User Manual

Residential Split Phase
Low Voltage Hybrid
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

Version 2.7 Release Date: 2026/03/05

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 supplied by Solis equipment.

- 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 is capable of pairing with low-voltage (48-52V) lithium-ion and lead-acid batteries to maximize self-consumption and provide backup power. This inverter can operate in both on-grid and off-grid applications. The S6 hybrid series consists of the following inverter sizes: 9.6kW, 11.4kW,12kW,14kW, and 16kW. The inverter by default comes with an integrated PLC rapid shutdown transmitter. The transmitter brand must be specified when ordering -APST for APS or -RSS for Tigo. There is no option for an integrated Tigo CCA.

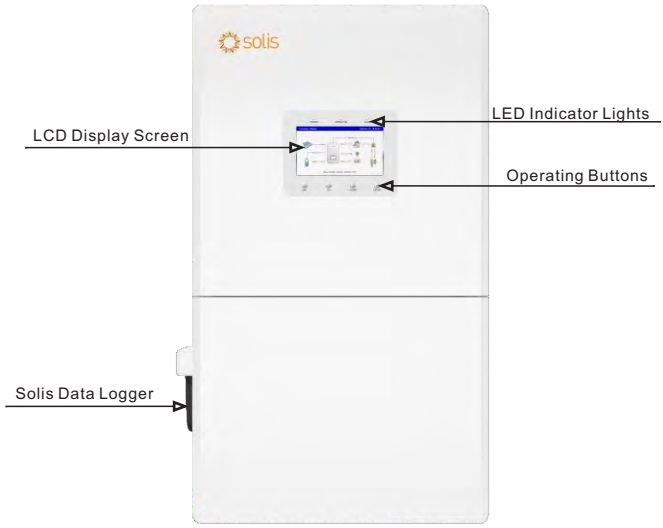

Figure 1.1 Front view

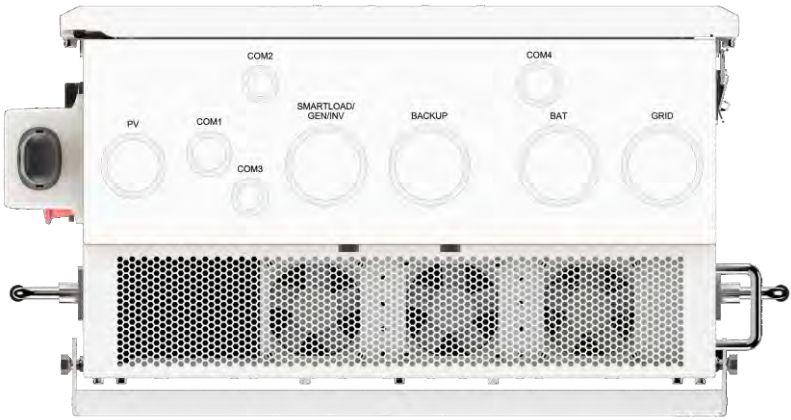

Figure 1.2 Bottom view (wire box)

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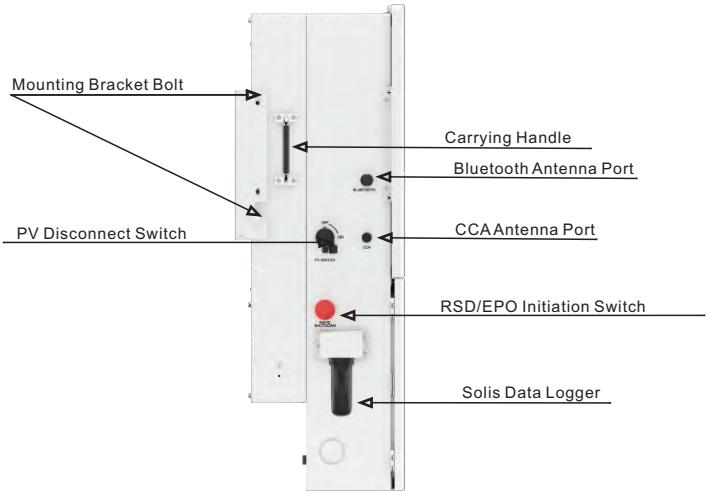

Figure 1.3 Right side view

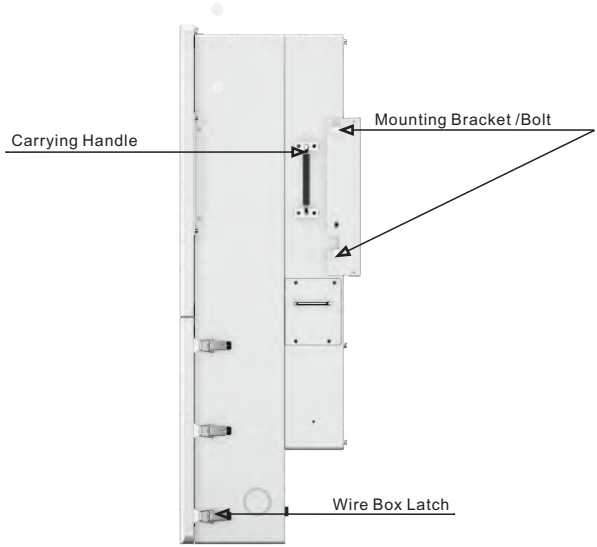

Figure 1.4 Left side view

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Figure 1.5 Back view

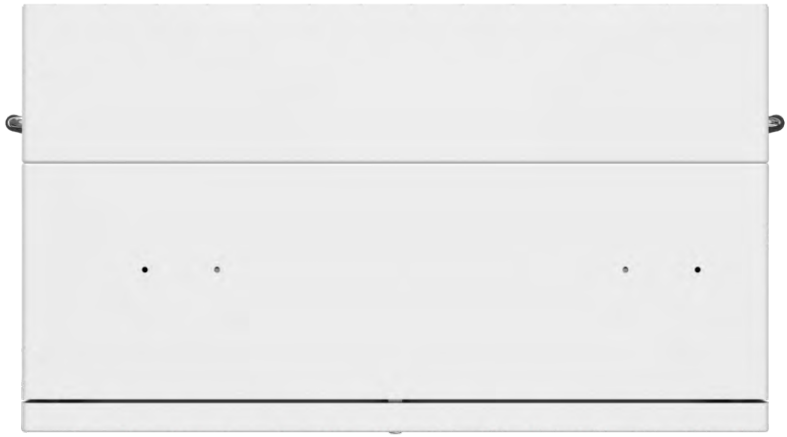


Figure 1.6 Top view

1. Introduction

1.2 Components Included with the Inverter

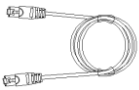
If any of these items are missing, please contact your local Solis distributor or the Solis service team.

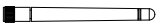

Inverter x1


Inverter Mounting Bracket x1


M6 Stabilizing Set Bolts x2


Concrete Anchor Bolts x4


Parallel Communication Ethernet Cable x1


Bluetooth Antenna


Current Transformers x2
CHINT NCTK-24 (250A)


RJ45 Connector x2


S2-WL-ST Wi-Fi & LAN
Solis Data Logger

1.3 Tools Required for Inverter Installation


Technician Screwdriver


Torque Wrench
Screwdriver


Wire Strippers
12 AWG to 6 AWG


Wire Strippers
20 AWG to 10 AWG
(for communication wires)


Channel Locks


Multimeter (AC/DC Amps)


Drill and Impact Driver


Ratcheting Crimper


Bubble Level


Smartphone
(for commissioning)


5mm & 8mm Hex Tips


Radial Cable Stripper

1. Introduction

1.4 Accessory Components

1.4.1 External Energy Meter and Rogowski Coils

The inverter comes with two CTs (250A-rated) that can be connected to the inverter directly unless one of the three conditions listed below is met. The purpose of the CTs and meter is to enable the inverter to monitor consumption power and manage export power. Self-use mode will only work if the CTs/meter are installed. Without the CTs/meter the monitoring portal will only show PV power generation and battery charging. All other icons will be greyed out with no data being displayed.

Condition 1: More than one inverter is going to be installed in the same system.
Condition 2: The inverter will be installed more than 4.5 feet (1.2 meters) from the utility point of common coupling. **The factory CT wires cannot be extended, they are 4.92 feet long (1.5m).**
Condition 3: Split-core CTs will not fit and flexible CTs (Rogowski coils) must be installed or CTs with a higher current rating than 250A are required since the provided CTs are 250A-rated. The Rogowski coils are rated for 1000A.

There are two accessory kits that can be purchased separately. The first kit includes a CHINT meter and additional set of CTs. The second kit is for the CHINT meter with two Rogowski coils in case flexible CTs are required.

CHINT Meter Kit
Part Number for Ordering:
CHINT DTSU666

Includes:
x1 CHINT DTSU666 Meter
x2 CTs - CHINT NCTK-36 (600A/5A)

Rogowski Coil Kit
Part Number for Ordering:
CHINT DTSU666 (Rogowski Coil)

Includes:
x1 CHINT DTSU666 Meter
x2 Rogowski Coils - MEATROL NRC-60

No other types of meters, CTs, or Rogowski coils are compatible with this inverter.

1.4.2 Compatible Data Loggers for Remote Monitoring

This inverter is compatible with three different Solis logger models as shown below. The S2-WL-ST logger, which supports both Wi-Fi and LAN, is included with each inverter. If 5 GHz Wi-Fi or cellular must be used, then one of the other loggers must be purchased separately. Be sure to order the USB version of the logger and not the 4-pin version as this inverter only supports the USB versions.
A third-party (non-Solis) gateway can be installed with this inverter. Please send a request to the Solis support team for the Modbus map. There is a dedicated RJ45 port for RS485 third-party communication.

S2-WL-ST S1-W4G-ST S2-WL-ST

Data Logger Model	Communication Type
S2-WL-ST (USB)	Wi-Fi (2.4 GHz only) Local Area Network (LAN)
S1-W4G-ST (USB)	Wi-Fi (2.4 GHz only) 4G Cellular US: Verizon, T-Mobile, Sprint Canada: Telus & Rogers
S5-WIFI-ST (USB)	Wi-Fi (2.4 GHz and 5 GHz)

Figure 1.7 Compatible Solis data loggers

1. Introduction

1.5 Ordering Guide

1.5.1 Inverter Model Number Explained

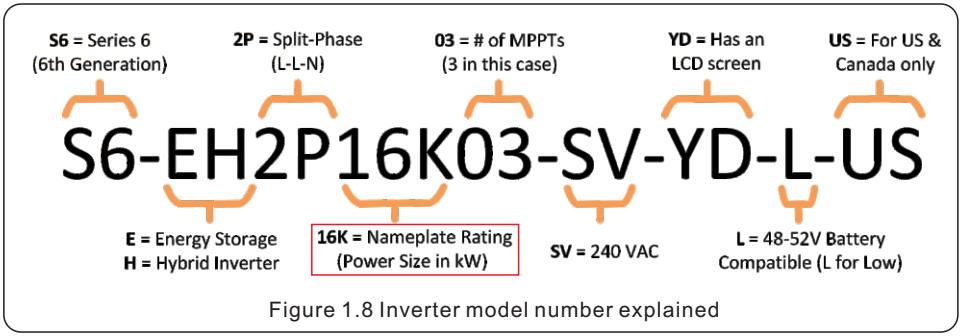


Figure 1.8 Inverter model number explained

The only part of the model number that changes between models is the *Nameplate Rating* found in the center of the model number. When ordering the inverter, the base model number is used. A suffix can be added to the end of the model number to denote which integrated RSD transmitter should be included with it. This is explained in section 1.5.3.

1.5.2 Available Models

Nameplate Rating	Inverter Model Number	Max. AC Output Power to Both Grid & Backup
9.6 kW	S6-EH2P9.6K03-SV-YD-L-US	9.6 kW
11.4 kW	S6-EH2P11.4K03-SV-YD-L-US	11.4 kW
12 kW	S6-EH2P12K03-SV-YD-L-US	12 kW
14 kW	S6-EH2P14K03-SV-YD-L-US	14 kW
16 kW	S6-EH2P16K03-SV-YD-L-US	16 kW

The model numbers listed above are UL 1741 SB-certified and can be found on the approved inverter lists under the manufacturer name "**Ginlong Technologies Co., Ltd.**" as "Solis" is the brand of the inverter and Ginlong is the official manufacturer name.

California: California Energy Commission (CEC)
Hawaii: Hawaiian Electric Company (HECO)
Puerto Rico: LUMA
New York: NY DPS

For regional approved equipment lists not shown above, please contact the Solis support team.
Derating of the inverter can be done by contacting the Solis support team, if required.

1. Introduction

1.5.3 Rapid Shutdown Transmitter Options (Integrated)

The inverter can be ordered with an integrated (built-in) rapid shutdown (RSD) transmitter. This transmitter generates a PLC signal that gets sent along the PV conductors up to the receivers (RSD shutdown devices) within the PV array. There are three options available. Each option has a correlating Suffix (or lack of suffix) that must be added to the end of the model number. The **manufacturing part number** used for ordering is formed by adding the **the suffix** to **the base model number**. Only the model numbers are CEC, HECO, and LUMA listed, not the full part numbers. Base model example: S6-EH2P16K03-SV-YD-L-US

Transmitter Brand	Suffix	Integrated Transmitter Model	Example Manufacturing Part Number for Ordering
No Transmitter	Nothing	N/A	S6-EH2P9.6K03-SV-YD-L-US
Tigo®	-RSS	RSS Transmitter	S6-EH2P9.6K03-SV-YD-L-US-RSS
APsmart	-APST	Transmitter-PLC	S6-EH2P9.6K03-SV-YD-L-US-APST

The inverter is UL 1741 CRD **P**hoto**v**oltaic **R**apid **S**hutdown **S**ystem (PVRSS) certified with the Tigo and APS transmitters. It is also PVRSS certified with the Tigo CCA; however, the CCA must be installed externally and cannot be purchased as an integrated component like the two transmitter options can be.

1.5.4 Rapid Shutdown Transmitter Options (External)

The inverter is compatible and PVRSS-certified with the Tigo CCA and TS4-A-O optimizer. But, the CCA cannot be installed inside of the inverter wire box. It must be installed within the external enclosure box that Tigo sells. The Tigo CCA should be connected to a 120VAC to 12VDC power supply that is tied to the backup side of the inverter so that the PV system can generate power in backup and off-grid modes. If backup/off-grid is not being used, then the power supply can be tied to the grid-side of the system instead.There is no direct communication between the inverter and the Tigo CCA. For module-level monitoring, the Tigo platform must be used. Please see Tigo's documentation for more technical details.

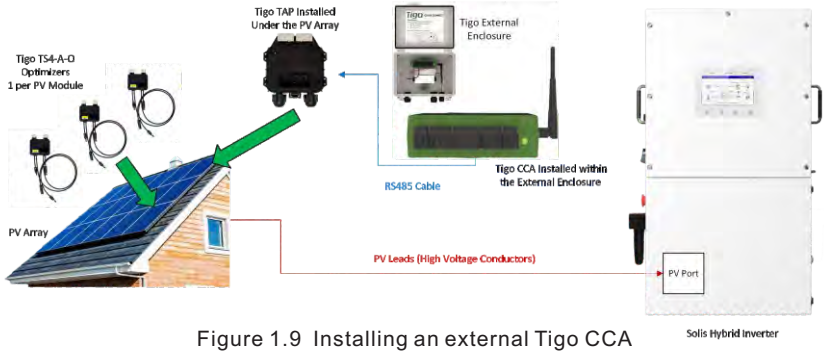


Figure 1.9 Installing an external Tigo CCA

1. Introduction

The inverter is PVRSS-certified with the Tigo transmitter, the Tigo CCA, and the APsmart transmitter only. No other types or brands of rapid shutdown equipment may be used with this inverter. The APS transmitter is SunSpec Rapid Shutdown certified.

1.6 Compatibility with Batteries & Other Equipment

1.6.1 Compatible Rapid Shutdown Devices

The components listed in this chart have been UL 1741 CRD Photovoltaic Rapid Shutdown System (PVRSS) certified together with the inverter. Equipment cannot be mixed and matched. Tigo must be used with Tigo and APS must be used with APS.Tigo CCA is only compatible with Tigo TS4-A-O optimizer and TS4-A-S receiver.Tigo RSS transmitter is only compatible with Tigo TS4-A-F and TS4-A-2F receivers. Mixing Tigo equipment such as using a transmitter with the TS4-A-O is not permitted or supported by Tigo or Solis.

RSD Brand	Transmitter Type	Transmitter Can be Integrated or External	Compatible RSD Receiver Models
Tigo	RSS Transmitter	Integrated or External	TS4-A-F: RSD only (1 module) TS4-A-2F: RSD only (2 modules)
	CCA	External Only	TS4-A-O: Optimizer TS4-A-S: Module-Level Monitoring
APsmart	Transmitter-PLC	Integrated or External	RSD-S-PLC: RSD only (1 module) RSD-D: RSD only (2 modules)

1.6.2 Compatible Lithium Batteries Using Closed-Loop (CAN) Communication

Battery Brand	Battery Model	UL 9540 Complete?	Solis Interoperability Test Report Complete?
DISCOVER ENERGY SYSTEMS	AES Rackmount	✓	✓
	Helios	✓	✓
Pytes	V5	✓	✓
	V10	✓	✓
	V12	✓	✓
RENON	Xcellent Plus	✓	✓
SOLUNA	10K LV Pack	✓	✓
	16K LV Pack	✓	✓
PYLONTECH	US5000	✓	✓
	Pelio	✓	✓

1.6.3 Batteries Using Voltage-Controlled (Open-Loop) Communication

It is allowed to connect a 48-52V lithium or lead-acid battery with open-loop comms. The inverter has an open-loop battery profile with configurable settings such as charge voltage, discharge voltage, max. charge/discharge current, etc. In this kind of setup, the inverter will not be able to provide an SOC% reading or any kind of faults from the battery. When operating in open-loop mode, system performance and battery protection depend on correct parameter configuration. Improper voltage or current settings may result in reduced battery life, unexpected shutdowns, or damage to the battery. Please check with the battery manufacturer to make sure their warranty covers open-loop.

1.6.4 Revenue-Grade Metering (RGM)

The included CHINT DTSU666 meter is revenue-grade; however, the purpose of this meter is not to perform revenue grade metering. Revenue grade metering measures the AC output power of the inverter within 0.5% accuracy. This would involve installing pairs of CTs around each of the two AC outputs: grid and backup. But, this is not what the provided CHINT meter & CTs are for. The purpose of the included CHINT meter is to give the inverter the ability to monitor import/export/consumption power and perform key functions such as controlling export power and utilizing default self-consumption mode where the inverter charges the battery with excess PV power before permitting export to the utility (or not if that is how the system is configured). The CHINT meter can be used as an RGM instead of being used as an export/consumption meter but it cannot do both functions at the same time.

1. Introduction

1.7 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 range from 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
TWO CARTONS (BOXES) 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 bodily 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 60950) may be connected to the RS485 and USB interfaces.

WARNING

Do not connect PV array positive (+) or negative (-) to ground. Doing so could cause major irreperable 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 top 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℃ (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. Only the AC Grid Port may 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 is 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 series 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.

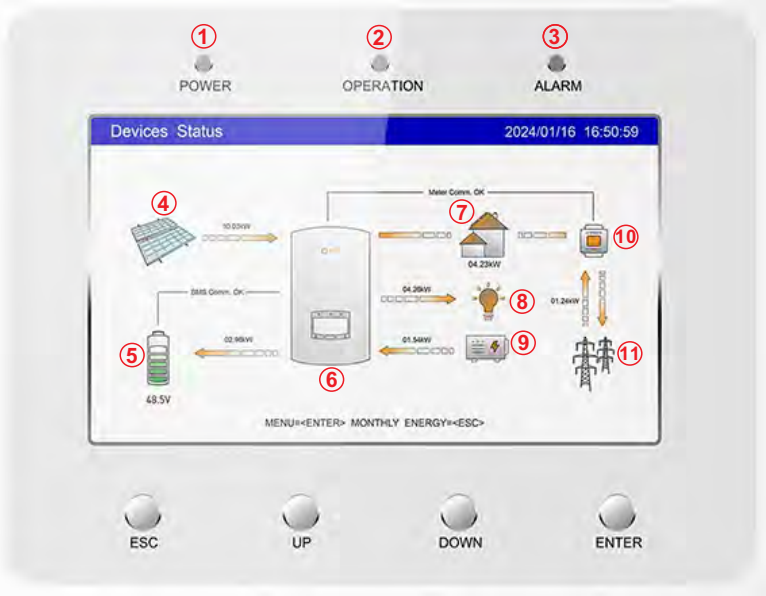
Anti-Islanding Protection:

Anti-Islanding is a condition where the inverter ceases 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

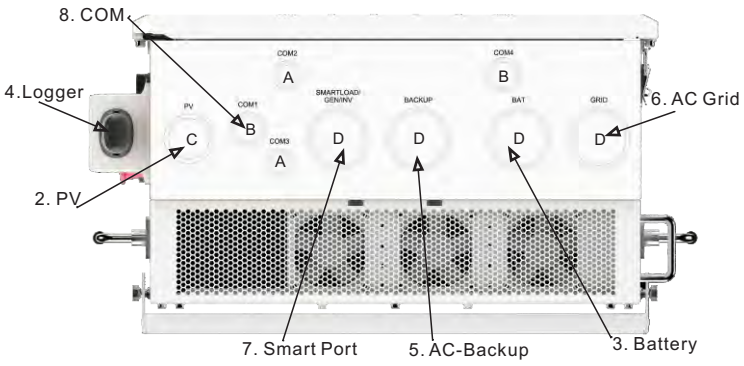
3.1 LCD Display Screen and Indicator Lights



#	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 will light up yellow or red anytime 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 the generator is on and grid is off.
10	Meter/CT Icon	Represents the energy meter/CT 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

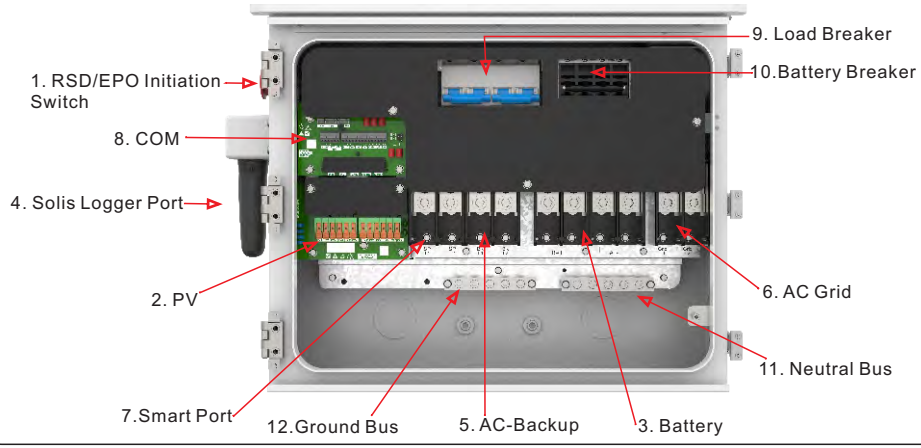


Knockout Sizes

A	0.5 in.
B	1 in.
C	1.5 in.
D	2 in.

To remove the conduit knockouts, use a mallet or hammer and a flat screwdriver.

Name	Description
1. RSD/EPO Initiation Switch	Initiates both rapid shutdown and emergency power off functions
2. PV	Conduit and PV conductors should be connected here
3. Battery	Conduit for battery conductors should be connected here (290A)
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 (125A)
8. Communication (COM)	RS485 & CAN communication cables should use these knockouts/terminals
9. Load Breaker	Breaker for the backup loads, rated for 250A
10. Battery Breaker	Breaker for the battery, rated for 400A
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



3. Overview

3.3 Integrated Overcurrent Protection Devices

Every inverter comes with an integrated breaker for the backup loads and another integrated breaker for the battery. Nothing special has to be done in order for the inverter to include these breakers, they come standard.

