

PV Grid Tie Inverter

# Solis Three Phase Inverter

For model Solis-20K, Solis-25K, Solis-30K,  
Solis-30K-MX, Solis-33K  
Installation and Operation Manual



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If you encounter any problem on the inverter, please find out the inverter S/N  
and contact us, we will try to respond to your question ASAP.



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# Important notes

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- Product specifications are subject to change without notice. Every attempt has been made to make this document complete, accurate and up-to-date. Individuals reviewing this document and installers or service personnel are cautioned, however, that Ginlong Technologies reserves the right to make changes without notice and shall not be responsible for any damages, including indirect, incidental or consequential damages caused by reliance on the material presented including, but not limited to, omissions, typographical errors, arithmetical errors or listing errors in the material provided in this document.
- Ginlong Technologies accepts no liability for customers' failure to comply with the instructions for correct installation and will not be held responsible for upstream or downstream systems Ginlong's equipment has supplied.
- The customer is fully liable for any modifications made to the system; therefore, any hardware or software modification, manipulation, or alteration not expressly agreed with the manufacturer shall result in the immediate cancellation of the warranty.
- Given the countless possible system configurations and installation environments, it is essential to verify adherence to the following:
  - There is sufficient space suitable for housing the equipment.
  - Airborne noise produced depending on the environment.
  - Potential flammability hazards.
- Ginlong Technologies will not be held liable for defects or malfunctions arising from:
  - Improper use of the equipment.
  - Deterioration resulting from transportation or particular environmental conditions.
  - Performing maintenance incorrectly or not at all.
  - Tampering or unsafe repairs.
  - Use or installation by unqualified persons.
- This product contains lethal voltages and should be installed by qualified electrical or service personnel having experience with lethal voltages.

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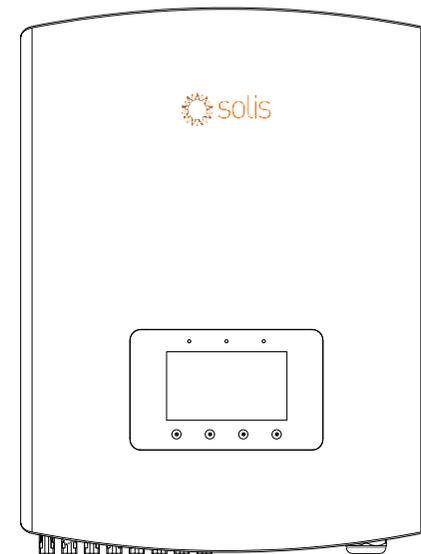
# 1. Introduction

## 1.1 Product Description

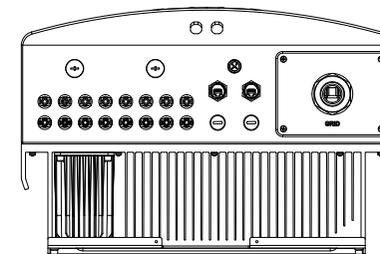
Solis three phase series PV inverters convert direct current (DC) power from the photovoltaic (PV) array into alternating current (AC) power to satisfy local loads as well as feed the power grid.

There are 5 models for Solis three phase inverter:

**Solis-20K Solis-25K Solis-30K Solis-30K-MX Solis-33K**



▲ Figure 1.1 Front view



▲ Figure 1.2 Bottom view

# 1. Introduction

## 1.2 Packaging List

Please check according to following table, to see whether all the parts were included in the packaging:



Part NO.	Description	Number
1	PV grid tie Inverter	1
2	Wall mounting bracket	1
3	Locking screws	2
4	RJ45 Connector	2 set
5	DC connectors	8 pairs
6	Adhesive tape set	1
7	Grounding M4 screw and washer	1
8	Manual	1

▲ Table 1.1 Material list

# 2. Safety Instructions

Improper use may result in potential electric shock hazards or burns. This manual contains important instructions that should be followed during installation and maintenance. Please read these instructions carefully before use and keep them for future reference.

## 2.1 Safety Symbols

Safety symbols used in this manual, which highlight potential safety risks and important safety information, are listed as follows:



### WARNING:

WARNING symbol indicates important safety instructions, which if not correctly followed, could result in serious injury or death.



### NOTE:

NOTE symbol indicates important safety instructions, which if not correctly followed could result in some damage or the destruction of the inverter.



### CAUTION :

CAUTION, RISK OF ELECTRIC SHOCK symbol indicates important safety instructions, which if not correctly followed, could result in electric shock.



### CAUTION:

CAUTION, HOT SURFACE symbol indicates safety instructions, which if not correctly followed, could result in burns.

## 2.2 General Safety Instructions



### WARNING:

DC input and AC output must be electrically isolated before operation. DO NOT connect PV array positive (+) or negative (-) to the ground. To do so may cause serious damage to the inverter.



### WARNING:

Electrical installations must be done in accordance with the local and national regulatory and electrical safety standards.

## 2. Safety Instructions



### WARNING:

To reduce the risk of fire, over-current protective devices (OCPD) are required for circuits connected to the Inverter. The recommended rated trip current of OCPD, Solis-20K should be 40A, Solis-25K, Solis-30K should be 63A.



### CAUTION:

Risk of electric shock. Do not remove cover. Refer maintenance servicing to qualified and accredited service technician.



### CAUTION:

The PV array (Solar panels) supplies a DC voltage when it is exposed to light.



### CAUTION:

Risk of electric shock from energy stored in capacitors of the Inverter. Do not remove cover until 5 minutes after disconnecting all sources of supply. Service technician only. Warranty may be voided if any unauthorized removal of cover.



### CAUTION:

The surface temperature of the inverter can exceed 75°C (167F). To avoid risk of burns, DO NOT touch the surface when inverter is operating. The inverter must be installed out of reach of children.

### 2.3 Notice For Use

The inverter was designed in accordance with relevant safety regulations to meet end user's demands. The usage of inverter and installation should meet the following requirement:

1. Secure inverter installation is required.
2. The inverter must be connected to a separate grounded AC group, to which no other electrical equipment is connected
3. The electrical installation must meet all the applicable regulations and standards.
4. The inverter must be installed according to the instructions stated in this manual.

## 3. Overview

5. The inverter must be installed according to the correct technical specifications.
6. To startup the inverter, the Grid Supply Main Switch (AC) must be switched on, before the solar panel's DC isolator switched on. To stop the inverter, the Grid Supply Main Switch (AC) must be switched off before the solar panel's DC isolator switched off.
7. DC input voltage of inverter must less than its maximum input voltage of inverter.

### 3.1 Inverter Interface Instructions



▲ Figure 3.1 Front Panel Display

### 3.2 LED Status Indicator Lights

There are three LED status indicator lights on the front panel of the inverter. On the Left: POWER LED indicates the power status of the inverter. On the Middle: OPERATION LED (green) indicates the operation status. On the Right: ALARM LED (yellow) indicates the alarm status. Please see Table 3.1 for details

## 3. Overview

Light	Status	Description
● POWER	ON	The inverter can detect DC power
	OFF	No DC power or low DC power
● OPERATION	ON	The inverter is operating properly.
	OFF	The inverter has stopped supplying power.
	FLASHING	The inverter is initializing.
● ALARM	ON	Alarm or fault condition is detected.
	OFF	The inverter is operating properly.

▲ Table 3.1 Status indicator

### 3.3 Keypad

There are four keys in the front panel of the Inverter(from left to right): ESC, UP, DOWN and ENTER keys. The keypad is used for:

- Scrolling through the displayed options (the Up and the Down keys).
- Access to modify the adjustable settings (the ESC and the ENTER keys).

### 3.4 LCD

The 7" Liquid Crystal Display (LCD) is located at the front panel of the Inverter, which displays the following information:

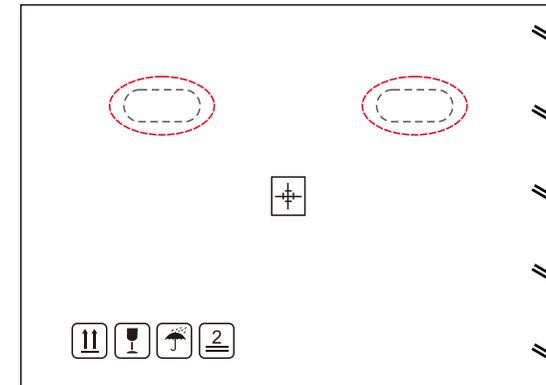
- 1. Inverter operation status and data;
- 2. Service messages for operator;
- 3. Alarm messages and fault indications.

## 4. Product handing and storage

### 4.1 Product handing

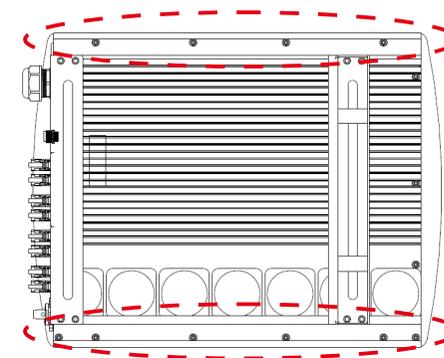
Refer to Figure 4.1 and below for instruction on handling the inverter.

1. The red marks below indicate perforations used to form handles for carrying the carton with the inverter. The inverter requires 2 people to lift and carry.



▲ Figure 4.1 move the inverter

2. Two people are required to remove the inverter from the carton. Handles are formed into the heatsink for ease of handling the inverter. See figure 4.2 below.



