SC1000KU
Power Conversion System (PCS)
Operation Manual

SC1000KU-V12-OEN-Ver14-201805 Ver.: 1.4
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1 About This Manual

1.1 Forward
Thank you for purchasing the SC1000KU device 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 Installation Manual is valid for the following device types:
- SC1000KU
  The SC1000KU 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 operation 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:
- Installation Manual (in the scope of delivery)
• Connection Requirements for Medium-voltage Transformers

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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.

ℹ️ **NOTE**

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

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 installing the equipment.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Explanations</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Risk of electric shock!" /></td>
<td>Risk of electric shock!</td>
</tr>
<tr>
<td><img src="image" alt="Hot surface!" /></td>
<td>Hot surface!</td>
</tr>
<tr>
<td><img src="image" alt="Connection point for earth conductor" /></td>
<td>Connection point for earth conductor</td>
</tr>
<tr>
<td><img src="image" alt="Protective conductor terminal" /></td>
<td>Protective conductor terminal</td>
</tr>
</tbody>
</table>
2 Safety Instructions

2.1 Intended Usage

The PCS developed and manufactured by Sungrow are designed without transformers. It provides an interface between the grid and batteries to realize the charging and discharging of the battery ESS. The PCS is connected to the grid after the voltage at the AC side is increased through the external step-up transformer. The PCS is NEMA I protected and is applicable for indoor use only.

Connect the PCS to the grid after AC output voltage is converted into grid-compatible voltage through the external transformer. For technical requirements for the transformer please refer to the Connection Requirements for Medium-voltage Transformer or contact our technical support engineers.

The charging and discharging system with the PCS is as shown below.

![Energy storage system diagram]

**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>SCT000KU PCS</td>
</tr>
<tr>
<td>C</td>
<td>Transformer</td>
</tr>
<tr>
<td>D</td>
<td>Utility grid</td>
</tr>
<tr>
<td>E</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 installing or commissioning of the PCS. Read the safety instructions in this section before installing. Please also respect all warnings, instructions, and cautions in respective chapters before installation and commissioning.

⚠️ DANGER
Shock Hazard!
Death resulting from burns and electric shock upon touching the PCS live components.
• Do not touch the live components of the PCS or the utility grid.
• Observe all safety regulations.

⚠️ DANGER
Shock hazard inside the product!
• Note and respect the warning labels in the product.
• Respect all safety instructions in this manual and other related documents.

⚠️ DANGER
Electric shock or fire due to device damage or system fault!
• Visual check if there is device damage or other potential dangers before operation.
• Check if other external devices or circuit connections are safe.
• Operate the device only when it is safe to do so.

2.3 During Operation
2.3.1 Manuals
Very important information about transportation and installation of the PCS are 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 transportation or installation work on the PCS. Device damage, personal injury and property loss may follow if otherwise.
• This manual and relevant documents should be available for relevant persons at all times.

2.3.2 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 PCS

- The 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 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 Storage Battery Protection

High Voltages exist between the positive and negative polarities of the storage batteries for large-scale plant. Electrical shock or life risk may occur by accidental touch.

**DANGER**

High voltages exist between the positive and negative polarities 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 LCD Screen Parameter Setting

Certain LCD 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 15 minutes after the PCS stops 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 maintain and 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 PCS with standard configuration. 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

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.

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).

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

![Fig. 3-1 Smart grid and energy storage system](image)

3.2 PCS Features

SC1000KU 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;
- Bi-directional inversion to charge and discharge the battery;
- Constant current charge, constant voltage charge, constant power charge (AC), constant power charge (DC);
- Constant current discharge, constant voltage discharge, constant power discharge (AC), constant power discharge (DC);
- Support various battery interfaces, e.g. li-battery, lead-acid battery, flow battery and super-capacitor;
- Complete communication and protection function;
• LVRT, reactive power compensation and active power adjustment functions;
• Continuous full power operation at -30°C ... +50°C
• Long time reliable and continuous operation at high altitude harsh environment condition
• Heating and dehumidification function (optional)

3.3 Product Appearance
The external appearance and components are shown in the figure below.

![Fig. 3-2 Appearance of the PCS](image)

