



User Manual

Split Phase Low Voltage
Energy Storage Inverter



Applicable Models:

S6-EH2P9.6K03-SV-YD-L-US
S6-EH2P11.4K03-SV-YD-L-US
S6-EH2P12K03-SV-YD-L-US
S6-EH2P14K03-SV-YD-L-US
S6-EH2P16K03-SV-YD-L-US

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 Solis 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.
- Solis accepts no liability for customers' failure to comply with the instructions for correct installation and will not be held responsible for upstream or downstream systems Solis equipment has supplied.
- The customer is fully liable for any modifications made to the system; therefore, any hardware or software modification, manipulation, or alteration not expressly approved by the manufacturer shall result in the immediate cancellation of the warranty.
- Given the countless possible system configurations and installation environments, it is essential to verify adherence to the following:
 - There is sufficient space suitable for housing the equipment.
 - Airborne noise produced depending on the environment.
 - Potential flammability hazards.
- Solis will not be held liable for defects or malfunctions arising from:
 - Improper use of the equipment.
 - Deterioration resulting from transportation or particular environmental conditions.
 - Performing maintenance incorrectly or not at all.
 - Tampering or unsafe repairs.
 - Use or installation by unqualified persons.
- This product contains lethal voltages and should be installed by qualified electrical or service personnel having experience with lethal voltages.

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1. Introduction

1.1 Inverter Description

The Solis Low Voltage (LV) Hybrid series is designed for residential applications. The inverter can work with low-voltage lithium ion batteries to maximize self-consumption and provide backup power if the grid fails and there is not enough PV power to cover load demand. This inverter can operate in both on-grid and off-grid applications. The S6 hybrid series consists of the following inverter models: 9.6kW, 11.4kW, 14kW, 16kW, The inverter comes with an integrated rapid shutdown transmitter that must be specified when placing an order for the inverter.

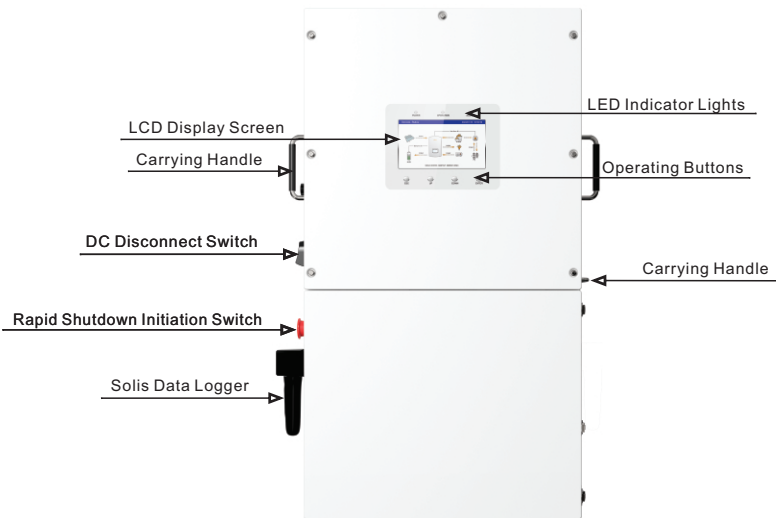


Figure 1.1 Frontal View

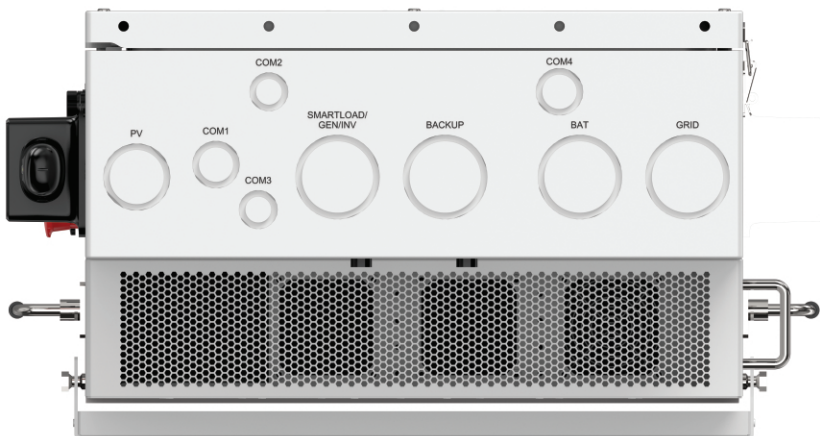
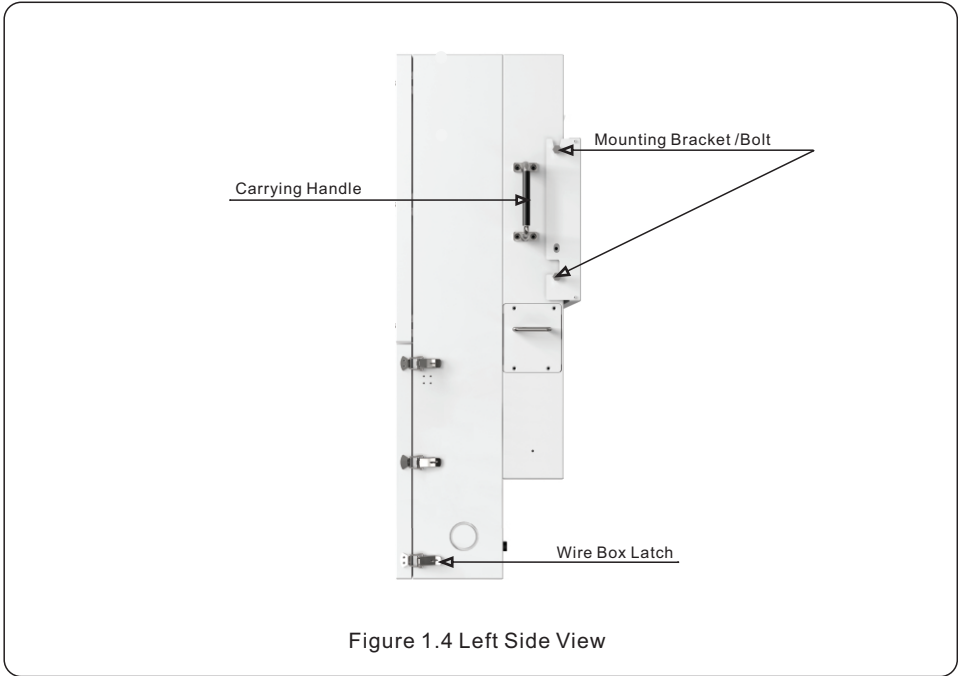
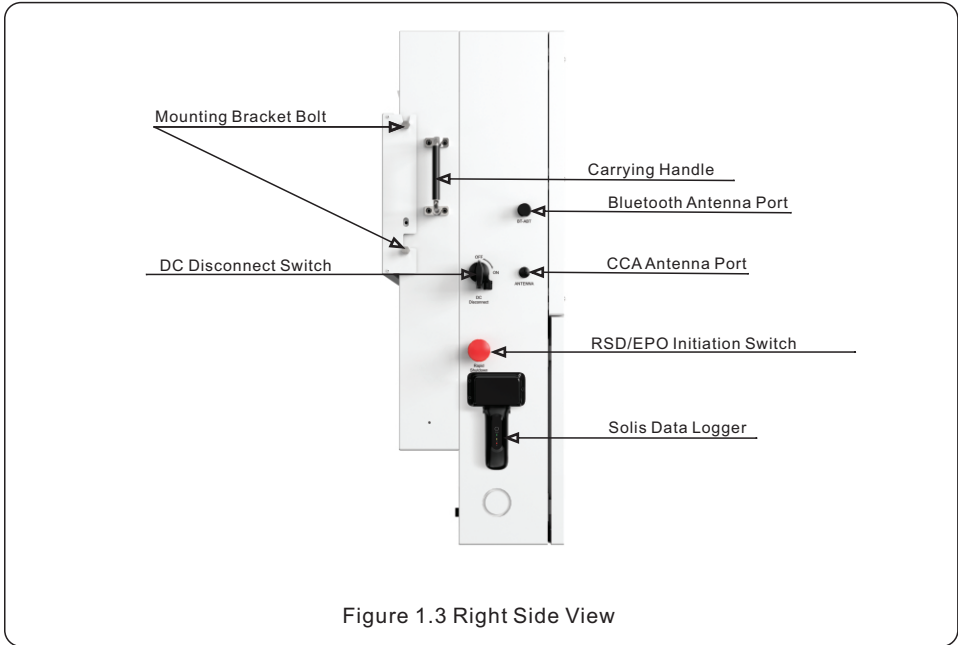


Figure 1.2 Bottom View (Wire Box)

1. Introduction



1. Introduction

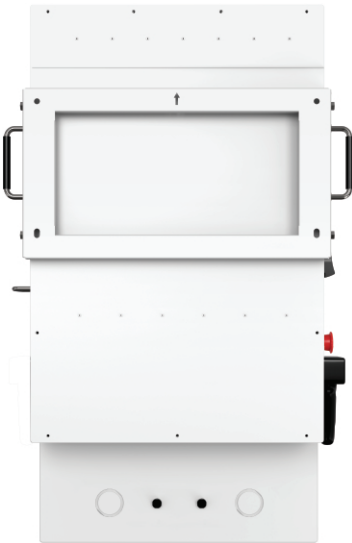


Figure 1.5 Back View

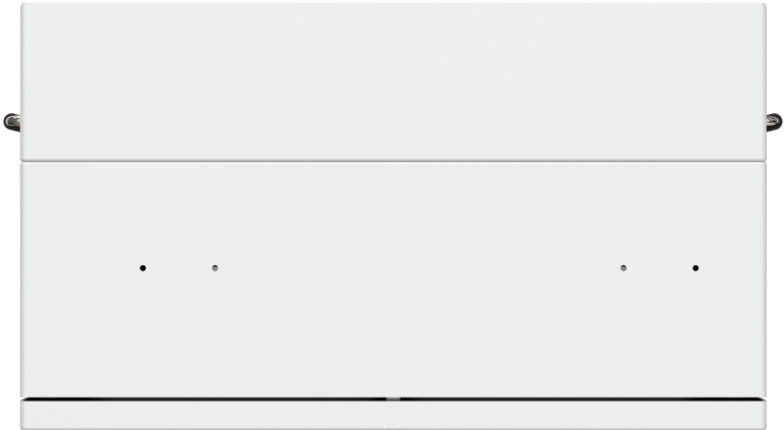
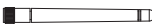


Figure 1.6 Top View

1. Introduction

1.2 Components Included with the Inverter

If any of these items are missing, please contact your local Solis distributor or the Solis service team.

 Inverter x1	 Inverter Mounting Bracket x1	 Stabilizing Set Bolts x2	 Concrete Anchor Bolts x4	 S5-WIFI-ST Data Logger
 Bluetooth Antenna	 Current Transformers x2	 RJ45 Connector x3	 Parallel Communication Cable (6.5 ft) x1	

1.3 Tools Required for Inverter Installation

 Technician Screwdriver	 Torqx T20 Screwdriver	 Wire Strippers 12AWG to 6AWG	 Wire Strippers 20AWG to 10AWG	 Phillips #2 Screwdriver
 Channel Locks	 Multimeter (AC/DC amps)	 Drill and Impact Driver	 Ratcheting Crimper	 Bubble Level
 Torque Wrench Screwdriver	 8mm Allen (Hex) Tip	 Radial Cable Stripper	 Smartphone (for commissioning)	

1. Introduction

1.4 Inverter Storage

- If the inverter is not installed immediately, please abide by the storage instructions and environmental conditions listed 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 -40~158°F and humidity should be between 0 to 100%, non-condensing.
- Do not stack more than two (2) inverters high on a single pallet. Do not stack more than 2 pallets high.
- Keep the box(es) away from corrosive materials to avoid damage to the inverter enclosure.
- Inspect the packaging regularly. If packaging is damaged (wet, pest damages, etc.), repackage the inverter immediately.
- Store inverters on a flat, hard surface -- not inclined or upside down.
- Do not remove the desiccant packet that is included with the inverter. It is included to ensure that any residual moisture is absorbed quickly.
- 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.
- Perform an annual visual inspection of the inverter box for signs of damage
- If the inverter has been removed from the box and then replaced, put desiccant packets in the inverter wire box to ensure the internal components stay dry
- Do not store the inverter outside or in a place that does not have environmental controls.



**DO NOT STACK
MORE THAN 2 HIGH**

2. Safety & Warning

2.1 Safety

The following types of safety instructions and general information appear in this document as described below:



DANGER

"Danger" indicates a hazardous situation which if not avoided, will result in death or serious injury.



WARNING

"Warning" indicates a hazardous situation which if not avoided, could result in death or serious injury.



CAUTION

"Caution" indicates a hazardous situation which if not avoided, could result in minor or moderate injury.



NOTE

"Note" provides tips that are valuable for the optimal operation of your product.



WARNING: Risk of fire

Despite careful construction, electrical devices can cause fires.

- Do not install the inverter in an area containing flammable materials or gases.
- Do not install the inverter in a potentially explosive atmosphere.

2.2 General Safety Instructions



WARNING

Only devices in compliance with SELV (EN 69050) may be connected to the RS485 and USB interfaces.



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

Do not touch any internal parts until 5 minutes after disconnection from the utility grid, PV array, and battery.

2. Safety & Warning



WARNING

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

The DC OCPD shall be installed per local requirements. All photovoltaic source and output circuit conductors shall have isolators that comply with the NEC Article 690, Part II.

All Solis single phase inverters feature an integrated DC disconnect switch.



CAUTION

Risk of electric shock, do not remove the cover. There are no serviceable parts inside, refer servicing to qualified and accredited service technicians.



CAUTION

The PV conductors are energized with high voltage DC when the PV modules are exposed to sunlight.



CAUTION

The surface temperature of the inverter can reach up to 75°C (167°F). To avoid risk of burns, do not touch the surface of the inverter while it is operating. The inverter must be installed out of direct sunlight exposure.



NOTE

PV modules used with inverter must have an IEC 61730 Class A rating.



WARNING

Operations must be accomplished by a licensed electrician or a person authorized by Solis.



WARNING

Installer must wear personal protective equipment during the entire installation process in case of electrical hazards.



WARNING

The AC Backup Port of the inverter cannot be connected to the grid.



WARNING

Please refer to the product manual of the battery before installation and configuration to the inverter.



Systems using this product shall be designed and built in accordance with the NEC & local electrical codes & standards.

2. Safety & Warning

2.3 Notice for Use

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

1. Permanent installation is required.
2. The electrical installation must be compliant with all local and national regulations & standards.
3. The inverter must be installed according to the instructions stated in this manual.
4. The inverter must be installed according to the inverter technical specifications.

2.4 Notice for Disposal

This product shall not be disposed of with household waste. It must be segregated and brought to an appropriate disposal facility to ensure proper recycling.

This it to be done in order to avoid negative impacts on the environment and human health. The inverter contains materials that should not end up in a landfill.

Local waste management rules shall be observed and respected.



2.5 Protection Circuitry and Controls

To meet relevant codes and standards, the Solis U.S. single phase inverter line is equipped with protective circuitry and controls. These include Arc Fault Circuit Interrupter (AFCI) & 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. After five arc fault detections in 24 hours, an AFCI-induced shutdown will be triggered. If this event occurs, the inverter must be manually reset. After clearing the source of the fault, the inverter can be powered back on and allowed to resume normal operation.

Anti-Islanding Protection:

Anti-Islanding is a condition where the inverter cease to produce power 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.

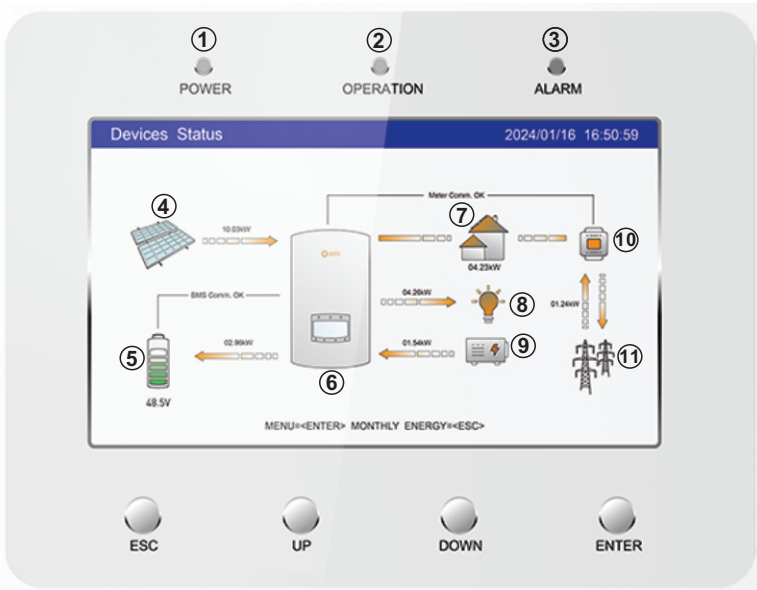


NOTE:

All Solis inverters come with AFCI and Anti-Islanding protections integrated and enabled by default. The settings cannot be disabled or modified.

3. Overview

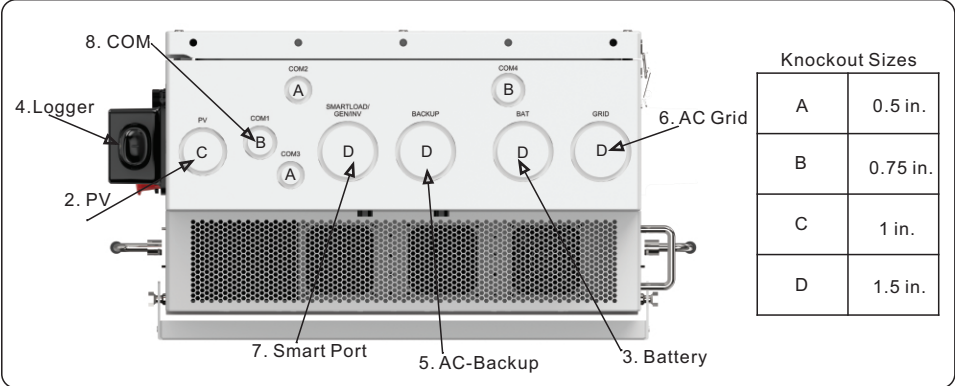
3.1 LCD Display Screen and Indicator Lights



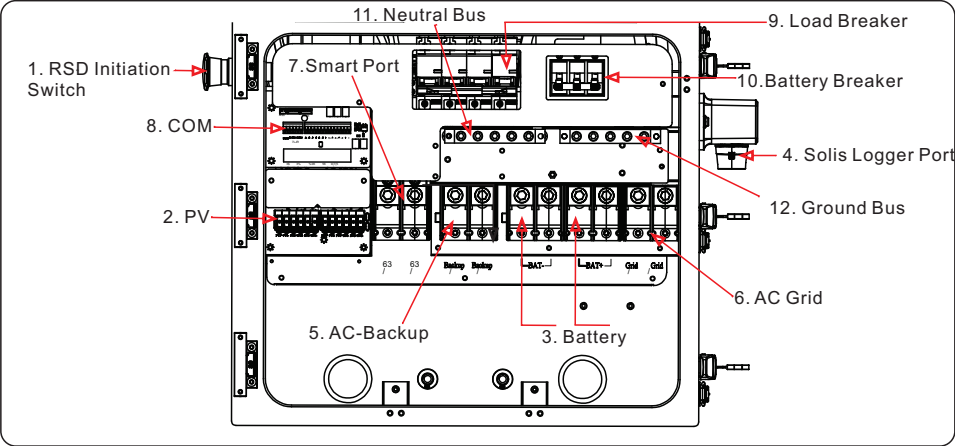
#	Name	Description
1	Power LED	This LED is always red when the inverter has adequate AC or DC voltage. This LED does not indicate any problems.
2	Operation LED	This LED is always green when the inverter is operating normally and producing AC power.
3	Alarm LED	This LED is will light up yellow any time the inverter has an alarm code.
4	PV Icon	Represents PV power being generated in DC kW.
5	Battery Icon	Represents the battery connected to the inverter charging and discharging in DC kW and state-of-charge (SOC)
6	Inverter Icon	Represents the Solis hybrid inverter in the system.
7	Home Icon	Represents the cumulative grid-side home load consumption & power being exported to or imported from the grid in AC kW.
8	Backup Icon	Represents home load consumption on the backup-side of the system in AC kW.
9	Generator Icon	Represents generator power being produced in AC kW. Only appears when generator is on.
10	Meter Icon	Represents the energy meter monitoring the consumption power & import/export power to/from the grid in AC kW.
11	Grid Icon	Represents the grid and power being imported from/exported to the utility (grid) in AC kW.

3. Overview

3.2 Inverter Wire Box and Connection Points



Name	Description
1. RSD Initiation Switch	Initiates both rapid shutdown and emergency power off
2. PV	Conduit and PV conductors should be connected here
3. Battery	Conduit for battery conductors should be connected here
4. Solis Logger Port	Port (USB) for connecting Solis data loggers only
5. AC-Backup	Conduit for AC conductors to backup loads panel should be connected here
6. AC-Grid	Conduit for AC conductors to the main service panel should be connected here
7. Smart Port	Conduit for AC conductors to a generator, AC-coupled PV system, or sheddable load
8. Communication (COM)	RS485 & CAN communication cables should use these knockouts/terminals
9. Load Breaker	Breaker for the backup loads, only included with the inverter if ordered that way
10. Battery Breaker	Breaker for the battery, only included with the inverter if ordered that way
11. Neutral Bus Bar	Common bus bar for all neutral conductors to terminate (not grounded)
12. Ground Bus Bar	Common bus bar for all ground conductors to terminate



4. Operating Modes

4.1 PV-Only

4.1.1 Grid-Tie PV String Inverter

For areas with seasonal power outages, such as concentrated in a certain month of the year and daily power outages lasting 1-2 hours, they operate as off grid machines during non outage periods. Only the PV load function of the energy storage machine can meet the short-term load requirements of customers under this working condition; At the same time, it also takes into account the feasibility of adding batteries in the future to cope with potential power shortage needs. This function only supports single machine use and can be restored within 30 seconds after the first overload. Second overload, recover in 3 minutes. Third overload, recover within 10 minutes. Fourth overload, recover within 10 minutes. Fifth overload, recover within 10 minute. If the fault is reported again after 5 times, a manual restart is required.

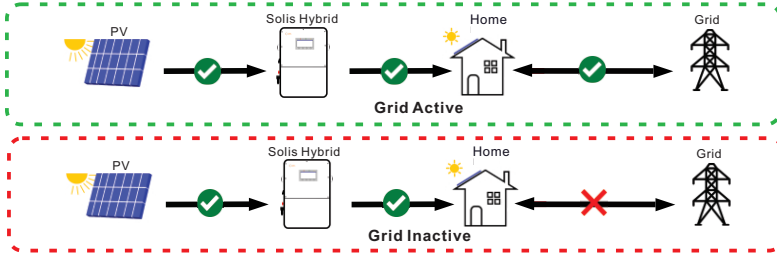


Figure 4.1 Solis S6 hybrid as a grid-tie PV string inverter

4.1.2 Export Power Control

The inverter offers the ability to manage export power. During the system commissioning process, export power control can be enabled. An export power limitation can then be set to the desired kW value. The inverter will then regulate how much power gets sold back to the utility company.

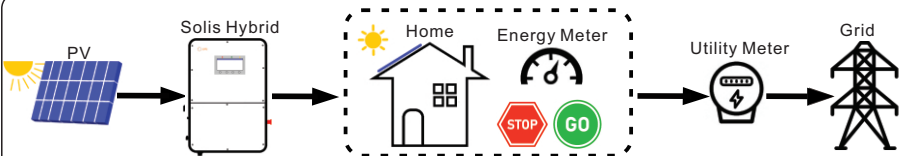


Figure 4.2 Solis S6 hybrid with export power control enabled

Each Solis hybrid comes with an energy meter, which gets installed externally to the inverter. The energy meter uses three CTs for three-phase, which measure the power being consumed and imported by the home. The hybrid uses the data from this meter to determine whether or not it needs to curtail the PV power to meet the export power limitation. Export power control can be enabled with or without a battery being installed.

Zero-Net Export

The inverter can be set to not export any active power to the utility. This does not end up being zero export as there is some power that leaks back to the utility each time there is a change in load demand. However, the *net import/export* will be near zero kWh each day when programmed for zero export.



