
User Manual

SG60KTL

PV Grid-connected Inverter



About This Manual

This manual is for string inverter SG60KTL (hereinafter referred to as inverter unless otherwise specified). The inverter is grid-connected, transformer-less, robust and of high conversion efficiency. We hope the inverter will satisfy you when you use it with your PV plant system.

Aim

This manual contains information about the inverter, which will provide you guidelines to connect the inverter into the PV power system and how to operate the inverter.

Related Documents

The manual cannot include all information about the PV system. You will get additional information at www.sungrowpower.com or via webpage of the manufacturer.

Target Group

This manual is for technical personnel who is responsible for inverter installation, operation and maintenance and inverter owner who will perform daily LCD operation.

How to Use This Manual

Read the manual and other related documents before any work on the inverter. Documents must be stored carefully and available at all times.

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

The contents of the manual will be periodically updated or revised due to the product development. It is probably that there are changes of manual in the subsequent inverter edition. The latest manual can be acquired via visiting the web site at www.sungrowpower.com.

Symbols Explanation

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

DANGER

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

WARNING

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

CAUTION

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


NOTICE


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






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


Symbols on the Inverter Body


 **WARNING**

 Disconnect the inverter from all the external power sources before service!

  Do not touch live parts until 10 minutes after disconnection from the sources!

 Hot surface! May exceed 60°C !

 Danger to life due to high voltages!
Only qualified personnel can open and service the product!

 Check user manual before service!

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1 Safety Instructions

The inverter has been designed and tested strictly according to the international safety regulations. As electrical and electronic equipment, safety instructions related to them must be complied with during installation, commissioning, operation and maintenance. Incorrect operation or work may result in damage to:

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

Therefore, the following general safety instructions must be read and always kept in mind prior to any work. All detailed work-related safety warnings and notes will be specified at the critical points in corresponding chapter.

WARNING

All installations should be performed by technical personnel. They have:

- **received professional training;**
- **read through this manual and understood all related safety instructions;**
- **been familiar with electric system related safety instructions.**

Technical personnel mentioned above may perform the following work:

- Install the inverter onto the wall;
- Connect the inverter to the PV system;
- Commission the inverter;
- Operate and maintain the inverter.

Before Installation

CAUTION

There is a risk of injury due to improperly handling the device!

- **Always follow the instructions in the manual when moving and positioning the inverter.**
- **Injuries, serious wounds, or bruise may follow if the device is improperly handled.**

NOTICE

The unit is thoroughly tested and strictly inspected before delivery. Damage may still occur during shipping.

If there is visible damage to the packaging or the inner contents, or if there is something missing, contact Sungrow or the forwarding company.

During Installation

DANGER

Make sure inverter is not electrically connected before installing the inverter.

CAUTION

System performance loss due to bad ventilation!

The equipment requires good quality ventilation during operation. Keep the unit upright and nothing covering the heatsink.

During Electrical

DANGER

Lethal voltage exists!

PV arrays will produce electrical energy when exposed to sunlight and thus can create potential electrical shock hazards.

WARNING

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

NOTICE

All electrical connection must be in accordance with national and local standards.

The connection to the grid can be done only after receiving approval from

the local utility grid company.

During Inverter Operation

DANGER

Do not disconnect inverter DC side connection while the inverter AC side is under load!

WARNING

Do not open inverter enclosure when inverter is under load or operating. Only intact and locked inverter cabinet can ensure personal and property safety.

Operate the inverter by strictly following the descriptions in this manual to avoid unnecessary injury to the persons and damage to the device. Arc flash, fire or explosion may follow if otherwise and Sungrow will hold no liability for the damages followed.

WARNING

At least the following improper operations can cause the arc flash, fire and explosion inside the device. Remember all the time that these accidents can only be handled by qualified personnel. Improper handling of the accidents occurred may lead to more serious fault or accident.

- **Plug and unplug the DC side HV fuse when it is alive;**
- **Touch the end of the cables that have no insulating treatment and may still be alive;**
- **Touch the connection copper bus bar, terminal or other spare parts inside the device that may be alive;**
- **The power cable connection is loose;**
- **Spare parts like the bolts are falling inside the inverter;**
- **Incorrect operation of the non-qualified persons that receives no training;**

⚠ WARNING

Before any operation to the device, a beforehand assessment of the possible arc flash in the operation area is necessary. If there is arc flash,

- The operators must receive related safety training;
- Try the best to assess the areas that may appear the electric shock;
- Before any operation in the area that may appear electric shock, wear personal protective equipment (PPE) that meets the requirement. A PPE category 2 is recommended.

⚠ CAUTION

There is a risk of burn!

Do not touch device hot parts (for example, the heatsink) during operation. Only the LCD display and DC switch can be touched during operation.

Maintenance and Service**⚠ DANGER**

There is a risk of inverter damage or personal injury due to incorrect service work!

Before any operation, you should perform the following steps:

- First disconnect the grid side switch and then disconnect the DC switch;
- Wait at least 10 minutes until the inner capacitors are discharged completely;
- Verify, using proper testing device to make sure there is no voltage or current.

⚠ CAUTION

Keep unrelated person away!

A temporary warning sign and barrier must be posted to keep non-related person away during electrical connection and maintenance.

NOTICE

- Restart the inverter only when the fault that may impair the inverter safety functions is removed.
- Inverter contains no owner serviceable part inside. Please contact local

authorized personnel if any service work is required.

NOTICE

Do not replace the inverter internal components without permission. Damages may follow and it may void any or all warranty rights from Sungrow.

NOTICE

There is a risk of inverter damage due to electrostatic discharge!

The printed circuit boards contain components sensitive to electrostatic discharge.

- **Wear a grounding wrist band when handling the boards.**
- **Avoid unnecessary touch with the boards.**

Others

WARNING

All safety instructions, warning labels nameplate on the inverter:

- **Must be clearly visible;**
- **Should not be removed or covered.**

WARNING

Respect the following regulations:

- **Grid-connection regulations;**
- **Safety instructions related to PV arrays;**
- **Safety instructions related to other electrical devices.**

NOTICE

Certain parameter setting (country selection, etc.) on the LCD display must only be done by professional persons.

Incorrect country setting may affect the inverter normal operation and cause a breach of the type-certificate marking.

2 Product Description

2.1 Intended Usage

SG60KTL inverter, 3-phase string inverter without transformer, is a crucial unit in the PV power system.

Inverter is designed to convert the direct current power generated from the PV modules into grid-compatible AC current and feeds the AC current to the utility grid. The intended usage of the inverter is illustrated in Fig. 2-1.

WARNING

Inverter cannot connect the PV strings whose positive and negative terminals need to be grounded.

Do not connect any local load between the inverter and the AC circuit breaker.

Inverter is applicable only to the grid-connected PV system in Industrial area. Any other usage is strictly forbidden.

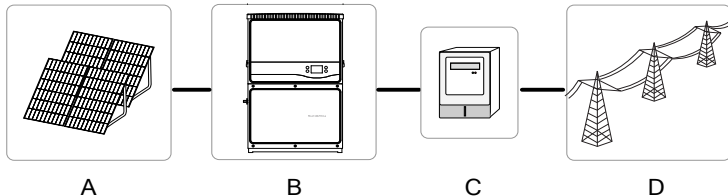
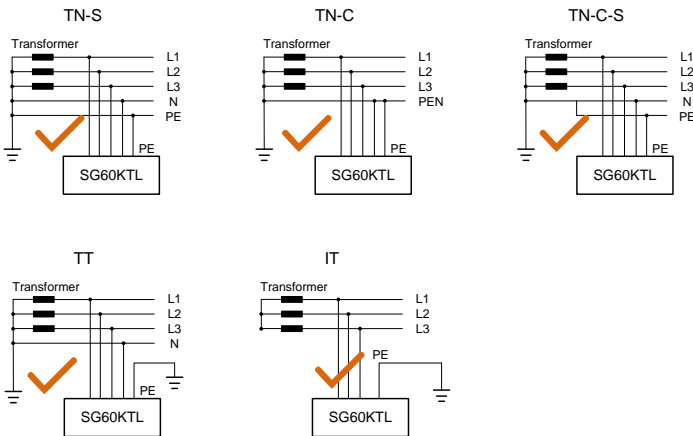


Fig. 2-1 Inverter application in PV power system

Item	Description	Note
A	PV strings	Monocrystalline silicon; polycrystalline silicon and thin-film without grounding
B	Inverter	SG60KTL
C	Metering device	Measure inverter output energy
D	Utility grid	TT, TN-C, TN-S, TN-C-S, IT

If the local altitude is above 3000m, the inverter cannot apply to the IT grid system.



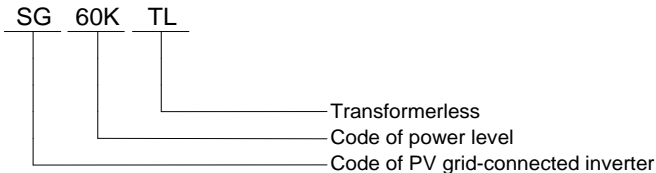
Customer can choose to connect the neutral cable or not, it's not mandatory to connect the neutral cable to the inverter.

More than one inverter can be connected to the system if the capacity of the PV system exceeds the capacity of a single inverter. Connect proper PV input for each inverter at the input side and connect the output side to the grid.

2.2 Product Introduction

2.2.1 Model Description

The model description is as follows:



Tab. 2-1 Power description

Model	Nominal output power	Nominal grid voltage
SG60KTL	66000 VA @ 45 °C 60000 VA @ 50 °C	3 / N / PE or 3 / PE, 230 / 400 V

2.2.2 Appearance

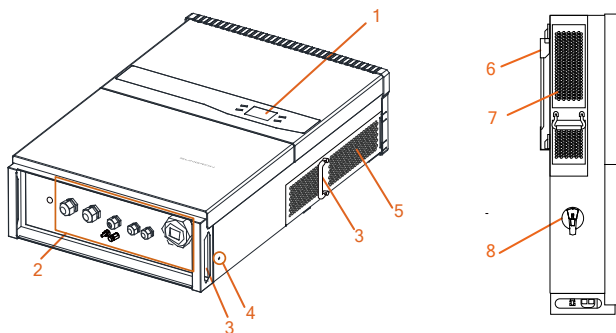


Fig. 2-2 Appearance

* Pictures are indicative only. Product in kind prevail.

No.	Name	Description
1	LCD display	Human-computer interface for viewing of the running information and parameter configuration.
2	Electrical connection area	Include DC terminal, AC terminal and RS485 communication terminal.
3	Handles	Handles are designed for transporting, installing and disassembling the inverter
4	PE second terminal	Specified in EN 50178, user can connect this terminal as per requirements.
5	Air outlet	Controlled forced-air cooling method. Ensure good ventilation.
6	Hanger	Hang the inverter to the backplate.
7	Fans	3 fans used for inverter forced cooling
8	DC switch	Protective components to safely disconnect DC side current.

2.2.3 Dimensions

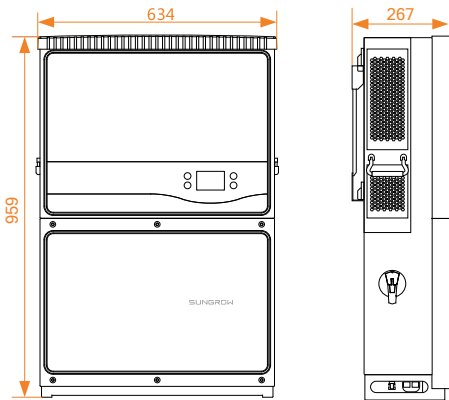


Fig. 2-3 Dimensions of the inverter (in mm)

2.2.4 LCD Display

As a human-computer interaction interface, LCD display comprises two LED indicators and two buttons for user to check the inverter operation information and configure inverter parameters.

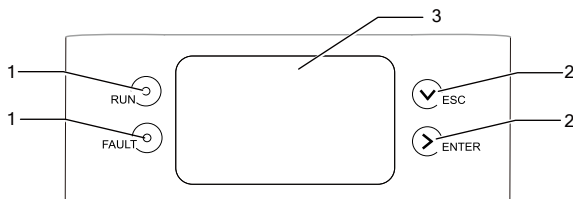


Fig. 2-4 LCD display

Tab. 2-2 Description of LCD display

No.	Name	Description
1	LED indicators	"RUN" and "FAULT". Indicate the inverter operation state. Detailed explanation is shown in Tab. 2-3
2	Buttons	Two buttons for LCD operation and parameter configuration. Detailed explanation is shown in 0
3	LCD screen	Display inverter present state, operation information, history information and parameters, etc.

Tab. 2-3 Description of LED indicators

LED state	Description
"RUN": ON	Inverter is running.

"FAULT": OFF	
"RUN": OFF	A fault occurs,
"FAULT": ON	or protection function is enabled.
"RUN": OFF	Inverter does not operate,
"FAULT": OFF	or communication fault occurs between the DSP and LCD display.
"RUN": Flicker	Warning information occurs to the inverter.
"FAULT": OFF	

2.2.5 DC Switch

DC switch is used to disconnect the DC current safely whenever necessary.

Inverter operates automatically when input and output requirements are met. Turn the DC switch to the OFF position to stop the inverter when a fault occurs or when you need to stop the inverter.



Turn the DC switch to the ON position before restarting the inverter.

2.3 Technical Description

2.3.1 Circuit Diagram

Fig. 2-5 shows the main circuit of the inverter.

MPPT is utilized for DC input to ensure the maximum power from the PV array at different PV input conditions.

Inversion circuit converts the DC power into AC power and feeds the AC power to the utility grid through the AC terminal. The protection circuit is equipped to ensure the device safe operation and personal safety.

DC switch is used to disconnect the DC current safely; inverter provides standard RS485 ports for communication. User can also check running data and set related parameter through the LCD display.

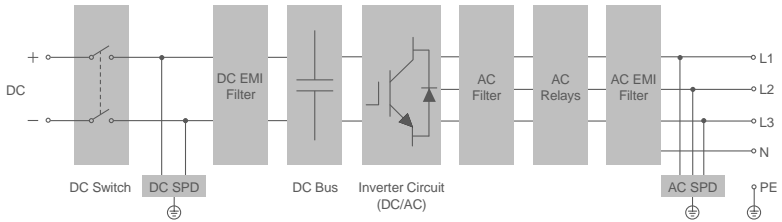


Fig. 2-5 Circuit diagram of SG60KTL

2.3.2 Function Description

- Inversion function
Inverter converts the DC current into grid-compatible AC current and feeds the AC current into grid.
- Data storage and display
Inverter achieves the running information, fault records and etc. and displays them on the integrated LCD display.
- Parameter Configuration
Inverter provides various parameter configuration for inverter optimal operation.
- Communication Interface
Standard RS485 port can be connected to monitoring device and PV system
- Protection Function
 - Short-circuit protection
 - Ground insulation resistance detection
 - Inverter output voltage monitoring
 - Inverter output frequency detection
 - Residual current protection
 - DC injection of AC output current surveillance
 - Anti-islanding protection
 - Ambient temperature monitoring
 - DC over-voltage protection
 - Over-current protection
 - Power module over-temperature protection

2.3.3 Derating

Output derating is a way to protect the inverter from overload or potential faults.

Situations require inverter power derating are:

- Internal temperature is too high (including ambient temperature and module temperature)
- Grid voltage is too low
- External power class adjustment
- Grid frequency is too high^[*]

Note: [*] valid only when the country selected is DE or IT.

Power Limit Setting

Inverter output power can be adjusted via the LCD display or remote grid dispatch from the grid company.

Over-temperature Derating

High ambient temperature, fan broken or poor ventilation will lead to inverter power derating.

- When the module temperature exceeds the upper limit, inverter will derate power output until the temperature drops within the permissible range.
- When the internal temperature exceeds the upper limit, inverter will derate power output until the temperature drops within the permissible range.

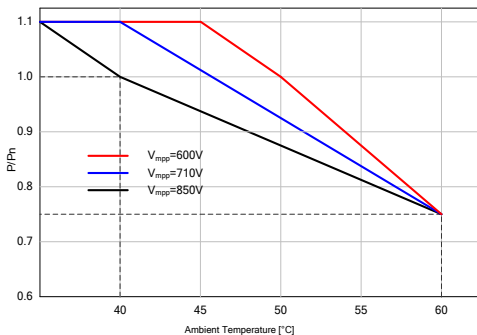


Fig. 2-6 Over-temperature Derating (Pf=1)



Lower limit of the over-temperature derating: 75% of the nominal power.