▲ Figure 4.2 Inverter handles

# 4. Installation

## 4.2 Product storage

If the inverter is not to be installed immediately, storage instructions and environmental conditions are below:

- Use the original box to repackage the inverter, seal with adhesive tape with the desiccant inside the box.
- Store the inverter(s) in a clean and dry place, free of dust and dirt.
- Storage temperature must be between -25 and 60C and the humidity should be between 0 and 100% non-condensing .
- Stack no more than four (4) inverters high.
- Keep box(es) away from corrosive materials to avoid damage to the inverter enclosure.
- Inspect packaging regularly. If packaging is damaged (wet, pest damage, etc), repackage the inverter immediately.
- Store the inverter(s) on a flat, hard surface – not inclined or upside down.
- After long-term storage, the inverter needs to be fully examined and tested by qualified service or technical personnel before using.
- Restarting after a long period of non-use requires the equipment to be inspected and, in some cases, the removal of oxidation and dust that has settled inside the equipment will be required.

# 5. Installation

## 5.1 Select a Location for the Inverter

When selecting a location for the inverter, consider the following:

- The temperature of the inverter heat sink can reach 75C.
- The inverter is designed to work in a temperature range of -25 – 60C ambient.
- If multiple inverters are installed on site, a minimum clearance of 500mm should be kept between each inverter and any other mounted equipment. The bottom of the inverter must be at least 500mm from the ground or floor. See figure 5.2.
- The LED status indicator lights and the LCD on the front panel should not be blocked.
- Adequate ventilation must be present if the inverter is installed in a confined space.
- Inverter is rated IP65. Choose the installation location accordingly.



▲ Figure 5.1 Recommended installation position

# 5. Installation

- A sun shade is recommended to minimise direct sun exposure where ambient temperature may exceed 40°C.
- Install on a vertical surface or structure capable of bearing the weight.
- Must install vertically within +/- 5. If the inverter is tilted from the vertical plane heat dissipation can be inhibited. This may reduce system performance or reduce service life of the inverter.



▲ Figure 5.2 Inverter mounting clearance

- A minimum of 500mm clearance is required top, bottom, left and right of the inverter (isolator enclosures excepted) for air flow and cooling.
- Visibility of the LED status indicator lights and LCD display screen should be considered.



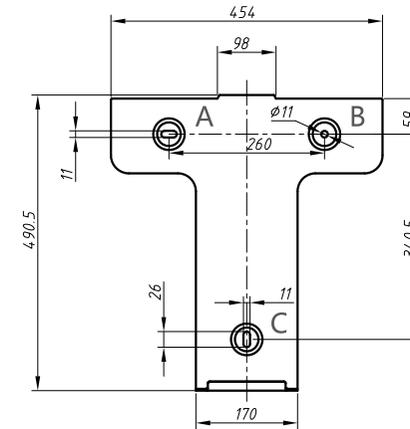
**NOTE:**

The inverter must be installed out of reach of children.

# 5. Installation

## 5.2 Mounting the Inverter

The inverter can be mounted to the wall or metal strut of module. The mounting holes should be consistent with the size of the bracket or the dimensions shows below.



▲ Figure 5.3 The dimensions of the mounting bracket (in mm)

The inverter should be mounted in a vertical position. The steps of mounting are as follows:

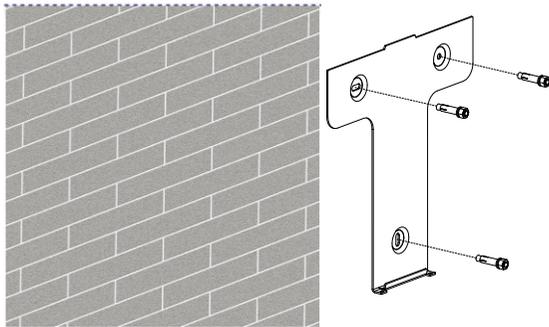
1. According to the figure 5.2, select the mounting height of the bracket and mark the mounting holes. For brick walls, the position of the holes should be suitable for the expansion bolts.
2. MAKE SURE the bracket is horizontal and the mounting holes A, B, and C (in Figure 5.3) are in the correct points. Drilling the holes on the wall according the marks.
3. Using the expansion bolts to fix the bracket to the wall.



**WARNING:**

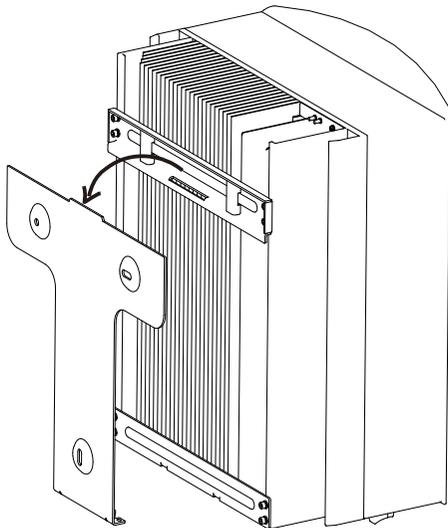
The inverter must be mounted vertically on a vertical wall. Use suitable expansion screws of bolts to attach the bracket To the wall of rack as shown in figure 5.4.

# 5. Installation



▲ Figure 5.4 Mount the bracket to the wall

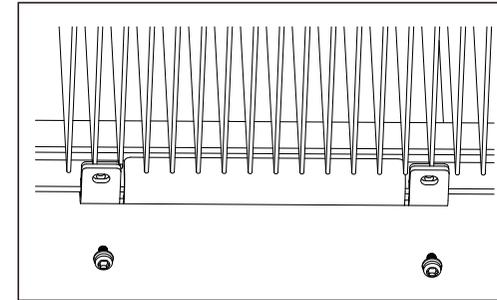
4. Lift up the inverter, and make the slot on the back bracket of inverter align to the lip on the mounting bracket. Then lower the inverter to the bracket slowly until it is stable (in figure 5.5).



▲ Figure 5.5 Attach the inverter to the bracket

# 5. Installation

5. Use supplied screws to secure the bottom of the inverter to the mount bracket.



▲ Figure 5.6 Secure the inverter

## 5.3 Electrical Connections

The Inverter is designed with quick-connect terminal port for electrical connection without removing the cover. The meanings of the symbols at the bottom of the inverter are listed in Table 5.1. All electrical installations must be in accordance with all local and national standards.

+	Positive DC input terminal
-	Negative DC input terminal
DC 1- DC4	DC input terminal
DC SWITCH	Switch of DC input terminals (optional)
COM1	Communication port for Wi-Fi or GPRS stick
COM2、 COM3	Communication port of RJ45
GRID	Connecting terminal of the Grid

▲ Table 5.1 Electrical connection symbols

The electrical connection of the inverter must follow the steps listed below:

1. Switch the Grid Supply Main Switch (AC) OFF. Switch the DC Switch OFF.
2. Connect the inverter to PV array.
3. Connect the inverter to the grid.

# 5. Installation

# 5. Installation

## 5.3.1 Protective ground wire connection(PE)

Ginlong recommends 2 ground protection methods: Through the grid terminal connection and the external heat sink connection.

If the AC terminal is used to connect the ground, please refer to the contents of 5.3.2.

If the heat sink is used to connect the ground, please follow the steps below:

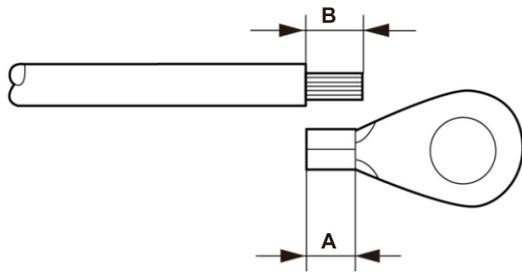
- 1) Prepare the grounding cable: recommend to use the 16mm<sup>2</sup> outdoor copper-core cable.
- 2) Prepare OT terminals: M4.



### Important:

For multiple inverters in parallel, all inverters should be connected to the same ground point to eliminate the possibility of a voltage potential existing between inverter grounds.

- 3) Strip the ground cable insulation to a suitable length as shown in Figure 5.7.



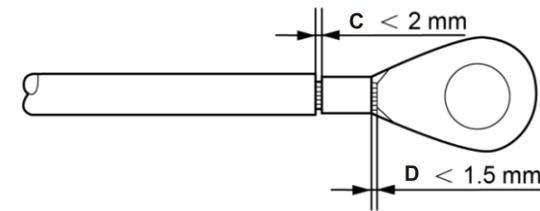
▲ Figure5.7 suitable length



### Important:

B (insulation stripping length) is 2mm~3mm longer than A (OT cable terminal crimping area) 2mm~3mm.

- 4) Insert the stripped wire into the OT terminal crimping area and use the hydraulic clamp to crimp the terminal to the wire (as shown as Figure 5.8).



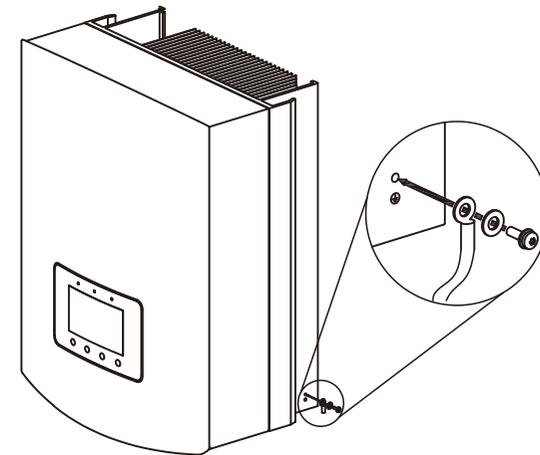
▲ Figure5.8 strip wire



### Important:

After crimping the terminal to the wire, inspect the connection to ensure the terminal is solidly crimped to the wire.

- 5) Remove the screw from the heat sink ground point.
- 6) Use the screw from the ground point to attach the grounding cable. Tighten the screw securely. Torque is 3Nm (as shown as in Figure 5.9).