NOTE:

The external energy meter must be installed to have visibility of export/import and power consumption. Without the meter, the inverter will still function, but with limited capabilities. **Export power control is not possible without the energy meter being installed.**

4. Operating Modes

4.2 Energy Storage

4.2.1 Overview of Energy Storage Modes

The S6 hybrid is capable of providing AC power to home loads using PV and battery power in the event of a grid failure. This is known as **backup power**. The amount of backup power that each S6 hybrid model can provide is equal to the amount of on-grid power that it can provide. For example, an 16K model can provide up to 16kW of continuous backup power.

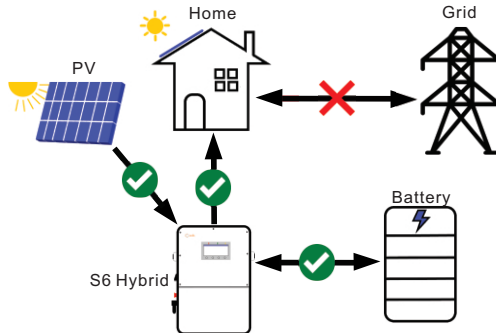


Figure 4.3 Backup power with Solis S6 hybrid

If the primary purpose of the energy storage system is to store as much of the PV power as possible so that it can be used later to offset the consumption of grid power, this is known as **energy arbitrage**. *Time-of-use*, *self-consumption*, and *peak-shaving* are all examples of **energy arbitrage**. Typically, the battery will cycle daily as it charges with PV during the day and then discharges in the evening to cover home load demand.

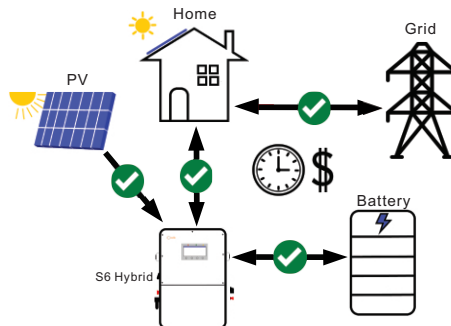


Figure 4.4 Energy arbitrage with Solis S6 hybrid

The S6 hybrid can also operate in an entirely remote system where there is no grid present at all. This is called **off-grid** mode. It is very similar to backup in that the inverter will supply AC power to loads with PV and battery power only. However, backup mode is only for grid-connected systems.



NOTE:

The inverter is able to provide off-grid/backup power with only PV and no battery. However, the load consumption must remain less than the available PV power or else an overload fault will occur and the system will shutdown for five minutes.

4. Operating Modes

4.2.2 Energy Arbitrage

The S6 hybrid inverter has multiple operating modes which can be programmed so that the performance of the system is tailored to the specific needs of each individual system owner. The backup power function of the inverter can be enabled or disabled independently of the energy arbitrage modes: (1) Self-Use (2) Selling first (3) Off grid (4) Peak-Shaving (Professional Setting)

Self-Use Mode

Self-Use is the default energy storage mode. PV power will always supply the building loads first. Any excess PV power gets stored in the battery. If the battery is fully charged, the remaining power can be exported if the system is configured to allow it. If not, the PV power will be curtailed.

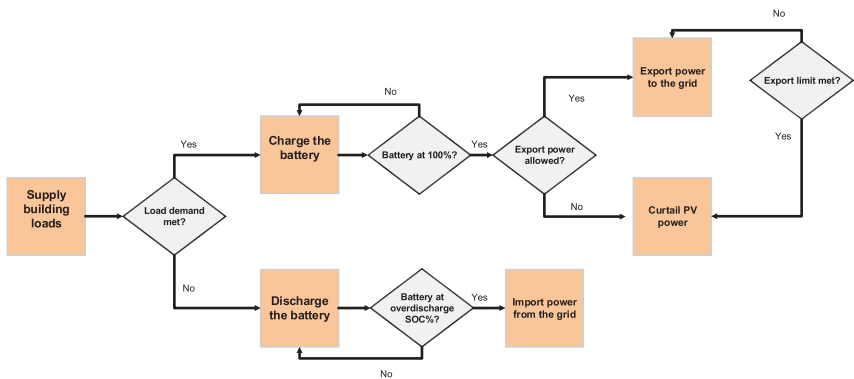


Figure 4.5 Self-Use Mode logic diagram

Selling first Mode

This mode can be thought of as export priority mode. The system will first supply the loads with PV power and then it will seek to export the excess PV power, up to the set limit. Once the limit is reached, the remaining power will be stored in the battery. If the battery is fully charged, the PV will at that point be curtailed. This mode is for those who receive an equal rate for power exported or who have a much higher ratio of PV power generated to power consumed.

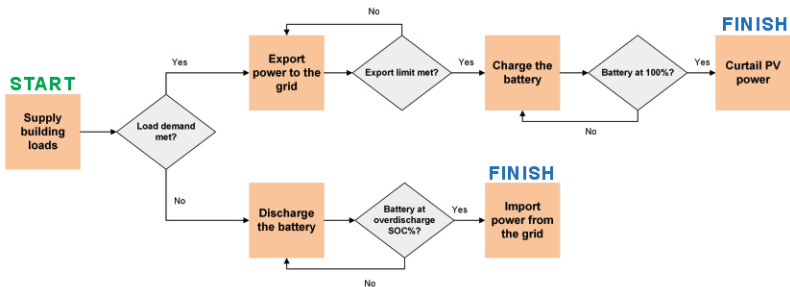


Figure 4.6 Selling first Mode logic diagram

4. Operating Modes

Off-Grid Mode

There is a dedicated mode specifically for off-grid remote systems which are not electrically connected to the grid at all, such as a standalone building. This mode is not to be confused with backup, which occurs only for grid-tied systems. The logic for Off-Grid mode is the same as Self-Use mode. However, there is no export power control and a generator is often used in place of the grid to supplement the PV & batteries. When the generator is turned on by the inverter the PV production is temporarily suspended as to not backfeed the generator. The inverter will use generator power to supply the loads and recharge the battery. For single inverter, battery is recommended to be connected to the inverter. For parallel system (≥ 2 inverters), the inverters must have batteries connected in order to provide power in an off-grid system. The inverter cannot operate in an off-grid system with PV only for parallel system.

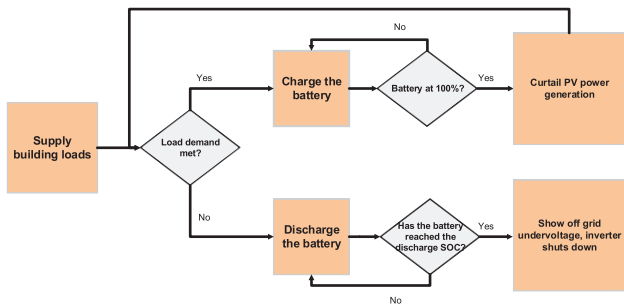


Figure 4.7 Off-Grid Mode logic diagram



NOTE:

To utilize off-grid mode, the inverter must not be connected to the grid at all. There cannot be any conductors landed in the grid terminals.

Peak-Shaving Mode

Peak-shaving mode is ideal for those who pay a variable rate for energy based on the amount of consumed power (kw). This mode limits the power imported from the grid. The inverter will only discharge the battery when the power imported from the grid exceeds a specified amount (kW).

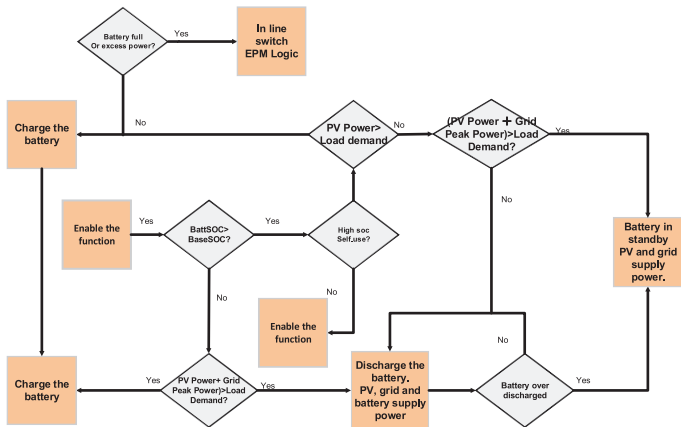


Figure 4.8 Peak-Shaving Mode logic diagram

4. Operating Modes

4.3 DC Coupling vs AC Coupling

4.3.1 DC-Coupling

DC-coupling is the recommended configuration for this inverter. This is because DC-coupling allows the full potential of this inverter to be utilized, maximizing the efficiency of the PV-to-battery charging. In a DC-coupled system, the PV also gets connected to the inverter in addition to the battery. The inverter will charge the battery directly with DC power from the PV. Typically, DC-coupling is done when additional PV is being added or when the system is new and being installed with energy storage.

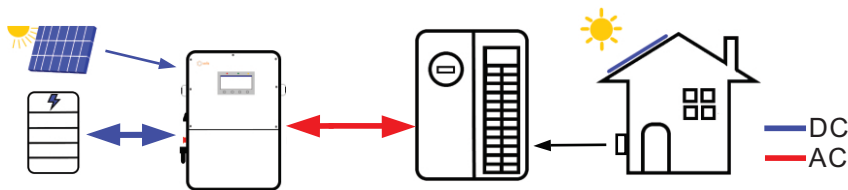


Figure 4.9 DC-coupled Solis S6 hybrid system

The next section explains how the S6 hybrid can be AC-coupled. The next several sections following it will all focus on DC-coupling methods..

4.3.2 AC coupling at grid side

The Solis S6 hybrid can be DC-coupled or AC-coupled to a home to add energy storage. In an AC-coupled the energy storage is connected to the AC-side of the system. Typically, the battery and Solis hybrid pairing get connected in parallel with an existing PV system. The battery will charge with PV power from the existing PV system. When AC-coupling with the S6 hybrid, new PV can either be added or not be added to the S6 hybrid, it is up to the system designer. The hybrid would just need to be installed with a compatible high-voltage battery and then be connected to the home load center in parallel with the existing PV system.

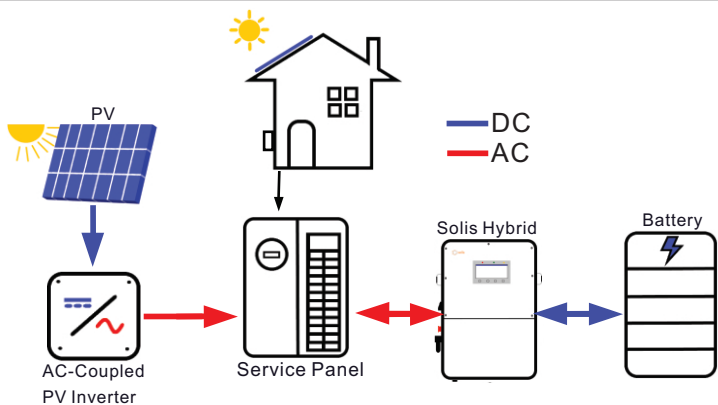


Figure 4.10 AC-coupled Solis S6 hybrid system

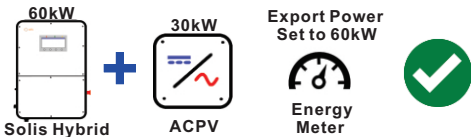
The ability to be AC-coupled makes the Solis S6 hybrid ideal for system retrofits. The hybrid can be installed in place of the old PV inverter but with energy storage added.

4. Operating Modes

4.3.3 AC-Coupled at Smart Port

An existing PV system can be AC-coupled to the smart port side so that it can be supported when the grid is down. It should be noted that AC coupled PV inverter power must < solis hybrid rated power. The acronym “ACPV” will be used to generically describe any existing PV system that will be AC-coupled with the energy storage and backup. This is to distinguish it from “PV”, which is connected on the DC-side of the S6 energy storage system alternatively. The breaker for the ACPV system will need to be relocated into the backup load center so that it can remain energized during a grid outage. If ACPV is to be connected on the smart port, it is recommended to be mindful of grid-side consumption when the system is connected to the grid, not in smart port. If the load consumption on the grid-side is higher than the inverter nameplate power rating while the grid is present, an overload alarm could occur. This is when the total PV power going to the loads from both the Solis and the ACPV system exceeds the Solis nameplate power rating.

The ACPV system connected to the smart port of the system must be smaller than or the same size as the Solis hybrid inverter. Export power must be set so that the maximum export power is equal to the Solis inverter nameplate power rating.



Do not connect an ACPV system to the smart port of the system that is larger than the nameplate power rating of the Solis inverters. If there are multiple Solis inverters, then the combined total power.

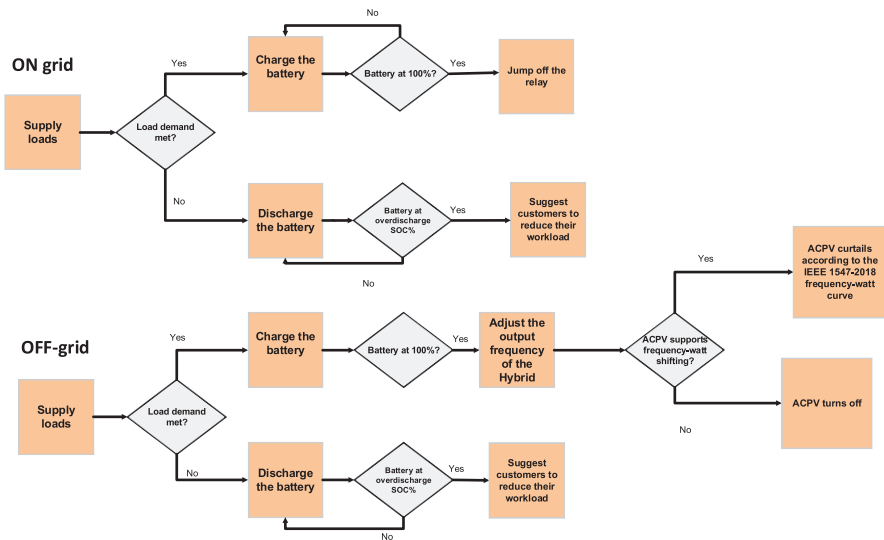


Figure 4.11 AC-Coupling (ACPV) with Backup Operating Logic

4. Operating Modes

4.4 Partial-Home vs Whole-Home Backup

This inverter is capable of providing AC power to home loads using PV and battery power in the event of a grid failure. When the inverter senses that the grid power has been lost, it automatically opens the relay between itself and the grid. It keeps the relay closed to the backup, allowing it to supply AC power to the home loads as long as power is available. The loads that are to be backed up will need to be located in a load center that is electrically isolated from the utility point-of-connection to ensure that the anti-islanding requirement remains unviolated. The inverter will automatically reconnect to the grid once it senses that power is restored.

The backup output of the inverter has the ability to handle unbalanced loads, with a load power range of 0-50% of the rated output power for each phase. It is recommended to evenly distribute the backup loads between the two phases during system installation. If a single phase load exceeds 50% of the inverter rated power, an overload alarm will trigger, and the inverter will temporarily shut down.

Note: The backup switch time is < 10 milliseconds.



Partial-home backup systems should only have *light loads* backed up. This ensures that the battery does not deplete too quickly, allowing the PV power generated to balance the load demand. Light loads include lights, TVs, computers, routers, and most things that can plug into an outlet.

Whole-home backup systems can have all home loads backed up, including the *heavy loads*. However, enough PV, battery, and (or) generator power must be available to meet the high current demand of the heavy loads. It is recommended to oversize the system for the needs of the owner.

4.4.1 Partial-Home Backup

The homeowner will need to be consulted to understand why they are installing a battery. It should also be determined how much power is consumed, how much power the PV will generate, how much storage power there will be, and which loads are to be backed up in the event of a power outage (grid failure). If they are willing to live with just a few key things such as the fridge, lights, and outlets, this is *partial-home backup*, also known as dedicated loads backup. For this system, the loads that are to be backed up when the grid fails must first be identified in the main service panel. The breakers for these loads must be relocated into a new sub panel that will be connected to the backup side of the inverter.

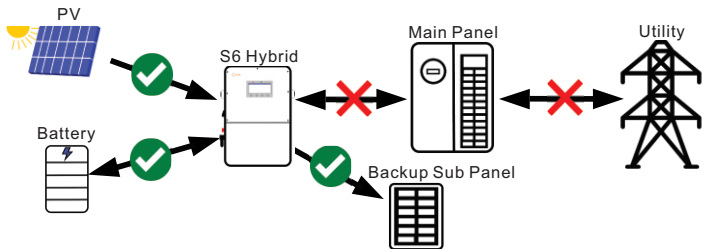


Figure 4.12 Partial-home backup with one S6 hybrid

4. Operating Modes

When grid power is lost, the inverter disconnects itself from the grid. It keeps the backup side energized using PV and battery power. When the grid is restored, it reconnects to the grid after a five minute period. While on-grid, the inverter is capable of passing power to the loads from the grid. Multiple units in parallel can increase the amount of available surge power to handle loads with more inductance such as air conditioners and pumps.

In a partial home backup system, the loads that are to be backed up must be relocated from the main service panel to a new backup sub panel that is connected to the backup side of the inverter. The loads left in the main panel are not backed up when the grid fails.

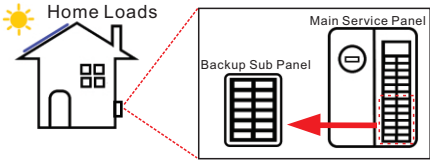


Figure 4.9 Dedicated loads for partial-home backup

Surge Capacity and Pass-Through Power

There will be times when the loads on the backup side require more power than the inverter is able to provide with PV and battery power. Each model of the S6 hybrid inverter is able to pass through 180A of power from the grid to the loads. The surge capacity depends on which inverter model and how much battery power is installed. Installing multiple inverters in parallel increases the surge power.

This chart shows the maximum surge power that each model can support. The surge capacity is 200% of the continuous for 10s and 300% for 1s..

Ex: 16kW x 200% = 32kW for 10 seconds

Inverter Model	Maximum Surge Power Backup (10 seconds)
S6-EH2P9.6K-L-US	20.8 kW (87A)
S6-EH2P11.4K-L-US	24.9 kW (104A)
S6-EH2P12K-L-US	26.1 kW (109A)
S6-EH2P14K-L-US	30.5kW (127A)
S6-EH2P16K-L-US	34.8 kW (145A)

Figure 4.13 Pass Through Power and Surge Capacity

Frequency Shifting for Controlling ACPV

There is no direct communication between the Solis S6 hybrid and the AC-coupled PV system. The inverter uses frequency-shifting to modulate the output of the ACPV system. The inverter uses the frequency-watt curve outlined in the IEEE 1547-2018 standard. When in backup mode, the S6 hybrid will begin to shift the AC frequency when it detects that the power supplied by all of the PV, including the ACPV, is greater than the power demanded (consumed). This change in frequency will be detected by the ACPV system. If the ACPV system also supports the IEEE 1547-2018 frequency-watt curve, then its output power will reduce according to that curve. If the ACPV system does not support frequency-watt, then it will shut off as the frequency shifts and then turn back on once the S6 hybrid corrects the frequency.

4. Operating Modes

4.5 Backup Power Inverter Paralleling

Up to *six* hybrid inverters can be installed together in parallel on the backup side of the system. The backup ports of each inverter would terminate in separate overcurrent protection devices within the backup load center. There is no limit for the number of inverters that can be paralleled together if they are only being paralleled on the grid-side.

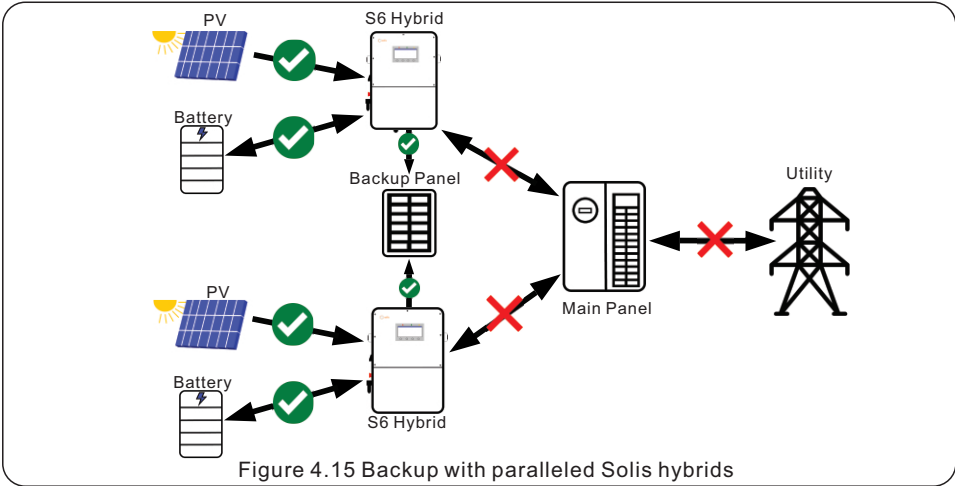


Figure 4.15 Backup with paralleled Solis hybrids

It should first be determined what the maximum continuous current needs to be in order to meet the energy demand of the home. Up to three S6 hybrid inverters can be installed in parallel with PV and batteries to provide continuous backup power. For example, three 16 kW hybrids in parallel can provide up to 200A (66.7A x 3) of continuous power to the home loads in backup or off-grid modes. For a whole-home backup system, the average daily power consumed should be less than or equal to the average daily PV power produced over the span of a year. Otherwise, some loads should not be backed up during a grid failure. The chart below shows how much continuous backup power can be produced depending on how many inverters are installed in parallel and what size they are.

Solis Model	Total Maximum Continuous Backup Current					
	1 unit	2 units	3 units	4 units	5 units	6 units
S6-EH2P9.6K	40A	80A	120A	160A	200A	240A
S6-EH2P11.4K	47.5A	95A	142.5A	190A	237.5A	285A
S6-EH2P12K	50A	100A	150A	200A	250A	300A
S6-EH2P14K	58.3A	116.6A	174.9A	233.2A	291.5A	349.8A
S6-EH2P16K	66.7A	133.4A	200.1A	266.8A	333.5A	400.2A

Backup Combiner Load Center

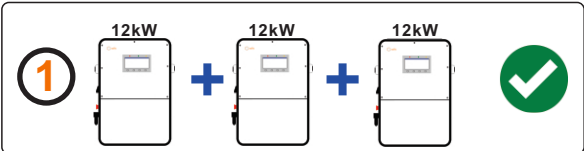
In the diagrams of this manual a Backup Combiner Load Center is often shown that is additional to the Backup Home Load Center. The Combiner is not required, but it does provide additional breaker slots to host multiple inveter breakers if one is installed. A single backup load center can be installed if there is adequate space to host all of the home load breakers in addition to the inverter breakers, provided that it is compliant with the NEC.

4. Operating Modes

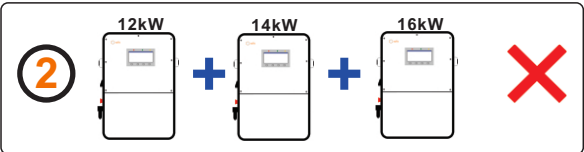
4.5.1Paralleling Limitations and Restrictions

There are a few limitations to installing multiple inverters in parallel for backup power. Please note that these caveats do not apply when only paralleling on the grid-side. The restrictions shown below are only with respect to paralleling the backup-sides together. All inverters in the same system must be on the same firmware version. Please be sure to install one Solis logger per inverter.

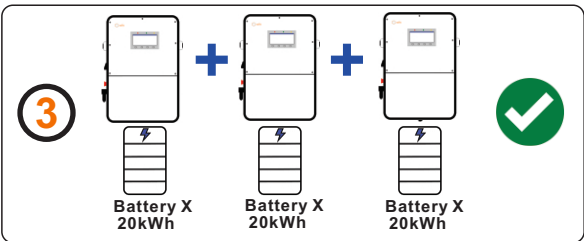
1. Paralleled inverters must be the same size (same model number).



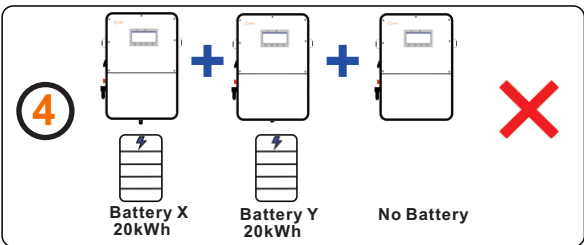
2. Do not parallel inverters that are different sizes. This is due to power balancing.



