Manual

1.1 Foreword

Thank you for purchasing the SG500MX PV grid-connected central inverter from Sungrow Power Supply Co., Ltd.. We hope that the device will meet with your satisfaction when you use it with your PV system. Your commands and feedbacks on the performance and function of the device are very important for our further improvement.

1.2 Validity

This Installation Manual is valid for the following inverter types:

- Central Inverter SG500MX

The Central InverterSG500MX is referred to as “inverter” hereinafter unless otherwise specified.

1.3 Contents

This manual contains the following information:

- Safety instructions

Safety instructions for the operation and maintenance of the inverter.

- Product description

Basic information about the inverter is described, including its structure, function, classification and so on.

- Use

Introduce the inverter operation and use of HMI.

- Routine maintenance

Introduce the daily maintenance of the inverter and the replacement of the accessories.

- Troubleshooting

Introduce the potential faults and troubleshooting of the inverter.

- Others

Technical data of the inverter, exclusion of liability and the way to contact Sungrow.

1.4 Target Group

This manual is aimed at technical personnel who are responsible and qualified for the inverter installation and commissioning in the PV power system.

1.5 How to Use This Manual

Read this manual and other related documents carefully before any work on the inverter.

Documents must be stored carefully and available at all times. Additional documents are also available to the users:

- Installation Manual (in the scope of delivery)
- Connection Requirements for Medium-voltage Transformers for Central Inverters without Transformer

All rights reserved including the pictures, markings and symbols used. Any reproduction or disclosure, even partially, of the contents of this manual is strictly forbidden without prior written authorization of Sungrow.



For user's convenience, there are a large number of pictures in this manual. These pictures are indicative only. For details about the device, please refer to the actual product you receive.

1.6 Symbols Explanation

This manual contains important safety and operational instructions that must be accurately understood and followed during the installation and maintenance of the equipment.

To ensure optimum use of this manual, note the following explanations of symbols used.

DANGER

DANGER indicates a hazard with a high level of risk which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a hazard with a medium level of risk which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which, if not avoided, could result in equipment or property damage.



NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.

1.7 Symbols on the Inverter Body

The symbols below may be pasted on the electrical parts of the inverter. Make sure to read the following symbols and fully understand them before installing the equipment.

Symbols	Explanations
	Risk of electric shock!
	Hot surface!
	Connection point for earth conductor Protective conductor terminal

2 Safety Instructions

2.1 Intended Usage

The MX-series inverter (It will be referred to as inverter hereinafter unless otherwise specified), a central inverter without transformer, is a crucial unit in a grid-connected PV power system.

Inverter is dedicated to converting direct current (DC) generated by the PV modules into alternating current (AC), which conforms to parameters of local utility grid, and feeds the alternating current into the utility grid.

With IP21 protection degree, the inverter must be installed indoors.

An example about intended usage of the inverter is shown below.

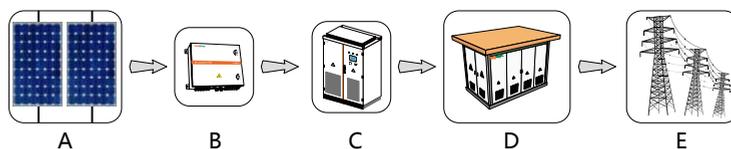


Fig. 2-1 Application of Inverter to the PV Power System

No.	Name
A	PV arrays
B	PV array combiner box
C	Inverter
D	Medium-voltage Transformer
E	Utility grid

⚠ WARNING

- The intended usage described in this section must be strictly observed. Any other or additional usage other than the intended usage is not permitted.
- Wiring and connections other than the contents described in this section may lead to device damages and void warranty claims.

2.2 Important Safety Instructions

This section introduces the safety precautions during inverter installation and commissioning. Read this manual carefully especially the safety instructions. For the detailed safety notices, please refer to the corresponding installation and commissioning chapter.

⚠ DANGER

Shock Hazard!

Death resulting from burns and electric shock upon touching the inverter live components.

- Do not touch the live components of the inverter or the utility grid.
- Observe all safety regulations.

 DANGER**Lethal voltage inside the device!**

- **Respect all warning labels on the product**
- **Respect all safety instructions in this manual and other related documents.**

 DANGER**Lethal Voltage!****Damage to the inverter or system fault may result in death by electric shock or fire!**

- **Visual check if there is device damage or other dangers before operation.**
- **Check if other external devices and circuit connection are safe.**
- **Only operate the device when it is safe to do so.**

 WARNING

After maintenance and service work to the inverter, power on the inverter following the procedures described in this manual.

2.3 During Operation

2.3.1 Manual

Product manuals are indispensable part of the product.

Very important information about operation of the inverter is included in this manual. All the descriptions in this manual, especially those safety-related items, must be complied with.

- Please read all the instructions thoroughly prior to any operation work on the inverter.
- This manual and relevant documents should be available for relevant persons at all times.

After maintenance or troubleshooting, no manual or paper should be left inside the inverter cabinet.

2.3.2 Qualified Personnel

- Only qualified electricians or personnel with professional knowledge can transport or install the device.
- Operators must be familiar with the whole power generation system and its working principle.
- Operators must be familiar with the Installation Manual and Operation Manual.
- Operators must be familiar with country-specific standards and regulations.

2.3.3 Markings on the Inverter

- Inverter enclosure and interior contains important warning and safety information. Do not tear or damage it.
- Nameplates located in the back panel and inside of the front door contain very important parameter information. Do not tear or damage them.

NOTICE

- **All safety instructions, warning labels and nameplate on the inverter body must be clearly visible;**
- **Replace the markings once they are damaged or unclear.**

2.3.4 Safety Warning Signs

Please respect the followings during installation, daily maintenance or troubleshooting of the inverter:

- An obvious marking should be placed in the inverter upstream and downstream to keep the switch from accidental reconnection;
- A temporary warning sign or barrier must be posted around the installation area;
- Remove the door keys and keep them appropriately after installation or maintenance work is finished.

2.3.5 Emergency Escape Route

The emergency escape route is critical during an emergency situation.

- Keep the escape route clear and unblocked at all times.
- Never block or lock the emergency escape route

2.3.6 PV Arrays Hazards

High Voltages will exist between positive and negative polarities immediately when the PV arrays are exposed to light. Electrical shock or arc may occur by accidental touch.

⚠ DANGER

High voltage exists between the positive and negative polarity of the PV array.

- **Ensure complete disconnection between the inverter and the PV array**
- **Avoid any accidental reconnections.**

2.3.7 Live Line Measurement**⚠ DANGER**

High voltages are present in the device. Death resulting from burning and electric shock upon touching the live components of the inverter. During live line measurement,

- **use suitable protective equipment , for example dielectric gloves, and**
- **accompany by other persons.**

2.3.8 Measuring Instrument

Instrument for measurement of the electrical parameters should meet the requirements listed below:

WARNING

- **Instrument for measurement of the electrical parameters should be high quality instrument with sufficient measuring range.**
- **Make sure the connection and use of the instrument are correct to avoid arc and other dangerous situations.**

2.3.9 LCD Parameter Setting

Certain LCD settable parameters are closely related to the inverter operation, therefore these parameters can only be set after reliable evaluation of the system and inverter.

WARNING

- **Improper parameter setting may affect the functionality of the inverter.**
- **Only qualified personnel can set the inverter parameter.**

2.3.10 ESD Protection**NOTICE**

The inverter may be damaged irreversibly by electrostatic discharge (ESD) at its components.

- **During the operation of the inverter, please observe all the ESD-related safety regulations!**
- **Discharge electrostatic charge by touching the grounded conductor before contacting any electronic components!**

2.3.11 Moisture protection**NOTICE**

Penetrating moisture may damage the inverter!

- **Don't open inverter doors when relative humidity is above 95%.**
- **Don't install the inverter in rainy days.**

2.3.12 Maintenance and Service**WARNING**

Wait at least 5 minutes for inner capacitors to discharge completely after stopping the inverter before opening the inverter front door to maintain or service.

Before any service work, observe the following procedures.

- Avoid any accidental re-connections.
- Verify that no voltage or current is present with appropriate testing devices.
- Ground and short-circuit whenever necessary.
- Cover possible live parts to avoid accidental contact.
- Ensure sufficient escape room.

2.3.13 Disposal of Waste

When the inverter is end of life, it cannot be disposed of together with household wastes. Please contact the local authorized collection point.

2.3.14 Others

WARNING

Please observe country-specific standards and regulations.

WARNING

- **Only service the device when it is voltage-free.**
- **Never work alone when servicing this equipment. Two persons are required until the inverter is properly shut down, de-energized and verified with a meter.**

Other protective measures:

- Use suitable protective equipment (for example safety goggles, earplugs, dielectric gloves, insulating shoes) when maintaining or servicing the device.
- Emergency aid should be prepared beforehand since the inverter is always installed far away from the downtown area.
- Every possible auxiliary method should be taken to ensure the safety of personnel and device.



All the pictures and descriptions in this manual apply to the standard configuration of the inverter. The actual product you receive may differ. Should you have any specific requirements, please inform us.

This manual may not cover all possible situations. Should a specific problem occur that is not explained in this manual, please contact Sungrow.

3 Product Description

3.1 Product Appearance

3.1.1 Brief Introduction

The front view and main external components of the inverter are shown below.

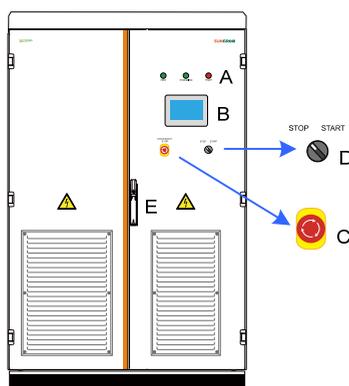


Fig. 3-1 Appearance of the Inverter

Item	Name	Description
A	LED Indicators	3 indicators: Power, Operation and Fault
B	LCD Touch Screen	Display data and perform control functions
C	Emergency Stop Button	Press down the button in emergency occasions and inverter AC side power supply will be stopped immediately
D	Start/Stop Switch	Start/Stop the inverter
E	Door Lock	Three door locks, to lock/unlock front doors

3.1.2 LED Indicators

There are three LEDs at the upper left side of the front panel: POWER indicates the power is on; OPERATION indicates the proper operation of the inverter; FAULT indicates a fault condition.