3.3.1 Backup Port Overcurrent Protection Device

The backup breaker is Nader brand and the model number NDB1-125. The breaker is rated at 250A max. It shows “125A” on the breaker, but that is for each set of poles and the breaker has two sets (125A x 2 = 250A). The rated insulation voltage is 500V. The rated frequency is 50Hz/60Hz. The rated impulse withstand voltage is 6kV. The instantaneous tripping characteristic is Type C and Type D.
The breaker is certified to UL489.

Figure 3.1 Backup port overcurrent protection device (breaker)

3.3.2 Battery Overcurrent Protection Device

The battery breaker is Nader brand and the model number is NDB3-100Z4F00/4LUL2A0-L. This device is a hydraulic-magnetic equipment breaker. The breaker is rated at a maximum of 400A . The rated voltage is 80VDC. The breaker is certified to UL489.

Figure 3.2 Battery overcurrent protection device (breaker)

It is not possible to purchase the inverter without these two breakers. Every unit will include these breakers already integrated inside the inverter, there are no installation steps that must be performed by the installer.

4. Operating Modes & Applications

4.1 PV + Grid

The Solis hybrid inverter supports a wide range of use cases with varying degrees of complexity. This section goes over common applications that the inverter can fit into. Each application includes a system layout showing what is connected to the inverter and what is not in that specific use-case. Logic tables are also included to show how the system behaves in each mode. The purpose of this section is to show the inverter's abilities and limitations. It will not explain every possible application since the potential combinations are numerous. This section starts with the simplest use cases and then gradually gets into increasingly complex applications as more equipment is added.

4.1.1 Grid-Tied PV String Inverter without Export Power Control

This inverter can be used as a PV-only grid-tied string inverter. Only the PV and grid ports would be utilized. The logic is very simple. When the grid is present, the inverter produces as much power from PV as it can. It does not monitor or control power exported to the grid. If the grid fails, the inverter shuts down and stops generating power. The inverter is capable of providing backup power with only PV. However, this section will not discuss backup. When the inverter is used in this fashion, there is no limit from Solis with respect to how many inverters can be connected in parallel within the same system. The inverter can be installed like this and a battery can be added later on, making this like a battery-ready inverter.

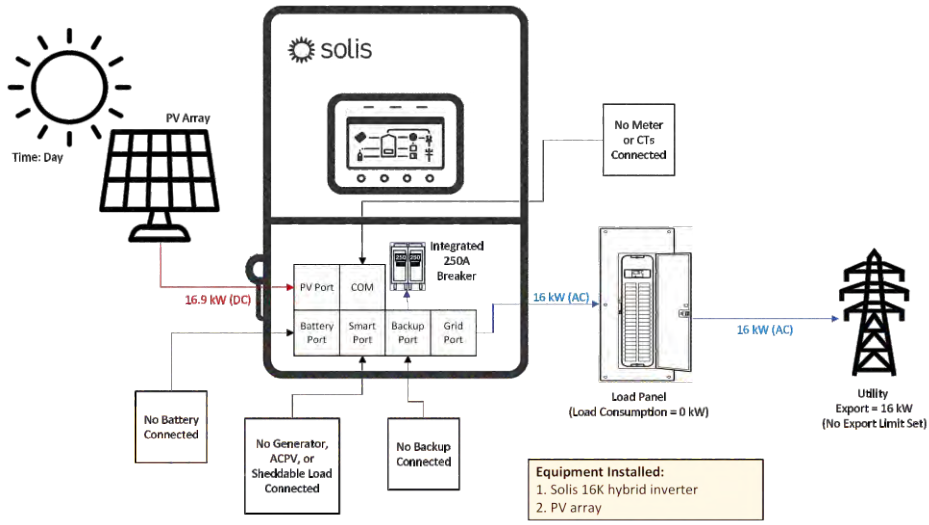


Figure 4.1 Grid-Tied PV only system layout (with no export power control or monitoring)

4.1.2 Grid-Tied PV String Inverter with Export Power Control

The inverter can monitor and regulate export power, defined as excess generation remaining after home load demand is met and available to be sent to the utility. Unlike the previous application, this function requires installation of the included CTs or an external energy meter so the inverter can measure power exchange between the home and the utility. Using this data, the inverter can control export power (including limiting export to 0 kW) and report export, import, and home load consumption. Installation of the meter and/or CTs is optional unless the owner wishes to monitor consumption or import/export power. The external meter and CTs are not equivalent to a revenue-grade meter (RGM), which measures only inverter AC output. Each Solis hybrid inverter includes split-core CTs and an external CHINT energy meter. The CTs may connect directly to the inverter without the meter only if both of the following

4. Operating Modes & Applications

conditions are met: (1) the inverter is installed within 19.68 ft (6 m) of the utility point of common coupling and (2) the system contains a single inverter. If the distance exceeds 19.68 ft or multiple inverters are installed, the CHINT meter is required. In this case, the CTs connect to the meter, and the meter communicates with the inverter via RS485. During commissioning, CT/meter configuration and export-power settings must be completed.

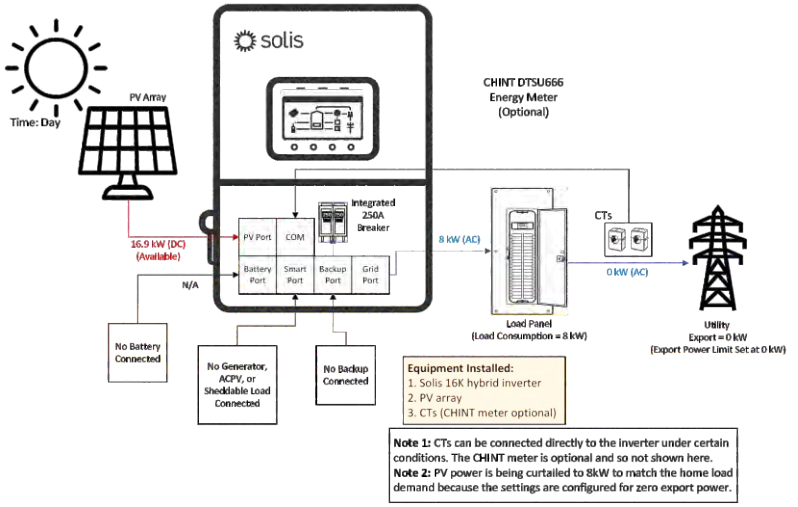


Figure 4.2 Grid-tied PV only system layout (with export power control & monitoring)

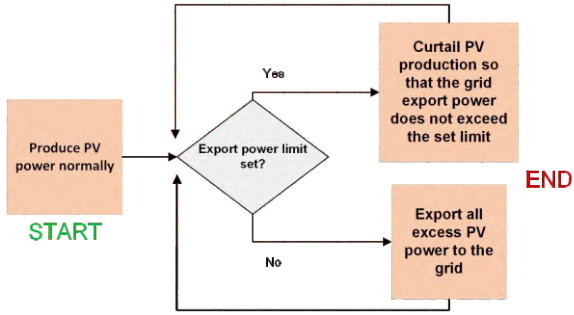


Figure 4.3 Grid-Tied PV only with export power control logic diagram

NOTE:
Without the CTs/meter the monitoring portal will only show PV power being produced & battery power (if a battery is installed). All other icons will be grey and will not show how much power is going to the home loads or the utility import/export. An example of what the portal will look like is shown here.

4. Operating Modes & Use Cases

4.2 PV + Grid + Battery

4.2.1 Grid-Tied PV + Battery without an Energy Meter/CTs (Time-of-Use mode)

The inverter has two sets of ports (+) and (-) for batteries to connect to it. Installation of a battery is not required, the inverter can operate with PV only as shown in the previous section 4.1. The addition of a battery allows the inverter to store excess PV power for use when the home load demand exceeds the available PV power. This is what we call “default self-use mode”. However, without the external meter & CTs only time-of-use can be used. Time of use is set up by configuring charge and discharge time windows along with maximum charge and discharge amperage values. The inverter will charge and discharge the battery based on the configuration of these settings. This can be thought of as a force--charge mode where the inverter manually charges and discharges the battery. To have the system automatically charge and discharge based on available PV power, load demand, and export power settings the external CHINT meter/CTs must be installed.

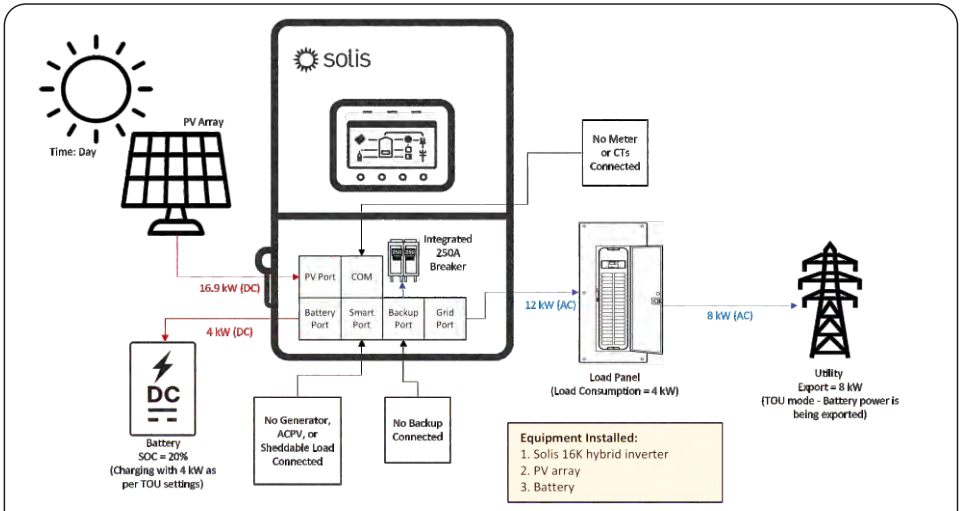


Figure 4.4 Grid-Tied Time-of-Use (TOU) mode system layout (no meter or CTs)

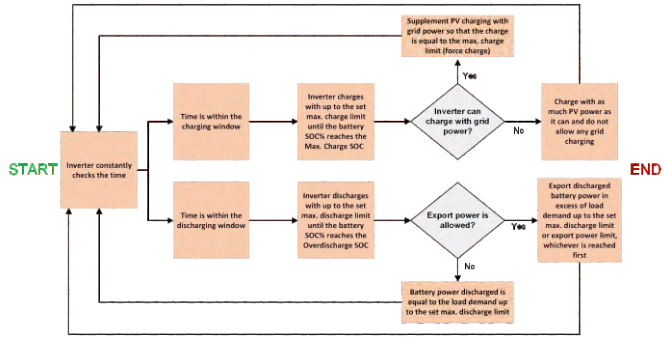


Figure 4.5 Time-of-Use (TOU) mode logic diagram

4. Operating Modes & Use Cases

4.2.2 Grid-Tied PV + Battery with an Energy Meter/CTs (Self-Use/Selling First Modes)

When the inverter is installed with both a battery and a CHINT meter/CTs it is able to automatically charge the battery with excess PV power, which is power left over after the home load demand has been met. This is what we call **self-use mode**. The included external meter/CTs must be installed in this case. If the battery is charged or the charge limit has been reached, any remaining power at that point can be exported to the utility if the system has been configured to allow that. If the system is configured for zero export, then the inverter will curtail the AC output power from the PV to equal the load demand such that there is no power fed back to the utility. The other mode available is **selling first mode**, which sets export power as the second priority after load demand with battery charging as third priority.

For the inverter to automatically execute energy arbitrage (self-use) the meter/CTs must be installed. Otherwise, only time-of-use mode can be utilized. This is because the meter/CTs allow the inverter to make necessary calculations to determine if power should be dispatched or not to cover load demand.

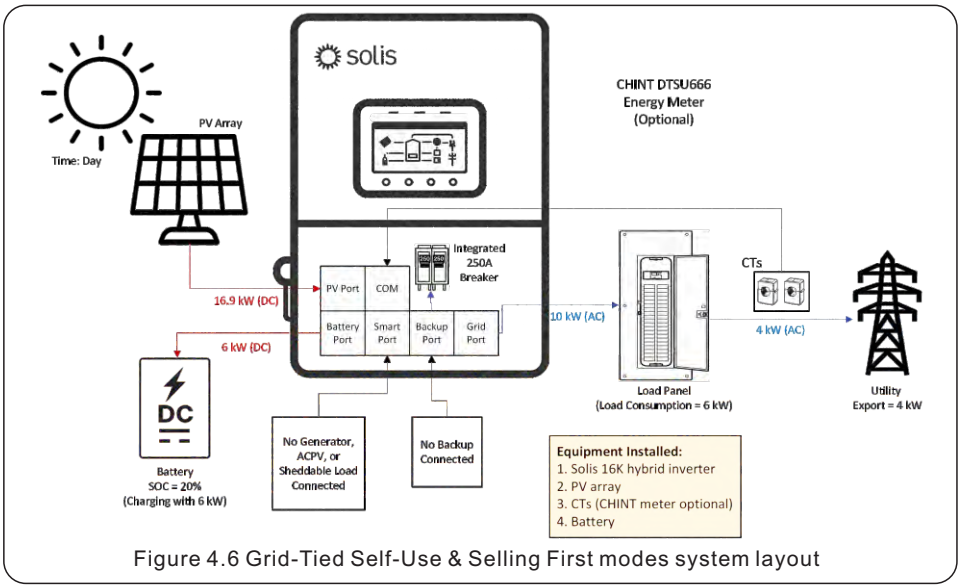


Figure 4.6 Grid-Tied Self-Use & Selling First modes system layout

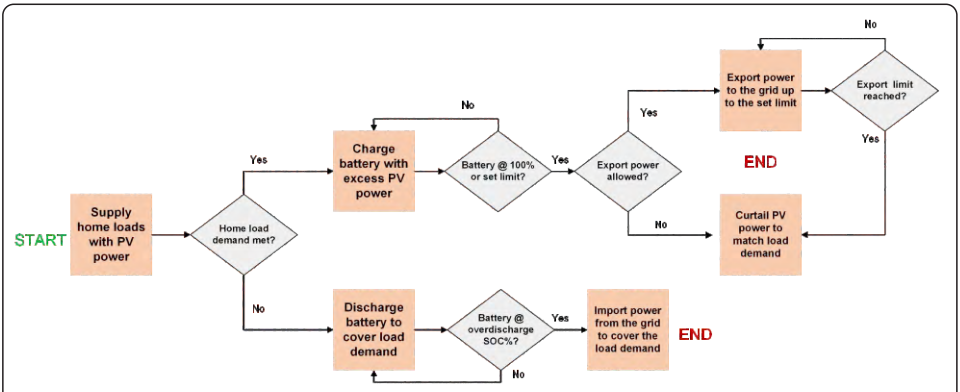


Figure 4.7 Self-Use mode logic diagram

4. Operating Modes & Use Cases

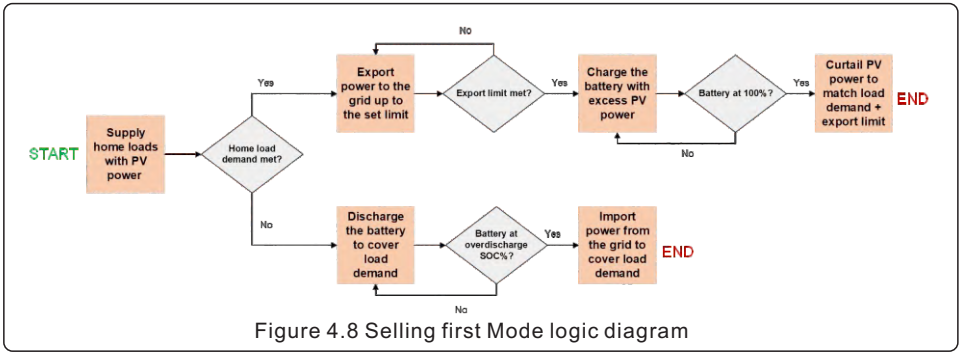
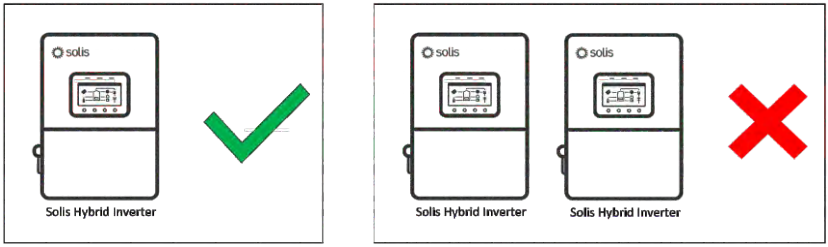


Figure 4.8 Selling first Mode logic diagram

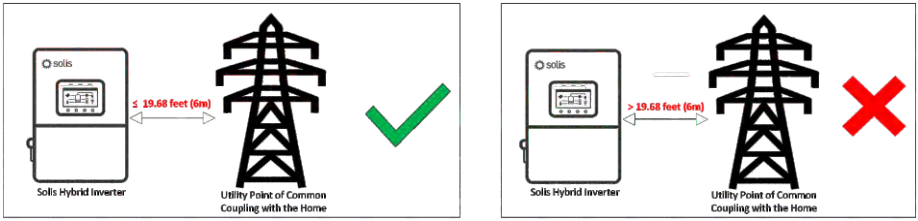
4.2.3 Conditions for Purchasing and Installing an Optional Meter Kit

Each inverter comes with only a pair of CHINT NCTK-24 CTs. The CTs can be connected directly to the inverter without installing the energy meter but only under certain circumstances. If any of the following three conditions is met then **the external meter must be purchased and installed** in addition to the CTs.

Condition 1: There is more than one inverter installed in the same system. The CTs may only be directly connected to the inverter if there is only one inverter total in the system; two or more requires the meter.



Condition 2: The inverter is physically installed more than 4.92 feet (1.5 meters) from the utility point of common coupling. The CT cables cannot be extended and are limited to 1.5 meters in length. CTs can only be directly connected to the inverter if it is installed within 4.92 feet of the utility point of common coupling.



Condition 3: Flexible CTs (Rogowski coils) must be used because solid split-core CTs do not fit. If this is the case, then Rogowski coils must be purchased separately and then connected to the same energy meter included with the inverter. Rogowski coils cannot be directly connected to the inverter. The meter must be purchased and installed in this case. Also, if a CT current rating greater than 250A is required, the external meter kits have 600A-rated CTs and Rogowski coil options.

4. Operating Modes & Use Cases

4.3 PV + Grid + Battery + Backup

4.3.1 Grid-Tied Systems Doing Energy Arbitrage with Backup for Emergencies

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, the 16K model can provide up to 16kW of continuous backup power even when the grid is absent.

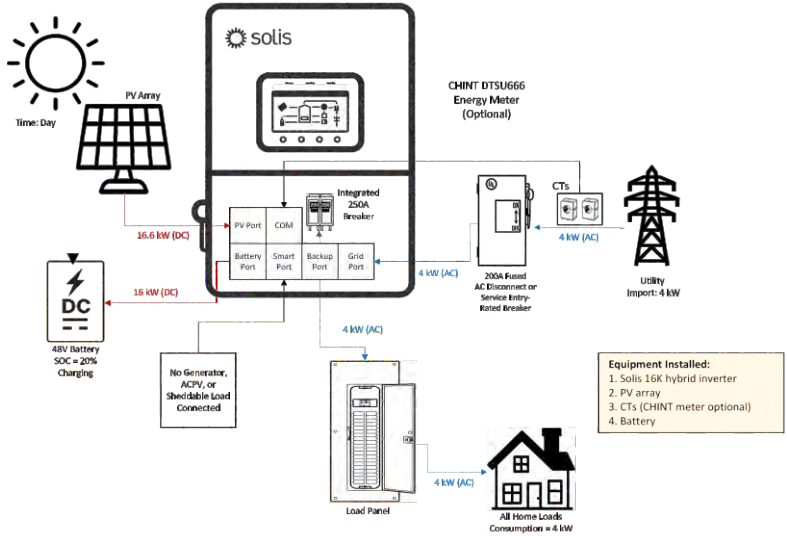


Figure 4.9 Energy arbitrage with backup system layout

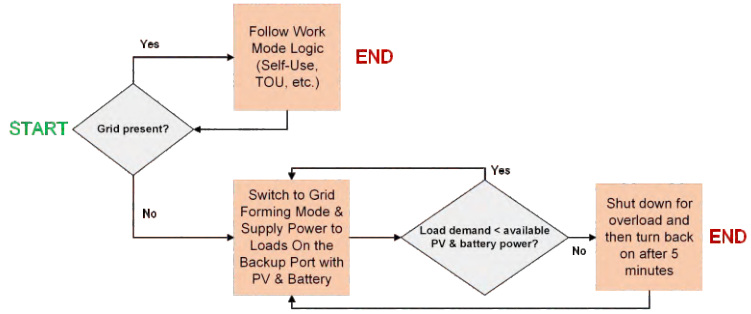


Figure 4.10 Energy arbitrage with backup logic diagram

The Solis hybrid inverter is capable of alternating between grid forming and grid following modes. It is able to perform grid forming on the backup port, it cannot grid form on the grid port. Therefore, the terms "**grid-forming**", "**backup**", and "**off-grid**" are all used synonymously throughout this manual. When the inverter senses the grid is no longer present, it opens the relays connecting itself to the grid effectively shutting off the grid port. It then switches to grid forming mode in under 4 milliseconds and generates AC power using PV first and then battery if there is no PV or not enough PV to support the loads connected to the backup side. The inverter continues to operate in this way constantly checking to see if the grid has returned. Once the grid is present again, the inverter switches back to grid following mode.

4. Operating Modes & Use Cases

4.4 PV + Grid + Battery + Backup + Smart Port

4.4.1 Grid-Tied Systems with a Generator on the Smart Port

A generator can be connected to the Smart Port of the inverter. The maximum size the generator can be is 24 kW. The Smart Port is rated for 125A maximium. Considering NEC, 24 kW is the largest generator that can be connected through a 125A breaker. If a larger generator is to be connected, it can only be connected on the grid-side of the inverter. When in backup or off-grid mode, the inverter will automatically start/stop the generator based on the battery state-of-charge (SOC) percentage.

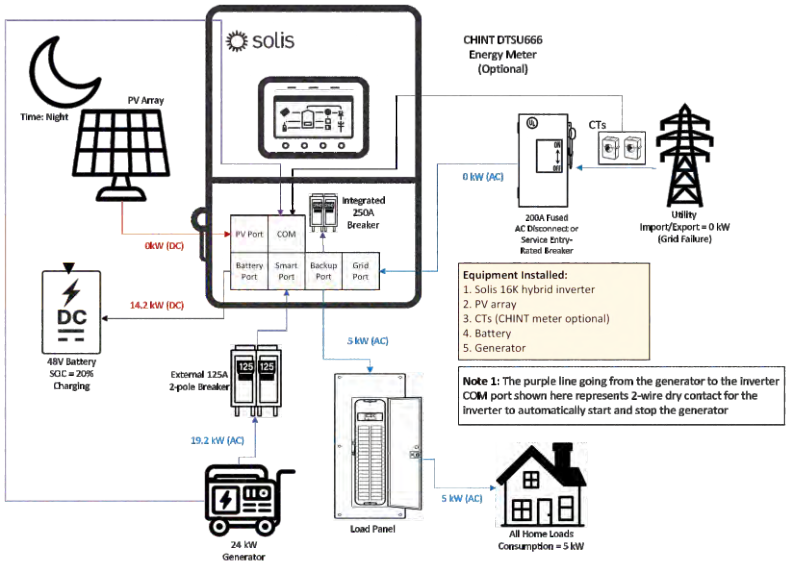


Figure 4.11 Grid-tied system with a generator system layout

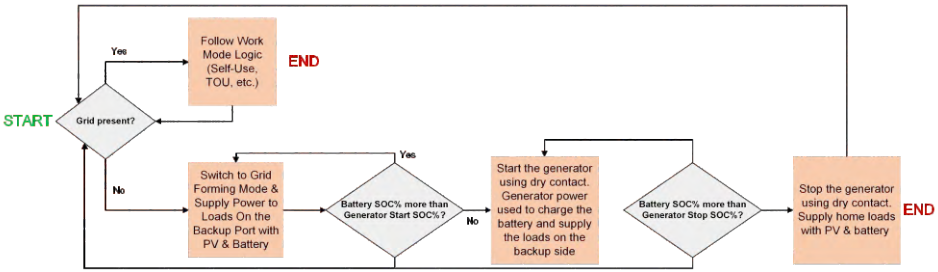


Figure 4.12 Grid-tied system with a generator logic diagram

The generator must support two-wire dry contact. A two-wire cable must be run between the inverter and the generator for dry contact. This is how the inverter is able to start and stop the generator automatically based on the SOC% of the battery. When the generator is on, the inverter goes back to grid-following and sychronizes with the generator. Please do not connect a generator to the Backup port of the inverter. Generators can only be connected to the Smart Port or to the Grid port (or grid-side in general).

