



Solis Three Phase Inverter

(80-200)K **Installation and Operation Manual**

Ver 1.0

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Please adhere to the actual products in case of any discrepancies in this user manual.

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.

Ginlong Technologies Co., Ltd.

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1. Introduction

1.1 Product Description

Solis Three phase Inverters covert DC power from the photovoltaic(PV) array into alternating current(AC) power that can satisfy local loads as well as feed the power distribution grid.

This manual covers the three phase inverter model listed below:

S6-GC3P150K07-HV-ND-US, S6-GC3P166K07-HV-ND-US, S6-GC3P174K07-HV-ND-US, S6-GC3P200K07-HV-ND-US, S6-GC3P80K07-LV-ND, S6-GC3P100K07-LV-ND

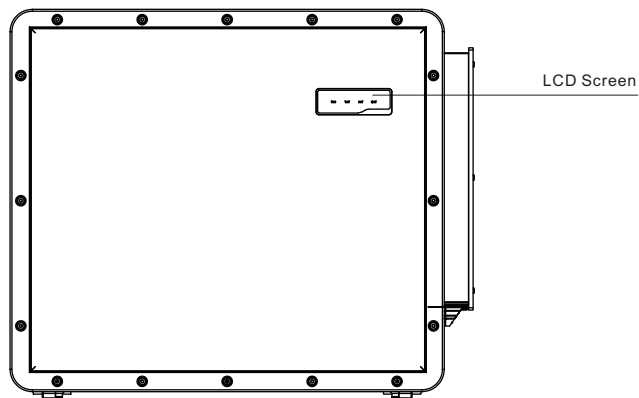


Figure 1.1 Front view

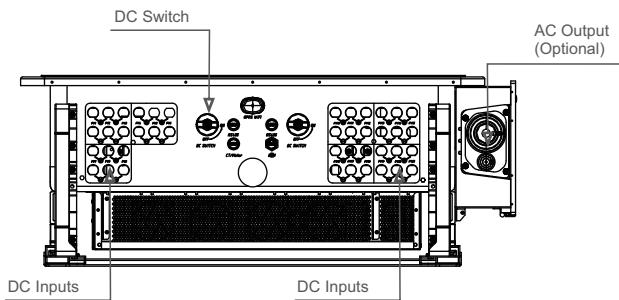


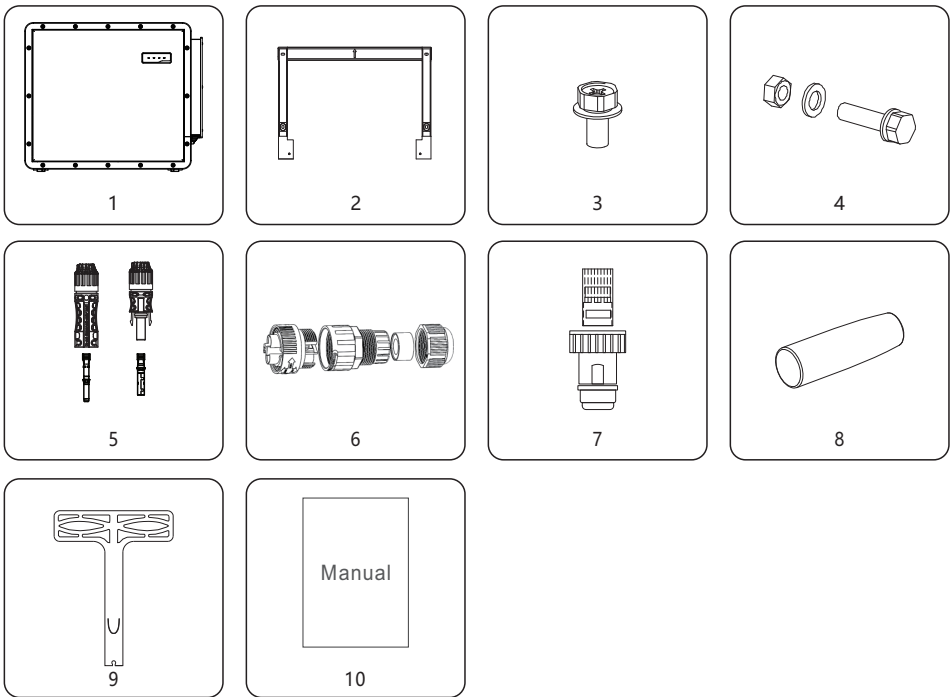
Figure 1.2 Bottom view

1. Introduction

1.2 Unpacking and storage

The inverter ships with all accessories in one carton.

