SC250KU
Power Conversion System (PCS)
Operation Manual
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1 About this Manual

1.1 Foreword
Thank you for purchasing the SC250KU power conversion system (PCS) from Sungrow Power Supply Co., Ltd. We hope that the device will meet with your satisfaction when you use it. Your commands and feedbacks on the performance and function of the device are very important for our further improvement.

1.2 Validity
This Operation Manual is valid for the following device types:
• SC250KU
The SC250KU device is referred to as “PCS” hereinafter unless otherwise specified.

1.3 Content
This manual contains the following information:
• Safety Instructions
Safety instructions for operation and maintenance of the PCS.
• Product Description
System composition, PCS function and operation mode is described.
• Use
Introduce the PCS operation and use of human machine interface (HMI).
• Routine Maintenance
Introduce the daily maintenance of the PCS and the replacement of certain accessories.
• Troubleshooting
Introduce the potential faults and troubleshooting of the PCS.
• Others
Technical data of the PCS, 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 PCS installation and commissioning. Readers should be familiar with the electrical and mechanical diagrams and characteristics of the electrical components.
1.5 How to Use This Manual

Read this manual and other related documents carefully before any work on the PCS. Documents must be stored carefully and available at all times. Additional documents are also available to the users besides this manual for installation:

- Installation Manual (in the scope of delivery)

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.

1.6 Symbol Explanation

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

⚠️ 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.

ℹ️ NOTE

NOTE indicates additional information, emphasized contents or tips to help you solve problems or save time.
Symbols on the PCS Body

The symbols below may be pasted on the electrical parts of the PCS. Make sure to read the following symbols and fully understand them before operating the device.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Symbol 1]</td>
<td>Risk of electric shock!</td>
</tr>
<tr>
<td>![Symbol 2]</td>
<td>Hot surface!</td>
</tr>
<tr>
<td>![Symbol 3]</td>
<td>Connection point for earth conductor</td>
</tr>
<tr>
<td>![Symbol 4]</td>
<td>Protective conductor terminal</td>
</tr>
</tbody>
</table>
2 Safety Instructions

2.1 Intended Usage

SC250KU, researched and developed by Sungrow Power Supply Co., Ltd., is a PCS for energy storage system with transformer. It provides an interface for the grid and battery for energy storage system charging and discharging. Through step up transformer, the PCS AC side can connect to the grid. With IP21 protection rate, the PCS can be installed indoors only.

The charging and discharging system with SC250KU is shown below:

![Diagram of energy storage system]

Fig. 2-1 Energy storage system

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Energy storage batteries (lead-acid battery, lithium battery and etc.)</td>
</tr>
<tr>
<td>B</td>
<td>SC250KU PCS</td>
</tr>
<tr>
<td>C</td>
<td>Utility grid</td>
</tr>
<tr>
<td>D</td>
<td>Loads</td>
</tr>
</tbody>
</table>

**WARNING**

- Installation described in this section must be strictly observed. Any other or additional installation other than the described installation is not permitted.
- Installation and connections other than the contents described in this section may lead to device damages and void warranty claims from Sungrow.

2.2 Important Safety Instructions

This section introduces the safety instructions during operation of the PCS. Read the safety instructions in this section before PCS operation. Please also respect all warnings, instructions, and cautions and respective chapter before operation.
## 2.3 During Operation

### 2.3.1 Manuals

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

- Operate the PCS by strictly following the description in this manual. Device damage, personal injury or property loss may follow if otherwise.
- This manual and other related documents should be available for relevant persons at all times.
2.3.2 Personnel
- Only professional electrician or personnel with professional training can operate the PCS;
- Operator should be familiar with the construction and working principle of the whole energy storage system;
- Operator should be familiar with the PCS Operation Manual and Installation Manual;
- Operator should be familiar with the country/local specific standards.

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

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

2.3.4 Safety Warning Signs
Please respect the followings during installation, daily maintenance or troubleshooting of the PCS:
- An obvious marking should be placed in the PCS upstream and downstream to keep the switch from accidental reconnection;
- A temporary warning sign or barrier must be posted around the operation area;
- Remove the door keys and keep them appropriately after maintenance or troubleshooting 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 Storage Battery Protection
High Voltages exist between positive and negative polarities of the storage batteries for large-scale PV plant. Electrical shock or life risk may occur by accidental touch.

**DANGER**
- High voltages exist between the positive and negative polarity of the storage batteries!
- Ensure the PCS and storage batteries are completely disconnected during device maintenance.
- Place warning labels in the disconnection place to avoid accidental reconnection.
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 PCS. During live line measurement,
• use suitable protective equipment, for example dielectric gloves, and
• accompany by other persons.

2.3.8 Measuring Instrument

Appropriate measurement instruments are recommended during the electrical connection, commissioning and operation of the PCS.

⚠️ WARNING

• Use high quality instruments that can meet the field requirements.
• Ensure the safety and correctness of instruments connection and use to avoid electric arc.

2.3.9 Touch Screen Parameter Setting

Certain touch screen settable parameters are closely related to the PCS operation; therefore these parameters can only be set after reliable evaluation of the system and PCS.

⚠️ WARNING

• Improper parameter setting may affect the functionality of the PCS.
• Only qualified personnel with authorization can set the PCS parameter.

2.3.10 ESD Protection

 NOTICE

PCS may be damaged irreversibly by electrostatic discharge (ESD) at its components.
• During the operation of the PCS, please observe all the ESD-related safety regulations, for example, wear antistatic wrist strap.
• Avoid unnecessary touch of the printed circuit board or other sensitive components!

2.3.11 Moisture Protection

 NOTICE

Moisture can damage the PCS. For normal operation of the PCS, please respect the followings:
• Do not open the PCS doors when relative humidity is higher than 95%.
• Do not maintain or service the PCS in rainy or other bad days.
2.3.12 Maintenance and Service

⚠️ WARNING

Wait at least 5 minutes after the PCS AC and DC connections are disconnected and then open the PCS front door to maintain or service.

Before any service work, observe the followings.

- Ensure that the PCS will not be started accidentally.
- Verify that the PCS interior is discharged completely with a multimeter.
- Necessary ground and short circuit connect.
- Cover the adjacent electrical components with insulation cloth during operation.
- Ensure the clearness of the safety route during maintenance and service work.

2.3.13 Disposal of Waste

When the PCS 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/local-specific standards and regulations.

⚠️ WARNING

- Only service the device when it is voltage-free.
- Never work alone when servicing this device. Two persons are required until the PCS is properly shut down and de-energized.

Other protection 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 PCS 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 PCS. 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 System Introduction

3.1.1 Prospect

Electric power system consists of the following six parts: development, generation, transmission, distribution, consumption and storage. Among which, the energy storage system is important to realize the following functions: demand side energy management, substation grid support, load balance, renewable energy application etc.

3.1.2 Introduction of PCS

SC-series PCSs produced by Sungrow are dedicated to charging/discharging the storage battery and providing intermediate link between the grid and the storage battery in different occasions (grid-connected system, islanded system or hybrid system).

3.1.3 Smart grid system

Smart grid system with PCSs for energy storage system is shown in Fig. 3-1.