<table>
<thead>
<tr>
<th>Item</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>LED indicators</td>
<td>POWER, OPERATION and FAULT</td>
</tr>
<tr>
<td>B</td>
<td>LCD touch screen</td>
<td>Displays data and executes control commands</td>
</tr>
<tr>
<td>C</td>
<td>Emergency stop button</td>
<td>Press in emergency situation to disconnect the AC side power supply of the PCS</td>
</tr>
<tr>
<td>D</td>
<td>Start/Stop Switch</td>
<td>Start/Stop the PCS</td>
</tr>
<tr>
<td>E</td>
<td>Grid Main Switch</td>
<td>Grid side disconnection switch</td>
</tr>
</tbody>
</table>

**LED indicators**

There are three LEDs at the upper left side of the LCD: 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 DC side has power for 5min, LED is on immediately when the AC side has power or both the AC and DC side have power</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.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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="on" alt="Power" /></td>
<td>“POWER” LED is on. PCS normal power supply, no charging or discharging.</td>
</tr>
<tr>
<td><img src="on" alt="Operation" /></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="on" alt="Fault" /></td>
<td>“POWER” is on. “FAULT” is on. A fault occurs and not removed yet.</td>
</tr>
<tr>
<td><img src="off" alt="Power" /></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 DC and AC side 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 disconnect from the AC and DC side immediately and the emergency button is locked.

You can restart the PCS by rotating the button clockwise to unlock it. Connect the grid and then the PCS will be restarted through the LCD touch screen.
Start/Stop Switch
This switch is used to control the start and stop of the PCS. When the switch is turned to START, you can give your instructions through the LCD; otherwise, the PCS will be in the emergency stop state.

When the switch is turned to STOP, a stop command is sent to the DSP controller to switch the PCS to the stop state.

Grid Main Switch
Grid main switch is an important disconnection device inside the PCS AC cabinet, controlling the AC main circuit. PCS output can be disconnected from the grid through this switch.

PCS will start when the grid main switch is in the ON position.

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

⚠️ WARNING
• Improper use of these switches may damage the PCS.
• Avoid frequent use of the switches.

3.4 Communication Solution

3.4.1 RS485 Communication
PCS communicates with the PC through RS485/RS232 converter. SolarInfo SC can be adopted to monitor the communication.

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 protocol. 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 directly by a network cable. SolarInfo SC can be used to monitor the communication.
Multiple PCSs communication

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

For more information of the SolarInfo SC, please contact Sungrow or download the latest document at www.sungrowpower.com.

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 requirement 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 emergency stop button is released and the Start/Stop switch is in Start position.
- Grid main switch is in OFF position.
- Measure the DC and AC voltage with multimeter to check if they fulfill the PCS startup conditions and there is no overvoltage hazard.
- The cabinet door is closed and the key is removed and stored by appointed personnel.

⚠️ WARNING

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

4.1.2 Steps to Start the PCS

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

1. The storage battery side and grid side are connected correctly
2. Turn the PCS grid main switch to the ON position
3. PCS starts according to the dispatch instructions

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

- PCS needs no manual control in daily operation.
- Keep the door closed and locked and store the keys of the door by appointed personnel during normal operation.

4.2 Stopping the PCS

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

4.2.1 Normal Stop

Proceed as follows to stop the PCS during normal maintenance and service work:
1. Stop the PCS through the stop instruction on the LCD touch screen
2. Turn the PCS grid main switch to the “OFF” position
3. Disconnect the PCS downstream switches
4. Disconnect the PCS upstream switches
5. Disconnect the external power supply if the PCS is in external power supply mode
6. PCS stops

**WARNING**

During normal operation, disconnection of the switches is strictly forbidden. Otherwise, arc may follow and the switch 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 or turn the Start/Stop button to the Stop position
2. Turn the PCS grid main switch to the OFF position
3. Disconnect the PCS downstream switches
4. Disconnect the PCS upstream switches
5. Disconnect the external power supply if the PCS is in external power supply mode
6. PCS stops

**WARNING**

- Use the emergency stop button only when emergency or a fault occurs. Under normal conditions, stop the PCS by performing the stop instruction in the LCD screen.
- Push the emergency stop button directly in times of crisis to ensure timely response.
5 Operation Mode

5.1 Basic Functions

PCS basic functions are shown below:

- Storage battery charge/discharge control

PCS can charge and discharge the storage battery. Operator can select the charge/discharge power. The upper computer or the touch screen modifies the modes of charge/discharge instructions.

