



PV Utility Interactive Inverter – U.S. Version

Solis Three Phase Inverter

(50-66kW) **Installation and Operation Manual**

Ver 1.2

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Ginlong Technologies Co., Ltd.

Important notes

- 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.
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 - There is sufficient space suitable for housing the equipment.
 - Airborne noise produced depending on the environment.
 - Potential flammability hazards.
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 - 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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1.1 Product Description

Solis U.S. Three Phase Inverters convert 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 Solis U.S. Three Phase Inverter four (4) models listed below:

Solis-50K-US Solis-50K-US-F Solis-60K-US-F Solis-66K-US-F

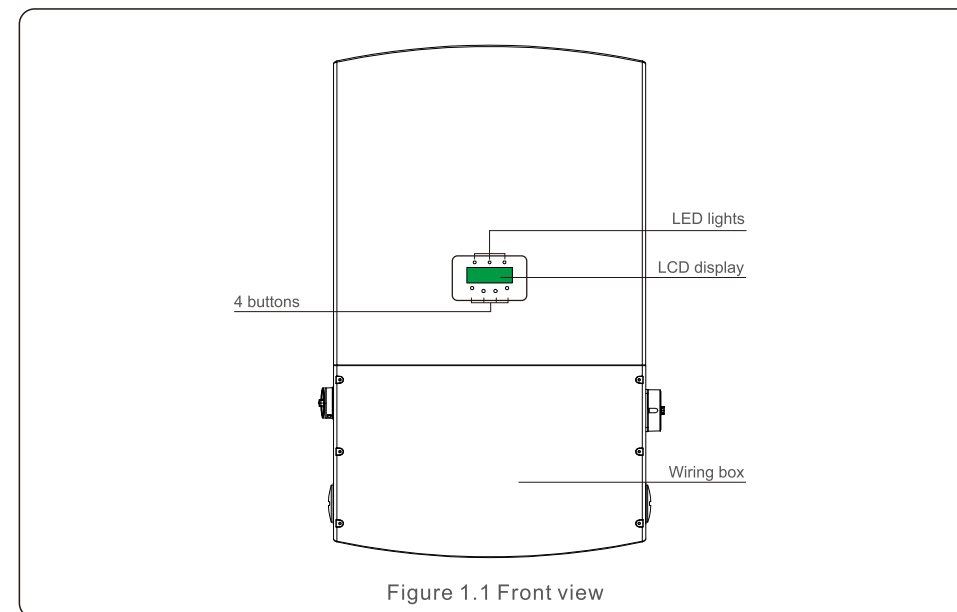


Figure 1.1 Front view

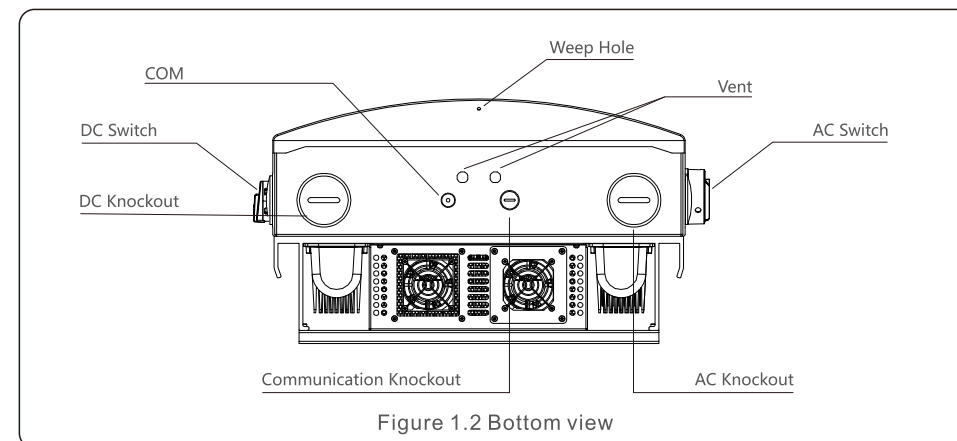
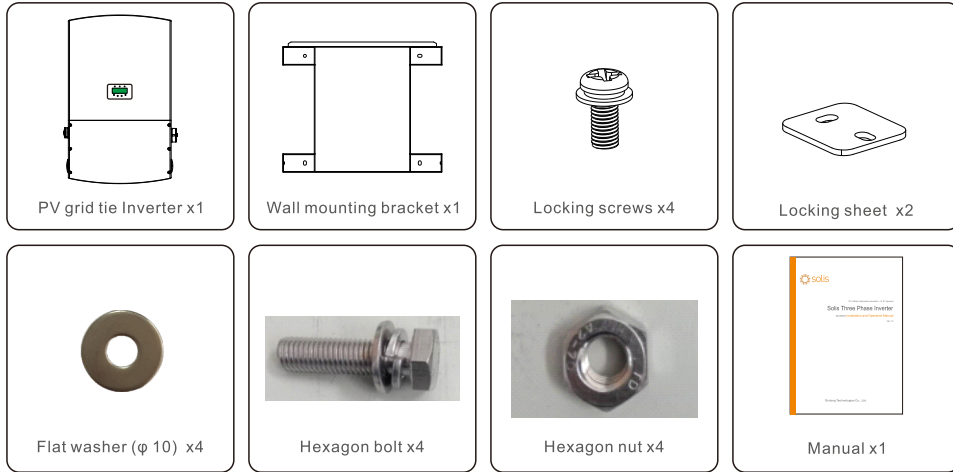


Figure 1.2 Bottom view

1. Introduction

1.2 Unpacking and storage

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



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 -16 and 140 F (-26 - 60C) and humidity should be between 0 to 100%, non-condensing.
- Do not stack more than two (2) inverters high.
- 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 long-term storage, 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.



**DO NOT STACK
MORE THAN 2 HIGH**

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.

2. Safety Instructions



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.



CAUTION

Risk of electric shock from energy stored in the inverter's capacitors. Do not remove cover until five (5) 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 75°C (167°F). 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.

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. Safety Instructions

2.4 Protection Circuitry and Controls

To meet relevant codes and standards, the Solis three phase inverter line is equipped with protective circuitry and controls. These include Arc Fault Circuit Interrupter (AFCI) and Anti-Islanding Protection.

Arc Fault Circuit Interrupter AFCI:

Edition 2011 of the National Electrical Code®, Section 690.11, requires that all PV plants attached to a building are fitted with a means of detecting and interrupting serial electric arcs in the PV wiring and array. An electric arc with a power of 300W or greater must be interrupted by the AFCI in the time specified by UL 1699B. A triggered AFCI fault may only be reset manually. After clearing the source of the fault, the AFCI can be deactivated via the inverter front panel interface.

Anti-Islanding Protection:

Islanding is a condition where the inverter continues to produce power even when the grid is not present. Circuitry, along with firmware, has been designed to determine if the grid is present by adjusting the output frequency of the inverter. In the case of a 60Hz resonant system where the inverter is partially isolated from the grid, the inverter programming can detect if there is a resonant condition or if the grid is actually present. It can also differentiate between inverters operating in parallel and the grid.

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:

- The temperature of the inverter heat-sink can reach 167°F(75C).
- The inverter is designed to work in an ambient temperature range between -13°F to 140°F(-25 - 60C).
- If multiple inverters are installed on site, a minimum clearance of 20 inches should be kept between each inverter and all other mounted equipment. The bottom of the inverter should be at least 20 inches 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.

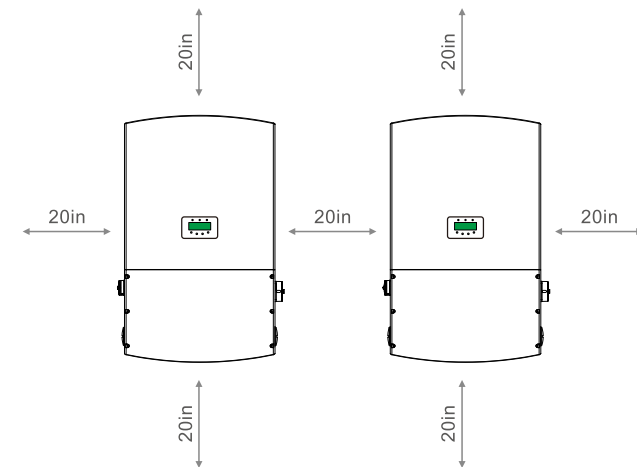


Figure 3.1 Distances required between inverters

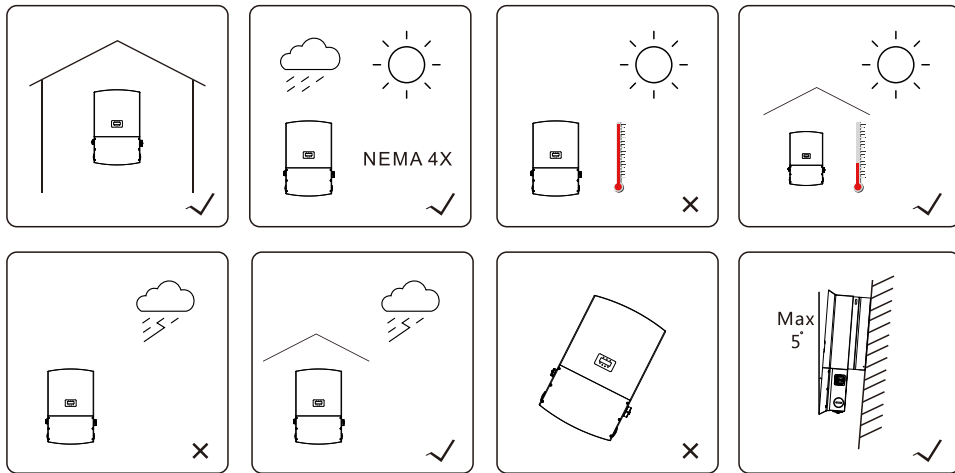



NOTE

Nothing should be stored on or placed against the inverter.

3. Installation

3.1.1.1 Examples of correct and incorrect installations



 **NOTE**
Units with a fan may be mounted at 15 – 90 degrees off horizontal.

3.1.2 Other environmental considerations

3.1.2.1 Consult technical data

Consult the specifications section (section 9) for additional environmental conditions (protection rating, temperature, humidity, altitude, etc.).

3.1.2.2 Vertical wall installation

Solis inverters are typically convection cooled and must be mounted vertically (90 +/- 5 degrees off horizontal). Units with a fan may be mounted at 15 – 90 degrees off horizontal.

3.1.2.3 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.

3.1.2.4 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. Installation

3.1.2.5 Flammable substances

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

3.1.2.6 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 instructions 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 (see Figure 3.2).