LED	Color	Description
POWER	Green	Control circuit power supply
OPERATION	Green	Inverter operates in the grid-connection mode.
FAULT	Red	A fault occurs and has not been removed. The LED will be off when the fault is cleared.

Possible LED combinations and the meaning are listed in the following table:

LED status	Description
 POWER OPERATION FAULT	All three LEDs are on System self-checking upon energization (only POWER LED is on after the self-checking)
 POWER OPERATION FAULT	"POWER" LED is on Normal power supply, inverter not connect to the grid
 POWER OPERATION FAULT	"POWER" is on "OPERATION" is on AC and DC side parameters meet grid-connection requirements. Inverter is powering the grid.
 POWER OPERATION FAULT	"POWER" is on "FAULT" is on A fault occurs and not removed yet.
 POWER OPERATION FAULT	All LEDs are off Inverter is disconnected from the power supply.

3.1.3 LCD Display

LCD screen displays the operational information of the inverter and performs many functions as follows:

- Start or stop the inverter
- Display real-time operating data
- Display current faults and fault records
- Adjust the running parameters
- View history records

3.1.4 Emergency Stop Button

The inverter will be disconnected from the internal power supply immediately when pressing down the emergency stop button.

WARNING

Electrical shock hazards!

- **The pressing of the emergency stop button in no way implies that no voltage is present in the electrical connection terminals inside the inverter.**
- **Lethal voltages are present inside the inverter.**

WARNING

Use the emergency stop button to stop the inverter only in a time of crisis.

Improper or frequent use of the emergency stop button may lead to inverter damages. Pressing the button with current carrying will lay great stress to the pertinent parts of the inverter.

When you push this button, the inverter will disconnect immediately from the grid and the button will be locked. You can restart the inverter by rotating the button clockwise to unlock it. Open the AC switch first and then close it. Connect to the grid and the inverter will restart by the LCD panel.

3.1.5 Start/Stop Switch

The Start/Stop Switch controls the start and stop of the inverter. Only when the start/stop switch is put in the "start" position can user send effective start instruction through the LCD panel. Otherwise, inverter will stay in Stop state.

When you put the switch in the “stop” position, the inverter will stop through a stop command sent to the control DSP.

3.2 Communication Solution

3.2.1 RS485 Communication Solution

- SolarInfo Logger

Inverter can communicate with SolarInfo Logger via the RS485 standard serial port. SolarInfo Logger can monitor the communication of single or multiple inverters.

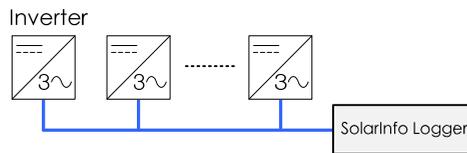


Fig. 3-2 SolarInfo Logger Collects Data through RS485

- PC

Inverter communicates with PC via RS485/RS232 converter. SolarInfo Insight is used to monitor the communication of single or multiple inverters.

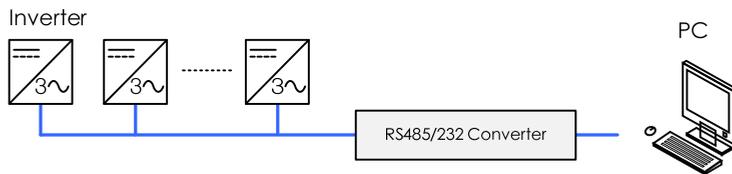


Fig. 3-3 PC collects data through RS485 Bus

- SolarInfo Logger + PC

One or more inverters communicate with PC via SolarInfo Logger. SolarInfo Insight is used to monitor the communication.

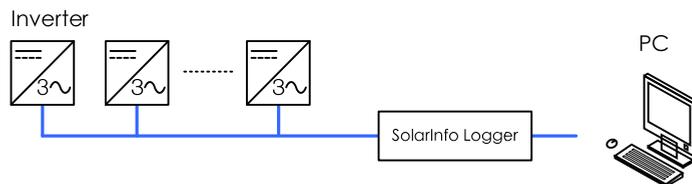


Fig. 3-4 SolarInfo Logger & PC Collect Data through RS485 Bus

3.2.2 Ethernet Communication Solution

Besides the standard RS485 communication, inverter also provides the optional Ethernet communication solution. Please specify in your order if you need this communication solution.

- Single inverter communication

If there is only one inverter, you can connect the RJ45 port of the inverter to the RJ45 port of the PC directly. SolarInfo Insight is used to monitor the communication.



Fig. 3-5 Ethernet communication of one inverter

- Multiple inverters communication

If there is more than one inverter, the Ethernet switch is required for communication. SolarInfo Insight is used to monitor the communication.

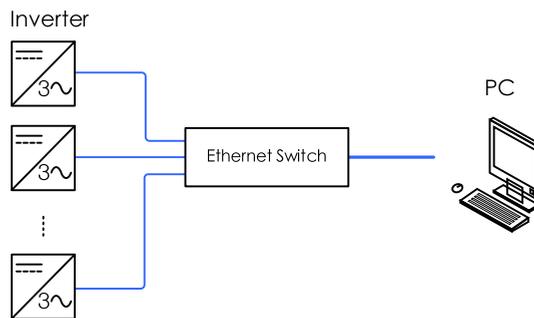


Fig. 3-6 Ethernet communication of multiple inverters



The details of SolarInfo Logger and SolarInfo Insight are available on Sungrow's website. Please download the latest product materials when necessary.

4 Inverter Start/Stop

4.1 Starting the Inverter

4.1.1 Inspection before starting the inverter

After the maintenance or service work, you may start the inverter. Inspect the following requirement before starting the inverter:

- All connections are done by strictly following the installation manual and circuit diagram.
- The coverings of the internal devices are fixed and secured.
- The cabinet door is closed and the key is removed and stored by appointed personnel.
- The emergency stop button is released and the Start/Stop switch is in the “Stop” position.
- Turn the AC (Grid) Main Switch and the DC Main Switch to the “OFF” position.
- Make sure, via suitable instruments, that there is no ground fault of the PV modules.
- Measure the DC and AC current with multimeter to check if they fulfill the inverter startup conditions and there is no overvoltage hazard.

WARNING

After longtime storage, a thorough and professional test is necessary before starting the inverter.

4.1.2 Steps to Starting the Inverter

When the abovementioned conditions are fulfilled, proceed as follows to start the inverter:

- Step 1** Open the inverter AC cabinet door; Turn the AC switches to “ON” position; and lock the AC cabinet door.
- Step 2** Close the switches of inverter upstream combiner box;
- Step 3** Open the DC cabinet door; Turn the DC switches to “ON” position; lock the DC cabinet door and wait 1 minute.
- Step 4** Turn the Start/Stop switch to the “START” position to start the inverter;

After startup, the inverter will automatically check if parameters of the DC and AC side meet the grid-connection requirements. If so and the set time have been reached, the inverter will turn to the OPERATION mode and feed the generated AC current to the grid.

WARNING

- **Inverter needs no manual control in daily operation. Open the cabinet door only for maintenance or troubleshooting and by qualified personnel only.**
- **Keep the door closed and locked and store the keys of the door by appointed personnel during normal operation.**

4.2 Stopping the Inverter

Inverter stops during normal maintenance and service work or when a fault occurs.

4.2.1 Normal Stop

Proceed as follows to stop the inverter during normal maintenance and service work as follows:

- Step 1** Stop the inverter through the stop operation on the LCD panel
- Step 2** Turn the inverter Start/Stop switch to the "STOP" position
- Step 3** Open the inverter AC cabinet door and disconnect the AC switch
- Step 4** Disconnect the inverter downstream switches
- Step 5** Open the inverter DC cabinet door and disconnect the DC switch
- Step 6** Disconnect the inverter upstream switches
- Step 7** Disconnect external power supply source if the inverter is in external power supply mode
- Step 8** Inverter stops

WARNING

During normal operation, disconnection of AC or DC switch is strictly forbidden. Otherwise, the switch can be damaged and the inverter may also be damaged.

4.2.2 Inverter Stops when a fault occurs

Proceed as follows to stop the inverter when a fault or emergency occurs as follows:

- Step 1** Push the emergency stop button or turn the start/stop switch to the "STOP" position
- Step 2** Open the inverter AC cabinet door and disconnect the AC switch
- Step 3** Disconnect the inverter downstream switches
- Step 4** Open the inverter AC cabinet door and disconnect the AC switch
- Step 5** Disconnect the inverter downstream switches
- Step 6** Disconnect external power supply source if the inverter is in external power supply mode
- Step 7** Inverter stops

WARNING

Use the Start/Stop switch or emergency stop button only when emergency or a fault occurs. Under normal conditions, stop the inverter by perform the stop command in the LCD panel.

Push the emergency stop button directly in times of crisis to ensure timely response.

5 Operation Mode

5.1 Mode Change

After being energized, inverter can switch among different modes as shown in the figure below.

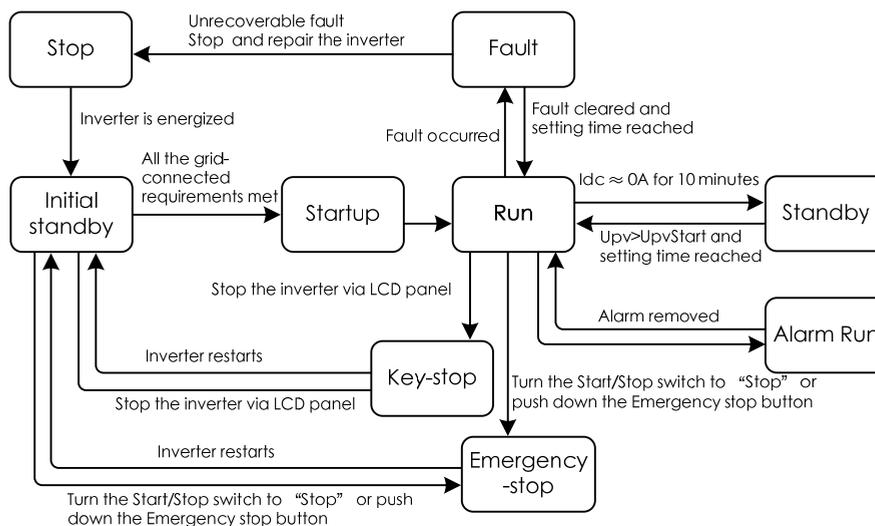


Fig. 5-1 Operation modes change



Upv is the DC input voltage of the inverter.
UpvStart is the inverter DC side startup voltage.

