Green and Effective

SUNGROW

SG6K

PV Grid-Connected Inverter

User Manual

SG5K-UEN-Ver31-201202 Version:3.1

Symbols Explanation

Important instructions contained in this manual should be followed during installation and operation of the inverter. And they will be highlighted by these symbols.

DANGER!

This symbol indicates a dangerous condition which, if not avoided, will bring death or serious injury.

WARNING!

This symbol indicates a dangerous condition which, if not avoided, could bring death or serious injury.

CAUTION!

This symbol indicates a dangerous condition which, if not avoided, could bring minor or moderate injury.

NOTE

This symbol indicates a situation which can help the equipment optimal operation.

Contents

1 Safety Instructions

About this Chapter

This chapter describes very important safety instructions. Please read “Safety Instructions” carefully before any work with the inverter.

The inverter is designed and tested according to international safety requirements. But as all electrical and electronic equipments, certain precautions should be observed during installing, operating and /or maintaining.

Incorrect operation or work performed incorrectly can result in damage to:

- The life and well-being of the operator or the third party
- The inverter and other properties that belong to the operator or the third party

Therefore in order to reduce risk of injury and ensure the safety of the inverter, you must carefully read and follow all instructions, cautions and warnings.

DANGER!

First disconnect the inverter from the grid!

DANGER!

- **Even when the inverter is disconnected, lethal voltages still exists within the inverter.**
- **Before any maintenance work, you should wait for at least five minutes and then perform work.**

WARNING!

All tasks of installation and maintenance must only be performed by qualified personnel.

- **They are trained specially.**
- **They have read this manual and comprehend all operation methods and related safety instructions.**

WARNING!

All electrical installations must be in accordance with local and national electrical codes.

WARNING!

Only after receiving prior approval from the utility company and qualified personnel installing the inverter, you can connect the inverter to the utility grid.

WARNING!

All cables must be firmly attached, undamaged, properly insulated and adequately dimensioned.

WARNING!

When choosing the installation site, ensure that there is no electromagnetic interference with other electrical and electronic equipments

WARNING!

Risk of damage to the inverter due to improper modification.

Never modify the inverter or other components of the inverter. Otherwise it will lead to loss of any and all warranty right.

WARNING!

Any malfunction that can impair inverter safety must be repaired immediately before the inverter is switched on again.

WARNING!

Please contact your local authorized personnel if any maintenance is required.

WARNING!

Electrostatic discharge can damage the inverter.

During replacing or installing the inner components, the technical personnel should take appropriate protective measures such as electrostatic bracelet.

CAUTION!

These regulations should also be followed:

- **The regulations related to the electricity fed into the grid**
- **The safety instructions related to the PV arrays**

2 Product Introduction

About this chapter

This chapter introduces intended use, main circuits and features of inverter.

Thank you for purchasing SG6K from Sungrow**.** We hope that the device will meet with your satisfaction when you use it with your PV plant system.

2.1 Intended Use

A grid-connected PV system is shown in Fig 2-1. SG6K converts the direct current generated by PV array into stable alternating current and feeds to utility grid.

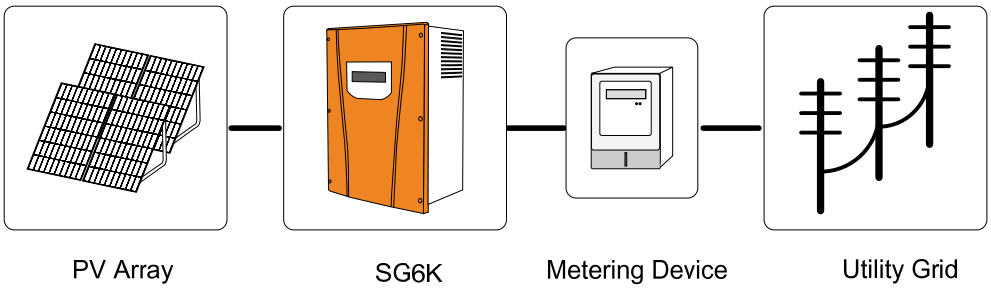


Fig 2-1 SG6K Applied in the PV Power System

WARNING!

If output of inverter is connected to local loads (household appliance, lights, motor loads, etc.), the inverter will stop working.

These local loads should be connected to the grid output side.

2.2 Circuit Description

Fig 2-2 shows the main circuit of SG6K -a transformer grid-connected inverter. An IGBT full-bridge converts the DC power to AC voltage and current. The AC power is then fed to the grid after being processed by a filter and a transformer.

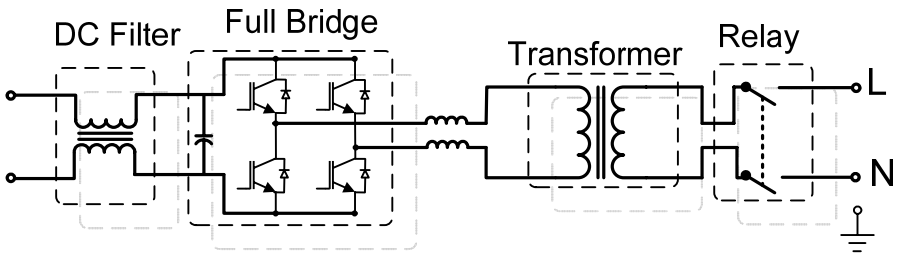


Fig 2-2 Circuit Diagram of SG6K

3 Installation

About this Chapter

This chapter proposes how to choose installation site, related safety instructions and electrical connection.