If the module temperature and internal temperature reach to power derating conditions, inverter will derate the power output according to the lower temperature between the two.

Grid Under-voltage Derating

When grid voltage is low, inverter will derate the output power to make sure the output current is within the permissible range. Once the grid voltage is within $V_{min} \dots 215V$, inverter will derate the output power.

$$P_{[V_{min} \dots 266V]} = P_n \times (V_{grid} / 230V)$$

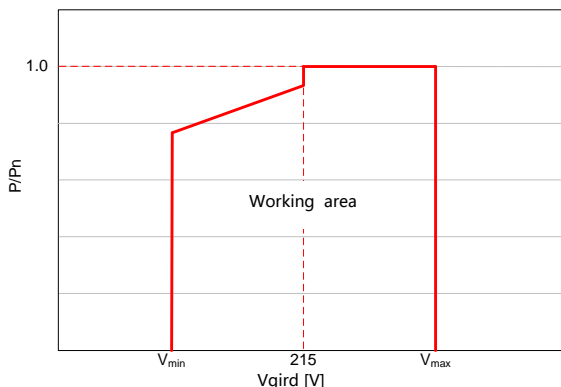


Fig. 2-7 Grid under-voltage derating(Pf=1)

3 Installation Flow

Fig. 3-1 shows the installation flow of the inverter and Tab. 3-1 gives the detailed explanation.

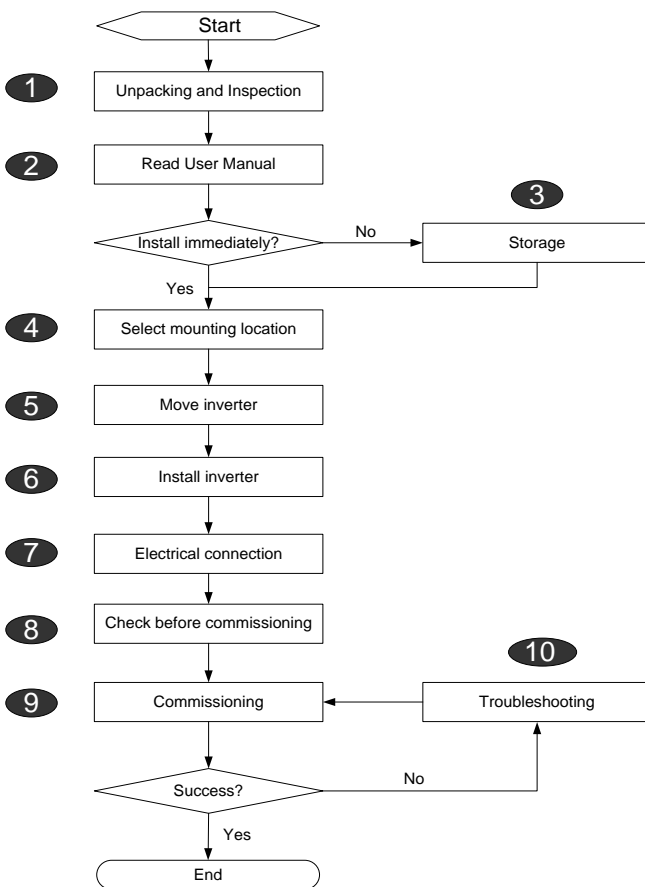


Fig. 3-1 Installation flow

Tab. 3-1 Description of installation flow

Step	Description	Reference
1	Unpacking and inspection	4.1
2	Read the User Manual, especially the section on "Safety Instruction"	1
3	Store the inverter if it is not to be installed immediately	4.4
4	Select optimal installation site	5.1
5	Move the inverter to the installation site	5.2
6	Install the inverter to the selected installation site	5.3
7	Electrical connection; DC side connection; AC side connection; Ground connection; Communication connection.	6.3~6.7
8	Inspection before commissioning	7.1
9	Start up the inverter and configure corresponding parameters.	7.2
10	Troubleshooting	9.1

4 Unpacking and Storage

4.1 Unpacking and Inspection

Although being strictly tested and checked, damages may still occur to the inverter during shipping. Therefore, the first thing you should do after receiving the device is to conduct a thorough inspection.

- Check the packing for any visible damage upon receiving.
- Check the completeness of delivery contents according to the packing list.
- Check the inner contents for damage after unpacking.

If any damage is found, please contact Sungrow or the forwarding company.

Do not disposal of the original packaging. It is best to store the inverter in its original packaging.

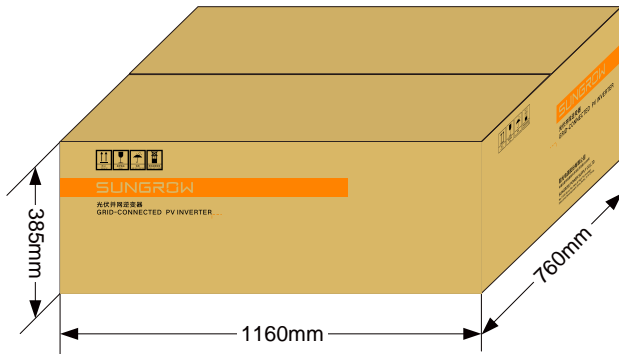


Fig. 4-1 Inverter paper packaging

4.2 Identifying Inverter

The nameplate is attached to one side of the inverter and the packaging carton respectively. It provides information on type of inverter, important specifications,

marks of certification institutions, and serial number which is available and identified by Sungrow.

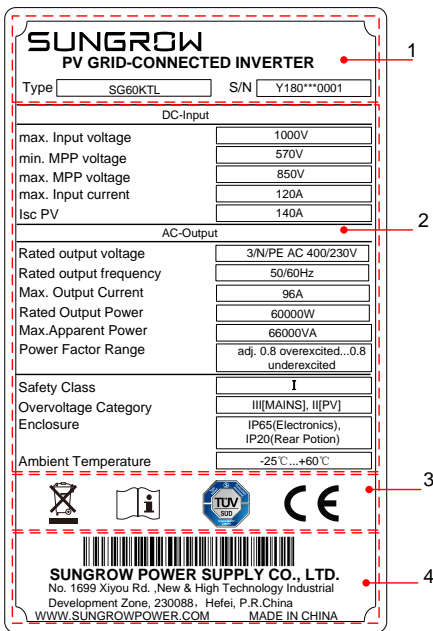


Fig. 4-2 Inverter nameplate

*Image shown here is indicative only. Product in kind prevail.

Item	Description
1	SUNGROW logo and product type
2	Inverter technical data
3	Marks of certification institutions
4	Company name, website and origin

Tab. 4-1 Description of icons on the nameplate

icon	Description
	Do not dispose of the inverter with household garbage.
	Refer to corresponding instructions.
	TUV mark of conformity. The inverter is in compliance with directives of TUV.



CE mark of conformity.
The inverter is in compliance with directives of CE.

4.3 Scope of Delivery

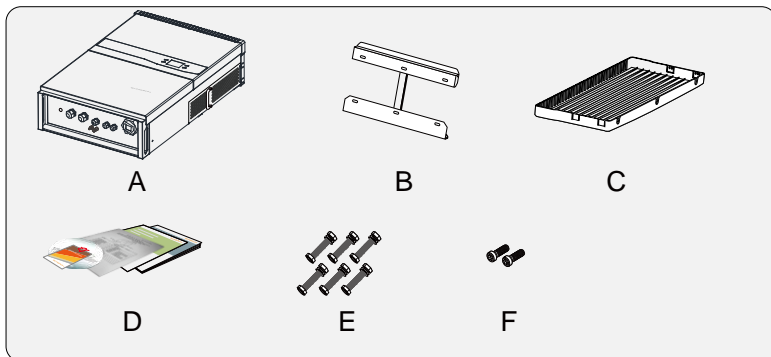


Fig. 4-3 Scope of delivery

Item	Name	Description
A	Inverter	---
B	Backplate	Used to fix the inverter to the installation site.
C	Inverter cap	For better weather-proof function of the inverter.
D	Documents	Quality certificate, packing list, product test report, CD and quick user manual
E	Fasten set	Six units to fasten backplate to metal frame.
F	Fix screw	Two M4×16 screws to fix the inverter with the backplate.

4.4 Inverter Storage

Store the inverter properly when the inverter is not to be installed immediately. Sungrow shall hold no liability for the corrosion of the device or the failure of device internal components caused by storage of the device not following the requirements specified in this manual. Inverter must be packed into its original carton with the desiccant bags inside.

- Seal the packing carton with adhesive tape.
- Store the inverter in a dry and clean place to protect it against dust and moisture.
- Relative temperature: -30°C...70°C; Relative humidity: 0-95%.

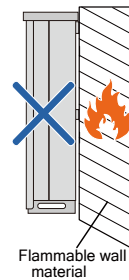
- If one inverter is stacked on top of the other inverter, the max. stack layer should be two.
- Keep distance from the chemical corrosive materials to avoid possible corrosion.
- Periodically (recommended: six months) check for any visible damages during the storage period. Replace the packing in time if necessary.
- The packing should be upright.
- If the inverter has been stored more than half a year, the qualified persons should thoroughly check and test it before using.

5 Mechanical Installation

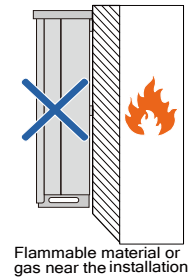
5.1 Installation Site Selection

Select an optimal installation site for install safe operation, long service life and outstanding performance.

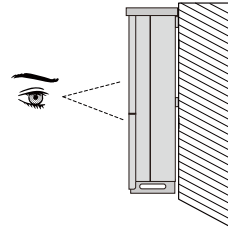
- Take the load capacity of the wall into account. The wall (concrete wall or metal frame) should be strong enough for the weight of the inverter over a long period.
- Install the inverter where is convenient for electrical connection, operation and maintenance.
- Do not install the inverter on the wall made up of flammable materials.



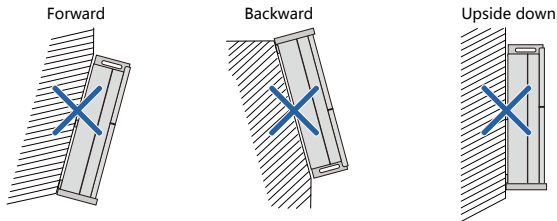
- Do not install the inverter near flammable materials or gas.



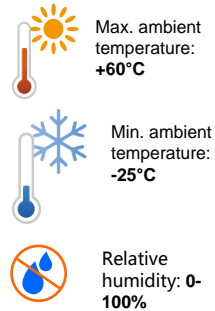
- Install the inverter at eye-level for easy button operation and display read.



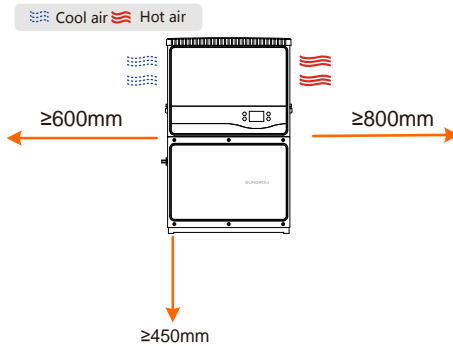
- Do not install the inverter upside down or with an inclination.



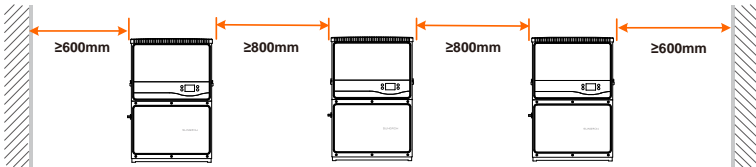
- With an IP65 protection rating, the inverter can be installed both outdoors and indoors.
- The ambient temperature should be within -25°C to 60°C . Inverter will operate with power derating if temperature is too high.
- The relative humidity range of the installation site is 0-100%.



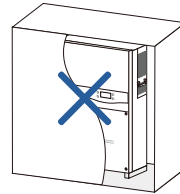
- Do not expose the inverter to direct sunlight or rain or snow. Shaded installation site is preferred.
- Ensure there is enough space for convection (The fans are maintained on the left side of the inverter, and a larger clearance is required.)



- When installing multiple inverters, it is recommended to install multiple devices side by side.



- Do not install the inverter in a confined space. Inverter will not work normally if otherwise.
- Install the inverter where children cannot reach.
- Do not install the inverter near residential area. Noise can be produced during inverter operation which may affect the daily life.



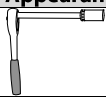






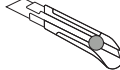


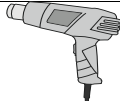

5.2 Moving Inverter to Installation Site

To install the inverter, remove the inverter from the packaging and move it to the installation site. Follow the instructions below during inverter moving:

- Always keep in mind the weight of the inverter.
- Lift the inverter by grasping the handles on two sides of the inverter.
- Move the inverter by two persons or proper moving devices.
- Do not release the equipment unless it has been secured to the wall firmly.

5.3 Installation Tools

Prepare the following tools before installation:

Tool	Description	Appearance
Socket wrench	Used to fasten the bolts for attaching the bracket onto the metal frame/wall	
Phillips screwdriver	Used to fasten the screws for attaching the inverter onto the bracket Used to fasten the screw for fixing the secondary ground cable	
Hammer drill	Used to drill holes on the metal frame or wall	
Electric screwdriver	Used to fix the bracket onto the wall	
Marker	Used to mark the hole positions	
Measuring tape	Used to measure distances during installation	
Safety gloves	To avoid or reduce injury	
Utility knife	Used for unpacking or cutting	
Wire stripper	Used for cable stripping	
Hydraulic pliers	Used to crimp the OT terminal	
Heat gun	Used to heat the heat-shrink tubing	
Multimeter	Measurement range: $\geq 1100\text{Vdc}$ Used to measure the voltage	

- Other auxiliary tools that may be used

5.4 Installing the Inverter

Inverter is installed to the wall by the backplate enclosed in the packing. If you do not use the supplied backplate, you can drill holes as per specifications below:

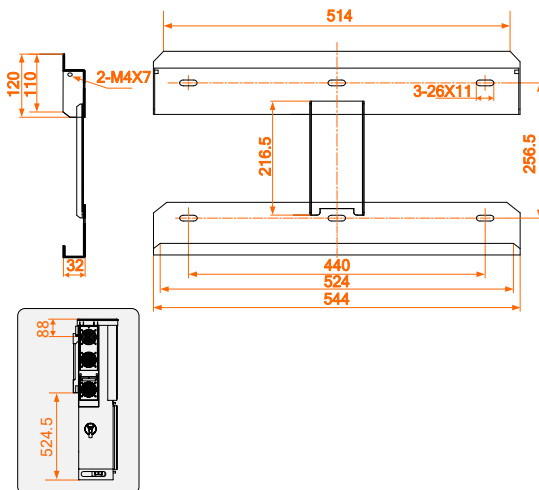


Fig. 5-1 Dimensions of the backplate (figures in mm)

The stainless fasteners are supplied for attaching the backplate to metal frame.

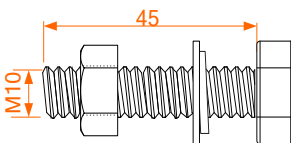


Fig. 5-2 Dimensions of fastener for metal frame (figures in mm)



To install the inverter to concrete walls, user needs to purchase expansion bolts with proper size (recommended: M10*65) to fix the backplate to the concrete walls.

5.4.1 Installing to Metal Frame

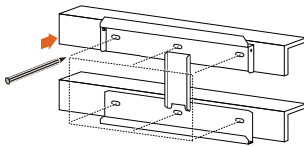
Step 1 Remove the backplate and fasteners from the packaging.

Step 2 Place the backplate to the chosen metal frame and adjust it to proper position and height.

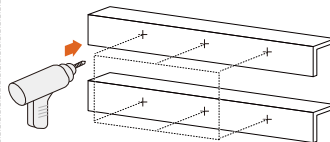
Step 3 Mark the position for holes drilling according to the holes position of the backplate.

Step 4 Drill holes according to the marks make before. If the shape of the metal frame does not match the backplate, re-drill holes on the backplate according to the metal frame chosen.