5.2 Operation Modes

Stop

This is the initial state of the inverter. The inverter DC and AC switches are in the “OFF” position; the upstream and downstream connections are disconnected. The inverter is therefore electricity-free.

Initial Standby

When the inverter upstream and downstream connections are connected and the AC/DC switches are in the “ON” position, the inverter turns to the **Initial Standby** mode.

Inverter will continuously check if the PV array and the grid meet the grid-connection requirements. If the inverter DC input voltage is higher than the inverter startup voltage and the startup time is reached, whilst the requirements of the grid side parameter are satisfied, inverter will turn from the **Initial Standby** mode into the **Startup** mode.

Startup

This is the transient process between the **Initial Standby** mode and the **Run** mode. Once the **Startup** mode is complete, inverter will start powering the grid.

Run

In this mode, inverter converts the DC into AC and feeds it to the grid. Inverter tracks the PV arrays' maximum power point (MPP) to maximum the output energy.

Standby

In **Run** mode, inverter will enter into the **Standby** mode if the DC side current is as low as 0A for a while.

Inverter will continuously check if the PV array meets the grid-connection requirements. If the inverter DC startup voltage and the startup time are reached, inverter will turn into the **Run** mode.

Fault

If a fault occurs during operation, inverter will automatically enter into the **Fault** mode. LCD panel will display the fault type with the "Fault" indicator on until the fault is removed and inverter turns into the **Run** mode.

During this period, if you want to start the inverter manually, first confirm the stop clear protection program from the LCD panel and then start the inverter.

If the fault is unrecoverable, inverter must be stopped to perform maintenance work. Inverter will automatically check if the fault is recoverable.

WARNING

When there is a DSP fault or module fault, restart of the inverter through the LCD is strictly forbidden. A power-off check is required before reenergizing the inverter. Otherwise, the inverter may be damaged.

Emergency-stop

Stop the inverter by turning the Start/Stop Switch to the "STOP" position or push the emergency stop button when a fault or emergency occurs.

If the inverter is stopped by the Start/Stop Switch, restart the inverter by

Step 1 Turning the Start/Stop switch to the START position.

Step 2 Perform Stop command from the LCD panel

Step 3 Perform Start command from the LCD panel



Step 2 is to remove the emergency stop protection program. Device will not respond if you push Start directly without removing the stop protection program.

If the inverter is stopped by pushing the emergency stop button, the AC switch will trip and the inverter will disconnect from the grid. Restart the inverter by

Step 1 Unlock the emergency stop button

Step 2 Turn the AC switch to the "OFF" position

Step 3 Turn the AC switch to the "ON" position

The inverter will be restarted automatically when the grid-connected requirements are met on both DC and AC side.

Key-stop

In **Run** mode, inverter will enter into the **Key-stop** mode by sending stop instruction via the LCD panel if user needs to conduct maintenance or service work.

Alarm Run

In **Warning Run** mode, inverter can keep running but send warning signal. User can check the present warning information through the Working state on the LCD default screen or check the latest 100 history warning information through Function/History information/his alarm. Inverter automatically turns to **Run** mode when the alarm is removed.

6 LCD Menu Operation

6.1 LCD Touch Screen

The LCD touch screen, located at the eye-level in the front side of the inverter, is used for user to view the data and set related parameters.

The LCD consists of two parts as shown in the following figure. The LEDs indicate the present working state.

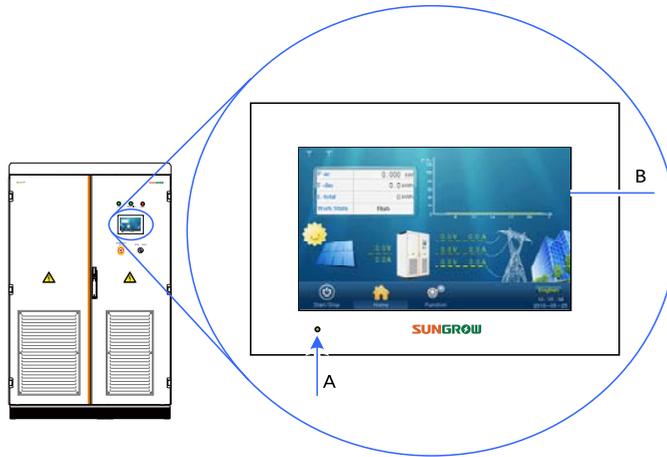


Fig. 6-1 Location and appearance of the LCD display

Item	Description
A	Run indicator, red at power on and green in normal operation
B	Data display and operation area



For user's convenience, there are a large number of pictures about the LCD interface in this chapter. The parameters and other details in those pictures are indicative only. The actual product you receive may differ.



If the time shown on the LCD panel is different from the actual local time after time calibration, please check and replace the button cells on the back of the LCD panel.

6.2 Default Screen

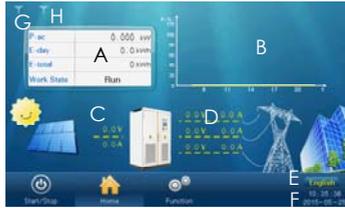
6.2.1 Initialization

The LCD is initialized when inverter is energized and then enters into the starting menu.



Initialization
Appears every time the inverter is energized. After initialization, the default screen follows.

6.2.2 Default Screen Introduction



Item	Description
A	Yield data. The first line from the top is the present active power; work state is the transient state of the inverter.
B	Today's active power curve to indicate the power percentage (power value divides the inverter nominal power value).
C	DC side voltage and current
D	AC side line-to-line voltage and phase current
E	Language selection button. Click to change among English, Chinese, French, and Italian.
F	Present date and time
G	Success rate of the inverter internal communication
H	Success rate of communication between the inverter and PC

Accessing to submenus mentioned below starts from the default menu.

WARNING

LCD screen contains lots of parameters pertinent to the inverter operation. All parameter configurations must be done by appointed personnel. DO NOT modify any parameters before you fully understand this manual or consult the staff from Sungrow.

6.2.3 Backlight and Screensaver

If there is no operation to the screen for 5 minutes or more, the backlight will be off. Activate the backlight by tapping the display and the display will return to the menu operated previously.

6.3 Overview of LCD Menu and Icon

6.3.1 Overview of Submenu and Icon

There are three buttons on the lower left side of the touch panel for user to operate



"Start/Stop"



"Home",



"Function"

The logical structures of these menus are shown below:

Main Menu	First sub-menu	Second sub-menu	Third sub-menu	
Start/Stop	Start	-	-	
	Stop	-	-	
Home	-	-	-	
Function	Run-information	Real Time Data	-	
		Power curve	-	
		E-histogram	-	
	History-information	His-event	-	
		His-fault	-	
		His-data	-	
		His-alarm	-	
	Start/Stop	Start	-	
		Stop	-	
	Set-parameter	Sys-parameter	Language & Firmware Ver.	-
			Time	-
			E-total adjust	-
			Remote/Local control	-
			Load default	-
Run-parameter		-		
Pro-parameter	-			
Com-parameter	Serial-port param.	-		
	Ethernet param.	-		

6.3.2 Layout of the submenus

The layout of submenus is the same as that shown below except for the default menu.



Item	Description
	Title bar
A	The first line from the top is the present success rate of communication. The left side of the second line is the name of the present page, while the right side is the present date and time.
B	Data display or parameter configuration.
C	From left to right: the three main icons; the return button to return to the previous menu by tapping it.

For convenience's sake, the operations on the menus are referred to as the menu name with

quotation marks. For example, the  menu will be referred to as "Set-parameter".

6.4 Entering Password

Inverter is protected by password. User can enter into the "Set-parameter" sub-menu only after entering the correct password. Proceed as follows to enter the password:

Step 1 Tap "Function" from the default menu;

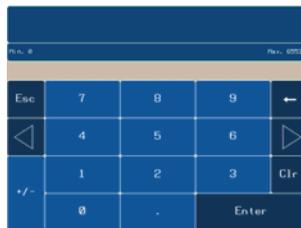
Step 2 Tap "Set-parameter" and the password entering window pops out;



Tap the white edit box and a keypad pops out.

Enter the password through the keypad.

- ←: backspace key, delete the digit input
- Clr: clear the digitals input
- Esc: escape and close the keypad
- Enter: confirm the password input
- Max./Min.: the maximum and minimum value can be input; digital outside this range is invalid



If the input password is **1111**, user can enter into the normal parameter setting page and set the system parameters, running parameters, protection parameters and communication parameters.

Step 3 Press "Enter" to confirm the password input.

Step 4 If the password is incorrect, an "Error password" window will appear. Tap "Enter" and re-enter the password.



6.5 Language Setting

User can set the language by either of the following two ways:

Conventional Way

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Set-parameter";

Step 3 Tap "Sys-parameter" after entering the correct password;

Step 4 Tap “Language & Firmware Ver.” and enter into the language and firmware version sub-menu;



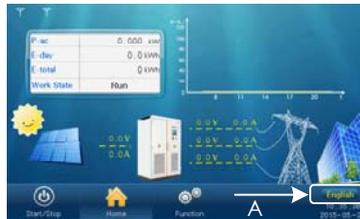
Step 5 Select the target language.

Shortcut

The language setting shortcut (A) is at the lower right side of the Home menu. Select either language by tapping the language button.