When unpacking, please verify all the parts listed below are included:



Part #	Description	Number	Remarks
1	Inverter	1	
2	Mounting Bracket	1	
3	Fastening screw	2	Hexagon bolt M6*12
4	Fastening screw, hex nut and flat gasket	4	Hexagon bolt M10*40
5	DC connector	21	Screw M10X40, Hexagonal nut M10, flat pad 10
6	2 pin port	3	
7	RJ45 connector	1	
8	Handle	4	
9	Switch reset rotary lever	1	
10	User manual	1	

Inverter packing list

1. Introduction

1.2.1 Storage

If the inverter is not 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 in a clean and dry place, free of dust and dirt. The storage temperature must be between -40 - 70°C and humidity should be between 0 to 95%, non-condensing.
- Do not stack more than three (3) inverters high on a single pallet.
- Keep the box(es) away from corrosive materials to avoid damage to the inverter enclosure.
- Inspect the packaging regularly. If packing is damaged (wet, pest damages, etc.), repackage the inverter immediately.
- Store inverters on a flat, hard surface -- not inclined or upside down.
- After 100 days of storage, the inverter and carton must be inspected for physical damage before installing. If stored for more than 1 year, the inverter needs to be fully examined and tested by qualified service or electrical personnel before using.
- Restarting after a long period of non-use requires the equipment be inspected and, in some cases, the removal of oxidation and dust that has settled inside the equipment will be required.



Figure 1.3

2. Safety Instructions

Improper use may result in electric shock hazards or burns. This product manual contains important instructions that are required to be followed during installation and maintenance. Please read these instructions carefully before use and keep them in an easily locatable place for future reference.

2.1 Safety symbols

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



WARNING

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



NOTE

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



CAUTION, RISK OF ELECTRIC SHOCK

Symbol indicates important safety instructions, which if not correctly followed, could result in electric shock



CAUTION, HOT SURFACE

Symbol indicates safety instructions, which if not correctly followed, could result in burns.

2.2 General safety instructions



WARNING

Do not connect PV array positive (+) or negative (-) to ground – doing so could cause serious damage to the inverter.



WARNING

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



WARNING

To reduce the risk of fire, branch circuit over-current protective devices (OCPD) are required for circuits connected to the Inverter.



CAUTION

The PV array (solar panels) supplies a DC voltage when exposed to light.

2. Safety Instructions



CAUTION

Risk of electric shock from energy stored in the inverter's capacitors. Do not remove cover until 20 minutes after disconnecting all sources of supply have passed, and this can only be done by a service technician. The warranty may be voided if any unauthorized removal of cover occurs.



CAUTION

The inverter's surface temperature can reach up to 70°C. To avoid risk of burns, do not touch the surface when the inverter is operating. Inverter must be installed out of the reach of children.



WARNING

The inverter can only accept a PV array as a DC input. Using any other type of DC source could damage the inverter.

2.3 Notice for use

The inverter has been constructed according to applicable safety and technical guidelines. Use the inverter in installations that meet the following requirements ONLY:

- 1). The inverter must be permanently installed.
- 2). The electrical installation must meet all the applicable regulations and standards.
- 3). The inverter must be installed according to the instructions stated in this manual.
- 4). The system design must meet inverter specifications.
- 5). The inverter can only be used for industrial.

To start-up the inverter, the Grid Supply Main Switch (AC) must be turned on, BEFORE the DC Switch is turned on. To stop the inverter, the Grid Supply Main Switch (AC) must be turned off before the DC Switch is turned off.

2.4 Notice for Disposal

This product shall not be disposed of with household waste. They should be segregated and brought to an appropriate collection point to enable recycling and avoid potential impacts on the environment and human health. Local rules in waste management shall be respected.



3. Installation

3.1 Environmental considerations

3.1.1 Select a location for the inverter

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



WARNING: Risk of fire

Despite careful construction, electrical devices can cause fires.

- Do not install the inverter in areas containing highly flammable materials or gases.
- Do not install the inverter in potentially explosive atmospheres.
- The mounting structure where the inverter is installed must be fireproof.