3.1 Inspection

The SG6K inverter is thoroughly checked and tested rigorously before they are shipped. Even though they are delivered in a rugged, heavy cardboard box, the inverters can be damaged in shipping which typically is the shipping company's fault. So you should check the inverter before installation.

Please inspect the inverter thoroughly after it is delivered. If any damage is seen please immediately notify the shipping company. If there is any question about potential shipping damage, contact Sungrow. A photo of the damage may be helpful.

Do not accept unit if visibly damaged or note visible damage when signing shipping company receipt. Please report the damage immediately to the shipping company. Do not remove the unit from packaging.

3.2 Basic Installation Requirements

The IP level of SG6K is IP65. So it can be installed outdoor.

WARNING!

SG6K should be installed in a place where it is not exposed to direct sunlight.

WARNING!

Some parts of the SG6K can reach temperature over 80°C. Keep a suitable distance to flammable materials!

WARNING!

Never install SG6K in areas that likely contain explosive atmospheres (battery rooms, fuel storage rooms etc.)!

WARNING!

It is advised not to install the inverter in living quarters, since the inverter may produce some operating noise (<40dB).

WARNING!

It is important to have air freely circulating around the inverter. Therefore keep the area within 30 centimeters of the inverter free from obstacles.

WARNING!

Avoid installing the inverter in a location subject to vibrations.

WARNING!

It is important to have air freely circulating around the inverter. Therefore keep the area within 30 centimeters of the inverter free from obstacles.

WARNING!

Avoid mounting the inverter in a dusty area.

WARNING!

The ambient temperature should remain within –25°C~+60°C.

NOTE

The LED and display should always be legible for users.

3.3 Mechanical Mounting

3.3.1 Safety

As with any electrical system, touching live components can be hazardous to life and limb. This device contains DC voltage of up to 450V and the grid voltage up to 260 V.

WARNING!

Only qualified personnel can work on this equipment. This work is only permissible if the AC and DC power supplies are safely disconnected from the SG6K.

3.3.2 Device Dimensions and Weight

The external dimensions and weight of the SG6K is in Fig 3-1.

Fig 3-1 Dimensions and Weight of SG6K

3.4 Electrical Connection

3.4.1 Safety

WARNING!

Improper operation during the wiring process can cause fatal injury to operator or unrecoverable damage to the inverter.

Only qualified personnel can perform the wiring work.

WARNING!

All electrical installations must be in accordance with local and national electrical codes.

WARNING!

Only after receiving prior approval from the utility company and qualified personnel installing the inverter, you can connect the inverter to the utility grid.

WARNING!

All cables must be firmly attached, undamaged, properly insulated and adequately dimensioned.

CAUTION!

These regulations should also be followed:

- **The regulations related to the electricity fed into the grid**
- **The safety instructions related to the PV arrays**

3.4.2 Wiring Interface

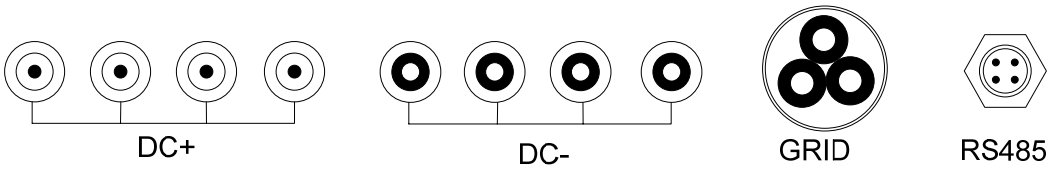


Fig 3-2 Wiring Interface of SG6K

Table 3-1 Terminal Description

Terminal	Description
RS485	RS485 A: pin 1.RS485 B: pin 3
DC+	DC+: DC positive input terminal
DC-	DC-: DC negative input terminal
Grid	Red wire connected to pin 1 of GRID L Black wire connected to pin 3 of GRID N Yellow-green wire connected to pin 4 of ground

3.4.3 Overview of Electrical Installation

The complete wiring for SG6K is shown schematically in the Fig 3-3.

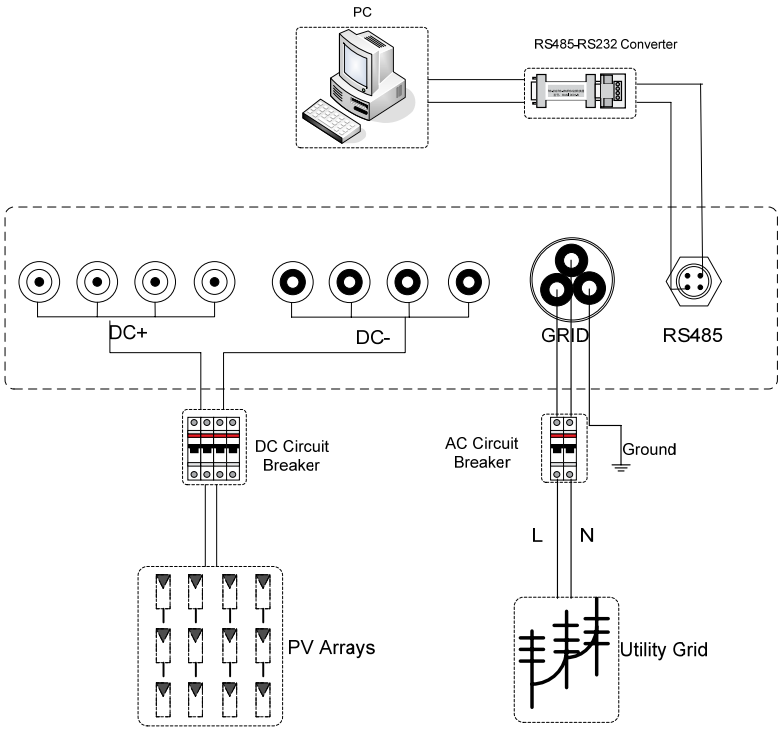


Fig 3-3 Simplified Electrical Connection Diagram

NOTE

Since the AC and DC connections are wired to the breakers or junction box only. There is no need to open the inverter enclosure during installation.