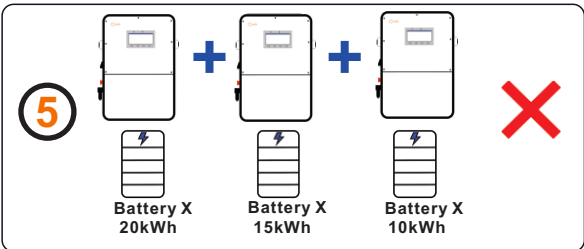
3. Paralleled inverters must have the same capacity (kWh), brand, and model of battery connected.



4. Do not install some inverters with batteries and some without batteries. Do not install different brand batteries on each inverter.



5. Do not install different sizes of batteries on each inverter. Each inverter needs to have the exact same battery connected.



NOTE:

Please follow these guidelines to maintain the warranty status of the inverter.

4. Operating Modes

4.5.2 Power Control System (PCS)

The Solis S6 hybrid inverter is UL 3141 PCS certified. This means that the inverter is able to regulate the current and limit the loading on the bus bars and conductors. The PCS can limit the power flow as to not exceed any busbar rating limits. With PCS, the 120% rule for breaker sizing becomes irrelevant, you can go up to the busbar rating. For the S6-EH2P16K-L-US model, the maximum controlled current on the busbar is 66.7A (16kW). The Export Only Mode is used to control the power delivered from the grid to the energy storage. system. Import Only Mode is used to control the power delivered from the ESS to the grid. The measured open loop response time is 1.95 seconds and the longest steady state time is 4.2 seconds.

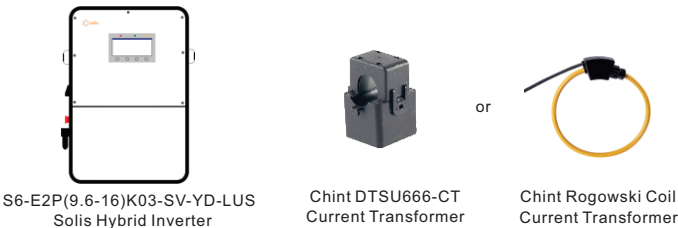


Figure 4.17 Components of a Solis PCS system

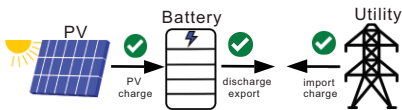


NOTE:

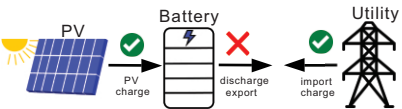
Every S6 hybrid comes with a pair of split-core CTs. If an external meter is to be installed, it must be purchased separately. Likewise, Rogowski Coils are compatible but must be purchased separately. The CTs must be installed for full functionality of the inverter.

Solis Power Control System (PCS) Operating Modes

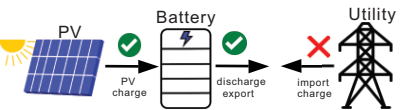
1. Unrestricted Mode: This mode should be used when PCS is not required. The system is permitted to charge the batteries with grid power and can discharge-export battery power to the grid. This mode is enabled by default.



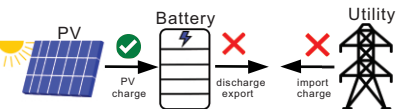
2. Import Only Mode: The system is permitted to charge the battery with grid power but is prohibited from discharge-exporting battery power to the grid.



3. Export Only Mode: The system is permitted to discharge-export battery power to the grid but prohibits the use of grid power to charge the battery.



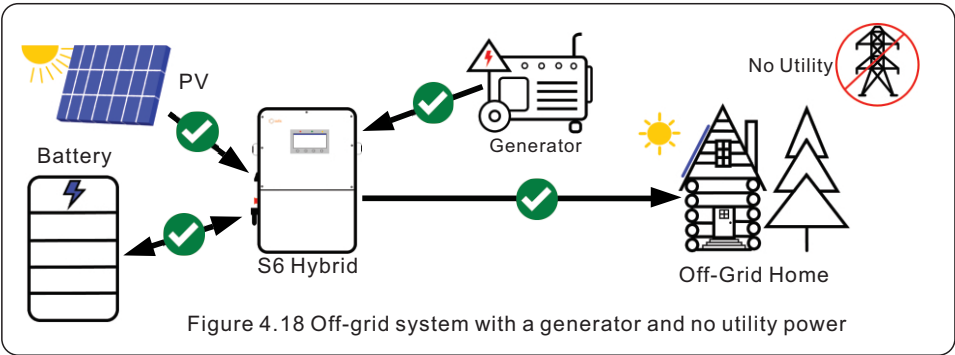
4. No Exchange Mode: The system is only permitted to charge with PV power and can only discharge to cover loads. The system is prohibited from discharging battery power to the grid.



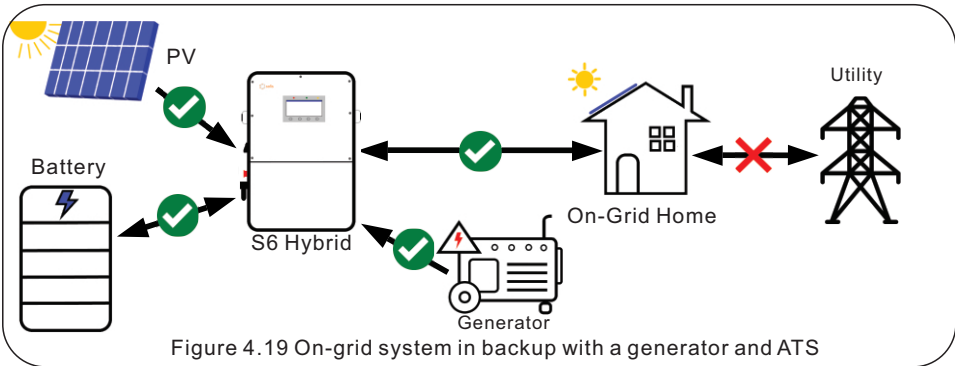
4. Operating Modes

4.6 Generator Operation

The generator must be connected to the grid-side of the inverter. For purely off-grid systems, a generator can be used as a grid replacement. The generator must support dry contact. The inverter is able to use dry contact to turn on the Generator which can then charge the batteries and feed the home loads when the PV power is insufficient. The generator is turned off once the battery SOC reaches another specified limit.



The Solis hybrid can work with a generator that is connected directly to it. When the grid is lost, the inverter is able to automatically turn on and off the generator using a dry contact two-wire signal. The inverter will only send the start signal once the battery SOC discharges to the specified generator start SOC. When the generator is turned on, the inverter will curtail the PV power to zero as to not back feed the generator with power which could damage the generator.



NOTE:

The generator must be connected to the generator port of the inverter. Do not connect the generator to any other port of the inverter.



NOTE:

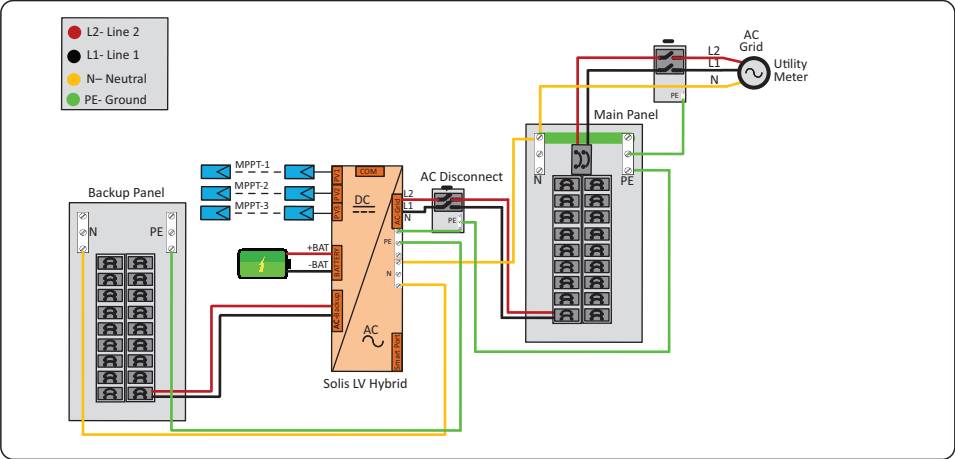
The generator must be connected in 240V split phase configuration, otherwise it may result in phase loss in the inverter and the system will be unable to operate.

4. Operating Modes

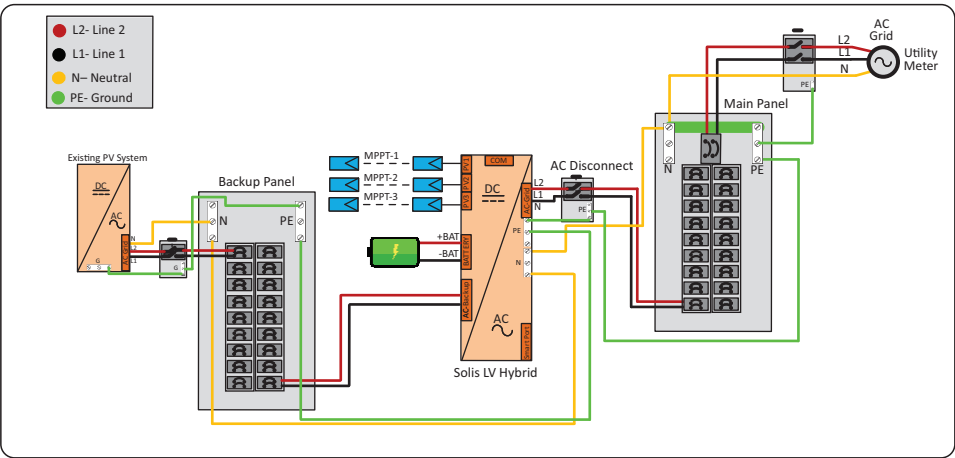
4.7 Wiring Diagrams

Note: The ground conductors from PV and battery to the inverter are not being shown in these diagrams but should be installed for every system.

4.7.1 Partial-Home Backup with One Solis Hybrid

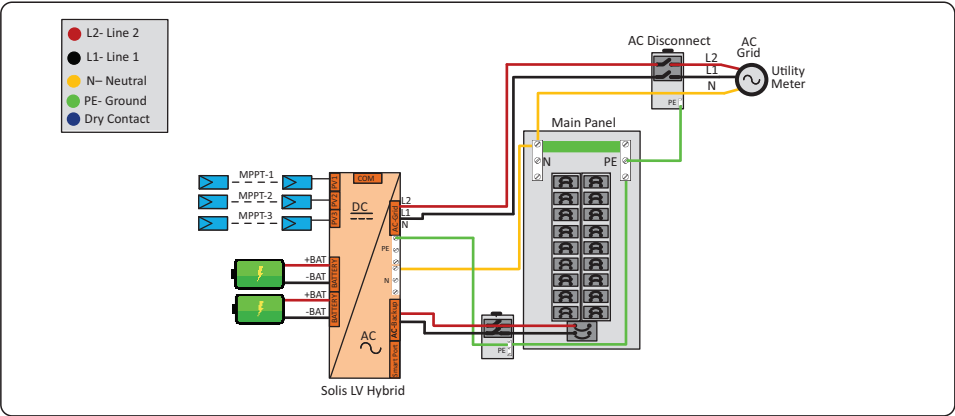


4.7.2 Partial-Home Backup with One Solis Hybrid and an AC-Coupled PV System

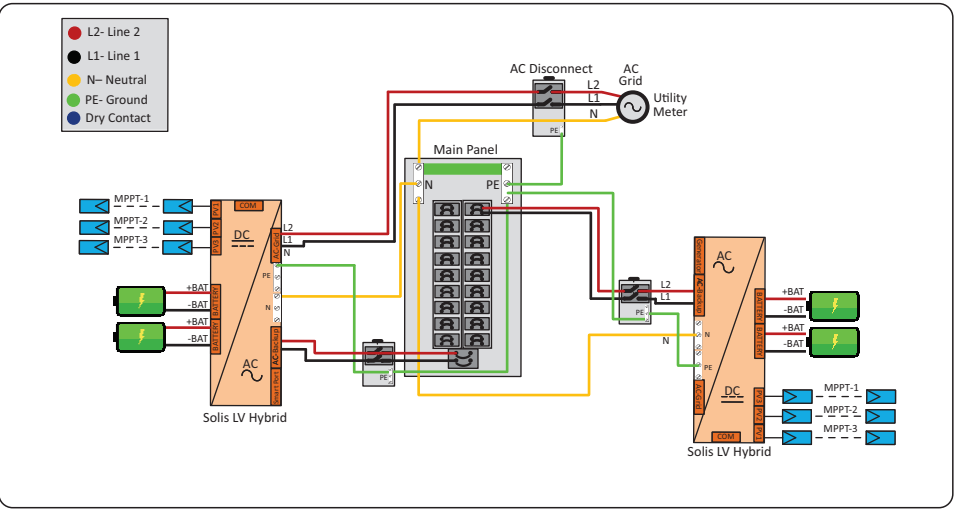


4. Operating Modes

4.7.3 Whole-Home Backup with One S6 Hybrid Inverter

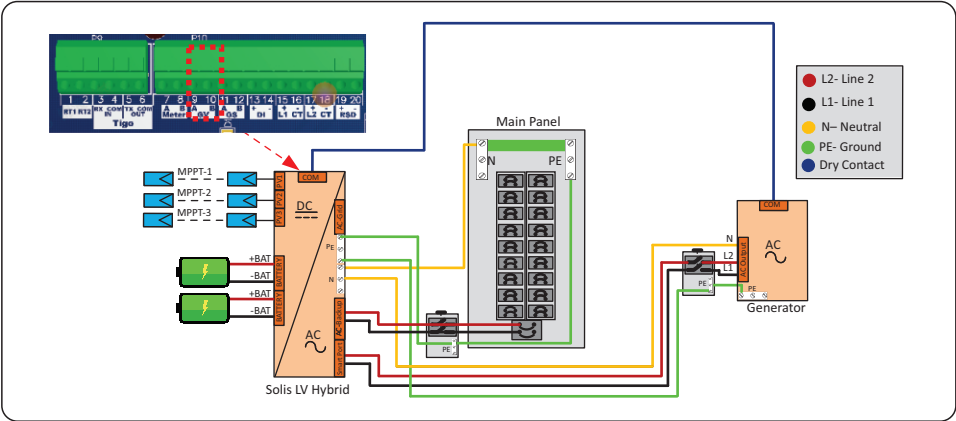


4.7.4 Whole-Home Backup with Multiple S6 Hybrid Inverters



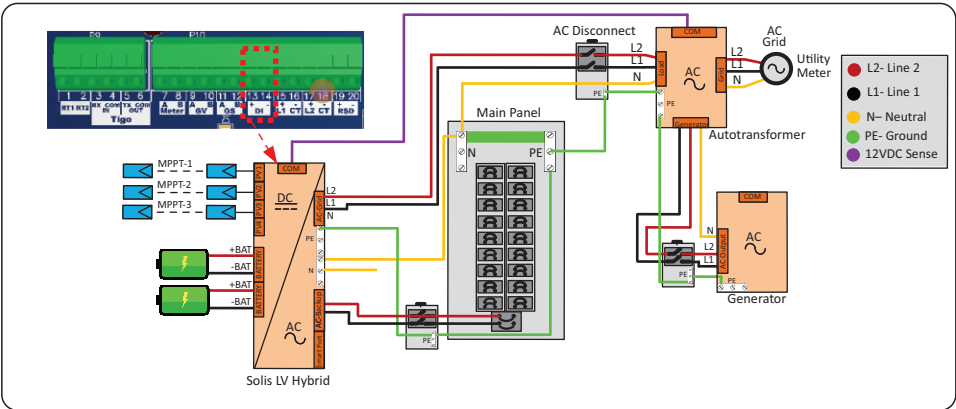
4. Operating Modes

4.7.5 Off-Grid System with a Generator and One Solis Hybrid Inverter



Note: Pins 9 (GV-A) and 10 (GV-B) should be used for the dry contact connection to the generator.

4.7.6 On-Grid System with a Generator and External Autotransfer Switch (ATS)



Note: Pins 13 (DI +) and 14 (DI -) should be used for the grid sense connection to the external ATS.



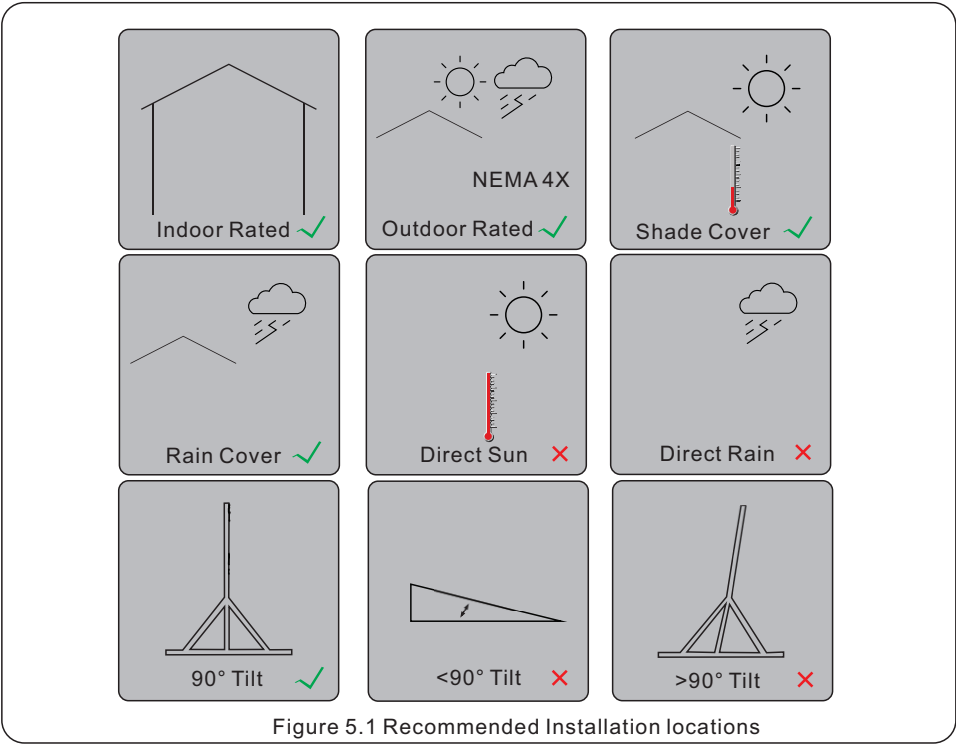
NOTE: Systems with an external ATS and generator that want the inverter to control the generator turning on and off but use the ATS to switch to generator from grid during a power outage should use all four pins: GV-A, GV-B, DI+, and DI-

5. Installation

5.1 Select a Location to Install the Inverter

When selecting a location for the inverter, the following criteria should be considered:

- Exposure to direct sunlight may cause output power derating due to overheating
It is recommended to avoid installing the inverter in direct sunlight. The ideal location is one where the ambient temperature does not exceed 40°C (140°F)
- It is also recommended to install the inverter somewhere the rain and snow will not land directly on it. The ideal installation location is on a north-facing wall under an eave.



WARNING: Risk of Fire

Despite careful installation, electrical equipment can cause fires.

- Do not install the inverter in an area that contains flammable materials, liquids, or gases.
- Do not install the inverter in a potentially explosive environment.
- The structure on which the inverter is being mounted must be fireproof.



NOTE:

If the inverter is installed in areas with high wind and sand, it is recommended to install a wind and sand-proof barrier around the inverter.

5. Installation

5.1.4 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.

5.1.5 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.

5.1.6 Flammable substances

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

5.1.7 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.

5.2 Inverter Handling

Please review the instruction below for handling the inverter:

1. The red circle below denotes the carrying handle cutout on the inverter box. Push in the cutouts on both ends of the box to form handles for moving the inverter.

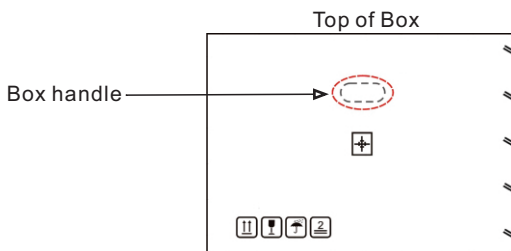


Figure 5.2 Handles for moving the inverter shown circled in red - one per side

2. Two people are required to carry and move the inverter while it is in the box.
3. When removing the inverter from the box, two people must use the handles integrated into the heat sink.
4. When setting the inverter down, do it slowly and gently. This ensures that the internal components and the outer chassis do not take any damage. Do not drop the inverter on any side from a height greater than 4 inches from the ground or it will cause damage.

5. Installation

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

WARNING: Risk of Shock



- Despite careful installation, electrical devices present a shock hazard.
- Install the equipment out of reach of children if children may be present.
 - Ensure that the equipment covers are always in place whenever the equipment is not being serviced.
 - Never service live equipment. Always turn the equipment off first. Use a multimeter to verify that conductor voltages are zero.



CAUTION: Hot Surface

- The temperature of the inverter heat sink can reach 167°F. Do not touch the heat sink while the inverter is operating.

The ambient temperature and relative humidity of the installation environment must meet the following requirements:

Maximum Temperature



140°F
60°C

Minimum Temperature



-13°F
-25°C

Max. Relative Humidity



100%
Non-Condensing

Maximum Altitude



13,123 feet
4,000 meters

Figure 5.3 Installation environment conditions

Load bearing structure requirements:



Made of nonflammable materials

Max. load bearing capacity ≥ 4
times of inverter weight



Figure 5.4 Load bearing structure

5.2.1 Clearances

- If multiple inverters are installed on site, a minimum clearance of 12 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 5.5 on page 23).
- The LED status indicator lights 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.

5.2.2 Consult technical data

- Consult the technical specifications sections at the end of this manual for additional environmental condition requirements (temperature range, altitude, etc.)

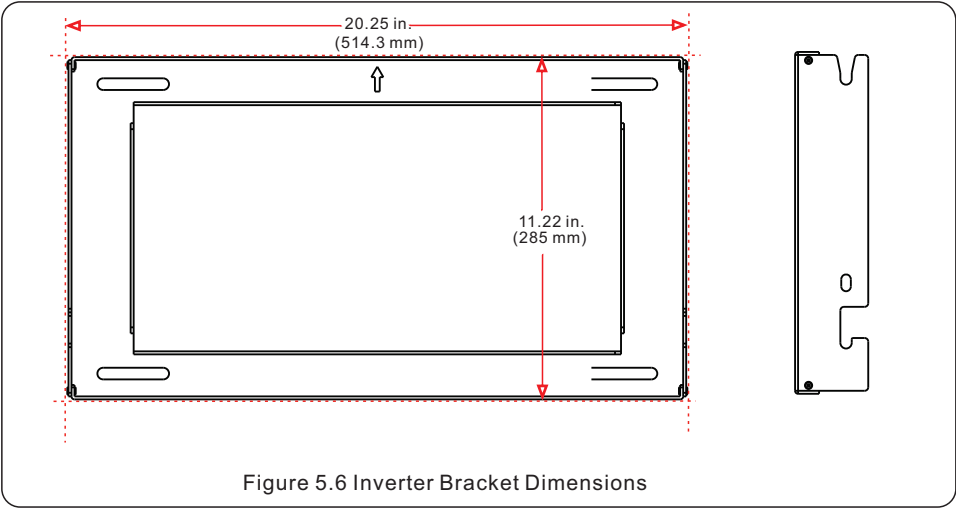
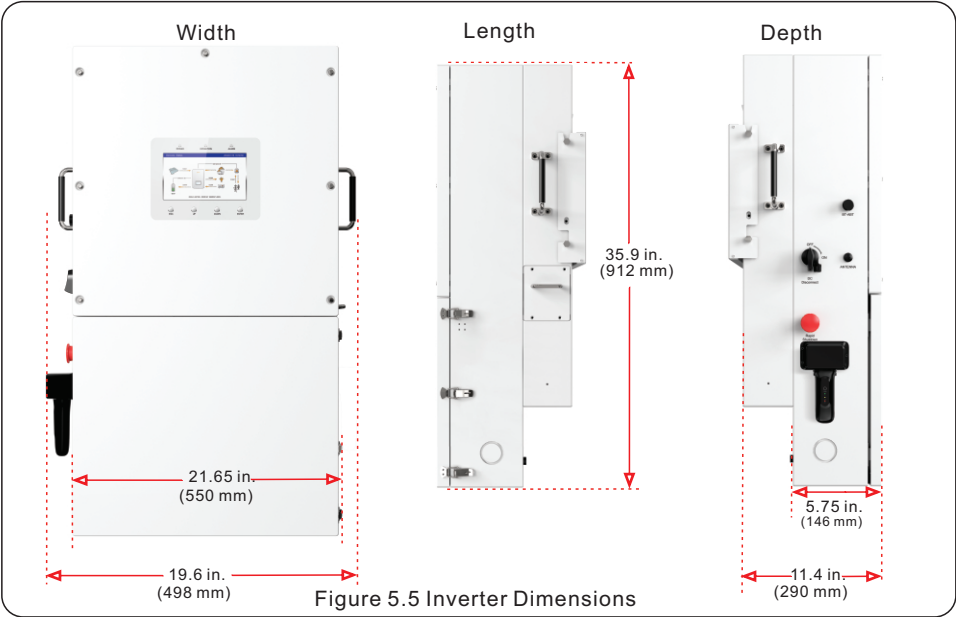
5.2.3 Angle of installation

- This model of Solis inverter must be mounted vertically (90° degrees not greater or less than 90° degrees straight up).