- The temperature of the inverter heat-sink can reach 70°C.
- The inverter is designed to work in an ambient temperature range between -30 to 60°C.
- If multiple inverters are installed on site, a minimum clearance of 700mm should be kept between each inverter and all other mounted equipment. The bottom of the inverter should be at least 500mm above of the ground or floor (see Figure 3.1).
- The LED status indicator lights and the LCD located on the inverter's front panel should not be blocked.
- Adequate ventilation must be present if the inverter is to be installed in a confined space.
- When multiple inverters are installed and the space is sufficient, a zigzag installation is recommended. Font type, back-to-back installation is not recommended. Do not install it stacked up and down.

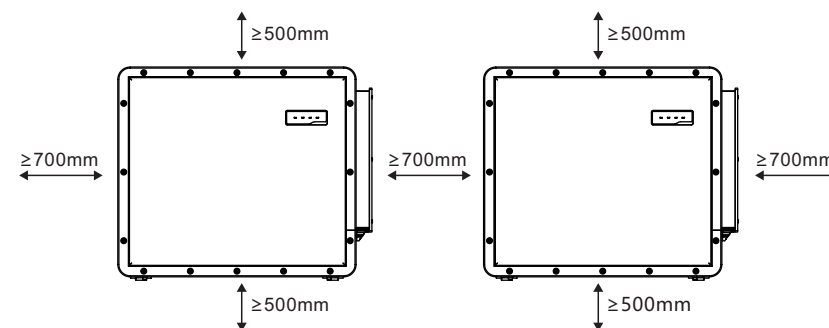


Figure 3.1 Distances required between inverters



NOTE

Nothing should be stored on or placed against the inverter.

3. Installation

When multiple inverters are installed and the space is sufficient, a zigzag installation is recommended. Front type, back-to-back installation is not recommended.

Do not install it stacked up and down.

When the installation site is a horizontal plane, the inverter can be installed at an Angle of more than 15 degrees horizontally, as shown in the figure.

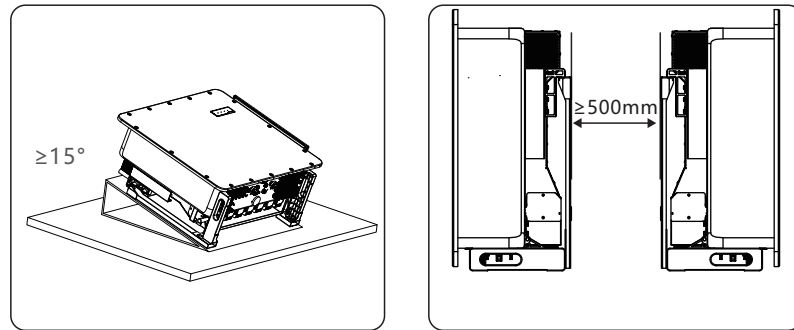


Figure 3.2 Horizontal and back-to-back installation

3.1.1.1 Examples of correct and incorrect installations

Ingress protection: IP66

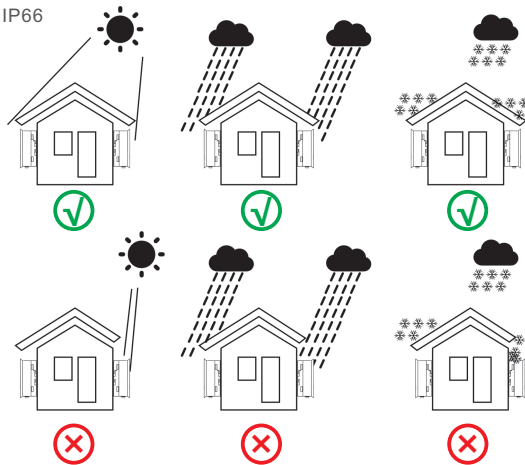


Figure 3.3 Recommended Installation locations

3. Installation

3.1.2 Other environmental considerations

3.1.2.1 Consult technical data

Consult the specifications section (section 10) for additional environmental conditions (protection rating, temperature, humidity, altitude, etc.).

3.1.2.2 Avoiding direct sunlight

Installation of the inverter in a location exposed to direct sunlight should be avoided.

Direct exposure to sunlight could cause:

- Power output limitation (with a resulting decreased energy production by the system).
- Premature wear of the electrical/electromechanical components.
- Premature wear of the mechanical components (gaskets) and user interface.

3.1.2.3 Air circulation

Do not install in small, closed rooms where air cannot freely circulate. To prevent overheating, always ensure that the air flow around the inverter is not blocked.