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

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

- Reactive power control

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

- Stable output voltage and frequency

PCS can stabilize the output voltage and frequency by controlling the reactive power and active power in the grid-connected system. A large-scale ESS plant is required to establish to realize this function.
5.2 Operating Status

5.2.1 Status Introduction

PCS has the following status: initialization, stop, run, emergency stop and fault.

**Initialization**
System continues self-checking in this status and then enters 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 **Run** status if conditions are fulfilled.
PCS enters **Stop** status once receiving Stop instruction.

**Run**
Run status includes charge and discharge.
In grid mode, PCS can adjust the electricity quality and control the reactive power.

**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.

**Emergency Stop**
Emergency stop is the stop of the PCS by pressing down the emergency stop button or turn the Start/Stop switch to the STOP position when a fault or emergency occurs.
Proceed as follows to restart the PCS if the PCS is stopped by turning the Start/Stop button to the STOP position.
1. Turn the Start/Stop switch to the START position.
2. If conditions are met, device will operate normally after receiving dispatch instruction.
If the PCS is stopped by pressing the emergency stop button, the AC and DC side contactors are disconnected, AC switch is tripped off, and the PCS is disconnected from the grid and storage battery. To restart the PCS, release the emergency stop button.

**Stop**
In normal **Run** status, if a daily maintenance or checking is required, you can send a stop commended by the upper computer to stop the PCS.

5.3 Status Switch

In the **initialization** status, the PCS control system will finish self-detection to verify the completeness of the control and sensor system. When the touch screen and the DSP start normally, PCS enters the **Stop** status, during which PCS locks the IGBT pulse and disconnects the
AC & DC contactors. During the **Standby** status, PCS locks the IGBT pulse and disconnects the AC/DC contactor.

To switch among different statuses, conditions in Fig. 5-1 should be fulfilled.

![Fig. 5-1 Operating status switch](image)

### 5.4 Operation Mode

#### 5.4.1 Introduction

The PCS can charge and discharge in grid-connected mode.

- Charge: constant current charge (DC), constant voltage charge (DC), constant power charge (DC), constant power charge (AC)
- Discharge: constant current discharge (DC), constant voltage discharge (DC), constant power discharge (DC), constant power discharge (AC).

#### 5.4.2 Mode Switch

The charge and discharge modes can be switched directly in the grid mode without through the Stop status.
6 LCD Touch Screen Operation

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. Three LED indicators indicate the present working state of the PCS and the screen. You may check and set related parameters by touching the LCD internal icons.

![LCD Touch Screen Diagram]

**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 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.

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COM</td>
<td>Red</td>
<td>Communication indicator to indicate the communication state of the touch screen and the internal measurement board. COM LED flashes once when the touch screen receives or sends an instruction; communication error when it is off.</td>
</tr>
<tr>
<td>CPU</td>
<td>Yellow-green</td>
<td>Operation indicator to indicate the operation state of the touch screen internal core. It is on when the operation is normal.</td>
</tr>
</tbody>
</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

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Power Yields data. The first line from the top is the present charge and discharge power; work state is the transient state of the PCS.</td>
</tr>
<tr>
<td>B</td>
<td>Today's charge and discharge power curve to indicate the power percentage (power value divides the PCS nominal power value).</td>
</tr>
<tr>
<td>C</td>
<td>DC side voltage and current</td>
</tr>
<tr>
<td>D</td>
<td>AC side line voltage and phase current</td>
</tr>
<tr>
<td>E</td>
<td>Present date and time</td>
</tr>
<tr>
<td>F</td>
<td>Strength of the PCS internal communication</td>
</tr>
<tr>
<td>G</td>
<td>Strength of communication between the PCS and PC or background monitor device</td>
</tr>
</tbody>
</table>

Initialization
Appearance every time the PCS is energized. After initialization, the default screen follows.