Fig. 3-1 Smart grid and energy storage system

3.2 PCS Features

PCS for energy storage system adopts the advanced digital control technology to optimize the control function and improve the system reliability. It is applicable for various battery charging and discharging situations. With module construction design, it is convenient for installation and maintenance. The major features are shown below:

- Grid dispatches; RS485, CAN and Ethernet communication;
- Grid-connection mode, off-grid mode, hybrid mode and etc.
• Various grid-connection charge/discharge, including DC side charge/discharge mode and AC side charge/discharge mode
• LVRT/HVRT and reactive power compensation
• Autonomous frequency-adjustment, voltage-adjustment and controlled frequency-adjustment, voltage-adjustment
• Off-grid independent inverter function; establish micro-grid system to ensure the power supply of important loads
• Multiple PCSs independent inverter in parallel connection
• Strong ability for 3-phase unbalance load in off-grid mode
• Long-time operation at 110% of the nominal output power
• AC and DC double inputs redundant power supply mode to make sure the reliability of the control power supply
• IP21 protection rate, anti-drip and anti-condensation function
• Long product service life: membrane capacitance design, service life of 30 years
• Module design: maintenance from the front, reliable wall-mounted installation to save customer installation space

3.3 Product Appearance

The appearance and external components of the PCS is shown below:

![Fig. 3-2 PCS appearance](image)

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCD touch screen</td>
<td>Displays data and executes control commands</td>
</tr>
<tr>
<td>LED indicators</td>
<td>“POWER”, “OPERATION” and “FAULT”</td>
</tr>
<tr>
<td>Emergency stop button</td>
<td>Stop the PCS in emergency by pressing this button down</td>
</tr>
<tr>
<td>GRID MAIN SWITCH</td>
<td>AC side circuit breaker</td>
</tr>
</tbody>
</table>
LED indicators

There are three LEDs at the front panel of the PCS: POWER indicates the power is on; OPERATION indicates the operation of the PCS; FAULT indicates a fault condition.

You can get the PCS operation state through these LEDs and control the PCS by the LCD touch screen. See the following table for the description of the LED indicators:

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>POWER</td>
<td>Green</td>
<td>Control the circuit power supply; LED is on when AC side or DC side is under voltage for 5 minutes</td>
</tr>
<tr>
<td>OPERATION</td>
<td>Green</td>
<td>PCS operates normally</td>
</tr>
<tr>
<td>FAULT</td>
<td>Red</td>
<td>A fault occurs and has not been removed. The LED will be off automatically when the fault is cleared.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>LED status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="LED combo 1" /></td>
<td>“POWER” LED is on. PCS normal power supply, no charging or discharging</td>
</tr>
<tr>
<td><img src="image" alt="LED combo 2" /></td>
<td>“POWER” is on. “OPERATION” is on. AC and DC side parameters meet the requirements. PCS operates normally</td>
</tr>
<tr>
<td><img src="image" alt="LED combo 3" /></td>
<td>“POWER” is on. “FAULT” is on. A fault occurs and not removed yet.</td>
</tr>
<tr>
<td><img src="image" alt="LED combo 4" /></td>
<td>All LEDs are off. PCS is disconnected from the power supply, no power supply</td>
</tr>
</tbody>
</table>

LCD touch screen

LCD screen displays the operational information of the PCS and performs certain control functions as follows:

- Control the PCS operation
- Display real-time operation data
- Display fault information
- Adjust the running parameters
- View history records

Emergency Stop Button

PCS will be disconnected from the grid when pressing down the emergency stop button in emergency situation or fault condition.

⚠️ WARNING

Electrical shock hazards!

- The pressing of the emergency stop button in no way implies that no voltage is present in the AC and DC connection terminals inside the PCS.
- Lethal voltages are present inside the PCS!
### WARNING

**Use the emergency stop button to stop the PCS only in a time of emergency.**
Improper use of the emergency stop button may lead to PCS damages. Use of the emergency stop button under load will bring great stress to PCS related components. Frequent use will damage the button.

When you push this button, the PCS will stop immediately and the DC & AC contactors will be disconnected.

You can restart the PCS by rotating the button clockwise to unlock it. The PCS will be restarted through the LCD touch screen.

### AC Switches

AC switches are important disconnection devices of the PCS, controlling the AC main circuits. PCS output side can be disconnected from the grid and PCS can be disconnected from the storage battery through these switches. PCS will start when the AC switch is in the ON position.

When only the AC switch is disconnected and the PCS downstream power supply is connected, the AC output terminal is still under-voltage. Please take proper protection methods when maintenance or troubleshooting under this circumstance.

### WARNING

- Improper use of the switches may damage the PCS.
- Avoid frequent use of the switches.

### 3.4 Communication Solution

#### 3.4.1 RS485 Communication

PCSs communicate with the PC through RS485/RS232 convertor. SolarInfo SC can be adopted to monitor the communication.

![Fig. 3-3 PC monitors through RS485](image)

#### 3.4.2 Ethernet Communication

Besides the standard RS485 communication, PCS also provides the optional Ethernet communication. PCS supports the MODBUS TCP/RTU and 104 protocols. If you have doubts about the communication solution, please contact Sungrow.

- Single PCS communication

For communication of a single PCS, connect the PCS RJ45 port to PC RJ45 port by a network cable. SolarInfo SC can be used to monitor the communication.
3.4.3 Communication with BMS

PCS can communicate with battery management system (BMS) to monitor the state of the battery and protect the battery according to the battery state. Communication supports the CAN and RS485 methods.

3.5 Circuit Diagram

PCS realizes rectification and inversion through 3-phase full bridge conversion. The rectified output feeds to the storage batteries through EMC filter. The inverted output turns to sine-wave voltage through LC filter and then feeds to the grid after step-up by 3-phase transformer.

The circuit diagram is shown in Fig. 3-7.
Fig. 3-7 PCS circuit diagram
4 PCS Start/Stop

4.1 Starting the PCS

4.1.1 Inspection before PCS Start

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

- All connections are done by strictly following the installation manual and circuit diagram.
- The protection cover inside the device has been installed securely.
- The cabinet door is closed and the key is removed and stored by appointed personnel.
- The emergency stop button is released.
- AC side circuit breaker is on the “OFF” position.
- Measure the DC and AC side voltage with multimeter to check if they fulfill the PCS startup conditions and there is no overvoltage hazard.

⚠️ WARNING

After a long downtime, thorough and detailed inspection is necessary to ensure all conditions are met before starting the PCS.

4.1.2 Steps to Start the PCS

When the above-mentioned conditions are met, proceed as follows to start the PCS:

The DC storage battery side and grid side are connected correctly;
Turn the PCS AC side breaker to the ON position;
PCS starts according to dispatch instruction.

After startup, PCS will automatically check if the AC and DC voltage and other parameters meet the operation requirements. If both the DC and AC parameters meet the requirements and the working instruction is received, PCS will automatically enter the Run mode and operate normally.

⚠️ WARNING

- The PCS needs no manual control in daily operation.
- Keep the door closed and locked, remove the keys and put them under safekeeping by appointed personnel during normal operation.

4.2 Stopping the PCS

PCS stops for normal maintenance and service work or when a fault or emergency occurs. Proceed as follows to stop the PCS as appropriate:

4.2.1 Normal Stop

Proceed as followsto stop the PCS during normal maintenance and service work:
1. Stop the PCS through the stop operation command on the LCD touch screen
2. Turn the PCS AC side disconnect switch to the "OFF" position
3. Disconnect the PCS downstream switches
4. Disconnect the PCS upstream switches
5. PCS stops

**WARNING**

During normal operation, disconnection of the circuit breaker is strictly forbidden. Otherwise, arc may follow and the circuit breaker or even the PCS will be damaged.

### 4.2.2 PCS Stop When a Fault Occurs

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

1. Push the emergency stop button
2. Turn the PCS AC side breaker to the OFF position
3. Disconnect the PCS downstream switches
4. Disconnect the PCS upstream switches
5. PCS stops

**WARNING**

- Use the emergency stop button only when an emergency or a fault occurs. Under normal conditions, stop the PCS by performing the stop command on the LCD screen.
- Press the emergency stop button directly under critical circumstances to ensure timely response.
5 Operation Mode

5.1 Basic Functions

PCS in SC250KU series features the following basic functions:

- Storage battery charge/discharge control

PCS can charge and discharge the storage battery. Operator can select the charge/discharge power. Modes of charge/discharge commands can be modified from the upper computer.