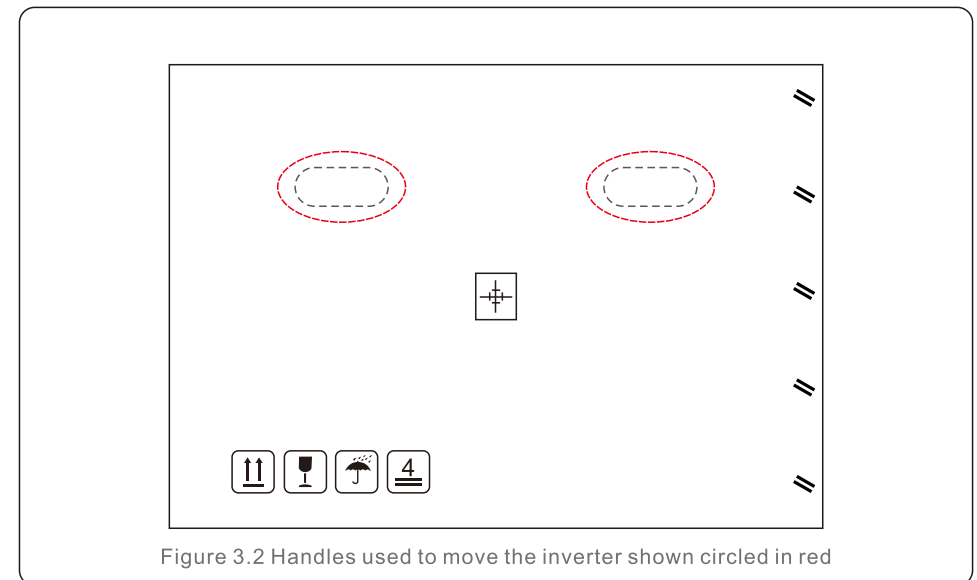


Figure 3.2 Handles used to move the inverter shown circled in red

- 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 box (see Figure 3.3).

3. Installation

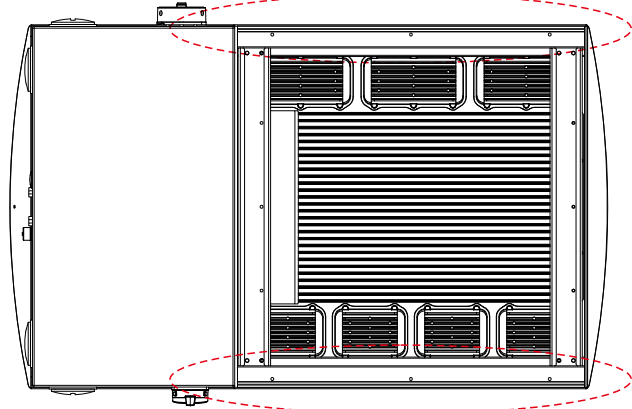


Figure 3.3 Handles shown circled in red are used to remove the inverter from the shipping box



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.

3.3 Mounting the inverter

The inverter can be mounted to a wall or metal array racking. The mounting holes should be consistent with the size of the bracket or the dimensions shown in Figure 3.4.

3. Installation

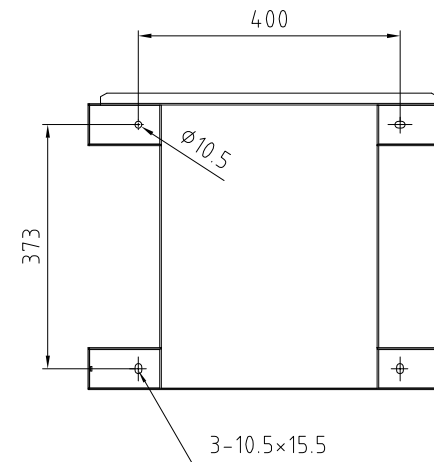


Figure 3.4 Mounting bracket and dimensions

The inverter must be mounted vertically ($\pm 5^\circ$) following the steps below:

Inverters with fans may be mounted at 15-90 degrees off horizontal.

- 1). Referring to Figure 3.4, select the mounting height of the bracket. For brick walls, the position of the holes should be suitable for expansion bolts.
- 2). Ensure the bracket is level and the mounting holes are in the correct positions depending on the mounting surface. Mark the surface through the bracket holes and drill the holes in the wall at the marks.
- 3). Use suitable fasteners and expansion bolts (if required) to attach the bracket to the wall.

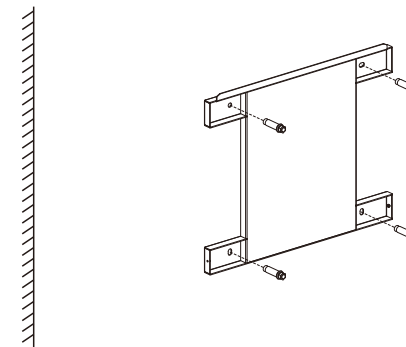


Figure 3.5 Mount the bracket to the wall

3. Installation



WARNING

The inverter must be mounted vertically on a wall. Ensure the bracket is level before mounting inverter. Inverter with fans may be mounted at 15-90 degrees off horizontal.

- 4). Lift the inverter and align the slot on the back of the inverter with the lip on the mounting bracket. Slowly lower the inverter onto the bracket until the inverter is secured on the bracket (see Figure 3.6).

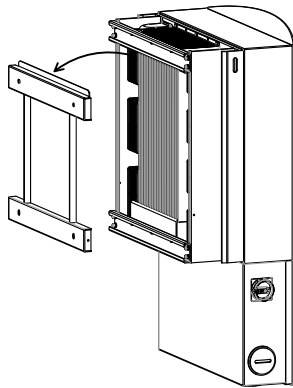


Figure 3.6 Lift and attach the inverter to the mounting bracket

- 5). Use two (2) M4 x 9mm screws (supplied) to secure the inverter to the mounting bracket. Torque to 20 in-lbs (2 N-m).

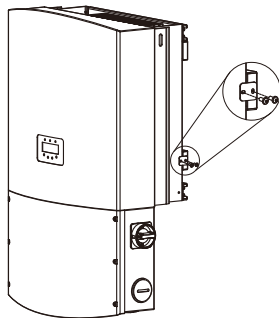


Figure 3.7 Secure the mounting bracket with screws

3. Installation

3.4 Wiring box configuration

The Solis U.S. Three Phase Inverter wiring box is designed for easy access to all connection terminals, including monitoring communication ports. The wire box features a spacious work area and pre-drilled 2 inch (ID) knockouts on the bottom and sides of the cabinet.

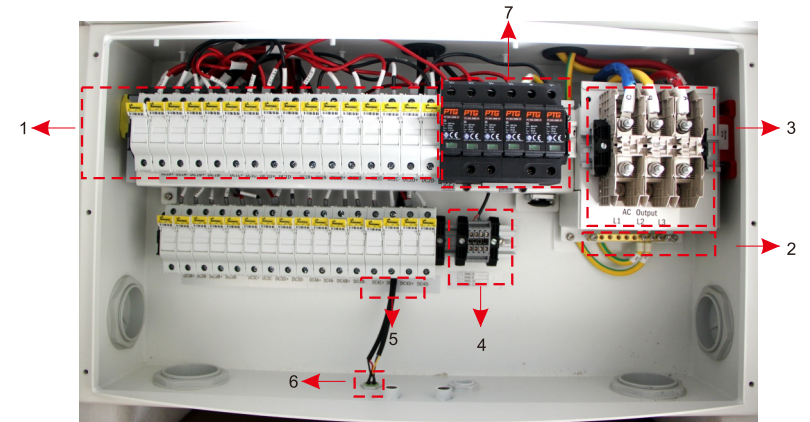


Figure 3.8 Inverter connection area of wiring box

# from Figure 14 above	Parts	Connection	Cable size	Torque
1	DC terminal	PV strings	12-6 AWG	30 in-lbs
2	Ground terminal	DC and AC ground	12-4 AWG	26 in-lbs
3	Grid terminal	Grid	8-2 AWG	26 in-lbs
4	RS-485 terminal	Communication cable	22-12 AWG	3.5-5.3 in-lbs
5	RJ45 terminal	Communication cable	Network cable	NA
6	COM terminal	Wi-Fi/GPRS stick	NA	NA
7	DC surge protection device	NA	NA	NA

Table3.1 Connections list

3.5 DC connection



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 inside the inverter wiring box.



Caution:

If DC positive and negative connections are accidentally reversed (reverse polarity) or inverter is not powering on, DO NOT turn off the DC switch as it may damage the inverter or cause a fire.

The correct actions are:

*Use a clip-on ammeter to measure the DC string current.

*If it is above 0.5A, please wait until the current decreases to below 0.5A (sunset). String current above 0.5A is considered as under load.

*Only after the current is below 0.5A, you are allowed to turn off the DC switch and disconnect the PV strings.

Note: Damage due to wrong connections or fire caused by removing string wires or opening fuse holders under load is not covered in the device warranty.

See Section 9 for acceptable wire sizes and Figure 10.1 for screw torque values for the AC and DC connections.

Both the DC and AC ground wires can be connected to the grounding terminal block (see Figure 3.9).



Figure 3.9 Grounding terminal block on the metal bracket

Requirements for the PV modules per MPPT input:

- All PV modules must be of the same type and power rating.
- 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 9 “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.

3.5.1 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 9 “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.

3.5.2 String sizing

For PV array sizing please refer Section 9 “Specifications” and utilize industry standard string sizing techniques as specified by your local code.

3.5.3 Recommended fusing section for each channel or connection

Solis Three phase inverters include an integrated wiring box which performs the combining of DC strings. The fuses and fuseholders in the wiring box are not rated to carry the current of multiple strings. Each DC string should be directly connected to the inverter. When using field combiners, the jumper bars must be used as shown below.

The sizing of the string fuses must take into account the two following conditions:

- 1). The nominal current rating of the selected fuse must not exceed the maximum fuse rating of the PV panels. Please refer to the applicable specifications for this value.

3. Installation

2). The fuse rating is determined based on the PV panel string current and on the sizing guidelines provided by the panel manufacturer or the local electrical code. In addition, the maximum fuse rating must not exceed the maximum input current of the inverter.

3.5.3.1 Maximum allowable amperage per fuse and channel

Figure 3.10 Shows eight (8) input channels for connecting DC strings. Each channel is protected by a fuse. The included fuses are rated at 15A. Replace fuses with like size and type. Do not exceed 20A fuse rating.

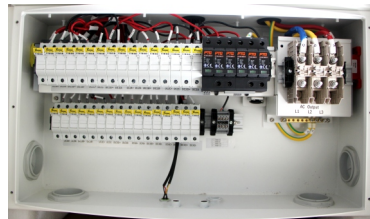


Figure 3.10 Eight (8) input channels



WARNING

If the amperage per connection is exceeded, the inverter could be damaged. Ensure all wire sizing procedures are completed per local codes and regulations. Ensure the AC grid and DC PV array connections have enough separation to prevent contact with each other.

3.5.4 Process of connecting DC wires to terminals

3.5.4.1 Using fuse terminal



Figure 3.11 Fuse terminal

Loosen the screw to open wire cage. Strip cable insulation about 1/2 inch. Check for proper string voltage and polarity. Do not close fuse holder until commissioning tests are completed. Insert the wire and tighten screw to secure wire. Torque to 2.5 ft-lbs.

3. Installation

3.6 Making connections to the AC side of the inverter



WARNING

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

- 1). Connect 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).

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:



NOTE

Use AL-CU transfer (bi-metallic) terminal if using aluminum cable.

Inverter	Rated voltage(V)	Rated output power (kW)	Current rating for protection device (A)
Solis-50K-US	480V	50	80
Solis-50K-US-F	480V	50	80
Solis-60K-US-F	480V	60	90
Solis-66K-US-F	480V	66	100

Table3.2 Over-current protection device characteristics for Solis inverters

3.6.1 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 9 "Specifications".

3. Installation

3. Installation

3.6.2 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.



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.



NOTE

Use M6 crimp terminals to connect to the inverter AC terminals.