Click the work state on the main screen and 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 start from the default screen.

**WARNING**

LCD screen contains lots of parameters pertinent to the PCS 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 LCD screen,
• For 3m, screen will go back to the default screen;
• For 4m, screen will go out
Activate the backlight by tapping the screen the screen will return to the default screen.

6.3 Overview of LCD Menu and Icon
User can operate on the LCD touch screen. There are three main buttons on the lower left side of
the screen: “Run”, “Stop”, “Function”.
The logical structures of these menus and icons are shown below:

<table>
<thead>
<tr>
<th>Main menu</th>
<th>1st sub-menu</th>
<th>2nd sub-menu</th>
<th>3rd sub-menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Run</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stop</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Run information
- Real time data
- Power curve
- E-column

History information
- History events
- History faults

Mode
- CC-mode (DC)
- CV-mode (DC)
- CP-mode (DC)
- CP-mode (AC)

Function
- Language & Firmware version
- Time
- E-adjust
- Load default

Set parameters
- Run-parameters
- Pro-parameters
- Com-parameters

Grid-connected mode includes CC-mode (DC), CV-mode (DC), CP-mode (DC) and CP-mode (AC). The following section will take the CC-mode (DC) for example.

6.4 Mode Setting
1. Tap “Function” from the default screen and the following interface will appear.

2. Tap “mode” and the following interface appears.

3. Tap “CC mode (DC)” and the following constant current mode interface will appear.

4. Input the I-CC(A) and then tap Run to start the grid-connected constant current mode.

6.5 Running Information Checking

Running information contains the 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 frequency, internal temperature, battery state, apparent power, reactive power, active power, power factor, positive insulation resistance to the ground, negative insulation resistance to the ground, work state and temperature of each modules, etc.

- **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 today. 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. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Run information” and the default run information interface of “Real time data” appears.

3. “Real time data” displays all PCS running information and work state. Tap “Next” to check other running information.

4. Tap “Power curve” and the left interface appears.

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

6. Tap “E-column” and the left interface appears.

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

6.6 History Information Checking

1. Tap “Function” from the default screen and the following interface will appear.
2. Tap “History information” and the following interface appears.

3. History information contains the history events and history faults.

4. Tap "History events" to view the latest 100 running records (including fault records) of the device.

5. Tap "History faults" to view the latest 100 faults records of the device, including the time the fault occurred and the fault type.
Up to 100 latest history faults can be viewed with the fault types and time the fault occurred. Fault types include: DC over-voltage/under-voltage, DC over-current, AC over-voltage/under-voltage, AC over-frequency/under-frequency, AC over-current, 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, BMS communication fault, fan fault, reverse polarity connection and etc.

6.7 Parameter Setting

6.7.1 Entering Password

1. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Set parameter” and the following interface appears.

3. Tap the blank area after the "please input password".

4. 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
5. Error password interface. Tap “Enter” to input the password again.

### 6.7.2 Language Setting

1. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Set-Parameter” and enter the password.

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

4. Tap “Language&Firmware Version”.

5. Check the languages system supported in this interface.

   The LCD measurement board version, the DSP software version and the touch screen software version is shown under the flag.
6.7.3 Date and Time Setting

1. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Set-Parameter” and enter the password.

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

4. Tap “Time”.

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

6.7.4 Energy Adjustment

1. Tap “Function” from the default screen and the following interface will appear.
2. Tap “Set-Parameter” and enter the password.

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

4. Tap “E-adjust.”

5. Set the charge and discharge energy adjustment value.

6.7.5 Load Default

1. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Set-Parameter” and enter the password.
3. Tap “Sys-parameters” and the following interface appears.

4. Tap “Load default”.

5. Input the password 1111 and Load Default will be performed.

6. 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.

**6.7.6 Running Information Setting**

1. Tap “Function” from the default screen and the following interface will appear.
2. Tap “Set-Parameter” and enter the password.