3.1.2.4 Flammable substances

Do not install near flammable substances. Maintain a minimum distance of three (3) meters (10 feet) from such substances.

3.1.2.5 Living area

Do not install in a living area where the prolonged presence of people or animals is expected. Depending on where the inverter is installed (for example: the type of surface around the inverter, the general properties of the room, etc.) and the quality of the electricity supply, the sound level from the inverter can be quite high.

3.2 Product handling

Please review the instruction below for handling the inverter:

1. The red circles below denote cutouts on the product package.

Push in the cutouts to form handles for moving the inverter around 135KG.

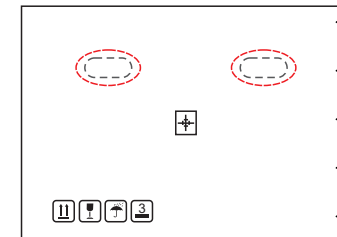


Figure 3.4 Handles used to move the inverter shown circled in red

2. Two people are required to remove the inverter from the shipping box. Use the handles integrated into the heat sink to remove the inverter from the carton (see Figure 3.5).

3. Installation

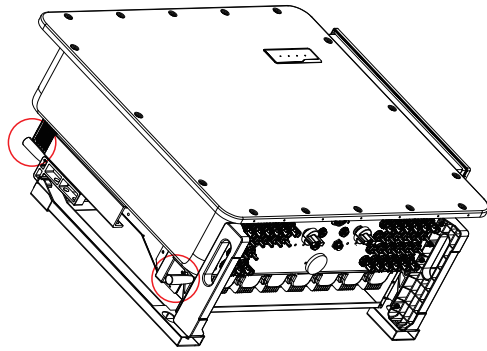


Figure 3.5 Inverter handles



WARNING

Due to the weight of the inverter, contusions or bone fractures could occur when incorrectly lifting and mounting the inverter. When mounting the inverter, take the weight of the inverter into consideration. Use a suitable lifting technique when mounting. When installers are carrying the inverter, please use 4 handles to secure safety. Lifting force of each handle shall not exceed 1.5 times of the inverter weight.

In case of using hoisting to lift the inverter, fix the hoisting cable to the hanger shown in the graph. Please make a reasonable selection of hoisting equipment considering the inverter weight of 105kg.

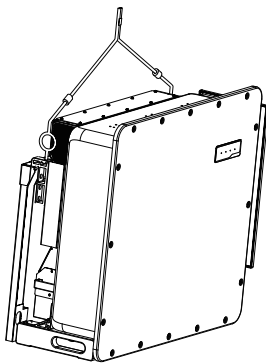


Figure 3.6 Hoisting sketch

3. Installation

3.3 Mounting the Inverter

The inverter can be mounted to the wall or metal array racking. The mounting holes should be consistent with the size of the bracket or the dimensions shown in Figure 3.7.

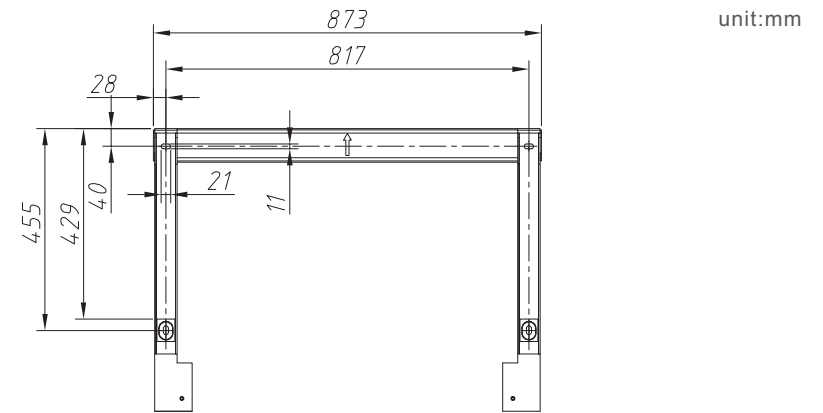


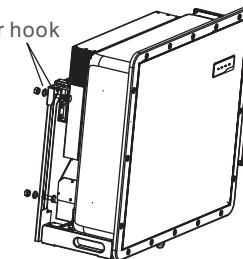
Figure 3.7 Inverter wall mounting

3.3.1 Wall mounting

Inverter shall be mounted vertically. The steps to mount the inverter are listed below.