By tapping the button, the language will switch among English, Chinese, French and Italian.

Language on the button is the present display language of the display.



6.6 Date and Time Setting

Step 1 Tap “Function” from the default menu;

Step 2 Tap “Set-parameter”;

Step 3 Tap “Sys-parameter” after entering the correct password;

Step 4 Tap “Time” and enter into the date and time setting sub-menu;



Step 5 Set the “Year”, “Month”, “Date”, “Hour”, “Minute” and “Second”. Tap the corresponding cell and the keypad will appear;

Step 6 Set the time and date by tapping the keypad and confirm setting by Tapping “Enter”.

6.7 Running Information Checking

Running information contains all data pertinent to the inverter operation:

Real-time data

The work state, power supply mode, output power, DC voltage current, grid frequency, power factor, internal temperature, module temperature, efficiency, positive insulation resistance to the ground, AC and DC main switches states are included.

Internal statistics

The total power yields, amount of CO₂ reduction, monthly power yields, total running hours and the running time in minutes per day are included.

Output power curve

The output power curve shows the power yield on that particular day in percentage of the nominal power. The data are updated every several seconds and the total diagram data will be cleared at the beginning of a new day.

Proceed as follow to view the running information:

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Run-information" and switch among "Real Time Data", "Power curve" and "E-histogram". The default display is "Real Time Data";



Step 3 Tap "Power curve" and enter into the power curve sub-menu;



Step 4 Tap "E-histogram" and enter into the electricity histogram sub-menu.



The display value is directive only and must not be used as a basis for invoicing.

6.8 History Information Checking

There are four kinds of history information: History event, history fault, history data and history

alarm.

6.8.1 History Event Checking

Step 1 Tap “Function” from the default menu;

Step 2 Tap “History-information” and enter into the history information sub-menu;

Step 3 Tap “His-event” and enter into the history event sub-menu.



Up to 100 history events can be viewed from this sub-menu, with up to 5 records can be shown in one page. The upper left side of the event table is the total number of the current event records. Tap “Prev” or “Next” to turn pages up or down.

6.8.2 History Data Checking

System can record the inverter running information for the latest 90 days with the records updated every 15 minutes.

History data displays the data related to the power yields and the electric quantity of the inverter. Proceed as follows to check the history information:

Step 1 Tap “Function” from the default menu;

Step 2 Tap “History-information” and enter into the history information sub-menu;

Step 3 Tap “His-data” and enter into the history data sub-menu.



Tap “Prev” or “Next” to turn pages up or down.

6.8.3 History Fault Checking

When a fault occurs, user can view the fault via the LCD screen and the history fault records as follows:

Step 1 Tap “Function” from the default menu;

Step 2 Tap “History-information” and enter into the history information sub-menu;

Step 3 Tap “His-fault” and enter into the history fault sub-menu.



Up to 100 history faults can be viewed from this sub-menu, with up to 5 records can be shown in one page. The upper left side of the event table is the total number of the current fault records. Tap "Prev" or "Next" to turn pages up or down.

6.8.4 History Alarm Checking

Proceed as follows to check the history warn information:

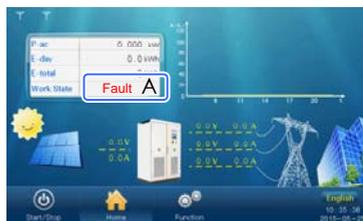
- Step 1** Tap "Function" from the default menu;
- Step 2** Tap "History-information" and enter into the history information sub-menu;
- Step 3** Tap "his-alarm" and enter into the history alarm sub-menu.



Up to 100 history alarms can be viewed from this sub-menu, with up to 5 records can be shown in one page. The upper left side of the event table is the total number of the current warn records. Tap "Prev" or "Next" to turn pages up or down.

6.9 Present Fault Information Checking

There may be one or more than one fault occurs to the inverter at the same time which can be viewed through the LCD screen. Follow the description in this chapter to view the fault information when faults occur.



Tap the cell (A) on the right of the "Work Status" from the Home menu.



The fault window will appear with the present fault in red.

6.10 Starting/Stopping the Inverter



Usually, the inverter will start automatically when the grid-connected requirements are met.

Follow either of the two ways below to start/stop the inverter through the LCD screen:

- Tap "Start/Stop" from the default menu.
- Tap "Start/Stop" from the Function menu.



6.10.1 Starting the Inverter

In Start/Stop screen, click Start and a "Confirm start" window appears.



Tap "Enter" to start the inverter while tap "Cancel" to cancel the operation.

6.10.2 Stopping the Inverter

In Start/Stop screen, click Stop and a "Confirm stop" window appears.



Tap "Enter" to stop the inverter while tap "Cancel" to cancel the operation.

6.11 Energy Output Deviation Adjustment

Energy output deviation adjustment is useful when the total power output displayed in LCD (E-total) is different from the reading value of the external power measuring device (e.g. an ammeter).

(Energy-adj value)= (Real measured value)-(E-tot reading value).

To adjust the date or time, proceed as follow:

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Set-parameter";

Step 3 Tap "Sys-parameter" after entering the correct password;

Step 4 Tap "E-total adjust" and enter into the energy output deviation adjustment sub-menu;



Tap the cell below the "Compensation" and the keypad appears. Enter the energy compensation by tapping the keypad;

Step 5 Tap "Enter" to confirm the setting.

6.12 Load Default

Proceed as follows to perform the load default:

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Set-parameter";

Step 3 Tap "Sys-parameter" after entering the correct password;

Step 4 Tap "Load default" and the password inputting window appears;



The password is "1111". The system will be reset after entering the password.

6.13 Firmware Version Checking

User can view the firmware version of LCD and DSP as follows:

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Set-parameter";

Step 3 Tap "Sys-parameter" after entering the correct password;

Step 4 Tap "Language & Firmware Ver." and enter into the language and firmware version sub-menu;



Step 5 The firmware version of LCD and DSP is shown at the bottom of the page.

7 Parameters of LCD

7.1 Communication Parameters

⚠ WARNING

Improper communication parameter configuration may lead to inverter communication failure!

Follow strictly the instructions of the plant staff to configure the communication parameters.

There are the standard RS485 communication and Network communication. User can set the communication address and protocol through the LCD screen when the hardware connection is complete and the inverter is energized.

Proceed as follows to set the communication parameters:

Step 1 Tap “Function” from the default menu;

Step 2 Tap “Set-parameter”;

Step 3 Tap “Com-parameter” after entering the correct password.

- Set parameter from the Serial Port Parameter interface for RS485 serial communication;
- Set parameter from the Network Parameter interface for Network communication



7.1.1 Serial Port Parameter Setting

Click “Serial port param” to enter the following interface.



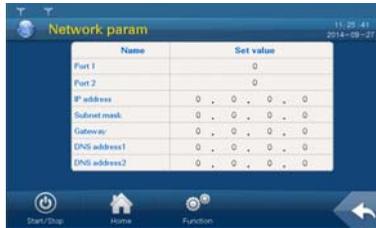
Three parameters pertinent to RS485 serial port communication can be set according to the parameter range shown on the display.

“Address” is prescribed by the plant staff and the address for each inverter must be unique when there is more than one inverter. “Baud” and “protocol” are selected according to the communication method adopted.

Enter the device address with the aid of the pop-up keypad while select the Baud rate and communication protocol through the pull-down list.

7.1.2 Ethernet Parameter Setting

Click Network Parameter to enter the following interface.



Seven parameters pertinent to the Network communication can be set. DNS address 1 and DNS address 2 can be set to the default value. Other parameters are assigned by plant staff.

Set parameter with the aid of the pop-up keypad.

7.2 Running Parameters

7.2.1 Setting Running Parameters

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Set-parameter";

Step 3 Tap "Run-parameter" after entering the correct password.



Step 4 Set the running parameter by tapping the pop-up keypad and tap ENTER to confirm setting. Tap "Prev" or "Next" to turn pages up or down.

7.2.2 Description of Running Parameters

Descriptions of the running parameters are shown in the following table.

Parameter	Description
Vmppt-max (V)	Unavailable
Vmppt-min (V)	Unavailable
T-start-wait (s)	The time from the AC/DC parameters meet the grid-connection conditions to the inverter begins to generate power.
T-stop-delay (s)	The time from the LCD display or upper computer sends stop command to inverter performs the stop command
stop slope (%/s)	Active power decline rate from inverter performs stop command to inverter stops
P-rise rate (%/s)	Percentage that the active power rise per second accounted for the nominal power (%/s)
P-decline rate (%/s)	Percentage that the active power decline per second accounted for the nominal power (%/s)
Limit Power (%)	Percentage of active power output in nominal output power (%)
Pf	cosφ
Q-limit (%)	Percentage that the reactive power rise accounted for the nominal power (%)
Q-adjust switch	Refer to 8.3

Parameter	Description
Power-off saved (Pf)	If the power factor setting can be saved when the LCD screen is powered off
Power-off saved (P-limited)	If the limit power(%) setting can be saved when the LCD screen is powered off
SVG switch	If the reactive power compensation is activated or deactivated
T-recover (s)	Automatic recovery time when fault occurs

Setting ranges and default values of the running parameters are described in the following table.

Parameter	Range	Default
Vmppt-max (V)*	460~850	850
Vmppt-min (V)*	460~850	460
T-start-wait (s)	0~600	60
T-stop-delay (s)	0~600	0
stop slope (%/s)	0.1~100	100
P-rise rate (%/s)	0.01~10	10
P-decline rate (%/s)	0.01~10	10
Limit Power (%)	0~110	110
Pf	-0.9~-1/0.9~1	1
Q-limit (%)	-100~100	0
Q-adjust switch	Close/Pf/Q-limit	Pf can be adjusted
Power-off saved (Pf)	Save/Not Save	Save
Power-off saved (P-limited)	Save/Not Save	Not Save
SVG switch**	Enable/Disable	Disable
T-recover (s)	20~600	60

Note: * non-settable

** at night when the inverter enters standby mode (but not enters the deep standby mode with lower power consumption), the SVG function needs to be activated: first stop the inverter by the LCD button and then start; set the SVG switch to "Enable". The SVG is an optional function for this inverter.