3. Tap “Run-parameters” and the following interface appears.

4. Set the grid-connected running parameters. Tap “Next” to set other grid-connected running parameters.

5. Set the running parameters.

### 6.7.7 Protection Parameter Setting

1. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Set-Parameter” and enter the password.
3. Tap “Pro-parameters” and the following interface appears.

4. Set the protection parameters. Tap “Next” to set other protection parameters. Parameter setting range can be got from the touch screen.

---

6.7.8 Communication Parameter Setting

Communication parameter setting includes the device address (Modbus address) setting, RS485 Baud rate with the PC, and communication method with BMS. Device and BMS communication method can be RS485 serial port communication and Network communication.

- RS485 serial port communication
  Modbus address range: 1 – 247; address of each device is unique. Default Baud rate of serial port communication: 9600bps.

- Network 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. Tap “Function” from the default screen and the following interface will appear.

2. Tap “Set-Parameter” and enter the password.
3. Tap “Com-parameters” and the following interface appears.

4. Set the corresponding communication parameters. Tap "Next" to set the Modbus parameters, IEC-104 parameters, and BMS parameters.

Note: the upper computer can select the serial port or network communication method; if the serial port communication method is selected, please make sure the BMS is no communication or CAN communication.
7 PCS Functions

7.1 SA function of SC1000KU

SC1000KU conforms to the SA functions including SA8 Anti-islanding Protection, SA9 L/HVRT Low and High Voltage Ride-Through, SA10 L/HVRT Low and High Frequency Ride-Through, SA11-RR - Normal Ramp Rate Ramp Rate, SA12 SPF - Specified Power Factor, SA13 Volt/Var Mode (Q(V)) and these functions have been evaluated.

Verified Precision and other parameters of SA function are shown in the following table:

<table>
<thead>
<tr>
<th>SA11-RR - Normal Ramp Rate Ramp Rate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Current Rating (A)</td>
<td>Irate</td>
</tr>
<tr>
<td>Minimum normal ramp-up rate (%/rated/sec)</td>
<td>RNorm_up_min</td>
</tr>
<tr>
<td>Maximum normal ramp-up rate (%/rated/sec)</td>
<td>RNorm_up_max</td>
</tr>
<tr>
<td>Minimum output current</td>
<td>I_low (A)</td>
</tr>
<tr>
<td>Ramp Rate Accuracy</td>
<td>MSARR (%/rated/sec)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SA12 SPF - Specified Power Factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Apparent Power Rating (VA)</td>
<td>Srated</td>
</tr>
<tr>
<td>Output Power Rating (W)</td>
<td>Prated</td>
</tr>
<tr>
<td>DC Input voltage range with function enabled (V)</td>
<td>810 – 1200V</td>
</tr>
<tr>
<td>AC voltage range with function enabled (V)</td>
<td>475– 594V</td>
</tr>
<tr>
<td>AC voltage measurement accuracy</td>
<td>MSAVac</td>
</tr>
<tr>
<td>DC voltage measurement accuracy</td>
<td>MSAVdc</td>
</tr>
<tr>
<td>Active power range of function</td>
<td>[Plow, Prated]</td>
</tr>
<tr>
<td>Power Factor Accuracy</td>
<td>MSAPF</td>
</tr>
<tr>
<td>Power Factor Settling Time (s)</td>
<td>5</td>
</tr>
<tr>
<td>Minimum Inductive (Underexcited) Power Factor</td>
<td>PFmin,ind</td>
</tr>
<tr>
<td>Minimum Capacitive (Overexcited) Power Factor</td>
<td>PFmin,cap</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SA13 Volt/Var Mode (Q(V))</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactive Power Accuracy (% or KVar)</td>
<td>2.5%</td>
</tr>
<tr>
<td>Maximum Rated Reactive Power Production (Capacitive, Overexcited) – Qmax,over cap (VAR)</td>
<td>300KVA</td>
</tr>
<tr>
<td>Maximum Rated Reactive Power Absorption (Inductive, Underexcited) – Qmax,under ind (VAR)</td>
<td>300KVA</td>
</tr>
<tr>
<td>Deadband Range (V)</td>
<td>0.967Vnom– 1.033Vnom</td>
</tr>
<tr>
<td>Settling Time (s)</td>
<td>5</td>
</tr>
</tbody>
</table>