▲ Figure5.9 connect the cable



### Important:

In order to improve the corrosion resistance of the grounding terminal, we recommend that the external grounding terminal should be coated with silica gel or paint for protection after completing the installation of the grounding cable.

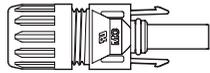
# 5. Installation

# 5. Installation

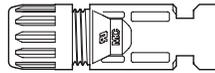
## 5.3.2 DC side connection

A) Please make sure the polarity of the output voltage of PV array matches the “DC+” and “DC-” symbols.

B) Connect the “DC+” and “DC-” to the input terminals; see Figure 5.10 and Figure 5.11.



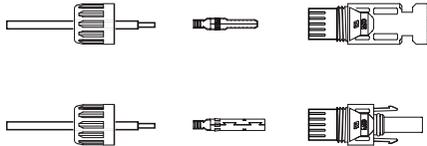
▲ Figure 5.10 DC+ Connector (MC4)



▲ Figure 5.11 DC- Connector (MC4)

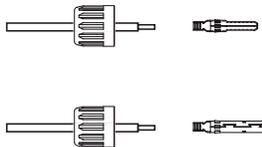
The steps of assembling the DC connectors are listed as follows:

i) Strip off the DC wire about 7mm, Disassemble the connector cap nut (see Figure 5.12).



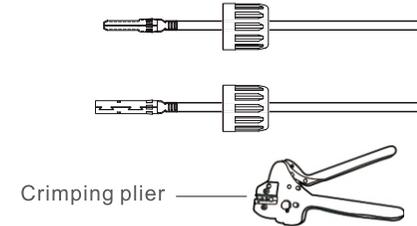
▲ Figure 5.12 Disassemble the Connector Cap nut

ii) Insert the wire into the connector cap nut and contact pin as shown in Figure 4.12.



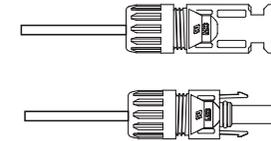
▲ Figure 5.13 Insert the Wire into the Connector Cap nut and contact pin

iii) Crimp the contact pin to the wire using a proper wire crimp tool as shown in Figure 5.14.



▲ Figure 5.14 Crimp the contact pin to the wire

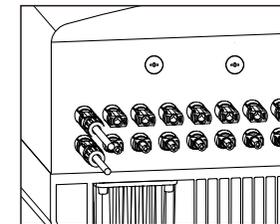
iv) Insert the contact pin into the connector housing until it locks in place. Screw the cap nut onto the connector housing. Torque to 2.5-3Nm (as shown in Figure 5.15).



▲ Figure 5.15 Connector with Cap nut Screwed on

Cable type	Traverse area (mm <sup>2</sup> )		Outside diameter of cable (mm)
	Range	Recommended value	
Industry generic PV cable (model: PV1-F)	4.0~6.0 (12~10AWG)	4.0 (12AWG)	5.5~9.0

v) Connect the finished DC cables to the inverter. A small click will confirm connection. See figure 5.16.



▲ Figure 5.16 Connect the DC Connectors to the Inverter

# 5. Installation

# 5. Installation

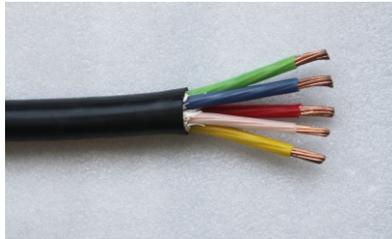
## 5.3.3 AC side connection

For all AC connections, 10- 35mm<sup>2</sup> 105 °C cable is required to be used.

Please make sure the resistance of cable is lower than 1.5 ohm. If the wire is longer than 100m, it's recommended to use 16-35mm<sup>2</sup> cable. Refer to local electrical codes for wire sizing.

The steps to assemble the AC grid terminals are listed as follows:

A) Strip the end of AC cable outer insulating jacket about 90mm then strip the end of each wire about 15mm. (as shown in figure 5.17)



▲ Figure 5.17 Strip AC cable



### Additional explanation:

If the diameter of the protective jacket of the AC cable is less than recommended (20K models: 17-25mm; 30K models: 21-30mm) spiral wound tape should be used to increase the cable diameter to the recommended size.

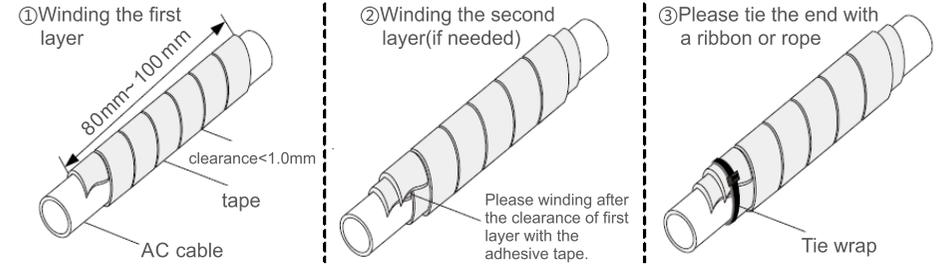
### The adhesive tape is provided in the accessories.

Use the table below for the number of layers of tape needed for a specific cable diameter.

Approximate number of layers needed according to actual cable diameter

AC cable diameter 20K model	AC cable diameter 30K model	layer	The length after winding
10mm~12.9mm	14mm~16.9mm	6	80mm~100mm
13mm~15.9mm	17mm~19.9mm	4	80mm~100mm
16mm~16.9mm	20mm~20.9mm	2	80mm~100mm

Wind the adhesive tape in a spiral pattern as shown in Figure 5.18.

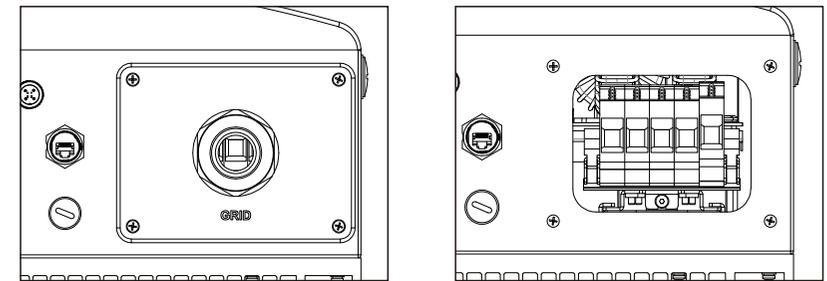


▲ Figure 5.18 Winding tape in spiral pattern

\* This picture is for reference only. Actual cable may differ, use it as the standard.

If the wire is over 10mm<sup>2</sup>, the L1 and PE can be 5mm longer than the L2, L3, and N. In this way the L1 and PE can be easier connected to the terminal connector.

B) Remove the 4 screws on the AC terminal cover and remove the cover. Remove the screw under the terminal slide and pull out the terminal. (as shown in figure 5.19)

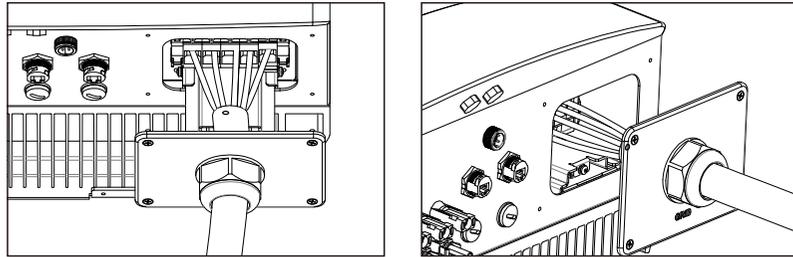


▲ Figure 5.19 Disassemble AC terminal cover

C) Insert the cable through cup nut, water proof sleeve and AC terminal cover into the AC terminal and use a 4mm Hex wrench to tighten the screws. The torque is 3Nm. (as shown in figure 5.20)

# 5. Installation

# 5. Installation



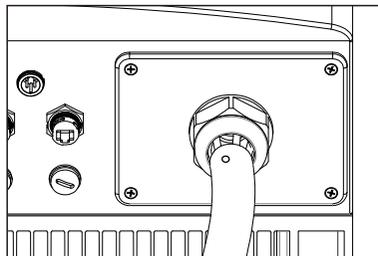
▲ Figure 5.20 Connect cable to AC terminal



**WARNING:**

Ensure the insulation of the is not in to the terminal when tightening the screws, otherwise it will cause poor contact.

D) Push the AC terminals along the rail to the inside of the inverter then tighten the screw under rack. Tighten the 4 screws of the AC terminal cover and tighten the AC entry cap nut. (see Figure 5.21)



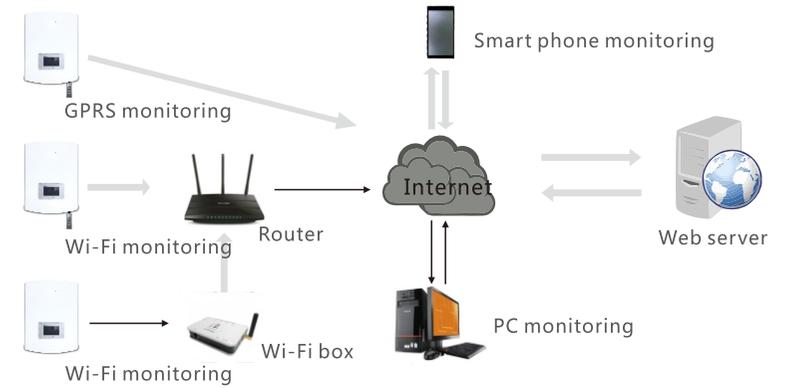
▲ Figure 5.21 Tighten the AC terminal

### 5.3.4 Inverter monitoring connection

There are 3 communication terminals for Ginlong 20-40kW inverter. COM1-COM3 are all for RS485 communication. COM1 is a 4-pin connector which matches with the Wi-Fi or GPRS wireless communication products.