1. Refer to Figure 3.8, drill holes for mounting screws based on the hole diameter of bracket using a precision drill keeping the drill perpendicular to the wall. Max depth is 3.7 in.
2. Make sure the bracket is horizontal. And the mounting holes are marked correctly. Drill the holes into wall at your marks.
3. Use the suitable mounting screws to attach the bracket on the wall.
4. Lift the inverter and hang it on the bracket, and then slide down to make sure they match perfectly.

Inverter hook

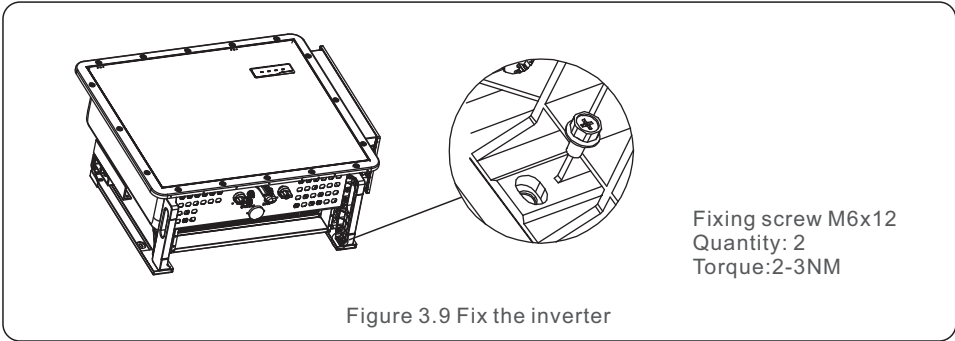


Torque:30-35NM

Figure 3.8 Install the inverter

3. Installation

5. Use screws in the packaging to fix the inverter to the mount bracket.



3.4 Electrical Connections

Inverter design uses PV style quick-connect terminal. The top cover needn't be opened during DC electrical connection. The labels located the bottom of the inverter are described below in table 3.1. All electrical connections are suitable for local or national standard.

Parts	Connection	Cable size	Torque
DC terminal	PV strings	4-6mm ²	NA
Ground terminal	AC ground	35-50mm ²	10-12N.m
Grid terminal	Grid	70-400mm ²	20-30N.m
RS-485 terminal	Communication cable	0.5-0.75mm ²	0.6N.m
COM terminal	Wi-Fi/Cellular stick	NA	NA
DC surge protection device	NA	NA	NA

Table 3.1 Electrical connection symbols

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

1. Switch the Grid Supply Main Switch (AC) OFF.
2. Switch the DC Isolator OFF.
3. Connect the inverter to the grid.
4. Assemble PV connector and connect to the Inverter.

3. Installation

3.4.1 Grounding

To effectively protect the inverter, two grounding methods must be performed.

Connect the AC grounding cable (Please refer to section 3.4.3)

Connect the external grounding terminal.

To connect the grounding terminal on the heat sink, please follow the steps below:

- 1) Prepare the grounding cable: recommend to use the outdoor copper-core cable. The grounding wire should be at least half size of the hot wires.
- 2) Prepare OT terminals: M10.



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.

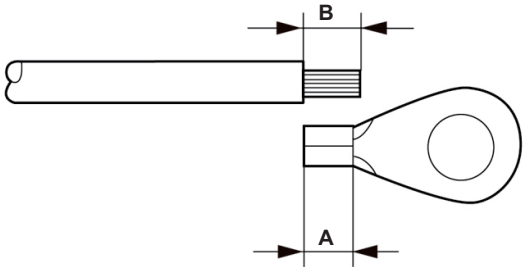


Figure 3.10 Suitable length



Important:

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

3. Installation

- 4) Insert the stripped wire into the OT terminal crimping area and use the hydraulic clamp to crimp the terminal to the wire.

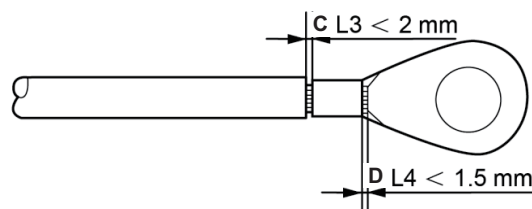


Figure 3.11 Strip wire

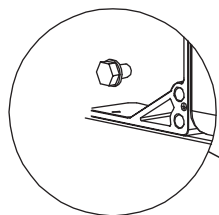


Important:

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) Connect the grounding cable to the grounding point on the heat sink, and tighten the grounding screw, Torque is 10-12Nm.