NOTE

Please note that RS485 wire and the corresponding RS485-232 converter is optional part and can be bought from Sungrow.

3.4.4 Electrical Connection Requirements

- Grid 230V AC

The SG6K is designed for 230V grid (single phase). The voltage should be within 180V to 260V and the frequency should be 47-51.5/57-61.5Hz.

Grid Voltage Range:	180V-260V
Grid Frequency Range:	47-51.5/57-61.5Hz

- PV array

Max. PV Power:	6.6kW
Max. PV Voltage:	780V

WARNING!

Make sure that DC input voltage never exceeds 780V. Higher input voltages will damage to SG6K.

- Ground

The inverter must be grounded in compliance with local safety codes using appropriately sized protective conductors.

3.4.5 Wiring Procedure

WARNING!

The wiring of the inverter's AC and DC cables must only be done with the DC and AC circuit breakers are in the off state.

Please follow Fig 3-3 to connect the wires:

- Connect the wires of the DC cable as follows:
  - SG6K's "DC＋" wire to PV arrays' positive pole.
  - SG6K's "DC－" wire to PV arrays' negative pole.

CAUTION!

There are 4 input ports of PV arrays. We recommend users at least connect 2 channels with each channel maximum current not more than 10A and total current not more than 20A.

- Connect the wires of the AC cable as follows:
  - SG6K's "L" wire to grid's "L".
  - SG6K's "N" wire to grid's "N".
  - SG6K's "GND" wire to ground.

WARNING!

Make sure all wires are firmly tightened.

Grid is connected regardless of L, N phase. It will not affect the inverter's work.

3.5 Connecting Communication Cables

3.5.1 Communication Types

Inverter may transfer the monitored information from inverter via its integrated RS485 interface to a PC with monitoring software (such as SolarInfo Insight), or to data logging device (such as SolarInfo Logger).

- Where there is only one inverter, a RS485 cable enables connection between inverter and PC.
- Where there is more than one inverter, all inverters can be connected to PC in daisy chain. The first inverter in the chain must be terminated with a resistor of 120 Ohm. And shielding layer of RS485 cable should be single-point grounded.
- A converter such as RS485-232 converter or SolarInfo Logger, which converts 485 to 232 signal, is needed between inverter and PC.

3.5.2 RS485 Communication Connection

RS485 is the standard communication choice for inverter.

The maximum number that inverters are connected in the daisy chain depends on converter and other factors. Please refer to converter's manual to obtain the limit.

RS485 cable supplied is equipped with plug and play terminal. It is simple to plug this terminal to the RS485 interface at the bottom of the inverter.

Now perform RS485 communication connection as the diagram shown below.

1. Connect connector of one cable end to RS485 terminal on the bottom of the inverter.
2. Connect the other end of cable to other devices. Communication terminal definition is referred to device manual.

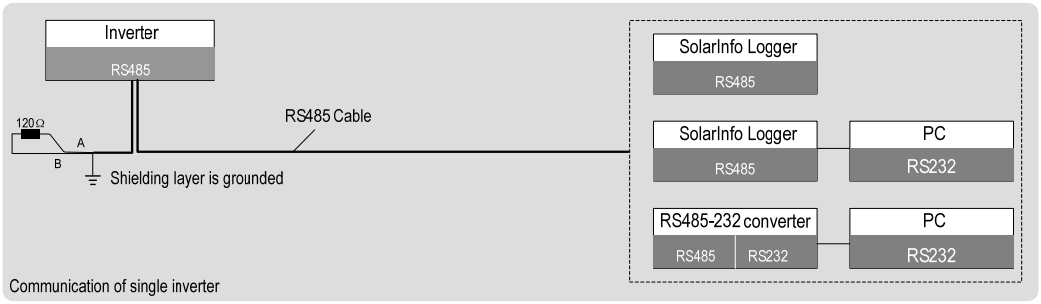


Fig 3-4 One Inverter Connected to PC or SolarInfo Logger

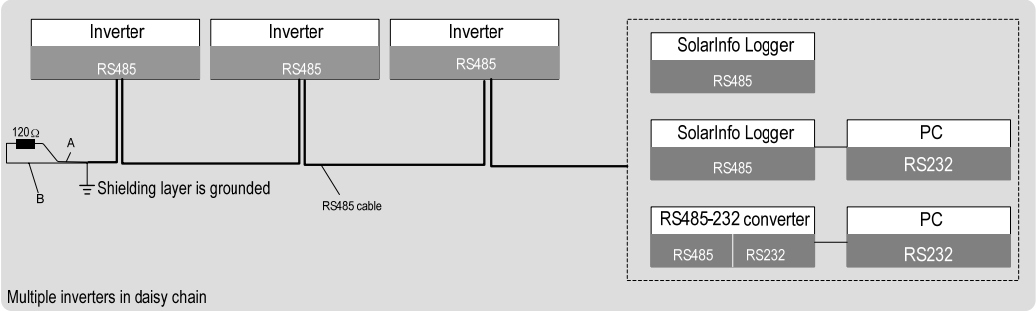


Fig 3-5 Multiple Inverters Communication with Other Devices

3. Verify the communication connection and configure communication parameters.

NOTE

If there is more than one inverter to communicate with a PC or a data logger, it is crucial to configure communication parameters of each inverter. See “6.8.4 Set Communication Parameters”.