COM2 and COM3 are for RJ45 terminal, which is used for communicating connection between inverters as well as the wired data monitoring.

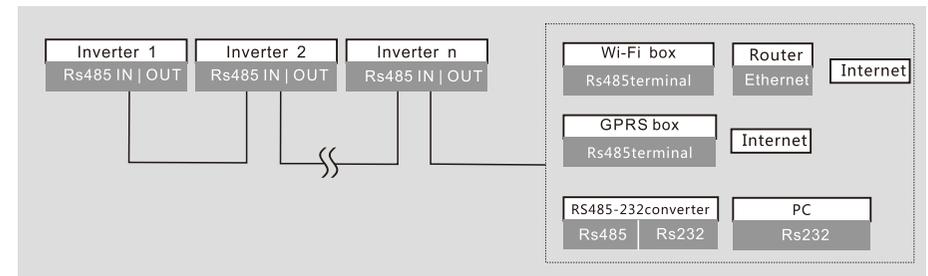
Figure 5.22 is the internet monitoring solution. Please refer to related instructions of Ginlong communication products.



▲ Figure 5.22 Internet monitoring solution

### Monitoring system for multiple inverters

Multiple inverters can be monitored by RS-485 daisy chain connection (As shown in figure 5.23)



▲ Figure 5.23 Multi-inverters monitoring system

### RS485 communication connection of RJ45 network port

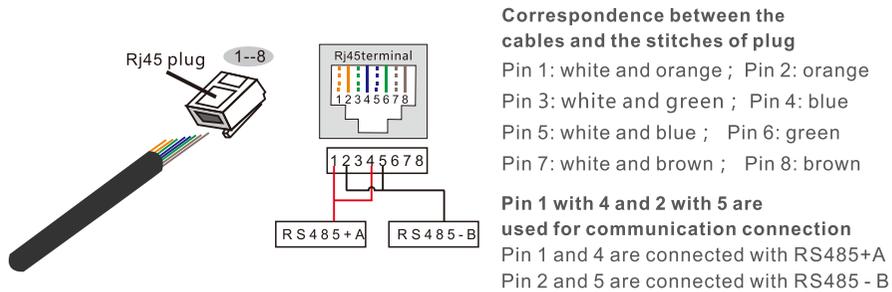
1. Insert the network cable into the communication connection terminal of RJ45. (As shown in figure 5.24)



▲ Figure 5.24 RJ45 communication connection terminals

# 5. Installation

2. Use the network wire stripper to strip the insulation layer off the communication cable. Using the standard wire sequence referenced in TIA/EIA 568B, separate the wires in the cable. Use a network cable crimp tool to trim the wire. Flatten the wire in the order shown in Figure 5.25. Insert the wire into the RJ45 connector then crimp with the crimping tool.



▲ Figure 5.25 Strip the insulation layer and connect to RJ45 plug

3. Connect the RJ45 to COM2 or COM3, and tighten the nut.



▲ Figure 5.26 Tighten the nut

# 6. Start and Stop

## 6.1 Start the inverter

To start up the inverter, it is important the steps below are strictly followed:

1. Switch the Supply Main Switch (AC) ON first.
2. Turn on the DC switch of PV array. If the voltage of PV array is higher than the start up voltage, the inverter will turn on, and the initial interface of LCD will show "Current status: Waiting" on the upper left corner.

Current status: Waiting

3. When both the AC and DC are supplied at the inverter, it will be ready to generate power. Initially, the inverter will check internal and AC parameters to ensure they are within acceptable limits. At the same time, the green LED will flash and the LCD displays INITIALIZING.

4. After around 30-180 second (based on local requirement), the inverter will start to generate power. The green LED will be on continually and the LCD displays "Current status: Generating."

Current status: Generating



**NOTE:**

This inverter is designed and manufactured for the Australian market and are pre-set for AS/NZS 4777.2 at the factory.



**NOTE:**

If the DC input switch is ON before grid breaker, inverter may show fault message "No\_Grid" on current status, the fault will clear when grid voltage is normal.

## 6.2 Stop the inverter

To stop the inverter, it is important the steps below are strictly followed:

1. Switch the Supply Main Switch (AC) OFF.
2. Wait 30 seconds. Switch the DC switch OFF or directly disconnect the DC output connector.

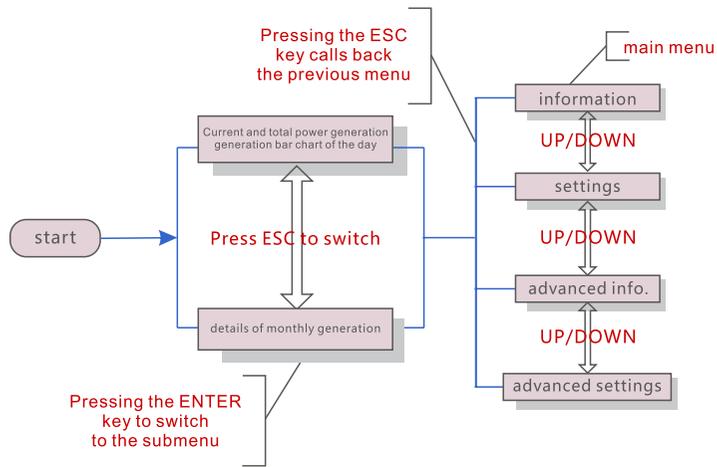
The LEDs and LCD of the inverter will be off within one minute.

# 7. General Operation

During normal operation, the LCD shows the current status of the inverter, including the current power, total generation, and a bar chart of power operation, etc.

Press ESC to switch from the initial interface to view the details of monthly generation.

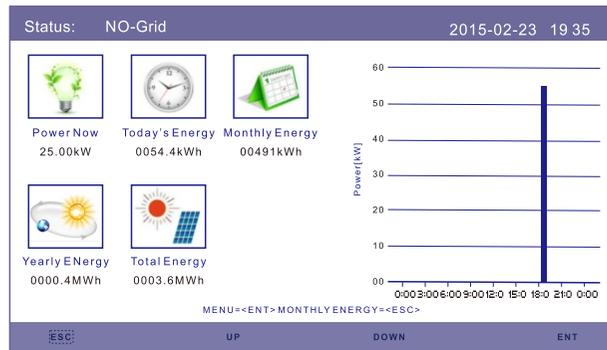
Press ENTER to switch to the Main Menu.



▲ Figure 7.1 Operation overview

## 7.1 Interface

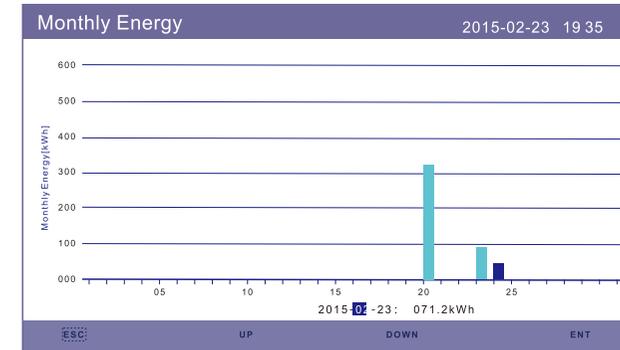
The initial interface of the inverter shows the current operation status, current power, generation of the day/month/year, and total generation. Through the bar chart, we can view the generation information of the day.



▲ Figure 7.2 The initial interface

# 7. General Operation

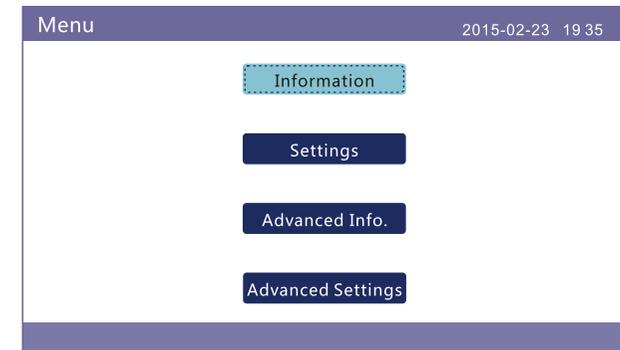
Press the Up or Down key to enter the inverter yearly, monthly energy detail screen. In the current interface, press the Enter key to move the cursor, press the Up or Down key to view yearly, monthly energy detail.



▲ Figure 7.2 Monthly energy detail

## 7.1.1 Main Menu

There are four submenu in the Main Menu:

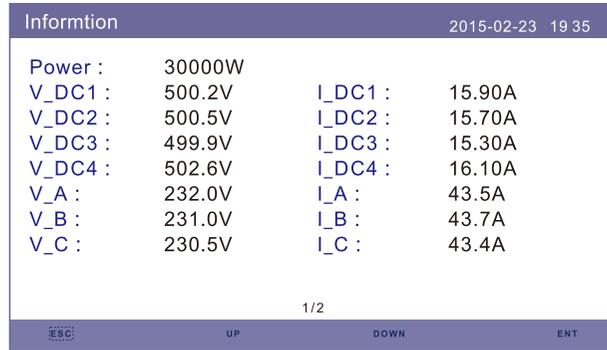


▲ Figure 7.3 Main Menu

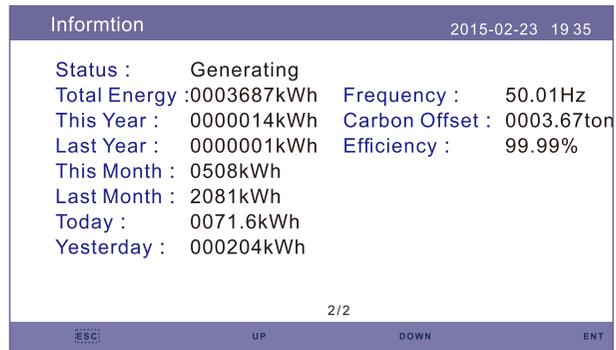
# 7. General Operation

## 7.2 Information

The inverter LCD provides access to operational data and information. Select "Information" sub menu, turn the page by scrolling up or down.