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

A) If using multi conductor cables, strip the end of AC cable outer insulating jacket about 3 inches. Strip the end of each wire . (as shown in figure 3.12)

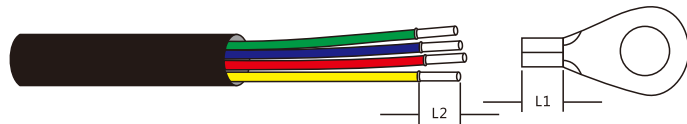


Figure 3.12 Strip AC cable



NOTE

L2 (insulation stripping length) is 1/8 inch longer than L1 (OT cable terminal crimping area)

B) 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.

Connect the cable to grid terminal as below:

- 1). Insert the conduit fitting into the opening and tighten from the inside using the counter nut.
- 2). Attach the conduit to the fitting in the enclosure opening.
- 3). Insert the AC cable through the conduit into the inverter.

4). Remove the nuts on the AC terminal block.

5). Use a maximum torque 3Nm to fasten the nuts.

6). Connect the equipment grounding conductor to the ground bar.

7). Depending on the grid configuration, connect the optional neutral.

8). Connect the conductors with crimp terminals to the AC terminals labeled L1, L2 and L3.

A neutral is not required for inverter operation.(see Figure 3.13).

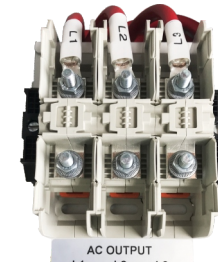


Figure 3.13

3.7 External ground connection point

An OPTIONAL external ground connection (PE) is provided on the right side of the inverter. To use the OPTIONAL external ground connection (see Figure 3.14):

- 1). Prepare the grounding conductor. Crimp a ring or fork (M4 size) terminal onto the grounding conductor.
- 2). Connect the grounding conductor (with crimped terminal) to the external ground connection point on the right side of the inverter. Use a maximum torque of 20 in-lbs (2N-m).

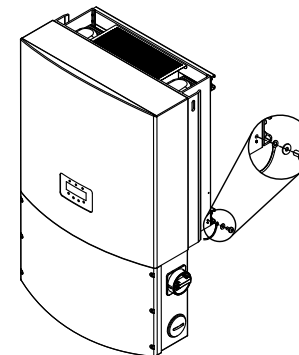


Figure 3.14 Connect the external grounding conductor

Overview

There are three (3) sets of terminals used for RS485 communication.
 Terminal 4 (Figure 3.10) has screw terminals for a multiple inverter communication solution using a standard MODBUS cable such as Belden stranded cable.
 Terminal 5 is a standard RJ45 terminal and is used for creating a daisy chain connection between inverters as well as the wired data monitoring.
 Terminal 6 is a 4-pin connector which is matched with Solis communication cables.

Monitoring system for multiple inverters

Multiples of inverters can be monitored in series using RS485 (as shown in Figure 4.1). All 3 connectors support this type of inverter connection.

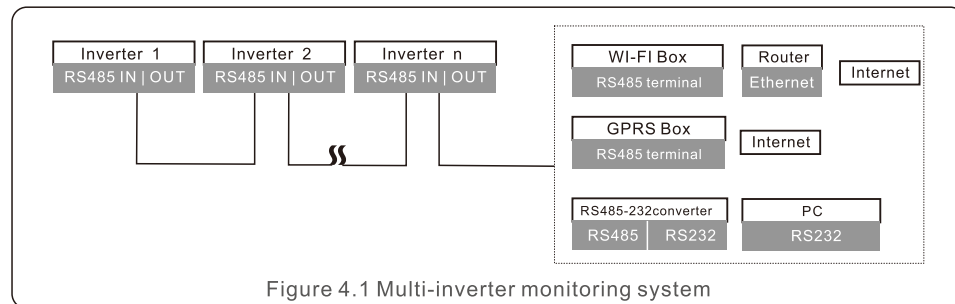


Figure 4.1 Multi-inverter monitoring system

RS485 communication connection of RJ45 network port

When using terminal 5 (RJ45 connector) to connect, use the following wiring sequence.
 Connect the Ethernet cable according to the TIA/EIA 568B standard. Insert the wire into the RJ45 plug and then use a standard network cable crimping tool to crimp connector to the cable.

4.1 RS485

4.1.1 Wiring a single inverter and daisy chain inverters

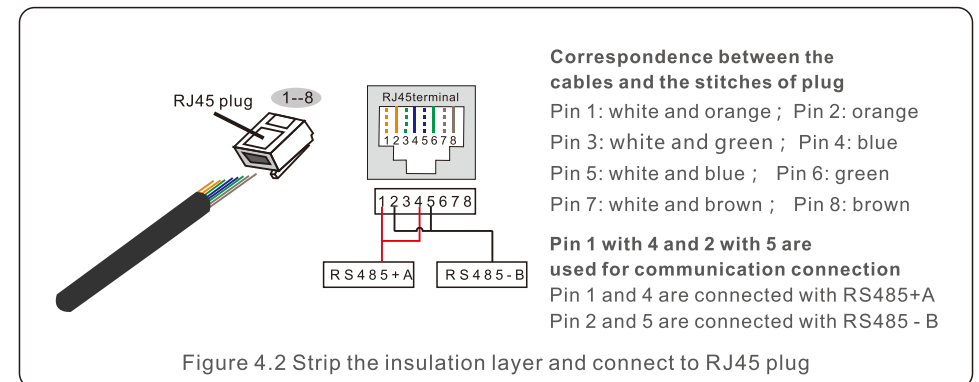


Figure 4.2 Strip the insulation layer and connect to RJ45 plug

4.1.2 Maximum allowable inverters using RS485

The maximum allowable inverters per RS 485 daisy chain is 32 pcs. Please contact monitoring supplier for details.

4.1.3 120-ohm (Ω) resistor placement

120Ω resistor placement for end of line communication

Please contact monitor supplier for details.

5. Commissioning

5.1 Selecting the appropriate grid standard

5.1.1 Verifying grid standard for country of installation

Solis inverters are used worldwide and feature preset standards for operating on any grid. Although the grid standard is set at the factory, it is essential the grid standard be verified for the country of installation before commissioning.

The menu for changing the grid standard or for creating a custom standard is accessible as described in Section 6.7 and below.



WARNING

Failure to set the correct grid standard could result in improper operation of the inverter, inverter damage or the inverter not operating at all.

5.2 Changing the grid standard

5.2.1 Procedure to set the grid standard



NOTE

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



NOTE

The "User-Def" function can only be used by the service engineer. Changing the protection level must be approved by the local utility.

- 1). From the main screen on the display, select ENTER. There are 4 sub-menu options, use the UP/DOWN arrows to highlight ADVANCED SETTINGS. Press enter to select.



Figure 5.1

- 2). The screen will show that a password is required. The default password is "0010", press the DOWN key to move cursor, press the UP key to change the highlighted digit.

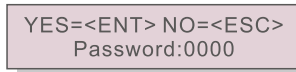


Figure 5.2

5. Commissioning

- 3). Use the UP/DOWN keys to highlight the SELECT STANDARD option. Press enter to select.



Figure 5.3

- 4). Select the grid standard for the country of installation.



Figure 5.4

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

UL-480 is default setting for the U.S. and Canada markets. UL-480-A is the standard for inverters with AFCI function.

5.3 Setting a custom grid standard



WARNING

- Failure to set the correct grid standard could result in improper operation of the inverter, inverter damage or the inverter not operating at all.
- Only certified personnel should set the grid standard.
- Only set the grid configuration that is approved by your location and national grid standards.

- 1). Please refer to section 6.7 "Advanced Settings" for procedures to create a custom grid configuration for User-Def menu option.

5. Commissioning

5. Commissioning

5.4 Preliminary checks



WARNING

High Voltage.
AC and DC measurements should be made only by qualified personnel.

5.4.1 DC Connections

Verify DC connections.

- 1). Lightly tug on each DC cable to ensure it is fully captured in the terminal.
- 2). Visually check for any stray strands that may not be inserted in the terminal.
- 3). Check to ensure the terminal screws are the correct torque.

5.4.2 AC Connections

Verify AC connections.

- 1). Lightly tug on each AC cable to ensure it is fully captured in the terminal.
- 2). Visually check for any stray strands that may not be inserted in the terminal.
- 3). Check to ensure the terminal screws are the correct torque.

5.4.3 DC configuration

Verify DC configuration.

5.4.3.1 VOC and Polarity

Measure VOC, and check string polarity.

5.4.3.1.1 Check string voltage

To measure the open circuit voltage (VOC) and polarity of the individual strings, perform the following steps:



WARNING

When the fuse holders are closed, parallel strings on the same MPPT are connected together. If there is a voltage difference between the parallel strings such as different string lengths, current will flow between the parallel strings. Opening and closing the fuse holder in this instance is the same as opening and closing under load. Damage to equipment and /or injury to personnel may occur.

- 1). Ensure that all fuse holders are open.
- 2). Connect the positive lead of the meter to the positive string cable of the string under test. Connect the negative lead of the meter to the negative string cable of the string under test.

- 3). Measure the voltage present between the positive and negative wires of each string. If the open circuit voltage of the string is near the maximum value accepted by the inverter, verify the string length. Low ambient temperatures cause an increase in the string voltage causing potential damage to the inverter.
- 4). Check the polarity of the string. All digital meters have a negative (“-”) indicator that indicates when a voltage is negative; in this case a string connected in reverse polarity.



WARNING

Input voltages higher than the maximum value accepted by the inverter (see “Specifications” in Section 9) may damage the inverter. Although Solis inverters feature reverse polarity protection, prolonged connection in reverse polarity may damage these protection circuits and/or the inverter.

5.4.3.2 Leakage to ground

Measure leakage to ground.

5.4.3.2.1 Detection of leakage to ground

Solis inverters are transformer-less and do not have an array connection to ground. Any measurement of a fixed voltage between ground and either the positive or negative string wiring indicates a leakage (ground fault) to ground and must be corrected prior to energizing the inverter or damage to the inverter may result.

To measure leakage to ground, perform the following steps:

- 1). Ensure that all fuse holders are open.
- 2). Ensure that neither negative nor positive DC conductors are connected to the ground strip.
- 3). Measure each string positive connection to ground.
- 4). Measure each string negative connection to ground.
- 5). Verify the voltage is “floating”, not a consistent voltage to ground. Make sure you notice the units of the measurement. mV is not the same as V.
- 6). Do not close the fuse holder and connect the strings if a leakage to ground has been detected. Improper operation and damage to the inverter may result.

Once all DC tests have been completed, close the fuse holders.

5. Commissioning

5.4.4 AC configuration

Verify AC configuration.

5.4.4.1 Measure VAC and frequency

Measure VAC and verify voltage is within local grid standards.

- 1). Measure each phase to ground (L-G).
- 2). Measure phases to the other phases in pairs (L-L). PHA to PH B, PH B to PH C and PH C to PH A.
- 3). If the meter is equipped, measure the frequency of each phase to ground.
- 4). Ensure each measurement is within local grid standards and the inverter specifications as noted in Section 9 "Specifications".

5.4.4.2 Phase rotation test

A phase rotation test is recommended to ensure the phases have been connected in the appropriate order. Solis inverters do not require a specific phase rotation connection. However, the local utility may require a specific phase rotation or a record of the phase configuration of the installation.

5.4.5 AC Secure inverter wiring box

Close the Solis inverter wiring box inverter.

Place the wiring box cover on the wiring box ensuring it is oriented correctly and start the screws. Apply pressure to the cover and tighten the screws in a cross pattern. Tighten screws to the appropriate torque setting.