4. Operating Modes & Use Cases

4.4.2 Grid-Tied Systems with AC-Coupled PV on the Smart Port (Grid-Following)

An existing or new AC-coupled PV (ACPV) system can be connected to the Smart Port of the inverter. Doing this allows the ACPV system to continue generating power even when the grid has failed or it is an off-grid system. The maximum size ACPV system that can be connected is equal to the nameplate rating of the Solis hybrid. For example, if the Solis hybrid is a 16kW unit, then a 16kW ACPV system can be connected to the Smart Port. If the system is larger, it must be connected to the grid side of the inverter and will not be supported in backup/off-grid mode. The diagram below shows that the maximum amount of power that can go to loads or to the grid is equal to twice the inverter nameplate rating. In the case shown below it would be 16kW from the Solis inverter and 16kW from the ACPV system totalling 32kW.

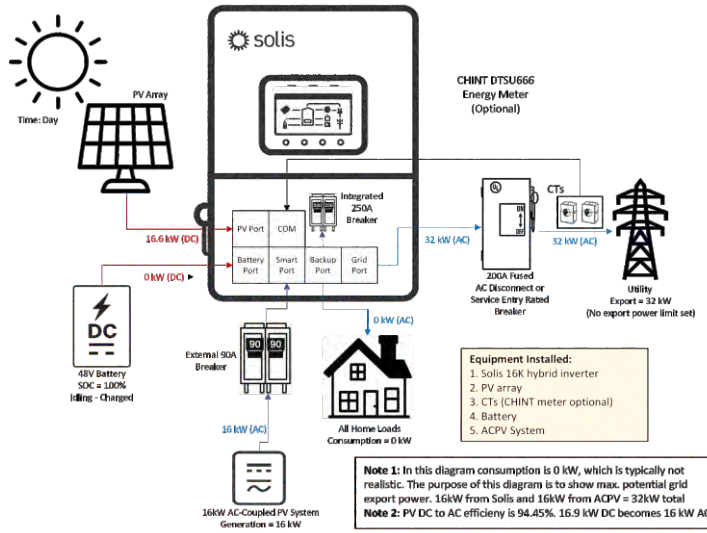


Figure 4.13 Grid-tied system with AC-coupled PV system layout

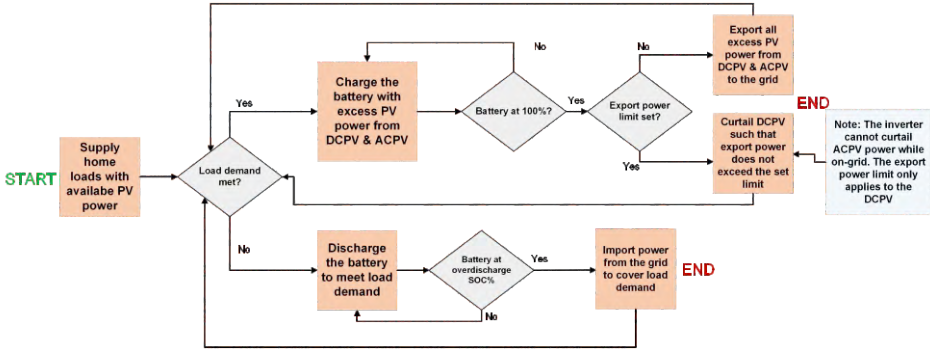


Figure 4.14 On-grid system with AC-coupled PV logic diagram

The reason the ACPV system must be the same size or smaller than the Solis hybrid is because the Solis hybrid must be able to control the ACPV system in grid-forming mode by shifting the frequency. It cannot do that if the ACPV system is larger.

4. Operating Modes & Use Cases

4.4.3 Grid-Tied Systems with AC-Coupled PV on the Smart Port (Grid-Forming)

When the grid is absent the Solis hybrid switches to grid-forming mode. This could either be on-grid backup mode or fully off-grid mode. The inverter will supply the home loads connected to the Backup port with power from the PV connected directly to the inverter (DCPV) and the ACPV system connected to the Smart Port. The inverter will also use ACPV power and DCPV power to charge the battery. If the battery is fully charged and the available PV power exceeds the load demand, the inverter will first curtail the DCPV power. If the DCPV power has been curtailed to 0kW and the ACPV power exceeds the load demand, then the inverter will use frequency-watt shifting in accordance with IEEE 1547 to curtail the ACPV power. There is no direct communication between the Solis hybrid and the ACPV system.

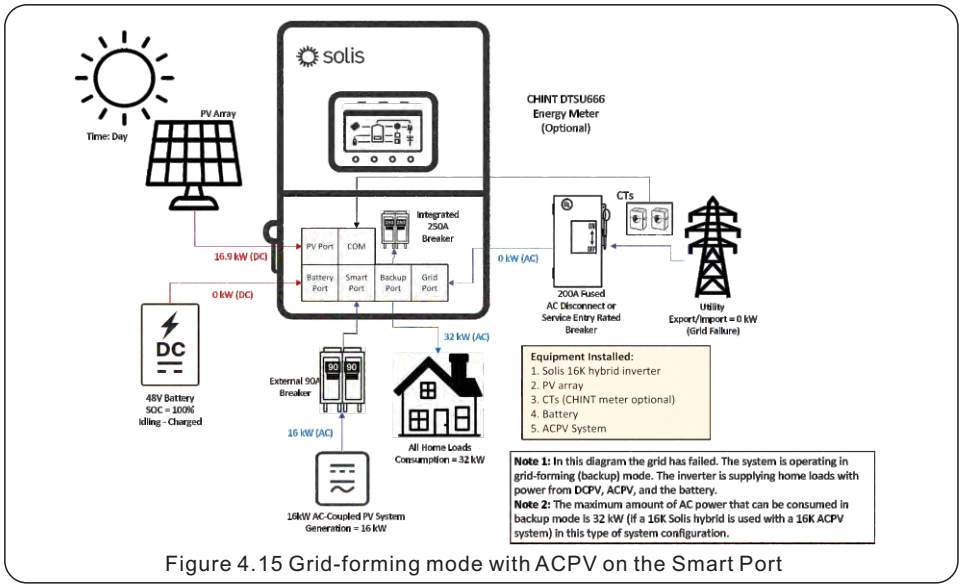


Figure 4.15 Grid-forming mode with ACPV on the Smart Port

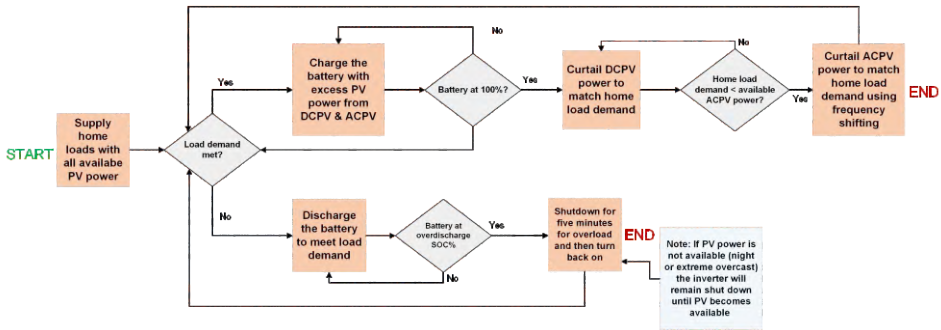


Figure 4.16 Grid-forming mode with ACPV logic diagram

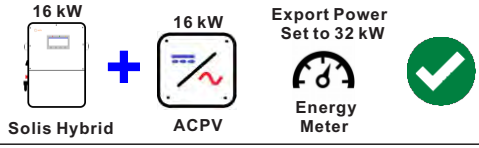
There is no advantage to connecting the ACPV system to the Smart Port if the system is only ever going to be on-grid (no backup at any time). If backup is not being used, it is likely easier and simpler to just connect the Solis inverter system in parallel to the existing PV system.

4. Operating Modes & Use Cases

The ACPV system connected to the Smart Port of the inverter must either be the same size as the Solis hybrid or smaller than it. It cannot be larger or else the Solis hybrid will not be able to control the ACPV system using frequency-shifting when in grid-forming (backup/off-grid) mode.

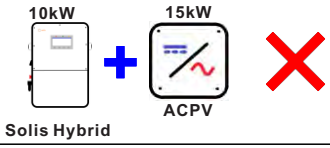
Allowed

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.



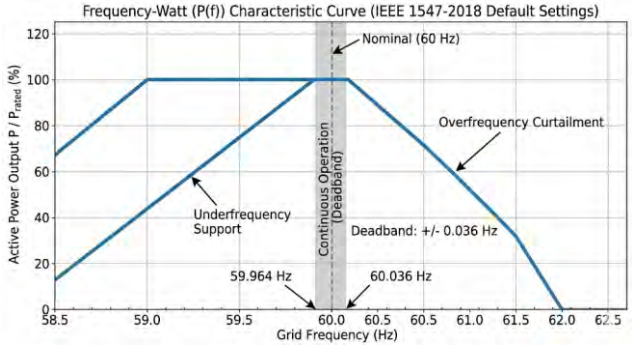
Prohibited

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.



4.4.4 Frequency Shifting for Controlling AC-Coupled PV in Grid-Forming Mode

There is no direct communication between the Solis hybrid inverter and the AC-coupled PV system that is connected to the Smart Port of the inverter. The Solis inverter uses frequency-shifting to modulate the output of the ACPV system while in grid-forming mode. The inverter uses the frequency-watt curve outlined in the IEEE 1547-2018 standard. When in backup mode, the Solis 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) and the battery is fully charged. This shift 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 be reduced according to that curve. If the ACPV system does not support frequency-watt shifting then it will completely stop outputting power. The ACPV will resume outputting power once the Solis hybrid normalizes the frequency.



Active output power P(f) is calculated using the following logic during an overfrequency event:

$$P(f) = P_{pre} \times \left[1 - \frac{f - (f_{nom} + db_{OF})}{f_{nom} \times k_{OF}}\right]$$

Figure 4.17 Frequency-watt shifting curve and active output power equation

The Solis hybrid inverter is only able to control the ACPV power output using frequency-shifting if the ACPV system is connected to the Smart Port. Please do not connect the ACPV system to the Backup port or the grid-side of the system if your goal is to have the Solis hybrid support the ACPV system in grid-forming (backup) mode so that it can generate power normally in addition to being curtailed by frequency-shifting. Also, it is not possible to connect an ACPV system to the Smart Port at the same time connect a generator to the Smart Port. Only one or the other can be connected due to the inverter settings only allowing for one to ever be configured at a time.

4. Operating Modes & Use Cases

4.4.5 Grid-Tied Systems with a Sheddable Load on the Smart Port

The last thing that can be connected to the Smart Port of the inverter is a large load, such as an AC EV charger, an air conditioner, pool pump, or heater. The benefit of doing this is that when in grid-forming mode (backup/off-grid) the battery power can be more efficiently maintained to support priority loads. During commissioning, you will set an on and off SOC% that dictates when the Smart Port will have power and not so that the battery does not get drained by supporting that large load indefinitely. The large load connected to the Smart Port can effectively be shed to save the battery power for more important loads. The diagram below demonstrates how in grid-forming mode the Smart Port will be turned off when the battery reaches 50% SOC at night when there is no PV power available. It is also possible to install a 125A load panel on the Smart Port that houses breakers for non-essential loads.

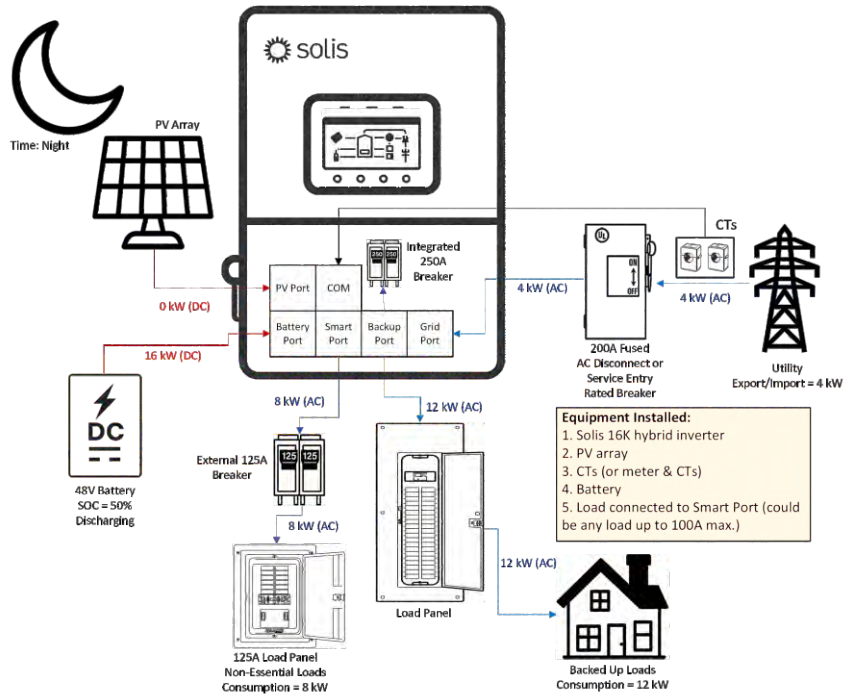


Figure 4.18 Grid-tied system with load shedding system layout

Limitations of Using the Smart Port for Load Control:

1.The largest load that can be connected to the Smart Port is a load that draws 24 kW of power or 100A maximum. The largest breaker that should be used is125A per NEC.

2. The load connected to the Smart Port will be supported so long as there is enough battery power stored to support it. Please be mindful when selecting a load to connect to the Smart Port that it should be a load that can be lived without when the grid is down.

3. DO NOT install a bi-directional EV charger on the Smart Port. This is not supported.

4. Operating Modes & Use Cases

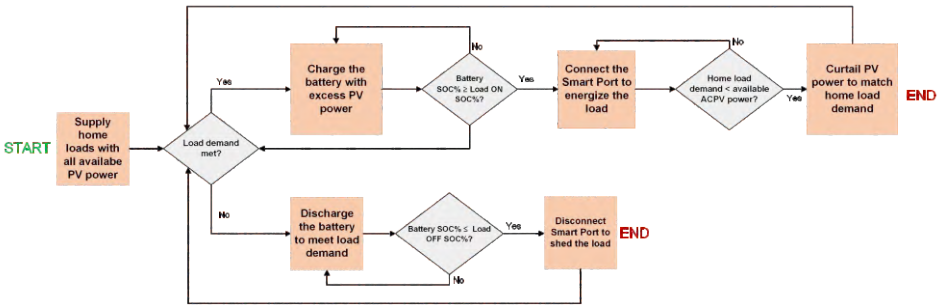


Figure 4.19 Grid-tied system with load shedding on the Smart Port logic diagram

4. Operating Modes & Use Cases

4.5 Off-Grid

Off-grid systems do not have grid connected at any time. This is not to be confused with grid-tied systems that lose grid power from time to time. This section is for systems that never have grid power and operate entirely with PV, batteries, loads, and a generator.

4.5.1 Grid-Forming Mode with PV Only

It is possible for the inverter to operate in grid-forming mode with PV only. This applies to both off-grid and on-grid systems using backup. The inverter will supply AC power to the loads on the backup port using available PV power. However, it is a delicate balance because if the load consumption exceeds the available PV power, the inverter will shut off temporarily before turning back on. This type of system configuration is only supported by one inverter. It is not possible to install multiple inverters like this.

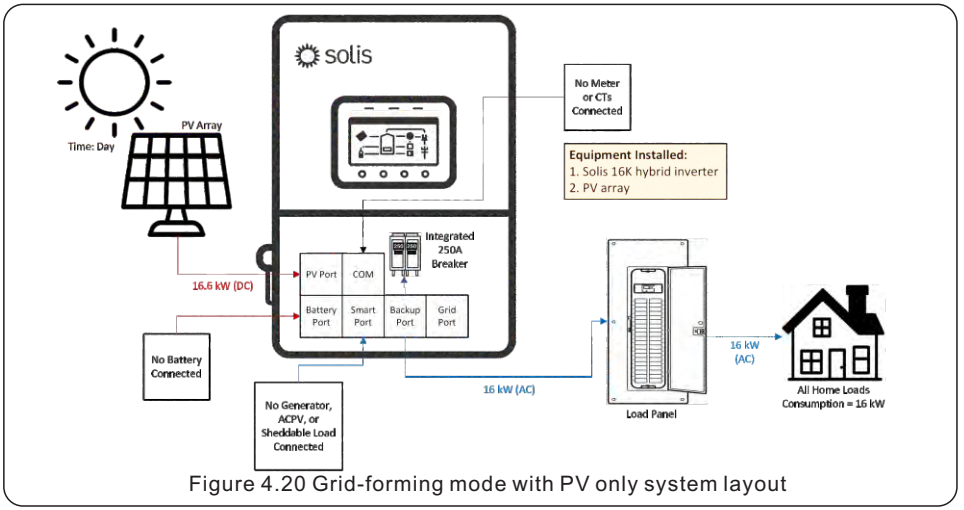


Figure 4.20 Grid-forming mode with PV only system layout

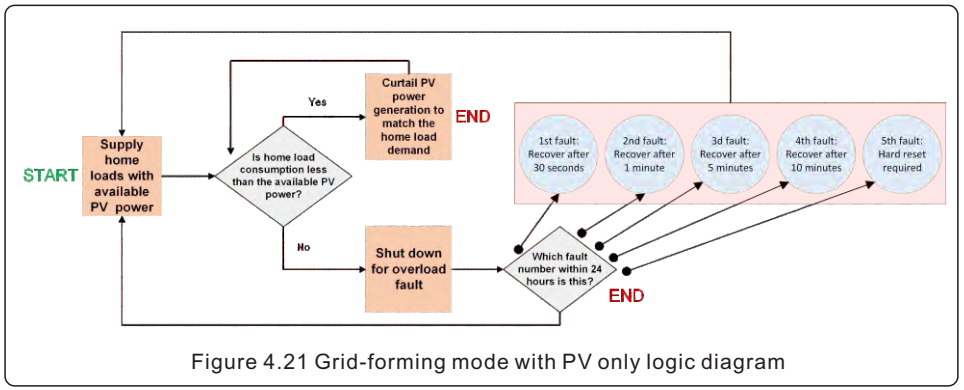


Figure 4.21 Grid-forming mode with PV only logic diagram

The figure above shows the recovery times correlated with consecutive overload trips. These occur every time the load consumption is greater than the PV power available. Because PV can dramatically fluctuate based on irradiance, it is recommended to keep the load consumption relatively low so that overload faults and recoveries can be avoided. If five trips happen within 24 hours, a hard reset will be required. Meaning, the inverter will need to be manually powered down and then back on. In all other cases, the PV will be curtailed to match the load demand.

4. Operating Modes & Use Cases

4.5.2 Off-Grid with PV & Battery

There is a dedicated mode specifically for off-grid remote systems that are not electrically connected to the grid at all, such as a cabin in the woods. 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.
The inverter will use generator power to supply the loads and recharge the battery. For single inverter systems, it is recommended to have a battery connected to the inverter. For parallel systems (≥ 2 inverters), the inverters must have batteries connected in order to provide power in an off-grid system. With PV and batteries, the inverter will supply power to the loads using PV first. Any excess power will go to charge the batteries. If there is insufficient PV power relative to the load demand, the inverter will discharge the battery to meet the deficit left after all PV power is utilized. Should the battery be fully charged and there is more PV power available than load demand, then theinverter will curtail the PV power to match the load demand.

The external meter does not need to be installed for off-grid systems.

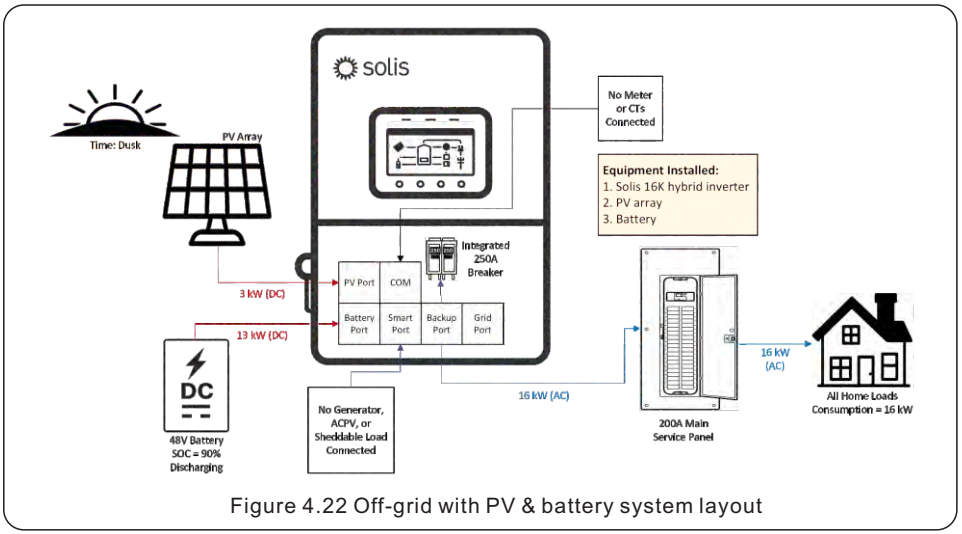


Figure 4.22 Off-grid with PV & battery system layout

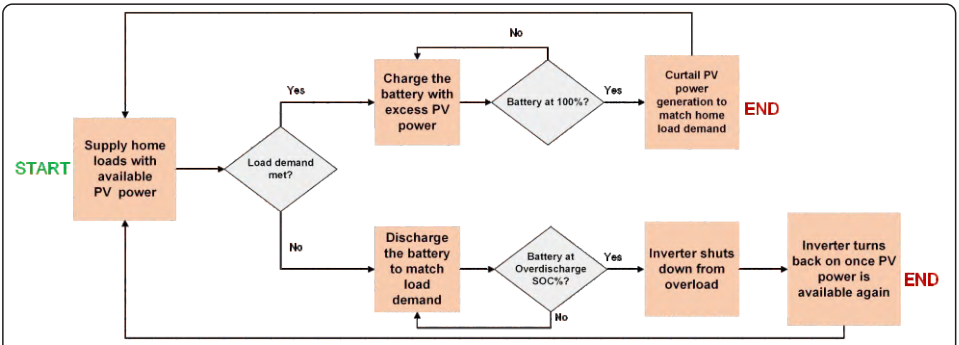


Figure 4.23 Off-grid system with PV & battery logic diagram

4. Operating Modes & Use Cases

4.5.3 Off-Grid with PV, Battery, & Generator on the Smart Port

As discussed in previous sections, a generator can be connected to the Smart Port of the inverter. The inverter will automatically connect/disconnect the generator as needed in grid-forming mode using 2-wire dry contact. When the generator is turned on, the inverter switches to grid-following mode and synchronizes with the generator. Power from the generator is used to recharge the battery and support the home loads. If it is daytime and there is PV power but not enough to support the loads and the battery drains to the set generator start SOC% then the PV will generate power at the same time as the generator. PV power will be curtailed if the load demandsuddenly drops or the PV power suddenly increases due to a rapid increase in irradiance. This is so the generator is not backfed by the PV. The maximum size generator that can be connected to the Smart Port is 24 kW. If a larger generator is required, it must be connected on the grid side as shown in the next section.