▲ Figure 7.4 Information (1)

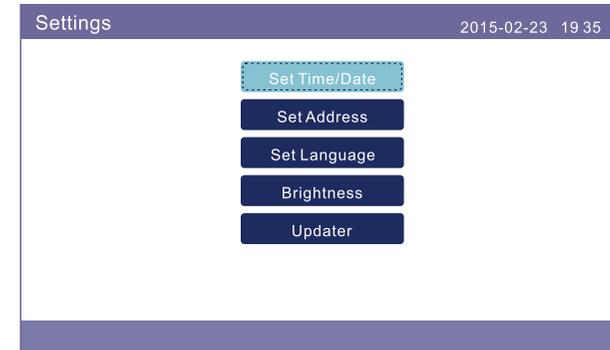


▲ Figure 7.5 Information (2)

# 7. General Operation

## 7.3 Settings

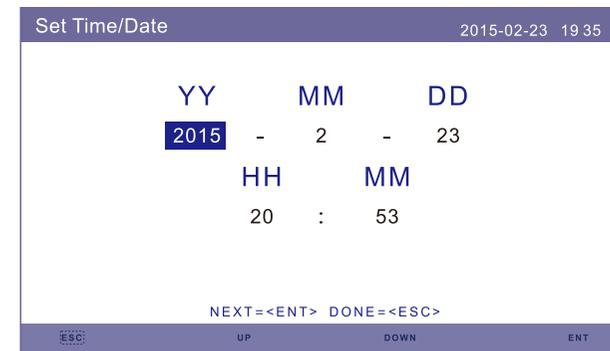
The following interface is displayed when the Settings menu is selected, press the UP/DOWN keys to select different option, press the ENTER key to enter the submenu.



▲ Figure 7.6 Setting

### 7.3.1 Setting Time

This function allows time and date setting. When this function is selected, the LCD will display as screen as shown in Figure 7.7.



▲ Figure 7.7 Setting time

# 7. General Operation

Press the UP/DOWN keys to set time and date. Press the ENTER key to move from one digit to the next (from left to right). Press the ESC key to save the settings and return to the previous menu.

## 7.3.2 Setting Address

This function is used to set the address of an inverter connected to PC for communication purposes. The address number can be assigned from "01" to "99" (see Figure 7.8). The default address number of the inverter is "01".



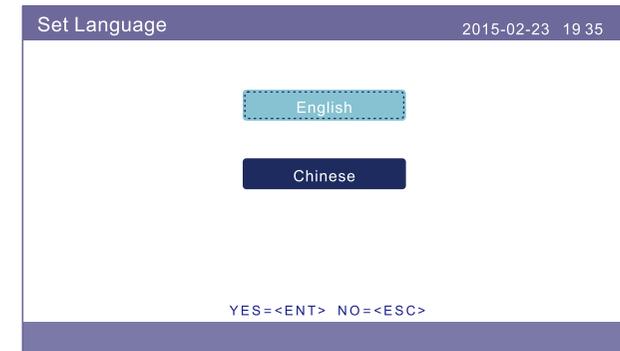
▲ Figure 7.8 Address setting

Press the UP/DOWN keys to set the address. Press the ENTER key to save the settings. Press the ESC key to cancel the change and return to the previous menu.

## 7.3.3 Language Setting

This function is used to set the language of inverter LCD display.

# 7. General Operation

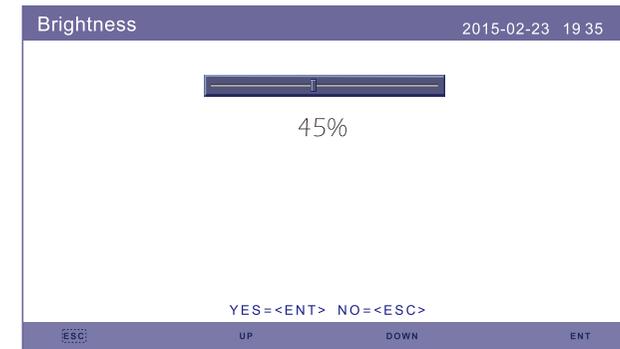


▲ Figure 7.9 Language settings

Press the UP/DOWN keys to select the language. Press the ENTER key to save the settings. Press the ESC key to cancel the change and return to the previous menu.

## 7.3.4 Screen Brightness Control

This function is used to set LCD screen brightness.



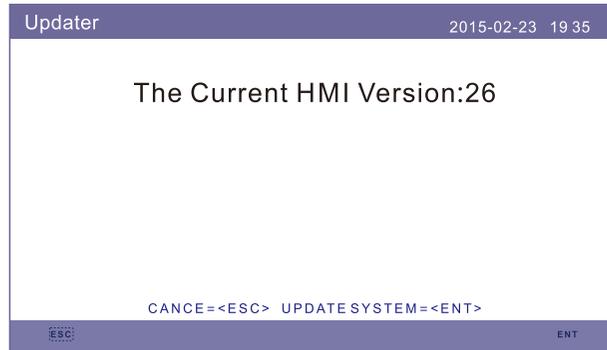
▲ Figure 7.10 Screen brightness adjustment

Press the UP/DOWN keys to set the brightness. Press the ENTER key to save the settings. Press the ESC key to cancel the change and return to the previous menu.

# 7. General Operation

## 7.3.5 System Update

This function is used to view the current system version.



▲ Figure 7.11 System version

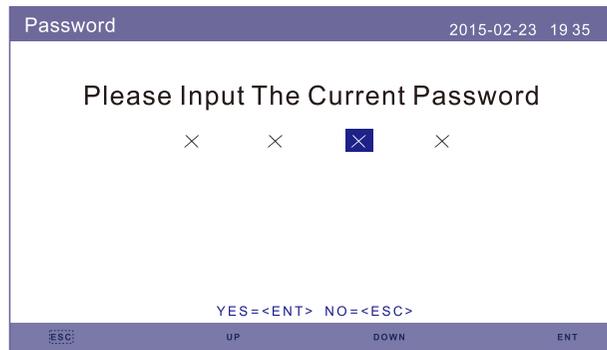
## 7.4 Advanced Info - Technicians Only



### NOTE:

Password required – restricted access – authorised technicians only  
Un-authorized access may void the warranty.

Select Advanced Info from main menu, the LCD screen show the password is needed:



▲ Figure 7.12 Enter a password

# 7. General Operation

The default password is "0010", press the DOWN key to move cursor, press the UP key to change the digit for password, after entering correct password, the LCD will show as below:

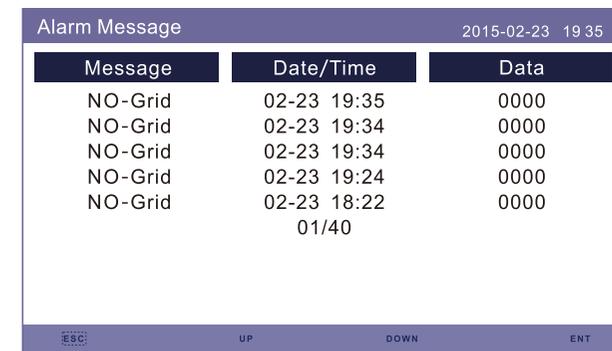


▲ Figure 7.13 Advanced information

The screen can be scrolled manually by pressing the UP/DOWN keys. Pressing the ENTER key gives access to a submenu.

## 7.4.1 Alarm Message

The display shows the 100 latest alarm messages (see Figure 7.14). Screens can be scrolled manually by pressing the UP/ DOWN keys.

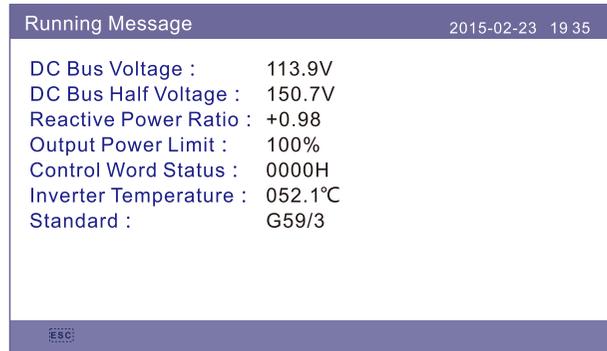


▲ Figure 7.14 Alarm message

# 7. General Operation

## 7.4.2 Operational Message

The screen shows the internal operation parameters of the inverter (see Figure 7.15).



▲ Figure 7.15 Running information

## 7.4.3 Version No.

The screen shows the hardware version and the software version of the inverter (see Figure 7.16).

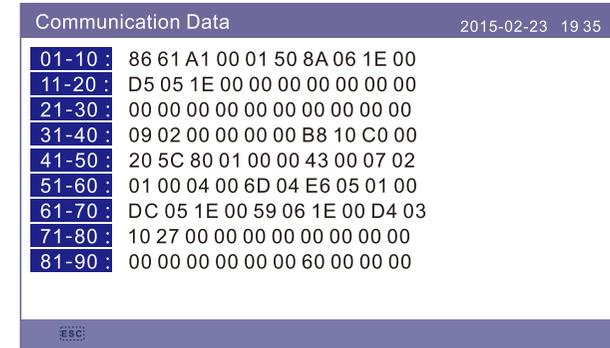


▲ Figure 7.16 Hardware and software versions

# 7. General Operation

## 7.4.4 Communication Data

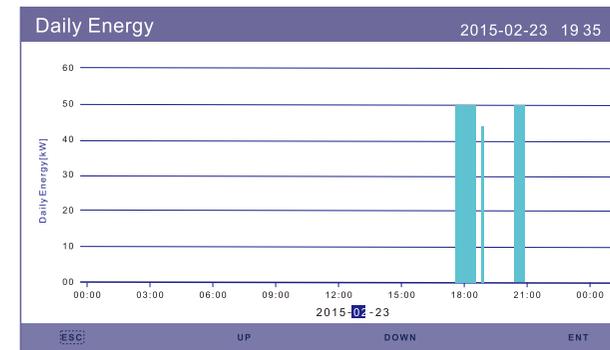
The screen shows the internal data of the inverter (see Figure 7.17), which is for service technicians only.