5. Installation

5.3 Inverter Dimensions

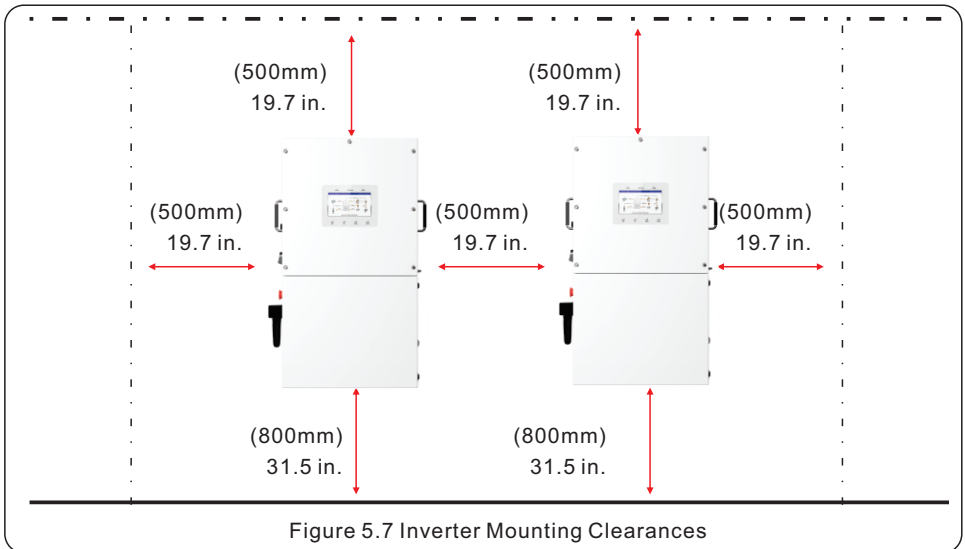
5.3.1 Dimensions of S6-EH2P(9.6-16)K03-SV-YD-L-US Inverter Models



5. Installation

5.4 Mounting the Inverter

- Mount the inverter on a wall or structure capable of bearing the weight of the machine
- The inverter must be mounted upright on a vertical structure with a tilt of 90°. A tilt greater or less than 90° may cause the inverter output power to derate.
- To prevent overheating, be sure that the inverter has adequate air flow around it. A minimum clearance of 19.7 inches (500mm) should be kept between inverter & other equipment. 31.5 inches (800mm) of clearance between the bottom of the inverter and the ground.



- Visibility of the LCD screen should be considered. Ideally, the screen would be at eye-level.
- Adequate ventilation around the inverter must be provided.



NOTE:

Nothing should be stored directly on top, underneath, or against the inverter.

- When the inverter is mounted on the wall, it sticks out approximately one foot.
 - Keep this in mind when selecting the installation location for the inverter.
- The exact dimensions of the inverter and the mounting bracket are on the next page.

Once a suitable location has been found according to Figures 5.3 and 5.4, use figures 5.6 and 5.7 to mount the bracket to the wall. You may drill additional holes in the bracket if you need to. The steps for mounting the inverter are listed below:

1. Place the bracket on the wall and use a bubble level to make sure it is level. The arrow in the middle of the bracket points up. With a pencil or marker, mark the mounting holes. Use a drill to prepare the holes for fasteners. Fasten the bracket to the wall, using the provided concrete anchor bolts. If the wall is wood or stucco, be sure the lag bolts you use go into wall studs.

5. Installation



NOTE:

The inverter must be mounted vertically at a 90° angle.
Four fasteners must be used to ensure the bracket does not come off the wall. At least two must embed in a wall stud to bear the inverter weight.

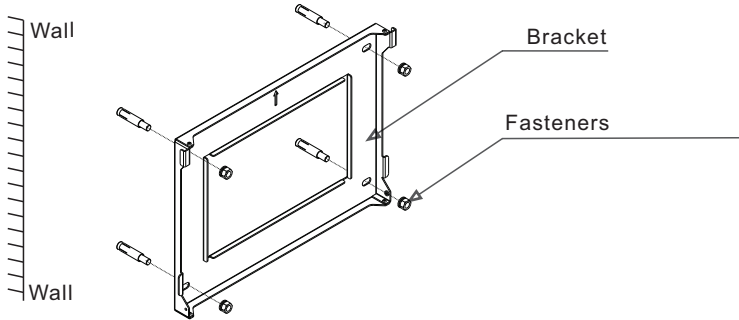


Figure 5.8 Fix the bracket to the wall

2. Lift up the inverter and align the two bolts on the inverter with the two hooks on the mounting bracket. Slowly lower the inverter down, guiding the bolts into the grooves. Then install the two set screws that are included with the inverter for stabilization.

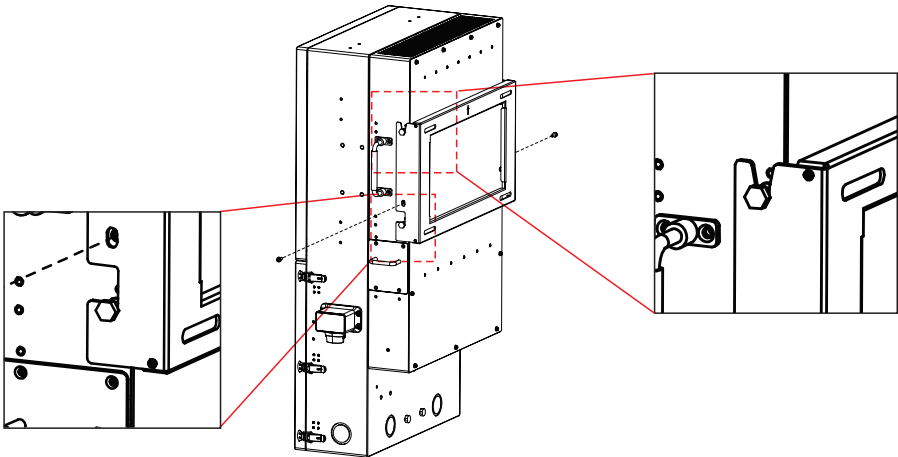


Figure 5.9 Inverter on mounting bracket and set screws



WARNING:

The inverter is very heavy. Please use proper lifting techniques to avoid potential injury. It is recommended that two people lift the inverter together.

5. Installation

5.5 Maximum Conductor Sizes & Torque Specs

5.5.1 Max. Conductor Sizes and Torque Specifications

Terminal	Max.Conductor Size	Torque Specifications
PV	8 AWG	N/A
Battery	2/0	13-15 N.m.
AC Grid	2/0	
AC Backup	2/0	
Ground	2/0	
Neutral	2/0	
Smart Port	2/0	

Figure 5.10 Max. Conductor Size and Torque Spec Chart

Inverter Terminal Operation

The inverter AC and battery terminals are all 8 mm Allen (hex).
Insert an 8mm Allen tip into a torque wrench screwdriver.
Use this assembled tool to open and close the inverter terminals
The PV terminals can be operated with fingers only, no tools.
The communication terminals require a small flat screwdriver.



Conductor, conduit, and overcurrent protection device sizing shall be done in accordance with the NEC and local electrical codes & standards.

5. Installation

5.6 Equipment Grounding and Neutrals

Within the inverter wire box there is a ground bar for the equipment grounding conductors to terminate. All equipment grounding conductors (EGCs) must be terminated in this bar. If there is not enough terminal space for all of the EGCs, please use a multi-port connector to provide additional terminals.

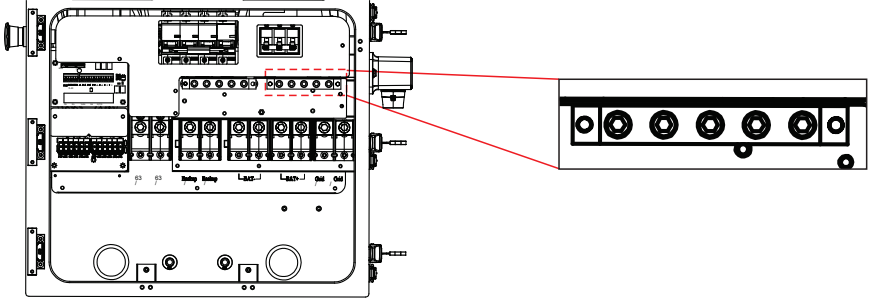


Figure 5.11 Internal Grounding Conductor Terminal Location

Steps for connecting grounding and neutral conductors to the ground and neutral bus bars:

1. Strip $\frac{1}{2}$ inch of insulation off the end of the ground conductor.
2. Use a Phillips #2 screwdriver to loosen the terminal screw in the ground bar
3. Insert the stripped end of the grounding conductor into the now open terminal.
4. Tighten the screw until snug, be careful not to over tighten and strip the screw.
5. Give the conductor a gentle tug test.

There is also an external terminal on the chassis of inverter for a grounding conductor to connect

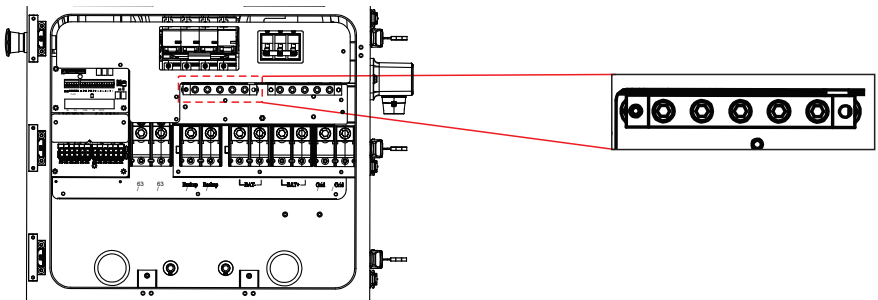


Figure 5.12 Internal Neutral Conductor Terminal Location



IMPORTANT:

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

5. Installation

5.7 PV Cable Installation



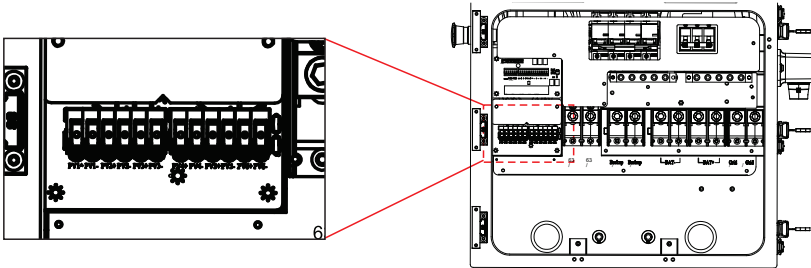
DANGER:

Before installing the PV cables, be sure that the PV array is disconnected. Use a multimeter to verify that the PV string voltages are 0V before proceeding. If rapid shutdown is being used, then under 30Vdc per string is safe.

Please verify the following before connecting the PV strings to the inverter:

- Ensure the DC voltage of the PV strings will not exceed the maximum DC input voltage (600Vdc). Violating this condition will void the inverter warranty.
- Ensure the polarity of the PV strings are correct (ex: positive is positive).
- Ensure the DC-switch, battery, AC-Backup, and AC-Grid disconnects are all off.
- Ensure the PV resistance to ground is higher than 20K ohms.
- Ensure that the Isc of the strings will not exceed the maximum DC input current.

Note: Each PV string input/set of + and - ports is a separate MPPT



1. Strip ½ inch of sheath off the ends of each PV cable.
2. Pull up on the orange lever above the PV terminal, this opens the terminal gate.
3. Insert the end of the PV cable into the now open terminal.
4. Release the orange lever and the terminal gate will clamp down on the PV cable.
5. Give the PV cable a gentle tug test to ensure that the connection is tight.
6. If the connection feels loose, repeat steps 1-5 again but push the cable deeper into the terminal before releasing the lever.

Figure 5.13 PV Cable Connection

CAUTION:

If the DC conductors are accidentally connected in reverse or if the inverter is not working properly, do NOT turn off the DC switch. Otherwise, it may cause a DC arc and damage to the inverter or a fire.

The steps for corrective actions are as follows:

- *Use a DC amp clamp multimeter to measure the DC string current.
- *If the current is above 0.5A, please wait for the irradiance on the PV array to diminish until the current drops below 0.5A.
- *Once the current is below 0.5A, you are allowed to open the DC switch and then disconnect the PV strings from the inverter.
- * In order to completely eliminate the potential for failure, leave the PV strings disconnected until the cause of the reverse polarity is corrected.



5. Installation

5.8 Rapid Shutdown and Emergency Power Off

5.8.1 Integrated Rapid Shutdown (RSD) and Emergency Power Off (EPO)



IMPORTANT:

The inverter can be ordered with an internal rapid shutdown transmitter. This transmitter brand must match the receivers that are being installed with the PV modules. **Not abiding by this will void the inverter warranty.**

How the inverter achieves module-level rapid shutdown:

The internal transmitter generates a PLC signal when it receives AC power. This signal travels up the PV strings to the receivers that are connected to the PV modules. When the receivers get this signal, they turn on and allow the string voltage to ramp up. When the receivers lose this signal, they turn off. When the receivers are off, each PV module only puts out less than 1VDC.

The red “Rapid Shutdown (E-Stop) switch disables the internal RSD transmitter

Rapid Shutdown & Emergency Power Off Initiation Process

1. Press the switch in to turn off the internal transmitter. This will initiate rapid shutdown of the PV by decreasing the PV voltage to safety level.
2. It will also shutdown all output power from the inverter (EPO).
3. Twist the switch clockwise to turn the transmitter back on. This will bring the PV string voltages back up to full Voc.



Note:

Rapid shutdown will only initiate if receivers have been installed in the PV array connecting to the PV modules directly. EPO will initiate regardless of MLPE being installed.

Without the receivers, rapid shutdown is not possible.

Figure 5.14 Inverter rapid shutdown and EPO initiation switch

Additional Details About Rapid Shutdown

1. With rapid shutdown receivers installed, the PV string voltages should be very low. Depending on the receiver type, you should be measure between 0.6 and 0.7Vdc per module. Example: x10 modules = 6V-7V for the whole string
2. If the PV string voltages are low, check that the AC breaker is turned on so that the inverter is getting AC voltage and that the rapid shutdown switch is popped out. Give the switch a twist clockwise to verify that is popped out.
3. The DC switch does not have to be turned on for the receivers to get the PLC signal from the internal transmitter. However, if an external DC switch is installed, ensure that it is turned on or else the receivers will not be able to get the PLC signal from the transmitter.



IMPORTANT:

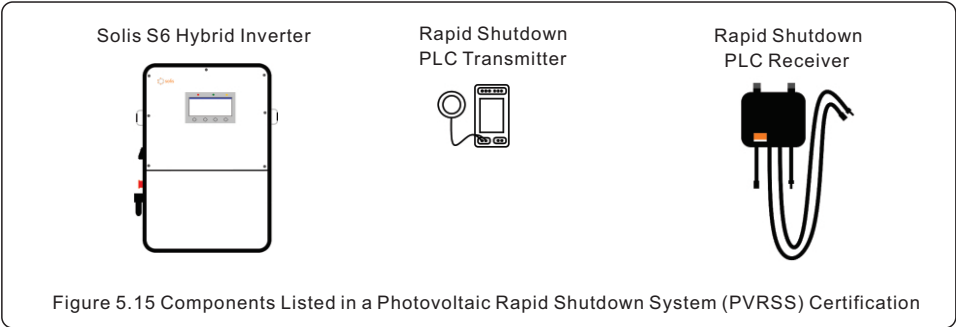
Consult the manual(s) of the rapid shutdown equipment supplier. These manuals must also be followed carefully to ensure normal operation.

5. Installation

Please see the [Compatibility Sheet](#) for details on which internal transmitter options are currently available for the Solis low voltage hybrid inverter.

5.8.2 Photovoltaic Rapid Shutdown System (PVRSS) Certification

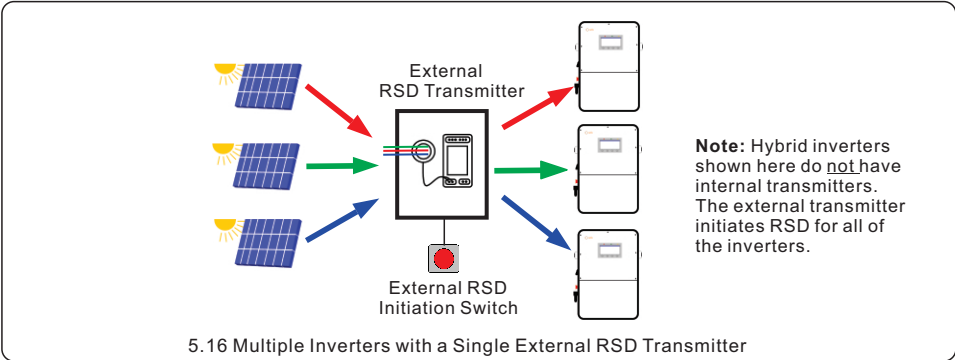
This inverter series is PVRSS-certified with several brands that manufacture rapid shutdown equipment. The certification includes the inverter, the PLC transmitter, and the receivers. The transmitter is located within the inverter, the receivers are installed with the PV modules. To avoid violating the PVRSS certification, the same brand of receivers must be installed as the internal transmitter. (Ex: Tigo transmitter with Tigo TS4-A-F receivers). There can be no mixing of different brands without violating both the PVRSS certification and the rapid shutdown equipment warranty. For this reason, please be sure to check the Compatibility Sheet and only install equipment that is matched under the same brand. The only exception to this is Midnite Solar receivers, which can be used with either Tigo or APS transmitters.



Batteries and PV modules are not listed (specified) in the PVRSS certification. The transmitter can come integrated inside of the inverter, but it must be ordered with the correct internal transmitter. Alternatively, the transmitter can be installed externally in a separate enclosure.

5.8.3 Multiple Inverters with One External Transmitter

If multiple inverters will be installed in parallel, it is ideal to use a single external rapid shutdown transmitter. This prevents cross-talk from occurring because there will only be one transmitter for all of the PV strings in the system. Run all of the strings through the external rapid shutdown enclosure first and then to each inverter. Cores can handle up to 10 strings each. Some transmitters allow for, two cores to be connected, meaning up to 20 strings can be supported by one external transmitter.



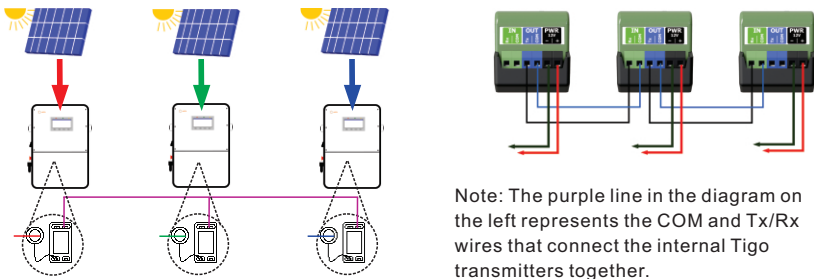
5. Installation

5.8.4 Cross-Talk

Cross-talk occurs when competing PLC signals sent from different transmitters reach the same RSD receivers. This causes the receivers to randomly cycle on and off at various times. Cross-talk must be avoided at all costs. If multiple transmitters must be used, then it is important to keep the PV leads going from each inverter to the arrays separated by one foot minimum. Tigo transmitters can be physically wired together in a daisy-chain. Be sure to understand what kind of cross-talk protection the transmitter uses so that the system can be designed to eliminate any chance of cross-talk happening. If an external rapid shutdown transmitter is going to be used and the inverter has an integrated transmitter, then the integrated transmitter must be disabled to prevent cross-talk.

5.8.5 Multiple Inverters with Multiple Integrated Tigo Transmitters

Tigo transmitters can be daisy-chained together with two wires. This allows the transmitters to synchronize such that cross-talk between transmitters is eliminated. With this type of installation, an external RSD transmitter box is not required. Link the internal transmitters together so that the PLC signals become synchronized. Engaging the RSD initiation switch on the inverter wire box will initiate rapid shutdown for all of the inverters.



5.17 Multiple Inverters with Multiple Internal Tigo Transmitters

IMPORTANT:



The inverter can either come with a Tigo transmitter (-RSS) or a Tigo CCA (-CCA). The Tigo transmitter only supports the TS4-A-F and TS4-A-2F. The transmitter does not support the optimizer TS4-A-O.

The Tigo CCA supports the optimizer, but it does not work with the TS4-A-F or TS4-A-2F receivers. When purchasing the inverter be sure to order the inverter with the correct internal Tigo component.

It is not permitted to swap out rapid shutdown components.

5. Installation

5.9 Battery Installation



DANGER:

Before installing the battery cables, be sure that the battery is turned off. Use a multimeter to verify that the battery voltage is 0Vdc before proceeding. Consult the battery product manual for instructions on how to turn it off.

1. The battery (+) and (-) cables shall only be connected to the inverter BAT terminals.
2. Run the cables into the wire box. Strip $\frac{1}{2}$ inch off the ends of each cable.
3. Crimp O-Ring connectors onto the ends of each battery conductor
4. Remove the bolts using a hex nut driver, then insert them into the O-Ring connectors
5. Reinstall the hex bolts into the terminals, tighten them to XX lbs using a torque wrench screwdriver
6. Give the cables a gentle tug test to ensure they are secure

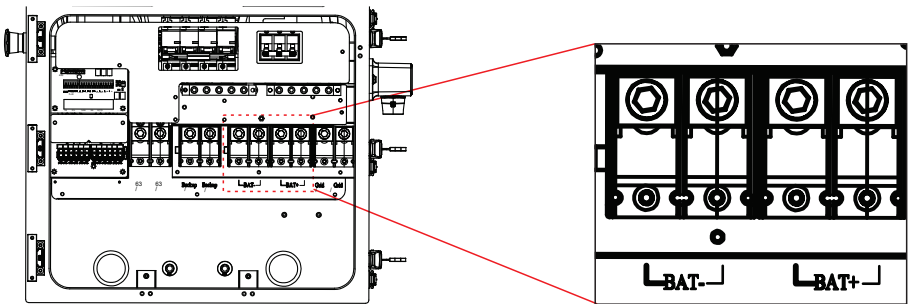


Figure 5.18 Battery Cable Connection

Battery Compatibility

This inverter only works with specific battery models. Please consult the Battery Compatibility table on page 54 for which battery models this inverter will support. **Installing a battery that is not on the list will void the inverter warranty.** The inverter has two battery inputs and so can connect to two battery stacks at the most, unless the battery allows for paralleling stacks.

Black Start

In a situation where there is no grid and no PV, the inverter is able to use the battery to black start. However, not all compatible batteries support this function. Be sure to consult the battery manual to determine if it is able to support black start. The battery must continue to provide voltage to the inverter such that the inverter can remain on all night until the sun comes up the next day. The inverter will not allow the loads to stay energized, only itself, until PV is available to charge the battery.