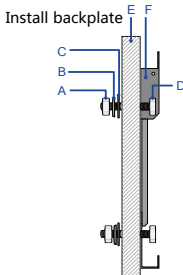
Mark positions



Drill holes



Step 5 Secure the backplate to the metal frame firmly by the supplied fastener. Torque of the fastener is 35 N·m.

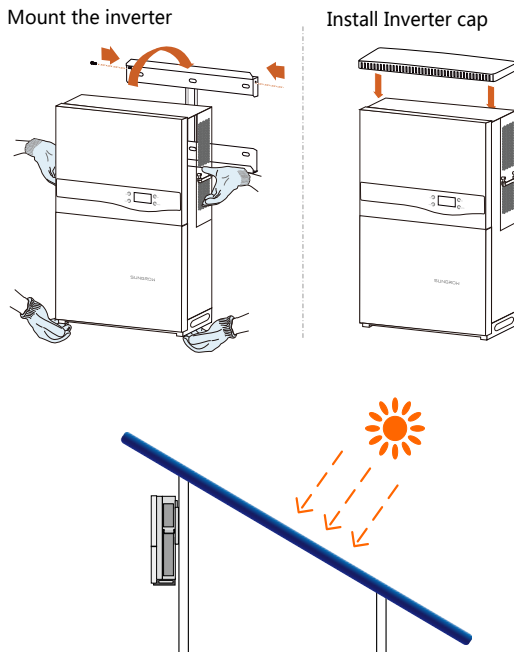


No.	Name	Description
A	Hexagon nut	M10
B	Spring washer	-
C	Flat washer	-
D	Screw bolt	M10*45
E	Metal frame	-
F	Backplate	-

Step 6 Install the inverter cap.

Step 7 Lift the inverter above the backplate and then slide down to make sure they match perfectly.

Step 8 After putting the inverter on the backplate, secure the inverter to the backplate with two M4×16 screws (fix screw hole has its own nut).

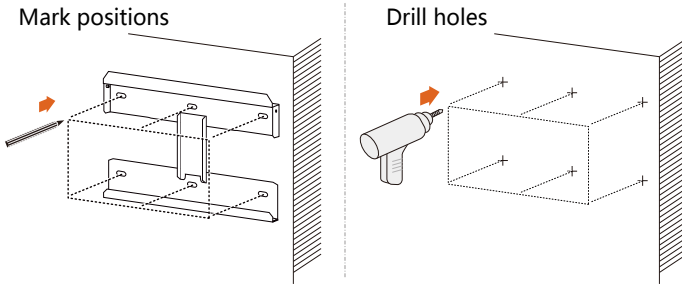


5.4.2 Installing to Concrete Wall

- Step 1** Remove the backplate and corresponding fasteners from the packaging.
- Step 2** Place the backplate to the chosen concrete wall and adjust it to proper position and height.
- Step 3** Mark the position for holes drilling according to the holes position of the backplate.
- Step 4** Drill holes according to the marks make before.

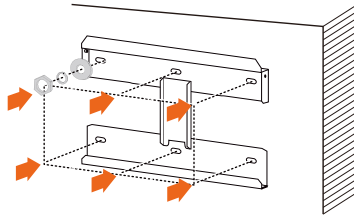
⚠ DANGER

Check to ensure that there is no other electronic or plumbing installation inside the wall before drilling holes.



Step 5 Secure the backplate to the wall firmly by the supplied expansion bolt sets. Torque of the fastener is 35 N·m.

Install backplate

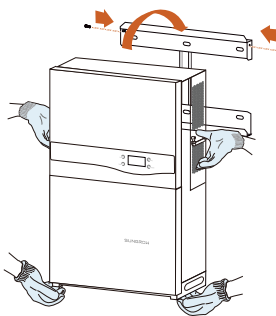


Step 6 Install the inverter cap.

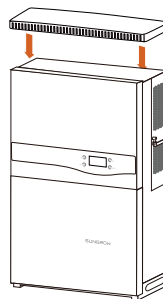
Step 7 Lift the inverter above the backplate and then slide down to make sure they match perfectly.

Step 8 After putting the inverter on the backplate, secure the inverter to the backplate with two M4×16 screws (fix screw hole has its own nut).

Mount the inverter



Install Inverter cap



6 Electrical Connection

Once the inverter is secured to the installation site, it can be connected to the PV system.

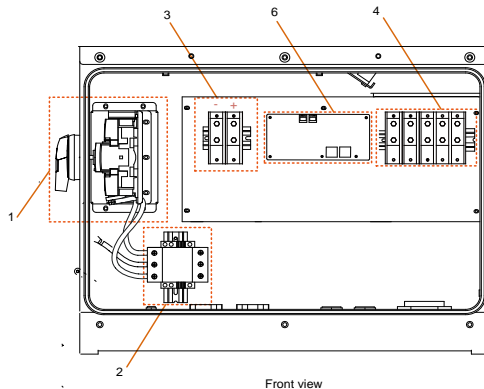
All electrical connection must comply with local regulations and related electrical rules (AS 4777.1 etc.).

WARNING

- **Improper cable connection may lead to fatal personal injury or device permanent damages.**
- **Cable connection can be done only by professional personnel.**
- **Always keep in mind that the inverter is dual power supplied. Electrical operators must wear proper personal protective equipment: helmet, insulated footwear and glove, etc.**

6.1 Terminal Description

Inverter electrical connection terminals and cable entries are all at the inverter junction box as shown in Fig. 6-1.



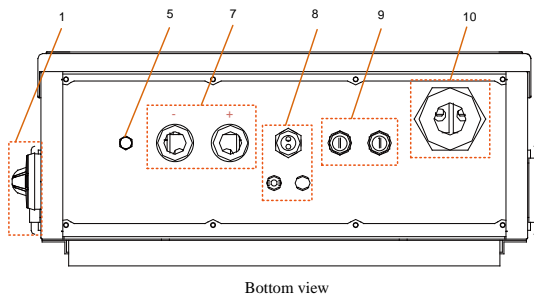


Fig. 6-1 Cable connection area

*Pictures are indicative only. Please in kind prevail.

No.	Description	No.	Description
1	DC switch	6	Configuration circuit board
2	DC SPD	7	DC cable glands
3	DC crimping terminal	8	Redundancy interface
4	AC crimping terminal	9	Communication cable glands
5	Waterproof air valve	10	AC cable gland

6.2 AC Side Cable Connection

6.2.1 AC side requirements



Connection to the utility grid must be done only after receiving approval from the local company.

Before grid-connection, verify to make sure the grid voltage and frequency meet the requirements of the inverter. Contact the local grid company for solution if otherwise. For detailed parameter, please refer to 11.1 Technical Data.

AC Circuit Breaker

An independent three or four-pole circuit breaker is installed outside the output side of the inverter to ensure that the inverter can be disconnected safely.

Inverter	Recommended AC circuit breaker
SG60KTL	120A

NOTICE

- **It is not allowed for several inverters to use one circuit breaker.**
- **It is not allowed to connect loads between inverter and circuit breaker.**

Residual Current Device

With an integrated comprehensive residual current monitoring unit inside, the inverter is able to distinguish the fault current from normal capacitive leakage current. Inverter will disconnect from the grid as soon as a fault current of more than limit value is detected.

If an external RCD or residual current breaker is installed, the switch should be triggered when the fault current is 600mA or higher.

Multiple Inverters in parallel Connection

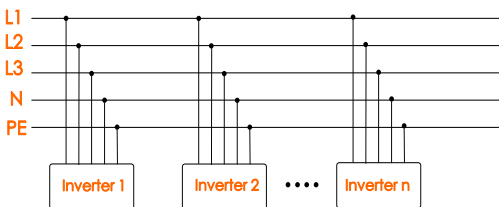
The following different requirements must be respected if several inverters are in parallel connection to the grid.

- Scenario 1:

Several inverters are in parallel connection to the 3-phase low voltage grid

Requirements:

If the number of the grid-connected inverters exceed 40, please contact Sungrow to confirm the technical solution.



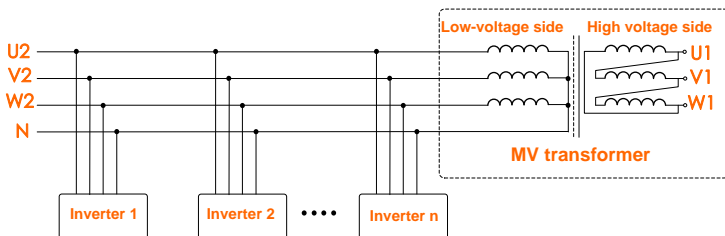
- Scenario 2:

Several inverters are in parallel connection to the low voltage side of the MV transformer. The high voltage side is connected to the middle voltage grid.

Requirements:

If the number of the grid-connected inverters exceed 40, please contact Sungrow to confirm the technical solution.

Nominal power of the transformer low voltage side matches the inverter output power.



Medium-voltage Transformers

The following requirements must be observed when installing medium-voltage transformers:

- The transformer for the inverter can be a distribution transformer, however it must be designed for the typical cyclical loads of a PV system (load in the day and possibly no load at night).
- The transformer can be of the liquid-immersed type or dry type. Shield winding is not necessary.
- The line-to-line voltage on the low-voltage side of the transformer must endure the output voltage of inverter. When connecting to the IT grid, the withstanding voltage of the low-voltage winding side of the transformer, the AC cables and the secondary devices (including the relay protection, detection & measuring, and other related auxiliary devices) to the ground should not be lower than 1000V.
- The line-to-line voltage on the high-voltage side of medium-voltage transformer should comply with the power grid voltage of installation site.
- A transformer with a tap changer on the high-voltage side is recommended in order to remain consistent with the grid voltage.
- At an ambient temperature of 25°C, transformers should withstand 110% of total load rating.
- Transformer with a short-circuit impedance less than 6% is recommended.

- For thermal rating, the load curve of the transformer and the ambient conditions at the respective installation site must be taken into account.
- The inverter apparent power is not permitted to exceed the transformer power. The maximum nominal AC current of all connected inverters must be taken into account. If the number of the grid-connected inverters exceed 40, please contact Sungrow.
- The transformer must be protected from overloading and short circuiting.
- The transformer is an important part of grid-connected PV generation system. The fault carrying capacity of the transformer should be taken into account at all times. The fault types include: system short-circuit, grounding fault, voltage drop, and etc...
- Ambient temperature, relative humidity, altitude, air quality, and the relevant indexes should be taken into account at all times.
- The country-specific power grid frequency should be taken into account at all times.
- The country-specific standards and directives should be taken into account at all times.

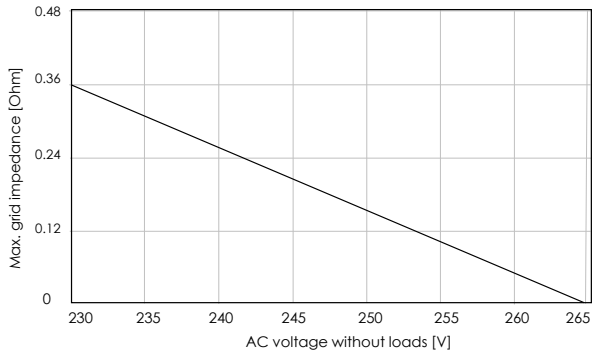
6.2.2 Grid Connection

AC terminal block is on the bottom of the inverter. AC connection is the three-phase-five-wire grid connection (L1, L2, L3, N and PE).

AC Cable Requirements

Select AC cables according to the following factors:

- Grid impedance corresponds to the specifications below to avoid accidental short-circuit or output power derating.



- Considering the voltage drop and other conditions, please enlarge the cable dimension. Power loss of the cable should be less than 1% of the nominal power.
- Withstand ambient temperature.
- Cable layout (inside wall, underground, free air, etc.)
- UV resistance, and so on.

Connecting Inverter to Grid

⚠ DANGER

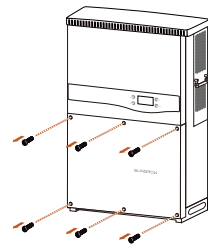
High voltage inside the inverter!

Ensure all cables are voltage-free before electrical connection.

Do not connect the AC circuit breaker until all inverter electrical connections are completed.

Step 1 Disconnect the AC circuit breaker and ensure it will not reconnect accidentally.

Step 2 Unscrew the 6 bolts on the front cover of the lower junction box.



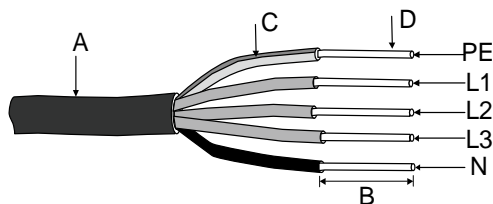
Step 3 Peel the cables as shown below.



The AC cables must be Hard-line.

Customer can choose to connect the neutral cable or not, it's not mandatory to connect the neutral cable to the inverter.

The cross-section of the AC cable must be selected carefully in order to prevent accidentally disconnections of the inverter from the grid due to high impedance of the cable.



No.	Description	Remark
A	Protective layer	External diameter of the cable: 30-50 mm
B	Length of insulation to be stripped off	24 mm
C	Insulation layer	-
D	Cross section of AC cables	Range: 25-150mm ² ; recommended value: 50 mm ²

The following table gives the recommended max. length of the AC cables based on the cross-section of the AC cables.

Cross-section of the AC cable (mm ²)	Max. length of the AC cables (m)
25	0-50
35	50-100
50	>100

Step 4 (Optional) If the outer diameter of the AC cable you choose is too thick, then take the fastening nut away from the AC cable gland, and remove the rubber loop with your hand.



Peel the plastic film on one end of the AC cable gland with proper tools before AC cable connection. Only the AC cable gland itself needs to be replaced; other accessories (packing nuts) can still be used.

Step 5 Fix the AC cable to the corresponding terminals with torque shown in the follow two tables.

Tab. 6-1 Screw tightening torque

Cable section(mm ²)	Screw tightening torque(N·m)	
	Min	Max
26.7~42.3	9.8	13.6
53.5~67.4	11.9	16.3
70~107	15.8	22.6
127~177	19.8	29.4

The table values are to used for the following cable type:

- 1.Copper stranded(including sector);
2. Aluminum solid(including sector).

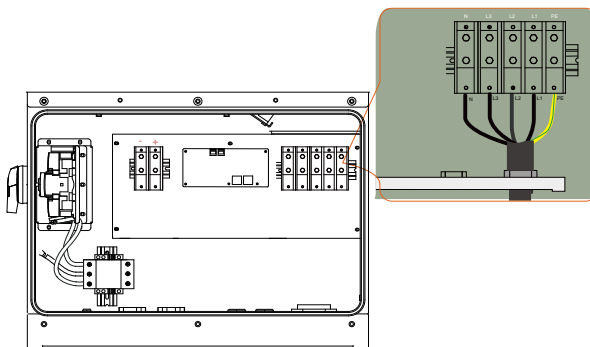
Tab. 6-2 Screw tightening torque

Cable section(mm ²)	Screw tightening torque(N·m)	
	Min	Max
26.7~42.3	7.9	10.8
53.5~67.4	9.5	13.0
70~107	12.7	18.1
127~177	15.8	23.5

The table values are to used for the following cable type:

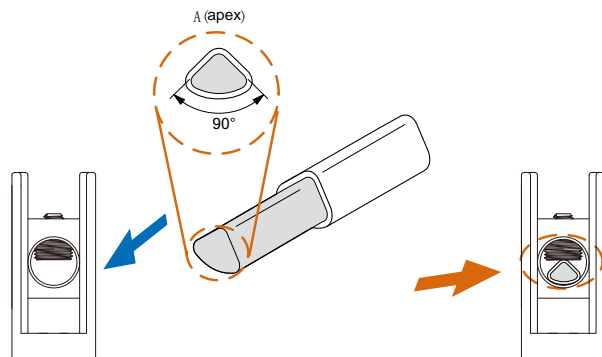
- 1.Aluminum stranded.

Step 6 Pull the cable gently to make sure it is secured.



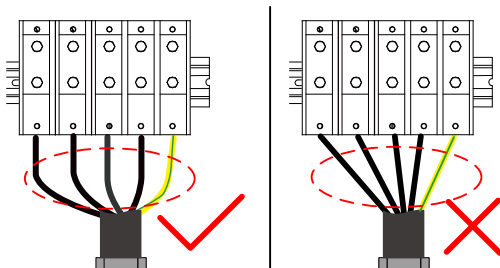
* Pictures here are indicatively only. Product in kind prevail.