Charge mode includes: constant current charge, constant voltage charge, constant DC power charge, constant AC power charge, etc.

Discharge mode includes: constant current discharge, constant voltage discharge, constant DC power discharge, constant AC power discharge, etc.

- Reactive power control

PCS can control the reactive power percentage by feeding the reactive power during charging and discharging.

Reactive power setting range:-250KVA~250KVA.

Reactive power limit can be realized during PCS charge and discharge by setting the reactive power through the upper computer or the touch screen.

- Off-grid system independent inverter control

PCS has independent inverter function in off-grid system to stabilize the output voltage and frequency and feed different loads. Independent inverter includes active mode and passive mode.

Active mode: PCS will stop when a recoverable fault occurs in independent inverter state. When the fault is removed, PCS can start independent inverter automatically without manual operation and recover its previous running state.

Passive mode: PCS will stop when a fault occurs in independent inverter state. When the fault is removed, PCS can start independent inverter by manually setting the startup instruction.

NOTICE

Consult Sungrow if the seamless handoff function is needed.
5.2 Operating Status

5.2.1 Status Introduction

PCS in SC250KU series has the following status: initialization, stop, standby, run, emergency stop and fault.

Initialization

Initialization status is the status by closing the inverter’s battery connection side to supply power of the battery to the control circuit and to check if the voltage of the storage battery meets the requirement of normal working voltage.

System performs self-checking in this status and then enters into the Stop status.

Stop

PCS stays in Stop status when there is no instruction or dispatch.

PCS receives instruction and dispatch from the LCD touch screen and the upper computer during this status. PCS enters into Run status if conditions are fulfilled.

PCS enters into the Stop status once receiving Stop instruction.

Standby

PCS enters into Standby status when receiving Standby instruction and dispatch from the LCD touch screen and upper computer during Stop or Run status. In Standby status, PCS AC main contactors are connected and the system is in hot standby state. PCS is able to switch to the corresponding statuses upon instruction or dispatch sent by the touch screen or upper computer.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
</table>

- **Conditions for PCS normal operation:**
  - No abnormality in the protection functions;
  - Voltage of the storage battery is within the allowable range.

Run

Run status contains the grid mode and off-grid mode. Grid mode includes charge and discharge, off-grid mode includes active mode and passive mode.

In grid mode, PCS can adjust the electricity quality and control the reactive power. In off-grid mode, PCS can provide reliable voltage and frequency output to the loads.

Fault

PCS stops running and disconnects the main circuit from the grid or load or battery by disconnecting the AC and DC side contactors once a fault occurs to the energy storage system.

System continues detecting if the fault is removed or not. If yes, PCS enters into the Stop status after 30 seconds, waiting for new instruction or dispatch; if no, PCS stays in Fault status.
**WARNING**

When a fault occurs to the DSP or the module, restart of the PCS from the LCD touch screen is strictly forbidden. Power off to check the device and then re-power it on after making sure there is no problem. Otherwise the device will be damaged.

**Emergency Stop**

Emergency stop is the manual stop of the PCS by pressing down the emergency stop button when a fault or emergency occurs.

To restart the PCS, release the emergency stop button.

**Stop**

In normal Run status, if routine maintenance or inspection is required, you can send a stop command from the upper computer to stop the PCS. Disconnect the AC and DC breakers to make sure the PCS interior is completely voltage-free.

**5.3 Status Switch**

In the initialization status, the PCS control system will finish self-checking to verify integrity of the control and sensor system. When the monitor and protection functions are normal, PCS enters into the Stop status, during which PCS locks the IGBT pulse and disconnects the AC/DC contactors. Under the Standby status, PCS locks the IGBT pulse but closes the AC/DC contactors and the PCS is in hot standby state.

To switch between different status, conditions in Fig.5-1 should be fulfilled.

![Fig. 5-1 Operation status switch](image)
5.4  Operation Mode

5.4.1  Introduction

PCS operation mode includes the grid mode and off-grid mode.

**Grid mode**

In grid mode, PCS can charge and discharge.

- Charge: constant current charge, constant voltage charge, constant DC power charge, constant AC power charge, etc.
- Discharge: constant current discharge, limited voltage discharge, constant DC power discharge, constant AC power discharge, etc.

Moreover in grid mode, functions such as power factor adjustment, reactive power adjustment, LVRT and active islanding are also available. Users can set these functions as appropriate.

**Off-grid Mode**

This mode can be set up through upper computer or PCS touch screen. In off-grid mode, PCS can supply AC power with constant frequency to loads.

Off-grid mode contains the active mode and passive mode.

- Active mode: PCS will stop when a recoverable fault occurs in independent inverter state. When the fault is removed, PCS can start independent inverter automatically without manual operation and recover its pervious running state.
- Passive mode: PCS will stop when a fault occurs in independent inverter state. When the fault is removed, PCS can start independent inverter by manual setting the startup instruction.

5.4.2  Modes Switch

The charge and discharge modes are switched directly in the grid mode without through the standby mode.

Independent inverter can be activated only when the PCS is not connected to the grid.

<table>
<thead>
<tr>
<th>NOTICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>To switch the PCS between the grid and off-grid mode, please stop the device and disconnect the power supply, change the cable connection according to the electrical connection chapter and then switch the device operation modes.</td>
</tr>
</tbody>
</table>
6  LCD Touch Screen Operation

This chapter introduces contents distributed on the PCS touch screen and how to operate the touch screen.

6.1 LCD Touch Screen

6.1.1 Location and Construction of LCD touch screen

The LCD touch screen, located at the eye-level in the front side of the PCS, is used 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 of the PCS and the screen. You may check and set related parameters by touching the LCD internal icons.

![Location and appearance of the LCD display](image)

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

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>LED indicators</td>
</tr>
<tr>
<td>B</td>
<td>Data display and operation area</td>
</tr>
</tbody>
</table>

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

6.1.2 LED Indicators

The color and description of the three LED indicators are shown in the following table.
### 6.2 Default Screen

Menu interface in this chapter is indicative only.

#### 6.2.1 Initialization

The LCD is initialized when PCS is energized and the initialization interface will appear.

**Initialization**

Appears every time the PCS is energized. After initialization, the default home screen follows.

#### 6.2.2 Default Home Screen Introduction

Click the work state on the main screen, then the fault screen and current faults will appear, as shown above.

For the sake of description, the default screen mentioned hereinafter refers to this screen. Accessing to submenus and operations starts from the default screen.
6.2.3 Backlight function

If there is no operation to the LCD screen

- for 3 minutes, screen will go back to the default screen;
- for 4 minutes, screen will go out.

Tapping the screen will activate the backlight and return to the default screen.

6.3 Overview of Menus and Icons

User can operate directly from the LCD touch screen. There are three main buttons set up on the lower left side of the screen, Start, Stop, and Function. The logical structures of these menus and icons are shown below:

<table>
<thead>
<tr>
<th>Main menu</th>
<th>Level 1 sub-menu</th>
<th>Level 2 sub-menu</th>
<th>Level 3 sub-menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home screen</td>
<td>Real time data</td>
<td>Constant current mode</td>
<td></td>
</tr>
<tr>
<td>Start</td>
<td>Power curve</td>
<td>Constant voltage mode</td>
<td></td>
</tr>
<tr>
<td>Stop</td>
<td>E-column</td>
<td>DC power</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>History information</td>
<td>Constant mode</td>
<td></td>
</tr>
<tr>
<td>Running information</td>
<td>History events</td>
<td>AC power</td>
<td></td>
</tr>
<tr>
<td>History information</td>
<td>History faults</td>
<td>Standby</td>
<td></td>
</tr>
<tr>
<td>Mode</td>
<td>Grid mode</td>
<td>Active</td>
<td></td>
</tr>
<tr>
<td>Off-grid mode</td>
<td></td>
<td>Passive</td>
<td></td>
</tr>
<tr>
<td>Set parameters</td>
<td>Sys-parameters</td>
<td>Language &amp; Firmware version</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>E-adjust</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factory reset</td>
<td></td>
</tr>
</tbody>
</table>
### 6.4 Mode Setting

#### 6.4.1 Grid Mode

In grid mode, the following modes can be set: constant current mode (CC-mode DC), constant voltage mode (CV-mode DC), constant DC power mode (CP-mode DC), constant AC power mode (CP-mode AC) and standby. Setting of “constant current mode” is taken as example herein for illustration. Setting of other modes is similar to this.