SolarInfo logger and RS485-232 converter are optional parts and can be ordered from Sungrow.

3.6 Start and Close

3.6.1 Start Inverter

To turn on the inverter, please follow the steps below.

Step 1: Switch on the DC side circuit breaker

Step 2: Switch on the AC side circuit breaker

Step 3: The inverter will to check whether that voltage, impedance and frequency parameters are within operating range.

Step 4: If the parameters check is correct, then the LCD will display the normal working screen.

Step 5: Then the inverter will export to the grid and the green Power LED will continuously lit (provided there is enough PV power).

3.6.2 Close Inverter

If users want to shut down the inverter, please refer to stop command in the LCD menu in “6.7 Start and Stop Inverter”.

If users want to shut down the inverter in emergency, first switch off the AC side breaker then switch off the DC side breaker.

WARNING!

Incorrect order may cause danger to the personnel and damage to the inverter.

4 User Interface

About this Chapter

This chapter proposes the modules that user can operate—LCD panel.

4.1 LCD Panel

The inverter operates automatically without user interaction. There are two LEDs and two buttons on the panel of the inverter.

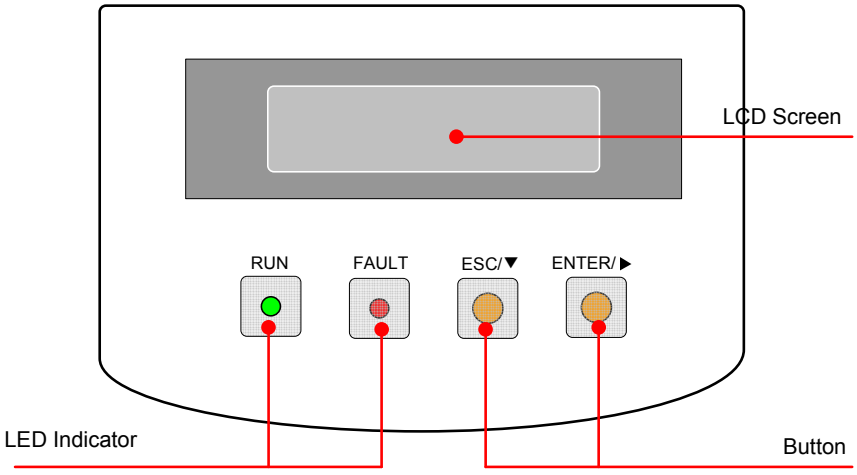


Fig 4-1 LCD Panel

4.2 LED Indicators

From leds we can get the basic work state of the SG6K.

Table 4-1 LED Descriptions

LED name	LED state	Explanation
“RUN” LED	light	SG6K is working
	shut	SG6K is not working
“FAULT” LED	light	A fault has occurred
	shut	No fault has occurred

4.3 Buttons

There are two buttons on the LCD panel: “ESC/▼” button and “ENTER/►” button.

- “ESC/▼” button

  When you short press “ESC/▼” button less than 2 seconds, this button performs the “▼” function, which is used to move the arrow up and down in the screen or increase/decrease number.

  The “ESC/▼” button will perform “ESC” function if it is pressed longer than 2 seconds, which is used as return/finish function.

- “ENTER/►” button

  when you short press “ENTER/►” button less than 2 seconds, this button performs “►” function ,which is used to move the arrow left or right in the screen.

  The “ENTER/►” button will perform “ENTER” function if it is pressed longer than 2 seconds, which is used to select menu item and confirm changes.

CAUTION!

The background illumination is activated by slightly press any button.

4.4 LCD Screen

The display board is equipped with two line LCD .Users can get basic information from the LCD display.

LCD screen and buttons provide a good human-computer interaction interface.

In its default interface, user can observe operation mode or fault type of inverter.

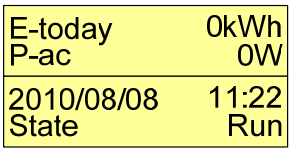


Fig 4-2 Default Interface

NOTE

If there is no button operation in three minutes, it will go back to default menu.

4.5 Operation Modes

- Run

  After being energized, the inverter tracks the PV arrays' maximum power point (MPP) and converts the DC power to AC power. This mode is the normal operational mode. If the PV power is more than 1650W, the output power is still 1650W.

- Fault

  If a fault occurs during operation, the inverter will automatically stop operation, disconnect the AC contactor and the display the fault type in the LCD panel with the "Fault" LED burns.

  Once the fault is removed in 5 minutes, the inverter will automatically resume running.

- Stop

  The inverter will stop operation by manual stop through LCD menu; this condition needs manual restart through LCD menu.

  During the "Stop" mode, the inverter will block the driving signals that control the switching IPM and disconnect the inverter from the grid by switching off the AC contactor.