If the cross-section of the AC cable is sectorial, please place the apex(A) of sector upside and then fix the AC cable to the corresponding terminals..



NOTICE

- **Observe the AC terminal layout. Device will not work normally if the phase cable is connected to the PE terminal.**
- **Do not squeeze or press the cable insulation layer. Improper connection may affect the normal operation of the inverter.**
- **During AC cable connection, the cables inside the lower part of the device should be bent to be surplus in length. In this way, cable dropping or loosening, which can cause arc or other problems impairing functionality of the device, due to self-weight of the cables in case of land subsidence is avoided.**



Step 7 Screw the cap nut to the cable.

Step 8 Seal the gaps between the AC cable and the gland inside the lower part of the cabinet by fireproofing mud.

NOTICE

Seal the gap between the cable and the gland with fireproofing mud or other suitable materials to prevent the entry of foreign bodies or moisture and ensure long-term and normal operation of the inverter.

6.3 PV Array Connection

 DANGER

Lethal voltage exists!

PV arrays produce electrical energy when exposed to light and thus can create an electrical shock hazard.

 DANGER

Make sure that the PV impedance to the ground is proper before connecting the PV array to the inverter.

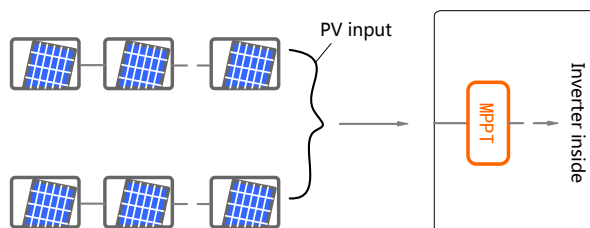
6.3.1 PV Input Configuration

Inverter has a PV input area and a MPP tracker is equipped.

NOTICE

The following two requirements must be respected. Ignorance of them may void any or all warranty rights.

- The inverter internal cable connection cabinet does not equip any positive or negative fuse. During system design, you can follow the local regulations to configure or not configure the external fuse to the positive and negative cables of the string.
- Make sure the voltage of each PV array is less than 1000V at all times. Irrevocable damage may follow if otherwise.
- Make sure the max. short-circuit current of the DC side is within the permissible range. Irrevocable damage may follow if otherwise.

**NOTICE**

To make full use of the DC input power, the PV string should be with a homogenous structure: including the same type, the same number of PV cells, identical tilt and identical orientation.

Before connecting PV array to inverter, the following electrical parameters must be met.

Total DC power limit	Max. open-circuit voltage limit for each input	Short-circuit current limit
67500W	1000V	140A

Considering the negative voltage temperature coefficient of PV cells, more attention should be paid to the open-circuit voltage of PV strings when the ambient temperature is the lowest. Meanwhile please notice that the max. open-circuit voltage of each PV string decreases with the increase of the altitude.

Take YL250P-29b PV cells for example.

Item	Parameter
PV cell type	YL250P-29b
Power	250W
Open-circuit voltage (STC)	37.6V
Short-circuit current (STC)	8.92A
Open-circuit voltage temperature coefficient (β)	-0.32%/°C
No. of PV cells in a PV string	23

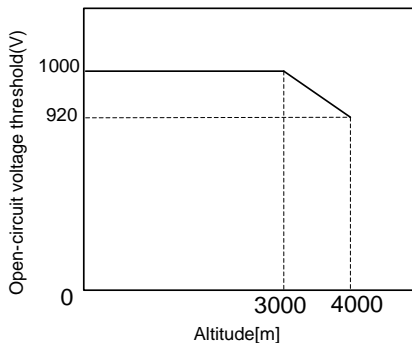
Under the STC condition, where ambient temperature is 25°C, the open-circuit voltage of PV cells is $37.6V \times 23 = 864.8V < 1000V$.

Supposed that the lowest temperature is -25°C, the open-circuit voltage of PV cells is $23 \times 37.6V \times [1 + \beta \times (\text{min. ambient temperature} - \text{STC temperature})] = 23 \times 37.6V \times [1 + (-0.32\%/^{\circ}\text{C}) \times (-25^{\circ}\text{C} - 25^{\circ}\text{C})] = 990V < 1000V$ (meet the operation requirement).

Therefore, PV string should be designed to meet the open-circuit voltage requirement even under the lowest ambient temperature condition.

The curve relationship between the open-circuit voltage threshold and the altitude

is shown below.



6.3.2 PV Input Connection

DC Cable Requirements

The cross-section of the DC cable must be selected carefully in order to prevent accidentally disconnections of the inverter from the grid due to high impedance of the cable.

Tab. 6-3 DC cable requirements

Cross-sectional area	Cable External diameter	Max. withstand voltage	Max. input current
35~150mm ²	14~32mm	1000V	120A

DC Cable Connection

DANGER

High voltage inside the inverter!

Make sure all DC and AC cables connected to the inverter are voltage-free before electrical connection.

Do not connect the AC circuit breaker before electrical connection is completed.

Step 1 Peel the cable.



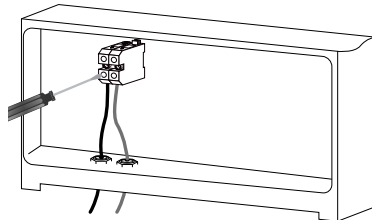
The DC cables can be Hard-line&flexible wires.

Step 2 (Optional) If the outer diameter of the DC cable you choose is too thick, then

take the fastening nut away from the DC cable gland, and remove the rubber loop with your hand.

Step 3 Fix the DC cable to the corresponding terminals with torque shown in the “Tab. 6-1 Screw tightening torque” and “Tab. 6-2 Screw tightening torque”.

Step 4 Pull the cable gently to make sure it is secured.



* Pictures here are indicatively only. Product in kind prevail.

Step 5 Screw the cap nut to the cable.

Step 6 Seal the gaps between the DC cable and the gland inside the lower part of the cabinet by fireproofing mud.

NOTICE

Seal the gap between the cable and the gland with fireproofing mud or other suitable materials to prevent the entry of foreign bodies or moisture and ensure long-term and normal operation of the inverter.

6.4 Grounding the Inverter

WARNING

Due to the transformer-less design of the inverter, neither the DC positive pole nor the DC negative pole of the PV string can be grounded.

6.4.1 Grounding System Overview

In this PV system, all non-current carrying metal parts and device enclosure should be grounded (such as the PV array frame and inverter enclosure).

When there is only one inverter in the PV system, ground the PE cable.

When there are multiple inverters in the PV system, they can be multi-point grounded. Connect PE cables of all inverters and the mounting metal frames of PV array to the equipotential cable (according to the on-site situation) to realize equipotential connection.

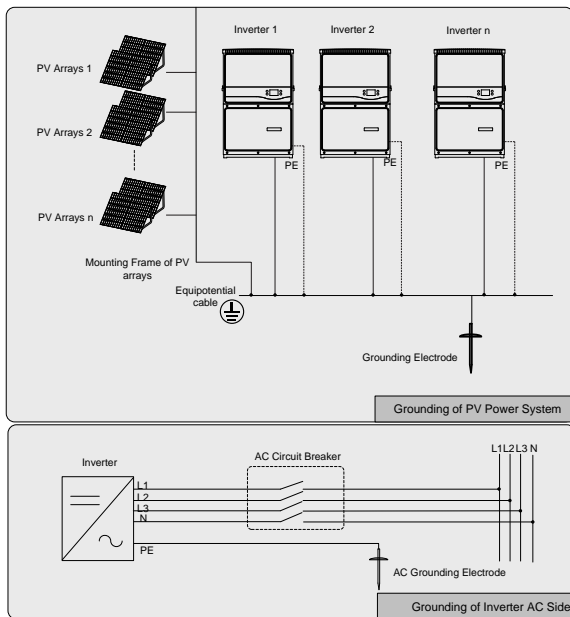


Fig. 6-2 Grounding of inverter

6.4.2 Second Protective Earth Terminal

There is a second PE terminal on one side of the inverter and it should be grounded.

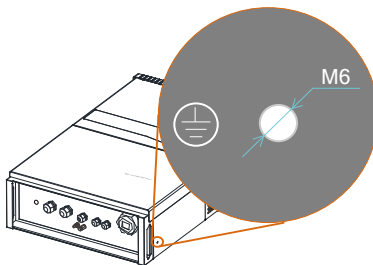


Fig. 6-3 Second PE terminal

WARNING

The ground connection of this second PE terminal cannot replace the connection of the PE terminal of the AC cables. Make sure the two PE terminals are all grounded reliably.

Cable Connection

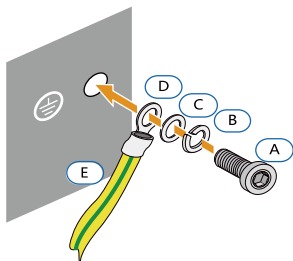


Fig. 6-4 Second PE connection

* Connection parts are not within the scope of delivery

Item	Name	Description
A	Screw	M6×12mm
B	Lock washer	-
C	Washer	-
D	Cable socket	-
E	Grounding cable*	-

*the cross-sectional area of the grounding cable shall be exactly the same with that of the PE cable of the AC cable.

6.5 Communication Connection

6.5.1 Communication Overview

There are two communication waterproof connection terminal on the bottom of the inverter. RS485 A/B terminals and RS485 interface are provided on the configuration circuit board of the junction box. A 120Ω terminating resistor can be connected between the A and B communication cable through the dip switch.

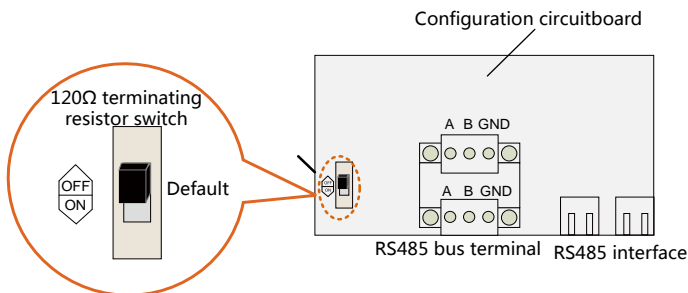


Fig. 6-5 Communication configuration

Inverter operation information can be transferred to the PC of the installed monitoring software or to a local data logging device through RS485 communication connection.

Prepare communication cable and RJ45 plug before communication connection.

NOTICE

RS485 communication cables should be:

- **Shielded twisted pair cables or Shielded twisted pair Ethernet cable.**



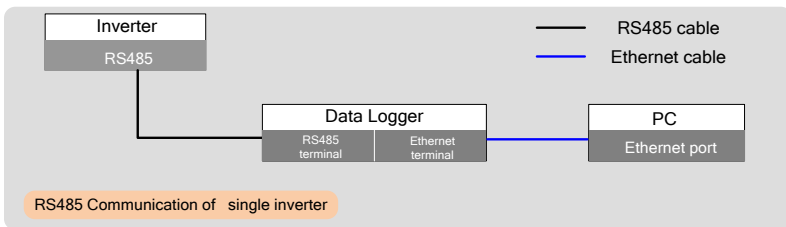
A converter such as Logger 3000 is needed to convert signal between inverter and PC.

Network interface is an optional function. Contact Sungrow if necessary.

6.5.2 RS485 Communication System

For Single Inverter

Where there is only one inverter, a RS485 cable can guarantee the communication connection.



Inverter	Communication connection (RS485 bus connection or RS485-RJ45 connection)		Terminating Resistor
	RS485 bus	RJ45	
Single inverter	Only out 	Only out RS485 in RS485out 	No 120ohM

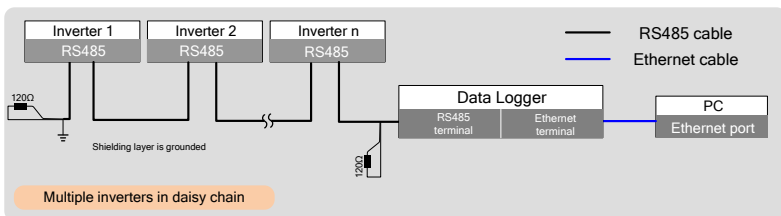
For Multiple Inverters

If there are multiple inverters, all the inverters can be connected for communication via the RS485 communication cables in the daisy chain manner. When more than 15

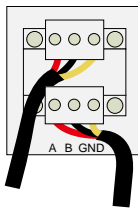
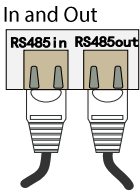


inverters are connected on the same daisy chain, the inverters on two ends of the chain should be equipped with 120-Ω terminal resistors to ensure communication quality, and the shielding layer of the communication cable should be single-point grounded.



- The length of RS485 communication cable should be less than 1200m.
- If multiple inverters are connected and connected to the Logger 3000, the maximum number of daisy-chains supported and the number of devices allowed to be connected must meet the device requirements (see the user manual for the Logger 3000).



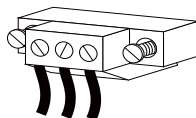
Inverter	Communication connection (RS485 bus connection or RS485-RJ45 connection)			
	RS485 bus	RJ45	n ≤ 15	n > 15
Inverter 1	<p>Only out</p>	<p>Only in out</p>	<p>No</p>	<p>Yes</p>
Inverter 2~n-1	<p>In and Out</p>	<p>In and Out</p>	<p>No</p>	<p>120ohm</p>

Inverter	Communication connection (RS485 bus connection or RS485-RJ45 connection) or Terminating Resistor			
	RS485 bus	RJ45	n ≤ 15	n > 15
In and Out				
Inverter n			120ohm OFF ON	120ohm OFF ON

6.5.3 RS485 Communication Connection

RS485A/B Bus Connection

- Step 1** Lead Network cable through communication cable gland to the configuration circuit board.
- Step 2** Strip off the insulation layer of the communication cable. Connect the A, B, and GND of RS485 communication cable to corresponding terminals according to the marks on the configuration circuit board.



- Step 3** According to the position of the inverter (refer to the prior section), repeat step 1...2 to connect the other RS485 cables.
- Step 4** Pull cables outwards to confirm whether they are fastened firmly.
- Step 5** According to the position of the inverter (refer to the prior section), switch ON or OFF the terminating resistor.
- Step 6** Tighten the tread-lock sealing lock. Block off the vacant terminals to protect the dust and moisture penetrating inside the inverter.
- Step 7** Seal the gaps between the cable and the gland inside the lower part of the cabinet by fireproofing mud. If there is no other connection procedure, reassemble and fix the front cover of the connection cabinet.

NOTICE

Seal the gap between the cable and the gland with fireproofing mud or other suitable materials to prevent the entry of foreign bodies or moisture and ensure long-term and normal operation of the inverter.

Step 8 Connect the communication devices. Refer to other manuals and documents if there are other devices.

Step 9 Confirm the communication connection and set the communication parameters.



If more than one inverter is connected to PC or Logger, please set the communication parameters from the LCD display. For more information, please refer to 10.12 Communication Parameter Setting.

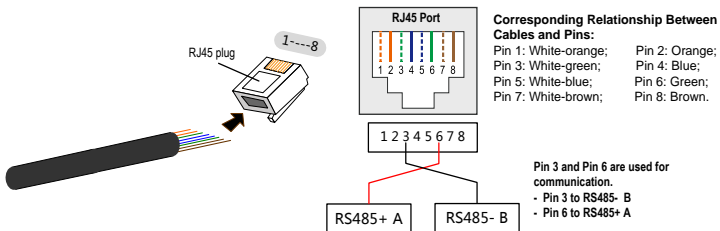


Logger 3000 is optional parts and can be ordered from Sungrow.

RJ45-RS485 Communication Connection

Step 1 Lead Network cable through communication cable gland to the configuration circuit board.

Step 2 Use the Ethernet crimping tool to crimp the cables and connect cables to RJ45 plug according to TIA/EIA 568B. In Ethernet cable, Pin 3 white-green cable defines RS485- B while Pin 6 green cable defines RS485+ A.



Step 3 Connect the RJ45 plug into the RS485 in/RS485 out terminal on the configuration circuit board.

Step 4 According to the position of the inverter (refer to the prior section), repeat step 1...3 to connect the other RS485 cable to the RS485 out/RS485 in terminal.