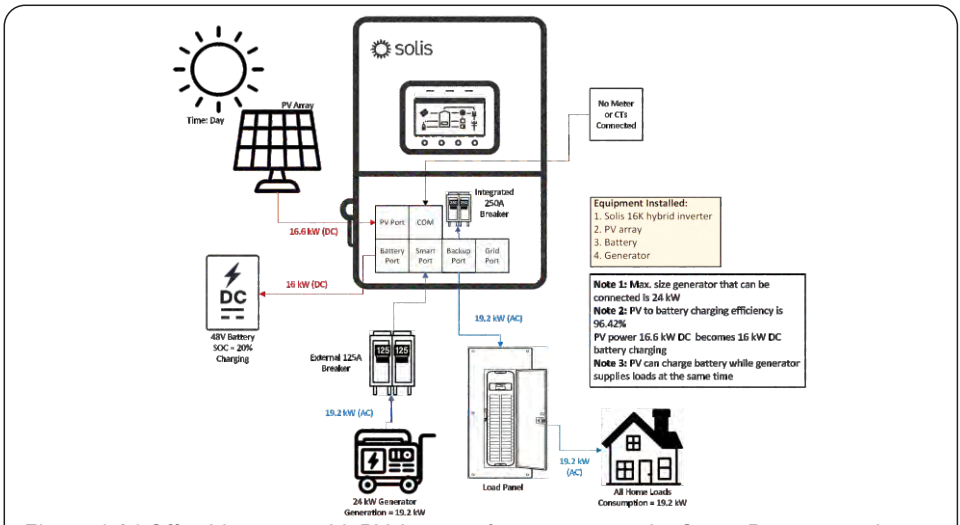


Figure 4.24 Off-grid system with PV, battery, & generator on the Smart Port system layout

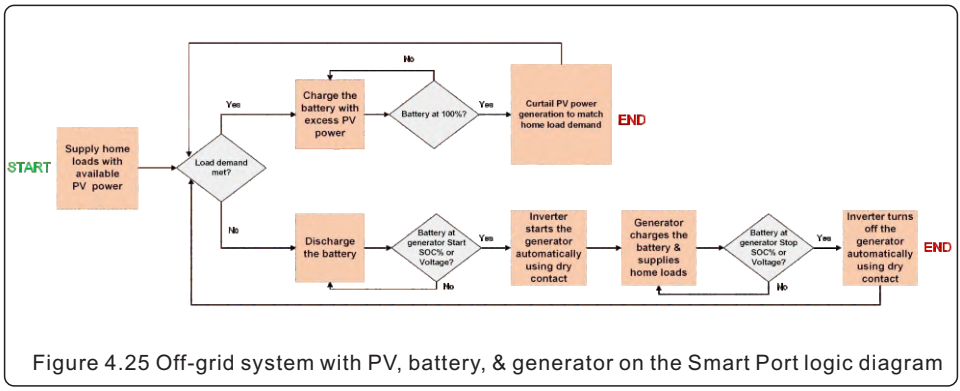


Figure 4.25 Off-grid system with PV, battery, & generator on the Smart Port logic diagram

The external meter does not need to be installed for off-grid systems. However, if a generator is to be installed on the grid side, then the meter + CTs should be installed for full monitoring of the generator.

4. Operating Modes & Use Cases

4.5.4 Off-Grid with PV, Battery, & a Generator on the Grid Port

A generator can also be connected to the grid-side of the inverter instead of directly to the smart port. In fact, if the generator is larger than 30 kW it must be done this way. The generator must support dry contact for the inverter to be able to automatically start/stop the generator based on battery SOC%. Alternatively, or if the generator does not support dry contact, the generator can be manually started and stopped. In this manual mode, the inverter will still synchronize to the generator and use the power from the generator to charge the battery and support loads connected to the backup port. The main disadvantage of this type of system configuration is additional equipment will be required to connect the generator since it is not connecting directly to the inverter.

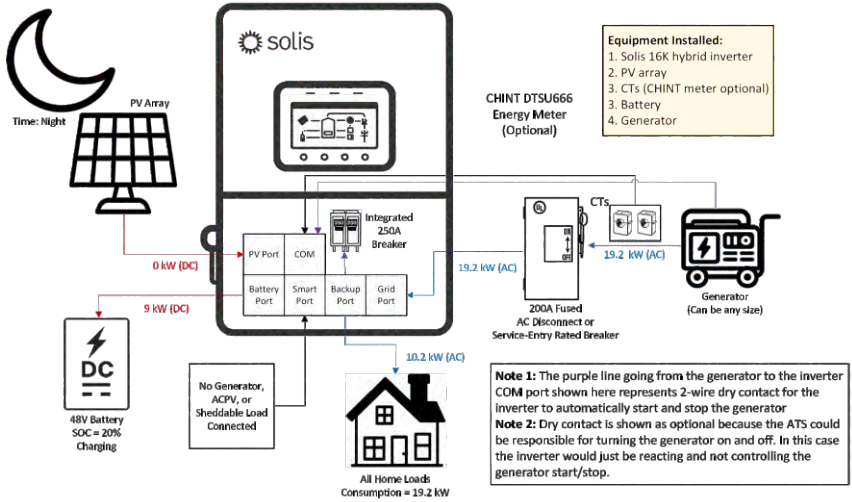


Figure 4.26 Off-grid system with PV, battery, & generator on the Grid Port system layout

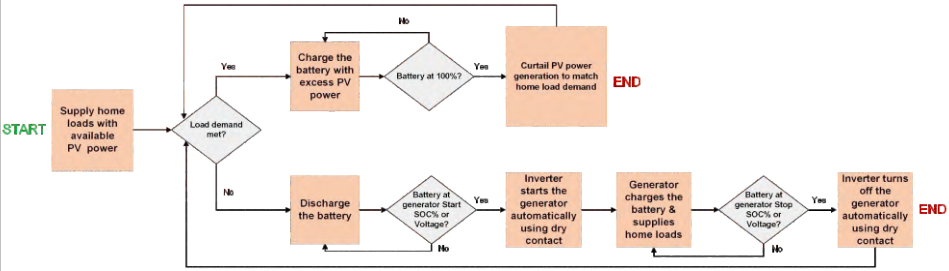


Figure 4.27 Off-grid system with PV, battery, & generator on the Grid Port logic diagram

NOTE:

It is not possible to connect the generator on the grid port and to connect an ACPV system to the Smart Port at the same time. Only one or the other can be done. If an existing system has both ACPV and a generator, it is recommended to connect ACPV to the Smart Port so that it can be supported in grid-forming mode. However, the generator will need to be started and stopped manually. The inverter cannot control both generator and ACPV simultaneously.

4. Operating Modes & Use Cases

4.6 Additional Use Cases

4.6.1 AC-Coupling Solis as a Battery Inverter (Battery + Grid + ACPV)

The Solis hybrid inverter can be AC-coupled to an existing PV system. This configuration involves installing the Solis inverter with a battery in parallel to an existing PV system. The existing PV system could be a microinverter system or another type of string-inverter. Regardless, the Solis inverter will charge the battery with AC power from the existing PV system and can then be programmed to discharge that power during certain times for energy arbitrage. This is the most basic setup as there is no additional PV being installed and connected to the Solis hybrid. Also, the energy meter/CTs are not required.

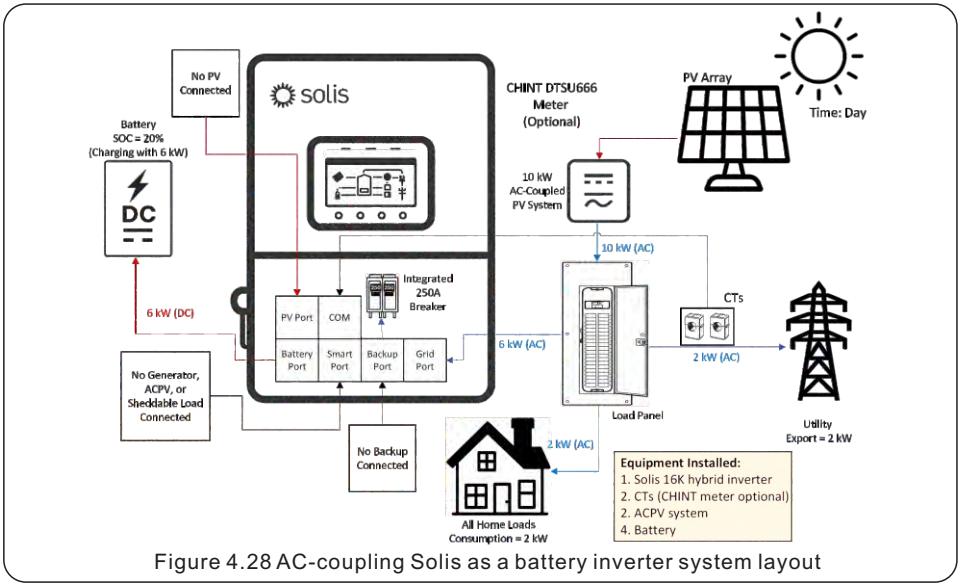


Figure 4.28 AC-coupling Solis as a battery inverter system layout

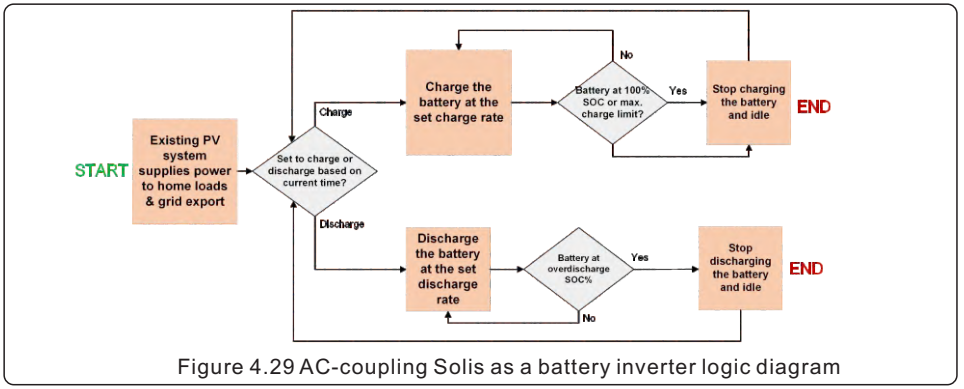


Figure 4.29 AC-coupling Solis as a battery inverter logic diagram

In this example, the battery can only charge and discharge with time-of-use (TOU) settings configured. If your goal is to have the inverter automatically charge/discharge the battery to minimize grid import power, the external CHINT DTSU energy meter and CTs will need to be installed so the inverter can tell when to charge/discharge and with how much power.

4. Operating Modes & Use Cases

4.6.2 Grid-Tied with a Generator & an External Auto Transfer Switch (ATS)

In some cases, an existing generator and auto transfer switch (ATS) are already installed. It may be a significant amount of work to relocate the generator to the Smart Port. The diagram below shows how to integrate the Solis system with an existing generator/ATS combo. A two-wire dry contact connection between the inverter and the generator is optional. If the goal is for the ATS to automatically turn on the generator, then dry contact is not required. However, if the goal is to have the Solis inverter control the start/stop of the generator based on the battery SOC%, then dry contact is required. Regardless of whether or not dry contact is used, a 12V "grid sense" set of two wires must be connected from the ATS to the inverter. If the ATS does not support 12V grid sense, then a 120VAC to 12VDC power converter must be installed on the grid side of the ATS and then connected to the inverter. The purpose of the 12V grid sense is for the inverter to know if the 240V power on the Grid Port is from the actual grid or from the generator. Without this 12V sense, the inverter will assume the power is always from the generator.

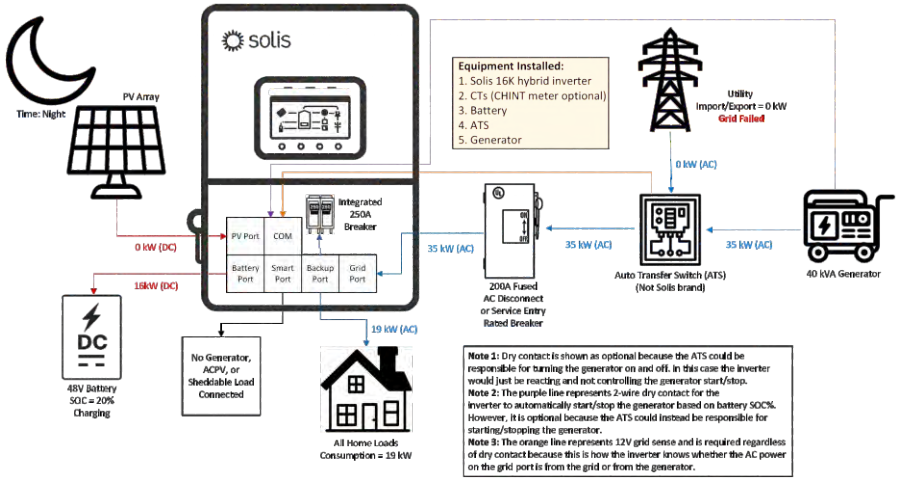


Figure 4.30 Grid-tied with a generator & external auto transfer switch (ATS) system layout

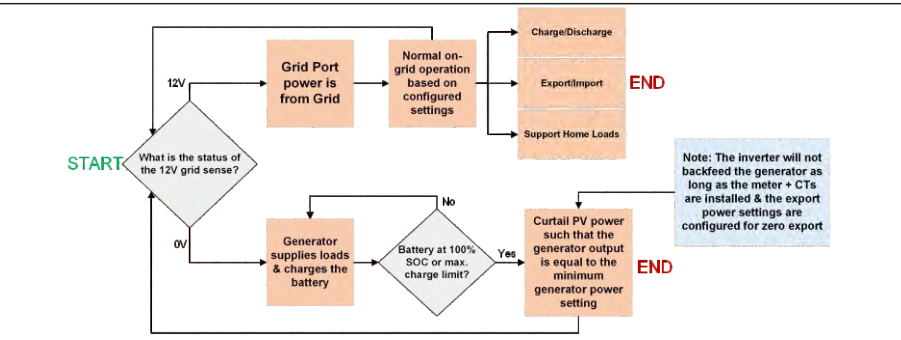


Figure 4.31 Grid-tied with a generator & external auto transfer switch (ATS) logic diagram

The logic table above assumes that the ATS is controlling the start/stop of the generator not the inverter. Dry contact is not being used in this case, only 12V grid sense so the inverter can distinguish grid from generator power.

4. Operating Modes

4.7 Paralleling Multiple Inverters

This section is split into two parts: (1) paralleling the Grid ports and (2) paralleling the Backup ports. The reason for this split is because there are rules and limitations that apply when paralleling the Backup ports together that do not apply if only the Grid ports are paralleled together. Paralleling multiple inverters together entials connecting the Grid ports of multiple inverters together in paralelled breakers within a combiner panel. The same can be done for the Backup ports, but in a different combinerpanel. Both the Grid and Backup Ports can be paralleled as long as separate combiner panels are installed. When using multiple batteries, all units must be connected to a common external busbar before being distributed to the inverters. This ensures balanced voltage and equal current sharing across the entire system. This applies to both paralleling the Grid ports and paralleling the Backup ports.

4.7.1 Paralleling Only the Grid Ports of the Inverters

If the objective is to utilize this inverter for on-grid energy arbitrage (peak shaving, time-of-use, etc.) and not use the grid-forming (backup) function, then only the Grid ports of the inverters will be paralleled together. The Backup ports will not be used in this type of configuration. When using the inverter in this manner, there is no limit to how many inverters can be connected together. All of the inverters in the system will synchronize with the grid and will charge/discharge evenly to meet load demand. One meter and set of CTs can be used for all of the inverters as long as the inverters are all daisy-chained together with communication cables as explained in Section 5.12.5

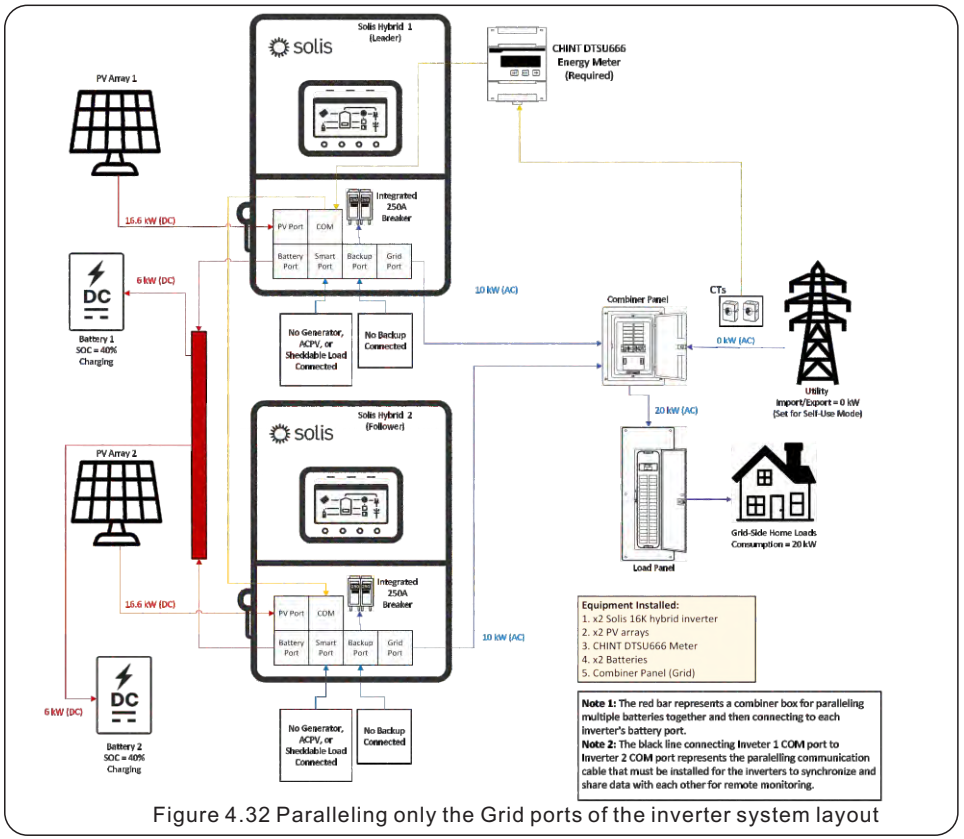
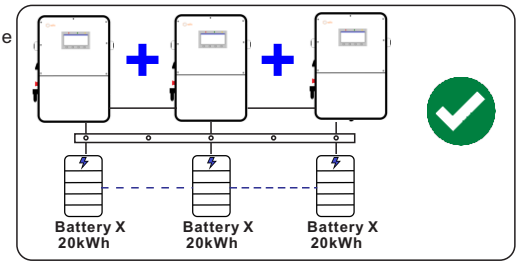


Figure 4.32 Paralleling only the Grid ports of the inverter system layout

4. Operating Modes

If multiple batteries are connected to paralleled inverters, they must all be the same brand, same model number, and same size kWh capacity. It is not possible to install batteries of different brands, models, and sizes in the same system. This rule applies both to paralleling only Grid ports and to paralleling Backup ports. Similar inverters have this same requirement, it is not unique to Solis.



4.7.2 Paralleling the Backup Ports & the Grid Ports of the Inverters

Paralleling the Backup ports of the inverter increases the amount of capacity the system owner can utilize when the grid fails or if there is no grid (off-grid systems). However, paralleling the Backup ports carries some restrictions, rules, and limitations that must be followed in order to ensure reliability, safety, and warranty integrity. These rules, explained in Section 4.7.3, apply when paralleling the Backup ports of the inverter and do not apply if only the grid ports of the inverter are being paralleled. This is because the inverter does grid-forming on the backup side and that requires tight synchronization between the inverters in order to properly balance power, maintain a stable microgrid, etc. If you are not paralleling the backup ports please skip this section and ignore the rules listed below as they do not apply to your system if you are paralleling the Grid ports only.

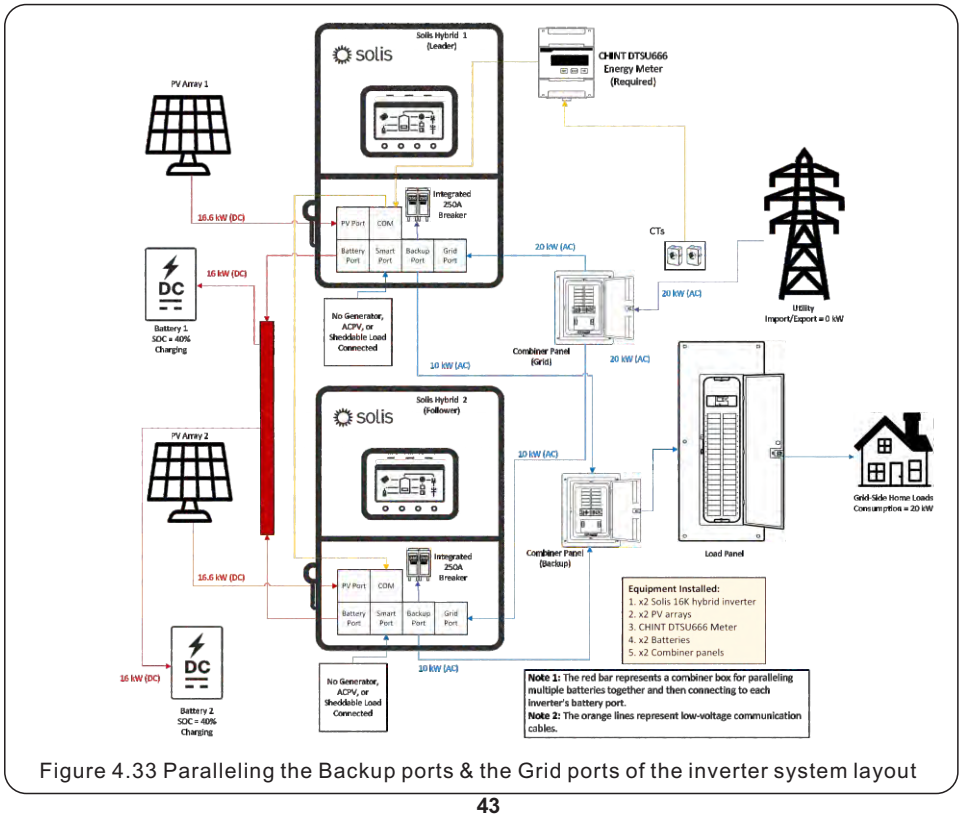


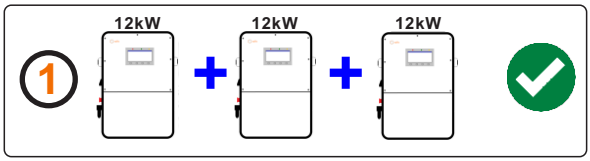
Figure 4.33 Paralleling the Backup ports & the Grid ports of the inverter system layout

4. Operating Modes

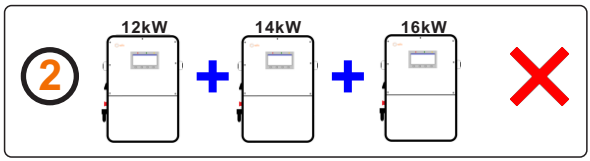
4.7.3 Paralleling Rules & Requirements (when Paralleling the Backup Ports)

There are a few requirements for installing multiple inverters in parallel for backup power. Please note that these caveats do not apply if you are only paralleling the Grid ports as explained in Section 4.7.1.
The restrictions outlined below only apply when you are paralleling the Backup ports together.

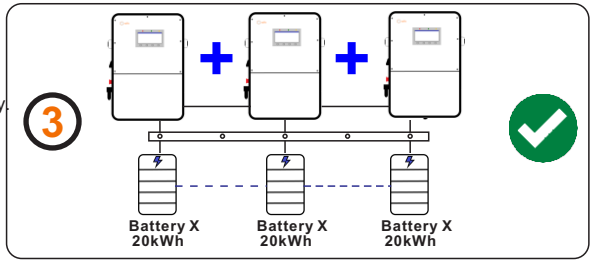
1. Paralleled inverters must all have the same nameplate rating, or same model number. Rule 2 is the same just explained in another way.