1. Enter the home screen.

2. Tap “Function” button and the following interface will appear.

3. Tap “Mode” to access to the interface shown below.

4. Tap “Grid mode” and the following grid mode interface will appear.

5. Tap “CC-mode (DC)” and the dialogue box for setting the current will pop up.
6. Enter the current value command in the interface as shown, and then click the button “Run” to confirm. On-grid constant current mode will run.

6.4.2 Off-grid Mode

Off-grid mode includes active mode and passive mode. In active mode, after the device has started and stops in the event of some fault, it will start and run off-grid automatically after the fault has been removed, and by tapping the Stop button or pressing the emergency stop button, the device stops and will not restart after restoration. In passive mode, after the device has started and stops due to any event, it will not re-start automatically, and the start command should be sent to proceed startup. Start in off-grid passive mode is taken as example herein for illustration. Start in off-grid active mode is similar to it.

1. Enter the home screen.

2. Tap “Function” button and the following interface will appear.

3. Tap “Off-grid mode” to access the following interface.

4. After “Passive mode” is selected, the following dialogue box for confirmation will prop up.
5. By clicking "Enter," the off-grid passive mode is selected and "Off-grid mode (Passive)" is displayed on the main screen.

6.5 View Running Information

Users can view the running information for real-time data, power curve and E-column.

- Internal Statistics: total charging/discharging (kWh), monthly charging/discharging (kWh), daily charging/discharging (kWh), total charging/discharging time (h), monthly charging/discharging time (h), daily charging/discharging time (min) and total operation time (h).

- Real-time data: DC voltage, DC current, grid voltage, grid current, grid power, interior temperature, charge power, discharge power, active power, reactive power, power factor, present work stage, temperature of each module, etc.

- Output power curve: charge and discharge power curve of the device by now; data is updated every 12 minutes. Data is cleared when the device is power down.

- E-column: charge and discharge energy histogram within 24 hours on the present day. The data is updated in real time and will be saved when PCS is power down. Data will be cleared at 0 o'clock every day. The value is displayed in the form of percentage of the present hourly charge/dischARGE energy to the nominal hourly charge/dischARGE energy.

1. Enter the home screen.

2. Tap "Function" button and the following interface will appear.

3. Tap "Run information" and the following interface will display.
4. Tap “Run information” and the default run information interface of “Real time data” appears.

5. “Real time data” displays all running parameters and work state of the PCS.

6. Tap “Power curve” and the left interface pops up.

7. “Power curve” shows the charge and discharge curve of the device.

8. Tap “E-column” and the left interface will appear.

9. “E-column” shows the percentage of hourly charge/discharge amount and the nominal hourly charge/discharge amount.

6.6 View History Information

1. Enter the home screen.

2. Tap “Function” button and the following interface will appear.

3. Tap “History information” and the following interface will display.
4. “History information” contains “history events” button and “history faults” button. Tap “History events” button and the following interface will appear.

5. History events are displayed.

6. Events include the latest 100 running records (including fault records).

7. Tap “History faults” button and the interface shown on the left will appear.

8. Display the latest 100 faults recorded of the device, including the time the fault occurred and the fault type.

---

Up to 100 latest faults with description and time are kept by the system. Fault mainly includes the following types: DC over-voltage/under-voltage, DC over-current, grid over-voltage/under-voltage, grid over-frequency/under-frequency, AC overcurrent, islanding protection, AD sampling fault, DSP communication fault, battery fault, AC leakage current protection, AC main contactor fault, DC main contactor fault, module fault, module over-temperature, reactor over-temperature, AC voltage imbalance, phase anomaly, battery communication fault, reverse polarity connection, etc.

---

6.7 Parameter Setting

6.7.1 Entering Password

1. Enter the home screen.

2. Tap “Function” button and the following interface will appear.
3. Tap “Set parameters” and the following interface will appear.

4. Tap the blank area after the “please input password”, and the following interface will appear.

5. Input the password. If the password is wrong, the following “Error password” interface will appear.

   System default password: 1111
   CE: clear; ESC: escape and close the password input keyboard; ENTER: confirm password; MIN, MAX: the maximum and minimum value can be input; value outside this range is invalid

6. The interface as shown will prop up if a wrong password is entered. Tap “Enter” to input the password again.

6.7.2 Language Setting

1. Enter the home screen.

2. Tap “Function” button and the following interface will appear.
3. Tap “Set parameters”, enter the password and the following interface appears.

4. Tap “Sys-parameters” and the following interface appears.

5. Tap “Language&Firmware Version” and the following interface appears.

6. You can view the languages supported by the system on this interface.
   The LCD measurement board version and the DSP version are shown below the national flag.

### 6.7.3 Date and Time Setting

1. Enter the default screen.

2. Tap “Function” and the following interface will appear.
3. Tap “Set-Parameter” and enter the password and the following interface will appear.

4. Tap “Sys-parameters” and the following interface will appear.

5. Tap “Time” and the time and the date and time modification interface will appear.

6. Set the system date and time in this interface.

6.7.4 Energy adjustment

1. Enter the default screen.

2. Tap “Function” and the following interface will appear.
3. Tap “Set-Parameter” and enter the password and the following interface will appear.

4. Tap “Sys-parameters” and the following interface will appear.

5. Tap “E-adjust” and the following interface will appear.

6. Set the charge and discharge energy adjustment value.

### 6.7.5 Load Default

1. Enter the default screen.

2. Tap “Function” and the following interface will appear.
3. Tap “Set-Parameter” and enter the password and the following interface will appear.

4. Tap “Sys-parameters” and the following interface will appear.

5. Tap “Load default” and the following interface will appear.

6. Input the password **1111** and all parameters will be resumed to the default factory values as the following interface.

7. All parameters resume to the default value.

**NOTICE**

Load default performance is unavailable when device is running. You can only perform load default when the device stops.

By performing load default, all records and information will be irrecoverably cleared. Please confirm all data have been backed up.
### 6.7.6 Running Information Setting

1. Enter the default screen.

2. Tap “Function” and enter the password.

3. Tap “Set-Parameter” and enter the following interface.


5. If the device operation mode is “Grid mode”, the grid mode Set-parameters interface will appear and it is able to set the Run-parameters for the grid mode.

6. Tap “Next” to set the other parameters.

7. If the device operation mode is “Off-grid mode”, the Off-grid mode Set-parameters interface will appear and it is able to set the Run-parameters for the Off-grid mode.

Note: during parameter setting, the positive value is charge and negative value is discharge.
6.7.7 Protection Parameter Setting

1. Enter the default screen.
2. Tap "Function" and the following interface will appear.
3. Tap "Set-Parameter" and enter the password and the following interface will appear.
4. Tap "Pro-Parameter" and enter the password and the following interface will appear.
5. The protection parameter setting interface.

6.7.8 Communication Parameter Setting

Communication parameter setting includes the device address (Modbus address) setting, RS485 Baud rate with the PC, communication method with BMS. Device and BMS communication method can be NO communication, CAN, or Serial port.