The default settings of these SA function are as follows:
- Anti-islanding – activated
- Low/High Voltage Ride Through – activated
- Low/High Frequency Ride Through – activated
- Dynamic Volt/Var Operations – activated
- Ramp rates – activated
- Fixed power factor – deactivated
- Reconnect by “soft-start” method – activated
- The normal ramp rate and soft-start Ramp rate of SC1000KU are in accordance with 1741SA. The default value of normal ramp rate is 100% and the default value of connect/reconnect ramp rate is 2%. The grid support utility interactive inverter SC1000KU has passed the unintentional islanding tests with the grid support functions enabled and disabled in accordance with 1741SA.

**NOTICE**

*Enabling the SA function may result in the failure of the original IEEE 1547 grid-connected protection function.*

### 7.2 LVRT

It is prescribed that the large and medium sized plant should be equipped with LVRT function.

LVRT requires: 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. Besides, the followings should also be met:

**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 dynamic reactive current to the grid when a short-circuit fault occurs and the voltage drops.

**Zero voltage ride through**

When the grid-connection point voltage drops to zero, power station can operate normally for 0.15 second.
The PCS meets the abovementioned requirements.

### 7.3 Protection Functions

PCS has complete 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 switches and discharge before testing or maintenance. |

- AC over-current protection
  When the AC current is abnormal, exceeds the setting value, PCS will stop operating. When the anomaly is removed, PCS can recover normal operation.
• AC current leakage protection

PCS is equipped with the Ground Fault Detection Interruption (GFDI) function. The grounding cables are equipped with the leakage current sensor. When the leakage current detected exceeds the setting value, system will send instruction to stop the PCS and display the fault type on the LCD display.

<table>
<thead>
<tr>
<th>PCS</th>
<th>SC1000KU</th>
</tr>
</thead>
<tbody>
<tr>
<td>GFDI setting value</td>
<td>5A</td>
</tr>
</tbody>
</table>

• 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 anomaly

When PCS detects the grid 3-phase are connected incorrectly during self-detection in initialization or stop or fault status, PCS will send warning signal and display the fault type on the LCD touch screen.

• 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.

• Reactor over-temperature

PCS reactor is equipped with high-precision thermal sensor to monitor the reactor 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.

• 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.

• Fan fault

PCS fans have self-detection function. When the grid voltage is above 250V and a fault is detected during fan self-detection, the fan 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 Stop or Fault status and the AC & DC main contactors are connected, or when the PCS is in grid mode 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. When the anomaly is removed, PCS begins self-detection and then starts normal operation.

• AD Sampling channel 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. When the anomaly is removed, PCS begins self-detection and then starts normal operation.
• 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 personnel can perform the work described in this chapter.
- Do not leave any screws, washers or other metallic parts inside the PCS 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,
  - Disconnect the switches;
  - Disconnect the upstream and downstream switch 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 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.

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 data software</td>
<td>• Read 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</td>
<td>• Check the PCS for visible damages or deformation;</td>
<td>Every six months</td>
</tr>
<tr>
<td>status and 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>Notice: Check the air inlet and outlet. The equipment may be damaged by overheating.</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 the dust deposits.</td>
</tr>
<tr>
<td></td>
<td>• Check the temperature and dust of the heat-sink. Use pressurized air 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 with the torque specified in the manual if necessary;</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>• Check if the power cables and control cables, especially the 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</td>
<td>• Check whether the screws of the control terminals are loose. Refasten them with screwdriver if necessary;</td>
<td>Once per year</td>
</tr>
<tr>
<td>connection</td>
<td>• Check whether the terminals of the main circuit are in poor contact 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</td>
<td>• Check if there is crack in the fan blade;</td>
<td>Once per year</td>
</tr>
<tr>
<td>replacement</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>Item</td>
<td>Method</td>
<td>Interval</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>Switches 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) 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>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**

Enter the electrical control room to check periodically if the fan of the module and fans on top of each cabinet are normal and if there is abnormal noise during fans operation. If yes, there may be dust penetrating inside the fans. Clean the fans after PCS stop operation.