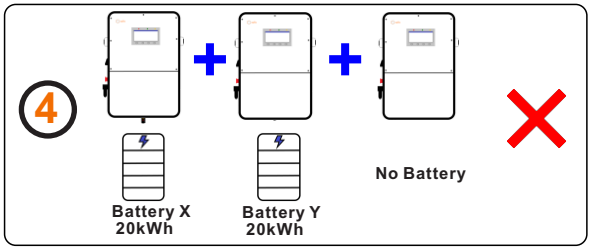
2. Do not parallel inverters that have different nameplate ratings. The inverter is unable to properly balance power when they are different sizes.



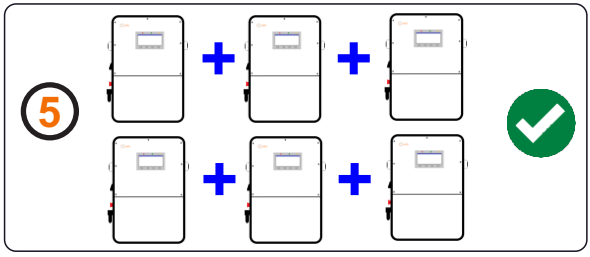
3. If multiple batteries are connected to paralleled inverters, they must all be the same brand, same model number, and same size kWh capacity. This rule applies both to paralleling only Grid ports and to paralleling Backup ports. The batteries must all be connected to a common bus or combiner box before going to each inverter.



4. Do not install some inverters with batteries and some without batteries. Every inverter must either have a battery or not have a battery. The batteries must all be the same size kWh capacity.

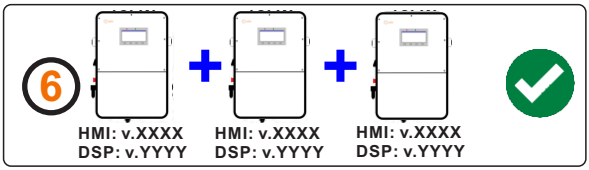


5. A maximum of six (x6) inverters can be paralleled together if the Backup ports are being paralleled. This limit does not apply if only the Grid ports are being paralleled.

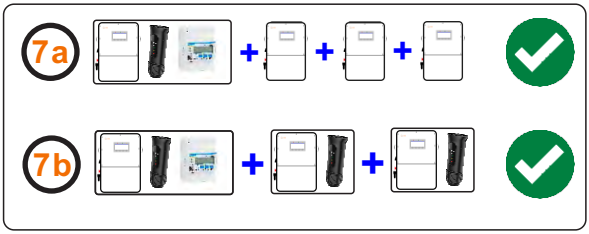


4. Operating Modes

6. During commissioning, check to make sure the inverters are all on the latest firmware version. The inverters must all be on the same firmware version and it should be the newest version available.



7a. The energy meter and the logger only need to be connected to the master.
7b. Doing remote firmware updates is smoother if every inverter has its own logger connected to it. Only the leader inverter needs the energy meter connected.



8. 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.

9. The parallel settings for each inverter must be configured prior to initiating operation. These settings can be found on page 85.

10. 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. Once you confirm each inverter is able to operate normally as a single independent master unit, then configure them for parallel operation.

11. When connecting multiple inverters in parallel, it is strictly required that all AC connections are perfectly phase-aligned across all units. L1 on Inverter 1 MUST connect to L1 on all subsequent inverters and the main electrical panel. L2 on Inverter 1 MUST connect to L2 on all subsequent inverters and the main electrical panel. Neutral must be shared and correctly landed across all units.

4. Operating Modes

4.8 Wiring Diagrams

Note 1: The diagrams on the next few pages show the grid connecting through a fused disconnect switch. However, a service entry-rated overcurrent protection device, such as a 2-pole circuit breaker, is also acceptable. For simplicity, each diagram will show a fused disconnect switch.

Note 2: The CHINT meter is only required when one of the following conditions occur:

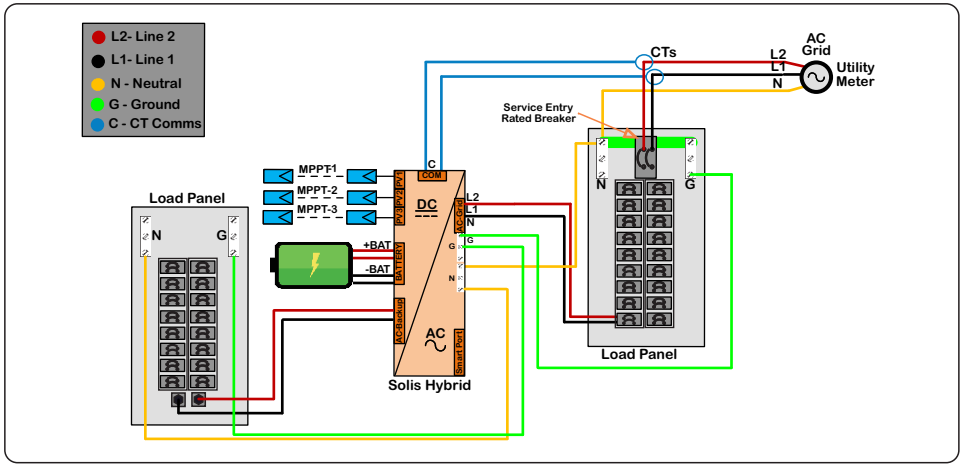
(1) there is more than one inverter in the system

(2) The inverter is installed more than 4.92 feet (1.5m) from the utility point of common coupling

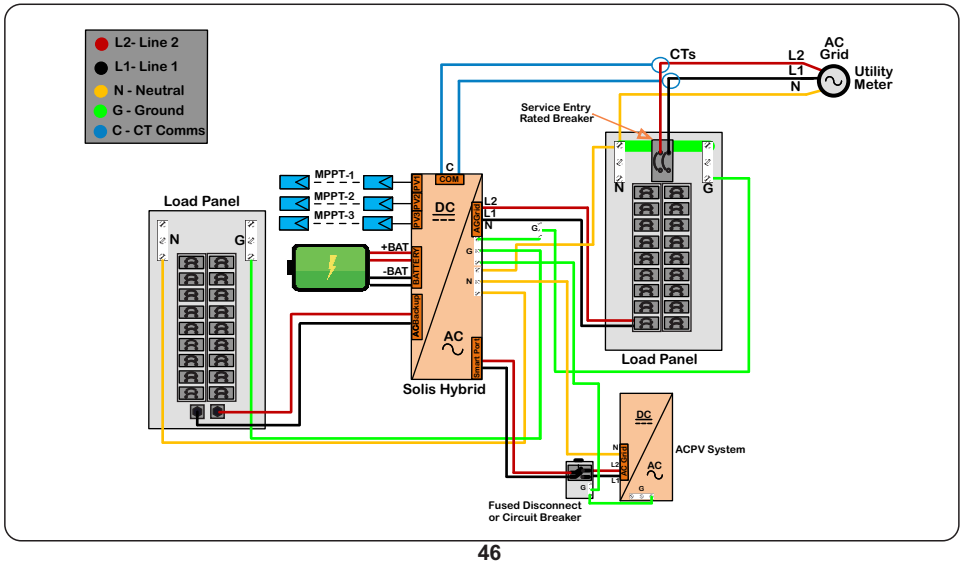
(3) split-core 250A CTs are inadequate and Rogowski coils or higher-rated CTs are required

If none of the conditions listed above are met, CTs can be directly connected to the inverter.

4.8.1 Partial-Home Backup with One Solis Hybrid Inverter

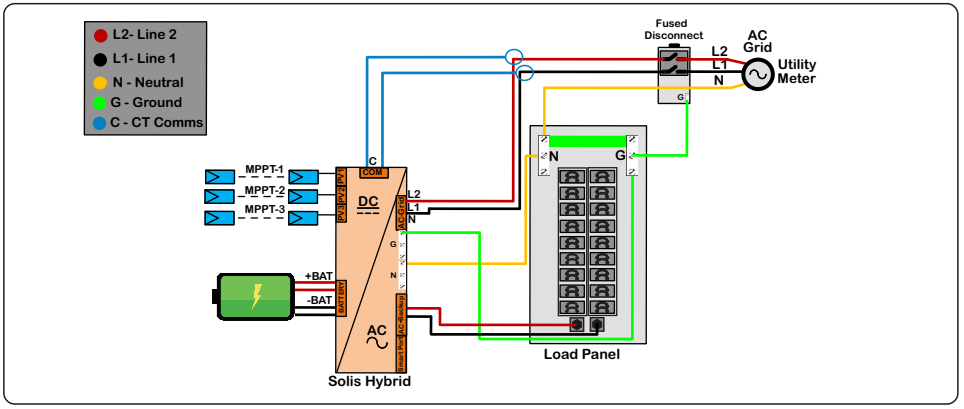


4.8.2 Partial-Home Backup with One Solis Hybrid Inverter & an AC-Coupled PV System



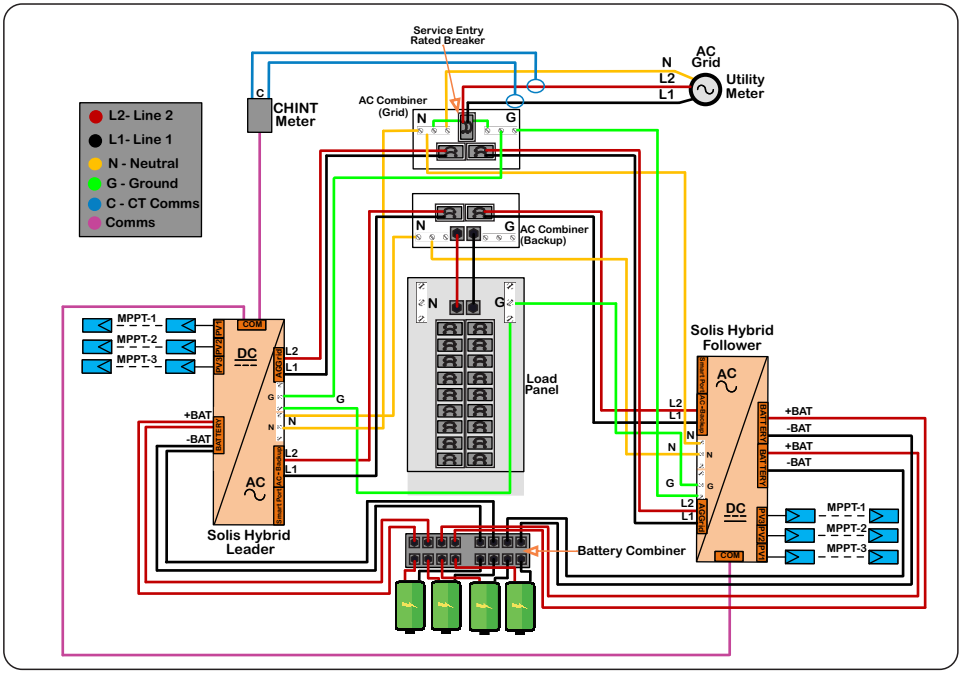
4. Operating Modes

4.8.3 Whole-Home Backup with One S6 Hybrid Inverter



4.8.4 Whole-Home Backup with Multiple S6 Hybrid Inverters

Whenever multiple inverters are installed, the batteries must all be paralleled together in some kind of combiner box. This is required whether only the Grid ports are being paralleled or both Grid and Backup ports are being paralleled. You will also need to install an AC combiner box to connect the Grid ports of the inverters together in parallel. Another combiner panel will need to be installed for paralleling the Backup ports of the inverters together. This is required for all multiple-inverter systems.



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.

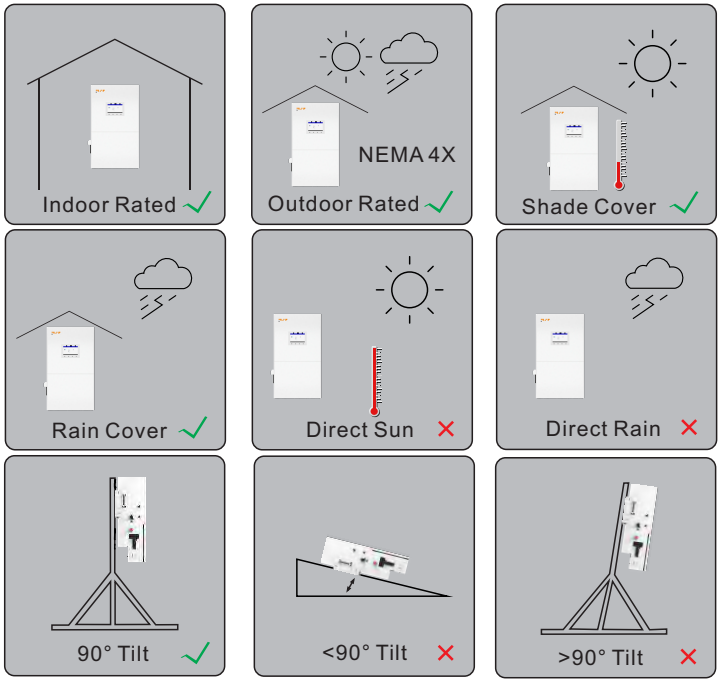


Figure 5.1 Recommended Installation locations

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

Avoiding direct sunlight

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

The inverter cannot be installed on a roof unless it is sheltered from direct sunlight.

Direct exposure to sunlight could cause:

- Power output limitation (decreased energy production based on the temperature derating curve).
- Premature wear of the electrical/electromechanical components.
- Premature wear of the mechanical components (gaskets) and user interface.

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.

Flammable substances

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

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.

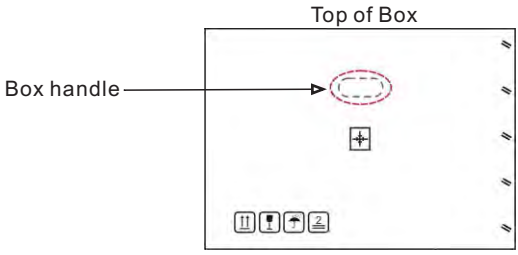


Figure 5.2 Handles for moving the inverter shown circled in red - one per side

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 (75˚C). Do not touch the heat sink while the inverter is operating. Do not store flammables near the inverter.

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

Maximum Temperature	Minimum Temperature	Max. Relative Humidity	Maximum Altitude
140°F 60°C	-13°F -25°C	100% Non-Condensing	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
145.06 lbs x 4 = **580.24 lbs**

Figure 5.4 Load bearing structure

Clearances

- If multiple inverters are installed on site, a minimum clearance of 19.7 inches should be kep between each inverter and all other mounted equipment. The bottom of the inverter should be at least 31.5 inches above the ground.
- 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.

Consult technical data

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

Angle of installation

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

5. Installation

5.3 Inverter Dimensions

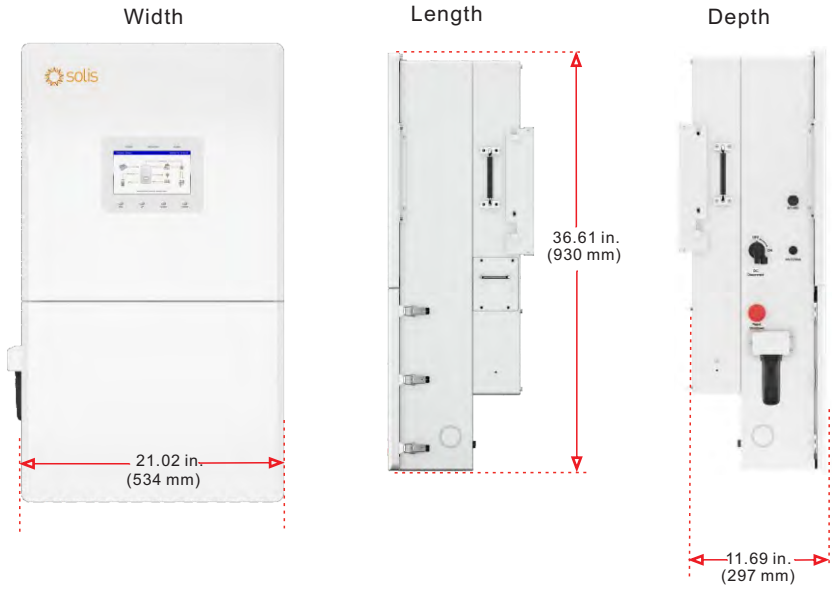


Figure 5.5 Inverter dimensions

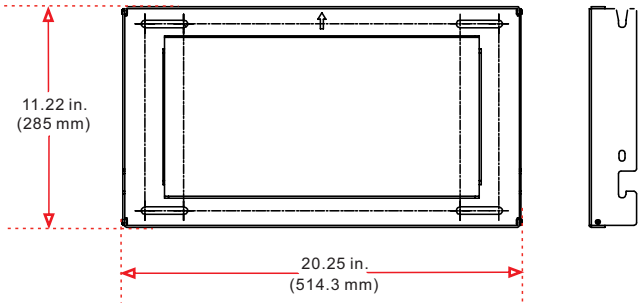


Figure 5.6 Inverter bracket dimensions

NOTE:
The inverter weighs 145.06 pounds (65.8 kg) outside of the box.

5. Installation

5.4 Mounting the Inverter

- Mount the inverter on a structure that is capable of bearing the weight, which is **145.06 lbs** (65.8 kg)
- 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 should be kept between the bottom of the inverter and the ground.

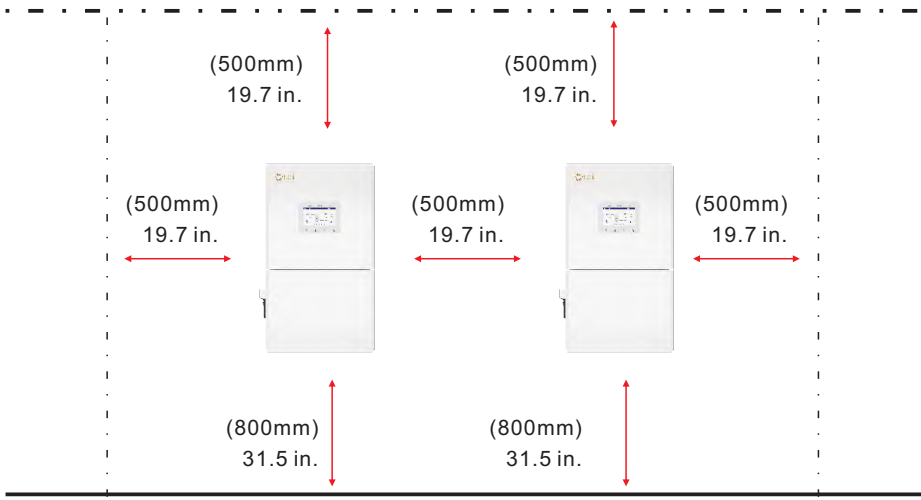


Figure 5.7 Inverter mounting clearances

- Visibility of the LCD screen should be considered. Ideally, the screen should be at eye-level.
- Adequate ventilation around the inverter must be provided. Do not store anything on top of, next to, or underneath the inverter. Be sure the room the inverter is installed in stays well-ventilated.

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 previous 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 necessary. 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.

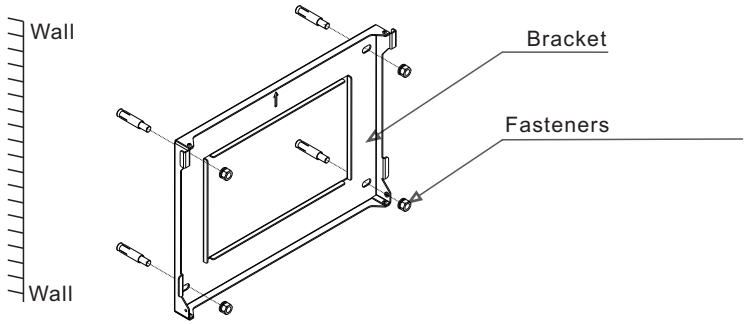


Figure 5.8 Fix the bracket to the wall

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.

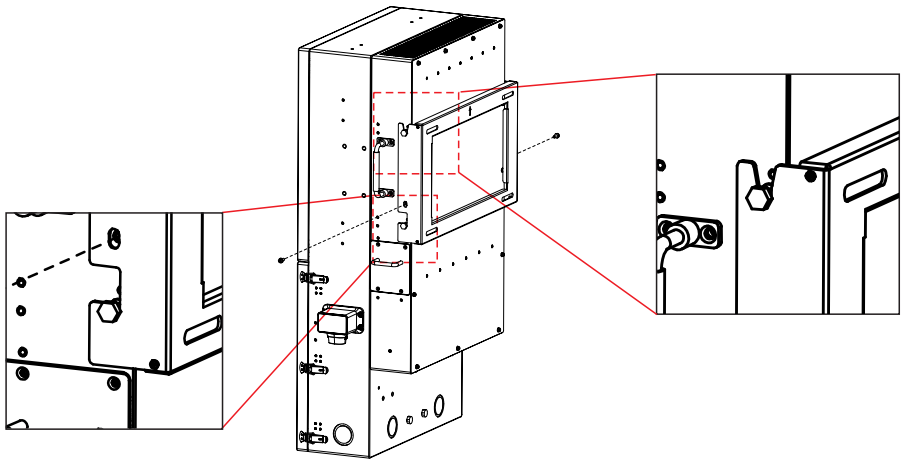


Figure 5.9 Inverter on mounting bracket and set screws

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

Terminal	Max.Conductor Size	Torque Specifications
PV	8 AWG	N/A
Battery	4/0 AWG	9.6-11 ft-lbs 13-15 N-m.
AC Grid	4/0 AWG	
AC Backup	4/0 AWG	
Ground	2/0 AWG	
Neutral	4/0 AWG	
Smart Port	4/0 AWG	

Figure 5.10 Max. conductor size and torque spec chart

Inverter Terminal Operation

AC and battery terminals are all 8mm Hex.
Neutral bus bar terminals use 8mm Hex.
Ground bus bar terminals use 5mm Hex
The PV terminals can be operated with fingers only, no tools.
The communication terminals require a small flat screwdriver.
Torque all terminals to 9.6-11 ft-lbs (13-15 N-m) with a torque wrench screwdriver. Do not overtighten the terminals.

5mm Hex Tip
8mm Hex Tip

Torque Wrench
Screwdriver

Removing the Conduit Knockouts

To remove the plastic conduit knockouts, hold the lock ring on the inside of the wire box with one hand. Hold the knockout face on the outside of the wire box with the other hand. Then, twist the lock ring counter-clockwise until the knockout plug comes apart and can be removed. Channel locks can be used if it is too tight to turn by hand.

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.

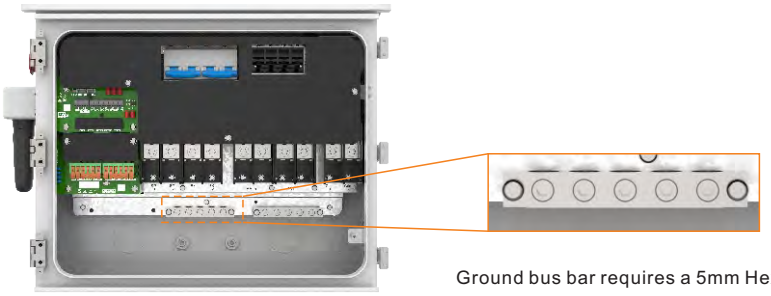


Figure 5.11 Internal grounding conducto terminal location

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

1. Strip ½ inch of insulation off the end of the ground conductor.
2. Use a 5mm Hex torque wrench 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 it is between 9 and 11 ft-lbs. 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

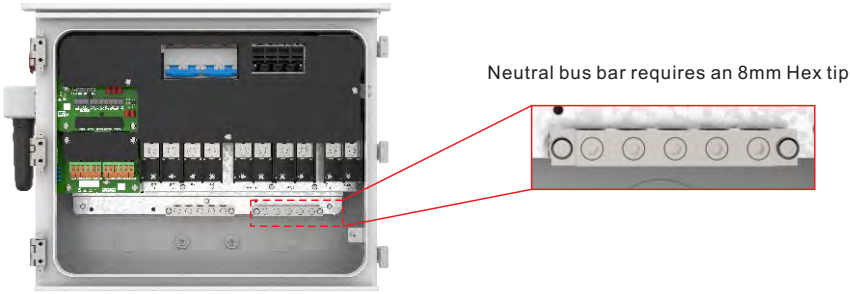


Figure 5.12 Internal neutral conductor terminal location

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.