Step 5 Pull cables outwards to confirm whether they are fastened firmly.

Step 6 Tighten the tread-lock sealing lock. Block off the vacant terminals to protect the inverter's internal from dust and moisture.

Step 7 According to the position of the inverter (refer to the prior section) switch ON or OFF the terminating resistor.

Step 8 Seal the gaps between the cable and the gland inside the lower part of the cabinet by fireproofing mud. If there is no other connection procedure, reassemble and fix the front cover of the connection cabinet.

NOTICE

Seal the gap between the cable and the gland with fireproofing mud or other suitable materials to prevent the entry of foreign bodies or moisture and ensure long-term and normal operation of the inverter.

Step 9 For the wires which connect to the logging devices, use the Ethernet wire stripper to strip the insulation layer and connect the RS485 A and B cables to data logging device. Pin 3 white-green cable defines RS485- B while Pin 6 green cable defines RS485+ A.

Step 10 Refer to other manuals and documents if there are other devices.

Step 11 Confirm the communication connection and set the communication parameters.



If more than one inverter is connected to PC or Logger, please set the communication parameters from the LCD display. For more information, please refer to 10.12 Communication Parameter Setting.



Logger 3000 is optional parts and can be ordered from Sungrow.

7 Commissioning

Commissioning is a critical part for a PV system, which can protect the system from fires, injury and electrical shock.

7.1 Inspection before Commissioning

Before starting the inverter, you should check the following items.

1. Inverter is accessible for operation, maintenance and service.
2. Check again to confirm that the inverter is firmly installed onto the wall.
3. Well ventilation.
4. Leave nothing on top of the inverter.
5. Inverter and accessories are correctly connected.
6. Cables are routed in safe place or protected against mechanical damage.
7. Specification of AC circuit breaker is reasonable.
8. Terminals not used underneath the inverter are sealed.
9. Warning signs & labels are suitably affixed and durable.
10. If the inverter has been stored more than half a year, the qualified persons should thoroughly check and test it before using.

7.2 Commissioning Procedure

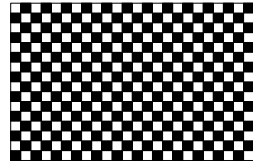
If all checking items mentioned above meet the requirements, proceed as follows to start up the inverter for the first time.

Step 1 Rotate the DC switch of the inverter to "ON" position.

Step 2 Connect the AC switch (if applicable) between the inverter and the grid.

Step 3 Connect the DC switch (if applicable) between the inverter and the PV string.

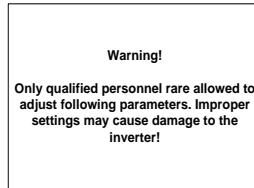
Step 4 Suppose there are sufficient sunlight and enough DC power. PV arrays initialize and supply DC power to inverter. The LCD display is activated when DC voltage exceeds inverter startup voltage. If there is a defect on the display, contact Sungrow.



Step 5 Press ▼ to choose country code. Confirm the settings by **Pressing ENTER**.

Countries											
<input type="radio"/>	GB	<input checked="" type="radio"/>	DE	<input type="radio"/>	FR	<input type="radio"/>	IT				
<input type="radio"/>	ES	<input type="radio"/>	AT	<input type="radio"/>	AU	<input type="radio"/>	CZ				
<input type="radio"/>	BE	<input type="radio"/>	DK	<input type="radio"/>	GR	<input type="radio"/>	NL				
<input type="radio"/>	PT	<input type="radio"/>	CN	<input type="radio"/>	SE	<input type="radio"/>	RO				
<input type="radio"/>	TH	<input type="radio"/>	TK	<input type="radio"/>	AE	<input type="radio"/>	IR				
<input type="radio"/>	HN	<input type="radio"/>	KR	<input type="radio"/>	ZAF	<input type="radio"/>	CHL				
<input type="radio"/>	BRA	<input type="radio"/>	TPE	<input type="radio"/>	IND	<input type="radio"/>	other				

Step 6 Select the country code according to the installation country of the inverter. Each country code represents corresponding local protective parameters that have been preset before delivery. Before country setting, there is warning screen. Operate according to the warning information and press **ENTER**.



After setting the Country parameter, please proceed to set other parameters of the inverter in accordance with the specific requirements of the local grid. Before commissioning, please check thoroughly if the set parameters meet the local grid requirement.

Step 7 If the country code set as GR, a Grid codes page as shown in the right will appear. **Press** ▼ to select grid code and **press ENTER** to confirm.

GR

Grid codes

GR_L

GR_IS

Step 8 If the country code set as DE, a Grid codes page as shown in the right will appear, where LV signifying low-voltage grid; MV signifying medium-voltage grid; HV signifying high-voltage grid.. **Press** ▼ to select grid code and **press ENTER** to confirm.

DE

Grid codes

LV

MV

HV

Under the “DE” code, after selecting “Low Voltage”, you need to continue to set parameters such as reactive power adjustment.



P-Q param	
▶ Q-Var switch	[OFF]
PF	+1.000
Q-Var limits	+000.0%
React-Resp EN	[OFF]
React-Resp Time	010.0S

Step 9 After selecting the Grid Code, there will be a “Pro-stage” type selection screen and then corresponding sub-menu will come up. For detailed information, please refer to “10.11 Protection Parameter Setting”.

Pro-Stage
<input checked="" type="radio"/> Single-stage
<input type="radio"/> Multi-stage

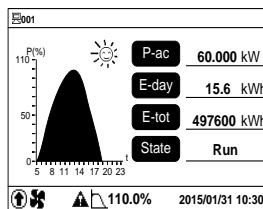
Step 10 Set the inverter time as per local time. Incorrect time setting will affect the data logging. **Press** ▶ to move the cursor and **Press** ▼ to set the specific time and date. **Press ENTER** to confirm setting.

Time
YY/MM/DD
Date: 15/01/31
Time: 10:30:55

Step 11 After configuring all parameters, there will be a “setting confirmation” screen. Check whether all above-mentioned parameters are correct. Confirm by **Pressing ENTER**. Cancel by **Pressing ESC** and reset.

Setting confirmation	
Countries	Other
Pro-stage	Single-stage
Grid codes	IM
Date	2015/01/31
Confirm above settings?	

Step 12 Inverter will enter into startup process. Observe the status of LED indicators and the LCD main screen. If commissioning succeeds, the “RUN” indicator will be on and “Run” will be displayed on the “State” area.



If commissioning fails, the “FAULT” indicator will be on and “Fault” will occur on the display. **Press** ▼ to view “current fault” information. Remove the existing fault and then repeat the commissioning procedures.

8 Disconnecting, Dismantling and Disposing the Inverter

8.1 Disconnecting the Inverter

For maintenance work or any service work, inverter must be switched off. During normal operation, switching off is not necessary.

Proceed as follows to disconnect the inverter from DC and AC power sources

Step 1 Disconnect the external AC circuit breaker and prevent it from accidental reconnecting.

Step 2 Turn off the upstream DC circuit break. Rotate DC switch to the "OFF" position.

NOTICE

Please strictly follow the above sequence. Inverter will not work normally if otherwise.

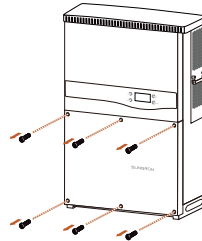
Step 3 Wait about ten minutes until the capacitors inside the inverter have been discharged.

Step 4 Loose the six screws on the lower connection cabinet and then remove the lid.

Step 5 Measure AC voltage to ground at the AC terminal to confirm AC output voltage of inverter at the AC circuit breaker is zero.

Step 6 Remove the AC cables.

Step 7 Remove the DC cables.



8.2 Dismantling the Inverter

Refer to Chapter 5 and Chapter 6 to dismantle the inverter in reserve steps.

NOTICE

If the inverter will be reinstalled in the future, please refer to “4.4 Inverter Storage” for a proper conservation.

8.3 Disposal of the Inverter

Users should take the responsibility for the disposal of the inverter.

NOTICE

Some parts and devices in the inverter, such as the LCD display, batteries, modules and other components, may cause environmental pollution. Users must comply with the related local regulations to avoid pollution.

9 Troubleshooting and Maintenance

9.1 Troubleshooting

9.1.1 Troubleshooting of LED Indicator

Fault type	Troubleshooting
LED indicators and LCD screen are OFF	Disconnect AC side circuit breaker. Rotate DC switch to the "OFF" position. Check the polarity of the PV arrays.
"RUN" indicator is OFF	Disconnect AC side circuit breaker. Rotate DC switch to the "OFF" position. Check the correctness of inverter electrical connection. Check whether DC input voltage exceeds the inverter startup voltage of inverter. If all above conditions are OK, please contact with Sungrow.
"Fault" indicator is ON	A fault is not removed yet. Perform troubleshooting according to fault type in LCD screen. If fault cannot be solved, please contact Sungrow.
"RUN" indicator is blinking	Warning fault occurs of the inverter. Perform troubleshooting according to fault type in LCD screen. If fault cannot be solved, please contact Sungrow.

9.1.2 Troubleshooting of Faults in LCD Screen

Once a fault occurs in the inverter, the fault information can be displayed on the APP interface or the LCD.

Fault codes and check methods are as follows:

Fault code	Description	Check method
002	Grid overvoltage, The grid voltage is higher than the set protection value.	<p>Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly:</p> <ol style="list-style-type: none"> 1. Measure the actual grid voltage, and contact the local electric power company for solutions if the grid voltage is higher than the set value. 2. Check whether the protection parameters are appropriately set via the APP or the LCD. 3. Check whether the cross-sectional area of the AC cable meets the requirement. 4. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
003	Transient overvoltage, The transient grid voltage is higher than the standard value.	<p>Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly, contact Sungrow Service.</p>
004-005	Grid undervoltage, The grid voltage is lower than the set protection value	<p>Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly:</p> <ol style="list-style-type: none"> 1. Measure the actual grid voltage, and contact the local electric power company for solutions if the grid voltage is lower than the set value. 2. Check whether the protection parameters are appropriately set via the APP or the LCD. 3. Check whether the AC cable is firmly in place. 4. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
006-007	AC output current exceeds the upper limit of the inverter.	<p>Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly, contact Sungrow Service.</p>

Fault code	Description	Check method
008	Grid overfrequency, Grid frequency exceeds the upper limit of the inverter.	Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly:
009	Grid underfrequency, Grid frequency is lower than the lower limit of the inverter.	<ol style="list-style-type: none"> 1. Measure the actual grid frequency, and contact the local electric power company for solutions if the grid frequency is beyond the set range. 2. Check whether the protection parameters are appropriately set via the APP or the LCD. 3. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
010	AC power failure, AC switch or circuit is disconnected.	<p>Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly:</p> <ol style="list-style-type: none"> 1. Check whether the grid supplies power reliably. 2. Check whether the AC cable is firmly in place. 3. Check whether the AC cable is connected to the correct terminal (whether the live wire and the N wire are correctly in place). 4. Check whether the AC circuit breaker is connected. 5. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
011	DC component in the AC current exceeds the permissible range of the inverter.	<ol style="list-style-type: none"> 1. The fault is caused by external fault of the inverter. Generally, the inverter will be reconnected to the grid after the external fault is removed. 2. If the fault occurs repeatedly, contact Sungrow Service.

Fault code	Description	Check method
012	Excessive leakage current	1. The fault can be caused by poor sunlight or damp environment, and the inverter will be reconnected to the grid after the environment is improved. 2. If the environment is normal, check whether the AC and DC cables are well insulated. 3. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
013	The grid voltage or frequency is out of the permissible range, and the inverter cannot be connected to the grid normally.	Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly: 1. Measure the actual grid frequency, and contact the local electric power company for solutions if the grid parameter exceeds the set value. 2. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
014	The grid voltage exceeds the preset AC voltage of the inverter for a long time.	Wait for the inverter to return to normal. If the fault occurs repeatedly, contact Sungrow Service.
015	Grid overvoltage, The grid voltage is higher than the set protection value	Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly: 1. Measure the actual grid voltage, and contact the local electric power company for solutions if the grid voltage is higher than the set value. 2. Check whether the protection parameters are appropriately set via the APP or the LCD. 3. Check whether the cross-sectional area of the AC cable meets the requirement. 4. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.

Fault code	Description	Check method
016	Output overload, The configured module power is excessively large and out of the normal operation range of the inverter.	Wait for the inverter to return to normal. If the fault still exists, contact Sungrow Service.
017	The inverter detects unbalanced three-phase grid voltage	Generally, the inverter will be reconnected to the grid after the grid returns to normal. If the fault occurs repeatedly, contact Sungrow Service.
019-020	Excessively high bus voltage	Generally, the inverter will be reconnected to the grid after the bus voltage returns to normal. If the fault occurs repeatedly: 1. Check the PV voltage via the APP or the LCD. If the PV voltage exceeds the maximum permissible voltage, it indicates that the PV module configuration is too high and needs to be optimized. 2. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
021-022	The inverter detects input overcurrent of the modules	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
024-026 030-034	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
036-037	Temperature anomaly, The temperature of the power module or the interior of the inverter is excessively high and out of the safe range.	1. Check whether the inverter is directly exposed to sunlight. If so, take some shading measures. 2. Check and clean the air ducts. 3. Check whether there is 070 (fan anomaly) alarm via the APP or the LCD. If so, replace the fans.

Fault code	Description	Check method
038	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
039	Low insulation resistance, which is generally caused by poor insulation to ground of the module/cable or by rainy and damp environment.	Wait for the inverter to return to normal. If the fault occurs repeatedly: <ol style="list-style-type: none"> 1. Check whether the ISO resistance protection value is excessively high via the APP or the LCD, and ensure that it complies with the local regulations. 2. Check the resistance to ground of the string and DC cable. Take correction measures in case of short circuit or damaged insulation layer. 3. If the cable is normal and the fault occurs on rainy days, check it again when the weather turns fine. 4. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
040-042	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
043	The ambient temperature is lower than the temperature at which the inverter can operate normally.	Stop and disconnect the inverter. Restart the inverter when the ambient temperature falls within the operation temperature range.
044-045	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
047	PV input mode error	Stop and disconnect the inverter. Reset the input mode of the PV array.

Fault code	Description	Check method
048-051 053-060	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
070	Fan fault	1. Check whether the fans operate normally and are blocked by sundries. If they are blocked, clear the sundries. 2. If a fan does not operate normally, stop and disconnect the inverter to replace the fan.
071	AC SPD fault	Check the SPD, and replace it if necessary.
072	DC SPD fault	
073	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
074	Internal communication anomaly, A fault occurs in the internal communication module of the inverter.	Contact Sungrow Service.
075-077	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
078-081	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
087	AFD module anomaly	1. Check whether the cable connection on the DC side is normal, and take correction measures if necessary. 2. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
088	Electric arc fault	
089	AFD disable alarm	

Fault code	Description	Check method
105	Protection self-check failure on grid side	Restart the inverter or clear the fault through the App. If the fault still exists, contact Sungrow Service.
106	Grounding anomaly	1. Check whether the AC cable is correctly connected. 2. Check whether the insulation between the ground cable and the live wire is normal. 3. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.
116-117	Device anomaly	Wait for the inverter to return to normal. Disconnect the AC and DC switches, and reconnect the AC and DC switches 15 minutes later to restart the inverter. If the fault still exists, contact Sungrow Service.
532-547	Reverse polarity string	1. Check whether the corresponding string is of reverse polarity. If so, disconnect the DC switch and adjust the polarity when the solar radiation is low and the string current drops below 1A. 2. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service. *The code 532 to code 547 are corresponding to string 1 to string 16 respectively.
548-563	String output current anomaly	1. Check whether the corresponding module is sheltered. If so, remove the shelter and ensure module cleanness. 2. Check the module for abnormal aging. 3. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service. *The code 548 to code 563 are corresponding to string 1 to string 16 respectively.