NOTE:

Before connecting the battery, please carefully read the product manual of the battery and perform the installation exactly as the battery manufacturer specifies in the manual



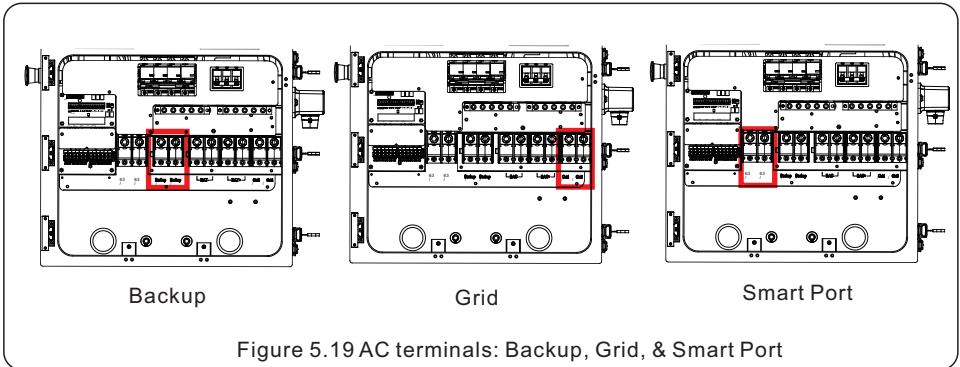
NOTE:

The largest cable size that will fit in the battery terminals is 4/0 AWG. Copper or aluminum conductors can be connected to the terminals.

5. Installation

5.10 AC Wiring

5.10.1 AC Terminals



- Backup:** This port remains energized with PV/ battery whenever the grid fails. Loads connected to the backup get power directly from the grid whenever there is not enough power available from PV/battery.
- Grid:** The inverter connects to the utility through this port. Excess PV power can be exported to the grid and the inverter can import power from the grid to charge the battery and support home loads.
- Smart Port:** This port is for connecting either a generator, an AC-coupled PV system, or a large load that can be shed during a grid outage if there is not enough power to support it (such as an EV charger).

The inverter has two AC outputs: (1) to a backup distribution panel and (2) to the main service panel that is connected directly to the utility. When utility power is lost, the Grid-side of the inverter shuts off. The backup-side of the inverter stays energized as long as there is enough PV and battery power to support the loads.

The inverter can be connected to other S6 hybrids in parallel to provide additional support to the backup loads. For whole-home backup systems, the AC grid terminals of the inverter will connect directly to the utility through a disconnect switch. The AC backup terminals will connect to the main breaker within the main service panel. The inverter is rated for 200A maximum, which is the pass through capability from the grid to the loads when grid is available.

5.10.2 Pass-through Power (AC Bypass)

In the event of a soft equipment malfunction the inverter will automatically switch into bypass mode. When this happens, the inverter will pass power to loads on the backup side from the grid so that the loads never lose power. There is no physical switch on the inverter for this function, it is achieved through relays within the inverter.

Should the inverter have a hard failure, the loads connected to the backup side will lose power.

The maximum pass-through power is 180A. During normal grid-connected operation the maximum continuous grid to backup pass-through current is stable up to 180A. Between 180A and 200A the inverter will trip for overload.



NOTE:

The bypass/pass-through feature does not need to be enabled in the settings to function normally. This feature is automatic and turned on by default.

5. Installation

AC Current Ratings for Sizing Over-Current Protection (OCPD)

To protect the inverter, we recommend installing a device for protection against over-current and leakage, based on the following current ratings noted in Figure 5.20

Inverter Model	Grid Max Output Current	Grid Max Pass Through Current	Backup Rated Output Current	Backup Max Output Current (10 sec)
S6-EH2P9.9K-L-US	41.25A	180A	41.25A	82.5A
S6-EH2P11.4K-L-US	47.5A	180A	47.5A	95A
S6-EH2P12K-L-US	50A	180A	50A	100A
S6-EH2P14K-L-US	58.3A	180A	58.3A	116.2A
S6-EH2P16K-L-US	66.7A	180A	66.7A	133.4A

Figure 5.20 Current ratings for sizing the OCPD



NOTE:

The largest cable size that will fit in the battery terminals is 4/0 AWG. Copper or aluminum conductors can be connected to the terminals.

5.10.3 Installing the AC cables

This section explains how to install the AC conductors which will connect to both the grid and the backed up home loads. **Partial-home** backup means that a limited number of loads will be backed up whenever the grid fails. **Whole-home** backup means that every home loads will be backed up. It is crucial to design the system so that the backed up home load consumption does not exceed the available PV and battery power. The next section explains how to wire the system based on if you are installing a partial or whole-home backup system.

Partial-home backup

1. Bring the AC cables for the backup loads panel (backup) and the main service panel (grid) into the inverter wire box. The backup loads panel should not be directly connected to the main service panel.
2. Strip ½ inch of insulation from the ends of each cable
3. Crimp O-ring connectors onto the ends of each conductor
4. Remove the hex bolts from the terminals and then insert them into the O-ring connectors
5. Reinstall the hex bolts into the terminals. Use a torque wrench to tighten them to XX lbs.
6. Give the conductors a gentle tug test to ensure they are secure
7. If the wire feels loose, repeat steps 3-6
8. Connect the other ends of the AC cables in the main service panel to a breaker and neutral bus
9. Connect the other ends of the AC cables in the backup service panel to the panel lugs or to a breaker
10. Keep the breakers OFF for now, turn them on when doing commissioning.

5. Installation

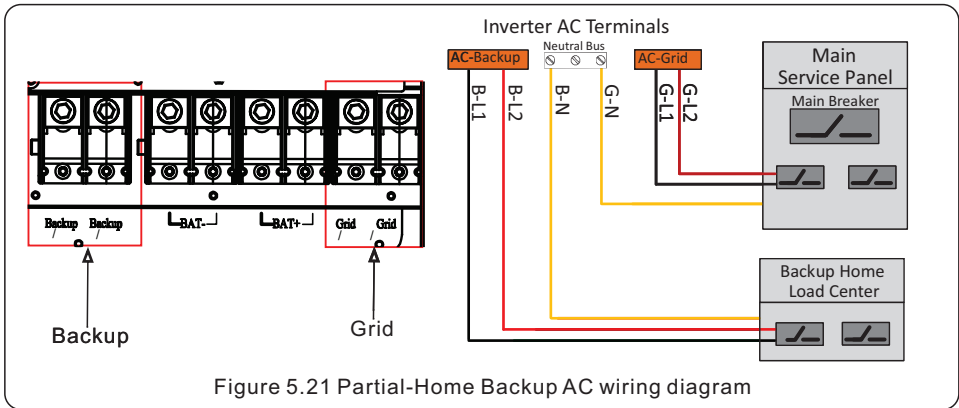


Figure 5.21 Partial-Home Backup AC wiring diagram

5.10.4 Steps for Installing the Backup Home Load Center for Partial Home Backup

1. Once you have determined which breakers supply power to the things that are to be backed up, mark the breakers so that you will be able to identify them once the panel cover is off.
2. Shut off power to the house so that it is safe to work inside of the main panel (or subpanel).
3. Remove the panel cover, use a multimeter to verify that the panel is deenergized.
4. Turn off the breakers that are to be relocated, remove the wires from them and then cap off the wires for now. Remove the breakers and then install them into the backup loads panel.
5. Run separate wires from the main panel (or subpanel) to the backup loads panel. You will need to run one wire for each breaker that you are relocating.
6. In the main panel, connect the cables that you ran to the backup loads panel to the circuit cables that you capped off earlier. This can be done with wire nuts or something similar.
7. In the backup panel, terminate the wires in the breakers that you moved from the main panel.
8. Be sure to label the breakers in the backup loads panel so that they can be identified.

Whole-home backup

1. Conductors for the AC Grid terminals should connect directly to the AC disconnect switch just after the utility meter. Conductors for the AC Backup terminals should go to the main breaker within the main service panel. The inverter is rated for 200A, the maximum that the inverter can connect to.
2. Strip $\frac{1}{2}$ inch of insulation from the ends of each cable
3. Crimp O-ring connectors onto the ends of each conductor
4. Remove the hex bolts from the terminals and then insert them into the O-ring connectors
5. Reinstall the hex bolts into the terminals. Use a torque wrench to tighten them to 13-15 N.m.
6. Give the conductors a gentle tug test to ensure they are secure
7. If the wire feels loose, repeat steps 3-6
8. The neutral conductors from the utility and the main service panel should both terminate in the neutral bus bar of the inverter.
9. Keep the AC disconnect switch and main breaker OFF for now, turn them on during commissioning.

5. Installation

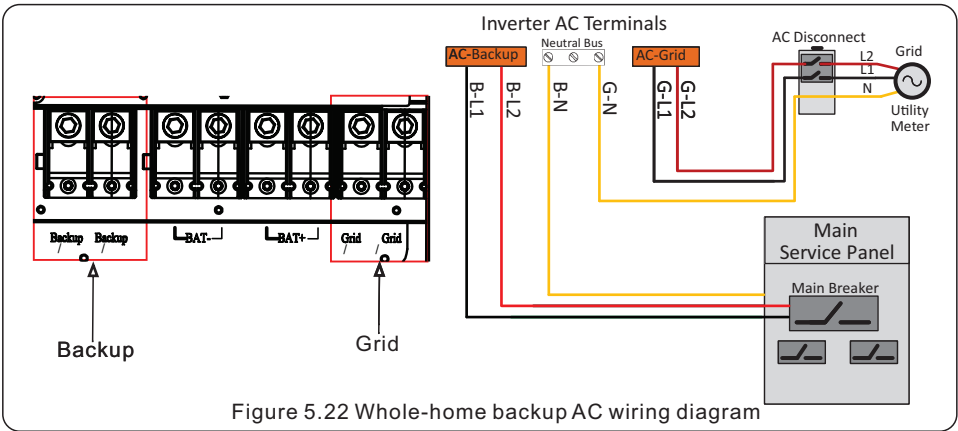


Figure 5.22 Whole-home backup AC wiring diagram

5.11 Generator, AC-Coupling, and Load Control

The inverter has a set of terminals called the “Smart Port”. Here you can connect either a generator, an AC-coupled PV system, or a large load such as an AC-EV charger. The input is rated for 100A max. This means that a 24kW generator is the largest that can be connected. Alternatively, a 100A load or 100A AC-coupled PV system could be connected instead. There are two pins DI + and DI - which can be connected to a 12V source from an external ATS or load which allows the inverter to control it.

5.11.1 Smart Port Location

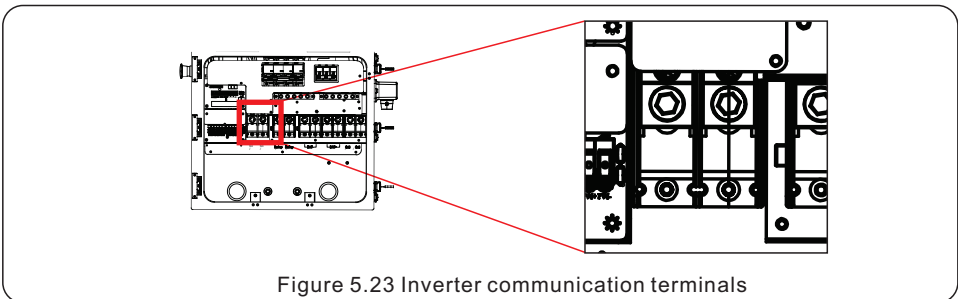
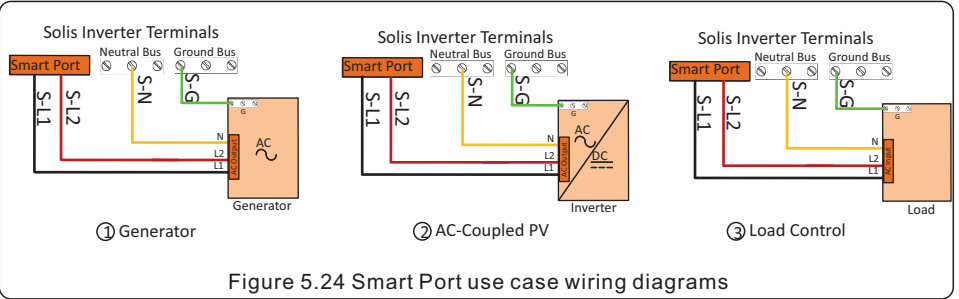


Figure 5.23 Inverter communication terminals

Smart Port Wiring

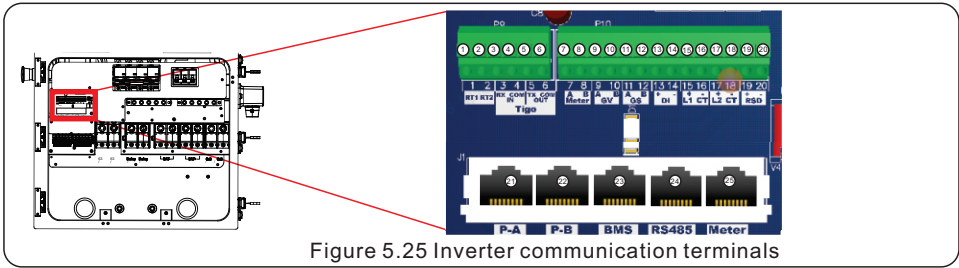
1. Bring the AC cables for the generator, load, or AC-coupled system into the inverter wire box.
2. Strip $\frac{1}{2}$ inch of insulation from the ends of each conductor.
3. Use an Allen (hex) tool to loosen the smart port L1 terminal
4. Insert the stripped end of the L1 conductor into the L1 terminal. Use the hex tool to tighten the terminal to between 13 and 15 N.m.
5. Repeat step 4 for the L2 conductor.
6. Connect a neutral conductor to the neutral bus bar and a ground conductor to the ground bus bar.

5. Installation



5.12 Inverter Communication

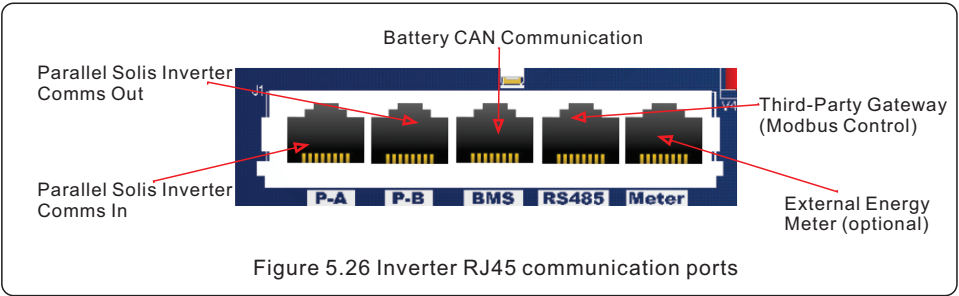
5.12.1 Communication Terminals Overview



The inverter communication terminal block consists of x20 pins and x5 RJ45 ports. The table on the next page explains what purpose of each port is.

For RS485 connection to the inverter, use the RS485 ethernet port. Email the Solis service team for the Modbus map.

The COM port on the side of the inverter is where you can connect a Solis data logger for remote monitoring on SolisCloud.



IMPORTANT:

Communication cables must be shielded or run outside of conduit and raceways

5. Installation

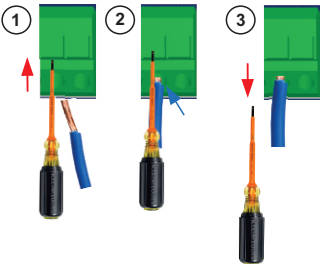
NO.	Port	Function	Acceptable Wire Size Range
1	RT1	Lead-acid battery temperature sampling	22-16 AWG
2	RT2		
3	Tigo Rx IN +	Tigo transmitter RS485 in (for daisy chaining multiple transmitters together)	
4	Tigo RX IN -		
5	Tigo TX OUT +	Tigo transmitter RS485 out (for daisy chaining multiple transmitters together)	
6	Tigo TX OUT -		
7	Meter A	External energy meter RS485	
8	Meter B		
9	GV A	Generator two-wire dry contact	
10	GV B		
11	GS A	Reserved (not for use)	
12	GS A		
13	DI +	Grid sense 12VDC for distinguishing grid from generator power	
14	DI -		
15	L1 CT +	L1 CT wires for grid current sensing	
16	L1 CT -		
17	L2 CT +	L2 CT wires for grid current sensing	
18	L2 CT -		
19	RSD +	External rapid shutdown switch	
20	RSD -		
10	P-A	Parallel inverter communication in	RJ45
11	P-B	Parallel inverter communication out	
12	BMS	Battery BMS CAN communication	
13	RS485	RS485 input for third-party gateway	
14	Meter	External meter communication	

Figure 5.27 Inverter communication ports explained

Installing the communication wires:

First, strip ¼ inch off the end of the com wire.

1. Use a technician screwdriver to push and hold the small button above the terminal. Hold it to keep the port open.
2. Insert the stripped com wire into the open terminal.
3. Remove the screwdriver and the terminal will clamp down on the wire.
4. Finally, give the cable a gentle tug to ensure that it is firmly secured. If it is not, repeat steps 2-5 but push the wire deeper into the terminal before releasing the screwdriver.



5. Installation

5.12.2 Installing CTs for the Inverter

The inverter comes with two CTs that must be installed for full functionality of the inverter. The CTs get installed on the L1 and L2 conductors from the grid to the inverter. The wiring diagram in Figure 5.25 shows how to properly install the meter in the system.

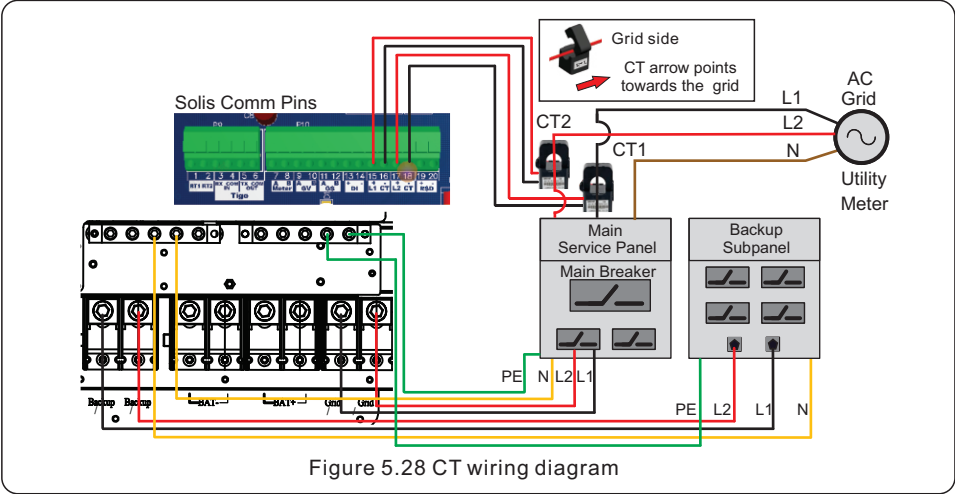


Figure 5.28 CT wiring diagram

The meter must be installed in order to have a fully-functioning system. If the meter is not installed, key functions such as export power control and default energy storage modes will not be available. It is possible for the system to function without the meter, but the capabilities will be limited. After installing the meter, in order to ensure correct wiring, please use a multimeter to measure the voltage of grid L1 and meter L1. The voltage should be between 0-5V, and L2 should be the same. If it is not, please check switch L1 and L2 at the meter so that the phases are matched up.

5.12.3 Battery Communication

CAN from Inverter to the Battery Management System (BMS)

Connect a standard ethernet cable from the BMS RJ45 port in the inverter to the battery CAN port. If the battery has pins for CAN instead of an RJ45 port, the diagram on the next page shows which two wires to use for CAN-H and CAN-L at the battery end.

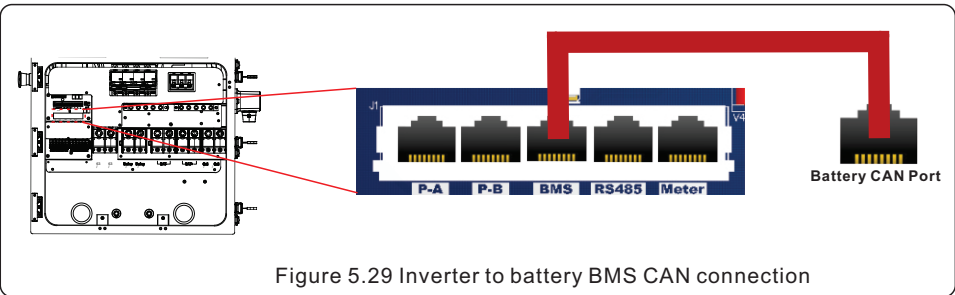


Figure 5.29 Inverter to battery BMS CAN connection

5. Installation

5.12.4 Battery Communication Wiring Table

Some batteries do not have an RJ45 port. If this is the case, use a standard ethernet cable to connect to the inverter BMS port. At the battery end, split the cable and use the blue wire for CAN-H and the blue-white striped wire for CAN-L.

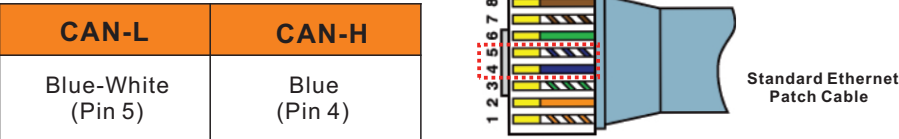


Figure 5.30 Battery Communication Wire Color Chart



IMPORTANT:

Solis cannot guarantee normal operation with any battery that is not on the battery compatibility list. It is possible to install a battery that is not on the list, but Solis cannot provide support or honor the inverter warranty.

Battery Manual and Battery Firmware

Please be sure to read through the battery manual for proper installation steps. The battery manual should be provided with the battery or it can be downloaded from the battery manufacturers website directly. It is very important to update the firmware of the battery during the installation and commissioning of the system. Failing to update both the inverter and the battery firmware can lead to communication issues and alarm codes like CAN_Comm_Fail & No-Battery.



NOTE:

Some alarm codes are being relayed from the battery. These alarms are caused by an issue with the battery itself. The troubleshooting section of this manual explains how to diagnose and treat each alarm.

5.12.5 Parallel Inverter Communication

There are two RJ45 ports reserved for communication between Solis hybrid inverters only. Those ports are P-A and P-B. Connect a standard ethernet cable from the P-B port of the master inverter to the P-A port of the slave inverter. Do not connect the P-A port of one inverter to the P-A port of another inverter. Parallel settings will be configured during the commissioning process later in this manual..

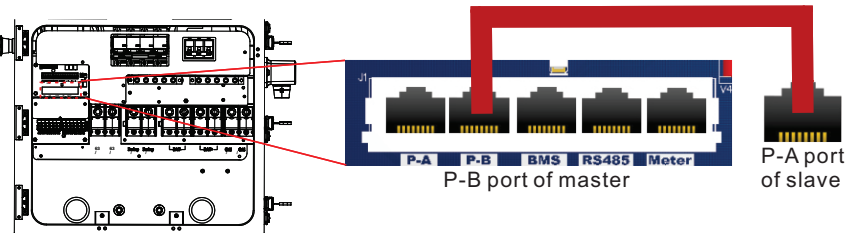


Figure 5.31 Inverter to inverter parallel communication

5. Installation



NOTE:

The master inverter will manage the output power of the slave inverter. If the master inverter has a fault, the slave inverter will continue to operate unless the fault is critical.

5.12.6 Paralleling Rules

In order to ensure normal operation and the safety of the equipment, the following rules must be followed when paralleling multiple inverters on the backup-side.

1. When connecting inverters in parallel, it is mandatory to match their sizes. For example, pair a 16kW inverter with another 16kW inverter. Do not parallel inverters of different sizes on the backup-side.
2. Before parallel connection, verify that both inverters are operating on the same firmware version. The inverters must never be on different versions of firmware.
3. Up to three hybrid inverters can be installed together in parallel, no more than that.
4. The energy meter and the data logger only need to be connected to the master. But to update the firmware, each inverter needs to have its own data logger connected to it.
5. All inverters in the system must be connected to the same ground point to eliminate the possibility of a voltage potential existing between inverter grounds.
6. Each inverter must have its own PV strings connected to it, as per the DC input PV specifications of the inverter. It is ok to have some inverters with only battery and no PV.
7. Each inverter must have the same brand, model, and size (kWh) battery connected to it. The inverters cannot have different batteries or sizes (kWh).
8. The inverter backup circuit breakers must be connected in a separate isolated load center that is not electrically connected to the grid.
9. The AC bypass switches for all inverters must all be in the same position always.
10. The parallel settings for each inverter must be configured prior to initiating operation.
11. Prior to initiating full system operation it is essential to verify that each inverter operates normally. Set each inverter one-by-one for single operation, ensure there are no alarms during operation, shut it down, and then go to the next inverter.

Note: These rules apply only to paralleling the backup ports of the inverters together. If the inverters are being paralleled on the grid-side only then these rules can be ignored.



NOTE:

A maximum of six (x6) inverters can be paralleled together on the backup side.