The inverter has a total of x3 MPPTs each with two PV string inputs. PV strings connected to the same MPPT must have voltages that are ± 10% of each other. For example, if string 1 is 450V, then string 2 cannot be greater than 495V (450V + 45V) or less than 405V (450V - 45V).

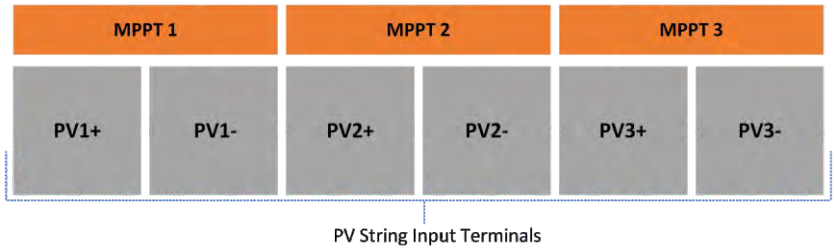
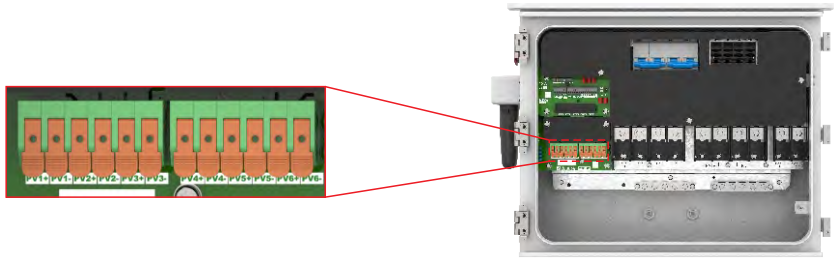


Figure 5.13 PV input terminals & correlated MPPTs

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 of **550Vdc** that occurs on the coldest day possible. Violating this condition will void the inverter warranty.
- Ensure the polarities of the PV strings are correct (ex: positive is positive & negative is negative).
- Ensure the inverter DC-switch, battery, AC-Backup, and AC-Grid breakers are all off.
- Ensure the PV resistance to ground is higher than 20K ohms.
- Ensure that the Isc and Imp of the strings will not exceed the maximum DC input current ratings: The maximum *input current* is **40A** per MPPT. The maximum *short-circuit current* is **50A** per MPPT.



1. Strip ½ inch of sheath off the ends of each PV cable.
2. Pull up on the orange tab above the PV terminal, this opens the terminal gate.
3. Insert the end of the PV cable into the now open terminal.
4. Pull down on the orange tab 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 5.14 PV cable connection

5. Installation

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:

1. Use a DC amp clamp multimeter to measure the DC string current.
2. 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.
3. Once the current is below 0.5A, you are allowed to open the DC switch and then disconnect the PV strings from the inverter.
4. In order to completely eliminate the potential for failure, leave the PV strings disconnected until the cause of the reverse polarity is corrected.

5.8 Rapid Shutdown and Emergency Power Off

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

IMPORTANT:

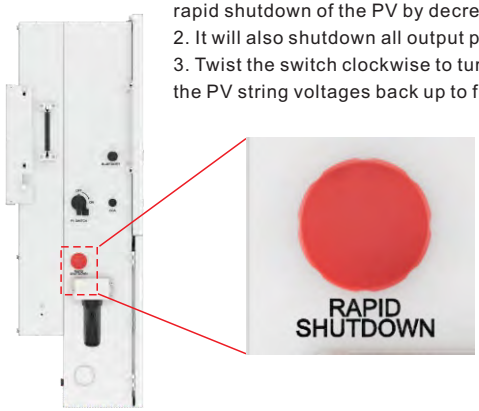
The inverter can be ordered with an internal rapid shutdown transmitter. This transmitter brand must match the receivers that are being installed with the PV modules. **Failing to use the transmitter per the requirements may damage the inverter. This damage will not be covered under the inverter warranty.**

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.

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 brings 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 5.15 Inverter rapid shutdown and EPO initiation switch

5. Installation

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:

Inverters without an integrated transmitter also do not include an RSD/EPO E-stop switch. An external switch will need to be installed if you purchased an inverter that does not have an integrated transmitter and you need EPO.

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.

Solis S6 Hybrid Inverter

Rapid Shutdown PLC Transmitter

Rapid Shutdown PLC Receiver

Figure 5.16 Components listed in a Photovoltaic Rapid Shutdown System (PVRSS) Certification

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 Installing an External Rapid Shutdown Transmitter

As explained in Section 1.6 the inverter can be ordered with either (1) a Tigo transmitter (2) an APS transmitter or (3) no transmitter. The Tigo and APS transmitters come built-into the inverter. However, if the wrong transmitter is ordered or if the only units available for purchase are the kind with no transmitter, it is possible to install an external transmitter, which in this section will also be referred to as a non-integrated transmitter. Another example is the Tigo CCA, which cannot come integrated in the inverter but can be installed externally or inside the wire box. Most transmitters requires 12V for power but the Tigo CCA requires 5V so a buck converter will be needed if the CCA is going to get power from the inverter. Alternatively, a 120VAC to 5VDC converter could be used.

IMPORTANT:

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

5. Installation

There are two options for providing 12VDC to the transmitter. The first option is to install a 120VAC to 12VDC converter. The second option is to get 12VDC from the inverter. It is recommended to install an external enclosure to house the transmitter and power supply. However, it is acceptable to lay the transmitter somewhere inside the inverter wire box, wherever it can fit. The PV cables will go through transmitter core and then land in the inverter PV terminals.

Steps for Installing a External Transmitter Using Inverter 12VDC Power:

1. Install the transmitter either inside the inverter wire box or within an external enclosure.
2. Connect one black wire (max. 16 AWG) to the RT2 port of the inverter shown in the diagram below. This wire will connect to the 12V negative port of the transmitter 12V input.
3. Remove the small red jumper that connects RSD+ to RSD- and then insert red wires into both of those ports. Then land those two wires into a three-port connector or wire nut.
4. Connect another red wire to the third port of the connector. Then land it in the 12 positive port of the transmitter.
5. If the inverter is purchased with no internal transmitter then it will not include a rapid shutdown E-stop button switch. Therefore, an external initiation switch will need to be installed as well.

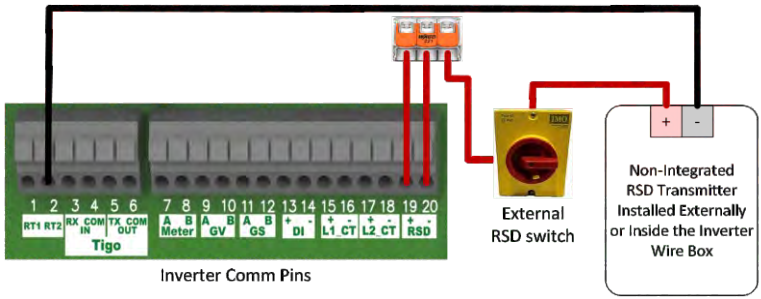


Figure 5.17 Installing an external transmitter using 12V from the inverter

5.8.4 Tigo Cloud Connect Advanced (CCA) and TS4-A-O Optimizers

The inverter is PVRSS-certified with the Tigo CCA and TS4-A-O optimizer. It is not certified with the TS4-A-S. However, the inverter cannot be purchased with an integrated Tigo CCA. The CCA must be installed externally or inside the wire box. There is no direct communication between the inverter and the Tigo CCA. Tigo and Solis monitoring can be used simultaneously, but Tigo data will not display on SolisCloud and Solis data will not appear on Tigo Energy Intelligence. For module-level monitoring Tigo's platform will have to be used. The CCA needs 5V at 1A (5W) max. but typically draws about 2W to 4W when operating. Since only 12V is available from the inverter, a buck converter is required to change the inverter 12V to 5V for the CCA. Do not connect 12V to the CCA, it will damage it.

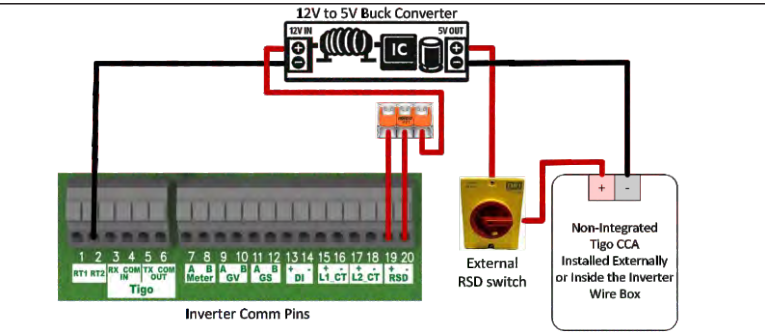
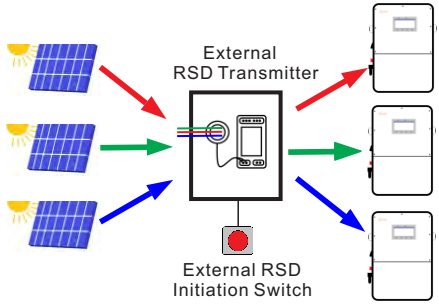


Figure 5.18 Installing an external Tigo CCA using 12V from the inverter and a buck converter

5. Installation

5.8.5 Multiple Inverters with a Single External Transmitter

If multiple inverters will be installed in parallel, it is possible 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 full system. Run all of the strings through the external rapid shutdown enclosure first and then to each inverter. Some transmitters allow for two cores to be connected, meaning up to 20 strings can be supported by a single external transmitter. Please see the diagram below.



Note: Hybrid inverters shown here do not have internal transmitters. The external transmitter initiates RSD for all of the inverters in the system.

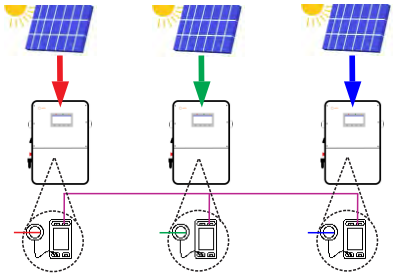
5.19 Multiple inverters with a single external RSD transmitter

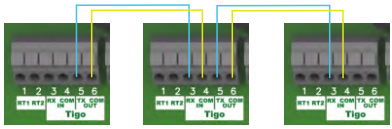
5.8.6 Multiple Inverters with Multiple Integrated APS Transmitters

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. APS transmitters cannot be synchronized with each other like Tigo. 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 from happening. This issue only occurs when installing multiple inverters that all have integrated transmitters. For systems with one inverter/transmitter, cross-talk is not a problem.

5.8.7 Multiple Inverters with Multiple Integrated Tigo Transmitters

Integrated Tigo transmitters can be daisy-chained together with two wires. This allows the transmitters to synchronize with each other so that cross-talk is eliminated. There are designated terminals on the inverter comm board specifically for daisy-chaining Tigo transmitters together. Link the integrated transmitters by running wires from TX out to RX IN and from COM out to COM in. Engaging the RSD initiation switch on the master inverter wire box will initiate rapid shutdown for all of the inverters.





Use a small common technician screwdriver to push in the small grey square above the terminal to open it. Insert the stripped end of a wire (up to #16 AWG max.) and then release pressure on the screwdriver to close the terminal, which uses a spring-clamp to secure the wire.

5.20 Daisy-chaining multiple inverters with multiple integrated Tigo transmitters

Failing to daisy-chain the Tigo transmitters together can result in cross-talk which may damage the inverter, RSD devices, or PV modules.

5. Installation

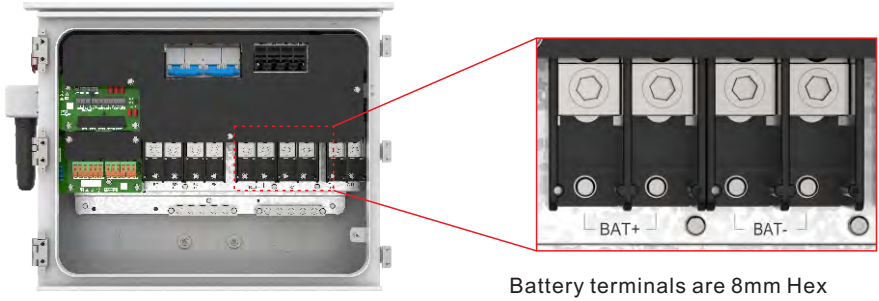
5.9 Battery Installation

The battery voltage range is 40 - 60VDC. The maximum charge/discharge current ratings vary by model. 9.6kW is rated for 200A and the 16kW is rated for 290A. The inverter can work with lead-acid or lithium batteries. However, it can only do closed-loop (CAN) with specific lithium batteries.

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.
Do not reverse the polarity of the battery conductors, this is crucial.

1. The battery (+) and (-) cables shall only be connected to the inverter BAT terminals.
2. Run the cables into the wire box. Strip ½ inch off the ends of each cable.
3. Loosen the battery terminals using an 8mm Hex torque wrench
4. Insert the ends of the battery cables into the terminals one at a time
5. Tighten the terminals to between 9.6 and 11.06 lbf-ft (13-15 N.m) using the torque wrench
6. Give the cables a gentle tug test to ensure that they are secure

If you are installing multiple inverters with multiple batteries, be sure to bus all of the batteries together first before connecting to the inverters. The inverters must all share a single DC bus with the batteries.



Battery terminals are 8mm Hex

Figure 5.21 Battery cable connection

Battery Compatibility and Connecting Multiple Batteries with Multiple Inverters

This inverter supports both closed-loop (CAN) communication with specific 48-52V lithium batteries. A table showing the compatible batteries can be found on page 13. The inverter can also work with open-loop (voltage-controlled) batteries not using communication with the inverter. The inverter has has two battery inputs and can connect to two different BMS at the most. However, if multiple inverters and multiple batteries are being installed, then all of the batteries must be bussed together before connecting to each inverter.

Black Start

In a situation where there is no grid and no PV, the inverter is able to use the battery to black start. The battery will 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 and the BMS until PV is available to charge the battery. It is best to keep the Overdischarge SOC% set to a minimum of 10% with 20% being a safer choice if there is a chance of a blackstart situation occuring.

NOTE:
Before connecting the battery, please read the product manual of the battery & perform the installation exactly as the battery manufacturer specifies.

5. Installation

5.10 AC Wiring

5.10.1 AC Terminals

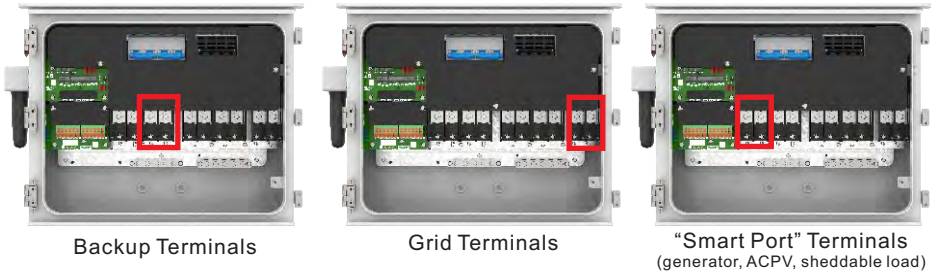


Figure 5.22 AC terminals: Backup, Grid, & Smart Port

Backup: **Grid-forming only.** 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: **Grid-following only.** 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).

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 service-rated breaker or fusible disconnect switch. The AC backup terminals will directly connect to the lugs of a service panel (up to 200A) where the home loads breakers are located.
The inverter has a power pass-through capability from the grid to the loads when grid is available and there is not enough PV or battery to support. The pass-through power limit is 180A. Per NEC requirements for continuous loads (NEC 210.20(A), 215.3, 230.42), a 200 A residential service is limited to 160 A of continuous current. Accordingly, passthrough current ratings above 160 A do not increase the allowable continuous load on a 200 A service. Therefore, 180A continuous can support a main service panel that is 200A-rated.

5.10.2 Using Aluminum Conductors

The battery and AC terminals are copper. If aluminum cables are used then you must use a CU/AL bimetallic compression ferrule or splice connector. This is to ensure there is no corrosion caused by using dissimilar metals. It is also recommended to apply a UL-listed an anti-oxidation compound to the conductors such as Noalox, Ox-Gard, or Penetrox.

5. Installation

5.10.3 Maximum Pass-Through Power

During normal grid-connected operation the maximum continuous grid to backup pass-through current is stable up to **180A**. Above 180A the inverter will trip off for overload and will turn back on after five minutes. If the home has a 200A main breaker, then per NEC **160A** is the maximum amount of continuous power that should ever be going through it. The previous page goes over this.

The two cases in which the inverter would need to pass through power to the loads from the grid are:

Case 1: Insufficient PV and Battery Power

In this case, the inverter does not have enough power from the PV and battery combined to support the home loads. It could be after the sun has set, in heavily overcast weather, or if there is a large amount of load consumption relative to how much PV and battery power has been installed.

Case 2: Soft-Fault

If the inverter has a soft fault then it may shut down temporarily. When this occurs, the PV and battery are suspended until the inverter recovers. This is covered in the next section.

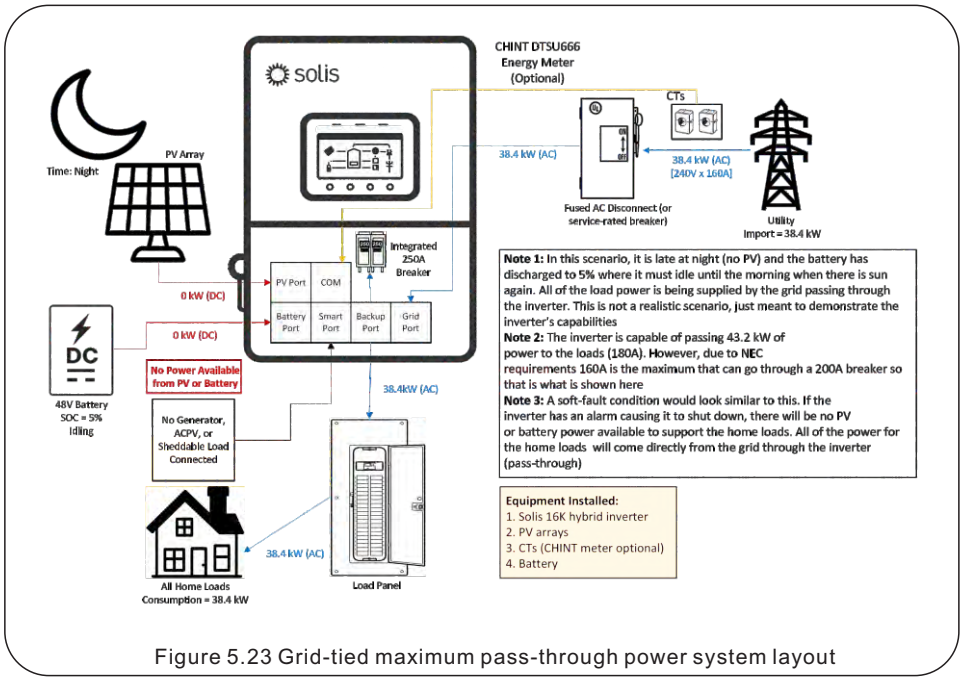
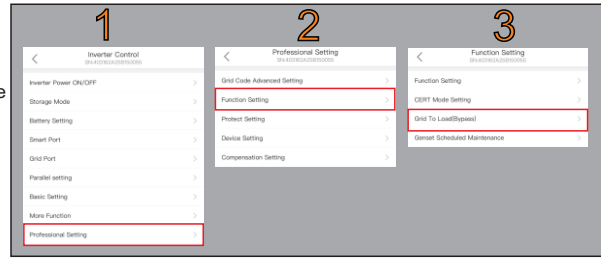


Figure 5.23 Grid-tied maximum pass-through power system layout

Automatic Bypass Setting



There is a setting for the automatic bypass function that comes enabled by default from the factory. If you have loads connected to the backup side of the inverter, it is recommended to check this setting to ensure that the loads will be supported with grid power if one of the two cases above are experienced. This can be done by going to the main settings/control menu for the inverter. Tap/click Professional Settings. Tap Function Setting, then tap Grid To Load(Bypass) setting. If the setting is missing, then it is enabled by default.

5. Installation

5.10.4 AC Bypass: Soft Fault (Automatic)

The second case discussed in the previous section is a soft-fault condition. In the event of a soft fault, such as an alarm state, the inverter will automatically switch into bypass mode. This is covered in the previous section and will be covered again in Section 6 Commissioning.When the soft fault occurs, the inverter will pass power to loads connected to 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 automatically when the inverter has an alarm and shuts down or does not have enough PV or battery power to support the loads and must supplement them by importing power from the grid.

5.10.5 AC Bypass: Hard Fault (Installing an External ATS)

A hard fault could be a component failure, thermal event, or other kind of hardware-related issue that causes a serious malfunction. In this case, the loads connected to the backup side may lose power. If you cannot risk the home ever being without power then it is recommended to install an external third-party autotransfer switch (ATS). This way the home loads will be protected even in the event of a catastrophic inverter failure. The diagram below shows how an external ATS in the system to ensure that the home loads get power from the grid no matter what happens to the inverter/PV/battery.

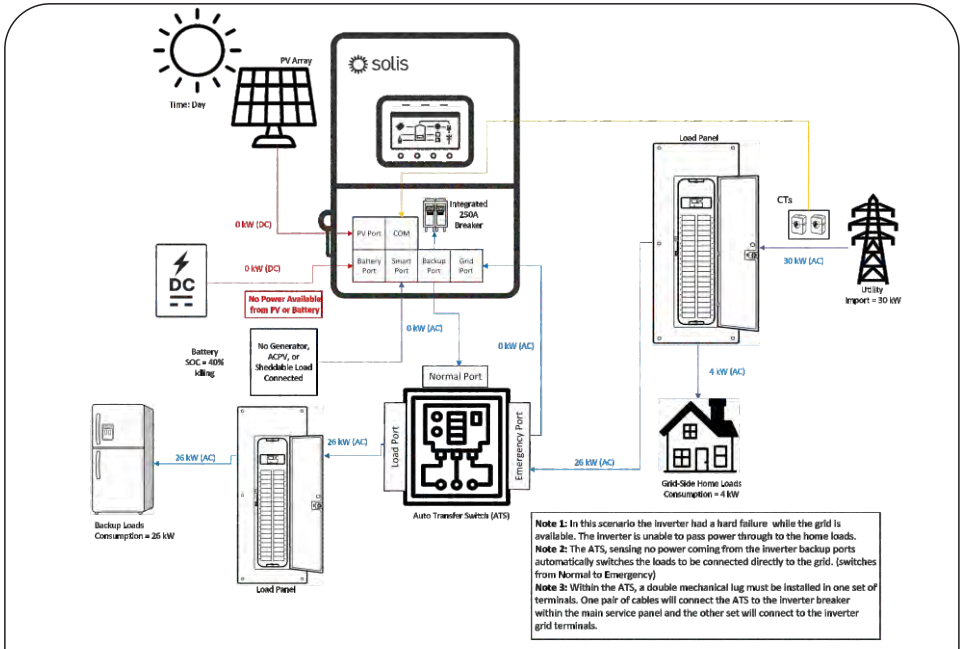


Figure 5.24 Using an external ATS to bypass the inverter during a hard failure layout

Since there is no comms between the inverter and external ATS, any ATS can be used. The ATS will automatically switch the loads to be connected to the grid if it senses there is no power coming from the backup port of the inverter. Generac, Eaton, Cummins, and ASCO all sell 200A-rated autotransfer switches that can be used as shown in the diagram above.