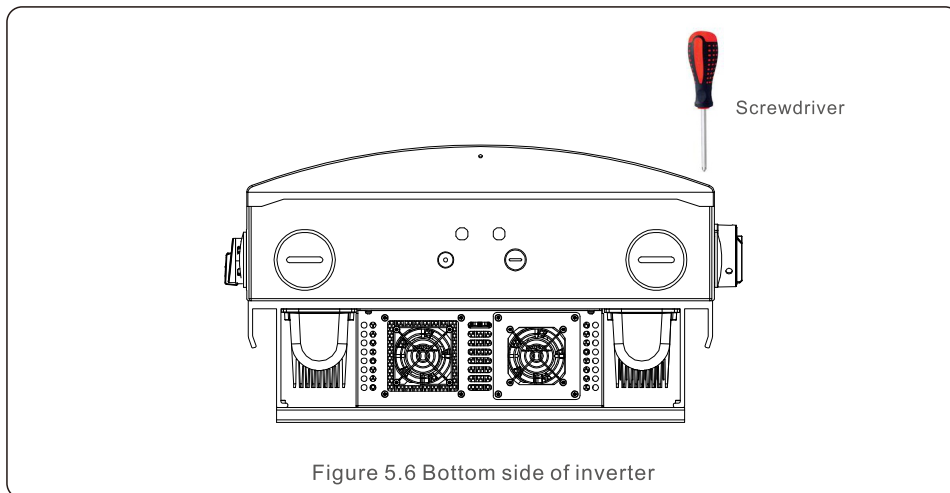


Figure 5.6 Bottom side of inverter

6. Normal operation

6.1 Start-up procedure

To start-up the inverter, it is mandatory that the steps below are followed in the exact order outlined.

- 1). Ensure the commissioning checks in Section 5 have been performed.
- 2). Switch the AC switch ON.
- 3). Switch the DC switch ON. If the PV array (DC) voltage is higher than the inverter's start-up voltage, the inverter will turn on. The red DC POWER LED and LCD will be continuously lit.
- 4). Solis inverters are powered from the DC side. When the inverter detects DC power that is within start-up and operating ranges, the inverter will turn on. After turn-on, the inverter will check internal parameters, sense and monitor AC voltage, hertz rate and the stability of the supply grid. During this period, the green OPERATION LED will flash and the LCD screen will show INITIALIZING. This tells the operator that the inverter is preparing to generate AC power.
- 5). After the locally mandated delay (300 seconds for IEEE-1547 compliant inverters), the inverter will start generating AC power. The green OPERATION LED will light continuously and the LCD screen will show GENERATING.



CAUTION

The inverter's surface temperature can reach up to 75°C (167°F). To avoid risk of burns, do not touch the surface when the inverter is in the operational mode. Additionally, the inverter must be installed out of the reach of children.

6.2 Shutdown procedure

To stop the inverter, it is mandatory that the steps below are followed in the exact order outlined.

- 1). Switch AC switch OFF.
- 2). Wait approximately 30 seconds (during this time, the AC side capacitors are dissipating energy). If the inverter has DC voltage above the start-up threshold, the red POWER LED will be lit. Switch the DC switch OFF.
- 3). Confirm all LED's switch OFF (~one (1) minute).

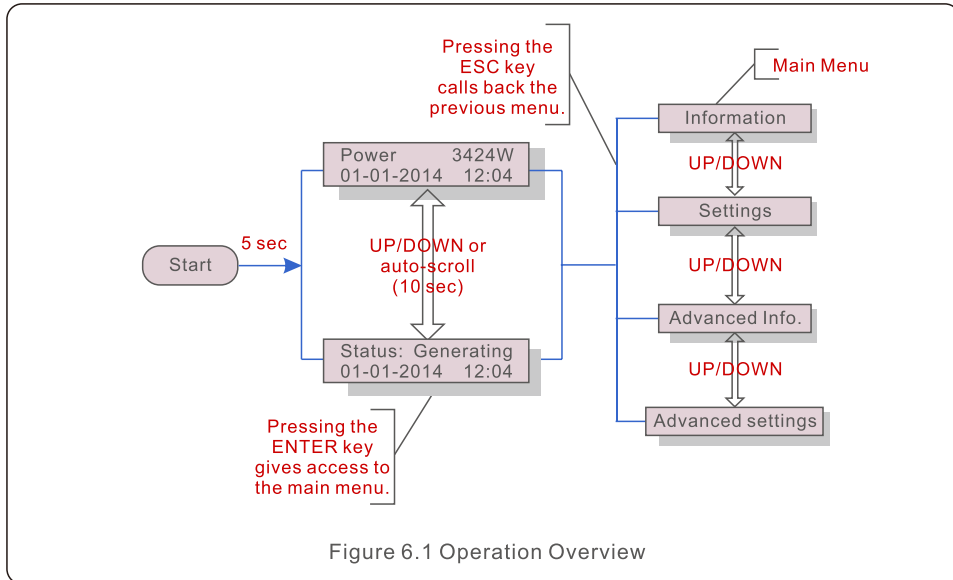


CAUTION

Although the inverter DC disconnect switch is in the OFF position and all the LED's are OFF, operators must wait five (5) minutes after the DC power source has been disconnected before opening the inverter cabinet. DC side capacitors can take up to five (5) minutes to dissipate all stored energy.

6. Normal operation

During normal operation, the LCD shows the current status of the inverter. The LCD will display current power generation, total generation, current AC power in watts and other data in rotation (See Table 6.1). Press the button labeled ESC to switch from the "home dashboard" (i.e., the initial interface for owners and operators) to other screens showing details of daily and monthly generation. Press the ENTER button to switch to the Main Menu. Pressing the ESC button will always return to the previous screen. See Figure 6.1 for an operational flow overview.



6.3 Main Menu

There are four sub-menu options in the Main Menu (see Figure 6.1):

1. **Information.**
2. **Settings.**
3. **Advanced Info.**
4. **Advanced Settings.**

6.4 Sub-menu: Information

The Solis inverter main menu provides access to operational data and information. The information is displayed by selecting "Information" from the menu and then by scrolling up or down.

6. Normal operation

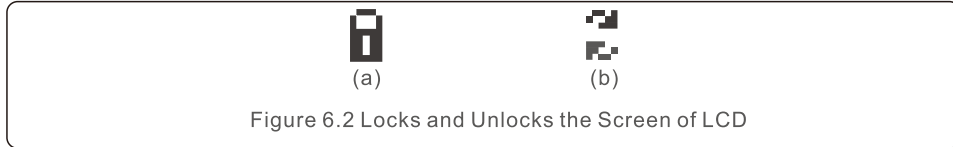
Display	Duration	Description
V_DC1: 350.8V I_DC1: 5.1A	10 sec	V_DC1: Shows input 01 voltage value. I_DC1: Shows input 01 current value.
V_DC4: 350.8V I_DC4: 5.1A	10 sec	V_DC4: Shows input 04 voltage value. I_DC4: Shows input 04 current value.
V_A: 230.4V I_A: 8.1A	10 sec	V_A: Shows the grid's voltage value. I_A: Shows the grid's current value.
V_C: 230.4V I_C: 8.1A	10 sec	V_C: Shows the grid's voltage value. I_C: Shows the grid's current value.
Status: Generating Power: 1488W	10 sec	Status: Shows instant status of the Inverter. Power: Shows instant output power value.
Grid Frequency F_Grid 50.06Hz	10 sec	F_Grid: Shows the grid's frequency value.
Total Energy: 0258458 kwh	10 sec	Total generated energy value.
This Month: 0123kwh Last Month: 0123kwh	10 sec	This Month: Total energy generated this month. Last Month: Total energy generated last month.
Today: 15.1kwh Yesterday: 13.5kwh	10 sec	Today: Total energy generated today. Yesterday: Total energy generated yesterday.
Inverter SN 00000000000000	10 sec	Display series number of the inverter.
Work Mode: Volt-watt DRM Number: 08	10 sec	Display inverter working mode and the DRM number.

Table 6.1 Information list

6. Normal operation

6.4.1 Lock screen

Pressing the ESC key returns to the Main Menu. Pressing the ENTER key locks (Figure 6.2(a)) or unlocks (Figure 6.2 (b)) the screen.



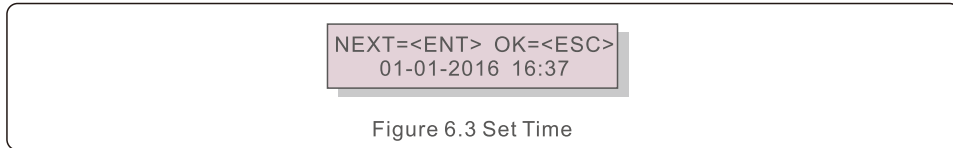
6.5 Sub-menu: Settings

The following sub-menus are displayed when the Settings menu is selected:

- 1.Set Time.
- 2.Set Address.

6.5.1 Set Time

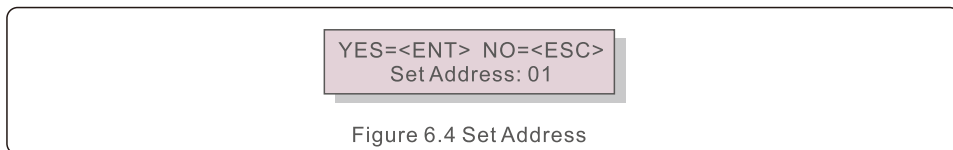
This function allows time and date setting. When this function is selected, the LCD will display a screen as shown in Figure 6.3.



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.

6.5.2 Set Address

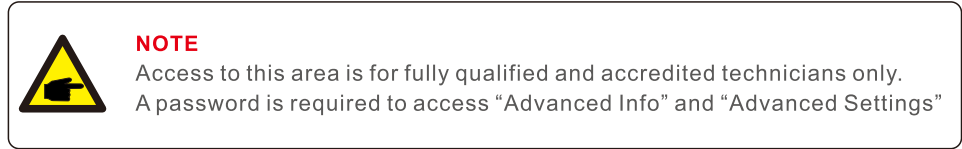
This function is used to set the address when multiple inverters are connected to single monitor. The address number can be assigned from "01" to "99"(see Figure 6.4). The default address is "01".



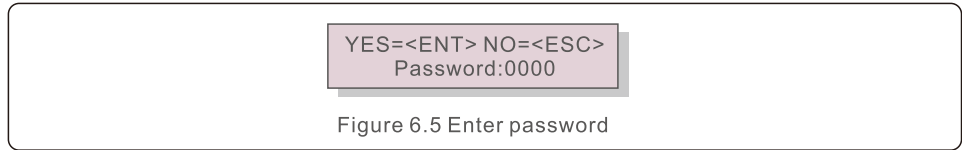
Press the UP/DOWN keys to set the address. Press the ENTER key to save the settings. Press the ESC key to cancel the change and return to the previous menu.

6. Normal operation

6.6 Sub-menu: Advanced Info - Technicians Only



Select "Advanced Info." from the Main Menu. The screen will require a password as below.



The default password is "0010". Press "down" to move the cursor to the next digit, press "up" to change the digit.

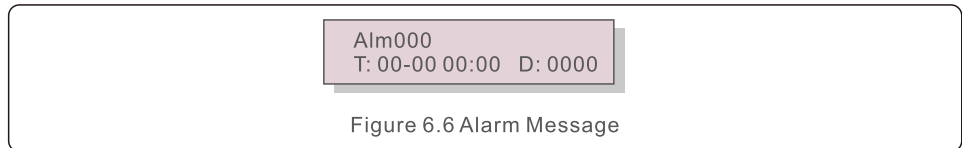
After entering the correct password, the LCD will display the following options:

- 1. Alarm Message
- 2. Running Message
- 3. Version
- 4. Daily Energy
- 5. Monthly Energy
- 6. Yearly Energy
- 7. Daily Records
- 8. Communication Data
- 9. Warning Message

The screen can be scrolled manually by pressing the UP/DOWN keys. Pressing the ENTER key gives access to a sub-menu. Press the ESC key to return to the Main Menu.