Grounding Screw



Torque: 10-12Nm

Figure 3.12 Fixed cable



Important:

For improving anti-corrosion performance, after ground cable installed, apply silicone or paint.

3. Installation

3.4.2 Connect PV side of inverter



WARNING

Before connecting the inverter, make sure the PV array open circuit voltage is within the limit of the inverter. Otherwise, the inverter could be damaged.



WARNING

DO NOT connect the PV array positive or PV array negative cable to ground. This can cause serious damage to the inverter!



WARNING

MAKE SURE the polarity of the PV array output conductors matches the DC- and DC+ terminal labels before connecting these conductors to the terminals of the inverter.



WARNING

Please use the original DC MC4 terminals, otherwise the unqualified DC connectors may cause damages to the inverter.



Important:

The inverter has a DC fuseless design with internal overcurrent protection. It is not needed to install any external DC string fuses or DC circuit breakers. If customers want to have redundant protection, they can choose to install external DC overcurrent protection devices with 1.5~2.4 times of the string I_{mp} . External DC overcurrent protection devices shall comply with IEC/EN 60269-6.

Please see table 3.1 for acceptable wire size for DC connections. Wire must be copper only. The steps to assemble the DC connectors are listed as follows:

1. Strip off the DC wire for about 7mm, Disassemble the connector cap nut.
2. Insert the wire into the connector cap nut and contact pin.

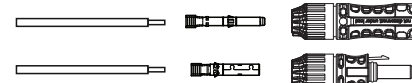


Figure 3.13 Disassemble the Connector Cap nut

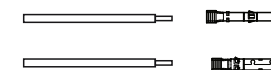


Figure 3.14 Insert the Wire into the Connector Cap nut and contact pin

3. Crimp the contact pin to the wire using a proper wire crimper.
4. Insert metal connector into top of connector, and tighten nut with torque 3-4 Nm.

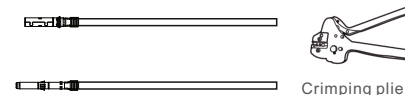


Figure 3.15 Crimp the contact pin to the wire

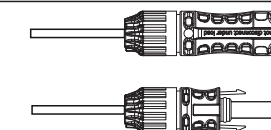


Figure 3.16 Connector with Cap nut Screwed on

3. Installation

5. Measure PV voltage of DC input with multimeter, verify DC input cable polarity (see figure 3.17), and ensure each string voltage is in range of inverter operation. Connect DC connector with inverter until hearing a slight clicking sound indicating successful connection. (see figure 3.18)

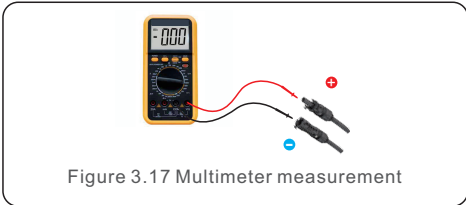


Figure 3.17 Multimeter measurement

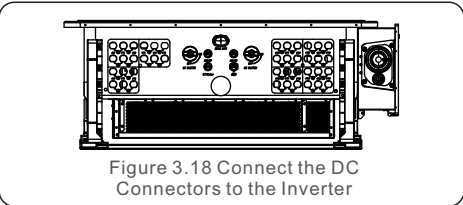


Figure 3.18 Connect the DC Connectors to the Inverter

Cable type	Traverse area (mm ²)		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



Caution:

If DC inputs are accidentally reversely connected or inverter is faulty or not working properly, it is NOT allowed to turn off the DC switch. Otherwise it may cause DC arc and damage the inverter or even lead to a fire disaster. The correct actions are:
*Use a clip-on ammeter to measure the DC string current.
*If it is above 0.5A, please wait for the solar irradiance reduces until the current decreases to below 0.5A.
*Only after the current is below 0.5A, you are allowed to turn off the DC switches and disconnect the PV strings.
* In order to completely eliminate the possibility of failure, please disconnect the PV strings after turning off the DC switch to avoid secondary failures due to continuous PV energy on the next day.
Please note that any damages due to wrong operations are not covered in the device warranty.