5. Installation

5.12.7 External Rapid Shutdown (RSD) and Emergency Power Off (EPO)

An external rapid shutdown initiation switch can be added to the system. There are two pins on the communication block RSD + and RSD - for connecting an external switch. If the switch is pressed in, to things will happen (1) the internal RSD transmitter will lose power, initiating rapid shutdown and (2) the inverter will cease operating and go into a standby state. After installing an external switch, run a 2-core cable between it and the inverter. Connect the two cores from the switch to pins 19 (RSD +) and 20 (RSD-).

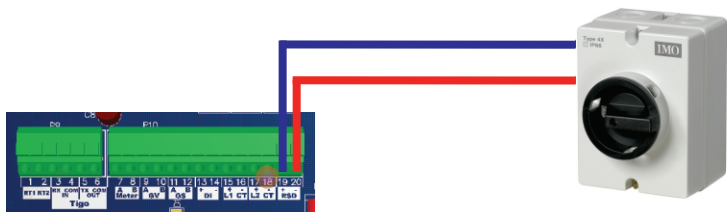


Figure 5.32 External rapid shutdown and emergency power off switch

5.12.8 Inverter Bluetooth Network

The Solis inverter generates a localized Bluetooth network which allows technicians to interface d directly with the inverter using a smart phone or tablet. The accessory kit includes a Bluetooth antenna. Remove the black protective cap from the "BT-ABT" port on the side of the inverter. Attach the Bluetooth antenna to the port by rotating it *counter-clockwise* until it feels tight. Please note, the antenna simply extends the range of the inverter Bluetooth network from 3 feet to about 10 feet, but it is *not* required for the Bluetooth network to function normally. Please be sure to tighten the antenna until it feels snug. The angle of the antenna is not important, it can be bent to point up or down.

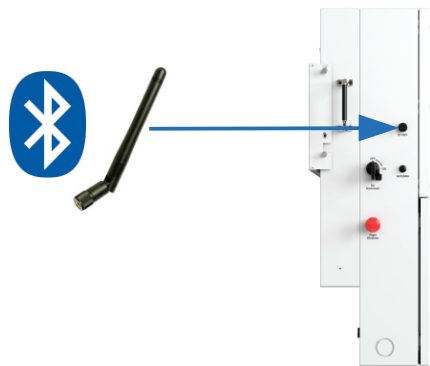


Figure 5.33 Bluetooth Antenna Port

5. Installation

5.12.9 Generator and External ATS Control

Off-Grid Generator Using Dry Contact 2-Wire Start/Stop (GV pins 9 and 10)

For purely off-grid systems, a generator can be used as a grid replacement. The inverter uses dry contact two-wire start to turn the generator on when the battery SOC discharges to a specified limit. Generator power is used to charge the batteries and supply the home loads when the PV power is insufficient. The generator is turned off once the battery SOC reaches another specified limit.

Connect the generator dry contact to pins 9 (GV-A) and 10 (GV-B).

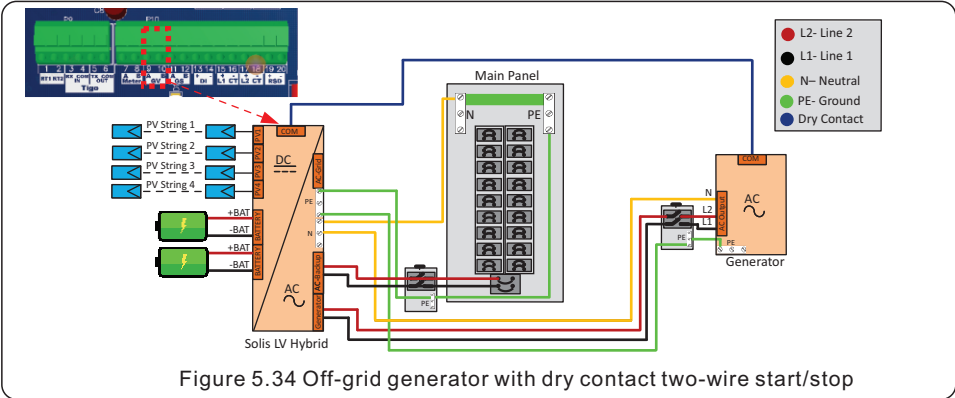


Figure 5.34 Off-grid generator with dry contact two-wire start/stop

On-Grid Generator with External ATS Using 12V Sense (DI pins 13 and 14)

Some on-grid systems use an external ATS to isolate from the grid during a power outage and control the generator start/stop. The inverter has a 12VDC input from the external ATS to determine if the AC power coming into the Grid input is from the grid or from the generator. Connect a 12VDC two-wire supply from the external ATS to pins 13 (DI +) and 14 (DI -).

When the sense voltage is low or absent, the inverter will recognize that the generator is on and not grid. When the 12V sense voltage is high, inverter recognizes that grid is on and not generator. Alternatively, the smart port can be connected to a load or AC-coupled system. The 12V signal can be used to control power to a load or from an AC-coupled PV system instead of a generator.

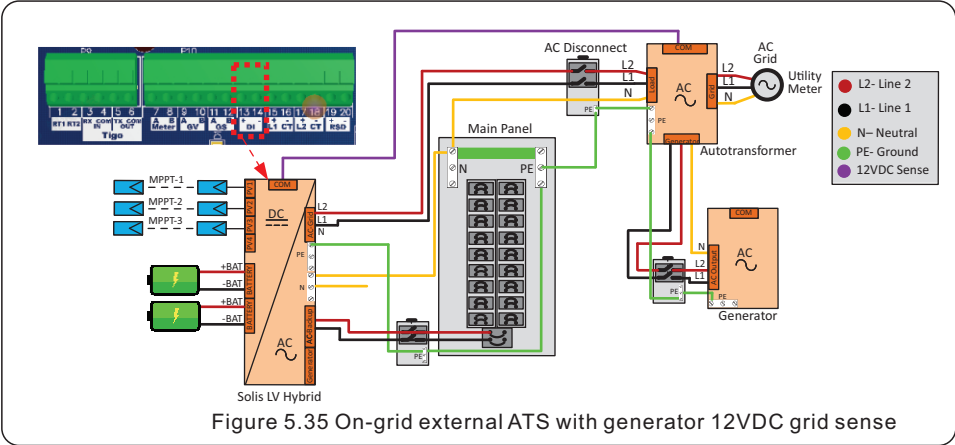


Figure 5.35 On-grid external ATS with generator 12VDC grid sense

6. Commissioning

6.1 Pre-Commissioning & Start-Up Procedure

1. Visually inspect each piece of equipment in the system closely.
 2. Check all conduit and cable connection points to ensure they are tight.
 3. Verify that all system components have adequate space for ventilation.
 4. Follow each conductor from end to end. Confirm that they are all terminated in the proper places.
 5. Ensure that all warning signs and labels are affixed on the system equipment.
 6. Check that the inverter is secured to the wall and is not loose or wobbly.
 7. Prepare a multimeter that can do both AC and DC amps.
 8. Use the multimeter to measure the PV string voltages in free air. With RSD the voltages will be low.
 9. Land the PV strings, turn on the grid-side breaker and the battery. Keep the inverter DC switch turned off. Measure the PV string voltages again. Verify that the polarities and voltages are correct.
- Note:** if the PV voltages are still low with the PV strings landed and the grid-side breaker turned on, check the rapid shutdown switch on the side of the inverter. Give it a clockwise twist to pop it out.
10. Check the AC voltages coming from the grid. Check the battery DC voltage and verify polarity.
 11. **Leave the inverter DC switch turned off for now. Only turn it on once you are ready to put the system into normal operation. Leave the battery on and the AC breaker connected to the grid-side on as well.**
 12. Download the battery app, register an account, and then be sure to update the battery firmware if there is a new version available. This step is very important and skipping it can lead to comms issues.

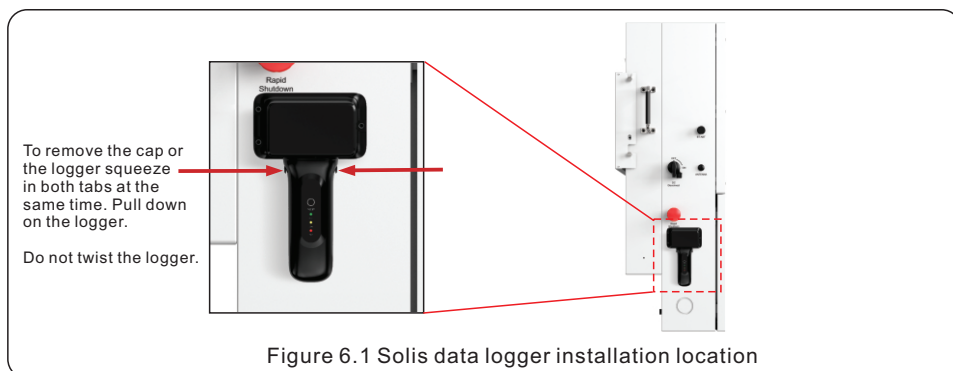
The next steps will be to install a Solis logger, download the SolisCloud application, register a new account on SolisCloud, and then configure the inverter settings using the SolisCloud app.

After that is all done, the logger will need to be connected to the Wi-Fi and configured using SolisCloud.

6.2 Solis Loggers & Third-Party Gateways

6.2.1 Solis Monitoring with Solis Data Loggers

For remote monitoring and control of the inverter using the Solis monitoring portal, a Solis data logger must be installed. The logger gets plugged into the port on the side of the inverter shown in the figure below. First, remove the black plastic protective cap from the port by squeezing in both tabs on either side simultaneously while pulling down on the cap. Insert the logger into the port by pressing up evenly on both sides, **do not twist the logger**. The logger port is USB-A and only supports USB versions of Solis data loggers, not the 4-pin versions. The Solis logger can only report to SolisCloud.



6. Commissioning

6.2.2 Compatible Solis Loggers

This inverter is compatible with only one type of Solis logger: S2-WL-ST, which has both a Wi-Fi and a local area network (LAN) option consisting of an RJ45 port for direct connection to a router.



Data Logger Model	Communication Type
S2-WL-ST (USB)	Wi-Fi (2.4 GHz) Local Area Network (LAN)

S2-WL-ST

Figure 6.2 Compatible Solis Data Loggers

6.2.3 Third-Party Monitoring with RS485 Modbus

If third-party monitoring is to be installed, connect the third-party gateway to the RS485 port of the inverter. Use pin 1 (orange-white stripe) for RS485B and pin 2 (orange) for RS485A. Be sure to not connect a Solis logger at the same time or there will be communication issues due to Modbus address conflict. The Solis hybrid inverter Modbus map can be downloaded from the Solis website or requested from the Solis service and support team. The inverter supports SunSpec Modbus.



Figure 6.3 Modbus RTU port for RS485 direct connection and port pinout

6.3 SolisCloud

SolisCloud is the monitoring platform where inverters can be monitored remotely. You will need to download the SolisCloud app and then register a new account. Please scan the QR code to pull up the app in the App Store or search “SolisCloud” and then look for the icon shown in the middle of the QR code. There are two account types available: Installer and Owner

Installer: for technicians and anyone that is not the asset owner such as the homeowner where the system is being installed. Installer accounts are for fleet management and are able to remotely control registered plants remotely through SolisCloud.

Owner: for homeowners who typically only have a small number of sites and are only looking to monitor their system(s) and not have any control.

Once the account registration has been completed, log into the SolisCloud app. You will use the app to configure the Wi-Fi settings of the Solis logger and the inverter settings while on-site.



6. Commissioning



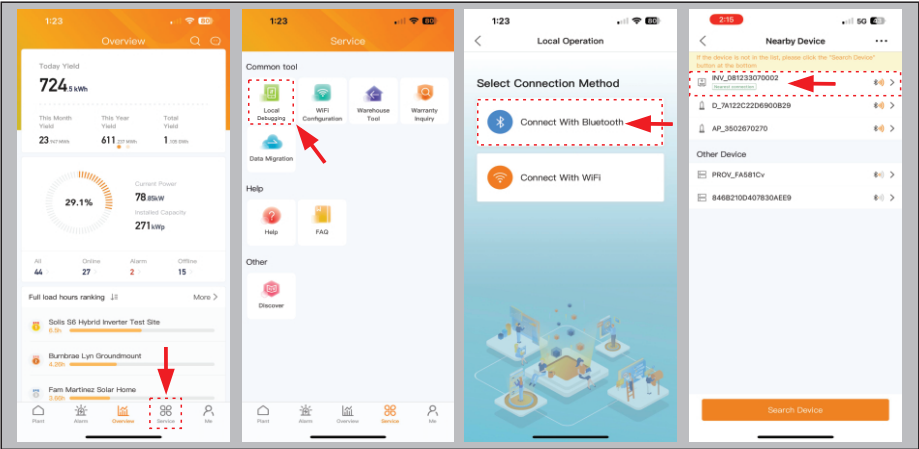
NOTE:

SolisCloud data is stored at Amazon Web Services (AWS) server in Germany. All data is stored indefinitely and is not deleted periodically. Solis is the OEM for the inverters as well as the loggers.

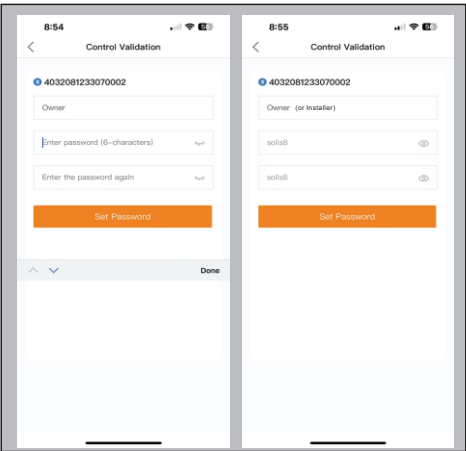
6.4 Configuring the Inverter Settings

Connect to the inverter with the SolisCloud application

Turn your phone Bluetooth on and then in the SolisCloud app tap *Service*, then tap *Local Debugging*, and then tap *Connect with Bluetooth*. The name of the inverter's Bluetooth network with display as “INV_” and then the inverter serial number. Tap on the inverter to connect to it.



The next screen will prompt you to create a password. Once you set the password, write the password on something and then leave it inside of the inverter for anyone that returns to the site in the future.



If the password is forgotten, contact the Solis service and support team and ask them to reset it for you.

You can access the same settings through the LCD screen that you can through this Bluetooth tool.

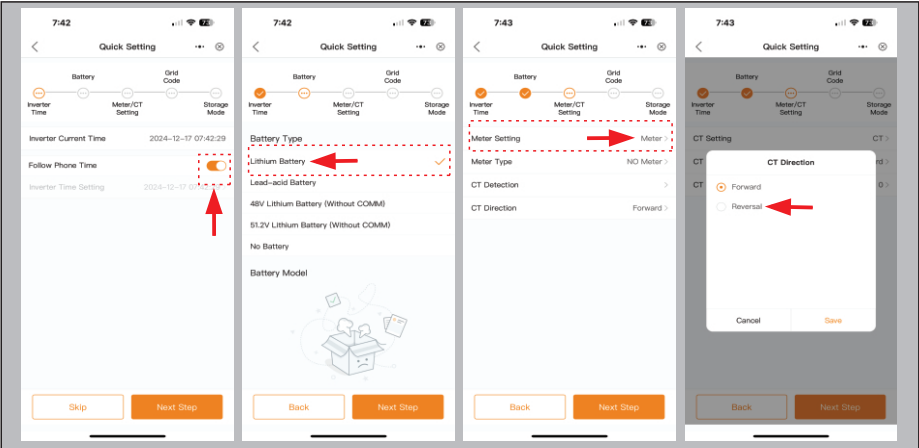
If the data logger plugged into the inverter is connected to the internet then all of the settings configuration and commissioning can be done remotely through SolisCloud.

Make sure that you have registered your account as the organization for the plant when you are making a new plant on SolisCloud. This will give you access to modifying the settings.

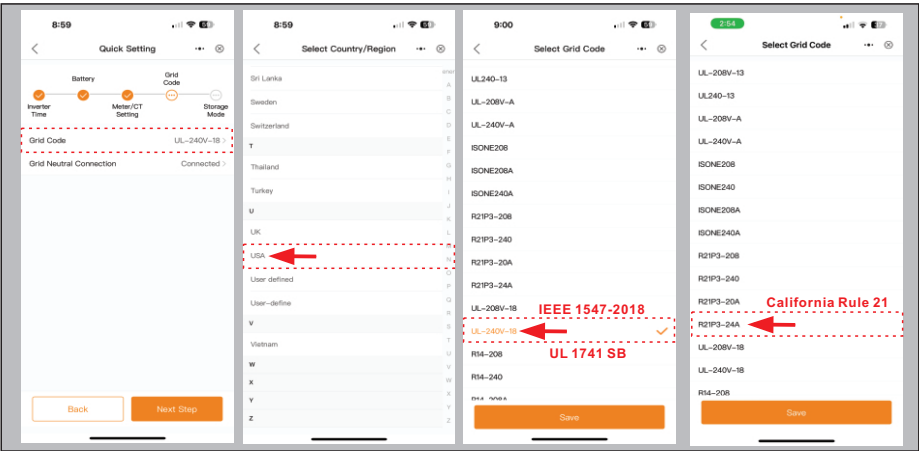
6. Commissioning

Configure the Quick Settings

After setting a password, you will be prompted to configure the Quick Settings. First, tap the toggle switch for *Follow Phone Time* to match the inverter time to your phone date and time. Tap Next Step. Select the battery that is installed from the list. If no battery is installed, tap *No Battery*. Tap Next Step. If only CTs are installed, tap Meter Setting, then select CT. CT orientation can be electronically reversed by tapping CT Direction and then changing Forward to Backward. This is the same as physically flipping the CTs around on the L1 and L2 conductors. Tap Next Step when you are ready.

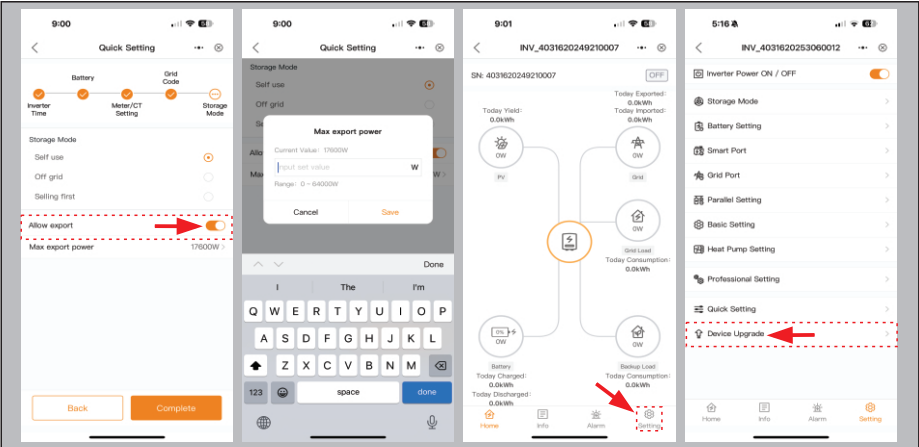


The inverter Grid Code is the grid interconnection profile by which the inverter will operate when it is connected to the grid. For systems installed in the United States, the base (default) profile is **UL-240V-18**. This grid profile is based on the IEEE 1547-2018 standard and is compliant with UL 1741 SB. Tap the standard at the top first to bring up the list of regions. The regions are organized alphabetically, scroll through until you find Canada or USA. Then select the standard you would like. You can then alter the trip point parameters by tapping the parameter, entering the desired value, and then tapping Save when finished. The Grid Neutral Connection setting should be set to Connected.



6. Commissioning

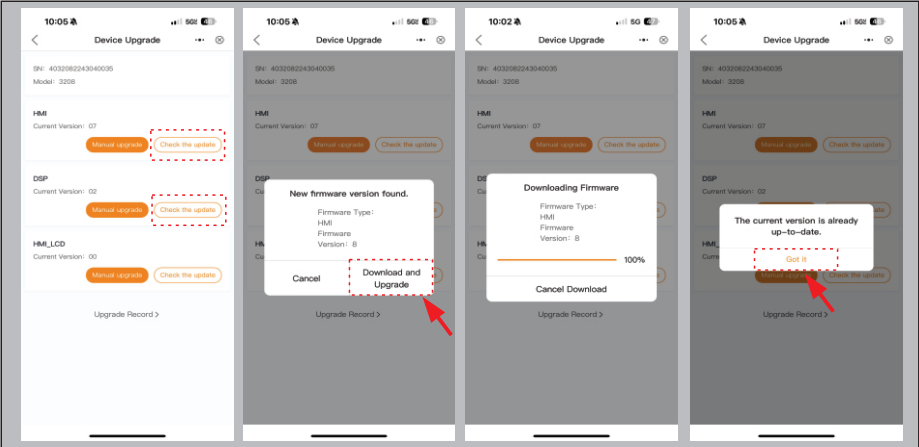
The *Storage Mode* is the energy storage operating mode of the inverter. Please see the logic tables on pages 17 through 19 for explanations on how the modes operate to determine which one you should select for each system. Self use mode prioritizes charging of the battery with excess PV power whereas Selling first mode prioritizes exporting excess PV power. Off grid mode should only be turned on for systems that are never connected to the grid, such as a cabin in the woods.



If you want to allow the inverter to export power to the grid, toggle on the Allow export setting and then set a maximum export value for the system. Tap Save and then tap Complete. You will now be at the main page. Tap Setting in the bottom right corner to go to the firmware updating menu.

Upgrade the inverter firmware

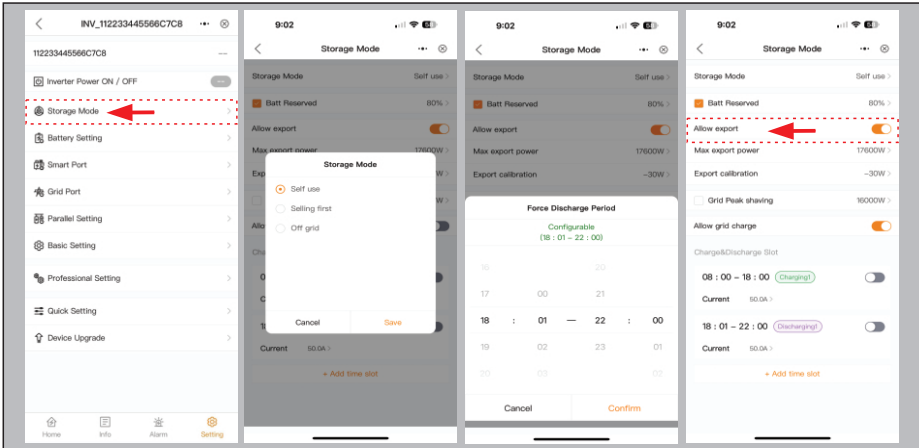
Tap Device Upgrade at the bottom of the list. Then, tap **Check the update** for HMI. A message will either prompt you to download and upgrade the new firmware version or it will inform you that the firmware is on the most current version. Wait for the firmware to finish downloading and then initiate the upgrade. Leave the SolisCloud app open until the update is complete. It could take between 10 and 30 minutes to upgrade. Repeat the process for the DSP firmware. The total upgrade time can take up to 60 minutes. You will only need to upgrade once on-site. Firmware upgrades can be remotely pushed by the Solis service team if an upgrade is required in the future or if the local upgrades are unsuccessful.



6. Commissioning

Storage Mode Settings

Tap Storage Mode at the top of the list. **Self use** mode is the default. Enabling the **Batt Reserved** setting will ensure that the battery has power in case of a grid outage. While on-grid the battery will cycle from 100% to the Batt Reserved SOC% and will only go below that % if the system loses grid power. **Grid Peak shaving** allows for a set amount of grid power to be imported before the battery discharges to cover load demand. **Allow grid charge** allows the grid to be able to charge the battery if there is not enough PV. **Charge and discharge time slots** let you manually control when the battery charges and discharges.



Time of Use Settings (Time Charging/Discharging)

This function allows you to customize when the battery can charge/discharge power and at what power rate, established by a DC current (A) setting. If the slider switch is on, the inverter will only use this schedule to determine when to charge and discharge the battery. Set the **Charge Time Slot** and **Discharge Time Slot**, be sure there is no overlap between them. Tap + **Add Time** and then set the start and end times. During the time outside of the set windows and if the Time-of-Use toggle switch is off, the inverter will exercise the default logic for the mode, see pages 18 to 19. If **Allow Grid Charging** is turned on, the inverter will use grid power to charge the battery only under two circumstances: (1) the battery discharges to the **Force Charge SOC** set in the **Battery Settings** and (2) Time of Use is enabled and there is not enough available PV power during the charge window to meet the current rate that is established.