6.6.1 Alarm Message

The display shows the 100 latest alarm messages (see Figure 6.6). Screens can be scrolled manually by pressing the UP/ DOWN keys. Press the ESC key to return to the previous menu.



6. Normal operation

6.6.2 Running Message

This function is for maintenance personnel to get operational data such as internal temperature, Standard NO. etc.

Screens can be scrolled manually by pressing the UP/DOWN keys.

6.6.3 Version

The screen shows the model version and the software version of the Inverter (see Figure 6.7).

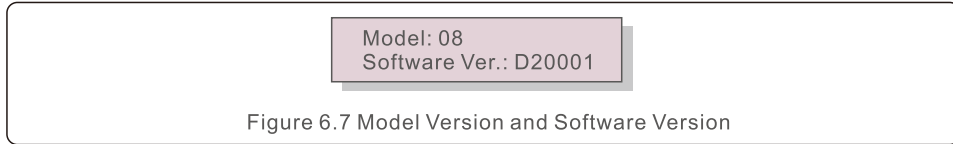


Figure 6.7 Model Version and Software Version

6.6.4 Daily Energy

This option is for viewing the energy generation for a specific day.

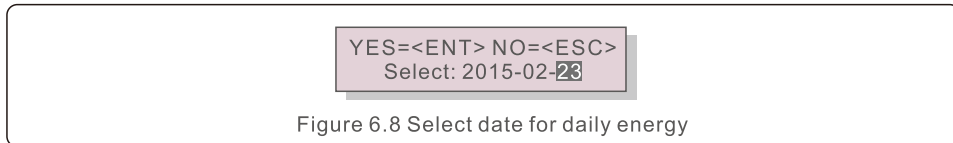


Figure 6.8 Select date for daily energy

Press DOWN key to move the cursor to day, month or year, press UP key to change the digit. Press Enter after the date is selected to display energy for that date.

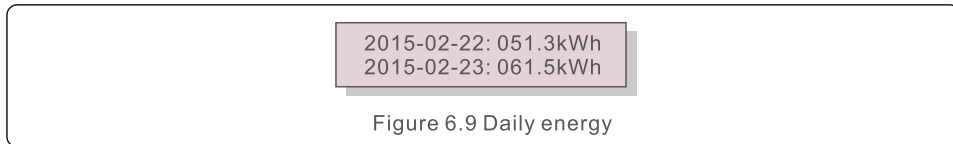


Figure 6.9 Daily energy

Press UP/DOWN key to move one date from another.

6.6.5 Monthly Energy and Yearly Energy

These two options are for viewing the energy generation for selected month or year.

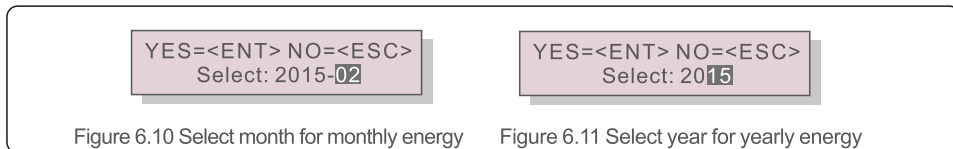


Figure 6.10 Select month for monthly energy

Figure 6.11 Select year for yearly energy

Press DOWN key to move the cursor, press UP key to change the digit.

Press Enter after the month/year is selected.

6. Normal operation

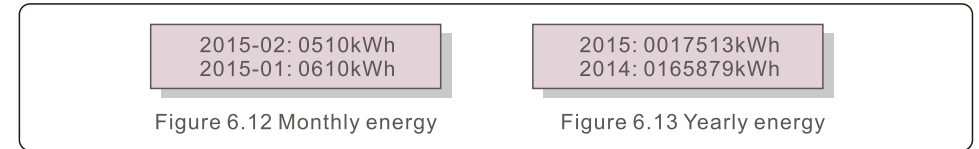


Figure 6.12 Monthly energy

Figure 6.13 Yearly energy

Press UP/DOWN key to move from one date from another.

6.6.6 Daily Records

The screen shows history of setting changes. It is only for maintenance personnel.

6.6.7 Communication Data

The screen shows the internal data of the Inverter (see Figure 6.14), which is for service technicians only.

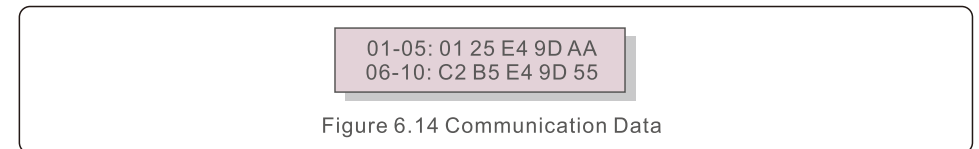


Figure 6.14 Communication Data

6.6.8 Warning Message

The screen shows the internal data of the Inverter (see Figure 6.15), which is for service technicians only.

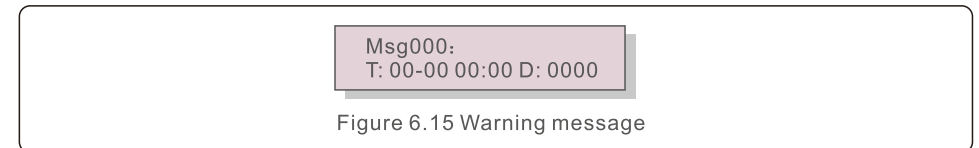


Figure 6.15 Warning message

6. Normal operation

6.7 Advanced Settings - Technicians Only



NOTE:

Access to this area is for fully qualified and accredited technicians only. Please follow 7.4 to enter password to access this menu.

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

1. Select Standard
2. Grid ON/OFF
3. Clear Energy
4. Reset Password
5. Power Control
6. Calibrate Energy
7. Special Settings
8. STD. Mode Settings
9. Restore Settings
10. HMI Update
11. Restart HMI
12. Debug Parameter
13. FAN Test
14. Compensation Set
15. External EPM Set

6.7.1 Selecting Standard

This function is used to select the grid reference standard (see Figure 6.16).

YES=<ENT> NO=<ESC>
Standard:AUS-Q-0.8

Figure 6.16

Selecting the “User-Def” menu will access the following sub-menu (see Figure 6.17).

→ OV-G-V1: 260V
OV-G-V1-T: 1.0S

Figure 6.17

Below is the range for each setting for use in the User-Def function. You may change the limit manually thus creating a custom grid profile by using this function.

Rule 21 uses the standard R21P3-480 for applications not requiring arc fault and R21P3-480-A for applications requiring arc fault protection.

Standard UL-480 and UL-480-A are used where Rule 21 is not required.

6. Normal operation

OV-G-V1: 236---335V	OV-G-F1: 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: 61-63Hz
OV-G-V2-T: 0.1---1S	OV-G-F2-T: 0.1---9S
UN-G-V1: 173---236V	UN-G-F1: 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: 57-59Hz
UN-G-V2-T: 0.1---1S	UN-G-F2-T: 0.1---9S
Startup-T: 10-600S	Restore-T: 10-600S

Table 6.2 Setting ranges for User-Def



NOTE

The initial value of the User-Def standard is for reference only. It does not represent a correct value suitable for use.

Setting value	480V Rated (L-L)	480V Rated (L-N)
Vup-Limit1	528<V<576	305<V<333
Time1	1S	1S
Vup-Limit2	V≥576	V≥333
Time2	0.16S	0.16S
Vdw-Limit1	288≤V<422	166≤V<244
Time1	2S	2S
Vdw-Limit2	V<288	V<166
Time2	0.16S	0.16S
Fup-Limit1	60.5Hz < F < 62Hz	60.5Hz < F < 62Hz
Time1	2S	2S
Fup-Limit2	F > 62Hz	F > 62Hz
Time2	0.16S	0.16S
Fdw-Limit1	57Hz < F < 59.5Hz	57Hz < F < 59.5Hz
Time1	2S	2S
Fdw-Limit2	57Hz < F	57Hz < F
Time2	0.16S	0.16S

Table 6.3 Baseline Inverter Settings

6. Normal operation

6.7.2 Grid ON/OFF

This function is used to start or stop the power generation of the inverter. (see Figure 6.18).



Figure 6.18 Set Grid ON/OFF

Select the desired function by pressing the UP/DOWN keys. Press the ENTER key to save the setting. Press the ESC key to return to the previous menu.

6.7.3 Clear Energy

Clear Energy can reset the historical yield of inverter to zero.



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

6.7.4 Reset Password

This function is used to set a new password for menu “Advanced info.” and “Advanced information” (see Figure6.19).



Figure 6.19 Set new password

Enter the current password before setting a new password. Press the DOWN key to move the cursor to the next digit, 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.

6.7.5 Power Control

Active and reactive power can be set through this sub-menu option.

There are 5 item for this sub menu:

1. Set Output Power
2. Set Reactive Power
3. Out_P With Restore
4. Rea_P With Restore
5. Select PF Curve

6. Normal operation



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

6.7.6 Calibrate Energy

Maintenance or replacement could clear or cause a different value to display for total energy. Use this function to allow the technician to reset or adjust the total energy.

Press the UP/DOWN keys to change the value, Enter to save, ESC to cancel changes. (see Figure 6.20).



Figure 6.20 Calibrate energy

6.7.7 Special settings



This section is applicable to maintenance personnel only.

Selecting “Special Settings” displays the sub-menu shown below:

1. Grid Filter Set
2. Relay_Protect Set
3. ILeak_Protect Set
4. GROUND_Protect Set
5. GRID INTF.02 Set
6. MPPT Parallel Mode
7. Cnst. Voltage Mode
8. V/FRT Set
9. IgZero_COMP. Set
10. PI Set
11. IgADCheckPRO Set
12. NoSmallPulse Set
13. VarCompensation



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

6. Normal operation

6.7.7.1 Grid Filter Set

Press the ENTER to show the submenu of Grid Filter Set.

Press the UP/DOWN key to select the value.

Press the ENTER key to save the setting and return to the previous menu.



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

6.7.7.2 Relay_Protect Set



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

6.7.7.3 ILeak_Protect Set



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

6.7.7.4 GROUND_Protect Set



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

6.7.7.5 GRID INTF.02 Set



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

6.7.7.6 MPPT Parallel Mode

This is used for parallel strings into different inverter MPPTs.

Press enter and press up or down to change the settings (see Figure 6.21).

YES=<ENT> NO=<ESC>
MPPT Parallel: STOP

Figure 6.21 MPPT Parallel Mode

6. Normal operation

Selecting RUN will enable parallel strings setup. All MPPT channels will operate in parallel. Selecting STOP disables parallel string setup. All MPPT channels will operate independently.

The default setting is STOP (disabled).



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

6.7.7.7 Cnst. Voltage Mode

This function is used for fixed input voltage(see Figure 6.22).

CV Mode: Run
Voltage: 700V

Figure 6.22 Cnst. Voltage Mode

Selecting RUN will enable fixed input voltage. The inverter will not operate if the input voltage is lower than the set voltage. Selecting STOP will disable this function.

The default setting is STOP (disabled).