The communication between the PCS and the PC can be made via RS485 or Internet. The method for the communication parameter setting is as follows:

- RS485 serial port communication
  The Modbus address ranges from 1 to 247 and the address of each PCS is unique. The default baud rate of the serial port communication is 9600bps.
- Internet communication
  - Default port number 502
  - Default IP address: 192.168.1.100
  - Subnet mask: 255.255.0.0
  - Default gateway: 192.168.100.2
1. Enter the default screen.

2. Tap “Function” and the following interface will appear.

3. Tap “Set-Parameter” and enter the password and the following interface will appear.

4. Tap “Communications” and the following interface will appear.

5. User can set port communication parameters.
   Tap “Next” to set the other communication parameters.

6. The Modbus parameters setting interface.

7. The IEC-104 parameters setting interface.
8. The BMS parameters setting interface.

Note: for PC communication, the internet communication and serial port communication can be adopted; if serial port communication is selected, the BMS should be no communication or CAN communication.
7 PCS Functions

7.1 L/HVRT

The Electric Rule 21, 2015 defines the L/HVRT requirements according to the figure and table below.

![Diagram of operating parameters for rule 21 ride-through and must trip regions in the time-voltage domain.]

**Fig. 7-1 Low /High voltage withstand requirements**

<table>
<thead>
<tr>
<th>Region</th>
<th>Voltage (% Nominal Voltage)</th>
<th>Ride Through Until</th>
<th>Operating Mode</th>
<th>Maximum Trip Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Voltage 2 (HV2)</td>
<td>$V \leq 120$</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>0.16 s</td>
</tr>
<tr>
<td>High Voltage 1 (HV1)</td>
<td>$110 \times V &lt; 120$</td>
<td>12 s</td>
<td>Momentary Cessation</td>
<td>13 s</td>
</tr>
<tr>
<td>Near Nominal (NN)</td>
<td>$88 \leq V \leq 110$</td>
<td>Indefinite</td>
<td>Continuous Operation</td>
<td>13 s</td>
</tr>
<tr>
<td>Low Voltage 1 (LV1)</td>
<td>$70 \leq V &lt; 88$</td>
<td>20 s</td>
<td>Mandatory Operation</td>
<td>21 s</td>
</tr>
<tr>
<td>Low Voltage 2 (LV2)</td>
<td>$50 \leq V &lt; 70$</td>
<td>10 s</td>
<td>Mandatory Operation</td>
<td>11 s</td>
</tr>
<tr>
<td>Low Voltage 3 (LV3)</td>
<td>$V \leq 50$</td>
<td>1 s</td>
<td>Momentary Cessation</td>
<td>15 s</td>
</tr>
</tbody>
</table>

*While these operating parameters correspond to the Rule 21 parameters, they may be substituted with operating parameters for other area EPCS requirements.

Note 1: Manufacturer may evaluate product over wider ranges of adjustment than those within the table.

Note 2: The table voltage could be either at the PCC or equipment terminals.

Note 3: For LV3 or HV2 the EUT shall cease to energize in not more than 0.16 s (and not trip). This may differ in other SRD(s).

For mandatory operation regions, the inverter shall be considered in compliance if it provides an average current greater than or equal to 80% of the pre-disturbance current or other percentage defined in the requirements documents during the ride-through event in each of the voltage ranges specified in the SRD(s), and returns to at least 80% of the pre-disturbance current level.
within the time specified in the local standards or regulations.

For momentary cessation regions, the inverter shall be considered in compliance if it provides an average active current less than or equal to 10% of the inverter rated current during the ride-through event in each of the voltage ranges specified in the SRD(s), and returns to the pre-disturbance current level or percentage as defined in the requirements document within the time specified in the local standards or regulations.

Sungrow's inverter meets the abovementioned requirements.

### 7.2 L/HFRT

The Electric Rule 21, 2015 defines the L/HFRT requirements according to the figure and table below.

![Figure SA10.1](image)

**Fig. 7-2 Low / High Frequency withstand requirements**

<table>
<thead>
<tr>
<th>Region</th>
<th>System Frequency Default Settings</th>
<th>Minimum Range of Adjustability (Hz)</th>
<th>Ride-Through Until (s)</th>
<th>Ride-Through Operational Mode</th>
<th>Trip Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Frequency 2</td>
<td>f &gt; 62</td>
<td>62.0 – 64.0</td>
<td>No Ride-Through</td>
<td>Not Applicable</td>
<td>0.16</td>
</tr>
<tr>
<td>(HF2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Frequency 1</td>
<td>60.5 &lt; f ≤ 62</td>
<td>60.1 – 62.0</td>
<td>299</td>
<td>Mandatory Operation</td>
<td>300</td>
</tr>
<tr>
<td>(HF1)</td>
<td></td>
<td></td>
<td></td>
<td>Continuous Operation</td>
<td></td>
</tr>
<tr>
<td>Near Nominal (NN)</td>
<td>58.5 ≤ f ≤ 60.5</td>
<td>Not Applicable</td>
<td>Indefinite</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Low Frequency 1</td>
<td>57.0 ≤ f ≤ 58.5</td>
<td>57.0 – 59.9</td>
<td>299</td>
<td>Mandatory Operation</td>
<td>300</td>
</tr>
<tr>
<td>(LF1)</td>
<td></td>
<td></td>
<td></td>
<td>Continuous Operation</td>
<td></td>
</tr>
<tr>
<td>Low Frequency 2</td>
<td>f ≤ 57.0</td>
<td>53.0 – 57.0</td>
<td>No Ride-Through</td>
<td>Not Applicable</td>
<td>0.16</td>
</tr>
<tr>
<td>(LF2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*While these operating parameters correspond to the Rule 21, 2015 parameters they may be substituted with operating parameters for other area EPS requirements.

Note 1: Manufacturer may evaluate product over wider ranges of adjustment than those within the table.

Note 2: Frequency / Watt functionality is an option under the Rule 21, 2015 filing.
For mandatory operation regions, the EUT shall be considered in compliance if it provides an average current greater than or equal to 80% of the pre-disturbance current (or other percentage as described in the requirements document) during the ride-through event in each of the frequency ranges specified in the SRD(s), and returns to at least 80% of the maximum allowable current level within the time specified in the SRD(s). For SRD(s) that require momentary cessation region(s), the EUT shall be considered in compliance if it provides an average current less than or equal to 10% of the EUT rated current during the ride-through event in each of the frequency ranges specified in the SRD(s), and returns to the pre-disturbance current level or percentage as defined in the requirements document within the time specified in the SRD(s).

Sungrow's inverter meets the abovementioned requirements.

### 7.3 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”;

Tap “Run-parameter” after entering the correct password;

**Step 3** Turn the page down to select the “Q-ac set mode”. 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-ac ratio: adjust the reactive power by setting reactive power percentage
- Q-U mode: adjust the reactive power by grid voltage

**Step 4** 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.

### 7.4 Protection Functions

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

- DC over-/under-voltage protection

When the battery DC voltage exceeds the allowable range, PCS will stop operation, send warning signal and display the fault type on the LCD touch screen.

- PCS can detect the anomaly and respond quickly.

- Grid over-/under-voltage protection

When the grid voltage exceeds the allowable range, PCS will stop operating, send warning signal
and display the fault type on the LCD touch screen.

PCS can detect the anomaly and respond quickly.

- Grid over-/under-frequency protection
  When the grid frequency exceeds the allowable range, PCS will stop operating, send warning signal and display the fault type on the LCD touch screen.

PCS can detect the anomaly and respond quickly.

- Islanding protection
  When the grid voltage is detected to be 0 or the grid frequency exceeds the allowable range, PCS will stop operating, send warning signal and display the fault type on the LCD touch screen.

PCS can detect the anomaly and respond quickly.

⚠️ DANGER

In anti-islanding protection state, high voltage is still present inside the PCS. Disconnect the main switch and discharge before testing or maintenance. Perform any actions after safety is confirmed.