▲ Figure 7.17 Communication data

## 7.4.5 Daily Energy Information

The screen shows the daily energy detail of the inverter (see Figure 7.18).



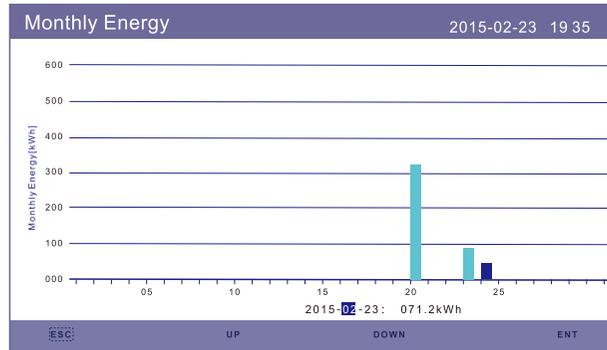
▲ Figure 7.18 Daily power generation capacity

Press the Enter key to move cursor, press the UP/DOWN keys to select energy power detail of different date.

# 7. General Operation

## 7.4.6 Monthly Energy Detail

The screen shows the inverter daily energy detail of one month (see Figure 7.19).

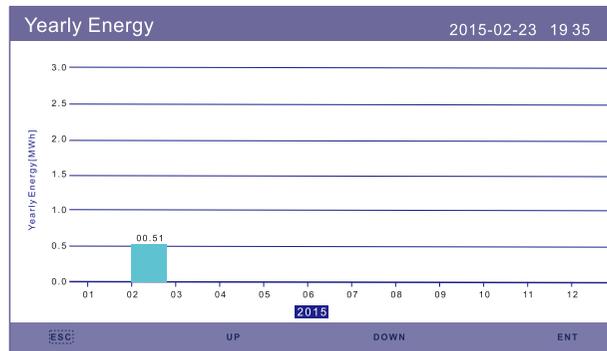


▲ Figure 7.19 Monthly power generation details

Press the Enter key to move cursor, press the UP/DOWN keys to select energy power detail of different date.

## 7.4.7 Yearly Energy Detail

The screen shows the inverter monthly energy detail of one year (see Figure 7.20).



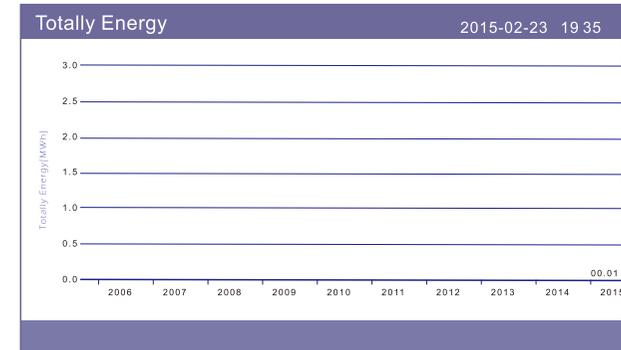
▲ Figure 7.20 Annual generating capacity details

Press the UP/DOWN keys to switch to view monthly energy of different year.

# 7. General Operation

## 7.4.8 Total Energy Detail

The screen shows the inverter total energy detail (see Figure 7.21).



▲ Figure 7.21 Total generating capacity details

## 7.4.9 Work Log

The screen shows the inverter work log and related information for Ginlong service technicians only.

Daily Records		
Message	Date/Time	Data
28C0	02-23 19:35	5E00
28C0	02-23 19:34	6400
28C0	02-23 19:34	6200
28C0	02-23 19:24	6200
28C0	02-23 18:22	0400
	01/40	

▲ Figure 7.22 Work log

# 7. General Operation

# 7. General Operation

## 7.5 Advanced Settings - Technicians Only



**NOTE:**

This function is for authorised technicians only. Improper access and operation may result in abnormal results and damage to the inverter. Password this function is for authorised technicians only. Password (refer to 7.4 section) required – restricted access – authorised technicians only. Un-authorised access may void the warranty. The default password is "0010".

Select Advanced Settings from the Main Menu to access the following options:



▲ Figure 7.23 Advanced settings

### 7.5.1 Select Grid Standard



**NOTE:**

This is for service technicians only. The inverter is customized according to the local standard before shipping, there should be no requirement to set the standard.



**NOTE:**

The "User-Def" function can be only used by the service engineer and changing protection level must be allowed by the local grid company.

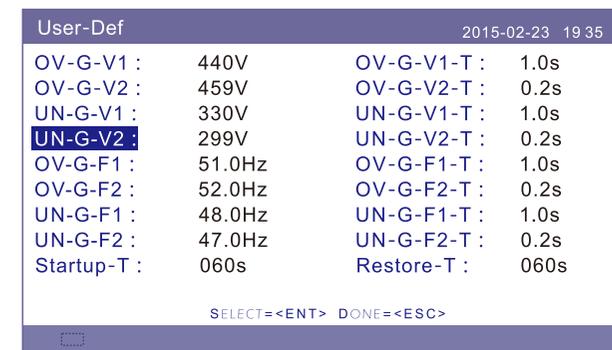
Select grid standard (Figure 7.24)



▲ Figure 7.24 Select national standards

Press the UP/DOWN keys to select the standard (AS4777, VDE4105, UL-1741, G59/3, CQC and "User-Def" function). Press the ENTER key to confirm the setting. Press the ESC key to cancel changes and returns to previous menu.

Selecting the User-Def submenu will access to the following submenu (see Figure 7.25):



▲ Figure 7.25 User-Def

# 7. General Operation

Below is the setting range for User-Def. You may change the limit manually by using this function.

OV-G-V1: 236---335V	OV-G-F1: 50.2-53Hz(60.2-63Hz)
OV-G-V1-T: 0.1---9s	OV-G-F1-T: 0.1---9s
OV-G-V2: 248---341V	OV-G-F2: 51-53Hz(61-63Hz)
OV-G-V2-T: 0.1---1s	OV-G-F2-T: 0.1---9s
UN-G-V1: 173---236V	UN-G-F1: 47-49.5Hz(57-59.5Hz)
UN-G-V1-T: 0.1---9s	UN-G-F1-T: 0.1---9s
UN-G-V2: 132---219V	UN-G-F2: 47-49Hz(57-59Hz)
UN-G-V2-T: 0.1---1s	UN-G-F2-T: 0.1---9s



▲ Figure 7.26 Save / cancel



**NOTE:**

The initial value of the User-Def standard are for reference only. It does not represents the correct value suitable for use.

Press the UP/DOWN keys to scroll through items. Press the ENTER key to edit the highlighted item. Press the UP/DOWN key again to change the setting. Press the ENTER key to save the setting. Press the ESC key to cancel the change and return to the previous menu.

# 7. General Operation

## 7.5.2 Grid ON/OFF

This function is used to start or stop the generation of the inverter (see Figure 7.27).

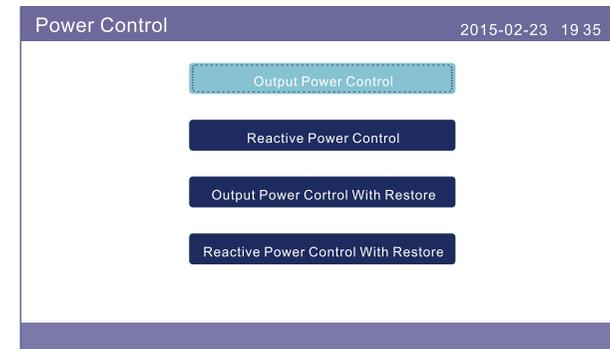


▲ Figure 7.27 Set Grid ON/OFF

Press the DOWN key to move the cursor, Press the UP key to revise the value. Press the ENTER key to execute the setting. Press the ESC key to return to the previous menu.

## 7.5.3 Power Setting

Active and reactive power can be set through power setting button.



▲ Figure 7.28 Power setting

# 7. General Operation



This function is applicable by maintenance personnel only, wrong operation will prevent the inverter from reaching maximum power.

## 7.5.4 Clear Energy and Restore Factory Settings

Clear Energy can reset the history yield of inverter, restore factory settings means all the settings are restored to default settings.

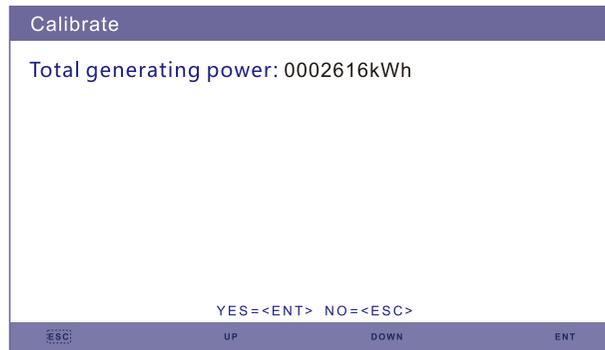


These two functions are applicable by maintenance personnel only, wrong operation will prevent the inverter from working properly.

## 7.5.5 Calibrate Energy

Warranty or maintenance may result in resetting total generation data, this function allows the maintenance personnel to amend the total generating data of a replacement inverter to the original one.

By using our data monitoring hardware, the data on monitoring website can automatically synchronize with the preset total generating power of inverter.