5 Commissioning

About this Chapter

This chapter demonstrates how to check before commissioning and operation procedures.

Verify before commissioning

Number	Item	Remark
1	Verify whether inverter is fastened onto the wall.	See “3.3 Mechanical Mounting”.
2	Check whether all cables are firmly attached and correctly.	See “3.4.5 Wiring Procedure”.

Commissioning Procedure:

Step 1: Make sure all items above meet demands.

Step 2: Switch off external AC air-switch.

Step 3: Switch off external DC air-switch.

NOTE

After external air-switch is closed in the PV power system:

- PV arrays initialize and supply DC power to inverter;
- Inverter verify whether grid conditions are OK;
- If the conditions are OK, inverter feeds AC power to grid and enters into the running state.

Step 4: Observe state of LED indicators and LCD screen.

CAUTION!

If inverter’s commissioning fails, “FAULT” indicator will be lit. And “state” in the LCD screen will display type of malfunction.

In this case malfunction must be removed and then repeat step1 to step 4.

NOTE

If inverter‘s commissioning succeeds, “RUN” indicator will be lit.

If inverter‘s commissioning succeeds, “state” in the LCD screen will display “RUN”.

6 Menu Operation

About this Chapter

This chapter shows all menu operations. User can know how to check the state of the inverter, current running information and history information. And how to set the parameters of the inverter is also included.

6.1 Overview of Menu

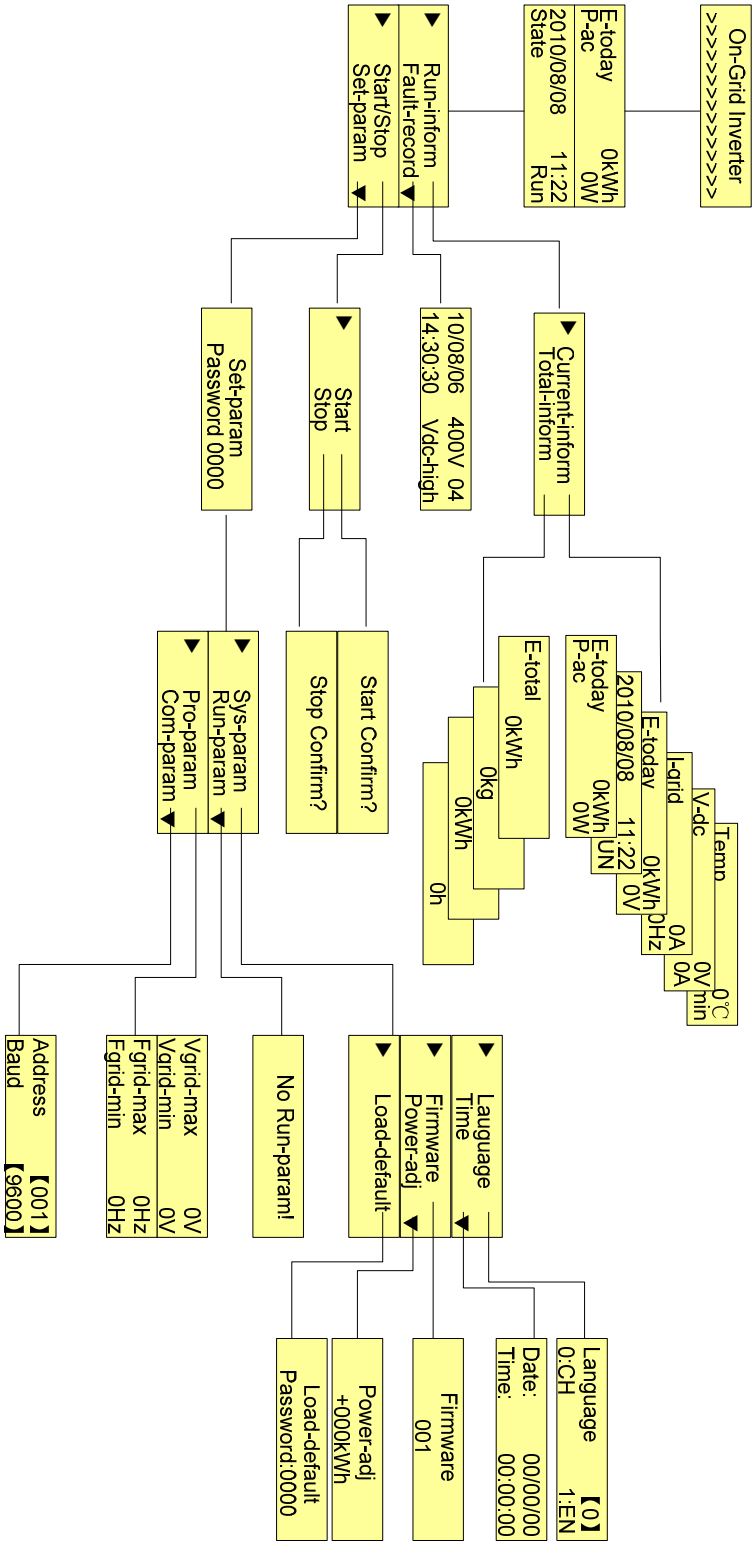


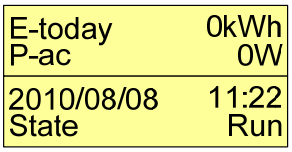
Fig 6-1 Menu Tree-English

6.2 Start-up Menu

NOTE

This screen I only appears once after start. LCD will automatically enter into the default menu after about 7 seconds.