WARNING

Improper parameter configuration may affect the normal operation of the inverter!

Only authorized personnel can configure these parameters.

Should any question or doubt occurs, please contact Sungrow.



Please refer to the LCD screen for the specific setting ranges of these parameters.

7.3 Protection Parameter

7.3.1 Setting Protection Parameter

Step 1 Tap "Function" from the default menu;

Step 2 Tap "Set-parameter";

Step 3 Tap "Pro-parameter" after entering the correct password.



Set the protection parameter by tapping the pop-up keypad and tap ENTER to confirm setting. Tap “Prev” or “Next” to turn pages up or down.

WARNING

Improper parameter configuration may affect the normal operation of the inverter!

Only authorized personnel can configure these parameters.

Should any question or doubt occurs, please contact Sungrow.

7.3.2 Description of Protection Parameters

Descriptions of the protective parameters are shown in the following table.

Parameter	Description
I_Vgrid-max(V)	Set the grid over-voltage protection I value. Protection is activated when voltage exceeds this value.
II_Vgrid-max(V)	Set the grid over-voltage protection II value. Protection is activated when voltage exceeds this value.
I_T-Vhigh trip(ms)	Set the protection time of grid over-voltage protection I
II_T-Vhigh trip (ms)	Set the protection time of grid over-voltage protection II
Recover_Vgrid-max(V)	Inverter recovers normal operation when grid voltage is below this value
I_Vgrid-min(V)	Set the grid under-voltage protection I value. Protection is activated when voltage is below this value.
II_Vgrid-min(V)	Set the grid under-voltage protection II value. Protection is activated when voltage is below this value.
I_T-Vlow trip(ms)	Set the grid under-voltage I tripping protection time
II_T-Vlow trip (ms)	Set the grid under-voltage II tripping protection time
Recover_Vgrid-min(V)	Inverter recovers normal operation when grid voltage exceeds this value
I_Fgrid-max((Hz)	Set the grid over-frequency protection I value. Protection is activated when frequency exceeds this value
II_Fgrid-max((Hz)	Set the grid over-frequency protection II value. Protection is activated when frequency exceeds this value
I_T-Fhigh trip(ms)	Set the grid over-frequency I tripping time
II_T-Fhigh trip (ms)	Set the grid over-frequency II tripping time
Recover_Fgrid-max(Hz)	Inverter recovers normal operation when grid frequency is below this value
I_Fgrid-min((Hz)	Set the grid under-frequency protection I value. Protection is activated when frequency exceeds this value
II_Fgrid-min((Hz)	Set the grid under-frequency protection II value. Protection is activated when frequency exceeds this value
I_T-Flow trip(ms)	Set the grid under-frequency I tripping time
II_T-Flow trip (ms)	Set the grid under-frequency II tripping time
Recover_Fgrid-min((Hz)	Inverter recovers normal operation when grid frequency exceeds this value
LVRT switch	Enable or disable the LVRT switch
LVRT normal vol min(V)	Refer to Fig. 8-1 Lower voltage withstand requirements, U1

Parameter	Description
	Unavailable
LVRT tolera vol min(V)	Refer to Fig. 8-1 Lower voltage withstand requirements, U2 Unavailable
LVRT T1(ms)	Refer to Fig. 8-1 Lower voltage withstand requirements, T1
LVRT T2(ms)	Refer to Fig. 8-1 Lower voltage withstand requirements, T2
LVRT dynamic Kf factor	Ratio of reactive power compensation and voltage dropping depth during LVRT
HVRT switch	Enable or disable the HVRT switch
HVRT normal vol max(%)	Refer to Fig. 8-2 High voltage withstand requirements, U2 Unavailable
HVRT tolera vol max (%)	Refer to Fig. 8-2 High voltage withstand requirements, U1 Unavailable
Tmax-HVRT normal(ms)	Refer to Fig. 8-2 High voltage withstand requirements, T2
Tmax-HVRT tolera(ms)	Refer to Fig. 8-2 High voltage withstand requirements, T1
Active Islanding	Enable or disable the Anti-islanding function
I leakage-pro(A)	Set the current leakage protection value
Anti-PID mode	If Anti-PID mode is enabled, you may set the Anti-PID mode (Invalid, Suppression and Repair)
Ins monitor measure time (S)	Set the insulation monitor measure time
Ins monitor protect threshold(K)	Set the threshold value of the insulation monitor resistance

Setting ranges and default values of the protective parameters are described in the following table.

Parameter	Range	Default
I_Vgrid-max(V)	346.5~472.5	362
II_Vgrid-max(V)	346.5~472.5	409.5
I_T-Vhigh trip(ms)	40~600000	2000
II_T-Vhigh trip (ms)	40~600000	100
Recover_Vgrid-max(V)	346.5~472.5	346.5
I_Vgrid-min(V)	31.5~283.5	252
II_Vgrid-min(V)	31.5~283.5	157.5
I_T-Vlow trip(ms)	40~600000	2000
II_T-Vlow trip (ms)	40~600000	100
Recover_Vgrid-min(V)	31.5~283.5	283.5
I_Fgrid-max((Hz)	50.2~53/60.2~63	50.5/61.5
II_Fgrid-max((Hz)	50.2~53/60.2~63	50.5/62
I_T-Fhigh trip(ms)	40~600000	160
II_T-Fhigh trip (ms)	40~600000	160
Recover_Fgrid-max(Hz)	50~53/60~63	50.2/60.2
I_Fgrid-min((Hz)	46~50/56~60	47.5/57.5
II_Fgrid-min((Hz)	46~50/56~60	47.5/57.5
I_T-Flow trip(ms)	40~600000	160
II_T-Flow trip (ms)	40~600000	160
Recover_Fgrid-min((Hz)	46~50/56~60	49.5/59.9
LVRT switch	Enable/Disable	Enable
LVRT normal vol min(V)	270~283.5	283.5
LVRT tolera vol min(V)	15.7~126	63
LVRT T1(ms)	500~1500	1000
LVRT T2(ms)	2500~3500	3000
LVRT dynamic Kf factor	0~3	1.5
HVRT switch	Enable/Disable	Enable

Parameter	Range	Default
HVRT normal vol max(%)	110~120	110
HVRT tolera vol max (%)	120~140	130
Tmax-HVRT normal(ms)	100~20000	10000
Tmax-HVRT tolera(ms)	100~5000	500
Active Islanding	Enable/Disable	Disable
I leakage-pro(A)	1~8	5
Anti-PID mode	Invalid/Suppression/Repair	Invalid (mode disabled)/ Suppression (mode enabled)
Ins monitor measure time (S)	30/150/300/600	150
Ins monitor protect threshold(K)	15~100	33

Note: * non-settable



Please refer to the LCD screen for the specific setting ranges of these parameters.

8 Inverter Functions

8.1 Perfect Control Strategy

The following three control strategies are provided for user to perform control functions and configure relevant parameters.

- “Remote”: The control codes can be sent only by the remote control machine.
- “Local”: The control codes can be sent only by the LCD screen.
- “Remote/Local”: Both “Remote” and “Local” codes are effective.

Proceed to set the control strategy on the LCD screen as follows:

Step 1 Tap “Function” from the default menu;

Step 2 Tap “Set-parameter”;

Step 3 Tap “Sys-parameter” after entering the correct password.

Step 4 Tap “Remote/Local control” and enter into the Remote/Local control sub-menu.



Step 5 Select the control method through the pull-down list.

8.2 Active Power Limitation

8.2.1 Active Power Limitation Introduction

Situations, call for power limitation, are listed below:

- Potential threatens to the inverter safety operation
- Over-load of the grid branch connected to the inverter
- Islanding
- Factors affecting the stability of the stable grid status and dynamic grid status
- Frequency rising affects the system stability
- Grid maintenance
- Grid management

8.2.2 How to Realize Power Limitation

WARNING

Improper parameter configuration may affect the normal operation of the inverter!
Only authorized personnel can configure these parameters.
Should any question or doubt occurs, please contact Sungrow.

User can adjust the active power output through the LCD display:

- Step 1** Tap "Function" from the default menu;
- Step 2** Tap "Set-parameter";
- Step 3** Tap "Run-parameter" after entering the correct password;
- Step 4** Set the "Limit Power (%)" parameter by tapping the pop-up keypad;
- Step 5** Tap "Enter" to confirm setting.



Parameters related to power limitation (P-rise rate (%/s) and P-decline rate (%/s)) are also included in the running parameter setting sub-menu and can be set accordingly.

8.3 Reactive Power Adjustment

Inverter can provide reactive power output. User can open or close the reactive power adjustment switch and set the reactive power output through the LCD screen.

Reactive power limitation is performed through the running information sub-menu as follows:

- Step 1** Tap "Function" from the default menu;
- Step 2** Tap "Set-parameter";
- Step 3** Tap "Run-parameter" after entering the correct password;
- Step 4** Turn the page down to select the "Q-adjust switch". Tap the pull-down list and there are three options:



- Close: reactive power cannot be adjusted
- Pf: adjust the reactive power by setting power factor
- Q-limit: adjust the reactive power by setting reactive power percentage

- Step 5** If Pf is selected, the power factor can be set in the "Run-information" sub-menu; if "Q-limit" is selected, the "Q-limit (%)" can be set in the "Run-information" sub-menu.

⚠ WARNING

Improper parameter configuration may affect the normal operation of the inverter!

Only authorized personnel can configure these parameters.

Should any question or doubt occurs, please contact Sungrow.

8.4 LVRT

LVRT requires: PV plant can operate normally within certain voltage drop range and duration when the voltage of the grid-connected point drops due to the power system failure or disturbance; PV plant can provide the dynamic reactive power support during the period.

Active power recovery

If the power station still connects to the grid during power system failure, the active power will recover from the moment the fault is removed at the speed of at least 30% nominal power/second.