Requirements for the PV modules per MPPT input:

- All PV modules must be of the same type and power rating.
- Please ensure the PV strings are evenly connected to the inverter and try to utilize all the MPPT trackers.
- All PV modules must be aligned and tilted identically.
- The open-circuit voltage of the PV array must never exceed the maximum input voltage of the inverter, even at the coldest expected temperature. (see section 10 “Specifications” for input current and voltage requirements)
- Each string connected to a single MPPT must consist of the same number of series-connected PV modules.

3. Installation

3.4.2.1 DC connection high voltage danger notice



CAUTION
RISK OF ELECTRIC SHOCK

Do not touch an energized DC conductor. There are high voltages present when PV modules are exposed to light causing a risk of death due to an electric shock from touching a DC conductor!

Only connect the DC cables from the PV module to the inverter as described in this manual.



CAUTION
POTENTIAL DAMAGE TO THE INVERTER DUE TO OVERVOLTAGE

The DC input voltage of the PV modules must not exceed the maximum rating of the inverter. (see section 10 “Specifications”)

Check the polarity and the open-circuit voltage of the PV strings before connecting the DC cables to the inverter.

Confirm proper string length and voltage range before connecting DC cable to the inverter.

3.4.3 Connect grid side of inverter



WARNING
An over-current protection device must be used between the inverter and the grid.

1. Connect the three (3) AC conductors to the three (3) AC terminals marked “L1”, “L2” and “L3”. Refer to local code and voltage drop tables to determine the appropriate wire size and type.
2. Connect the grounding conductor to the terminal marked “PE” (protective earth, the ground terminal).
3. Connect the terminal marked “N”: NV&LV models only . For HV model DO NOT connect.

Over-Current Protection Device (OCPD) for the AC side

To protect the inverter's AC connection line, we recommend installing a device for protection against over-current and leakage, with the following characteristics noted in Table 3.2 (The OCPD shall comply with IEC/EN60947-3):



NOTE
Use AL-CU transfer (bi-metallic) terminal or anti-oxidant grease with aluminum cables and terminals.

3. Installation

Inverter	Rated voltage(V)	Max. output current (Amps)	Current for protection device (A)
S6-GC3P150K07-HV-ND-US	480V	180.4	250
S6-GC3P166K07-HV-ND-US	480V	199.7	250
S6-GC3P174K07-HV-ND-US	480V	209.3	250
S6-GC3P200K07-HV-ND-US	480V	240.6	300
S6-GC3P80K07-LV-ND	220V/230V	230.9	300
S6-GC3P100K07-LV-ND	220V/230V	251.0	300

Table 3.2 Rating of grid OCPD

3.4.3.1 Connecting the inverter to the utility grid

All electrical installations must be carried out in accordance with the local standards and the National Electrical Code® ANSI/NFPA 70 or the Canadian Electrical Code® CSA C22.1. The AC and DC electric circuits are isolated from the enclosure. If required by section 250 of the National Electrical Code®, ANSI/NFPA 70, the installer is responsible for grounding the system.

The grid voltage must be within the permissible range. The exact operating range of the inverter is specified in section 10 “Specifications”.

3.4.3.2 Wiring procedure



CAUTION

RISK OF ELECTRIC SHOCK. Prior to starting the wiring procedure, ensure that the three-pole circuit breaker is switched off and cannot be reconnected.



NOTE

Damage or destruction of the inverter's electronic components due to moisture and dust intrusion will occur if the enclosure opening is enlarged.



NOTE

Use M10 crimp terminals to connect to the inverter AC terminals.



CAUTION

Risk of fire if two conductors are connected to one terminal. If a connection of two conductors to a terminal is made, a fire can occur. NEVER CONNECT MORE THAN ONE CONDUCTOR PER TERMINAL.

3. Installation

Inverter	Max AC cable length(m)
S6-GC3P150K07-HV-ND-US	280
S6-GC3P166K07-HV-ND-US	250
S6-GC3P174K07-HV-ND-US	240
S6-GC3P200K07-HV-ND-US	210
S6-GC3P80K07-LV-ND	110
S6-GC3P100K07-LV-ND	90

Table 3.3

Cable specification		Copper-cored cable
Traverse cross sectional area (mm ²)	Range	95-300
	Recommended	120
Conduit diameter (mm)	Range	40-75



NOTE

Cable ampacity of ground wire should be more than half of cable ampacity of live wire.

1) Strip the end of AC cable insulating jacket about 300mm then strip the end of each wire.