- AC over-current protection
  When the battery power exceeds the PCS maximum DC input power, PCS will limit the current to the maximum allowable AC output power. When the AC current is 1.2 times higher than nominal current, PCS will stop operating. When the anomaly is removed, PCS can recover normal operation.

- GFDI protection
  PCS is equipped with the GFDI (Ground Fault Detection Interruption) function. The grounding cables are equipped with the leakage current sensor. When the leakage current detected exceeds 2A, PCS will stop operating. When the leakage current is lower than 1.5A, protection is removed and the faults can be displayed on the LCD touch screen.

- Module over-temperature protection
  PCS IGBT module is equipped with high-precision thermal sensor to monitor the real-time temperature of the module. Once over-temperature is detected, DSP will help to maintain the safe operation of the PCS by sending instruction to stop the PCS.

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

- Phase fault protection
  When PCS detects the grid 3-phase are connected incorrectly during self-detection in Initialization, Stop or Fault status, PCS will stop operation, send warning signal and display the fault type on the LCD touch screen. When the anomaly is removed, PCS begins self-detection and then starts normal operation.

- AC voltage unbalance
  When the three-phase AC voltage differences detected exceed the allowable range, PCS will stop operating, send warning signal and display the fault type on the LCD touch screen.

PCS can detect the anomaly and respond quickly.

- Transformer over-temperature
  The PCS transformer is equipped with high-precision thermal sensor to monitor the temperature
of the module on real time. Once over-temperature is detected, DSP will help to maintain the safe operation of the PCS by sending instruction to stop the PCS.

- Module fault
PCS IGBT module is equipped with self-protection function. When over-current is detected during module self-detection, module will send fault information to the DSP. And the DSP will send instruction to stop the PCS and send warning signal and display the fault type on the LCD touch screen.

- AC & DC main contactor fault
When the PCS is in Standby, Grid mode, or Off-grid mode status and the AC & DC main contactors are detected to be disconnected, PCS will stop operating, send warn signal and display the fault type on the LCD touch screen.

- AD Sampling fault
If PCS detects that the sampling channel zero-offset value exceeds the allowable range, PCS will send warning signal and display the fault type on the LCD touch screen.

- Reversed polarity connection fault
When the DC voltage is detected to be negative value, PCS will send warning signal and display the fault type on the LCD touch screen.
8 Routine Maintenance

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

All methods or operations to keep the PCS in good working condition are PCS maintenance.

8.1 Safety Instructions

8.1.1 Safety Rules

⚠️ WARNING

• Only qualified and authorized personnel can perform the work described in this chapter.
• Do not leave any screws, washers or other metallic parts inside the PCS during maintenance to avoid damages to the PCS!

⚠️ 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, please disconnect the breakers and the upstream and downstream switches of the PCS.

⚠️ WARNING

Wait at least 15 minutes after PCS stops before any work on the PCS.

8.1.2 Five Safety Rules

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

• Disconnect the PCS from all the external connections and internal power supplies.
• Ensure that the PCS will not be energized accidentally.
• Verify that the PCS interior is deenergized completely with a multimeter.
• Necessary ground and short circuit connection.
• Cover the adjacent charged components with insulation cloth during operation.

8.2 Maintenance and Interval

Recommended routine maintenance work and maintenance interval are shown in the following table:
<table>
<thead>
<tr>
<th>Item</th>
<th>Method</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Save software data</td>
<td>• Read out LCD touch screen data;</td>
<td>Once a month</td>
</tr>
<tr>
<td></td>
<td>• Save running data, parameters and logs to a disk or a file;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check each parameter setting;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Update software</td>
<td></td>
</tr>
<tr>
<td>System general running status and</td>
<td>• Check the PCS for visible damages or deformation;</td>
<td>Every six months</td>
</tr>
<tr>
<td>environment</td>
<td>• Check the PCS for any abnormal noise during running;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check each parameter of the PCS during normal operation;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the principal components;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the enclosure temperature is normal with the thermal imager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the air inlet and outlet;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the ambient humidity, dust and air inlet filter;</td>
<td></td>
</tr>
<tr>
<td>Notice</td>
<td>Check the air inlet and outlet. The equipment may be damaged by overheating.</td>
<td></td>
</tr>
<tr>
<td>System cleaning</td>
<td>• Check whether the circuit board and the component are clean;</td>
<td>From every six months to annually depending on dust deposits.</td>
</tr>
<tr>
<td></td>
<td>• Check the temperature and dust of the radiator. Use compressed air</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and open the fan to clean the module if necessary;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Replace the air filter.</td>
<td></td>
</tr>
<tr>
<td>Power circuit connection</td>
<td>• Check whether the power cable connections are loose. Retighten them</td>
<td>Six months after commissioning for the first time and then once every six month to a year</td>
</tr>
<tr>
<td></td>
<td>with the torque specified in the manual if necessary;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the power cables and control cables, especially the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>surface in contact with the metal are damaged;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the wrap belt of the connection terminals is strip-off.</td>
<td></td>
</tr>
<tr>
<td>Terminal and cable connection</td>
<td>• Check whether the screws of the control terminals are loose. Refasten</td>
<td>Once per year</td>
</tr>
<tr>
<td></td>
<td>them with screwdriver if necessary;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check whether the terminals of the main circuit are in poor contact</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and whether the screws are hot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check if the connection busbar or screws are discoloring.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Visual check the device terminal connection and cable layout.</td>
<td></td>
</tr>
<tr>
<td>Fan maintenance and replacement</td>
<td>• Check if there is crack in the fan blade;</td>
<td>Once per year</td>
</tr>
<tr>
<td></td>
<td>• Check if there is abnormal noise during the running of the fan;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Replace the fan if necessary</td>
<td></td>
</tr>
<tr>
<td>Breakers maintenance</td>
<td>• Routine check of the corrosion of the metal components</td>
<td>From every six months to annually</td>
</tr>
<tr>
<td></td>
<td>• Annually check the contactors (auxiliary switches and micro-switches)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to ensure the optimal operation;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the running parameters (Voltage and insulation especially)</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Method</td>
<td>Interval</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Safety function</td>
<td>• Check the emergency stop button and the LCD stop function;</td>
<td>From every six months to annually</td>
</tr>
<tr>
<td></td>
<td>• Simulation shutdown and check the shutdown signal communication signal;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the warning labels and other markings for damage or uncleanness. Replace them if necessary.</td>
<td></td>
</tr>
<tr>
<td>Software maintenance</td>
<td>• Optimize software</td>
<td>From every six months to annually</td>
</tr>
<tr>
<td></td>
<td>• Check each parameter setting</td>
<td></td>
</tr>
</tbody>
</table>

**WARNING**

Wait at least 15 minutes after the PCS discharge completely since the DC bus contains capacitance. Before cleaning, make sure, with multimeter, the PCS 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 reassemble the grid and fasten all the screws after the maintenance work.

Make sure all bolts are securely fixed.

The form only provides the routine maintenance periods of the recommended product. The frequency of maintenance operations could be increased according to the environmental conditions of the place where the PCS is suited, plant capacity and on-site situations.

If the operation environment is windy and dusty or with heavy dust, it is very necessary to shorten the maintenance period and increase the maintenance frequency.

### 8.3 Filter Checking and Cleaning

1. Read the safety instructions carefully.
2. Open the cabinet door.
3. Check the air filter. If it needs to be replaced, remove it with a screwdriver. Please notice the direction of the filter cotton.
4. Check the cabinet cleanliness. If necessary, clean the cabinet with soft rag or vacuum cleaner.
5. Close the cabinet door.
8.4 Replacing Electronic and Electrical Components

⚠️ WARNING
The electronic and electrical components inside the PCS 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 PCS or the component itself. If otherwise, please contact Sungrow.