5. Installation

5.10.6 AC Current Ratings Including Surge Capacity

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 5.21. The largest cable size that will fit in the AC Grid, Backup, Smart Port , and Neutral terminals is 4/0 AWG. Copper cable should be used. If aluminum conductors are used, then a bimetallic splice connector or compression terminal pin must be used along with an anti-oxidant compound.

Inverter Nameplate Rating	Grid Maximum Output Current	Grid Max Pass-Through Current	Backup Rated Output Current	Surge Current (10 seconds)	Surge Current (1 second)
9.6 kW	41.25A	180A	41.25A	80A (19.2 kW)	120A (28.8 kW)
11.4 kW	47.5A	180A	47.5A	95A (22.8 kW)	142.5A (34.2 kW)
12 kW	50A	180A	50A	100A (24 kW)	150A (36 kW)
14 kW	58.3A	180A	58.3A	116.6A (28 kW)	174.9A (42 kW)
16 kW	66.7A	180A	66.7A	133.4A (32 kW)	200.1A (48 kW)

Figure 5.25 Current ratings for sizing the over current protection device (circuit breaker)

5.10.7 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. The next section explains how to wire the system based whether you are installing a partial or whole-home backup system.

1. Partial-home backup: A limited number of loads will be backed up. Some loads will be left on the grid-side not to be backed up when the grid fails. A separate distribution panel will need to be installed and connected to the backup port of the inverter.

2. Whole-home backup*:* Every home load will be backed up. No loads will be left on the grid-side, all will be supported when the grid fails. The existing distribution panel can be used, a new panel does not have to be installed depending on the exact setup.

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. Loosen the BK-L1, BK-L2, Grid-L1, and Grid-L2 terminals using an 8mm Hex screwdriver
4. Insert the ends of the L1 and L2 conductors into the appropriate terminals one at a time
5. Use a torque wrench screwdriver to tighten the terminals to between 9.6 and 11.06 lbf-ft (13-15 N.m)
6. Give the conductors a gentle tug test to ensure that they are secure
7. If any of the conductors feel loose, repeat steps 3-6
8. Connect the other ends of the Grid L1 and Grid L2 conductors in the main service panel to a breaker and to the neutral bus bar.
9. Connect the other ends of the Backup L1 and Backup L2 conductors to the corresponding terminals within the backup service panel either to the panel lugs or to a breaker.

Note: The inverter can be ordered with a Backup breaker built into the inverter.

10. Keep all AC breakers turned OFF for now. Only turn them on when doing the commissioning.

5. Installation

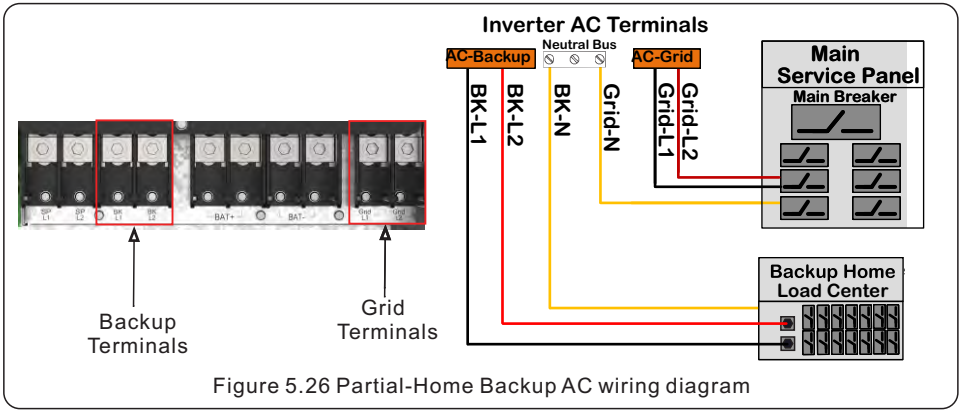


Figure 5.26 Partial-Home Backup AC wiring diagram

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 ½ inch of insulation from the ends of each cable
3. Loosen the BK-L1, BK-L2, Grid-L1, and Grid-L2 terminals using an 8mm Hex screwdriver
4. Insert the ends of the L1 and L2 conductors into the appropriate terminals one at a time
5. Use a torque wrench screwdriver to tighten the terminals to between 9.6 and 11.06 lbf-ft (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.
8. Keep the AC disconnect switch and main breaker OFF for now, turn them on during commissioning.

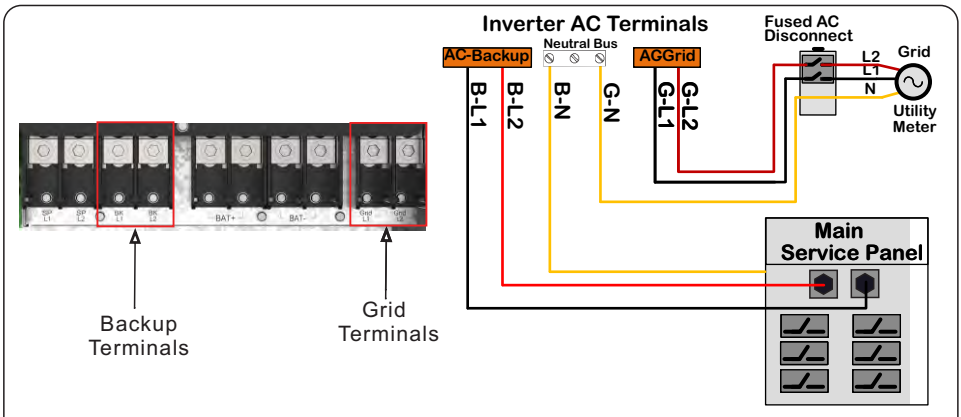


Figure 5.27 Whole-home backup AC wiring diagram

5. Installation

5.11 Smart Port

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. It is not possible to connect two or more of those things to the Smart Port simultaneously. The input is rated for 125A maximum.(24 kW considering NEC). AC-coupled PV systems must be the same size or smaller than the nameplate rating of the Solis hybrid inverter. This ensures the hybrid is able to control the output of the ACPV system in grid-forming mode.

Generator
Max. Size: 24 kW

Sheddable Load
Max. Size: 24 kW
(or 125A Load Panel)

AC-Coupled PV
Must be ≤ the Solis Hybrid Nameplate Rating (Ex: 16 kW)

5.11.1 Smart Port Location & Wiring Instructions

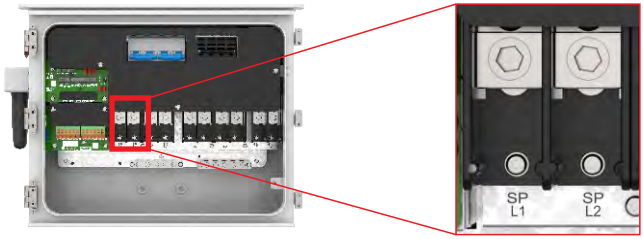


Figure 5.28 Inverter Smart Port terminals

Smart Port Wiring

1. Bring the AC cables for the generator, load, or AC-coupled system into the inverter wire box.
2. Strip ½ inch of insulation from the ends of each conductor.
3. Loosen the SP-L1 and SP-L2 terminals using an 8mm Hex screwdriver
4. Insert the ends of the L1 and L2 conductors into the appropriate terminals one at a time
5. Use a torque wrench screwdriver to tighten the terminals to between 9.6 and 11.06 lbf-ft (13-15 N.m)
6. Give the conductors a gentle tug test. Repeat steps 3-5 if the conductors feel loose.
7. Connect a neutral conductor to the neutral bus bar and a ground conductor to the ground bus bar.

5.11.2 Generator, AC-Coupled PV, & Load Shedding

Generator: With a generator connected to the Smart Port, the inverter is able to use it to supplement power whenever there is not enough PV/battery power during a backup situation or in off-grid mode. A 2-wire dry contact connection would also need to be made between the Solis hybrid and the generator. There are designated ports for exactly this.

AC-Coupled PV (ACPV): When the AC-coupled PV (ACPV) is connected to the Smart Port it will be sustained during grid outages.The power from the ACPV system is used by the Solis hybrid to charge the batteries and support the home loads. The Solis hybrid uses frequency shifting to regulate the ACPV power. There is no direct communication link between the ACPV and the Solis.

Sheddable Load (Load Control): The inverter can be configured to deenergize the Smart Port in a backup situation when the battery SOC% reaches a specified point.This helps maintain the battery for more important loads. It is ideal to connect a large load or up to 125A load panel to this port that can be shut down to preserve stored energy for higher priority loads.

5. Installation

The Smart Port does not have to be used. It just provides a means to connect additional sources and loads directly to the inverter. In each of these cases, a neutral and ground must also be connected to the inverter.

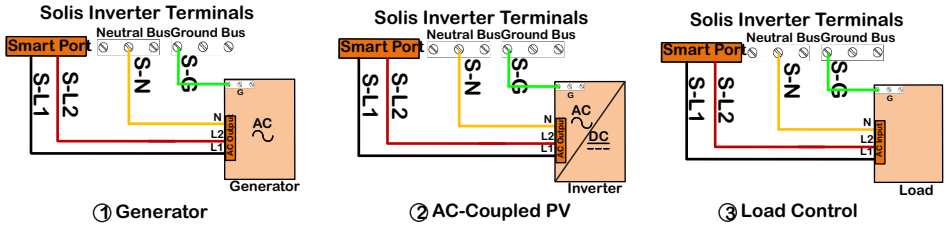


Figure 5.29 Smart Port use case wiring diagrams

5.12 Inverter Communication

5.12.1 Communication Terminals Overview

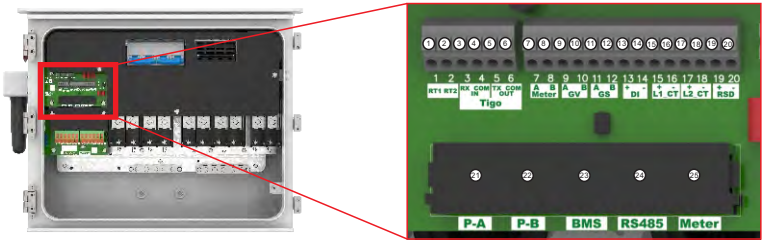


Figure 5.30 Inverter communication terminals

The inverter communication terminal block consists of x20 pins and x5 RJ45 ports. The table on the next page explains the purpose of each port. For RS485 connection to the inverter, use the "RS485" port. Email the Solis support team for the Modbus map.

The COM port on the side of the inverter is where you connect a Solis data logger for remote monitoring on SolisCloud. One logger per inverter allows remote firmware upgrades to be pushed.

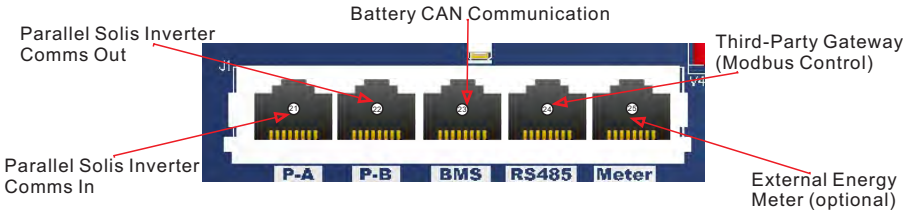


Figure 5.31 Inverter RJ45 communication ports (bottom view)

IMPORTANT:

Communication cables must either be shielded or not included in the same conduit as the high voltage conductors or else there will be intermittencies.

5. Installation

NO.	Port	Function	Acceptable Wire Size Range
1	RT1	Lead-acid battery temperature sampling Rt2 can be used for 12V- if needed	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 Pins can be linked together to make 12V+	
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 5.32 Inverter communication ports explained

Installing the communication wires:

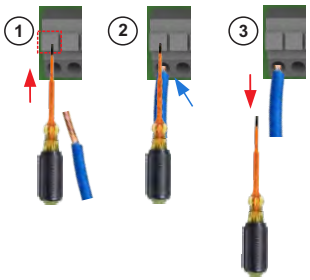
First, strip ¼ inch off the end of the com wire.

1. Use a technician screwdriver to push and hold the small square button above the terminal. Hold it to keep the port open.

2. Insert the stripped end of the 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 the CTs and the External CHINT Energy Meter

Connecting CTs Directly to the Inveter (without an energy meter)

The inverter comes with two CTs that must be installed for full functionality of the inverter. The CTs can be directly connected to the inverter, under certain conditions. See page 9 for more details. The CTs get installed on the L1/L2 conductors at the utility point of common coupling. The blue CT wires are negative and the white CT wires are positive. The wires cannot be extended are limited to 4.92 feet (1.5m). The CTs included with the inverter are CHINT brand model number NCKT-24 (250A/50mA).

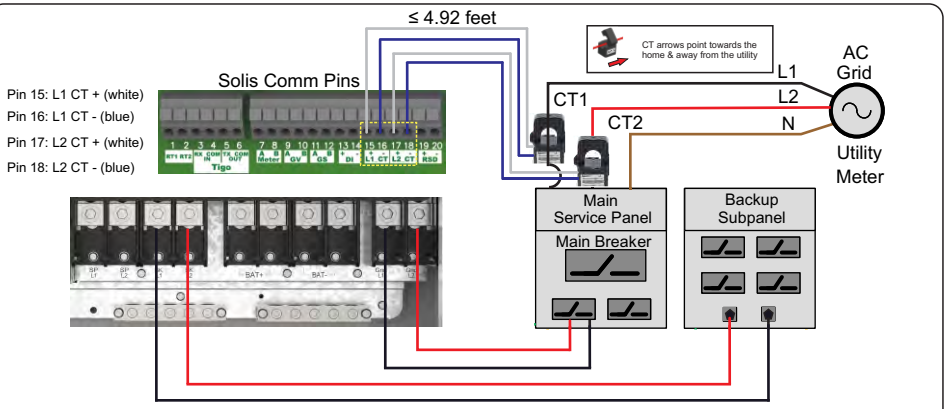


Figure 5.33 CT Wiring diagram for export/import power monitoring and control

If the CTs are 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 CTs, 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.

Installing the External Meter and CTs (Meter Sold Separately)

The CTs will instead connect to the CHINT meter. The meter will also need split-phase (240V) power from a 2-pole breaker (15A). The diagram below shows how to install the meter and CTs.

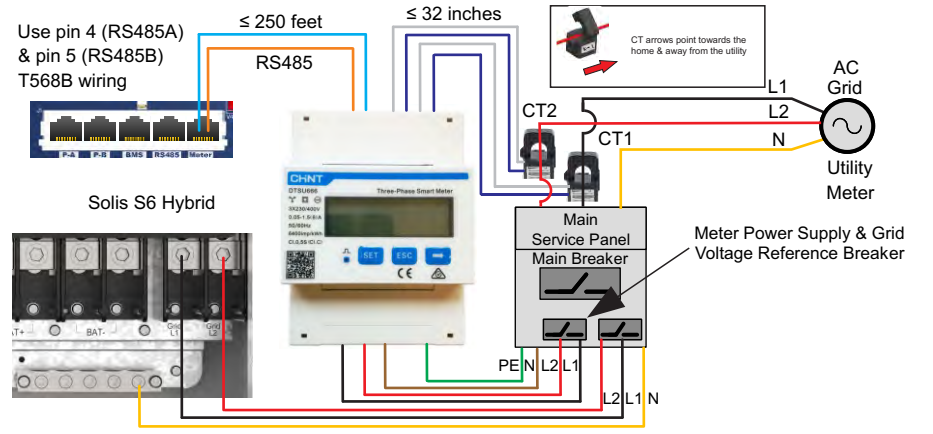


Figure 5.34 CHINT meter wiring diagram (CHINT DTSU666)

5. Installation

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 from the inverter.

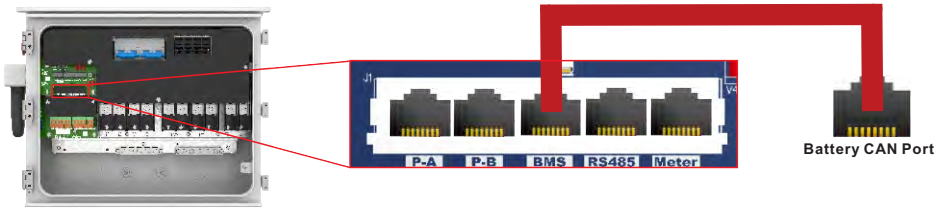


Figure 5.35 Inverter to battery BMS CAN connection

This is only for batteries that have closed-loop communications with the inverter. So far, all of them use CAN and not RS485.

5.12.4 Battery CAN Port Pinout

Some batteries do not have an RJ45 port for the inverter CAN connection. 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 then use the blue wire for CAN-H and the blue-white striped wire for CAN-L.

CAN-L	CAN-H
Blue-White (Pin 5)	Blue (Pin 4)

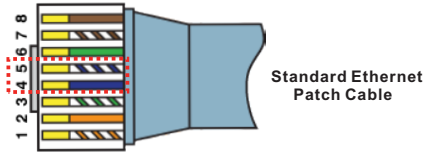


Figure 5.36 Battery communication wire color chart

IMPORTANT:

Solis cannot guarantee closed-loop 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 testing of that battery will not have been done by Solis. Open-loop comms is also possible.

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. Installation

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. The DIP switches must all be in the up (on) position unless there are three or more inverters.

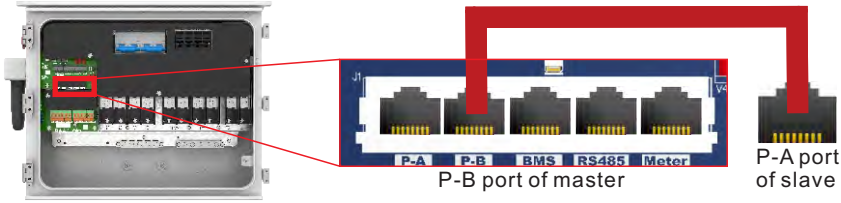


Figure 5.37 Multiple inverter parallel communication ports

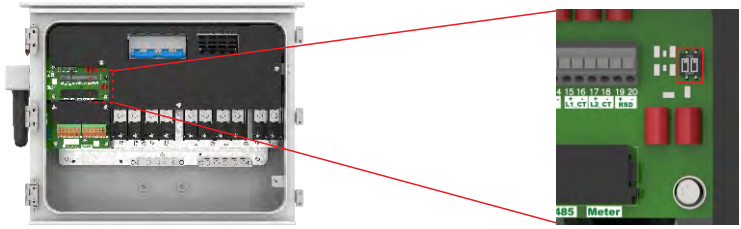


Figure 5.38 Inverter DIP switch location

The number of inverters installed in the same system determines whether or not the DIP switches must be adjusted. If there are only 1 or 2 inverters then the DIP switches should all be in the up (on) position. Since the DIP switches are in the up (on) position from the factory, they should not need to be changed. To be safe, check that they are in the right position. When there are three or more inverters the master and the last slave inverters should have their DIP switches in the up (on) position. All of the other slave inverters in between should have their DIP switches in the down (off) position.

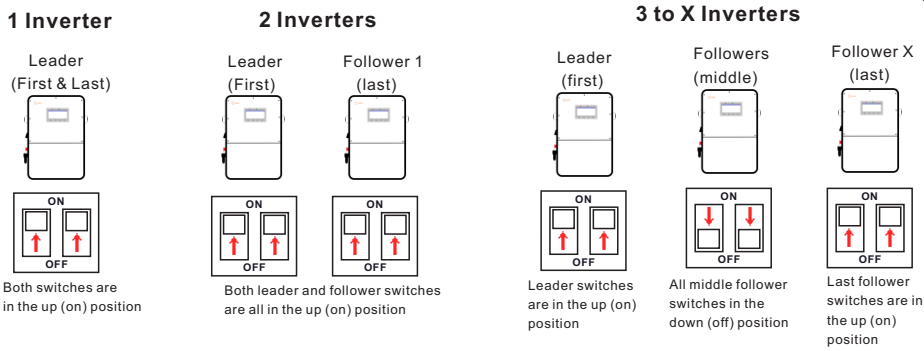


Figure 5.39 Inverter DIP switch settings

The maximum number of inverters that can be connected in parallel for backup power is **6** units. If backup is not being used there is no limit to how many can be paralleled on the grid side of the system.

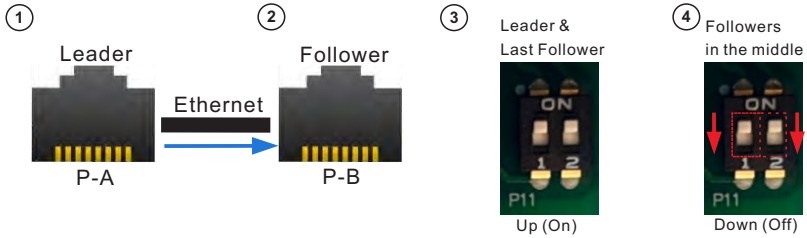
5. Installation

Steps for daisy-chaining inverters together:

The inverter comes with a standard ethernet cable for parallel communication. Use this cable or a similar cable for connecting inveters togethether.

1. Plug one end of the cable into the P-A port of the master inverter
2. Plug the other end of the cable into the P-B port of the slave inverter
3. Set the DIP switches for the leader and the last follower in the chain to the up (on) position
4. Set the DIP switches for all of the followers in the middle to the down (off) position

Note: If there are only two inverters, then all DIP switches must be set to up (on) position



NOTE:

The master inverter will manage the output power of the slave inverters. If any of the inverters in the system have an alarm, the system will behave abnormally.

5.12.6 External Rapid Shutdown (RSD) and Emergency Power Off (EPO) Switch

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. A small red jumper comes installed from the factory connecting these two pins. If the RSD E-stop switch is pressed in, two 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-) shown boxed in red in the image below. Solis recommends using an IMO switch, but any normally-closed two-pin switch will work. If there are multiple inverters then each will need to have a switch connected to it.

Figure 5.40 External RSD/EPO switch wiring and compatible switch examples

If you install an inverter that does not have an integrated RSD transmitter, it will also not have the RSD/EPO E-stop switch. However, an external switch can still be installed using the RSD pins.

5. Installation

5.12.7 Inverter Bluetooth

The Solis inverter generates a localized Bluetooth network which allows technicians to interface directly with the inverter using a smart phone or tablet. The accessory kit includes a Bluetooth antenna. Remove the black protective cap from the “BLUETOOTH” port on the side of the inverter by twisting it counter-clockwise. Attach the Bluetooth antenna to the port by rotating it **counter-clockwise (not clockwise)** until it feels tight. Please note, the antenna only extends the range of the inverter Bluetooth network from 3 feet to about 10 feet. 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 does not matter. It can be bent to point up, down, or whichever direction best suits the installation.

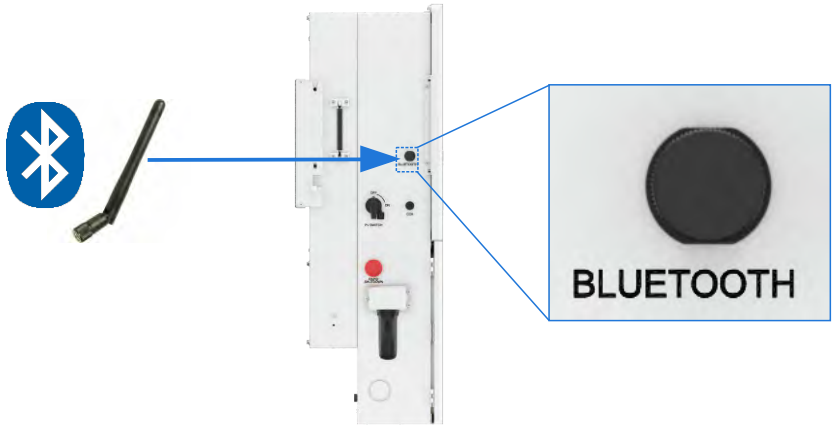


Figure 5.41 Bluetooth antenna port location

5.12.8 Generator Dry-Contact Control and External ATS 12V Grid Sense

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 2-wire dry contact to pins 9 (GV-A) and 10 (GV-B) on the inverter.