Fault code	Description	Check method
564-565	Reverse polarity string	<p>1. Check whether the corresponding string is of reverse polarity. If so, disconnect the DC switch and adjust the polarity when the solar radiation is low and the string current drops below 1A.</p> <p>2. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.</p> <p>*The code 564 and code 565 are corresponding to string 17 and string 18 respectively.</p>
580-581	String output current anomaly	<p>1. Check whether the corresponding module is sheltered. If so, remove the shelter and ensure module cleanness.</p> <p>2. Check the module for abnormal aging.</p> <p>3. If the fault is not caused by the foregoing reasons and still exists, contact Sungrow Service.</p> <p>*The code 580 and 581 are corresponding to string 17 and string 18 respectively.</p>

9.2 Maintenance

9.2.1 Routine Maintenance

Item	Method	Period
System clean	<p>Check the temperature and dust of the inverter. Clean the inverter enclosure if necessary. Check if the air inlet and outlet are normal. Clean the air inlet and outlet, if necessary.</p>	Six months to a year (depend on the dust contents in air.)
Fans	<p>Check whether there is crack of the fan blade. Check whether there is any abnormal noise when the fan is turning. Clean or replace the fans if necessary (see the following section).</p>	Once a year
SPD	<p>Check the fuse and DC SPD. Replace the fuse (refer to the following section) and DC SPD (contact Sungrow) whenever necessary.</p>	Every Six months

9.2.2 Maintenance Instruction

Fan Maintenance

Fans inside the inverter are used to cool the inverter during operation. If the fans do not operate normally, inverter may not be cooled down and efficiency may decrease. It is therefore necessary to clean the dirty fans and replace the broken fans in time.

! DANGER

- **Stop the inverter and disconnect it from all power supplies before maintenance.**
- **Lethal voltage still exists in the inverter. Please wait for at least ten minutes and then perform maintenance work.**
- **Only qualified electricians can maintain the fans.**

Step 1 Disconnect the AC circuit breaker.

Step 2 Turn off the upstream DC circuit break. Rotate DC switch to the "OFF" position.

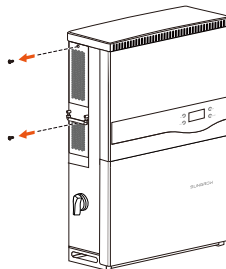
Step 3 Wait for at least ten minutes.

Step 4 Disconnect all electrical connection in the reverse procedures in the "6 Electrical Connection".

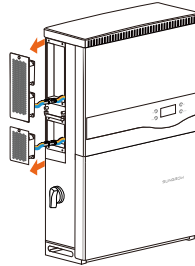
Step 5 Lift up the inverter.

Step 6 Place the inverter on the platform.

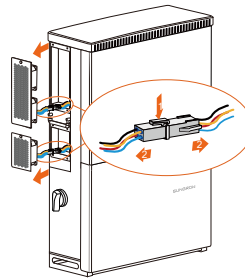
Step 7 Unscrew the bolts as shown in the right picture.



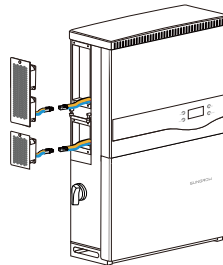
Step 8 Disassemble the metal plate slightly.



Step 9 Press on the ribbing of the locking hooks and pull the cable outwards.



Step 10 Remove the fans out of the inverter.



Step 11 Clean the fan with soft brush or vacuum cleaner; or replace the broken fans.

Step 12 Reassemble the fans back into the inverter and restart the inverter.

Cleaning Air Inlet and Outlet

A huge amount of heat is generated in the process of running the inverter. The inverter adopts a controlled forced-air cooling method.

In order to maintain good ventilation, please check to make sure the air inlet and outlet are not blocked.



Clean the air inlet and outlet with soft brush or vacuum cleaner if necessary.

10 Operation of LCD Display

10.1 Description of Button Function

Inverter offers two buttons for user to look up the running information and configure parameters. The two buttons have multiple functions. Please refer to Tab. 10-1 before any operation onto inverter.

Tab. 10-1 Button function

Button	Operation	Description
	Press for less than 2 seconds	Move upwards or downwards or scroll among set values. Hereinafter, it is referred to as "Press ▼ ".
	Press for more than two seconds	Return to the previous menu or cancel the command. Hereinafter, it is referred to as "Press ESC ".
	Press for less than 2 seconds	Move left or right, or turn pages. Hereinafter, it is referred to as "Press ➤ ".
	Press for more than two seconds	Enter into the sub-menu or confirm the command. Hereinafter, it is referred to as "Press ENTER ".



If there is no button operation for:

- 1 minute, LCD backlight is OFF;
- 2 minutes, system returns to the default menu (main screen).

10.2 Menu Tree

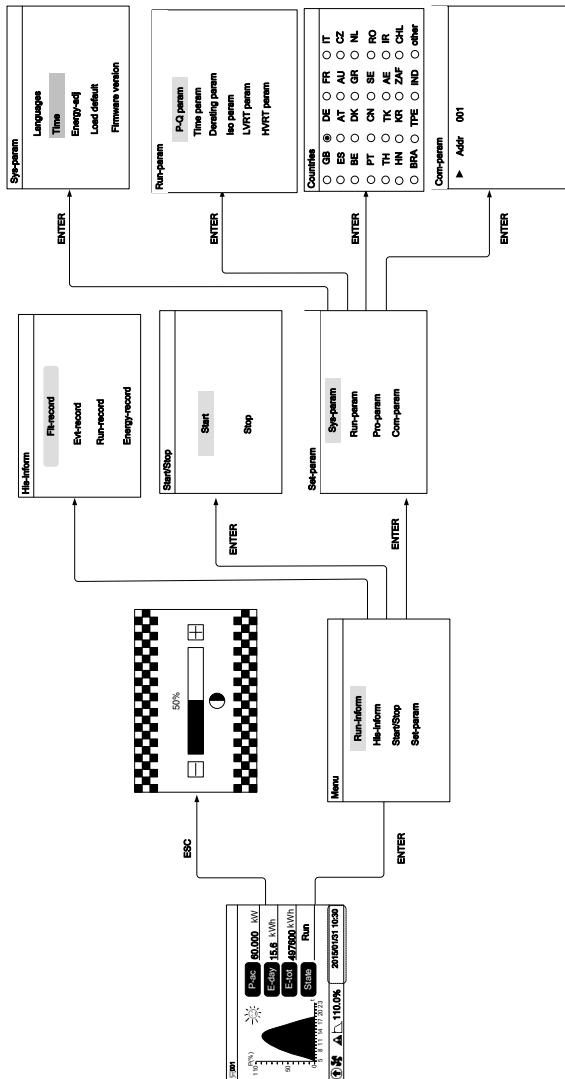


Fig. 10-1 Menu tree

10.3 Main Screen

Once the inverter commissioning is finished, LCD display will enter the main screen as shown in Fig. 10-2.

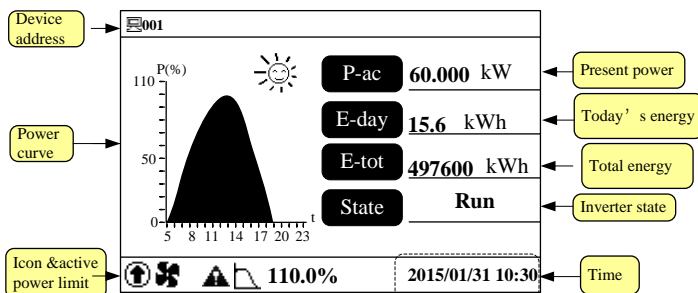


Fig. 10-2 Main screen





Tab. 10-2 Description of the main screen

State	Description
Run	After being energized, inverter tracks the PV arrays' maximum power point (MPP) and converts the DC power into AC power. This is the normal operation mode.
Standby	Inverter enters Standby mode when DC side input is insufficient. In this mode inverter will wait within the Standby duration (set by user, refer to 10.10.1 Main Screen of Run-param).
Stop	Inverter is stopped.
Key-stop	Inverter will stop operation by manual "stop" through LCD menu. In this way, inverter internal DSP stops. To restart the inverter, manually start from the LCD menu.
Start...	The inverter is initializing and synchronizing with the grid.
Upd-fail	IAP upgrade failure
Fault	If a fault occurs, inverter will automatically stop operation, disconnect the AC relay, and display the fault information on the LCD display with the "FAULT" indicator on. Once the fault is removed in recovery time (set by user, refer to 10.10.1 Main Screen of Run-param), inverter will automatically resume running.
Warning	Warning information is detected.

If inverter is in "Fault" state, press \blacktriangleright or \blacktriangledown to view "Current fault" information. To know the meaning of the fault code, please refer to 9.1.2 Troubleshooting of Faults in LCD Screen".

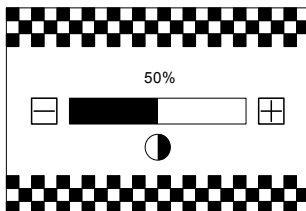
Current fault	PI/I
1 GRID	008

Tab. 10-3 Icon Description

Icon	Description
	Inverter is in IAP update process.
	Inverter in power derating state.
	Fans inside are working.
	Inverter is operating in warning state.

10.4 Contrast Adjustment

Step 1 Press **ESC** to enter into the contrast adjustment screen.



Step 2 Press **▼** to increase the setting value and press **▶** to decrease the value.

Step 3 Press **ENTER** to confirm the contrast setting.



Contrast adjustment range: 0...100%

Recommended value: 50% or 60%.

10.5 Checking Running Information

The main screen displays some basic information about the inverter. For more detailed information, please operate as follows:

Main Screen (Press **ENTER**)→**Menu**→**Run-inform** (Press **ENTER**)

LCD display will show the detailed running information. Scroll pages by pressing **➤** / **⏪**.

DC power input: the total PV input power.

Vdc[V]: DC voltage of each input.

Ide[A]: DC current of each input.

Pdc[W]: DC power of each input.

DC power input	00000W
	DC
Vdc[V]	560.0
Ide[A]	10.0
Pdc[W]	00000

Vac[V]: Line-voltage.

Iac[A]: Phase current.

F[Hz]: Frequency of each phase.

	R	S	T
Vac[V]	230.0	230.0	230.0
Iac[A]	6.0	6.0	6.0
Pac[W]	0000	0000	0000
F[Hz]	00.00	00.00	00.00

CO₂-reduce: Total CO₂ emission reduction due to the inverter.

E-month: The energy generated in this month.

h-Total: Total running hours of the inverter.

T-today: Inverter running time today.

Temp: Internal temperature of the inverter.

ISO: Insulation resistance to the ground of the input side.

CO ₂ -reduce	6kg
E-month	10kWh
h-Total	1h
T-today	63min
Temp	25.0 °C
ISO	30kΩ

P-W: Inverter output active power.

S-Va: Inverter output apparent power.

Country: Inverter selected country code.

Grid code: Inverter selected grid code (note: if country selected is DE, grid code here is LV or MV; country selected is TH, grid code here is 380V or 400V; country selected is TK, grid code here is AG or YG; country selected is Other, grid code here is 50Hz or 60Hz).

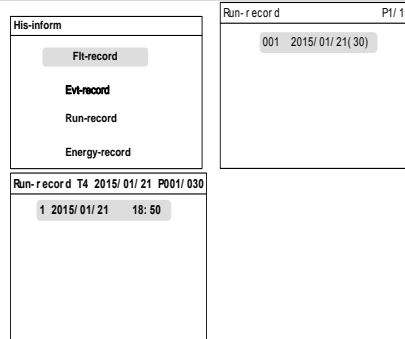
P-W	100W
S-Va	130VA
Country	DE
Grid code	LV

10.6 Checking History Information

10.6.1 Checking Running Records

Main Screen (Press **ENTER**)→**Menu** (Press **▼**, Press **ENTER**)→**His-inform** (Press **▼**×2, Press **ENTER**)→**Run-record** (Press **ENTER**)

On the “Run-record” interface, scroll pages by pressing **▶**, and press **▼** to select the date you want to view. Confirm by pressing **ENTER**.



LCD display shows the running records. Press **▶** to turn pages and press **▼** to view the records of the selected date.

DC power input	0000W			
DC		R	S	T
Vdc(V)	230.0	230.0	230.0	230.0
Ivdc(A)	0.0	0.0	0.0	0.0
Pdc(W)	0000	0000	0000	0000
Fvdc(Hz)	00.00	00.00	00.00	00.00

P-W	100W	CO ₂ reduce	0kg
S-Vol	130kVA	E-month	1000Wh
Country	DE	In-Total	1h
Grid code	LV	T-today	0min
		Temp	20.0°C
		WPD	2000kWh

10.6.2 Checking Fault Records

Main Screen (Press **ENTER**)→**Menu** (Press **▼**, Press **ENTER**)→**His-inform** (Press **ENTER**)→**Fit-record** (Press **ENTER**)

On the “Fit-record” interface, scroll pages forwards by pressing **▶**, and press **▼** to scroll pages backwards.

Fit-record	P 1/2
001	2015/01/31 10:16:10 [0008]
002	2015/01/31 10:16:10 [0008]
003	2015/01/31 10:16:10 [0008]
004	2015/01/31 10:16:10 [0008]
005	2015/01/31 10:16:10 [0040]



The inverter can only store at most 100 latest fault records.

10.6.3 Checking History Event Records

Main Screen (Press **ENTER**)→**Menu** (Press **▼**, Press **ENTER**)→**His-inform**(Press **▼**, Press **ENTER**)→**His-event** (Press **ENTER**)

On the “Evt-record” interface, scroll pages forwards by pressing **▶**, and press **▼** to scroll pages backwards.

Evt-record	P 1/1
001 2014/01/31 10:16:10	Fault



The inverter can only store at most 100 latest fault records.

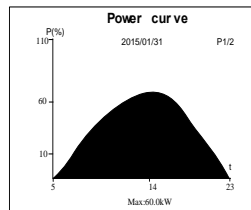
10.6.4 Checking Energy Records

Main Screen (Press **ENTER**)→**Menu** (Press **▼**, Press **ENTER**)→**His-inform**(Press **▼**, Press **ENTER**)→**Energy-record** (Press **ENTER**)

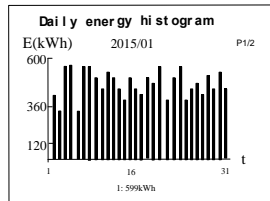
LCD display shows the energy records. User can view various energy records by pressing **▼**: power curve, daily energy histogram, monthly energy histogram, and annual energy histogram.

Energy-record
Power curve
Daily energy histogram
Monthly energy histogram
Annual energy histogram

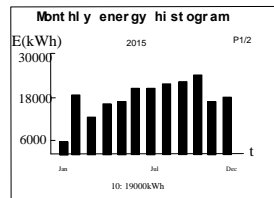
Power curve: shows the power output from 5 am to 11 pm in a single day. Each point in the curve is the percentage of present power and nominal power. Press **▶** or **▼** to view the power curve of the latest 7 days.



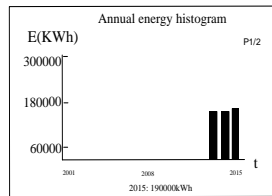
Daily energy histogram: shows the power output every day in the present month. Press **➤** or **▼** to view the daily energy of the latest 12 months.



Monthly energy histogram: shows the power output every month in a year. Press **➤** or **▼** to view the monthly energy of the latest 15 years.



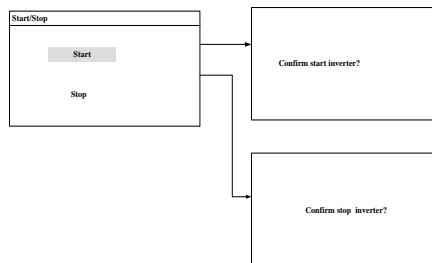
Annual energy histogram: shows the power output every year. Press **➤** or **▼** to view the annual energy of the latest 90 years.



10.7 Starting/Stopping

Main Screen (Press **ENTER**) → Menu (Press **▼** × 2) → Start/Stop (Press **ENTER**)

Press **▼** to choose "Start"/"Stop" and press **ENTER** to confirm the choice.



Press **ENTER** to confirm.

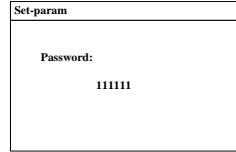
10.8 Password Entry

Parameter setting is password-protected. To set the parameters, you should enter the correct password.

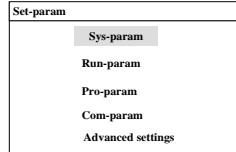
Step 1 Press **ENTER** to enter the Menu screen.

Step 2 Press **▼** to move the cursor to “Set-param” item and confirm by **pressing ENTER**.

Step 3 A password confirmation screen will occur. Press **▶** to move cursor right and Press **▼** to input the password 111111.