⚠️ WARNING
If you need 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.
9 Troubleshooting

⚠️ WARNING

Lethal voltages are present inside the PCS 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.

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 the PCS
- Serial number of the PCS
- Manufacturer, model and configuration of the battery and other modules connected to the PCS
- PCS communication solution
- Fault and brief description of the fault phenomenon
- A picture of the fault if necessary

9.1 Fault Checking

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

- Open-circuit voltage of the storage battery
- State of the emergency stop button
- Grid is connected correctly
- Measurement board communication is normal

9.2 Fault and Troubleshooting of LED

<table>
<thead>
<tr>
<th>LED state</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No LED is on</td>
<td>Disconnect the AC/DC voltage for 5 minutes. Reconnect the AC/DC voltage.</td>
</tr>
<tr>
<td></td>
<td>If the LEDs keep off, repair or replace them.</td>
</tr>
<tr>
<td></td>
<td>Contact Sungrow if the malfunction cannot be removed following these instructions.</td>
</tr>
</tbody>
</table>
### 9.3 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.

<table>
<thead>
<tr>
<th>Fault</th>
<th>Possible reason</th>
<th>Measures</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vdc-high</td>
<td>DC voltage exceeds the maximum DC voltage</td>
<td>Check the configuration of the battery and reduce the battery open-circuit voltage</td>
<td>Contact the battery manufacturer</td>
</tr>
<tr>
<td>Vdc-low</td>
<td>DC voltage is lower than the minimum DC voltage</td>
<td>Check the configuration of the battery and increase the battery open-circuit voltage</td>
<td>Contact the battery manufacturer</td>
</tr>
<tr>
<td>Idc-high</td>
<td>PCS short-circuit or internal component damage</td>
<td>Check the PCS DC side cable connection and control circuit board for anomaly</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td>Vac-high</td>
<td>Grid voltage exceeds the maximum grid voltage</td>
<td>Check the grid (or if the grid-connection cables are too thin)</td>
<td>Recover operation when grid voltage is back to normal</td>
</tr>
<tr>
<td>Vac-low</td>
<td>Grid voltage is lower than the minimum grid voltage</td>
<td>Check the grid</td>
<td>Recover operation when grid voltage is back to normal</td>
</tr>
<tr>
<td>Fre-high</td>
<td>Grid frequency exceeds the maximum grid frequency</td>
<td>Check the grid; Reconnect to the grid manually when grid frequency is back to normal</td>
<td>Recover operation when grid frequency is back to normal</td>
</tr>
<tr>
<td>Fre-low</td>
<td>Grid frequency is lower than the maximum grid frequency</td>
<td>Check the grid; Reconnect to the grid manually when grid frequency is back to normal</td>
<td>Recover operation when grid frequency is back to normal</td>
</tr>
<tr>
<td>Iac-high</td>
<td>PCS short-circuit or internal component damage</td>
<td>Check the PCS AC side cable connection and control circuit board for anomaly</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td>Fault</td>
<td>Possible reason</td>
<td>Measures</td>
<td>note</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------------------------</td>
<td>-----------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Island</td>
<td>Islanding is detected</td>
<td>Check the grid</td>
<td>Reconnect to the grid when grid is back to normal.</td>
</tr>
<tr>
<td>Phase-flt</td>
<td>Grid voltage phase error</td>
<td>Check the grid</td>
<td>Recover operation when grid voltage is back to normal</td>
</tr>
<tr>
<td>PM-flt</td>
<td>Device internal fault</td>
<td>Device internal fault. First</td>
<td>Contact Sungrow if this fault occurs 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>disconnect the AC and DC</td>
<td>times per day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>current, then disconnect the</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>control circuit, and reconnect.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact Sungrow if this fault</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>still occurs</td>
<td></td>
</tr>
<tr>
<td>PM tem high</td>
<td>Module temperature exceeds the</td>
<td>Check the module when the</td>
<td>Contact Sungrow if this fault occurs 10</td>
</tr>
<tr>
<td></td>
<td>allowable range</td>
<td>device is discharged completely</td>
<td>times per day</td>
</tr>
<tr>
<td>Temp-high</td>
<td>PCS temperature exceeds the allowable</td>
<td>Check the cooling fan when the</td>
<td>Contact Sungrow if this fault occurs 10</td>
</tr>
<tr>
<td></td>
<td>range</td>
<td>device is discharged completely</td>
<td>times per day</td>
</tr>
<tr>
<td>AD sample-flt</td>
<td>Circuit board sampling channel</td>
<td>Check if the PCS sampling circuit</td>
<td>Recover operation when sampling channel is back to normal</td>
</tr>
<tr>
<td></td>
<td>damaged</td>
<td>board is abnormal</td>
<td></td>
</tr>
<tr>
<td>DSP-com-flt</td>
<td>Communication fault between the DSP</td>
<td>Check if the DSP board is loose</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td></td>
<td>and PC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery-flt</td>
<td>DC side abnormal</td>
<td>Check if the storage battery is</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td></td>
<td></td>
<td>correctly connected</td>
<td></td>
</tr>
<tr>
<td>BMS-com-flt</td>
<td>Communication fault between the PCS</td>
<td>Check if the PCS is correctly</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td></td>
<td>and BMS</td>
<td>connected to the BMS</td>
<td></td>
</tr>
<tr>
<td>AC main</td>
<td>Contactor connected to grid fault</td>
<td>Check the contactor when the</td>
<td>Contact Sungrow if this fault occurs 5</td>
</tr>
<tr>
<td>Contactor-flt</td>
<td></td>
<td>device is discharged completely</td>
<td>times per day</td>
</tr>
<tr>
<td>DC main</td>
<td>Contactor connected to the battery</td>
<td>Check the contactor when the</td>
<td>Contact Sungrow if this fault occurs 5</td>
</tr>
<tr>
<td>Contactor-flt</td>
<td>fault</td>
<td>device is discharged completely</td>
<td>times per day</td>
</tr>
<tr>
<td>Vac unbalanced</td>
<td>Voltage differences of the three phase</td>
<td>Check the grid</td>
<td>Recover operation when grid voltage is back to normal</td>
</tr>
<tr>
<td></td>
<td>exceed the allowable range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reversed</td>
<td>DC voltage positive and negative</td>
<td>Check the positive and negative</td>
<td>Recover operation when DC voltage is back to normal</td>
</tr>
<tr>
<td>polarity-flt</td>
<td>polarity connected reversely</td>
<td>polarity of the storage battery</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trans temp-high</td>
<td>Transformer temperature exceeds the</td>
<td>Check the transformer when the</td>
<td>Contact Sungrow if this fault occurs 10</td>
</tr>
<tr>
<td></td>
<td>allowable range</td>
<td>device is discharged completely</td>
<td>times per day</td>
</tr>
<tr>
<td>Iac leak-pro</td>
<td>PCS AC leakage current exceeds the</td>
<td></td>
<td>Recover operation when leakage current is back to normal</td>
</tr>
<tr>
<td></td>
<td>allowable range</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.4 Other Faults

**Hear-Sink is Over-Temperature**
Possible reason: cooling fan failure; over-temperature of the air inlet and outlet; 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 PCS Operation**
Possible reason: abnormal operation of the PCS and transformer; fan failure.
Solution: check if the power is within the allowable 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 Touch Screen Cannot Start or Stop PCS**
Possible reason: communication malfunction between the LCD touch screen and the DSP; LCD power supply malfunction.
Solution: check the connection between the LCD touch screen and the DSP.

**Communication Failure with PC**
For serial port communication:
1. Check to ensure the circuits are properly connected and A/B is connected correctly.
2. Check if the communication adapter is matched. Communicate again after replacing the adapter.
3. Check if the local address is the same with the PC.