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.

ℹ️ 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.

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 Electrical Components

⚠️ WARNING

The 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
- If the grid is connected correctly
- If the 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</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></td>
<td>exceeds DC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>maximum voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vac-high</td>
<td>Grid voltage</td>
<td>Check the grid</td>
<td>Recover operation when grid voltage is back to normal</td>
</tr>
<tr>
<td></td>
<td>exceeds grid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>maximum voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vac-low</td>
<td>Grid voltage</td>
<td>Check the grid</td>
<td>Recover operation when grid voltage is back to normal</td>
</tr>
<tr>
<td></td>
<td>is lower than</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>minimum voltage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fre-high</td>
<td>Grid frequency</td>
<td>Check the grid</td>
<td>Recover operation when grid frequency is back to normal</td>
</tr>
<tr>
<td></td>
<td>exceeds grid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fre-low</td>
<td>Grid frequency</td>
<td>Check the grid</td>
<td>Recover operation when grid frequency is back to normal</td>
</tr>
<tr>
<td></td>
<td>is lower than</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>maximum grid</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>frequency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iac leak-pro</td>
<td>PCS AC leakage</td>
<td>-</td>
<td>Recover operation when leakage current is back to normal</td>
</tr>
<tr>
<td></td>
<td>exceeds allowable range</td>
<td></td>
<td></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>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>Temp-high</td>
<td>PCS internal temperature exceeds the allowable range</td>
<td>Check the cooling fan when the device is discharged completely</td>
<td>Contact Sungrow if this fault occurs 10 times per day</td>
</tr>
<tr>
<td>PM tem high</td>
<td>Module temperature exceeds the allowable range</td>
<td>Check the module when the device is discharged completely</td>
<td>Contact Sungrow if this fault occurs 10 times per day</td>
</tr>
<tr>
<td>Reactor temp-high</td>
<td>Reactor temperature exceeds the allowable range</td>
<td>Check the reactor when the device is discharged completely</td>
<td>Contact Sungrow if this fault occurs 5 times per day</td>
</tr>
<tr>
<td>PM-flt</td>
<td>Device internal fault</td>
<td>Device internal fault. First disconnect the AC and DC current, then disconnect the control circuit, and reconnect. Contact Sungrow if this fault still occurs</td>
<td>Contact Sungrow if this fault occurs 5 times per day</td>
</tr>
<tr>
<td>AC main contactor-ft</td>
<td>Contactor connected to the grid fault</td>
<td>Check the contactor when the device is discharged completely</td>
<td>Contact Sungrow if this fault occurs 5 times per day</td>
</tr>
<tr>
<td>DC main contactor-ft</td>
<td>Contactor connected to the battery fault</td>
<td>Check the contactor when the device is discharged completely</td>
<td>Contact Sungrow if this fault occurs 5 times per day</td>
</tr>
<tr>
<td>DC fuse-flt</td>
<td>DC side fuse fault</td>
<td>Check and replace the fuse when the device is discharged completely</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td>AC SPD-flt</td>
<td>AC side SPD fault</td>
<td>Check the SPD when the device is discharged completely</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td>Ac fuse-flt</td>
<td>AC side SPD fuse fault</td>
<td>Check and replace the fuse when the device is discharged completely</td>
<td>Contact Sungrow</td>
</tr>
<tr>
<td>AC power-flt</td>
<td>Switch trip off due to over-current of the AC power loop</td>
<td>Check and maintain the switch when the device is discharged completely</td>
<td>Contact Sungrow</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>
</tbody>
</table>