6.3 Default Menu



This menu includes 2 separate pages.

The first screen includes parameters of “E-today” and “P-ac”. “E-today” indicates the daily output energy generated by SG6K in the unit of kWh. “P-ac” indicates the real time output power of SG6K in the unit of kW.

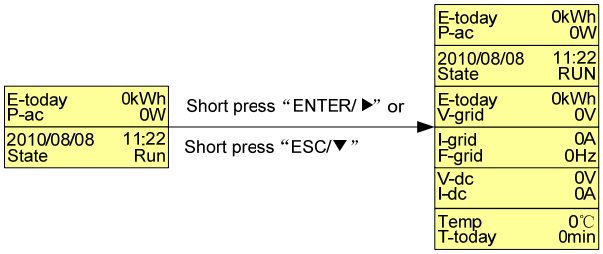
The second screen includes parameters of date/time and “state”. Date/Time display the current time and can be adjusted. The “State” shows the inverter’s working state according to Table 6-1.

Table 6-1 State of the inverter

Data name	explanation
RUN	The inverter in normal （function）operation
Stand-by	The inverter in stand-by state
Stop	The inverter stops working
Com-fault	Fault of LCD-inverter communication channel

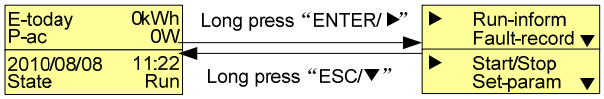
NOTE

Short press “ESC/▼” button or “ENTER/►” when in default menu, you can quickly access the system running parameters, as shown in the figure below.



6.4 Main Control Menu

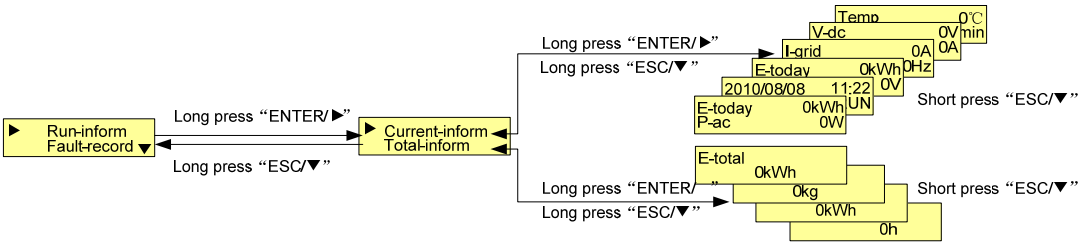
This menu contains running information-“Run-inform”, fault record-“Fault-record”, start/stop control of the inverter-“Start/Stop” and parameters setting-“Set-param”. Users can short press “ESC/▼” button to make the arrow pointed to selected menu.



6.5 Check Run−inform

In order to check run information of inverter, you can access “Current-inform” and “Total-inform” following instructions in the picture below.

There is a direct way to access “Current-inform” from default menu via short pressing “ESC/▼” button or “ENTER/►” button.



The “Run-inform” menu contains the “Total-inform” and “Current-inform” menu.

The “Total-inform” includes history logged data such as: total generated energy-“E-total”, monthly generated energy-“E-month”, total running hour-“h-total” and reduced CO2 weight -“CO2-total”.

The “Current-inform” includes real time system data. All the data are explained in the Table 6-2 and Table 6-3.

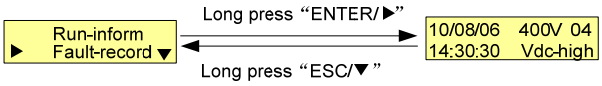
Table 6-2 Electrical Real Time Data (Current-inform)

Data name	explanation	Unit
V-grid	Grid voltage	V
I-grid	Output AC current	A
F-grid	Grid frequency	Hz
V-dc	DC Voltage (of PV array)	V
I-dc	DC Current (of PV array)	A
P-ac	Output ac power	W
E-today	Energy generated today	kWh
E-month	Energy generated this month	kWh
E-total	The whole generated Energy	kWh

Table 6-3 Non-electrical Real Time Data (Total-inform)

Data name	explanation	Unit
Temp	Temperature within the enclosure	℃
T-today	The Operation time of today	min
T-total	Total hours of Operation time	h
CO2-total	Reduced CO2 weight	kg
2006/11/22 11:44	The current date/time	

6.6 Check Fault-record



The "Fault-record" menu displays the latest fault records, which includes fault type (see Table 6-4), fault occurred time, fault parameter and fault record number.

NOTE

Inverter SG6K can store at most 20 fault records.

The latest fault record number is always 01. The oldest fault record number is always 20(suppose there are at least 20 fault records).

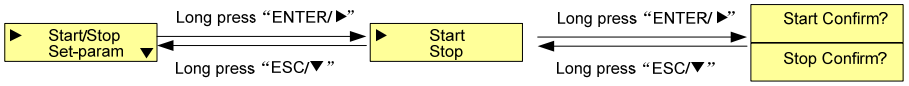
Table 6-4 Fault Type with Simple Explanation

Fault name	Explanation
Vdc-high	DC voltage exceeds maximum DC voltage of inverter.
Vac-high	AC voltage exceeds the upper limit value of grid voltage range.
Vac-low	AC voltage is less than the lower limit value of grid voltage range.
F-fault	Grid frequency exceeds range.
Island	Island fault.
IPM-flt	IPM fault occurs.