Step 4 Press **ENTER** to confirm the password and enter the “Set-param” sub menu.



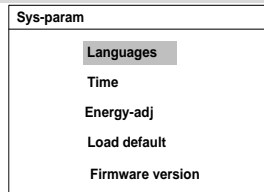
10.9 System Parameter Setting

There are various user settable system parameters. You can set the system parameters after entering the correct password.

10.9.1 Language Setting

Main Screen (Press **ENTER**)→Menu (Press **▼**×3) →Set-param (Press **ENTER**)→Enter password (Press **ENTER**)→Sys-param (Press **ENTER**, Press **▼**)→Languages (Press **ENTER**)

If Auto is selected for languages, the inverter system language will be the language of the country selected



Languages	
<input checked="" type="radio"/>	Auto
<input type="radio"/>	English
<input type="radio"/>	Deutsch
<input type="radio"/>	Francaise
<input type="radio"/>	Italia
<input type="radio"/>	中文

10.9.2 Time Setting

Time deviation between the time on the inverter and the local time of the installation site may cause data logging failure. Please adjust inverter time according to the local time.

Main Screen(Press **ENTER**)→Menu (Press **▼** ×3)→Set-param(Press **ENTER**)→Enter password (Press **ENTER**)→Sys-param(Press **ENTER**, Press **▼**)→Time(Press **ENTER**)

Press **▶** to move the cursor and press **▼** to change value. Press **ENTER** to confirm setting.

Time
YY/MM/DD
Date: 15/01/31
Time: 10:30:55

NOTICE

For user with higher accuracy requirement of the inverter internal clock, time calibration can be performed everyday through the upper computer (or other channel communicated with the device). For details, please refer to the time calibration description in the inverter communication protocol.

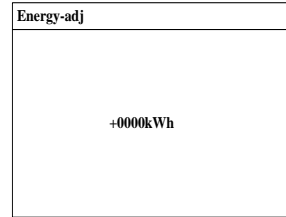
Please contact Sungrow if there is still time deviation after calibration.

10.9.3 Total Energy Deviation Adjustment

If the accumulative value “E-total” in the inverter is different from the value in the external metering device, you should adjust energy by “Energy-adj” setting.

Main Screen(Press **ENTER**)→Menu (Press **▼** ×3)→Set-param(Press **ENTER**)→Enter password (Press **ENTER**)→Sys-param(Press **ENTER**, Press **▼** ×2)→Energy-adj(Press **ENTER**)

Press **▶** to move the cursor and press **▼** to change value. Press **ENTER** to confirm setting.
 The positive symbol “+” can be changed to the negative symbol “-”.
 The adjustment range is from -9999 to +9999 kWh.
 (Energy-adj value)= (Real measured value) - (E-tot reading value).



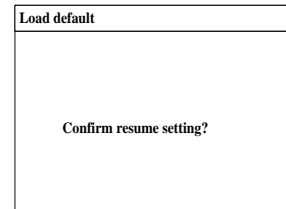
10.9.4 Load Default

NOTICE

All history information will be unrecoverable cleared and all parameters will return to the default value except the protective parameters and time once the “load default” operation is performed.

Main Screen (Press **ENTER**)→Menu (Press **▼** ×3)→Set-param(Press **ENTER**)→Enter password (Press **ENTER**)→Sys-param(Press **ENTER**, Press **▼**×3)→Load default (Press **ENTER**)

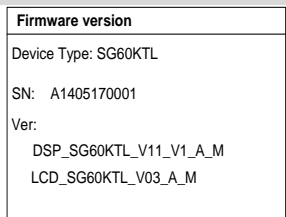
Press **ENTER** to confirm “load default”.



10.9.5 Checking Firmware Version

Main Screen (Press **ENTER**)→Menu (Press **▼** ×3)→Set-param(Press **ENTER**)→Enter password (Press **ENTER**) → Sys-param(Press **ENTER**, Press **▼**×4) → Firmware version(Press **ENTER**)

Inverter shows detailed firmware information, including LCD version and DSP version.
 The firmware version information is read only.



10.10 Running Parameter Setting

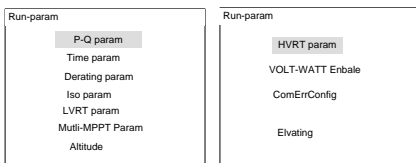
10.10.1 Main Screen of Run-param

Main Screen (Press **ENTER**)→Menu (Press **▼** ×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**)→Run-param (Press **ENTER**)

On the “Run-param” screen, press **▼** to select one item and press **ENTER** to enter the setting interface.

For each item, **Press ▶** to move the cursor and **Press ▼** to set the appropriate value.

Confirm settings by Pressing **ENTER**.



Tab. 10-4 Description of Running Parameters

Parameter	Description	Default	Range
P-W limits	Inverter active power limitation	110.0%	0~110%
Rate limit	Set the active power change rate. When it is set to [ON], user can set the raise and decline rate.	[OFF]	[OFF]/ [ON]
Power raise	When Rate limit is ON, set the active power rise rate.	100%/min	8~100%/min
Power Decline	When Rate limit is ON, set the active power decline rate.	6000%/min	8~6000%/min
Fault slowup	Set the power rise rate when a fault is removed. When it is ON, the active power raise rate can be set.	[ON]	[OFF]/ [ON]
Slowup rate	Set the active power raise rate.	100%/min	8~100%/min
Save P-W Setting	Whether to save the active power setting	[OFF]	[OFF]/ [ON]
Save Q-Var setting	Whether to save the reactive power setting	[ON]	[Pt]/[Qt]/ [Off] / [Q(P)] / [Q(U)]
Q-Var witch	Set the reactive power regulation function	[OFF]	[OFF]/ [ON]

Parameter		Description	Default	Range
	PF	Inverter output power factor	+1.000	-1.000~-0.800/ +0.800~+1.000
	Q-Var limits	Inverter reactive power limitation	0.0%	0~+100%/ 0~-100%
Time param	Standby time	Time from inverter standby to startup	20s	20~255s
	Recover time	Time from inverter fault is removed to standby	30s [IT: 300s]	0-900s
Derating param		Set the Derating param to OFF or ON. If it is ON, inverter will operate with power derating when grid frequency exceeds the set value.	[OFF]	[OFF]/ [ON]
Iso param	ISO	Set the ISO protection function to ON or OFF. When it is ON, inverter will not connect to the grid when resistance to the ground is below the set value.	[ON]	[OFF]/ [ON]
	ISO pro value	Set the resistance to the ground.	30KΩ	20~3000KΩ
LVRT param		Set the LVRT to OFF or ON. When it is ON, inverter can keep grid-connection for a certain time when grid fault occurs and provide reactive power for grid recovery.	-	[OFF]/ [ON]
HVRT param		Set the HVRT to OFF or ON. When it is ON, inverter can keep grid-connection for a certain time when grid fault occurs and provide reactive power for grid recovery.	[OFF]	[OFF]/ [ON]
ComErrConfig		When enabled, the inverter turns on the communication interrupt configuration function.	[OFF]	[OFF]/ [ON]

Parameter	Description	Default	Range
Elvating	When enabled, when the grid frequency is lower than the set frequency value, the inverter power is up.	Choose according to local grid standards	[OFF]/ [ON]

10.10.2 Active/Reactive Power Parameters

Main Screen (Press **ENTER**)→Menu (Press **▼** ×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**)→Run-param (Press **ENTER**) →P-Q Param (Press **ENTER**)

P-Q Param	
▶ P-W limits	100.0%
Rate limit	[ON/OFF]
Praise	100%/min
Pdecline	6000%/min
Fit slowup	[ON/OFF]
Slowup rate	10%/min

10.10.3 Reactive Power Regulation

Inverter provides reactive power regulation function. Use the “*Q-Var switch*” parameter to activate this function and select proper regulation mode.

Tab. 10-5 Explanation of reactive power regulation switch

Regulation Mode	Explanation
Pf	The reactive power can be regulated by the parameter <i>PF (Power Factor)</i> .
Qt	The reactive power can be regulated by the parameter <i>Q-Var limits (in %)</i> .
Off	The <i>PF</i> is limited to +1.000, and the “ <i>Q-Var limits</i> ” is limited to 0.0%.
Q(P)	The <i>PF</i> changes with the output power of the inverter.
Q(U)	The reactive power changes with the grid voltage.

“PF” Mode

The reactive power can be regulated by the parameter *PF* on the Run-param screen.

“Qt” Mode

The reactive power can be regulated by the parameter *Q-Var limits (in %)* on the Run-param screen.

“Off” Mode

Reactive power cannot be regulated. The *PF* is limited to +1.000, and the *Q-Var limit* is limited to 0.0%.

“Q(P)” Mode(when the country selection is not “IT”)

PF changes with the inverter output power.

If the country selection is not “IT” (Italy), after selecting Q(P) Mode, **Press** ▼ to enter the Run-param-Q(P) submenu.

For each item setting, **Press** ▶ to move cursor and **Press** ▼ to set the appropriate value. Confirm settings by Press **ENTER**.

ComErrConfig	
▶ QP-Cur-Select	[A/B]
Preset PA	050.0%
PresetK A	1.000/+000.0%
Preset PB	060.0%
Preset K_B	+000%
Preset PC	100.0%
Preset K_C	0.900/+000.0%

Tab. 10-6 “Q(P)” Mode Parameters Explanation

Parameter	Explanation	Default	Range
Upper PF Cap	Power factor of point P1 in the Q(P) mode curve	1	0.9~1
Lower Power*	Output power of point P1 in the Q(P) mode curve (in %)	50%	0%~50%
Lower PF Ind	Power factor of point P2 in the Q(P) mode curve	0.9	0.9~1
Upper Power*	Output power of point P2 in the Q(P) mode curve (in %)	100%	50%~100%

* Lower Power < Upper Power

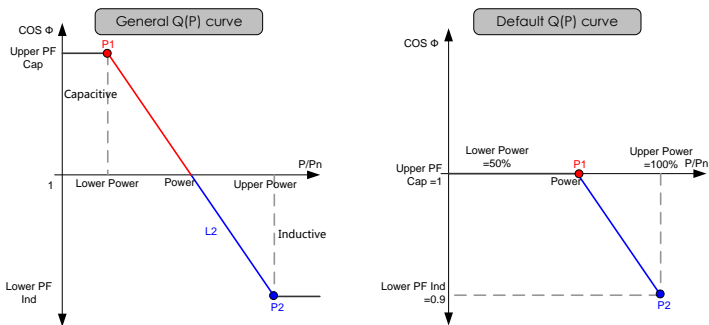


Fig. 10-3 Reactive Power Regulation Curve in Q(P) Mode

“Q(U)” Mode (when the country selection is not “IT”)

The reactive power ratio changes with the grid voltage.

If the country selection is not “IT” (Italy), after selecting Q(U) mode, **Press** ▼ to enter the Run-param-Q(U) submenu.

For each item setting, **Press** ▶ to move cursor and **Press** ▼ to set the appropriate value. Confirm settings by Pressing **ENTER**.

ComErrConfig	
▶	QU-Cur-Selct [A/B]
Preset	Upper Q/Pn Cap 050.0%
Preset	Lower Q/Pn Ind 050.0%
Preset	Upper U Limit 115.0%
Preset	Lower U Limit 095.0%

Tab. 10-7 “Q(U)” Mode Parameters Explanation

Parameter	Explanation	Default	Range
Lower Q/Sn Ind	Inductive Q/Sn value of point P4 in the Q(U) mode curve	25%	0%~50%
Upper Q/Sn Cap	Capacitive Q/Sn value of point P1 in the Q(U) mode curve	25%	0%~50%
Lower U Limit	Grid voltage limit (in %) of point P1 in the Q(U) mode curve	80%	80%~90%
Upper U Limit	Grid voltage limit (in %) of point P4 in the Q(U) mode curve	115%	110%~115%
U1 Limit*	Grid voltage limit (in %) of point P2 in the Q(U) mode curve	95%	95%~100%
U2 Limit*	Grid voltage limit (in %) of point P3 in the Q(U) mode curve	105%	100%~105%
Hysteresis*	Hysteresis voltage width (in %)	3%	0%~5%

* U1 Limit + Hysteresis < U2 Limit - Hysteresis

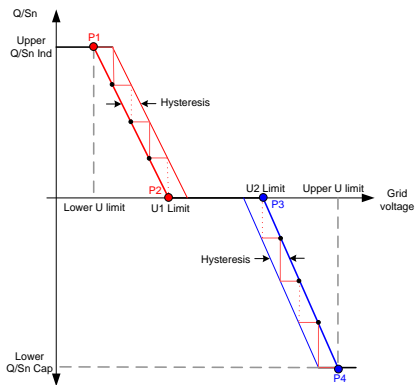


Fig. 10-4 Reactive Power Regulation Curve in Q(U) Mode

10.10.4 Reactive Power Setting for Italy

If the “Countries” selected is “IT” (Italy), several LCD menus and operation methods are different from other countries.

The differences focus on “Run-param” as shown below.

Italy “Q(P)” Mode

Power factor changes with the output power of the inverter.

Select Q(P) mode and **Press** ▼ to enter into the “Run-para-Q(P)” sub-menu.

Press ▼ to move the cursor; **Press** ▶ to enter the editing mode, then the selected parameter will be shaded.

Press ▼ to increase one-step value; **Press** ▶ to decrease one-step value.

Press ENTER to confirm the setting and exit from the editing mode.

ComErrConfig	
▶ Preset PA	020.0%
Preset PB	050.0%
Preset PC	100.0%
Preset Pf max	0.900
Preset Uin	105.0%
Preset Uout	100.0%

Tab. 10-8 Italy “Q(P)” Mode Parameters Explanation

Parameter	Explanation	Default	Range	Step
PA*	Active power at point A (in %)	20%	20~100%	1%
PB*	Active power at point B (in %)	50%	20~100%	1%
PC*	Active power at point C (in %)	100%	20~100%	1%

Parameter	Explanation	Default	Range	Step
Pf max	Power factor at point C	0.9	0.9~1	0.01
Uin**	Enter Q(P) regulation mode when grid voltage is above Uin	105%	100~110%	1%
Uout**	Exit from the Q(P) regulation mode when grid voltage is below Uout	100%	90~100%	1%

*PA < PB ≤ PC ** Uin > Uout

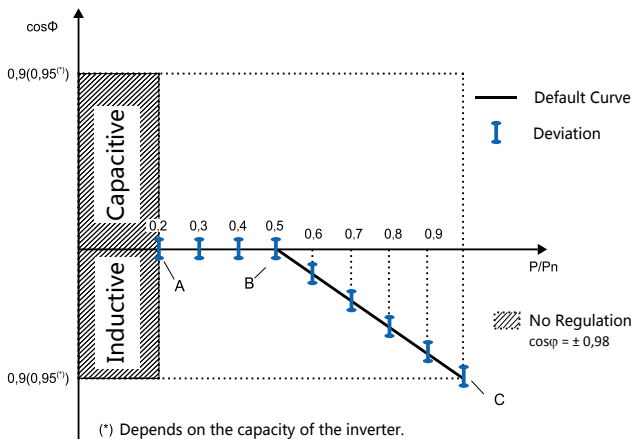


Fig. 10-5 Reactive Power Regulation Curve in "IT" Q(P) Mode

Italy "Q(U)" Mode

The reactive power ratio changes with the grid voltage.

Select Q(U) mode and **Press** ▼ to enter the "Run-para-Q(U)" sub-menu.

Press ▼ to move the cursor; **Press** ▶ to enter the editing mode, then the selected parameter will be shaded.

Press ▼ to increase one-step value; **Press** ▶ to decrease one-step value.

Press ENTER to confirm the setting and exit from the editing mode.