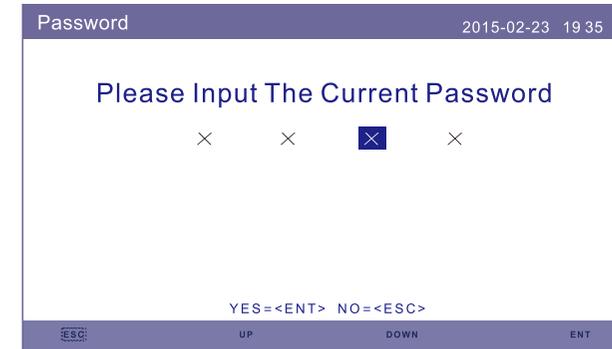
▲ Figure 7.29 Setting the total generating capacity

Press the DOWN key to move the cursor, Press the UP key to revise the value. Press the ENTER key to execute the setting. Press the ESC key to return to the previous menu.

# 7. General Operation

## 7.5.6 Change Password

First enter the current password, Press the DOWN key to move the cursor, press the UP key to revise the password digit.



▲ Figure 7.30 Password setting

After entering the current password, you can create a new password. Upon confirming the new password, press the ENTER key to execute the setting.(See Figure 7.31).



▲ Figure 7.31 Setting new password

## 8. Maintenance

Solis three phase string inverter does not require any regular maintenance. However, cleaning the heat-sink will help in dissipating heat and increase the life time of inverter. The dirt on the inverter can be cleaned with a soft brush.



### CAUTION:

Do not touch the surface when the inverter is operating. Some parts may be hot and cause burns. Turn OFF the inverter (refer to Section 6.2) and let it cool down before you do any maintenance or cleaning of inverter.

The LCD and the LED status indicator lights can be cleaned with cloth if they are too dirty to be read.



### Note:

Never use any solvents, abrasives or corrosive materials to clean the inverter.

## 9. Troubleshooting

The inverter has been designed in accordance with international grid tied standards for safety, and electromagnetic compatibility requirements. Before delivering to the customer the inverter has been subjected to several tests to ensure it's optimal operation and reliability.

In case of a failure the LCD screen will display an alarm message. In this case the inverter may stop feeding energy into the grid. The alarm descriptions and their corresponding alarm messages are listed in Table 9.1:

## 9. Troubleshooting

Alarms	Cause	Solution
No Information (Blank Screen)	<ul style="list-style-type: none"> <li>Input voltage low/missing</li> <li>Polarity reversed</li> <li>Main board damaged</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check PV connections</li> <li>Check polarity</li> <li>Check voltage &gt;120V Single, &gt;350V three</li> </ul> <p><b>Test – DC Switch ON</b></p> <ul style="list-style-type: none"> <li>Check voltage &gt;120V Single, &gt;350V three</li> <li>If DC voltage is "0" replace inverter</li> </ul>
Initializing (Inverter stuck in this mode)	<ul style="list-style-type: none"> <li>Inverter is waiting for driving signal</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check PV connections</li> <li>Check polarity</li> <li>Check voltage &gt;120V Single, &gt;350V three</li> </ul> <p><b>Test – DC Switch ON</b></p> <ul style="list-style-type: none"> <li>Check voltage &gt;120V Single, &gt;350V three</li> <li>A cable may have been damaged or loosened in shipping replace inverter</li> </ul>
OV-G-V: Over Grid Voltage	<ul style="list-style-type: none"> <li>Inverter detects grid voltage as too high</li> <li>228VAC for 208V mode</li> <li>264VAC for 240V mode</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check AC at the inverter</li> <li>If AC measures high, adjust upper limit with permission from utility</li> </ul> <p><b>Test – DC Switch ON, full power</b></p> <ul style="list-style-type: none"> <li>Check AC at inverter test points</li> <li>Compare with LCD</li> <li>If AC measures high, cables between inverter and interconnect are too small</li> <li>Check ampacity and voltage drop calculations</li> </ul>
UN-G-V: Under Grid Voltage	<ul style="list-style-type: none"> <li>Inverter detects grid voltage as too low</li> <li>183VAC for 208V mode</li> <li>211VAC for 240V mode</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check AC at the inverter test points</li> <li>If AC measures low, adjust lower limit with permission from utility</li> <li>Check LCD voltage reading, may be a bad measurement circuit</li> </ul> <p><b>Test – DC Switch ON</b></p> <ul style="list-style-type: none"> <li>Check grid standard</li> <li>Replace inverter</li> </ul>

# 9. Troubleshooting

Alarms	Cause	Solution
OV-G-F: Over Grid Frequency	<ul style="list-style-type: none"> <li>Inverter detects grid Frequency as too high</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check frequency at the inverter test points</li> <li>If Frequency measures high, adjust upper limit with permission from utility</li> <li>Check LCD reading, may be a bad measurement circuit</li> </ul> <p><b>Test – DC Switch ON</b></p> <ul style="list-style-type: none"> <li>Check grid standard</li> <li>Replace inverter</li> </ul>
NO-GRID	<ul style="list-style-type: none"> <li>Inverter does not detect the grid</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check AC at the inverter test points</li> <li>L-L, L-GND</li> <li>Do NOT tell me 240VAC</li> <li>Check LCD reading, may be a bad measurement circuit</li> </ul> <p><b>Test – DC Switch ON</b></p> <ul style="list-style-type: none"> <li>Check grid standard</li> <li>Replace inverter</li> </ul>
OV-DC: DC voltage is too high	<ul style="list-style-type: none"> <li>Inverter detects High DCV</li> </ul>	<p><b>Test – DC switch OFF</b></p> <ul style="list-style-type: none"> <li>Check DC at the inverter test points</li> <li>If DCV is high, too many panels in the string</li> </ul> <p><b>Test – DC Switch ON</b></p> <ul style="list-style-type: none"> <li>Check LCD reading, may be a bad measurement circuit</li> <li>Replace inverter</li> </ul>
OV-BUS: DC BUS voltage is too high	<ul style="list-style-type: none"> <li>Inverter detects High DCV on internal bus</li> </ul>	<p><b>Test</b></p> <ul style="list-style-type: none"> <li>Measure DC and AC voltages</li> <li>Compare with LCD</li> <li>Replace Inverter</li> <li>Internal damage</li> <li>Wire came loose during shipping</li> </ul>
UN-BUS: DC BUS voltage is too low	<ul style="list-style-type: none"> <li>Inverter detects low DCV on internal bus</li> </ul>	<p><b>Test</b></p> <ul style="list-style-type: none"> <li>Measure DC and AC voltages</li> <li>Compare with LCD</li> <li>Replace Inverter</li> <li>Internal damage</li> <li>Wire came loose during shipping</li> </ul>

# 9. Troubleshooting

Alarms	Cause	Solution
GRID-INTF: Grid unstable	<ul style="list-style-type: none"> <li>Inverter detects grid instability, internal fault current high</li> </ul>	<p><b>Test – With DC Switch OFF</b></p> <ul style="list-style-type: none"> <li>Measure AC voltage</li> <li>Test AC line for THD</li> <li>Test – With DC Switch ON</li> </ul> <p><b>Test AC line for THD</b></p> <ul style="list-style-type: none"> <li>Multiple inverters/turn one off</li> <li>Impedance matching adjustment or box</li> <li>Internal damage</li> <li>Wire came loose in shipping</li> </ul>
INI-FAULT: Initialization Protection	<ul style="list-style-type: none"> <li>Master and Slave DSP have different values</li> </ul>	<p><b>Reset Inverter</b></p> <ul style="list-style-type: none"> <li>DC switch OFF</li> <li>Wait until all lights/LCD turn off</li> <li>DC switch ON</li> <li>Replace inverter</li> </ul>
OV-TEM: Temperature Protection	<ul style="list-style-type: none"> <li>Inverter detects high ambient temperature &gt;60C</li> </ul>	<p><b>Inspect installation</b></p> <ul style="list-style-type: none"> <li>Check heatsink for obstructions/ventilation</li> <li>Is inverter in direct sunshine</li> <li>Measure ambient temperature near inverter</li> <li>If temp is in range replace inverter</li> </ul>
PV ISO-PRO 01/02: Ground Protection	<ul style="list-style-type: none"> <li>Inverter detects low DC insulation resistance</li> </ul>	<p><b>Inspect installation</b></p> <ul style="list-style-type: none"> <li>Reset inverter</li> <li>Note weather conditions when alarm occurs</li> <li>Measure insulation resistance</li> <li>If normal, measure in SAME weather as alarm</li> <li>Physically check cables</li> <li>Replace inverter</li> </ul>

Table 9.1 Fault messages and descriptions

## 9. Troubleshooting



### NOTE:

If the inverter displays any alarm message as listed in Table 9.1; please turn off the inverter (refer to Section 6.2 to stop your inverter) and wait for 5 minutes before restarting it (refer to Section 5.1 to start your inverter). If the failure persists, please contact your local distributor or the service center. The below that we will need so that we can assist you.

1. Serial number of the Inverter;
2. The distributor/dealer of the Inverter (if available);
3. Installation date.
4. The description of problem (i.e. the alarm message displayed on the LCD and the status of the LED status indicator lights. Other readings obtained from the Information submenu (refer to Section 7.2) will also be helpful.);
5. Your contact details.