Dynamic reactive current support

During LVRT, power station should feed reactive current to the power system as per requirements. For a station whose 500kV or 750kV voltage is stepped up from the 220kV or 330kV voltage and then connects to the power station group, it should feed reactive current to the grid when a short-circuit occurs and the voltage drops.

Zero voltage ride through

When the grid-connection point voltage drops to zero, power station can operation normally for 0.15 second.

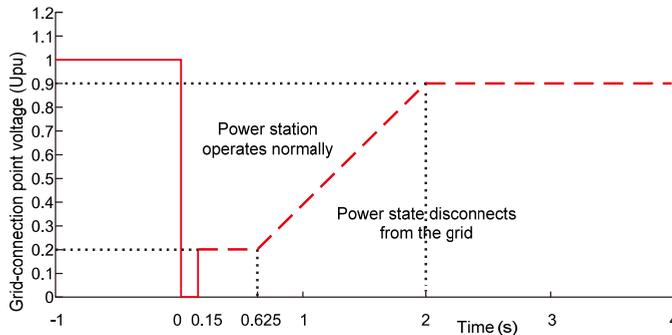


Fig. 8-1 Lower voltage withstand requirements

The inverter meets the abovementioned requirements.

8.5 High Voltage Ride Through (HVRT)

The detailed requirements of HVRT is shown in the following table:

Grid-connection pint voltage	Requirements
$1.1U_{pu} < U_T < 1.2U_{pu}$	Operate for at least 10s
$1.2U_{pu} \leq U_T \leq 1.3U_{pu}$	Operate for at least 0.5s

Note: U_T is the grid-connection point voltage, U_{pu} is the grid-connection point nominal voltage

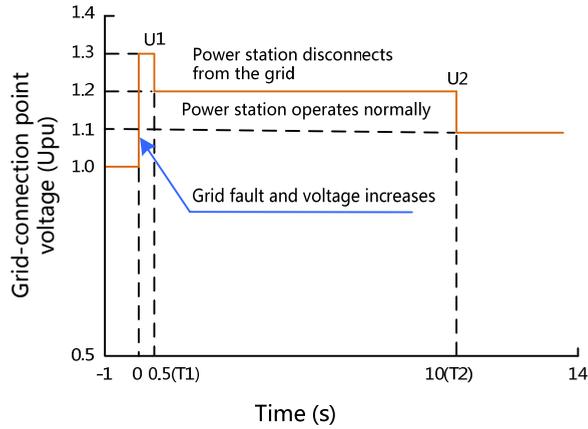


Fig. 8-2 High voltage withstand requirements

The inverter meets the abovementioned requirements.

8.6 Temperature Derating

When the ambient temperature is below 50°C, inverter can operate at 110% of the overload condition. When the ambient temperature reaches 55°C, inverter can keep the nominal power output. When the ambient temperature is above 65°C, inverter enters into protection mode.

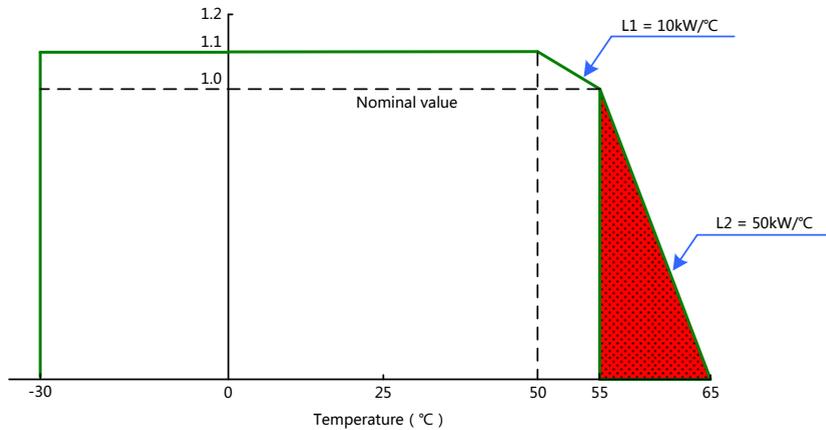


Fig. 8-3 Inverter temperature derating function

Ambient temp. T	Inverter operation situation
T < -30°C	Inverter starts with the aid of auxiliary heater
-30°C < T ≤ 50°C	Operate for a long time at 110% of the overload condition
50°C < T ≤ 55°C	Operate with derating at 10kW/°C
55°C < T ≤ 65°C	Operate with derating at 50kW/°C
T > 65°C	Enter protection mode; Automatically restart when temperature drops below 55°C

8.7 MPPT

Maximum Power Point Tracking (MPPT) is a technique that the inverter uses to get the maximum power from the PV arrays. PV arrays have a complex relationship between solar irradiation, temperature and total resistance that produces a non-linear output efficiency known as the I-V curve.

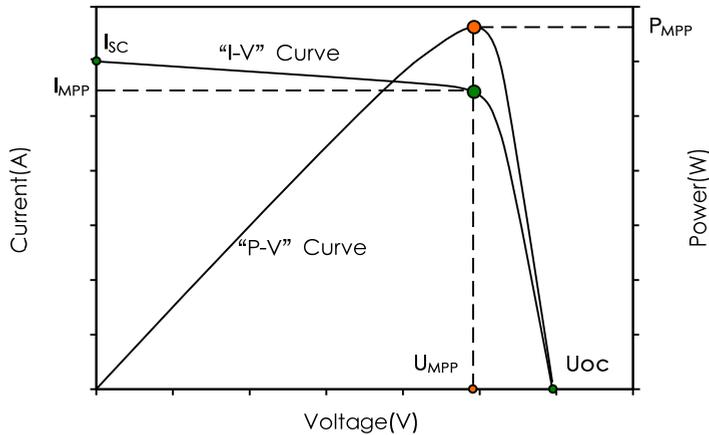


Fig. 8-4 I-V curve

8.8 Intelligent Temperature-Control Technology

Inverter will continuously detect the IGBT temperature and adjust the fan speed accordingly. When the module temperature is low, inverter will decrease the fan speed to lower the device noise and decrease the device operation consumption. As the module temperature increases, inverter will increase the fan speed for well ventilation.

The intelligent temperature-control technology can synchronize the speed of fan and temperature of the IGBT module and thus optimize the module temperature and other conditions.

8.9 Anti-PID Effect Function (Optional)

8.9.1 Introduction to PID Effect

Potential Induced Degradation (PID) of the solar modules is a performance degradation caused by high negative voltage. The PID effect can occur with all crystalline silicon solar cells that are embedded in glass-foil modules, leakage currents can result under unfavorable conditions (accelerated by high humidity and temperature) where the module joins with the frame and causes short-circuits that lower the overall performance of the system.

This inverter is equipped with optional anti-PID function to effectively prevent the PID at the station side.

8.9.2 Anti-PID Function Setting

WARNING

For inverter with optional anti-PID function, the enable and disable of this function can only be performed by personnel from Sungrow. Please contact Sungrow if you need to switch this function.

Proceed as follows to set the mode if the Anti-PID mode is enabled:

- Step 1** Tap "Function" from the default menu;
- Step 2** Tap "Set-parameter";
- Step 3** Tap "Pro-parameter" after entering the correct password;
- Step 4** Click Next to find the page with "Anti-PID mode" and select the mode by the drop-down list (Suppression/Repair)
- Step 5** Select according to the on-site situation.



8.9.3 PID Repair

WARNING

Please make sure the "Anti-PID mode" in the protection parameter of the inverter is "Repair" when enabling the PID repair function.

If the inverter is in deep standby state or the repair process is interrupted, user can enable the repair function manually from the LCD as follows:

- Step 1** Tap "Function" from the default menu;
- Step 2** Tap "Set-parameter";
- Step 3** Tap "Pro-parameter" after entering the correct password;
- Step 4** Click Next to find the page with "PID repair" and click to enable the manual repair.

If this function is enabled, the Work state in the main screen will show "Anti-PID run". User may find the "Negative Vgnd" is about 500V from "Function/Run-information/Real Time Data"



If there is Key stop or Emergency stop or a device fault during the repair process, the repair process will automatically stop.

8.10 Insulation Monitoring Function

8.10.1 Introduction

Insulation resistance is an important parameter related to safety operation. If the insulation resistance is low, the direct contact protection and indirect contact protection may be failed; meanwhile the fault current against the ground and the short circuit caused by low insulation resistance may lead to electric fire, device damage or even physical hazards. Sungrow inverter is

equipped with insulation resistance monitoring function to detect the system insulation resistance in real time. If the resistance is detected to be low, it will send alarm at the first time to remind the user and prevent potential hazards.

The insulation monitoring function can be divided into two kinds:

- For inverter without the anti-PID function or inverter is equipped with this function but it is disabled, both the negative insulation resistance and positive insulation resistance against the ground should be detected.
- For inverter with the anti-PID function and this function is enabled, the DC negative and the ground is equipotential. Therefore, only the positive insulation resistance to the ground needs to be detected.

8.10.2 Simple Troubleshooting

Regardless of the inverter setting, when the insulation resistance is below the threshold (settable from the LCD display), inverter will send alarm signal and the Operation LED will turn to yellow. After receiving the "low insulation resistance" alarm signal, user should stop the device and check the specific insulation resistance from the LCD screen "Function/Run-information/Real time data".

- If the insulation resistance recovers to normal, the fault loop is in the AC side.
- If the insulation resistance is still low, the fault loop is in the DC side.

No matter the fault is in the DC side or in the AC side, a thorough checking and troubleshooting after the system is power down is necessary.

8.11 Protection Function

Inverter has perfect protection functions to protect itself when input voltage or grid is abnormal until the anomaly is removed and the inverter can operate normally.

DC over-voltage protection

When the DC voltage of the PV array exceeds the max. DC voltage, inverter will stop operating, send warning signal and display the fault type on the LCD screen.

Inverter can detect the abnormal voltage and respond quickly.

AC over/under-voltage protection

When the inverter AC output voltage exceeds the allowable range, inverter will stop feeding the grid, send warning signal and display the fault type on the LCD screen.

Inverter can detect the abnormal voltage and respond quickly.