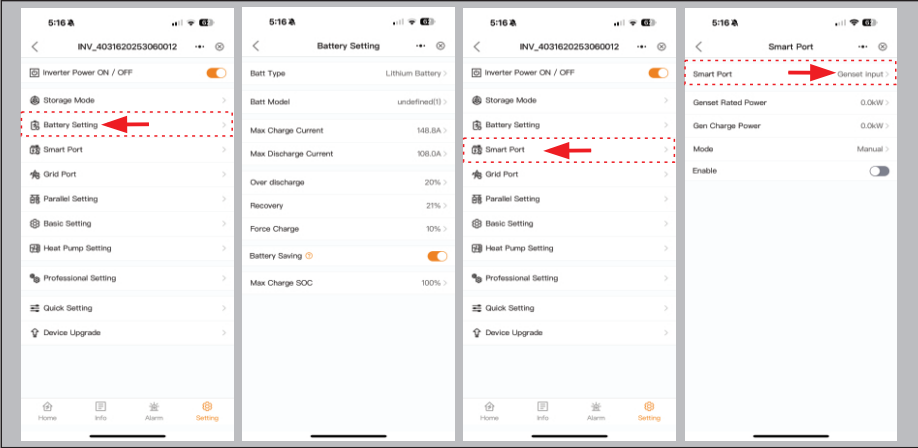
NOTE:

Allow grid charge should be enabled for every system. The inverter will float charge the battery when there is not enough PV power available. This ensures the battery never drains past the point-of-no-return.

Export Power Settings

The export power settings are found within the self-use mode settings. Toggling on the **Allow export** setting permits the inverter to export excess PV power to the grid. Set the **Max. export power** setting to the value you need. Set it to zero for no export. **Export calibration** compensates for measurement deviation. It is recommended to have it be -30W for zero export configuration.

6. Commissioning

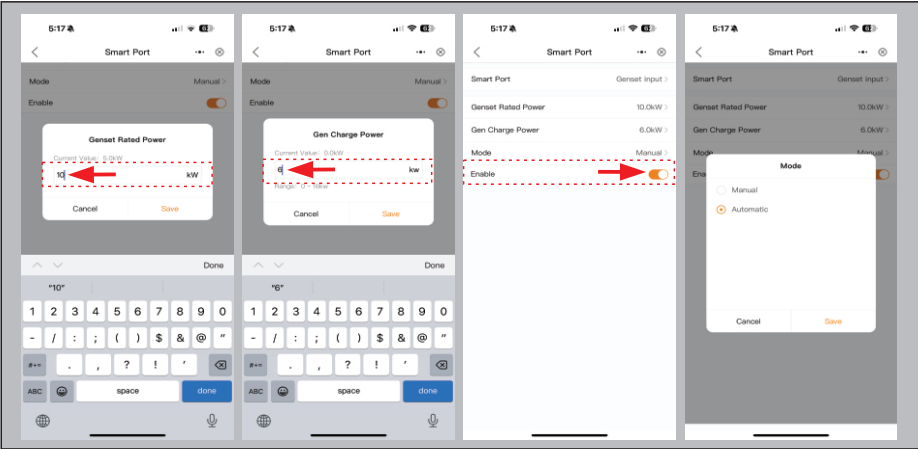


Battery Settings

Go to the main settings menu. Tap Battery Setting. You can modify the battery type and model here. **Max. charge and discharge** can be altered, but the BMS will always have final control over the battery so it may limit the inverter. The battery will discharge until it reaches the **Over Discharge SOC%**, then it will charge to the **Recovery SOC%**. If the battery is only allowed to charge with PV power, then it will trickle discharge from the Over discharge SOC% to the **Force Charge SOC%** before using some grid power to float charge the battery until there is enough PV power to charge. The inverter uses some power to operate. Turning on **Battery Saving** mode means the inverter will import power from the grid to cover its own needs instead of getting that power from the battery. **Max. Charge SOC%** is the upper limit that the battery can charge to. Force charge SOC% < Over discharge SOC% < Recovery SOC% or there could be abnormal operation.

Smart Port Settings (Generator)

Tap Smart Port in the main Settings menu. If a generator is being connected to the inverter, first tap None and change and then change it to Genset Input. Set the Genset Rated Power, which is the size in kW of the generator. Then, set the Gen Charge Power or amount of generator power that the battery will be allowed to charge with. Finally, change the Mode to Automatic if you want the generator to start



6. Commissioning

based on the battery SOC%. The **OFF** SOC% determines when the generator will be shut off by the inverter while in backup/off-grid mode. The **ON** SOC% determines when the generator will be turned on to charge the battery and supply the home loads. When this occurs, the PV power will become zero as to not back feed the generator. These SOC% values can be adjusted as needed.

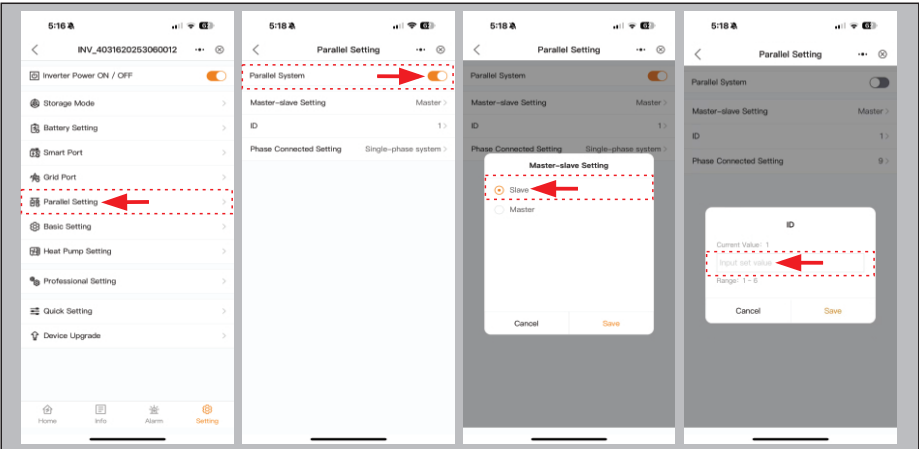
Smart Port Settings (AC-Coupling & Load Control)

If an AC-coupled PV system is being connected to the Smart Port of the inverter, set the Smart Port to **AC Coupled**. The **OFF** and **ON** SOC values dictate when the inverter will turn the AC Coupled system on and off while in backup/off-grid mode. If a large load such as an EV charger, air conditioner, or subpanel with non-essential loads is being connected to the Smart Port of the inverter, set the Smart Port to **Smart load output**. This load can be controlled when the system in backup/off-grid mode. The **ON** and **OFF** SOC values establish when the load will be energized and when it will not. The toggle switch for **On grid always on** should be enabled if the load is to always have power while on-grid. If the load is to be shed anytime there is an outage regardless of available power, turn on **Off grid always off**.



Paralleling Steps

If there are two or more Solis hybrid inverters connected together with communication cables, Tap **Parallel Setting** and then turn on the **Parallel System** toggle switch. The first inverter should be set to



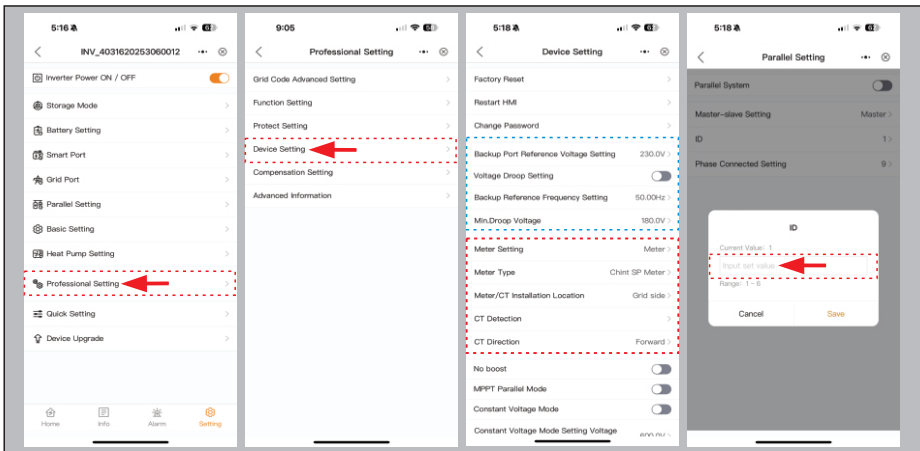
6. Commissioning

Master and all of the other inverters should be set to Slave. The Master should have an ID of 1 and the slaves should be numbered 2-6.

Professional Settings: Device Settings: Backup and Meter Settings

The last few key settings can be found in the Device Setting menu. From the main settings menu, tap Professional Setting, then tap Device Setting. Here the **Backup Port Reference Setting** can be verified at 240VAC. There is a toggle switch for backup **Voltage Droop** along with a **Minimum Droop Voltage** setting. Ensure that the **Backup Reference Frequency Setting** is set to 60Hz.

Meter Setting can be changed from Meter to CT if CTs are directly connected to the inverter. Meter type should be set to No Meter if CTs are directly connected. Most installations will need to set Meter/CT installation location to Grid side. If the CTs were physically installed backwards, the CT Direction setting allows you to electronically reverse the CTs so a technician does not need to physically reverse them.



Miscellaneous Settings

Within Professional Setting > Device Setting you will find an option to Factory Reset the inverter. Restart HMI will reboot the LCD screen. Change Password is to change the login password for the inverter Bluetooth tool.

Inverter settings configuration are now complete

Turn the inverter ON

Now that the settings are done, turn on the inverter DC switch. The system will begin to generate PV power after about five minutes provided there are no persistent alarms. The main screen of the Bluetooth tool and the inverter LCD screen both provide an overview of the system behavior. It can quickly be determined if the battery is properly communicating or not and what the SOC is. If you are looking at the plant on SolisCloud remote view, the data is about 5 minutes behind since the logger sends data once every five minutes. If you are using SolisCloud Bluetooth tool local view, the data is in real-time with marginal delay.

If you notice the inverter is taking longer than five minutes to start up. Check the alarm tab, instructions are on the next page.

6. Commissioning

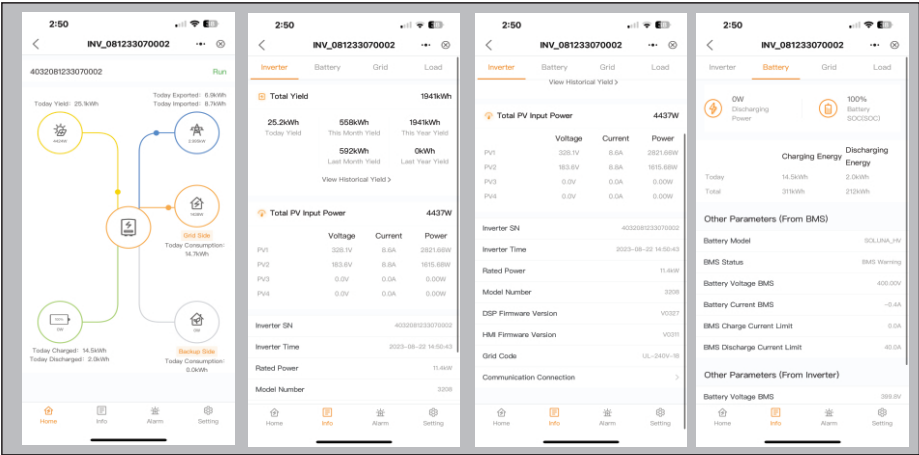
At the bottom of the main page are four submenus: Home, Info, Settings, and More. The Info page breaks down into four categories: Inverter, Battery, Grid, and Load.

Inverter: inverter power production history, PV voltages and currents, inverter info (serial number, model number, and firmware version), grid code, and alarm code history

Battery: battery model and status, battery voltage, current, SOC, SOH, and historical data

Grid: Active power, voltage, current, historical power produced, imported and exported, grid AC voltage and frequency

Load: power, voltage, current of the backup (load) port

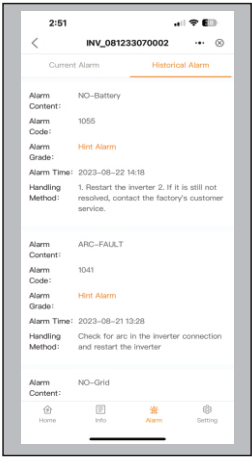


Alarm History

It is recommended to check the alarm history as the final step of the commissioning process, excluding creating a site on SolisCloud for the system. Tap **Alarm** and then tap **Historical Alarm** to view the full alarm history. Each alarm will have a date and time stamp as well as a suggestion on how to handle the alarm. The next section goes over troubleshooting and you can always contact Solis USA technical support with any questions or concerns.

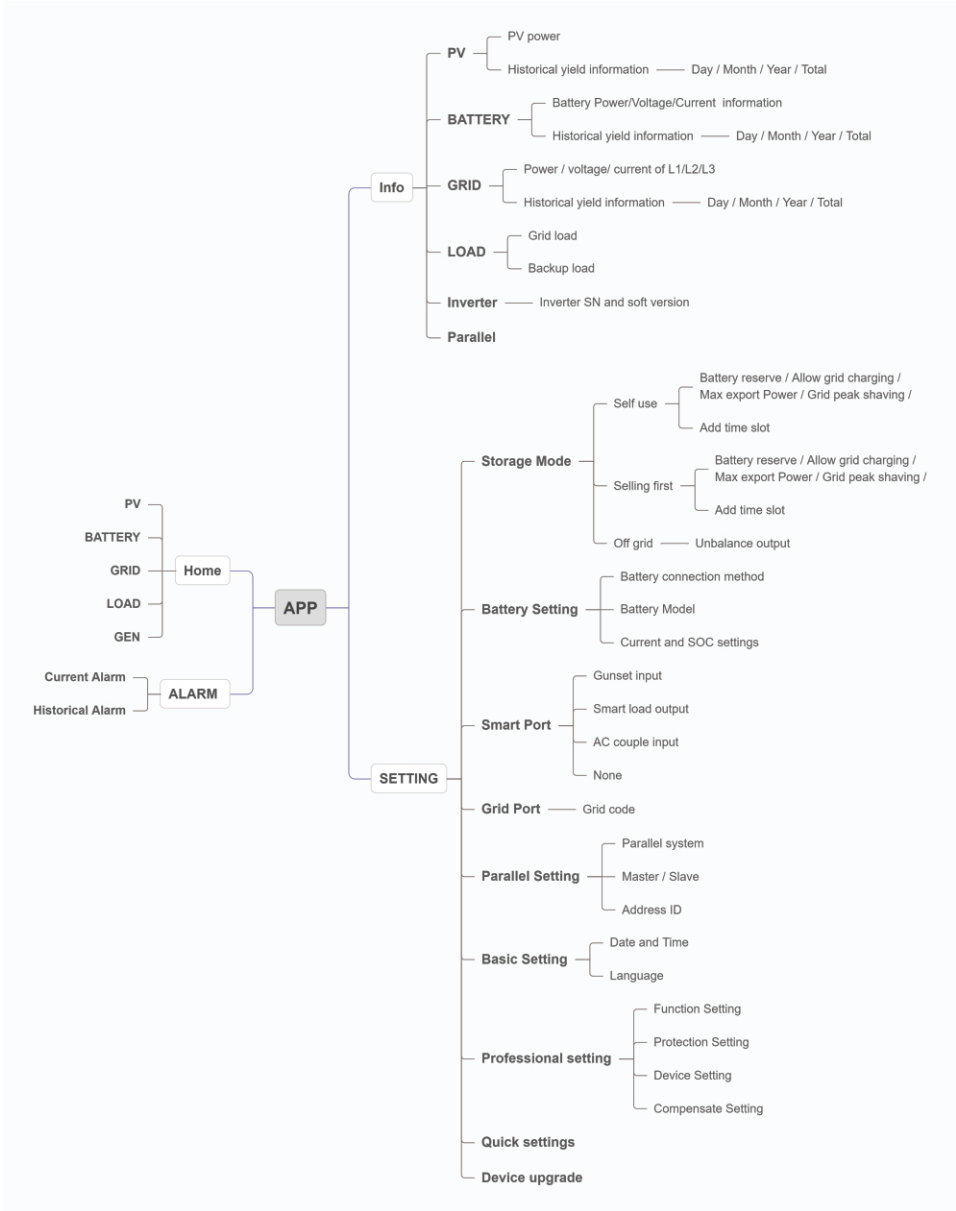
Finishing the Commissioning Process

The inverter commissioning process has now been completed. It is recommended to monitor the system closely over the next week to ensure that everything is working as it should. Please refer to the Solis data logger manual for assistance with registering a new plant on SolisCloud.



6. Commissioning

6.5 SolisCloud Bluetooth Tool Settings Tree



7. Troubleshooting

Solis US Technical Support Contact Information

Phone Number: **+1(866)438-8408**

Email: usservice@solisinverters.com

If you are having an issue with your system, please contact Solis Technical Support for assistance. If the inverter is having an issue, it will show it in one of the following ways: (1) the Inverter (circle) LED indicator light will flash orange. (2) the inverter status will be an alarm code (3) an alarm code will display on SolisCloud or (4) the inverter will simply be off. The next several pages explain how to troubleshoot each alarm code. If it is suspected that the issue is coming from the DC side of the system, it is recommended to turn the inverter off so that the PV strings can be more safely tested.

7.1 Inverter Shutdown Procedure

- Step 1. Turn off the AC disconnect switch to disable AC power to the inverter
- Step 2. Push in the RSD Initiation Switch and then turn off the DC switch of the inverter
- Step 3. Turn off the battery breaker on the battery BMS
- Step 4. Use a multimeter to verify that the battery and AC voltages are 0V. If RSD is being used, the PV string voltages should be at safety levels

7.2 Inverter Maintenance

Solis S6 hybrid inverter does not require any regular maintenance. However, keeping the heatsink clean will ensure the inverter is able to dissipate heat, increasing the life span of the inverter. Any grease smudges on the inverter chassis can be cleaned off with soap and water.



CAUTION:

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

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



Note:

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

The inverter has been designed in accordance with international standards for safety and electromagnetic compatibility requirements. Before being shipped from the manufacturing center, the inverter is subjected to multiple tests to ensure operation reliability.

If you are not able to resolve the alarm code using the troubleshooting steps, or if the alarm code you are seeing is not listed, please contact Solis US Technical support. Use the Bluetooth tool, go to the Info page and then to the Inverter tab. Scroll down and tap Alarm History and then screen shot or write down the alarms as well as the dates and times the alarms were recorded. Please also take note of the inverter model number, serial number, and internal transmitter type.

7. Troubleshooting

7.3 Inverter Alarm Codes

Message Name	Information Description	Troubleshooting Suggestion
BatName-FAIL	Wrong battery brand selection	1. Confirm whether the battery model selection is consistent with the actual one.
CAN Fail	CAN Fail	1. Can failure is a failure of communication between inverter and battery. Check cable conditions. Check to ensure you have it plugged in on the CAN port of the battery and inverter. Check that you are using the right cable. Some batteries require a special battery from the battery manufacturer.
OV-Vbatt	Battery undervoltage detected	1. Verify battery voltage is within standards. Measure battery voltage at inverter connection point. Contact your battery manufacturer for further service.
UN-Vbatt	Battery overvoltage detected	1. Restart the system and check if the fault persists. If it is still not eliminated, please contact the manufacturer's customer service.
Fan Alarm	Fan alarm	1. Check if the internal fan is working correctly or jammed.
OV-DC01 (1020 DATA:0001)	DC 1 input overvoltage	1. Check if the PV voltage is abnormal 2. Restart the system, confirm that the fault continues
OV-DC02 (1020 DATA:0002)	DC 2 input overvoltage	
OV-BUS (1021 DATA:0000)	DC bus overvoltage	1. Restart the system, confirm that the fault continues.
UN-BUS01 (1023 DATA:0001)	DC bus undervoltage	
UNB-BUS (1022 DATA:0000)	DC bus unbalanced voltage	
UN-BUS02 (1023 DATA:0002)	Abnormal detection of DC bus voltage	
DC-INTF. (1027 DATA:0000)	DC hardware overcurrent (1, 2, 3, 4)	1. Check if the DC wires are connected correctly without loose connection.
OV-G-I (1018 DATA:0000)	A phase RMS value overcurrent	1. Confirm that the grid is abnormal. 2. Confirm that the AC cable connection is not abnormal. 3. Restart the system, confirm that the fault continues.
OV-DCA-I (1025 DATA:0000)	DC 1 average overcurrent	1. Restart the system, confirm that the fault continues.
OV-DCB-I (1026 DATA:0000)	DC 2 average overcurrent	
GRID-INTF. (1030 DATA:0000)	AC hardware overcurrent (abc phase)	

7. Troubleshooting

Message Name	Information Description	Troubleshooting Suggestion
Off	Control device to shutdown	1. Turn on the device in the ON/OFF Setting.
LmtByEPM	The device's output is under controlled	1. Confirm whether the inverter is connected to an external EPM/meter to prevent reverse current. 2. Confirm whether the inverter is controlled by an external third-party device. 3. Confirm whether the power setting of the inverter power control is limited. 4. Verify settings in section 6.6.7 and check your meter readings.
LmtByDRM	DRM Function ON	1. No need to deal with it.
LmtByTemp	Over temperature power limited	1. No need to deal with it, the device is in normal operation.
LmtByFreq	Frequency power limited	
LmtByVg	The device is in the Volt-Watt mode	1. Due to the requirements of local safety regulations, when the grid voltage is high, the Volt-watt working mode is triggered, which generally does not need to be dealt with. 2. Inverter factory test errors causing this mode to open, if you need to close, you can close this mode in LCD, set the process: Main menu → Advanced Settings → Password 0010 → STD mode settings → Working Mode → Working mode: NULL → Save and exit.
LmtByVar	The device is in the Volt-Var mode of operation	1. Due to the requirements of local safety regulations, when the grid voltage is high, the Volt-watt working mode is triggered, which generally does not need to be dealt with. 2. Inverter factory test errors causing this mode to open, if you need to close, you can close this mode in LCD, set the process: Main menu → Advanced Settings → Password 0010 → STD mode settings → Working Mode → Working mode: NULL → Save and exit.
LmtByUnFr	Under frequency limit	1. No need to deal with it.
Standby	Bypass run	
StandbySynoch	Off grid status to On grid status	
GridToLoad	Grid to load	

7. Troubleshooting

Message Name	Information Description	Troubleshooting Suggestion
DCInj-FAULT (1037 DATA:0000)	The current DC component exceeds the limit	1. Confirm that the grid is abnormal. 2. Confirm that the AC cable connection is not abnormal. 3. Restart the system, confirm that the fault continues.
IGBT-OV-I (1048 DATA:0000)	IGBT overcurrent	1. Restart the system, confirm that the fault continues.
OV-TEM (1032 DATA:0000)	Module over temperature	1. Check whether the surrounding environment of the inverter has poor heat dissipation. 2. Confirm whether the product installation meets the requirements.
RelayChk-FAIL (1035 DATA:0000)	Relay failure	1. Restart the system, confirm that the fault continues.
UN-TEM (103A DATA:0000)	Low temperature protection	1. Check the working environment temperature of the inverter. 2. Restart the system to confirm if the fault continues.
PV ISO-PRO01 (1033 DATA:0001)	PV negative ground fault	1. Check whether the PV strings have insulation problems. 2. Check whether the PV cable is damaged.
PV ISO-PRO02 (1033 DATA:0002)	PV positive ground fault	
12Power-FAULT (1038 DATA:0000)	12V undervoltage failure	1. Check current leakage to ground. Verify your grounding. Verify all wires are in good condition and not leaking current to ground.
ILeak-PRO01 (1034 DATA:0001)	Leakage current failure 01 (30mA)	
ILeak-PRO02 (1034 DATA:0002)	Leakage current failure 02 (60mA)	
ILeak-PRO03 (1034 DATA:0003)	Leakage current failure 03 (150mA)	
ILeak-PRO04 (1034 DATA:0004)	Leakage current failure 04	
ILeak_Check (1039 DATA:0000)	Leakage current sensor failure	
GRID-INTF02 (1046 DATA:0000)	Power grid disturbance 02	1. Confirm whether the grid is seriously distorted. 2. Check whether the AC cable is connected reliably.
OV-Vbatt-H/ OV-BUS-H (1051 DATA:0000)	Battery overvoltage hardware failure / VBUS	1. Check if the battery circuit breaker is tripping. 2. Check if the battery is damaged.