ComErrConfig	
▶ Preset V2i	090.0%
Preset V1i	092.0%
Preset V1s	108.0%
Preset V2s	110.0%
Preset Qmax	100.0%

ComErrConfig	
▶ Preset Pin	020.0%
Preset Pout	020.0%
Preset Curve	[A/B]

Tab. 10-9 Italy“Q(U)” Mode Parameters Explanation

Parameter	Explanation	Default	Range	Step
V2i*	Grid voltage at point D (in %)	90%	90~110%	1%
V1i*	Grid voltage at point C (in %)	92%	90~110%	1%
V2s*	Grid voltage at point A (in %)	108%	90~110%	1%
V1s*	Grid voltage at point B (in %)	110%	90~110%	1%
Qmax	The max. ratio of reactive power (in %)	90%	50~100%	1%
Pin**	Enter the Q(U) regulation mode when power is above Pin	20%	20~100%	1%
Pout**	Exit from the Q(U) regulation mode when power is below Pout	9%	1~20%	1%
Curve	Curve type	A	A/B	-

*V2i < V1i < V1s < V2s**Pin > Pout

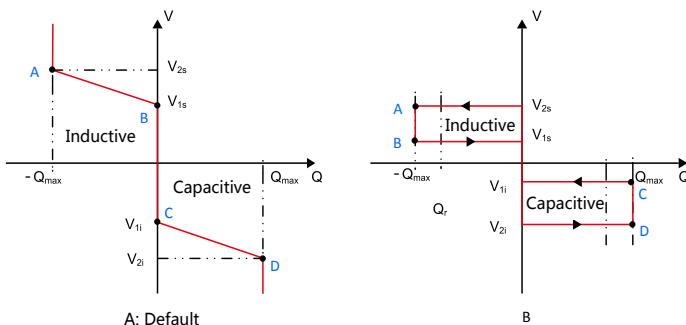


Fig. 10-6 Reference Reactive Power Regulation Curve in “IT” Q(U) Mode

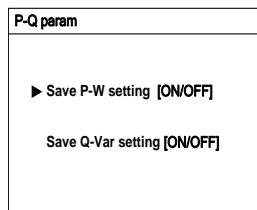
10.10.5 Save P/Q-set

On the “Save P/Q-set” screen, Press **▼** to move arrow to one item, Press **▶** to move cursor and Press **▼** to set.

Confirm by Pressing **ENTER**.

Select “ON” to save the values set after power down.

Select “OFF” to restore default values after power down.



10.10.6 Time Parameters

Main Screen (Press **ENTER**) → Menu (Press **▼** ×3) → Set-param (Press **ENTER**) →

Enter password (Press **ENTER**, Press **▼**) → Run-param (Press **ENTER**, Press **▼**) →

Time-param (Press **ENTER**)

Time-param	
Standby time	020s
Recovery time	000s

10.10.7 Derating Parameters

Main Screen (Press **ENTER**) → Menu (Press **▼** × 3) → Set-param (Press **ENTER**) → Enter password (Press **ENTER**, Press **▼**) → Run-param (Press **ENTER**, Press **▼** × 2) → Derating param (Press **ENTER**)

Derating param	
▶ Fre-Derating	[ON/OFF]
F1	50.00Hz
P1	100%
F2	50.20Hz
P2	100%
F3	52.00Hz
P3	100%

10.10.8 ISO Parameters

Main Screen (Press **ENTER**) → Menu (Press **▼** × 3) → Set-param (Press **ENTER**) → Enter password (Press **ENTER**, Press **▼**) → Run-param (Press **ENTER**, Press **▼** × 3) → ISO param (Press **ENTER**)

ISO param	
▶ ISO	[ON/OFF]
ISO pro value	30kΩ

10.10.9 LVRT Parameter

Main Screen (Press **ENTER**) → Menu (Press **▼** × 3) → Set-param (Press **ENTER**) →

Enter password (Press **ENTER**, Press **▼**)→Run-param (Press **ENTER**, Press **▼**×4)→LVRT param (Press **ENTER**)

LVRT param	
▶ LVRT	[ON/OFF]
LVRTGridUnBalnEN	[ON/OFF]
LVRT kf	02
LVRT normal volt	195.5V
LVRT T1	300.00S
LVRT tolera volt	034.5V
LVRT T2	000.62S

10.10.10 HVRT Parameter

Main Screen (Press **ENTER**)→Menu (Press **▼** ×3)→Set-param(Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**)→Run-param (Press **ENTER**, Press **▼**×5)→HVRT param (Press **ENTER**)

HVRT param	
▶ HVRT	[ON/OFF]
HVRT GridUnBalnEN	[ON/OFF]
HVRT kf	02.0
HVRT normal volt	105.0%
HVRT T1	010.00S



This running parameter is optional. You can purchase the device equipped with this optional function. For details, please consult Sungrow.

10.11 Protection Parameter Setting

Protection parameters are designed for the threshold value that can trigger the protection function of the inverter.

Main Screen (Press **ENTER**)→Menu (Press **▼**×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**×2)→Pro-param (Press **ENTER**)

Press **▶** to move cursor and Press **▼** to input the password.



User can only check the parameter in this interface. The default values of the protection parameters have been preset as per grid code of corresponding countries.
 To set the protection parameter, please contact Sungrow to acquire advanced password.

10.11.1 Country Setting

To make the protection parameters setting convenient, inverter provides in-built protection parameters for certain countries.

Press **▼** to choose countries and press **ENTER** to confirm.

If the country selected is not in the list, please choose Other and then input the protection parameters manually.

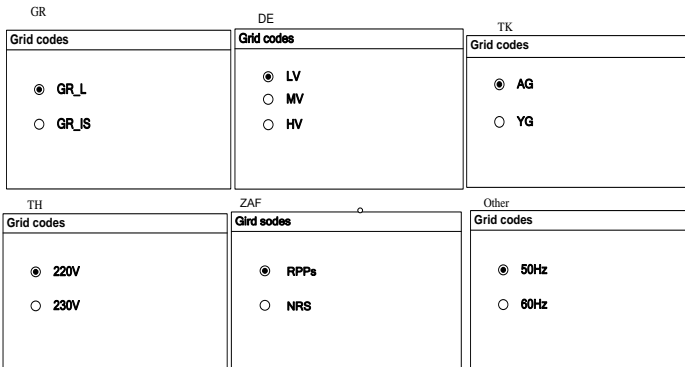
Countries															
<input type="radio"/>	GB	<input checked="" type="radio"/>	DE	<input type="radio"/>	FR	<input type="radio"/>	IT	<input type="radio"/>	ES	<input type="radio"/>	AT	<input type="radio"/>	AU	<input type="radio"/>	CZ
<input type="radio"/>	BE	<input type="radio"/>	DK	<input type="radio"/>	GR	<input type="radio"/>	NL	<input type="radio"/>	PT	<input type="radio"/>	CN	<input type="radio"/>	SE	<input type="radio"/>	RO
<input type="radio"/>	TH	<input type="radio"/>	TK	<input type="radio"/>	AE	<input type="radio"/>	IR	<input type="radio"/>	HN	<input type="radio"/>	KR	<input type="radio"/>	ZAF	<input type="radio"/>	CHL
<input type="radio"/>	BRA	<input type="radio"/>	TPE	<input type="radio"/>	IND	<input type="radio"/>	other								

Tab. 10-10 Country code description

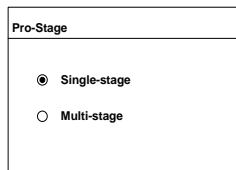
Country(region) Code	Country(region)	Language
GB	Great Britain	English
DE	Germany	German
FR	France	French
IT	Italy	Italian
ES	Spain	English
AT	Austria	German
AU	Australia	English
CZ	Czech	English
BE	Belgium	French
DK	Denmark	English
GR	Greece	English
NL	Netherlands	English
PT	Portugal	English
CN	China	Chinese
SE	Sweden	English
RO	Romania	English
TH	Thailand	English
TK	Turkey	English
AE	United Arab Emirates	English
IR	Israel	English
HN	Hungary	English
KR	Republic of Korea	English
ZAF	The Republic of South Africa	English
CHL	Chile	English
BRA	Brazil	English
TPE	Chinese Taipei(region)	English
IND	India	English

Country(region) Code	Country(region)	Language
Other	Country not mentioned above	English

When the country selected is TH, TK, DE, GR, ZAF or Other, the grid code specific to them will appear on the LCD display as shown below. Press **▼** to choose grid code and press **ENTER** to confirm.



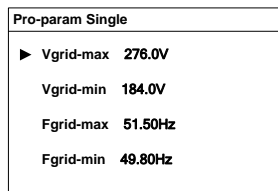
If country selected is not the seven countries mentioned above, you need not to choose grid code. The Pro-Stage interface will appear. You may choose Single-stage or Multi-stage. Press **▼** to choose single-stage or Multi-stage and press **ENTER** to confirm.



10.11.2 Single-stage Protection Parameter Setting

The following interfaces will appear if Single-stage is selected.

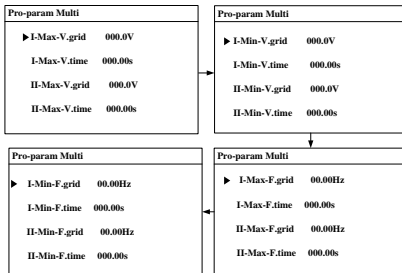
Press ▼ to select parameter, **Press ▶** to move cursor and **Press ▼** to set the appropriate value. Confirm settings by Pressing **ENTER**.



10.11.3 Multi-stage Protection Parameter Setting

The following interfaces will appear if Multi-stage is selected.

Press **▼** to select parameter, Press **▶** to move cursor and Press **▼** to set the appropriate value. Confirm settings by Pressing **ENTER**.



Tab. 10-11 Multi-stage Protection Parameters Explanation

Parameter	Explanation
Max-V. prot	Over-voltage protection
I -Max-V. grid	Stage I Grid over-voltage (U>)
I -Max-V. time	Stage I Grid over-voltage (U>) tripping time
II -Max-V. grid	Stage II Grid over-voltage (U>>)
II -Max-V. time	Stage II Grid over-voltage (U>>) tripping time
Min-V. prot	Under-voltage protection
I -Min-V. grid	Stage I Grid under-voltage (U<)
I -Min -V. time	Stage I Grid under-voltage (U<) tripping time
II -Min -V. grid	Stage II Grid under-voltage (U<<)
II -Min -V. time	Stage II Grid under-voltage (U<<) tripping time
Max-F. prot	Over-frequency protection
I -Max-F. grid	Stage I Grid over-frequency (f>)
I -Max-F. time	Stage I Grid over-frequency (f>) tripping time
II -Max-F. grid	Stage II Grid over-frequency (f>>)
II -Max-F. time	Stage II Grid over-frequency (f>>) tripping time
Min-F. prot	Under-frequency protection
I -Min-F. grid	Stage I Grid under-frequency (f<)
I -Min -F. time	Stage I Grid under-frequency (f<) tripping time
II -Min -F. grid	Stage II Grid under-frequency (f<<)
II -Min -F. time	Stage II Grid under-frequency (f<<) tripping time

10.11.4 Protection Recovery Setting

After setting the protection parameters, inverter enters protection recovery interface.

Pro-recover	
▶ Vmax-recover	240.0V
Vmin-recover	220.0V
Fmax-recover	50.10Hz
Fmin-recover	49.50Hz

Tab. 10-12 Description of protection recovery parameters

Parameter	Explanation
Vmax-recover	Max. protection recovery voltage
Vmin-recover	Min. protection recovery voltage
Fmax-recover	Max. protection recovery frequency
Fmin-recover	Min. protection recovery frequency

10.11.5 Protection Parameter Confirmation

The setting confirmation interface will appear once the protection parameters are input. Press **ENTER** to confirm the parameter selection and press **ESC** to reset the protection parameters.

Setting confirmation	
Countries	Other
Pro-stage	Single-stage
Grid codes	MV
Date	2015/01/31
Confirm above settings?	

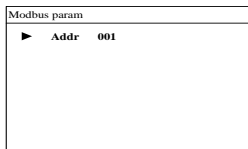
10.12 Communication Parameter Setting

Main Screen (Press **ENTER**)→Menu (Press **▼** ×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼** ×3)→Com-param (Press **ENTER**)

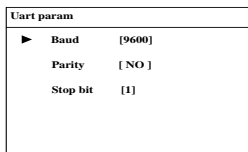
Press **▶** to move cursor and press **▼** to set the appropriate value. Confirm settings by Pressing **ENTER**.

Com-param	
▶	Modbus param
	Uart param

Device address range: 1-247.



Baud rate can be set to 9600bps or 19200bps.
 Parity can be set to NO, ODD or EVEN.
 Stop bit can be set to 1b or 2b.



10.13 Advanced Parameters Setting

The inverter provides a variety of advanced protection features.

Main Screen(Press **ENTER**)→Menu (Press **▼**×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**×4)→Advanced settings(Press **ENTER**)

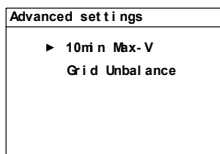


User can only check the parameter in this interface. The default values of the advanced parameters have been preset as per grid code of corresponding countries. To set the advanced parameters, please contact Sungrow to acquire advanced password.

10.13.1 10min Max-V

Main Screen(Press **ENTER**)→Menu (Press **▼**×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**×4)→Advanced settings(Press **ENTER**)→10min Max-V(Press **ENTER**)

Press **ENTER** to confirm.



Press **▼** to select 10min Max-V function settings, set the over-voltage protection point in 10min. Press **ENTER** to confirm the selection.

10mi n Max-V	
10mi n Max-V	[OFF]
Pro-val ue	000. 0V
Rec-val ue	000. 0V



This protection function is optional. You can purchase the device equipped with this optional function. For details, please consult Sungrow.

10.13.2 Grid Unbalance

Main Screen(Press **ENTER**)→Menu (Press **▼**×3)→Set-param (Press **ENTER**)→Enter password (Press **ENTER**, Press **▼**×4)→Advanced settings(Press **ENTER**, Press **▼**×1)→Grid Unbalance(Press **ENTER**)

Press **▼** to select and set the grid voltage unbalance protection point. Confirm the selection by Pressing **ENTER**.

Grid Unbalance	
► Grid Unbalance	[OFF]
Ampl i tude	10%
Pro-t i me	05. 00S

11 Appendix

11.1 Technical Data

Parameters	SG60KTL
Input (DC)	
Max. PV input voltage	1000V
Min. PV input voltage / Startup input voltage	570 V / 620 V
Nominal input voltage	710 V
MPP voltage range	570~850V
MPP voltage range for nominal power	570 – 850 V
No. of independent MPP inputs	1
No. of DC inputs	1
Max. PV input current	120A
Short-circuit current of PV input	140A
Max. inverter backfeed current to the array	0A
Output (AC)	
AC output power	66000 VA @ 45 °C / 60000 VA @ 50 °C
Max. AC output current	96A
Nominal AC voltage	3 / N / PE or 3 / PE, 230 / 400 V
AC voltage range	310 – 480 V
Nominal grid frequency / Grid frequency range	50 Hz / 45 – 55 Hz, 60 Hz / 55 – 65 Hz
THD	< 3 % (at nominal power)
DC current injection	< 0.5 % I _n
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading – 0.8 lagging
Feed-in phases / Connection phases	3 / 3
Efficiency	
Max. efficiency / Euro. efficiency	98.9% / 98.7 %
Protection	
AC short-circuit protection	Yes

Parameters	SG60KTL
LVRT	Yes
Leakage current protection	Yes
Grid monitoring	Yes
DC switch / AC switch	Yes / No
Overvoltage protection	DC Type II; AC Type III
General Data	
Dimensions (W*H*D)	634*959*267 mm
Weight	60 kg
Isolation method	Transformerless
Degree of protection	IP65
Night power consumption	< 1 W
Operating ambient temperature range	-25 to 60 °C (> 50 °C derating)
Allowable relative humidity range (non-condensing)	0 – 100 %
Cooling method	Smart forced air cooling
Max. operating altitude	4000 m (> 3000 m derating)
Display / Communication	Graphic LCD / RS485
DC connection type	Screw clamp terminal (Max. 95 mm ²)
AC connection type	Screw clamp terminal (Max. 150 mm ²)
Compliance	IEC 62109, IEC 61727, IEC 62116, IEC 60068, IEC 61683, VDE0126-1-1, G59/3, VDE-AR-N-4105, VDE-AR-N-4120, BDEW, IEC 61000-3-11/-12, EN 50438, UTE C 15-712-1/07.13, CEA, PEA, MEA
Grid support	LVRT, HVRT, active & reactive power control and power ramp rate control
Type designation	SG60KTL-142

11.2 Exclusion of Liability

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- 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
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11.3 Contact Information

Should you have any question about this product, please contact us.

We need the following information to provide you the best assistance:

- Type of the device
- Serial number of the device
- Fault code/name
- Brief description of the problem

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