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

6.7.7.8 V/FRT Set

There are 5 option under this setting:

1.LVRT_CQC 2.LVRT.GN 3.LVRT-BAR are not used for the US ,

The function VRT_US (voltage ride through) and FRT_US (frequency ride through) operations are used for UL1741SA (see Table 6.3,Table 6.4).

Selecting the setting to RUN will enable the inverter grid protection limits in accordance with UL 1741 SA requirements. Selecting STOP will reset the inverter to IEEE 1547 requirements. The default setting is STOP.

Region	System Frequency Default Settings	Minimum Range of Adjustability (HZ)	Ride-through until	Ride-Through Operational Mode	Trip Time	Remarks
1	f > 62	62.0-64.0	//	Not Applicable	0.16S	//
2	60.5 < f ≤ 62	60.1-62.0	299S	Mandatory Operation	300S	Enter protected state
3	58.5 < f ≤ 60.5	//	//	Continuous Operation	//	//
4	57.0 < f ≤ 58.5	57.0-59.9	299S	Mandatory Operation	300S	Enter protected state
5	f ≤ 57.0	53.7-57.0	//	Not Applicable	0.16S	//

Table 6.3 Frequency ride through

6. Normal operation

Wear pressure	Region	voltage (% nominal voltage)	Ride-through until	Operating mode	Maximum time limit
		480Va.c.			
1	Hv2	$V \geq 576$	//	Not Applicable	0.16S
2	Hv1	$528 < V < 576$	12S	Momentary Cessation	13S
3	NN	$422.4 \leq V \leq 528$	//	Continuous Operation	//
4	Lv1	$336 \leq V < 422.4$	20S	Mandatory Operation	21S
5	Lv2	$240 \leq V < 336$	10S	Mandatory Operation	11S
6	Lv3	$V < 240$	1S	Momentary Cessation	1.5S

Table 6.4 Voltage ride through

The voltage and frequency ride through limit is fixed, can't change.

VRT_US: STOP
FRT_US: STOP

Figure 6.23 V/FRT Set

6.7.7.9 IgZero_COMP.Set



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

6.7.7.10 PI Set



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

6.7.7.11 IgADCheckPRO Set



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

6.7.7.12 NoSmallPulse Set



This function is for maintenance personnel only.

6. Normal operation

6.7.7.13 VarCompensation



This function is for maintenance personnel only.

6.7.8 STD Mode Settings



This section is applicable to maintenance personnel only.

Selecting "STD Mode. Settings" displays the sub-menu shown below:

1. Working Mode Set
2. Power Rate Limit
3. Freq Derate Set
4. 10mins Voltage Set
5. Power Priority
6. Initial Settings
7. Voltage PCC Set
8. Freq-Watt

6.7.8.1 Working Mode Set

There are TWO situations with different grid standards selected.

6.7.8.1.1 With UL Standard selected



NOTE

The following modes are for "UL-480V", "UL-480V-A".

Solis US version inverters have Seven working modes:

1. NULL
2. Volt-watt
3. Volt-Var
4. Fixed-PF
5. Reac-power
6. Power-PF
7. VgWatt-UL

Based on UL1741SA, working mode 1,3,4,7 can be used by grid operator.

6. Normal operation

1.NULL

Description: Inverter is not under any working mode.

2. Volt-Watt (Not Required)

Description: Inverter will change the active output power based on voltage change.

Note: This Setting is NOT required by UL1741SA Standards.



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

3. Volt-Var (Default)

Description: Inverter will change the reactive output power based on voltage change.

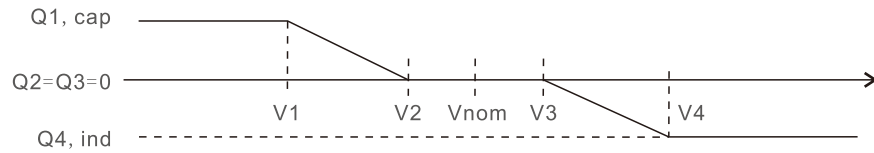


Figure 6.24 Volt-Var curve for Q (V)

Default Settings for UL1741SA:

Q1: (0-60%) Default +30% Q4: (-60%-0%) Default -30%

Rated 480V Grid

V1:(221-279V) Default 242V V2: (221-279V) Default 273V

V3:(277-320V) Default 281V V4: (277-320V) Default 305V

Voltage1: 242V
Voltage2: 273V

Figure 6.25 Volt-Var

6. Normal operation

4.Fixed-PF

Description: Inverter will output power with fixed power factor.

Setting Range: -0.8 to +0.8

Default value is PF = 1

YES=<ENT> NO=<ESC>
Power Factor: +1.00

Figure 6.26 Fixed-PF

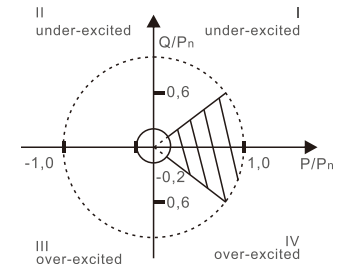


Figure 6.27 PF Range

5. Reac-power (Not Required)

Description: Inverter will generate reactive power based on changing output power.

Note: This Setting is NOT required by UL1741SA Standards.



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

6. P-factor (Not Required)

Description: Inverter will change power factor based on changing output power.

Note: This Setting is NOT required by UL1741SA Standards.



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

6. Normal operation

7.VgWatt-UL

Description: Inverter will change the active output power based on voltage change.

Note: This is the Volt-Watt Setting for UL1741SA Standards.

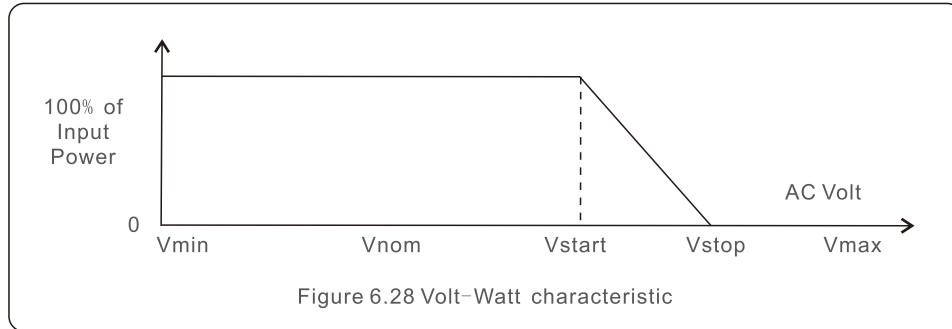


Figure 6.28 Volt-Watt characteristic

Default Settings for UL1741SA:

Rated 480V Grid

V1:less than V2

V2:less than Vstart

V3 (Vstart): (277-333V) Default305V

V4 (Vstop): (305-360V) Default 333V

P1:100% P2:100% P3: 100% P4:0%

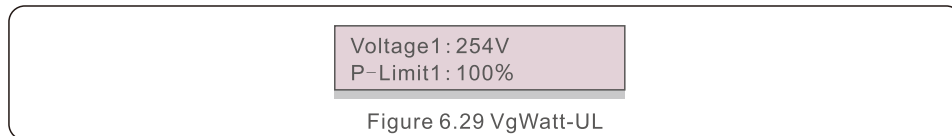


Figure 6.29 VgWatt-UL

6. Normal operation

6.7.8.1.2 With Rule21 Standard selected



NOTE

The following modes are for "R21P3-480", "R21P3-48A".

Solis US version inverters have Ten working modes:

1. NULL
2. Volt-watt
3. Volt-Var
4. Fixed-PF
5. Reac-power
6. Power-PF
7. VgWatt-UL

Based on Rule21, working mode 1,2,3,4 can be used by grid operator.



NOTE

The other three working mode "P1-V-Watt", "P1-V-Var" and "P1-V-P&V-Q" are NOT applicable for settings.

1.NULL (Mode Reset)

Description: Inverter is not under any working mode.

2. Volt-Watt

Description: Inverter will change the active output power based on voltage change.

Note: This is the Volt-Watt Setting for Rule21 Standards.

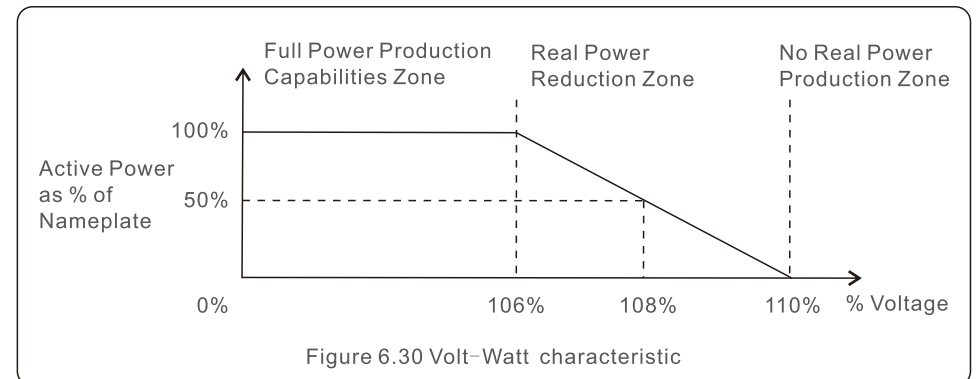


Figure 6.30 Volt-Watt characteristic

6. Normal operation

Default Settings for Rule21 Standards:

Rated 480V Grid

V1: less than Vstart

V2 (Vstart): (221-304V) Default 293V

V3 (Vstop): (277-332V) Default 304V

V4: larger than Vstop

P1:100% P2:100% P3: 0% P4:0%

3. Volt-Var

Description: Inverter will change the reactive output power based on voltage change.

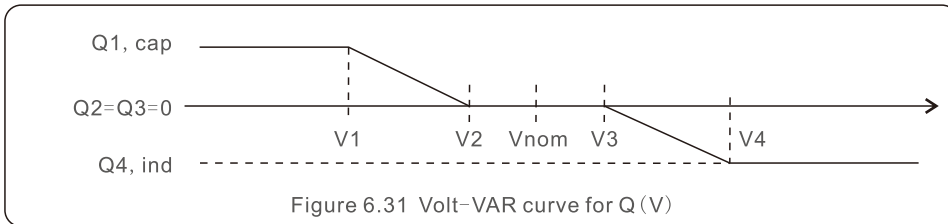


Figure 6.31 Volt-Var curve for Q (V)

Default Settings for Rule21 Standard:

Q1: (0-60%) Default +30% Q4: (-60%-0%) Default -30%

Rated 480V Grid

V1:(221-277V) Default 254V V2: (221-304V) Default 268V

V3:(277-332V) Default 286V V4: (277-332V) Default 296V

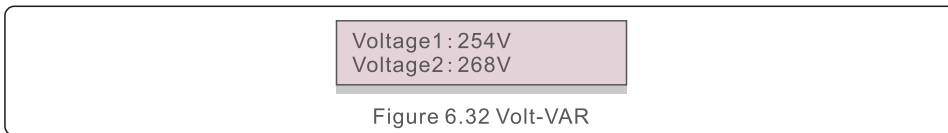


Figure 6.32 Volt-Var

4.Fixed-PF

Description: Inverter will output power with fixed power factor.