Frequency anomaly protection

When the grid frequency exceeds the allowable range, inverter will stop feeding the grid, send warning signal and display the fault type on the LCD screen.

Inverter can detect the abnormal frequency and respond quickly.

Islanding protection

Islanding is a condition that can occur if the utility grid is disconnected while the inverter is operating and the local load of the inverter is similar to the present output power.

“Islanding” is a potential threaten to devices and operators.

- If the inverter continues power supply after the grid is out of power supply, death or injury may occur to the maintainers during maintenance.
- When power grid fails, the inverter continues power supply. Once the grid resumes, a surge current may occur and damage devices.

Inverter is equipped with anti-islanding protection function.

 DANGER

In anti-islanding protection state, high voltage is still present. Disconnect the main switch and discharge before testing or maintenance.

Reverse polarity protection

When the PV array inputs' polarities are connected reversely, inverter will stop and protect itself against damage and resume normal operation after the connection is corrected.

Overload protection

When the PV array output power exceeds the inverter permissible maximum input power, inverter will limit the power yield at maximum AC power point. If the temperature exceeds the permissible value, inverter will automatically stop operating unless the condition resumes normal.

Ground protection

The grounding cables are equipped with the leakage current sensor. When the leakage current is detected to exceed the setting value (default value is 5A, can be set from the LCD screen) , system will send instruction to stop the inverter and display the fault type on the LCD screen.

Module over-temperature protection

IGBT modules inside the inverter uses thermal sensor with high-precision to monitor the real-time module temperature. Once the module temperature is detected to be high, DSP will send direction to stop the inverter or derate the output.

Internal over-temperature protection

The inverter is equipped with high-precision thermal sensor to monitor the internal temperature of the inverter. Once the over-temperature is detected, DSP will help to maintain the safe operation of the inverter by sending instruction to stop the inverter or derate the power output.

9 Routine Maintenance

Due to the effect of ambient temperature, humidity, dust and vibration, the inner components of the inverter will be aging and worn out. To ensure the system safety and maintain the efficiency of the inverter, it is necessary to carry out routine and periodic maintenance.

All measures, which can help the inverter be in good working conditions, are within the maintenance scope.

9.1 Safety Instructions

9.1.1 Safety Rules

WARNING

Only qualified personnel can perform the work described in this chapter.

Do not leave any screws, washers or other metallic parts inside the inverter to avoid damages to the inverter.

WARNING

Disconnection of the switches in no way implies that there is no voltage of the cable connection terminals inside the AC and DC cabinet. To avoid the risk of electric shock before opening the cabinet door,

- **Disconnect the switches;**
- **Disconnect the upstream and downstream switch of the PCS.**

WARNING

Wait at least 5 minutes after inverter stops before any work on the inverter.

9.1.2 Five Safety Rules

Respect the following five rules during maintenance or service on the inverter to ensure the safety of the maintainer.

- Disconnect the inverter from all the external connections and internal power supplies.
- Ensure that the inverter will not be started accidentally.
- Verify that the inverter interior is discharged completely with a multimeter.
- Necessary ground and short circuit connect.
- Cover the adjacent electrical components with insulation cloth during operation.

9.2 Maintenance and Interval

Recommended routine maintenance work and maintenance interval are shown in the following table.

Item	Method	Interval
Save software data	<ul style="list-style-type: none"> • Read out SolarInfo Logger data; • Save running data, parameters and logs to a disk or a file; • Check each parameter setting; • Update software 	Once a month
System general running status and environment	<ul style="list-style-type: none"> • Check the inverter for visible damages or deformation; • Check the inverter for any abnormal noise during running; • Check each parameter of the inverter during normal operation; • Check the principal components; • Check if the enclosure temperature is normal with the thermal imager; • Check the air inlet and outlet; • Check the ambient humidity, dust and air inlet filter; <p>Notice! Check the air inlet and outlet. The equipment may be damaged by overheating.</p>	Every six months
System cleaning	<ul style="list-style-type: none"> • Check whether the circuit board and the component are clean; • Check the temperature and dust of the heat-sink. Use vacuum cleaner to clean the module if necessary; • Replace the air filter. 	From every six months to annually depending on the dust deposits.
Power circuit connection	<ul style="list-style-type: none"> • Check whether the power cable connections are loose. Retighten them with the torque specified in the manual if necessary; • Check if the power cables and control cables, especially the surface in contact with the metal are damaged; • Check if the wrap belt of the connection terminals is strip-off. 	Six months after commissioning for the first time and then once every six month to a year
Terminal and cable connection	<ul style="list-style-type: none"> • Check whether the screws of the control terminals are loose. Refasten them with screwdriver if necessary; • check whether the terminals of the main circuit are in poor contact and whether the screws are hot; • check if the connection busbar or screws are discoloring. • Visual check the wiring copper bus or bolt for discoloration; 	Once per year
Fan maintenance and replacement	<ul style="list-style-type: none"> • check if there is crack in the fan blade; • Check if there is abnormal noise during the running of the fan; • Replace the fan if necessary. 	Once per year
Device maintenance	<ul style="list-style-type: none"> • routine check of the corrosion of the metal components (once six months) • annually check the contactors (auxiliary switches and micro-switches) to ensure the optimal operation; • Check the running parameters (Voltage and insulation especially) 	From every six months to annually
Safety function	<ul style="list-style-type: none"> • Check the emergency stop button and the LCD stop function; • Simulation shutdown and check the shutdown signal communication signal; • Check the warning labels and other markings for damage or unclearness. Replace them if necessary. 	From every six months to annually
Software maintenance	<ul style="list-style-type: none"> • Optimize software • Check each parameter setting 	From every six months to annually

Item	Method	Interval
LCD display	time <ul style="list-style-type: none"> • Check if the time displayed on the LCD display is correct; • Replace the button cells on the back of the LCD panel if time is incorrect after calibration. 	Everyone and a half year

WARNING

Check the module fans inside the cabinet periodically and the fans on top of the cabinet for abnormal operation and abnormal noise. If so, there may be dust penetrating inside the inverter. Stop the inverter and clean the dust.

Wait at least 5 minutes after the inverter discharge completely. Before cleaning, make sure, with multimeter, the inverter internal is discharged completely to avoid electric shock.

WARNING

Almost all maintenance work needs to remove the internal protective grid during maintenance. Make sure to reassembly the grid and fasten all the screws after the maintenance work.

Make sure all bolts are securely fixed.



The frequency of maintenance operations could be increased according to the environmental conditions of the place where the inverter is suited, plant capacity and on-site situations.

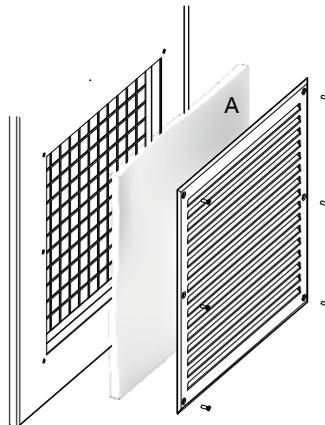
9.3 Filter checking and cleaning



It is recommended to check and clean the inverter filter at least once every six months.

The maintenance interval should be shortened to once every three months or shorter if the dust deposition is heavy.

Cool air comes into the inverter from the front and hot air is exhausted from the inverter from the top. There are two air inlet windows on the lower front side of the inverter cabinet (as marked by item "A" in the following figure). Proceed as follows to clean or replace the filter periodically.



Proceed as follows to clean or replace the filter:

- Step 1** Remove the six screws used to fix the frame of the air inlet windows.
- Step 2** Remove the filters and clean them with warm water and detergent, and wait until it is completely dry; if the filter needs to be replaced, remove the old filter and place the new one.
- Step 3** Reassemble the filter according to the reverse procedure shown above.



Contact Sungrow to order the filter. User can cut proper filters out of the larger filter.

9.4 Replacement of the electrical components

WARNING

The electrical components inside the inverter must be replaced by the same components from the same manufacturer and with the same model number.

The model number can be acquired from the marking of the inverter or the component itself. If otherwise, please contact Sungrow.

WARNING

If the field work needs to replace the components with products from other manufacturer and with different model number, a prior analysis and confirmation by Sungrow is needed.

Failure to follow this procedure may lead to physical injury or death and void all warranty from Sungrow.

10 Troubleshooting

WARNING

Lethal voltages are present inside the inverter when a fault occurs.

- **Only qualified personnel can perform the troubleshooting described in this chapter. Qualified means that the operator has received professional training on devices troubleshooting.**
- **Do not perform any troubleshooting other than that specified in this manual.**
- **Respect all safety instructions during troubleshooting.**

WARNING

Disconnect all AC and DC Switches and external power supplies before troubleshooting.

Should any questions or doubts arise that are not covered by this manual, please contact us.

If you provide our customer service assistant the following information, it will be of great help for us to diagnose and solve the problem in your system:

- Type of inverter
- Serial number of the inverter
- Manufacturer, model and configuration of the PV arrays connected to the inverter
- Inverter communication solution
- Fault and brief description of the fault phenomenon
- A picture of the fault if necessary

10.1 Fault Checking

If any power output anomaly is observed, you may check the following items before contacting Sungrow.

- Open-circuit voltage of the PV arrays
- State of the emergency stop button
- Power limitation state

10.2 Fault and Troubleshooting of LED

LED state	Description
No LED is on	Disconnect the AC/DC voltage for 5 minutes. Reconnect the AC/DC voltage. If the LEDs keep off, repair or replace them. Contact Sungrow if the malfunction cannot be removed following these instructions.

LED state	Description
POWER is off	No power supply to the inverter. First ensure the power supply and the grid-connection are normal. Disconnect the AC/DC voltage for 5 minutes and reconnect them. If the LED keeps off, please contact Sungrow.
OPERATION is off	The grid is not in grid-connection state. First check all the AC/DC connection. Make sure, using multimeter, that the DC input voltage exceeds the inverter startup voltage. Make sure the grid and parameters meet the requirements of safe operation. If the malfunction cannot be removed by following these instructions, please contact Sungrow.
FAULT is on	A fault is not removed yet. Please refer to the touch screen for the detailed fault information and take corresponding troubleshooting. If the malfunction cannot be removed by following these instructions, please contact Sungrow.