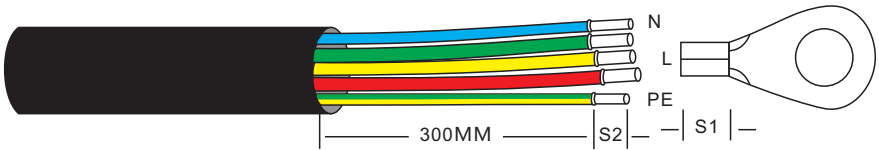


Figure 3.19 Strip AC cable



NOTE

S2 (insulation stripping length) is 2mm-3mm longer than S1. (OT cable terminal crimping area)

2) Strip the insulation of the wire past the cable crimping area of the OT terminal, then use a hydraulic crimp tool to crimp the terminal. The crimped portion of the terminal must be insulated with heat shrinkable tube or insulating tape.



NOTE:

If choosing aluminum alloy cable, you must use copper aluminum transfer terminal in order to avoid direct contact between copper bar and Aluminum alloy cable. (Please select a copper aluminum transfer terminal based on your cable specification).

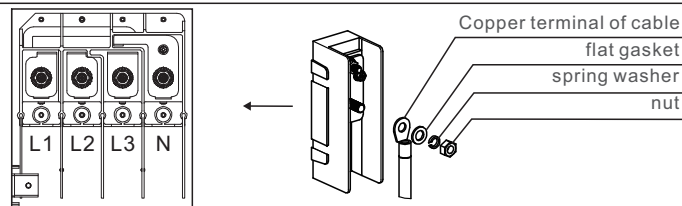


Figure 3.20 Copper aluminum transfer terminal

- 3) Leave the AC breaker disconnected to ensure it does not close unexpectedly.
- 4) Remove the 3 screws on the inverter junction box and open the junction box cover.

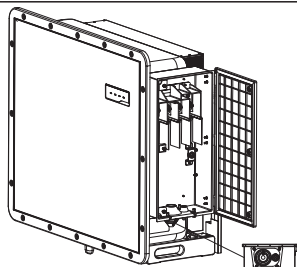
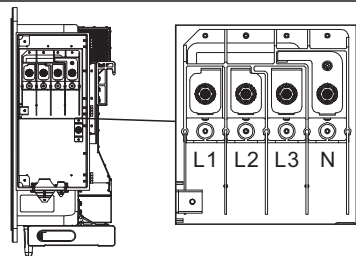


Figure 3.21 Remove the junction box cover

- 5) Insert the cable through the nut, sheath, and AC terminal cover. Connect the cable to the AC terminal block in turn, using a socket wrench. Tighten the screws on the terminal block. The torque is 20-30Nm.



M6 5-7 N.m
M10 12-16 N.m
M12 20-30 N.m

Figure 3.22 Wiring with Neutral



NOTE

Transformer needs to be connected during installation.

3.4.3.3 Multiple Inverters in Parallel Connectio

When multiple inverters are connected to the grid in parallel, ensure that the maximum number of inverters connected in parallel to a single winding of the box-type substation is 15. Otherwise, please contact Solis for technical scheme.

3.4.3.4 MV Transformer

The MV transformer used together with the inverter should meet the following requirements:

- The transformer must comply with IEC 60076, IEC 62271, IEC61439 standards.
- Either a oil immersed transformer or a dry transformer can be used., and the shield winding is not a requisite.
- The line-to-line voltage on the LV side of the transformer should endure the output volt-age of inverter.
- The line-to-line voltage on the HV side of the transformer should comply with the local power grid voltage.
- At an ambient temperature of 40°C, the transformer can run in 1.1 times of load for a long time.
- A transformer with a rated capacity of 9100kVA and a short-circuit impedance equal to 9.5% is recommended.
- The voltage drop of system cable is no more than 3%.
- The DC component that the transformer can withstand is 1% of the fundamental current at rated power.
- The apparent power of the inverter should never exceed the power of the transformer.
- Take ambient temperature, relative humidity, altitude, and other environmental conditions into account when selecting and installing the transformer.
- The overall technical requirements of the box-type LV cabinet are as follows:
 - If the S3-Logger is used for communication, an external power supply of 220 Vac is required. So a power supply port and an input port (including switches) should be reserved in the LV power distribution room of the transformer.
 - If PLC communication is selected, an 800Vac switch should be reserved in the LV power distribution room of the transformer for PLC communication signal sampling.