## 10. Specification

Model	Solis-20K
Max. DC input power (Watts)	27000
Max. DC input voltage (Volts)	1000
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	350
MPPT voltage range (Volts)	200...800
Max. input current (Amps)	18+18+18+18
Max short circuit input current (Amps)	23.4+23.4+23.4+23.4
MPPT number/Max input strings number	4/8
Rated output power (Watts)	20000
Max. output power (Watts)	22000
Max. apparent output power (VA)	22000
Rated grid voltage (Volts)	3/N/PE~400
Grid voltage range (Volts)	304...460
Rated output current (Amps)	28.7
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Operating frequency range (Hertz)	47...52 or 57...62
Max. efficiency	98.6%
EU efficiency	98.3%
MPPT efficiency	99.9%
Dimensions	530W*700H*356.5D (mm)
Weight	57.2kg
Topology	Transformerless
Operating ambient temperature range	-25°C . . . 60°C
Ingress protection	IP65
Noise emission (typical)	<30 dBA
Cooling concept	Natural convection
Max. operation altitude	4000m
Designed lifetime	>20 years
Grid connection standard	EN50438, G83/2, AS4777.2:2015, VDE0126-1-1, IEC61727, VDE N4105
Operating surroundings humidity	0...100% Condensing
Connention	Mc4 connector and Ip67 rated plug
Display	7.0"LCD color screen display
Communication connections	4 pins RS485 connector , 2 RJ45 connector
Monitoring	WiFi or GPRS
Warranty Terms	5 Years STD (Extendable to 20 Years)

# 10. Specification

Model	Solis-25K
Max. DC input power (Watts)	33000
Max. DC input voltage (Volts)	1000
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	350
MPPT voltage range (Volts)	200...800
Max. input current (Amps)	18+18+18+18
Max short circuit input current (Amps)	23.4+23.4+23.4+23.4
MPPT number/Max input strings number	4/8
Rated output power (Watts)	25000
Max. output power (Watts)	27500
Max. apparent output power (VA)	27500
Rated grid voltage (Volts)	3/N/PE~400
Grid voltage range (Volts)	304...460
Rated output current (Amps)	36.1
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Operating frequency range (Hertz)	47...52 or 57...62
Max. efficiency	98.6%
EU efficiency	98.3%
MPPT efficiency	99.9%
Dimensions	530W*700H*356.5D (mm)
Weight	58.2kg
Topology	Transformerless
Operating ambient temperature range	-25°C. . . 60°C
Ingress protection	IP65
Noise emission (typical)	<30 dBA
Cooling concept	Natural convection
Max. operation altitude	4000m
Designed lifetime	>20 years
Grid connection standard	EN50438, G83/2, AS4777.2:2015, VDE0126-1-1, IEC61727, VDE N4105
Operating surroundings humidity	0...100% Condensing
Connention	Mc4 connector and Ip67 rated plug
Display	7.0"LCD color screen display
Communication connections	4 pins RS485 connector , 2 RJ45 connector
Monitoring	WiFi or GPRS
Warranty Terms	5 Years STD (Extendable to 20 Years)

# 10. Specification

Model	Solis-30K
Max. DC input power (Watts)	40000
Max. DC input voltage (Volts)	1000
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	350
MPPT voltage range (Volts)	200...800
Max. input current (Amps)	18+18+18+18
Max short circuit input current (Amps)	23.4+23.4+23.4+23.4
MPPT number/Max input strings number	4/8
Rated output power (Watts)	30000
Max. output power (Watts)	33000
Max. apparent output power (VA)	33000
Rated grid voltage (Volts)	3/N/PE~400
Grid voltage range (Volts)	304...460
Rated output current (Amps)	43.3
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Operating frequency range (Hertz)	47...52 or 57...62
Max. efficiency	98.6%
EU efficiency	98.3%
MPPT efficiency	99.9%
Dimensions	530W*700H*356.5D (mm)
Weight	58.2kg
Topology	Transformerless
Operating ambient temperature range	-25°C. . . 60°C
Ingress protection	IP65
Noise emission (typical)	<30 dBA
Cooling concept	Natural convection
Max. operation altitude	4000m
Designed lifetime	>20 years
Grid connection standard	EN50438, G83/2, AS4777.2:2015, VDE0126-1-1, IEC61727, VDE N4105
Operating surroundings humidity	0...100% Condensing
Connention	Mc4 connector and Ip67 rated plug
Display	7.0"LCD color screen display
Communication connections	4 pins RS485 connector , 2 RJ45 connector
Monitoring	WiFi or GPRS
Warranty Terms	5 Years STD (Extendable to 20 Years)

# 10. Specification

Model	Solis-30K-MX
Max. DC input power (Watts)	40000
Max. DC input voltage (Volts)	1000
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	350
MPPT voltage range (Volts)	200...800
Max. input current (Amps)	18+18+18+18
Max short circuit input current (Amps)	23.4+23.4+23.4+23.4
MPPT number/Max input strings number	4/8
Rated output power (Watts)	29990
Max. output power (Watts)	29990
Max. apparent output power (VA)	29990
Rated grid voltage (Volts)	3/N/PE~400
Grid voltage range (Volts)	304...460
Rated output current (Amps)	43.3
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Operating frequency range (Hertz)	47...52 or 57...62
Max. efficiency	98.6%
EU efficiency	98.3%
MPPT efficiency	99.9%
Dimensions	530W*700H*356.5D (mm)
Weight	58.2kg
Topology	Transformerless
Operating ambient temperature range	-25°C . . . 60°C
Ingress protection	IP65
Noise emission (typical)	<30 dBA
Cooling concept	Natural convection
Max. operation altitude	4000m
Designed lifetime	>20 years
Grid connection standard	EN50438, G83/2, AS4777.2:2015, VDE0126-1-1, IEC61727, VDE N4105
Operating surroundings humidity	0...100% Condensing
Connention	Mc4 connector and Ip67 rated plug
Display	7.0"LCD color screen display
Communication connections	4 pins RS485 connector , 2 RJ45 connector
Monitoring	WiFi or GPRS
Warranty Terms	5 Years STD (Extendable to 20 Years)

# 10. Specification

Model	Solis-33K
Max. DC input power (Watts)	44000
Max. DC input voltage (Volts)	1000
Rated DC voltage (Volts)	600
Start-up voltage (Volts)	350
MPPT voltage range (Volts)	200...800
Max. input current (Amps)	18+18+18+18
Max short circuit input current (Amps)	23.4+23.4+23.4+23.4
MPPT number/Max input strings number	4/8
Rated output power (Watts)	33000
Max. output power (Watts)	33000
Max. apparent output power (VA)	33000
Rated grid voltage (Volts)	3/N/PE~400
Grid voltage range (Volts)	304...460
Rated output current (Amps)	47.8
Power Factor (at rated output power)	0.8leading~0.8lagging
THDi (at rated output power)	<3%
Rated grid frequency (Hertz)	50/60
Operating frequency range (Hertz)	47...52 or 57...62
Max. efficiency	98.7%
EU efficiency	98.3%
MPPT efficiency	99.9%
Dimensions	530W*700H*356.5D (mm)
Weight	58.2kg
Topology	Transformerless
Operating ambient temperature range	-25°C . . . 60°C
Ingress protection	IP65
Noise emission (typical)	<30 dBA
Cooling concept	Natural convection
Max. operation altitude	4000m
Designed lifetime	>20 years
Grid connection standard	EN50438, G83/2, AS4777.2:2015, VDE0126-1-1, IEC61727, VDE N4105
Operating surroundings humidity	0...100% Condensing
Connention	Mc4 connector and Ip67 rated plug
Display	7.0"LCD color screen display
Communication connections	4 pins RS485 connector , 2 RJ45 connector
Monitoring	WiFi or GPRS
Warranty Terms	5 Years STD (Extendable to 20 Years)



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## Installation environment caution

Ginlong Solis installation parameters:

Note: Product specifications are subject to change without notice. Every attempt has been made to make this document complete, accurate and up-to-date. Individuals reviewing this document and installers or service personnel are cautioned, however, that Ginlong Technologies reserves the right to make changes without notice and shall not be responsible for any damages, including indirect, incidental or consequential damages caused by reliance on the material presented including, but not limited to, omissions, typographical errors, arithmetical errors or listing errors in the material provided in this document.

Ginlong Technologies accepts no liability for customers' failure to comply with the instructions for correct installation and will not be held responsible for upstream or downstream systems Ginlong's equipment has supplied.

The customer is fully liable for any modifications made to the system; therefore, any hardware or software modification, manipulation, or alteration not expressly agreed with the manufacturer shall result in the immediate cancellation of the warranty.

Given the countless possible system configurations and installation environments, it is essential to verify adherence to the following:

Installation environment caution:

- Refer to the local regulatory requirements, Australian Standards, and CEC guidelines
- Consult the Ginlong Solis technical data when considering the environmental elements such as sun exposure, heat, light, rain, noise and airflow
- Inverter installations in locations where there is unprotected exposure to direct sunlight must be avoided (or the warranty will be voided) as this may cause:-
  1. Compromise of the operational life and function of the electrical / electromechanical components
  2. Damage to the mechanical sealing components (gaskets), identification labels and markings or the LCD display
  3. Compromise of the optimum productivity and operation delivering decreased energy production from the system
  4. Do not install in small rooms, cupboards, or confined spaces where airflow is restricted or limited
  5. To avoid potential for over heating always ensure airflow around the inverter is unrestricted
  6. Do not install above any heat source such as heating, air-conditioning, water heating equipment etc.
  7. never install inverter equipment on unprotected and exposed north or west facing walls
  8. Do not install directly onto flammable wall surfaces such as wooden cladding (e.g. use cement sheet barrier)
  9. Do not install in rooms or on walls directly abutting those used for prolonged periods by people (e.g. bedroom walls)

Note: This product contains lethal voltages and should only be installed by qualified and appropriately accredited electrical or service personnel having experience with lethal voltages.

Ginlong Technologies will not be held liable for defects or malfunctions arising from:

- Improper use of the equipment,
- Performing maintenance incorrectly or not at all.
- Tampering or unsafe repairs.
- Use or installation by unqualified persons directly abutting those used for prolonged periods by people (e.g. bedroom walls)