**9.4 Other Faults**

**Heatsink 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>Unit</th>
<th>Specification</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC side parameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal DC power</td>
<td>kW</td>
<td>1000 kW</td>
<td></td>
</tr>
<tr>
<td>Max. DC voltage</td>
<td>V</td>
<td>1200V</td>
<td></td>
</tr>
<tr>
<td>Working voltage range</td>
<td>V</td>
<td>810V - 1200V</td>
<td></td>
</tr>
<tr>
<td>Max. DC current</td>
<td>A</td>
<td>1358A</td>
<td></td>
</tr>
<tr>
<td>AC side parameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working mode</td>
<td>-</td>
<td>Continuous</td>
<td></td>
</tr>
<tr>
<td>Nominal Output Power</td>
<td>kW</td>
<td>1000 kW</td>
<td></td>
</tr>
<tr>
<td>Output overload capacity</td>
<td>KVA</td>
<td>1100 KVA</td>
<td>110% overload, longtime operation</td>
</tr>
<tr>
<td>Max. AC current</td>
<td>A</td>
<td>1176A</td>
<td></td>
</tr>
<tr>
<td>Max. THD</td>
<td>%</td>
<td>&lt;3% at nominal power</td>
<td></td>
</tr>
<tr>
<td>Nominal grid voltage</td>
<td>V</td>
<td>540V</td>
<td></td>
</tr>
<tr>
<td>Grid voltage range</td>
<td>V</td>
<td>475V - 594V</td>
<td></td>
</tr>
<tr>
<td>Nominal grid frequency</td>
<td>Hz</td>
<td>60Hz</td>
<td></td>
</tr>
<tr>
<td>Grid frequency range</td>
<td>Hz</td>
<td>55 - 65Hz</td>
<td></td>
</tr>
<tr>
<td>Power factor at nominal power</td>
<td>-</td>
<td>&gt;0.99</td>
<td></td>
</tr>
<tr>
<td>Isolated transformer</td>
<td>-</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>DC current injection</td>
<td>-</td>
<td>&lt;0.5% at nominal output current</td>
<td></td>
</tr>
<tr>
<td>Grid-connected power factor range</td>
<td>-</td>
<td>0.8 (lagging) - 0.8 (leading)</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>1606mm(63.2inch)×2065mm(81.3inch)×935mm(36.8inch)</td>
</tr>
<tr>
<td>Weight</td>
<td>1400kg(3086 lbs)</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>98.4% (without transformer)</td>
</tr>
<tr>
<td>Protection Degree</td>
<td>NEMA II</td>
</tr>
<tr>
<td>Stop Power Consumption</td>
<td>&lt;127W</td>
</tr>
<tr>
<td>Noise level</td>
<td>&lt;70dB</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-30°C~ + 50°C</td>
</tr>
<tr>
<td>Cooling Method</td>
<td>Temperature-controlled forced air cooling</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0 - 95% (Non-condensing)</td>
</tr>
<tr>
<td>Working Altitude</td>
<td>2000 m (operation with derating above 2000m)</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>IEC104/Modbus TCP/Modbus RTU</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 + fuse</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>
<tr>
<td>Reverse polarity protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Module protection temperature</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.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.
10.3 About Us

Sungrow power supply is a Chinese leading manufacturer of various power electronics products for renewable energy generation systems. Our products include PCSs, 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.

10.4 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!

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 Xiyu Rd, New &amp; High Technology Industrial Development Zone, Hefei, P. R. China.</td>
</tr>
<tr>
<td>Zip:</td>
<td>230088</td>
</tr>
<tr>
<td>Telephone:</td>
<td>+86 551 6532 7834, +86 551 6532 7845</td>
</tr>
<tr>
<td>Fax:</td>
<td>+86 551 6532 7856</td>
</tr>
</tbody>
</table>

North America

- Sungrow Canada
  
  | Add              | 6535 Millcreek Dr, Unit 63-64, Mississauga, ON, Canada L5N 2M2 |
  | Tel              | +1 905 286 9266                                               |
  | Fax              | +1 905 286 9668                                               |
  | Sales            | sales@sungrow.ca                                             |
  | After-Sales      | service@sungrow.ca                                           |

- Sungrow USA Corporation
  
  | Add              | 426 17th St. Suite #700, Oakland, CA, USA 94612               |
  | Tel              | +1 510 656 1259                                               |
  | Sales            | sales@sungrow.ca                                             |
  | After-Sales      | service@sungrow.ca                                           |