7. Troubleshooting

Message Name	Information Description	Troubleshooting Suggestion
Surge Alarm	On-site grid surge	1. Grid side fault, restart the device. If it is still not eliminated, please contact the manufacturer's customer service.
OV-G-V01	Grid voltage exceeds the upper voltage range	1. Confirm whether the power grid is abnormal. 2. Confirm that the AC cable is properly connected. 3. Restart the system and check if the fault persists.
UN-G-V01	Grid voltage exceeds the lower voltage range	
OV-G-F01	Grid frequency exceeds the upper frequency range	
UN-G-F01	Grid frequency exceeds the lower frequency range	
G-PHASE	Unbalanced grid voltage	
G-F-GLU	Grid voltage frequency fluctuation	
NO-Grid	No grid	
OV-G-V02	Grid transient overvoltage	
OV-G-V03	Grid transient overvoltage	1. Restart the system, confirm if that the fault continues.
IGFOL-F	Grid current tracking failure	1. Confirm whether the power grid is abnormal. 2. Confirm that the AC cable is properly connected. 3. Restart the system and check if the fault persists.
OV-G-V05	Grid voltage RMS instantaneous overvoltage fault	
OV-G-V04	Grid voltage exceeds the upper voltage range	
UN-G-V02	Grid voltage exceeds the lower voltage range	
OV-G-F02	Grid frequency exceeds the upper frequency range	
UN-G-F02	Grid frequency exceeds the lower frequency range	
NO-Battery	Battery is not connected	1. Check on information page 1 – Verify the battery voltage is within standards. 2. Measure battery voltage at plug.
OV-Vbackup	Inverting overvoltage	1. Check whether the backup port wiring is normal 2. Restart the system, confirm that the fault continues.
Over-Load	Load overload fault	1. Backup load power is too large, or some inductive load startup power is too large, need to remove some backup load, or remove the inductive load on the backup.

7. Troubleshooting

Message Name	Information Description	Troubleshooting Suggestion
OV-ILLC (1052 DATA:0000)	LLC hardware overcurrent	1. Check whether the backup load is overloaded. 2. Restart the system, confirm that the fault continues.
INI-FAULT (1031 DATA:0000)	AD zero drift overlink	1. Restart the system, confirm that the fault continues.
DSP-B-FAULT (1036 DATA:0000)	The master-slave DSP communication is abnormal	
AFCI-Check (1040 DATA:0000)	AFCI self-test failure	
ARC- FAULT (1041 DATA:0000)	AFCI failure	1. Verify connections are tight within your PV system. Arc fault settings can be changed in advanced settings if further adjustment is necessary.

NOTE:



If the inverter displays any alarm messages listed in Table 7.1, please turn off the inverter and wait for 5 minutes before restarting it . If the alarm persists, please contact Solis after-sales service +1(866)438-8408 or email usservice@solisinverters.com

If you have any technical problems with the hybrid system, please contact Solis after-sales service. We recommend gathering the following information before making contact in order to get a quicker resolution.

Item	Supplemental Information
Inverter serial number (SN)	Serial number can be found on the spec label
Inverter Firmware Version	A six character number that can be found in the information section of the inverter interface page - requires Bluetooth connection
Alarm history	Codes found in the Inverter section of the interface
DC voltages	Use a multimeter to measure the voltages
Detailed description of the problem	Frequency of the occurrence and any other relevant details about the issue
Battery serial number and Firmware version	Consult the battery product manual to determine how to collect this information
Is the system reporting to SolisCloud?	Yes/No - if yes, what is the site ID?
Take pictures showing all the cable connections in the system (Videos preferred)	If this is possible, it will help us to troubleshoot

7. Troubleshooting

7.4 Inverter Firmware

Solis inverters have a few different types of firmware that should all be on the latest version. If one site has several inverters installed, they should all be on the same versions to prevent errors.

Solis Inverter Firmware Types:

DSP: Digital Signal Processor

HMI: Human-Machine-Interface

AFCI: Arc-Fault-Circuit Interruption

To check which version the inverter is currently on, first connect to the inverter with Bluetooth. Go to the Information tab and be sure that you are on the Inverter tab. Scroll to the bottom and look for the DSP and HMI versions. The AFCI and SolisHub current versions can only be upgraded remotely with the assistance of Solis Technical Support. However, new AFCI and SolisHub firmware versions are released far less frequently than DSP and HMI. It is likely that the inverter does not need to have AFCI and SolisHub firmware upgraded, but best to check with Solis Support.

There are three methods of updating the inverter firmware: (1) remotely (2) locally with Bluetooth, and (3) locally with a tool.

7.4.1 Remote Firmware Updating

The inverter firmware can be updated remotely but only if the inverter has a Solis data logger connected directly to it. The logger must also be connected to the internet. Once that has been done, please call or email Solis after-sales-service to request the firmware be updated remotely.

Please note: Only Solis Tech Support can update inverters remotely.

7.4.2 Local Firmware Updating Through Bluetooth

The recommended method for updating the inverter firmware is locally using the SolisCloud Bluetooth tool. The steps for this process can be found on pages 61-62 (Step 3 of Commissioning). It is highly advisable to upgrade the inverter firmware during the commissioning process before configuring the settings.

7.4.3 Local Firmware Updating with the Solis Upgrade Tool

If the upgrades are not going through using the first two methods, the inverter can be upgraded using a proprietary Solis Upgrade Tool. Please contact Solis Technical Support to request an Update Tool be mailed to you. You will also need to request the firmware files themselves. Solis Technical Support can guide you through the process.



IMPORTANT:

If there are multiple inverters in parallel, please connect one data logger to each inverter to ensure that firmware can be updated remotely. Slave firmware cannot be updated through a logger connected to the master.
All inverters in the same system must be on the same firmware version.

8 Inverter Datasheet

S6-EH2P(9.6-16)K03-SV-YD-L-US

Solis Split Phase Low Voltage Energy Storage Inverters

Smart Energy Management

- Flexible charge and discharge settings allows for greater utilization of the energy storage system
- Eligible for enrollment in most VPP programs which yields additional benefits for the system owner

Flexible & Scalable

- Compatible with a wide variety of 48V lithium-ion and lead-acid batteries
- Expandable up to six inverters in parallel for increased power and storage capacity

High Performance

- 160% PV input capacity to maximize solar energy utilization
- Switching time < 4ms

Simple & Fast Configuration

- Commissioning can be done with the intuitive 7-inch LCD screen
- Bluetooth connection allows the inverter to be commissioned locally through the SolisCloud app

Models:

S6-EH2P9.6K03-SV-YD-L-US
S6-EH2P11.4K03-SV-YD-L-US
S6-EH2P12K03-SV-YD-L-US
S6-EH2P14K03-SV-YD-L-US
S6-EH2P16K03-SV-YD-L-US



8 Inverter Datasheet

	9.6K		11.4K		12K		14K		16K	
Input DC (PV side)										
Max. input voltage					550 V					
Rated voltage					380 V					
Start-up voltage					100 V					
MPPT voltage range					100-450 V					
Max. input current per MPPT					40 A					
Max. short circuit current per MPPT					50 A					
Number of MPPTs / Number of strings per MPPT					3 / 2					
Battery										
Battery type					Li-ion / Lead-acid					
Battery voltage range					40 - 60 V					
Max. charge / discharge current	200 A		237.5 A		250 A				290 A	
Communication					CAN / RS485					
Number of batteries per inverter					See Battery Compatibility Sheet					
Output AC (Grid side)										
Rated output power	9.6 kW		11.4 kW		12 kW		14 kW		16 kW	
Max. apparent output power	9.6 kVA		11.4 kVA		12 kVA		14 kVA		16 kVA	
Rated output voltage					240 V					
Rated grid frequency					60 Hz					
Rated grid output current	40 A		47.5 A		50 A		58.3 A		66.7 A	
Max. output current	40 A		47.5 A		50 A		58.3 A		66.7 A	
THDi					< 3%					
Input AC (Grid side)										
Input voltage range					211 - 264 V					
Max. input current					180 A					
Frequency range					58.8 - 61.2 Hz					
Output AC (Back-up)										
Rated output power	9.6 kW		11.4 kW		12 kW		14 kW		16 kW	
Max. apparent output power					3 times of rated power, 1 s					
Back-up switch time					< 4 ms					
Phase power					L1/L2/N(PE), 120 V / 240 V (split phase)					
Rated output voltage (L1-L2)					240 V					
AC output voltage range					211 - 264 V					
Rated frequency					60 Hz					
Frequency range					55 - 65 Hz					
Rated output current	40 A		47.5 A		50 A		58.3 A		66.7 A	
Max. output over current protection, 10 sec	87 A		104 A		109 A		127 A		145 A	
Max. continuous AC passthrough					200 A					
Max. allowable phase imbalance					50%					
Backup support configurations					Dedicated loads and whole-home					
Power factor					> 0.99 (0.8 leading - 0.8 lagging)					
THDv (@linear load)					< 3%					
Input Generator										
Max. input power					24 kW					
Max. input current					100 A					
Rated input frequency					60 Hz					
Efficiency										
Max. efficiency					96.02%					
CEC efficiency					95.45%					
Battery charged by PV max. efficiency					96.42%					
Battery charged / discharged to AC max. efficiency					94.49%/94.56%					
Protection										
Ground fault monitoring					Yes					
Integrated AFCI					Yes					
DC reverse-polarity protection					Yes (PV only)					
Rapid shutdown NEC 2017					Integrated SunSpec-certified Transmitter					
Compatible RSD receivers					See MLRSD compatibility Sheet					
Protection class / Over voltage category					I / II					
General Data										
Dimensions (W × H × D)					19.7 × 37.6 × 11.7 in (500 × 955 × 297 mm)					
Weight					141.76 lbs (64.3 kg)					
Topology					Transformerless					
Operating ambient temperature range					-13°F to 140°F (-25°C to 60°C)					
Ingress protection					TYPE 4X					
Self-consumption (night)					< 35 W					
Noise emission (typical)					<65 dB(A)					
Cooling concept					Intelligent fan-cooling					
Mounting type					Wall Bracket					
Max. operation altitude					13120 ft (4000 m)					
Grid Certifications					UL 1741, UL 1741 SA, UL 1741 SB, UL 1741 PCS, IEEE 1547-2018, IEEE1547.1-2020, CSA C22.2107.1-1, CA Rule 21 ⁽¹⁾ , HECO Rule 14H ⁽¹⁾ , Luma ⁽¹⁾					
Safety Certifications					UL 1741 PVRSS, UL 1699B, UL 1998 (US), UL 3741					
Emissions					FCC Part 15 Class B					
Features										
DC connection					Terminal Block (PV port) / Terminal Block (BAT port)					
AC connection					Terminal Block					
Interface					7.0" LCD display & Bluetooth + APP					
Revenue grade meter					Optional					
Monitoring platform					SolisCloud (modbus map and API sharing available upon request)					
Communication					RS485, Optional: Cellular, Wi-Fi, LAN					

(1) Utility approvals pending.

9. Appendix

9.1 Default Setting for IEEE1547-2018 (UL-240V-18)

Parameter	Adjustment Range (p.u.)	Default (p.u.)	Description
OV-G-V01	$1.10 < V \leq 1.21$	1.10 p.u.	Set grid over-voltage protection 01 value
OV-G-V01-T	0.1-13 S	13 S	Grid over-voltage protection 01 trip time
OV-G-V02	$1.20 < V \leq 1.30$	1.20 p.u.	Set grid over-voltage protection 02 value
OV-G-V02-T	0.1-5 S	0.16 S	Grid over-voltage protection 02 trip time
UN-G-V01	$0.5 \leq V < 0.88$	0.88 p.u.	Set grid under-voltage protection 01 value
UN-G-V01-T	2.0-50 Sec.	21 S	Grid under-voltage protection 01 trip time
UN-G-V02	$0.45 \leq V < 0.70$	0.5 p.u.	Set grid under-voltage protection 02 value
UN-G-V02-T	0.16-21 S	2 S	Grid under-voltage protection 02 trip time
UN-G-V03	$0.050 < V < 0.5$	0.5 p.u.	Set grid under-voltage protection 03 value
UN-G-V03-T	0.16-21 S	2 S	Grid under-voltage protection 03 trip time
OV-G-F01	$60.5 < F < 66 \text{ Hz}$	61.2 Hz	Set grid over-frequency protection 01 value
OV-G-F01-T	180-1000 S	300 S	Set grid over-frequency protection 01 trip time
OV-G-F02	$61.2 < F < 66 \text{ Hz}$	62 Hz	Set grid over-frequency protection 02 value
OV-G-F02-T	0.16-1000 S	0.16 S	Set grid over-frequency protection 02 trip time
UN-G-F01	$50 < F < 59 \text{ Hz}$	58.5 Hz	Set grid under-frequency protection 01 value
UN-G-F01-T	180-1000 S	300 S	Set grid under-frequency protection 01 trip time
UN-G-F02	$50 < F < 58 \text{ Hz}$	56.5 Hz	Set grid under-frequency protection 02 value
UN-G-F02-T	0.16-1000 S	0.16 S	Set grid under-frequency protection 02 trip time
Reconnection Voltage	$0.88 \leq V \leq 0.95$ $1.05 \leq V \leq 1.06$	0.917 p.u. 1.05 p.u.	Set grid recovery voltage range after grid fault
Reconnection Frequency	$59 \leq F \leq 59.9$ $60.1 \leq F \leq 61$	59.5 Hz 60.1 Hz	Set grid recovery frequency range after grid fault
Reconnection Time after Fault	0-600 S	300 S	Set reconnection time after a fault is cleared
Ramp-up Slew Rate	0.10-100%	100% W/S	Set Ramp-up power slew rate during start-up
Reconnect Slew Rate	0.10-100%	0.33% W/S	Set Ramp-up power slew rate during reconnect

9. Appendix

Parameter	Adjustment Range (p.u.)	Default (p.u.)	Description
Volt Watt P3Tau	0.5-60 S	10 S	Set the time to ramp up to 90% of the new active power target in response to the change in voltage
Volt Var Q3Tau	1-90 S	5 S	Set the time to ramp up to 90% of the new reactive power target in response to the change in voltage
Dead Band-OF	60.017-61 Hz	60.036Hz	Set OV frequency start dead band for power derate
Droop-OF	2-5 %	5 %	Set OV frequency derate droop slope
Response Time	0.2-10 S	5 S	Set frequency derate response time
Dead Band-UF	59-59.983 Hz	59.964 Hz	Set UN frequency start dead band for power derate
Droop-UF	2-5 %	5 %	Set UN frequency derate droop slope
Droop Pmin	0-100 %	0 %	Set frequency droop P minimum
Volt-Watt	Enabled/ Disabled	Enabled	Set Volt - Watt function
V1	Hybrid: $0.40 \leq V \leq 1.00$ Grid-tied: $0.90 \leq V \leq 1.30$	Hybrid: 0.5 p.u. Grid-tied: p.u.	Set grid voltage V1 limit for Volt-Watt control
P1	0-100 % Pn	100% Pn	Set power P1 for Volt-Watt control
V2	Hybrid: $0.60 \leq V \leq 1.05$ Grid-tied: $1.00 \leq V \leq 1.35$	Hybrid: 0.7 p.u. Grid-tied: p.u.	Set grid voltage V2 limit for Volt-Watt control
P2	0-100 % Pn	100% Pn	Set power P2 for Volt-Watt control
V3	$1.05 \leq V \leq 1.09$	1.06 p.u.	Set grid voltage V3 limit for Volt-Watt control
P3	0-100 % Pn	100% Pn	Set power P3 for Volt-Watt control
V4	$1.06 \leq V \leq 1.10$	1.10 p.u.	Set grid voltage V4 limit for Volt-Watt control
P4	0-100 % Pn	20% Pn	Set power P4 for Volt-Watt control
Volt-Var	Enabled/ Disabled	Enable	Set Volt-Var function
V1	$0.77 \leq V \leq 1.03$	0.92 p.u.	Set grid voltage V1 limit for Volt-Var control
Q1	0-60% Sn	+44% Sn	Set reactive power Q1 for Volt-Var control
V2	$0.92 \leq V \leq 1.05$	0.98 p.u.	Set grid voltage V2 limit for Volt-Var control
Q2	-60-60% Sn	0% Sn	Set reactive power Q2 for Volt-Var control
V3	$0.95 \leq V \leq 1.08$	1.02 p.u.	Set grid voltage V3 limit for Volt-Var control
Q3	-60-60% Sn	0% Sn	Set reactive power Q3 for Volt-Var control
V4	$0.97 \leq V \leq 1.23$	1.08 p.u.	Set grid voltage V4 limit for Volt-Var control
Q4	-60-0% Sn	-44% Sn	Set reactive power Q4 for Volt-Var control
Fixed PF	-0.8 -+0.8	1	Set Fixed Power Factor limit
Reactive Power	-60 -60 %	0%	Set Reactive Power level

9. Appendix

9.2 Default Setting for California Rule 21 (R21P3-24A)

Parameter	Adjustment Range (pu)	Default (pu)	Description
OV-G-V01	$1.10 \leq V \leq 1.21$	$1.10V_n$	Set grid over-voltage protection 01 value
OV-G-V01-T	$0.1 \leq t \leq 13 \text{ S}$	13 S	Grid over-voltage protection 01 trip time
OV-G-V02	$1.20 \leq V \leq 1.30$	$1.20V_n$	Set grid over-voltage protection 02 value
OV-G-V02-T	$0.1 \leq t \leq 5 \text{ S}$	0.16 S	Grid over-voltage protection 02 trip time
UN-G-V01	$0.05 \leq V \leq 0.88$	$0.88V_n$	Set grid under-voltage protection 01 value
UN-G-V01-T	$2.0 \leq t \leq 50 \text{ S}$	21 S	Grid under-voltage protection 01 trip time
UN-G-V02	$0.05 \leq V \leq 0.70$	$0.5V_n$	Set grid under-voltage protection 02 value
UN-G-V02-T	$0.16 \leq t \leq 21 \text{ S}$	2 S	Grid under-voltage protection 02 trip time
UN-G-V03	$0.05 \leq V \leq 0.50$	$0.5V_n$	Set grid under-voltage protection 03 value
UN-G-V03-T	$0.16 \leq t \leq 21 \text{ S}$	2 S	Grid under-voltage protection 03 trip time
OV-G-F01	$60.5 \leq f \leq 66 \text{ Hz}$	61.2 Hz	Set grid over-frequency protection 01 value
OV-G-F01-T	$180 \leq t \leq 1000 \text{ S}$	300 S	Set grid over-frequency protection 01 trip time
OV-G-F02	$61.2 \leq f \leq 66 \text{ Hz}$	62 Hz	Set grid over-frequency protection 02 value
OV-G-F02-T	$0.16 \leq t \leq 1000 \text{ S}$	0.16 S	Set grid over-frequency protection 02 trip time
UN-G-F01	$50 \leq f \leq 59 \text{ Hz}$	58.5 Hz	Set grid under-frequency protection 01 value
UN-G-F01-T	$180 \leq t \leq 1000 \text{ S}$	300 S	Set grid under-frequency protection 01 trip time
UN-G-F02	$50 \leq f \leq 58 \text{ Hz}$	56.5 Hz	Set grid under-frequency protection 02 value
UN-G-F02-T	$0.16 \leq t \leq 1000 \text{ S}$	0.16 S	Set grid under-frequency protection 02 trip time
Reconnection Voltage	$0.88 \leq V \leq 0.95$ $1.05 \leq V \leq 1.06$	$0.917V_n$ $1.05V_n$	Set grid recovery voltage range after grid fault
Reconnection Frequency	$59 \leq f \leq 59.9$ $60.1 \leq f \leq 61$	59.5 Hz 60.1 Hz	Set grid recovery frequency range after grid fault
Reconnection Time after Fault	$0 \leq t \leq 600 \text{ S}$	300 S	Set reconnection time after a fault is cleared
Ramp-up Slew Rate	0.10-100%	100% Pn/S	Set Ramp-up power slew rate during start-up
Reconnect Slew Rate	0.10-100%	0.33% Pn/S	Set Ramp-up power slew rate during reconnect

9. Appendix

Parameter	Adjustment Range (pu)	Default (pu)	Description
Volt Watt P3Tau	$0.5 \leq t \leq 60$ S	10 S	Set the time to ramp up to 90% of the new active power target in response to the change in voltage
Volt Var Q3Tau	$1 \leq t \leq 90$ S	5 S	Set the time to ramp up to 90% of the new reactive power target in response to the change in voltage
Dead Band-OF	$60.017 \leq f \leq 61$ Hz	60.036Hz	Set OF frequency start dead band for power derate
Drop-OF	2-5 %	5 %	Set OF frequency derate droop slope
Response Time	$0.2 \leq t \leq 10$ S	5 S	Set frequency derate response time
Dead Band-UF	$59 \leq f \leq 59.983$ Hz	59.964 Hz	Set UF frequency start dead band for power derate
Drop-UF	2-5 %	5 %	Set UF frequency derate droop slope
Drop Pmin	0-100 %	0 %	Set frequency droop P minimum
Volt-Watt	Enabled/ Disabled	Enabled	Set Volt - Watt function
V1	Hybrid: $0.40 \leq V \leq 1.00$ Grid-tied: $0.90 \leq V \leq 1.30$	Hybrid: 1.00Vn Grid-tied: 1.00Vn	Set grid voltage V1 limit for Volt-Watt control
P1	0-100 % Pn	100% Pn	Set power P1 for Volt-Watt control
V2	Hybrid: $0.60 \leq V \leq 1.05$ Grid-tied: $1.00 \leq V \leq 1.35$	Hybrid: 1.00Vn Grid-tied: 1.00Vn	Set grid voltage V2 limit for Volt-Watt control
P2	0-100 % Pn	100% Pn	Set power P2 for Volt-Watt control
V3	$1.05 \leq V \leq 1.09$	1.06Vn	Set grid voltage V3 limit for Volt-Watt control
P3	0-100 % Pn	100% Pn	Set power P3 for Volt-Watt control
V4	$1.06 \leq V \leq 1.10$	1.10Vn	Set grid voltage V4 limit for Volt-Watt control
P4	0-100 % Pn	Hybrid: 0%Pn Grid-tied: 0%Pn	Set power P4 for Volt-Watt control
Volt-Var	Enabled/ Disabled	Enable	Set Volt-Var function
V1	$0.77 \leq V \leq 1.03$	0.92Vn	Set grid voltage V1 limit for Volt-Var control
Q1	0-60% Sn	+30% Sn	Set reactive power Q1 for Volt-Var control
V2	$0.92 \leq V \leq 1.05$	0.97Vn	Set grid voltage V2 limit for Volt-Var control
Q2	-60-60% Sn	0% Sn	Set reactive power Q2 for Volt-Var control
V3	$0.95 \leq V \leq 1.08$	1.03Vn	Set grid voltage V3 limit for Volt-Var control
Q3	-60-60% Sn	0% Sn	Set reactive power Q3 for Volt-Var control
V4	$0.97 \leq V \leq 1.23$	1.07Vn	Set grid voltage V4 limit for Volt-Var control
Q4	-60-0% Sn	-30% Sn	Set reactive power Q4 for Volt-Var control
Fixed PF	-0.8 -+0.8	1.0	Set Fixed Power Factor limit
Reactive Power	-60 -60 %	0%	Set Reactive Power level

9. Appendix

9.3 Data Collection and Storage

In order to improve our products and provide you with higher quality services, this device has a built-in data logging module for collecting relevant information during operation (such as power generation data, fault data)

Commitment:

1. We will only collect, use and process your device information for the purpose of improving our products and services.
2. We will take all reasonable and feasible measures to ensure that no irrelevant information is collected and we will protect your device information.
3. We will not share, transfer or disclose the collected device information with any company, organization or individual.
4. When we stop operating products or services, we will stop collecting information from your devices.
information in a timely manner.
5. If you do not want to provide such information, you can notify our company to turn off this function, which will not affect your normal use of other functions of the product.

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If you encounter any problems with the inverter, please take note of the inverter serial number and then contact us using the phone number or email listed above.



**SunSpec
Certified**



**Compliant with CA Rule 21 & HECO Rule 14H
Certified to UL 1741 SA and UL 1741 SB
Certified to UL Std. No. 1741-Second Edition
& CSA-C22.2 No.107.1-16**