Setting Range: -0.8 to +0.8

Default value is PF = 1

6. Normal operation

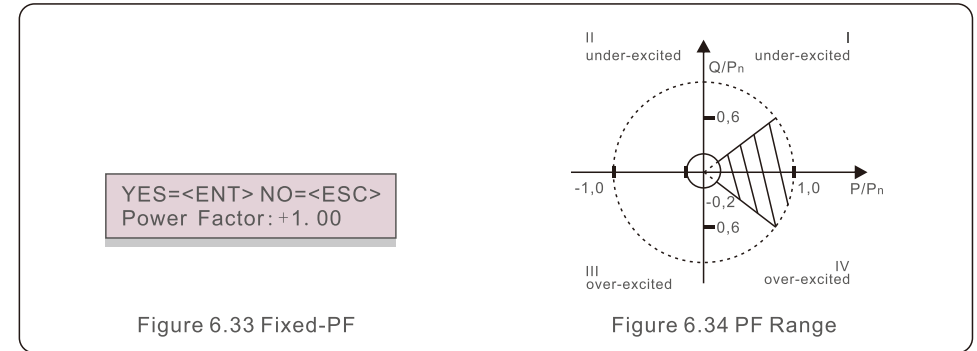


Figure 6.33 Fixed-PF

Figure 6.34 PF Range

5. Reac-power (Not Required)

Description: Inverter will generate reactive power based on changing output power.

Note: This Setting is NOT required by Rule21 Standards.

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

6. P-factor (Not Required)

Description: Inverter will change power factor based on changing output power.

Note: This Setting is NOT required by Rule21 Standards.

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

7. VgWatt-UL (Not Required)

Description: Inverter will change the active output power based on voltage change.

Note: This Setting is NOT required by Rule21 Standards.

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

6. Normal operation

8. Enable both Volt-Var and Volt-Watt modes

Description: Rule21 requires both Volt-var and Volt-watt modes can be enabled.

To set both modes (Volt-var in high priority)

Step 1: Select and set Volt-watt mode at first.

Step 2: Enter "Working Mode" again and select and set Volt-var mode then.

Step 3: To check the priority, a new mode will appear as "V-Q & V-P" which indicates (Q) Volt-var is in high priority.

YES=<ENT> NO=<ESC>
Work Mode : V-Q & V-P

Figure 6.35 Work Mode

To set both modes (Volt-watt in high priority)

Step 1: Select and set Volt-var mode at first.

Step 2: Enter "Working Mode" again and select and set Volt-watt mode then.

Step 3: To check the priority, a new mode will appear as "V-P & V-Q" which indicates (P) Volt-watt is in high priority.

YES=<ENT> NO=<ESC>
Work Mode : V-P & V-Q

Figure 6.36 Work Mode

To reset dual-mode or exit the dual-mode situation

Step 1: Select "Null" mode at first.

Step 2: Enter "Working Mode" again. Redo above dual-mode setting steps to reset OR set other modes to exit dual-mode situation.



NOTE

To check the Volt-watt and Volt-var priority, simply enter the working modes. V-Q&V-P indicates Volt-Var First V-P&V-Q indicates Volt-Watt First

6. Normal operation

6.7.8.2 Power Rate Limit

This function is used for change Power Ramp-up rate. When inverter start up or input string MPPT changes, inverter power ramp-up rate is limited in this menu.

The default setting is stop (disable).

The setting range from 10% to 600%, means inverter power change rate per minute.

Values are not allowed to change. If they are set, they may not conform to the UL1741SA standard.

Power Rate:016%
RateP_Sts-US:STOP

Figure 6.37 Power Rate Limit

6.7.8.3 Freq Derate Set

This setting is applicable when UL Standards are selected.

There are 5 derate modes in this menu. When operating under standard UL-1741 limits, modes 00 to 03 are disabled. Mode 04 is used for UL1741SA frequency derating setting.

This sets the f start and f stop point.

The default setting is 00, means this function is disabled.

Derate Mode: 04
OV-F-Start: 60. 20Hz

Figure 6.38 Freq Derate Set

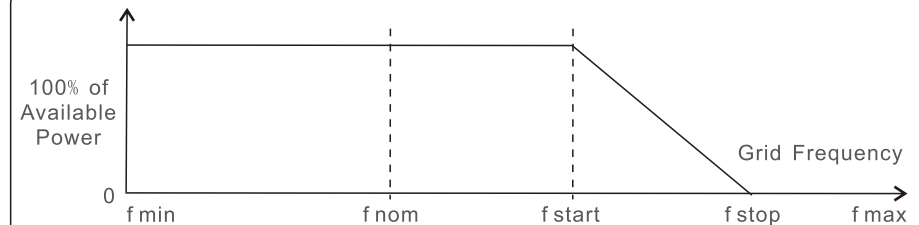


Figure 6.39 Freq-Watt characteristic

Over frequency load shedding Fstart range 60~62Hz, default setting 60.2Hz

Fstop can set the scope: 61-64Hz, the default setting 62Hz.

Press the Enter key to select the mode or frequency.

Press Up/Down to set. Press ESC to save the settings.

6. Normal operation

6.7.8.4 10mins Voltage Set

This function is disabled and not used for the US.



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

6.7.8.5 Power Priority

This setting is used to set the priority between Active Power Control (Watt) and Reactive Power Control (Var).

YES=<ENT> NO=<ESC>
Select: Var First

Figure 6.40 Power Priority

Two options are available: Watt First and Var First.



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

6.7.8.6 Initial Settings

In initial settings it will reset each work mode from 6.5.8.1 to 6.5.8.4 back to default.

Work Mode Default
Power Rate Default

Figure 6.41 Initial Settings

6.7.8.7 Voltage PCC Set

Set the voltage at the PCC point.

This setting is required by RULE 21 requirements.

PCC: Point of Common Coupling, the point where a Local EPS is connected to an Area EPS.



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

6. Normal operation

6.7.8.8 Freq-Watt

This setting is used to control real power based on the frequency excursion

This setting is applicable when Rule21 Standards are selected.

→ Start Freq: 60.50Hz
WGradient: 040%

Figure 6.42 Freq-Watt (1)

Start Freq: This is the frequency that active power reduction starts.

WGradient: This is the active power reduction rate in terms of the frequency.

Stop Freq: This is the frequency that stops the correction cycle.

Hysteresis: This indicates whether hysteresis is enabled.

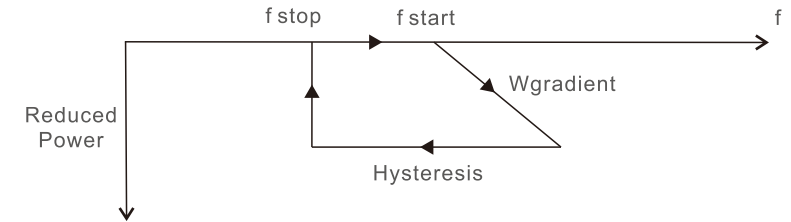


Figure 6.43 Freq-Watt (2)



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

6.7.9 Restore Settings



This section is applicable to maintenance personnel only.

6. Normal operation

Selecting "Restore Settings" displays the option shown below:

```
Are you sure?  
YES= <ENT> NO= <ESC>
```

Figure 6.44

Press the ENTER key to reset to factory defaults. Press the ESC key to return to the previous menu.

6.7.10 HMI Updater



This section is applicable to maintenance personnel only.

Selecting "Updater" displays the sub-menu shown below:

```
HMI Current Ver.: 02  
YES= <ENT> NO= <ESC>
```

Figure 6.45

Updater is for updating LCD firmware. Press the ENTER key to start the process. Press the ESC key to return to the previous menu.

6.7.11 Restart HMI

This function reboots the HMI and LCD display.

6. Normal operation

6.7.12 Debug Parameter



This section is applicable to maintenance personnel only.

Debug Parameter as shown as below:

```
→ S16DAT1: +0000  
S16DAT2: +0000  
S16DAT3: +0000  
S16DAT4: +0000  
S16DAT5: +0000  
S16DAT6: +0000  
S16DAT7: +0000  
S16DAT8: +0000
```

Figure 6.46

Press the UP/DOWN keys to scroll through items. Press the ENTER key to select. Press the DOWN key to scroll and press the UP key to change the value. Press the ENTER key to save the setting. Press the ESC key to cancel changes and return to the previous menu.

6.7.13 FAN Test



This section is applicable to maintenance personnel only.

Selecting "Fan Test" displays the sub-menu shown below:

```
Are you sure?  
YES= <ENT> NO= <ESC>
```

Figure 6.47

Fan Test is a factory test function. Press the ENTER key to start the test. Press the ESC key to return to the previous menu.

6. Normal operation

6.7.14 Compensation Set

This function is used to calibrate inverter output energy and voltage. It will not impact the energy count for inverter with RGM.

Two sections are included: Power Parameter and Voltage Parameter.

The screen shows:

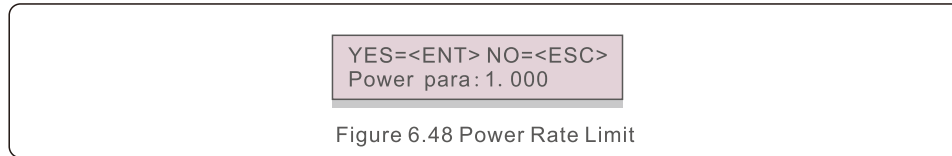
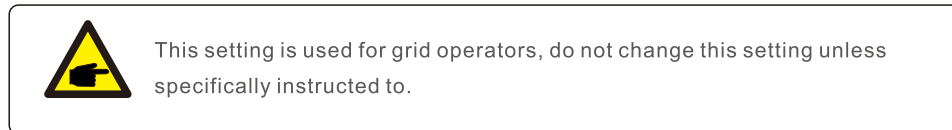


Figure 6.48 Power Rate Limit

Press the Down key to move the cursor.

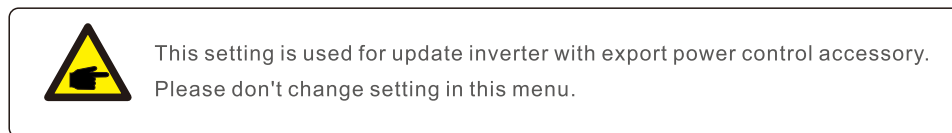
Press the Up key to change the digit.

Please press the Enter to save the setting and press the ESC key to return to the previous menu.



6.7.15 External EPM Set

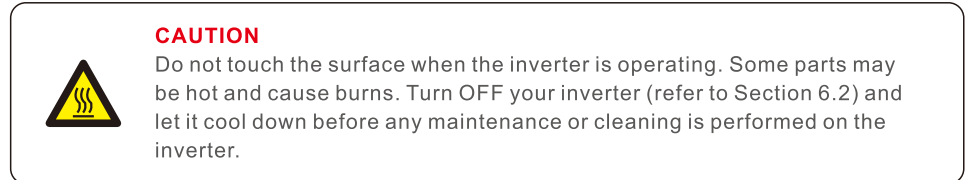
This setting is for export power control. Please don't change settings in this item.



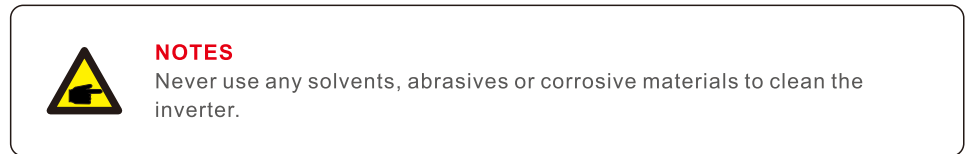
7. Maintenance

The Solis U.S. Three Phase series inverters do not require any regular maintenance.

However, cleaning the dust off the heat sink will help dissipate heat away from the inverter, which will increase the life of the inverter.