For Internet communication
4. Check if the IP address, subnet mask and gateway are set correctly.
5. Check if the communication cables are through line and connected properly.
6. If all above-mentioned items are correct and this fault still occurs, replace the LCD measurement board.

**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.
## 10 Appendix

### 10.1 Technical Data

#### 10.1.1 Electrical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC side parameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal DC power</td>
<td>250kW</td>
<td></td>
</tr>
<tr>
<td>Max. DC voltage</td>
<td>870V</td>
<td></td>
</tr>
<tr>
<td>Working voltage range</td>
<td>500V - 850V</td>
<td>-</td>
</tr>
<tr>
<td>Min. DC voltage</td>
<td>480V</td>
<td></td>
</tr>
<tr>
<td>AC side parameter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working mode</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Nominal Output Power</td>
<td>250kVA</td>
<td></td>
</tr>
<tr>
<td>Output overload capacity</td>
<td>275 kVA</td>
<td></td>
</tr>
<tr>
<td>Max. AC current</td>
<td>300A</td>
<td></td>
</tr>
<tr>
<td>Max. THD</td>
<td>&lt;3% at nominal power</td>
<td></td>
</tr>
<tr>
<td>Nominal grid voltage</td>
<td>480V</td>
<td></td>
</tr>
<tr>
<td>Grid voltage range</td>
<td>480V±10%</td>
<td></td>
</tr>
<tr>
<td>Nominal grid frequency</td>
<td>60Hz</td>
<td></td>
</tr>
<tr>
<td>Grid frequency range</td>
<td>55 - 65Hz</td>
<td></td>
</tr>
<tr>
<td>Power factor at nominal power</td>
<td>&gt;0.99</td>
<td></td>
</tr>
<tr>
<td>Isolation transformer</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>DC current injection</td>
<td>&lt;0.5% at nominal output current</td>
<td></td>
</tr>
<tr>
<td>Grid-connected power factor range</td>
<td>1(leading)- 1 (lagging)</td>
<td></td>
</tr>
<tr>
<td>Independent inverter voltage range</td>
<td>480V±10%</td>
<td></td>
</tr>
<tr>
<td>Independent inverter output voltage THD</td>
<td>&lt;3%(linear load)</td>
<td></td>
</tr>
<tr>
<td>Independent inverter unbalance load capacity</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Independent inverter voltage transition range</td>
<td>Within 10% (resistance load 0% - 100%)</td>
<td></td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Overvoltage/Fast</td>
<td>576-624 V</td>
<td>Default setting: 576</td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Overvoltage/Slow</td>
<td>528-576 V</td>
<td>Default setting: 552</td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Undervoltage/Slow</td>
<td>240-430 V</td>
<td>Default setting: 422</td>
</tr>
<tr>
<td>Utility interconnection voltage trip limits - Undervoltage/Fast</td>
<td>192-240 V</td>
<td>Default setting: 240</td>
</tr>
<tr>
<td>Utility interconnection voltage trip times - Fast</td>
<td>0.12-10.0 s</td>
<td>Default setting: 0.2</td>
</tr>
<tr>
<td>Utility interconnection voltage trip times - Slow</td>
<td>0.12-10.0 s</td>
<td>Default setting: 2.0</td>
</tr>
<tr>
<td>Utility interconnection frequency trip limits - Overfrequency</td>
<td>60.2-65.0 Hz</td>
<td>Default setting: 61.0</td>
</tr>
<tr>
<td>Parameter</td>
<td>Specification</td>
<td>Note</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>---------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Utility interconnection frequency trip limits</td>
<td>55.0-59.8 Hz</td>
<td>Default setting: 58.0 Hz</td>
</tr>
<tr>
<td>Underfrequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utility interconnection frequency trip time</td>
<td>0.12-600 s</td>
<td>Default setting: 0.2 s</td>
</tr>
<tr>
<td>Accuracy of voltage measurement</td>
<td>±1%</td>
<td></td>
</tr>
<tr>
<td>Accuracy of frequency measurement</td>
<td>±0.1 Hz</td>
<td></td>
</tr>
<tr>
<td>Accuracy of time measurement</td>
<td>±0.5%+20mS</td>
<td></td>
</tr>
<tr>
<td>Maximum Input short circuit current</td>
<td>6000A</td>
<td></td>
</tr>
<tr>
<td>Maximum branch-circuit overcurrent protection</td>
<td>400A</td>
<td></td>
</tr>
<tr>
<td>Maximum output fault current (ac and duration)</td>
<td>2.27kA rms (3.08kA peak) / 10.15ms</td>
<td></td>
</tr>
<tr>
<td>Synchronization in-rush current</td>
<td>48A max</td>
<td></td>
</tr>
<tr>
<td>Limits of accuracy of Voltage measurement</td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Limits of accuracy of frequency measurement</td>
<td>0.1 Hz</td>
<td></td>
</tr>
</tbody>
</table>

### 10.1.2 Mechanical Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions(W×H×D)</td>
<td>1006mm×39.6inch × 203480inchmm x 850mm(33.5inch)</td>
</tr>
<tr>
<td>Weight</td>
<td>1600kg (3520lbs)</td>
</tr>
</tbody>
</table>

### 10.1.3 System Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. efficiency</td>
<td>97.3%</td>
</tr>
<tr>
<td>Protection Degree</td>
<td>IP21 (indoor), Type1</td>
</tr>
<tr>
<td>Power Consumption at shutdown</td>
<td>&lt;80W</td>
</tr>
<tr>
<td>Noise level</td>
<td>&lt;70dB</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-30°C<del>45°C (-22°F</del>113°F)</td>
</tr>
<tr>
<td>Cooling Concept</td>
<td>temperature-controlled forced air cooling</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0~95% (Non-condensing)</td>
</tr>
<tr>
<td>Max. Working Altitude</td>
<td>6000m (operation with derating above 4000m)</td>
</tr>
</tbody>
</table>

### 10.1.4 Display and Communication

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display</td>
<td>Touch screen</td>
</tr>
<tr>
<td>Standard communication</td>
<td>RS485, Ethernet</td>
</tr>
<tr>
<td>Communication with BMS</td>
<td>CAN, RS485</td>
</tr>
<tr>
<td>Communication protocol</td>
<td>Modbus/ IEC104</td>
</tr>
</tbody>
</table>

### 10.1.5 Other Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC side disconnection device</td>
<td>Contactor</td>
</tr>
<tr>
<td>AC side disconnection device</td>
<td>Circuit breaker</td>
</tr>
<tr>
<td>DC over-voltage protection</td>
<td>Yes</td>
</tr>
<tr>
<td>AC over-voltage protection</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### 10.2 Exclusion of Liability

The content of these documents is periodically checked and revised where necessary. Please call us or check our website [www.sungrow.com](http://www.sungrow.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 assume 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.

### 10.3 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!

**Headquarters**

<table>
<thead>
<tr>
<th>Company</th>
<th>Sungrow Power Supply Co., Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website</td>
<td><a href="http://www.sungrowpower.com">www.sungrowpower.com</a></td>
</tr>
<tr>
<td>Email</td>
<td><a href="mailto:info@sungrow.cn">info@sungrow.cn</a>, <a href="mailto:service@sungrow.cn">service@sungrow.cn</a></td>
</tr>
<tr>
<td>Address</td>
<td>No.1699 Xiyou Rd., New &amp; High Technology Industrial Development Zone, Hefei, P. R. China</td>
</tr>
<tr>
<td>Zip</td>
<td>230088</td>
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<tr>
<td>Telephone</td>
<td>+86 551 6532 7834, +86 551 6532 7845</td>
</tr>
</tbody>
</table>
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  - Sales: sales@sungrow.ca
  - After-Sales: service@sungrow.ca

- **Sungrow USA Corporation**
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  - Sales: sales@sungrow.ca
  - After-Sales: service@sungrow.ca