10.3 Fault and Troubleshooting on the LCD screen

This section is dedicated to the faults shown on the LCD, possible reasons and troubleshooting. In case the fault cannot be removed following the instructions in this section, please contact Sungrow.

Fault	Vdc-high
Possible reason	DC voltage exceeds the max. DC voltage
Measure	Check the configuration of the PV array and reduce the open-circuit voltage of the PV array
Note	Please contact the installers of the PV arrays

Fault	Vac-high
Possible reason	The grid voltage is above the maximum grid voltage
Measure	Check the grid voltage (or if the grid-connected wire is too thin)
Remark	Inverter automatically reconnects to the grid once the grid voltage recovers normal

Fault	Vac-low
Possible reason	The grid voltage is below the minimum grid voltage
Measure	Check the grid voltage Check if the AC cables are securely connected.
Remark	Inverter automatically reconnects to the grid once the grid voltage recovers normal

Fault	PV pol-rev
Possible reason	The positive and negative poles of the DC side are connected reversely.
Measure	Check the DC connection to for reverse connection after inverter voltage-free
Remark	-

Fault	F-fault
Possible reason	The grid frequency is outside the permitted range
Measure	Check grid frequency Check if the AC cables are securely connected.
Remark	Inverter automatically reconnects to the grid once the grid voltage recovers normal

Fault	Gnd-flt
Possible reason	Inverter AC side leakage current to the ground exceeds the set value (default: 5A)
Measure	-
Remark	Inverter automatically reconnects to the grid once the leakage current recovers

Fault	Iac-high
Possible reason	Internal short-circuit or internal components damages
Measure	Check the AC side cable connection and the control circuit board.
Remark	Contact Sungrow

Fault	Temp-flt
Possible reason	Inverter internal temperature exceeds the permitted value
Measure	Check functionality of fan after the device is voltage-free
Remark	Stop the inverter if this fault occurs 10 times per day

Fault	PM-high
Possible reason	Module temperature exceeds the permitted value
Measure	Check the module and ventilation after the device is voltage-free
Remark	Stop the inverter if this fault occurs 5 times per day

Fault	L over-temp
Possible reason	Reactor temperature exceeds the permitted value
Measure	Check the reactor after the device is voltage-free
Remark	-

Fault	PDP-pro
Possible reason	Internal fault
Measure	Wait 5 minutes for inverter auto-reconnection or disconnect first and then connect the AC main switch Contact Sungrow if the fault insists
Remark	Stop the inverter if this fault occurs 5 times per day

Fault	Cntr-flt
Possible reason	Contactors connected to the grid failure
Measure	Check the contactor after the device is voltage-free
Remark	Stop the inverter if this fault occurs 5 times per day.

Fault	Fan-flt
Possible reason	Inverter internal fan fault
Measure	Check the functionality of fan after the device is voltage-free
Remark	Contact Sungrow

Fault	DC SPD flt
Possible reason	DC SPD tripping, over-voltage protection
Measure	Replace the SPD with the same model after the device is voltage-free
Remark	Contact Sungrow

Fault	AC SPD flt
Possible reason	AC SPD tripping, over-voltage protection
Measure	Replace the SPD with the same model after the device is voltage-free
Remark	Contact Sungrow

Fault	Mism-ac
Possible reason	Sensor is damaged
Measure	Replace the sensor with the same model after the device is voltage-free
Remark	Contact Sungrow

Fault	Island
Possible reason	Islanding detected
Measure	Inverter enters into anti-islanding protection state automatically
Remark	Inverter automatically reconnects to the grid once the grid becomes normal

Fault	Ctrol power supply-flt
Possible reason	CPS (Control power supply) inside the inverter cannot work normally
Measure	-
Remark	Inverter automatically reconnects to the grid once the CPS reverts to normal and the grid-connection requirements are fulfilled

Fault	Ctrol cabt. Temp-flt
Possible reason	Inverter control cabinet fans fault
Measure	Check and maintain the control cabinet fan when device is voltage-free
Remark	Contact Sungrow

10.4 LCD Display Alarm Information and Troubleshooting

During warn running state, inverter can operate normally and send warn signal. User can check the warn information through the Work state on the default menu or through the Function->History-information->His-alarm interface to check the latest 100 history alarm information. Inverter will recover normal operation once the alarm is removed.

Fault	LVRT Run
Possible reason	Grid voltage is below 0.9Un and the LVRT function is enabled
Measure	Warn will disappear automatically when grid voltage recover normal
Remark	-

Fault	CT-Unbalanced
Possible reason	Current transformer (CT) on the inverter control cabinet is abnormal
Measure	Check and service the CT on the measuring board when inverter is voltage-free
Remark	-

Fault	RISO-low
Possible reason	Inverter DC side insulation resistance is lower than the set value.
Measure	-
Remark	Only alarm display. Inverter can operate normally.

Fault	DC Sensor-err
Possible reason	Inverter DC sensor abnormal
Measure	Check and service the DC sensor when inverter is voltage-free
Remark	-

10.5 Other Faults

Inverter Shuts Down Shortly After Start-Up

Possible reason: DC input voltage just reaches the inverter start-up voltage. Voltage will decrease and inverter will stop when it is under load.

Solution: design the serial and parallel connection in accordance with the open circuit voltage; increase the input DC voltage; avoid adopting the critical voltage.

Hear-Sink is Over-Temperature

Possible reason: cooling fan failure; over-temperature of the air inlet; bad ventilation of the switch room, etc..

Solution: check and replace the cooling fan; reduce the temperature of the switch room; clean the air duct and widen the air duct.

Noise is Too Loud during Inverter Operation

Possible reason: abnormal operation of the inverter and transformer; fan failure.

Solution: check if the power is within the permissible range; measure if the grid-connected current and voltage waveform are normal (if not, the noise will be loud and the transformer will be overheating); check and replace the fan.

LCD Display Cannot Start or Stop Inverter

Possible reason: communication malfunction between the LCD display and the DSP; LCD power supply malfunction.

Solution: check the connection between the LCD display and the DSP.

Communication Failure with PC

Check if the address and the Baud rate of the LCD are the same with that of PC.

- Check to ensure the circuits are properly connected and A/B is connected correctly.
- Check if the converters are matched. Communicate again after replacing the converter.
- The monitor disk is installed incorrectly. It is recommended to reinstall the disk.
- If all the above-mentioned items are correct and this fault continues, please replace the PC communication module on the LCD display.

NOTICE

The monitor disk might be incompatible with the antivirus software and thus cannot be installed correctly. You are recommended to disable the antivirus software and then install the monitor software.

11 Appendix

11.1 Technical Data

11.1.1 Electrical Parameters

Input data (DC side)

Parameter	Specification
Max. DC Voltage	1000Vdc
Start-up voltage	500V
MPP Voltage Range	460V~850V
Min. DC Voltage	460V
Max. DC Power	560kW
Max. Input Current	1220A

Output data (AC side)

Parameter	Specification
Nominal Output Power	500kW
Max. Output Power	550kW
Max. AC Output Current	1008A
Nominal Grid Voltage	315Vac
Grid Voltage Range (3-phase)	252Vac~362Vac
Nominal Grid Frequency	50Hz/60Hz
Grid Frequency Range	47~52Hz/57~62Hz
Output Current THD	<3% at nominal power
DC current injection	<0.5% of nominal output current
Power factor	0.9(lagging) - 0.9(leading)

11.1.2 Mechanical Parameters

Parameter	Specification
Dimensions(WxHxD)	1205mmx1915mmx835mm
Weight	950kg

11.1.3 System Parameters

Parameter	Specification
Max. Efficiency	98.7%
European Efficiency	98.5%
Protection Degree	IP21
Power Consumption at Night	<20W
Operating Temperature	-30°C~ + 55°C (without power derating at 55°C)
Cooling Method	Temperature-controlled forced air cooling
Relative humidity	0 ~ 95% (Non-condensing)
Max. Working Altitude	6000m (operation with derating above 3000m)

11.1.4 Display and Communication

Parameter	Specification
Display	LCD
Communication	RS485/Ethernet

11.2 Exclusion of Liability

The content of these documents is periodically checked and revised where necessary. Please call us or check our website www.sungrowpower.com for the latest information. No guarantee is made for the completeness of these documents. Please contact our company or distributors for the latest version.

Guarantee or liability claims for damages of any kind are excluded if they are caused

- Improper or inappropriate use or install of the product
- Install or operate the product in unintended environment
- Install or operate the product without observing relevant safety regulations in the deployment location
- Ignore the safety warnings or instructions contained in all documents relevant to the product
- Install or operate the product under incorrect safety or protection conditions
- Alter the product or supplied software without authority
- Product malfunctions due to operation attached or neighboring devices running out of the allowed limit values
- Unforeseen calamity or force majeure

The use of supplied software produced by Sungrow Power Supply Co., Ltd. is subject to the following conditions:

- Sungrow Power Supply Co., Ltd. assumes no liability for direct or indirect damages arising from the use of SolarInfo software. This also applies to the provision or non-provision of support activities.
- SolarInfo software used for commercial purposes is prohibited.
- Decompiling, decoding or destroying the original program, including SolarInfo software and the embedded software, is prohibited.

11.3 About Us

Sungrow power supply is a Chinese leading manufacturer of various power electronics products for renewable energy generation systems. Our products include converters, inverters, battery chargers and other power supplies for distributable generation systems in both grid-connected and stand-alone applications. The power rating of SUNGROW products covers a range from several hundred watts to large mega-watt systems.

The pursuit of SUNGROW is to help our customers acquire stable and clean power with minimum cost, maximum reliability and enhanced safety.

11.4 Contact Information

Should you have any questions or queries about this product, please contact us through the following information. We will be more than happy to assist you!

Company:	Sungrow Power Supply Co., Ltd.
Website:	www.sungrowpower.com
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