6.7 Start and Stop Inverter

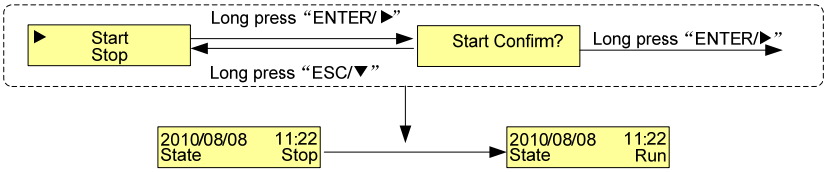
If input and output conditions are OK, inverter will work automatically. And if input and output conditions fail, inverter will stop automatically.

If you want start and stop inverter manually, you can operate as the following picture.



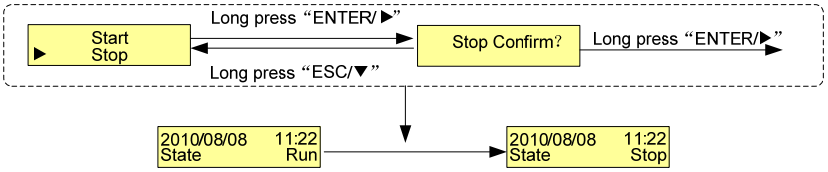
- Start through LCD

  If you want to restart inverter after LCD "stop" operation, you can perform "Start" operation. And state shown in the default menu will change after "start" operation.



- Stop through LCD

  If you perform "Stop" operation through LCD, the inverter will stop work immediately. And state shown in the default menu will change after "stop" operation.



WARNING!

If you want to stop the inverter in emergency, you should first disconnect AC circuit breaker and then DC circuit breaker. Otherwise it can lead to damage to inverter and operator.

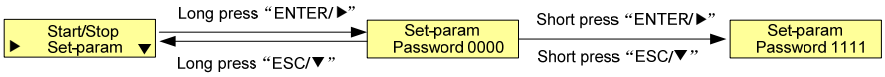
6.8 Set Parameters for Inverter

NOTE

If you want to set inverter's parameters, you have to input correct password.

The default password is 1111.

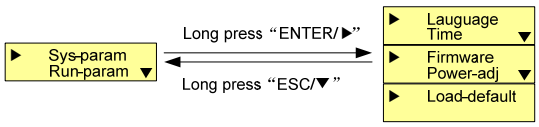
The process of input password is indicated in the following picture.



There are "Sys-param", "Run-param", "Pro-param" and "Com-param" that can be set.

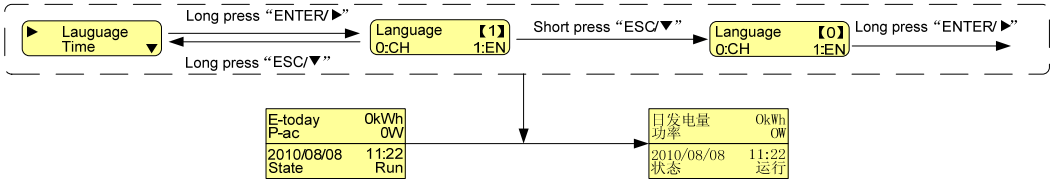
6.8.1 Set System Parameters

System parameter contains language, time, firmware, power-adj and load default.



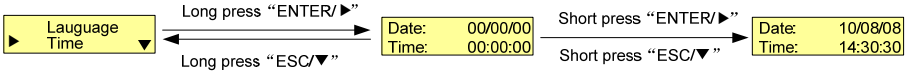
- Set language

Inverter SG6K supports two languages: Chinese and English. You can select your language as the following picture.



- Adjust time displayed in inverter

If "time" displayed in inverter is not in accordance with your local time, you should perform the following operation.



NOTE

The date format is year/month/date. The time format is hour/minute/second.

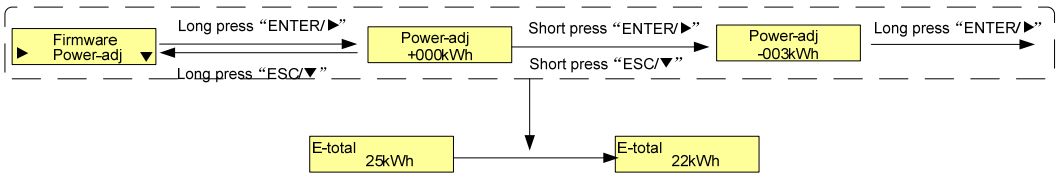
Hour is 24-hour type.

- Firmware

User can not set this parameter.

- Set power-adj

If “E-total” value deviates from the value in metering device, you should set the parameter “power-adj”.



NOTE

The value of “Power-adj” is the difference between value in metering device and “E-total” value in LCD.

Adjustable range: -999kWh~+999kWh

- Load default

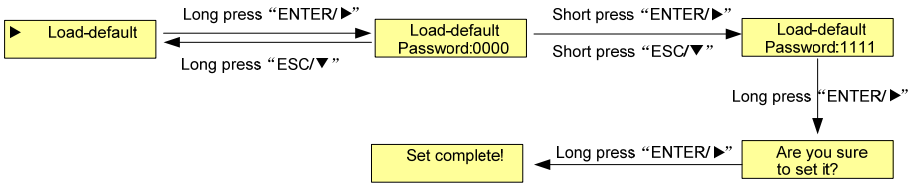
CAUTION!