The status indicator lights and LCD cover can be cleaned with a soft cloth if they are too dirty to read.



7.1 Inverter models with fan-assisted cooling

The function of the fan is to assist the convection cooling of the inverter. If the fan is fails or is not working properly, the output power will be curtailed. It is important to ensure the fan runs efficiently and replace any damaged fan.

Replacement steps are as follows:

- 1). Turn AC switch to the "OFF" position
- 2). After 30 seconds, switch the DC switch to the 'OFF' position.
- 3). Wait for at least 5 minutes.

7. Maintenance

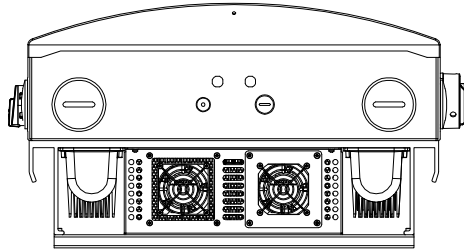


Figure 7.1

4). Loosen the screws and remove the fan plate carefully from the bottom of inverter.

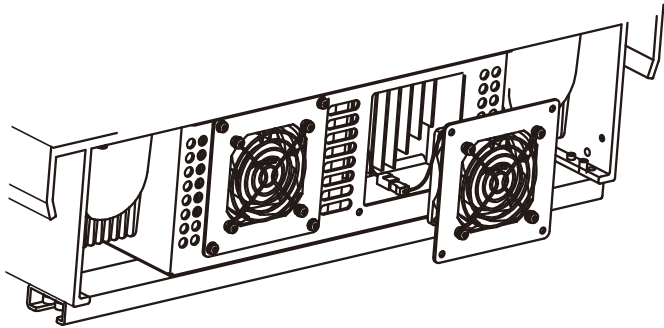


Figure 7.2

5). Disconnect the power cable and remove the fan assembly from the inverter.

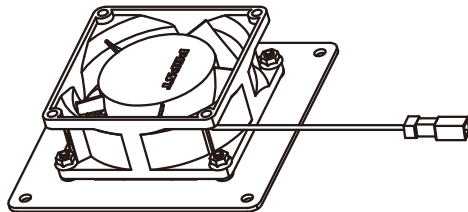


Figure 7.3

7. Maintenance

6). Remove the screws holding the fan to the fan plate. Replace or clean the fan as required.

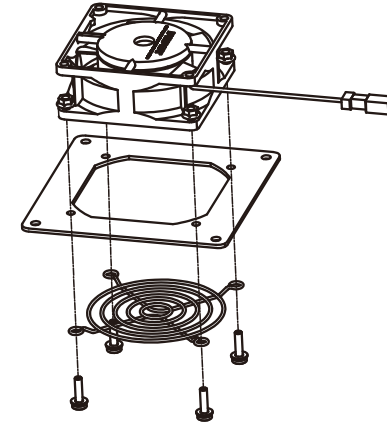


Figure 7.4

7). Reassemble the fan assembly.

8). Reconnect the electrical connections and reinstall the fan assembly.

9). Start the inverter by switching the AC switch ON then the DC switch ON.

8. Troubleshooting

8.1 Current alarm

8.1.1 Running messages

Running messages can be viewed on the screen including any current alarms.

8.2 Alarm history

8.2.1 Viewing alarm history

Refer to LCD Operation 6.6.8 for instructions on viewing Alarm History.

8.3 Error messages

NOTES



The first step to clearing alarms as listed in Table 9, is to reset the inverter. To reset the inverter, turn off the inverter (refer to Section 6.2) and wait for five (5) minutes before restarting it (refer to Section 6.1). If the failure persists, please first contact your local distributor and then Ginlong Support Service.

If you need to contact Ginlong Support Service at <http://www.ginlong.com/en/Login.html> or 1-866-438-8408, please have available the following:

Please have the following information available when contacting technical support:

- 1). Inverter serial number
- 2). The inverter distributor/dealer (if available)
- 3). Installation date
- 4). The description of problem (e.g., the alarm message displayed on the screen and the status of the screen status indicator lights. Other readings obtained from the Information sub menu (refer to Section 6.4) will also be helpful.)
- 5). PV array configuration (e.g. number of panels, panel capacity, number of strings, etc.)
- 6). Your contact details

8.3.1 Troubleshooting guide

Solis inverters are designed in accordance with international grid standards, safety standards and electromagnetic compatibility requirements. Before delivery to the customer, the inverter has been subjected to intensive testing to ensure its optimal operation and reliability.

In case of failure, the screen may display an alarm message, stop feeding energy into the grid or both. Typical failure descriptions and their corresponding alarm messages are listed in Table 9 on the following pages.

8. Troubleshooting

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

8. Troubleshooting

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

8. Troubleshooting

Alarms	Cause	Solution
GRID-INTF: Grid unstable	<ul style="list-style-type: none"> Inverter detects grid instability, internal fault current high 	<p>Test – With DC Switch OFF</p> <ul style="list-style-type: none"> Measure AC voltage Test AC line for THD Test – With DC Switch ON <p>Test AC line for THD</p> <ul style="list-style-type: none"> Multiple inverters/turn one off Impedance matching adjustment or box Internal damage Wire came loose in shipping
INI-FAULT: Initialization Protection	<ul style="list-style-type: none"> Master and Slave DSP have different values 	<p>Reset Inverter</p> <ul style="list-style-type: none"> DC switch OFF Wait until all lights/LCD turn off DC switch ON Replace inverter
OV-TEM: Temperature Protection	<ul style="list-style-type: none"> Inverter detects high ambient temperature >60C 	<p>Inspect installation</p> <ul style="list-style-type: none"> Check heatsink for obstructions/ventilation Is inverter in direct sunshine Measure ambient temperature near inverter If temp is in range replace inverter
PV ISO-PRO 01/02: Ground Protection	<ul style="list-style-type: none"> Inverter detects low DC insulation resistance 	<p>Inspect installation</p> <ul style="list-style-type: none"> Reset inverter Note weather conditions when alarm occurs Measure insulation resistance If normal, measure in SAME weather as alarm Physically check cables Replace inverter
ARC-FAULT	<ul style="list-style-type: none"> Inverter detects arc in DC circuit 	<p>Inspect installation</p> <ul style="list-style-type: none"> Check cable with string tester Physically check cables Inspect panel junction boxes Inspect cable connections Reset inverter Replace inverter
Screen OFF with DC applied	<ul style="list-style-type: none"> Inverter internally damaged 	<ul style="list-style-type: none"> Do not turn off the DC switches as it may damage the inverter. Please wait for sunset and confirm the string current is less than 0.5A with a clip-on ammeter and then turn off the DC switch. String current above 0.5A is under load. Note: Damage due to wrong connections or fire caused by removing string wires or opening fuse holders under load is not covered in the device warranty.

Table 8.1 Fault messages and descriptions

9. Specifications

Model	Solis-50K-US
Max DC input power	64000W
Max DC input voltage	1000Vdc
MPPT operation range	200~850Vdc
Max DC input current	88A (22A per MPPT)
Number of MPPT/strings per MPPT	4/3
Rated output power	50kW
Max. output power	50kW
Rated grid voltage	480Vac
Grid voltage range	422. 4~528Vac
Operation phase	Three phase
Rated grid output current	60.2Aac
Output power factor range	0.8leading ... 0.8lagging
Grid current THD	<3%
DC injection current	<50mA
Rated grid frequency	60Hz
Max. Efficiency	>98.8%
Protection	DC class II and AC class III(optional)
Size(inch)	24.8W*40.7H*13.9D
Weight	165lb
Topology	Transformerless
Internal consumption	<1W(Night)
Running temperature	-25 ~ 60°C
Ingress protection	NEMA 4X
Interface	RS485 WIFI GPRS(Optional)
Design lifetime	>20years
Operating Range Utility Frequency	59.5-60.5Hz
Compliance	CAN/CSAC22.2 N107.1, UL1741, IEEE1547 UL1998, UL1699B, FCC part 15, Class B
Operation Surroundings Humidity	0~100% Condensing
Connections	4 knockout for 2" conduit at bottom and side. DC Input - Copper only 12-6AWG AC Input - Copper or aluminum 8-2AWG Aluminum requires bi-metallic compatible terminal

9. Specifications

Model	Solis-50K-US-F
Max DC input power	75000W
Max DC input voltage	1000Vdc
MPPT operation range	200~850Vdc
Max DC input current	114A (28.5A per MPPT)
Number of MPPT/strings per MPPT	4/3
Rated output power	50kW
Max. output power	50kW
Rated grid voltage	480Vac
Grid voltage range	422. 4~528Vac
Operation phase	Three phase
Rated grid output current	60.2Aac
Output power factor range	0.8leading ... 0.8lagging
Grid current THD	<3%
DC injection current	<50mA
Rated grid frequency	60Hz
Max. Efficiency	>98.8%
Protection	DC class II and AC class III(optional)
Size(inch)	24.8W*40.7H*13.9D
Weight	172lb
Topology	Transformerless
Internal consumption	<1W(Night)
Running temperature	-25 ~ 60°C
Ingress protection	NEMA 4X
Interface	RS485 WIFI GPRS(Optional)
Design lifetime	>20years
Operating Range Utility Frequency	59.5-60.5Hz
Compliance	CAN/CSAC22.2 N107.1, UL1741, IEEE1547 UL1998, UL1699B, FCC part 15, Class B
Operation Surroundings Humidity	0~100% Condensing
Connections	4 knockout for 2" conduit at bottom and side. DC Input - Copper only 12-6AWG AC Input - Copper or aluminum 8-2AWG Aluminum requires bi-metallic compatible terminal

9. Specifications

Model	Solis-60K-US-F	Solis-66K-US-F
Max DC input power	90000W	
Max DC input voltage	1000Vdc	
MPPT operation range	200~850Vdc	
Max DC input current	114A (28.5A per MPPT)	
Number of MPPT/strings per MPPT	4/4	
Rated output power	60kW	66kW
Max. output power	60kW	66kW
Rated grid voltage	480Vac	
Grid voltage range	422. 4~528Vac	
Operation phase	Three phase	
Rated grid output current	72.2Aac	79.4Aac
Output power factor range	0.8leading ... 0.8lagging	
Grid current THD	<3%	
DC injection current	<50mA	
Rated grid frequency	60Hz	
Max. Efficiency	>98.8%	
Protection	DC class II and AC class III(optional)	
Size(inch)	24.8W*40.7H*13.9D	
Weight	172lb	
Topology	Transformerless	
Internal consumption	<1W(Night)	
Running temperature	-25 ~ 60°C	
Ingress protection	NEMA 4X	
Interface	RS485 WIFI GPRS(Optional)	
Design lifetime	>20years	
Operating Range Utility Frequency	59.5-60.5Hz	
Compliance	CAN/CSAC22.2 N107.1, UL1741, IEEE1547 UL1998, UL1699B, FCC part 15, Class B	
Operation Surroundings Humidity	0~100% Condensing	
Connections	4 knockout for 2" conduit at bottom and side. DC Input - Copper only 12-6AWG AC Input - Copper or aluminum 8-2AWG Aluminum requires bi-metallic compatible terminal	

10. Appendices

10.1 Appendix A

Part	Torque
AC Terminal	2.2-4.4 ft-lbs
DC Fuse Terminal	2.5 ft-lbs
Screw For Wiring Box Cover	1.3-1.4 ft-lbs
Ground Terminal	2.2 ft-lbs

Figure 10.1