If you perform “Load-default” operation, all non-real time data will be reset to zero, including “E-today”, “T-today”, “E-total”, “CO2-total”, “E-month” and “H-total”.

This operation is irreversible.

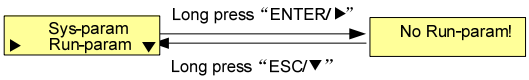
NOTE

If language of inverter is Chinese, it will change into English after operation of “Load-default”,



6.8.2 Set Run Parameter

There is not run parameter for setting. If you perform "Run-param" operation, LCD just displays "No Run-param".



6.8.3 Set Protective Parameters

Protective parameters include "Vgrid-max", "Vgrid-min", "Fgrid-max" and "Fgrid-min".

If actual condition exceeds these setting value, inverter will stop running and display corresponding fault.

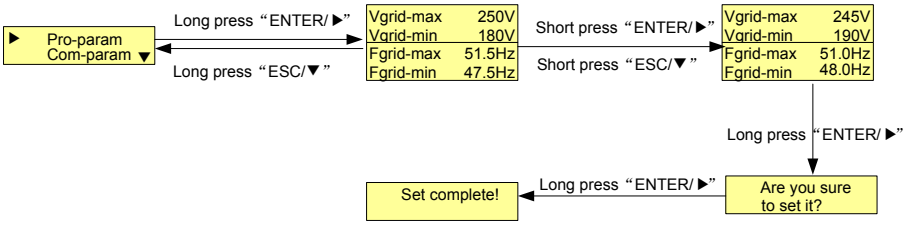
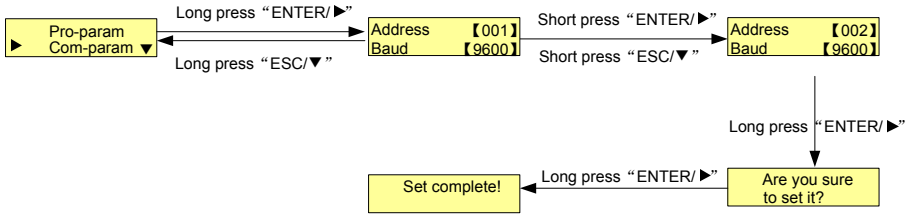


Table 6-5 Protective Parameters Range

Data name	Simple explanation	Adjustable range	Default value
Vgrid-max	maximum AC voltage	240V-260V	250V
Vgrid-min	minimum AC voltage	180V-200V	180V
Fgrid-max	maximum AC frequency	50.5Hz-51.5Hz	51.5Hz
		60.5Hz-61.5Hz	61.5Hz
Fgrid-min	minimum AC frequency	47.0Hz-49.5Hz	47.5Hz
		57.0Hz-59.5Hz	57.5Hz

6.8.4 Set Communication Parameters

If there is more than one inverter to be monitored, you should set appropriate address and baud rate for each inverter.



CAUTION!

Each inverter should have different address and have same baud rate to ensure good communication.

Address range: **1~247**

Baud rate: **1200,2400,4800,9600**

7 Technical Data

About this Chapter

This chapter illustrates technical data, including input data, output data, system, display and communication data.

Input Data	
Max. DC Voltage	780V
MPP Voltage Range	320V~650V
Max. DC Power	6600W
Max. Input Current	20A
Recommend PV ArrayOpen Circuit Voltage	600V
Output Data	
Rated output power	6000W
Rated Grid Voltage	230V
Grid Voltage Range	180V~260V
Rated Grid Frequency	50Hz/60Hz
Grid Frequency Range	47Hz~51.5Hz/57Hz~61.5Hz
Output Current THD	<3%(at nominal power)
DC Current Injection	<0.5% of rated inverter output current
PF	≥0.99(at nominal power)
System	
Max. Efficiency	94.5%
Euro. Efficiency	93.8%
Protection Degree	IP65
Operating Temperature	-25℃~+60℃
Relative Humidity	0~95%，non-condensing
Cooling method	natural cooling
Max. Altitude	2000m
Display and Communication	
Display	LCD
Communication Interface	RS485
Mechanical Data	
Dimensions（W*H*D）	410mm*580mm*283mm
Net weight	62.6kg

8 Appendix

About this Chapter

This chapter proposes contents related to exclusion of liability and contact.

8.1 Exclusion of Liability

The content of these documents is periodically checked and revised, when necessary, please call us or check our website www.sungrowpower.com for the latest information. However discrepancies cannot be excluded. No guarantee is made for the completeness of these documents. Please contact our company or distributors to get the latest version.

Guarantee or liability claims for damages of any kind are excluded if they are caused by one or more of the following:

- Improper or inappropriate use of the product
- Operating the product in an unintended environment
- Operating the product when ignoring relevant safety regulations
- Ignoring safety warnings and instructions contained in all documents relevant to the product
- Operating the product under incorrect safety or protection conditions
- Altering the product or supplied software without authority
- The product malfunctions due to operating attached or neighboring devices beyond allowed limit values
- In case of unforeseen calamity or force majeure

8.2 Contact Us

If you have any questions about or technical problems of inverter, our hotline will be happy to assist you. Please note the following contact information.

Company:	Sungrow Power Supply Co., Ltd.
Website:	www.sungrowpower.com
Contact:	Mr. Henry (Director of International Trade)
Email:	info@sungrow.cn; service@sungrow.cn
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Green and Effective

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