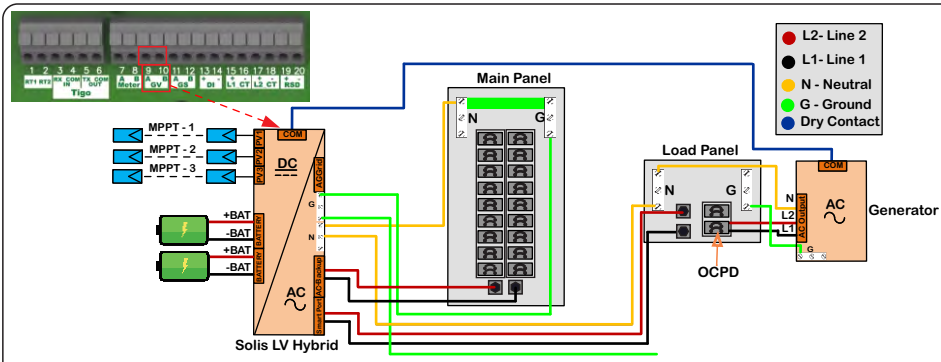


Figure 5.42 Off-grid generator with dry contact two-wire start/stop

5. Installation

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.

There are no settings associated with the 12V grid sense. This feature is enabled when the generator settings are configured for manual start/stop. On-grid systems with a generator are prone to nuisance tripping when the generator is running. It is recommended to widen the grid profile parameters for the generator. In this scenario, the inverter is not controlling the start/stop of the generator. That is being done by the external ATS. It is possible to have the inverter control the generator start/stop while the external ATS only handles isolating from the grid. In that case, dry contact would instead be connected to the inverter instead of the ATS.

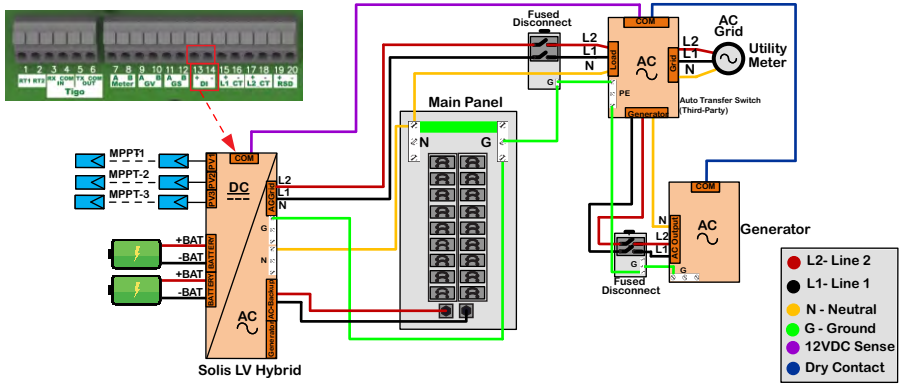


Figure 5.43 On-grid external ATS with generator 12VDC grid sense

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-

More Details Regarding Dry Contact and 12V Grid Sense

In some cases, a dry contact connection between the inverter and generator is not required. One case is when the system is configured such that the ATS controls the start/stop of the generator. Another case is where the geneartor is turned on and off manually. A dry contact connection is only required if the goal is for the inverter to control the start/stop of the generator based on battery SOC%. There is no other criteria by which the inverter can control the generator, only battery SOC%.

For all grid-tied systems using a generator where it could be either grid power or generator power going to the inverter Grid ports, a set of wires for grid-sense must be installed. This so so the inverter is able to distinguish between grid and generator power. If you are installing an off-grid system where it will only ever be generator power on the inverter Grid ports, it is not required to install a 12V grid sense set of wires to the inverter.

6. Commissioning

6.1 Pre-Commissioning

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 measure 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 but not 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 communication issues between the batteries and the inverter(s).

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 Installing the Included Solis Logger

For remote monitoring and control of the inverter using the Solis monitoring portal, a Solis data logger must be installed. Each inverter includes an S2-WL-ST Wi-Fi/LAN data logger that can connect to the local router. 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.

Figure 6.1 Solis data logger installation location

6. Commissioning

6.2.2 Commissioning the Solis Data Logger

After installing the logger, it must then be connected to the internet. The steps for doing that are listed below. Scan the QR code for the full User Manual.

Scan with your smartphone camera to access the full **S2-WL-ST** logger manual

1. Provide the inverter with AC or DC power
2. The logger LED lights should turn on and start flashing
3. If you have not downloaded the SolisCloud app and registered an account yet please skip to Section 6.3 SolisCloud first, otherwise open SolisCloud
4. Go to Service > Local Debugging > WiFi Connection
5. Scan the QR code on the data logger or enter the logger serial number
6. Turn on your phones Bluetooth and allow connecting to new devices
7. Tap Configuration by Bluetooth and then tap D_serial number of logger
8. Select the local Wi-Fi network, be sure it is 2.4 Ghz and not 5 Ghz
9. Enter the Wi-Fi network password
10. Wait for the logger to connect, you will see a green check mark
11. The green NET light on the logger should go solid after a few minutes indicating the logger has successfully connected to the internet

6.2.3 Third-Party Monitoring with RS485 Modbus

Connect a third-party gateway to the **RS485** port of the inverter. The pinout for the port is as follows:
RS485A:Brown, brown-white, green, and blue-white
RS485B: Blue, green-white, orange, and orange-white
The Solis hybrid inverter Modbus map can be downloaded from the Solis website or requested from the Solis support team. The inverter supports SunSpec Modbus. A Solis logger can be connected to the inverter at the same time as a third-party gateway using Modbus. The inverter is able to report to both SolisCloud and a third-party platform at the same time.

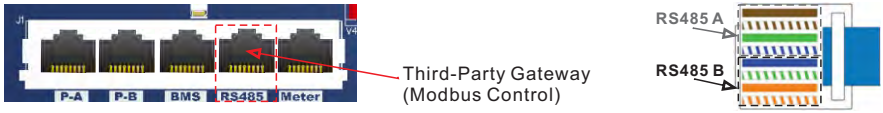


Figure 6.2 Modbus RTU port for RS485 direct connection and port pinout

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: Organization and Owner

Organization: Installer account 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 over operational settings.

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.

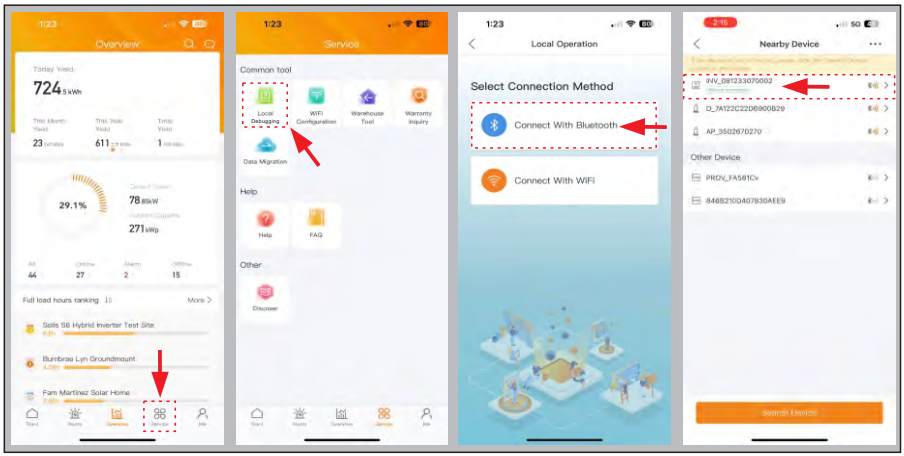
6. Commissioning

NOTE:
SolisCloud data is stored on an 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.

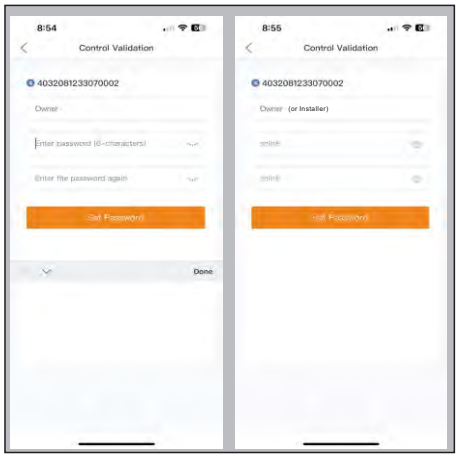
6.4 Configuring the Inverter Settings

6.4.1 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.

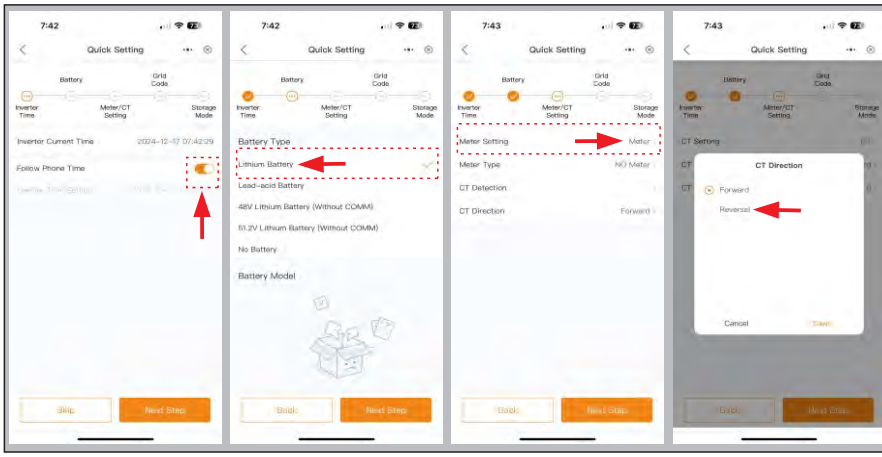
If the data logger plugged into the inverter is connected to the internet then all of the settings configuration and commissioning can be done remotely through SolisCloud.

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.

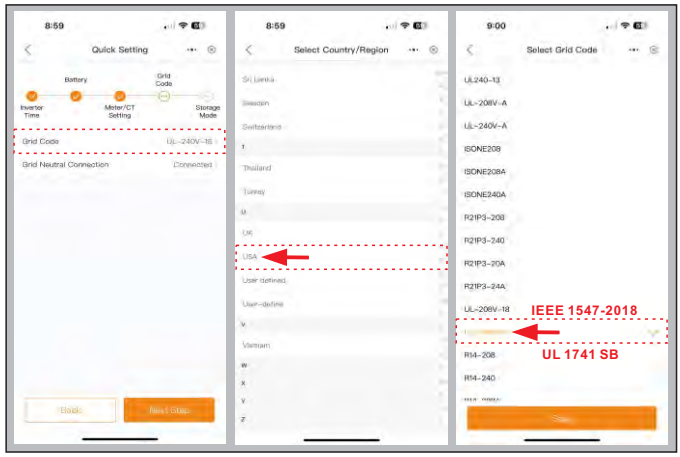
6. Commissioning

6.4.2 Configure the Quick Settings (Initial 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***. The CT orientation can be electronically reversed by tapping ***CT Direction*** and then changing ***Forward*** to ***Backward.*** This is the same as physically flipping both of the CTs around on the L1 and L2 conductors. Then tap Next Step.

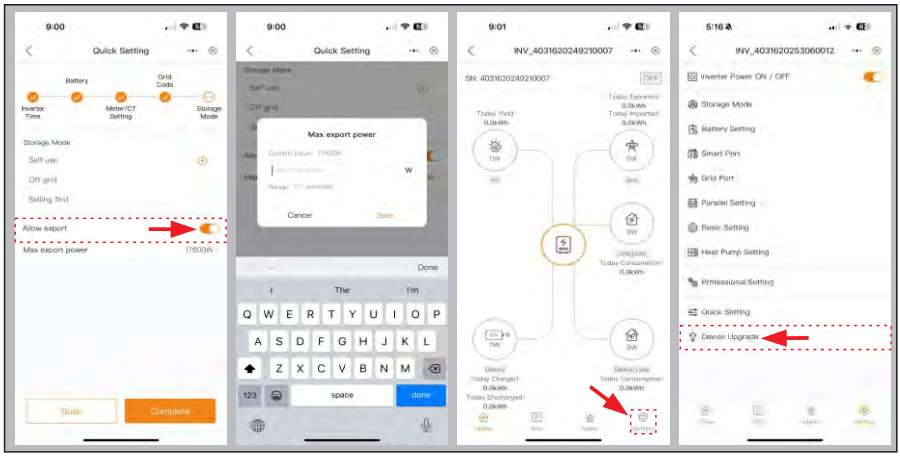


The inverter Grid Code is the grid interconnection profile by which the inverter will operate when it is connected to the grid. For systems installed in the United States, the base (default) profile is **UL-240V-18**. This grid profile is based on the IEEE 1547-2018 standard and is compliant with UL 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 UL-240V-18 profile. 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

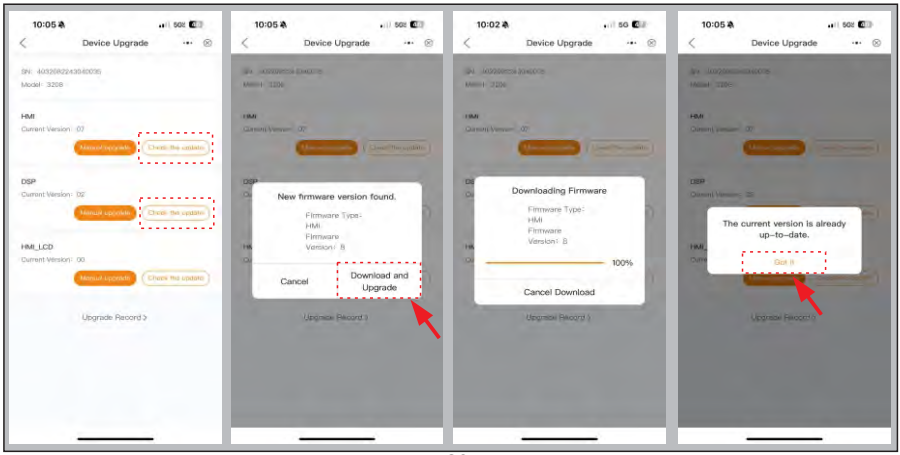
The *Storage Mode* is the energy storage operating mode of the inverter. Please see the logic tables on pages 17 through 19 for explanations on how the modes operate to determine which one you should select for each system. Self use mode prioritizes charging of the battery with excess PV power whereas 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.

6.4.3 Upgrade the Inverter Firmware Locally Using the SolisCloud App

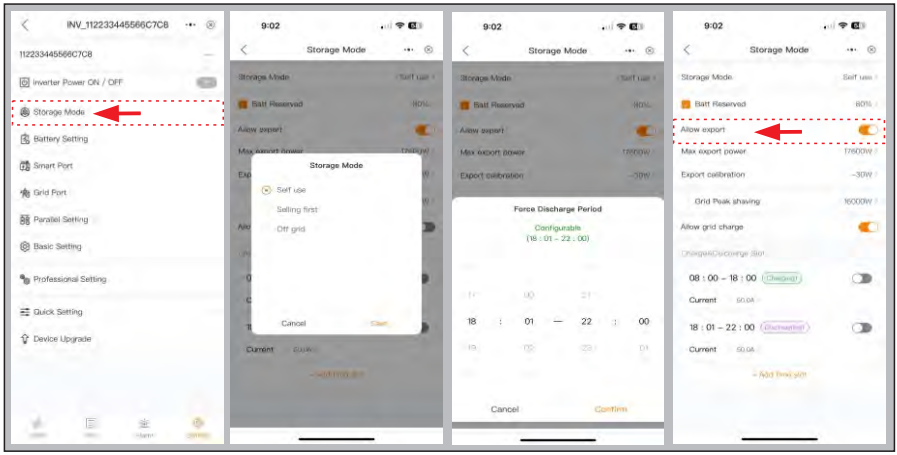
Tap Device Upgrade at the bottom of the list. Then, tap ***Check the update*** for HMI. A message will either prompt you to download and upgrade the new firmware version or it will inform you that the firmware is on the most current version. Wait for the firmware to finish downloading and then initiate 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

6.4.4 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 slot***, 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 when there are long durations of little-to-no PV power.

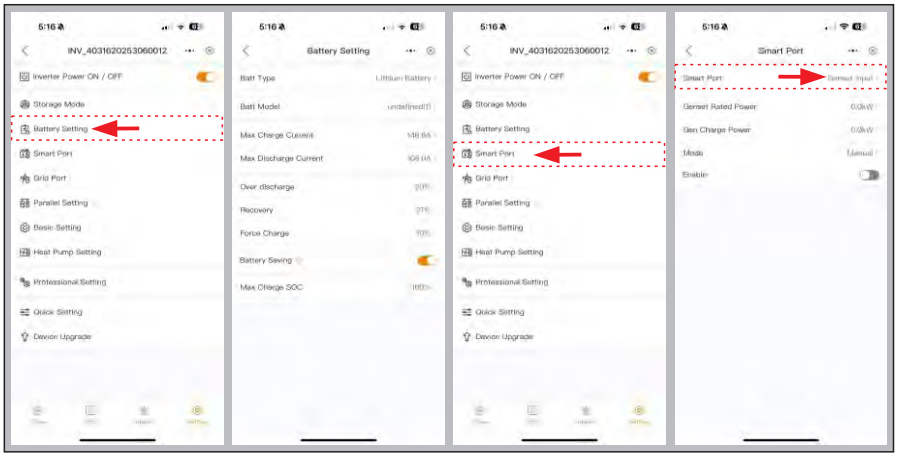
6.4.5 Export Power Control Settings

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

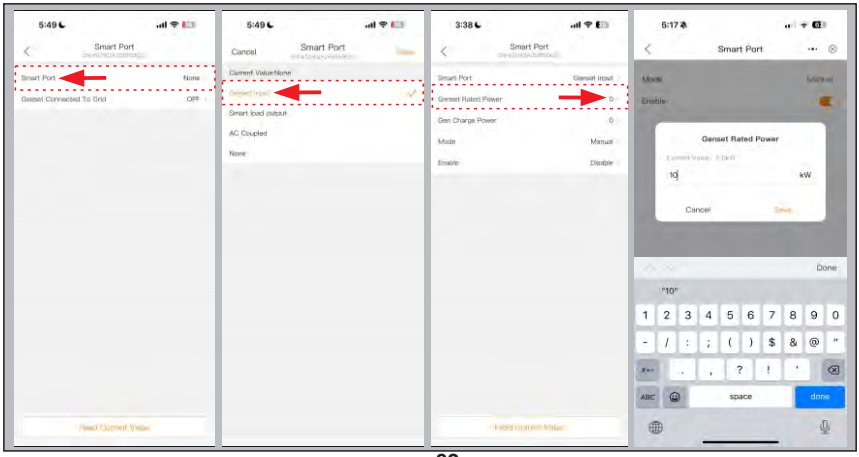
6.4.6 Battery Settings

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 battery management system (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 itwill 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.



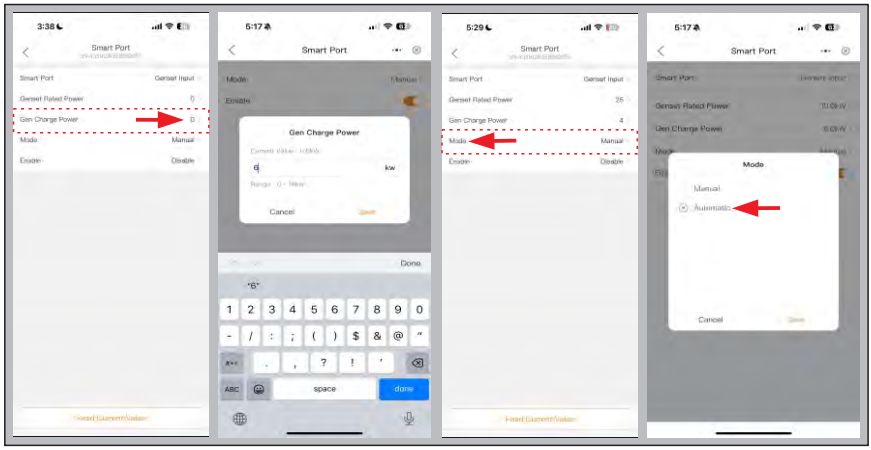
6.4.7 Smart Port Settings (Generator Automatic Start/Stop)

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*** & then tap Save. Set the ***Genset Rated Power***, which is the size in kW of the generator. If a generator is being connected to the Smart Port, the largest it can be is 24 kW. However, if the generator is connected to the grid-side there is no limit from the inverter for how large generator can be. Then, set the ***Gen Charge Power*** or amount of generator

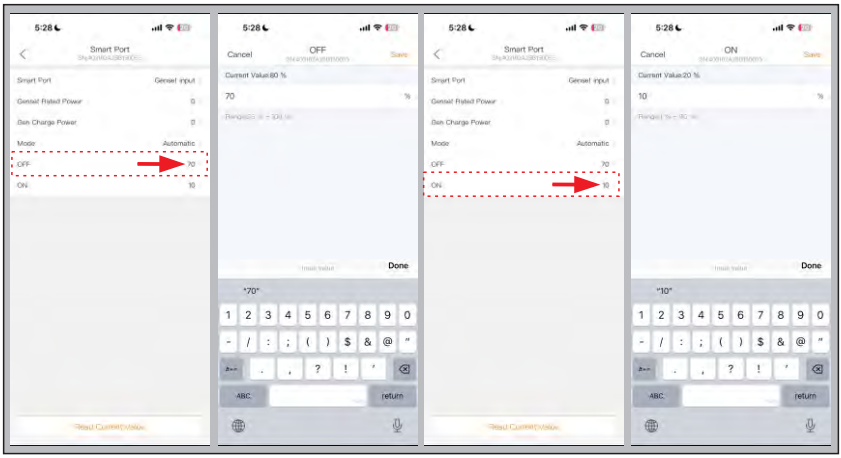


6. Commissioning

power that the battery will be allowed to charge with. Finally, set the ***Mode*** to ***Automatic*** if your goal is for the inverter to control the starting and stopping of the generator. The inverter is only able to do this with a battery connected since the start/stop is based on the battery SOC%. A 2-wire dry contact connection must be made between the inverter and the generator.



The ***ON*** SOC% determines when the generator will be turned on through dry contact on to charge the battery and supply the home loads. The ***OFF*** SOC% determines when the generator will be shut off by the inverter while in backup/off-grid mode. These SOC% values can be adjusted as needed.
Generator ***ON*** (Start) SOC% range is from 1% to 95%
Generator ***OFF*** (Stop) SOC% range is from 25% to 100%

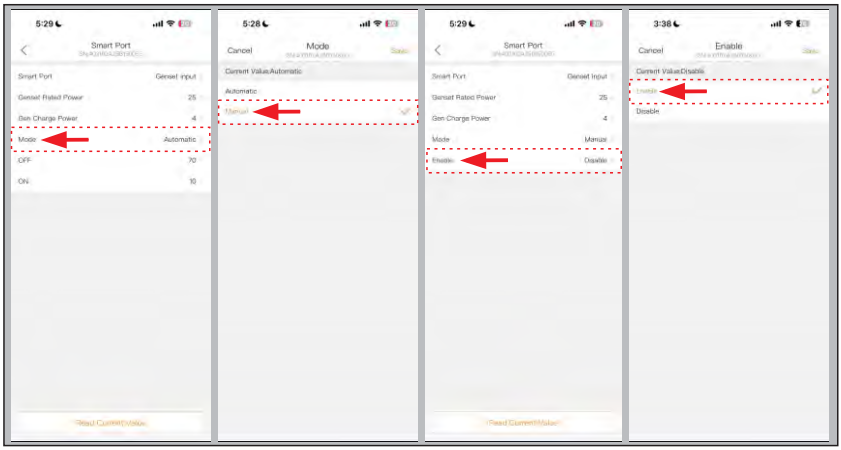


Example Scenario of Automatic Start/Stop: ON SOC% is 40% and OFF SOC% is 90%. When the grid fails the inverter switches to grid-forming mode. It supports loads connected to the backup side with PV and battery. Once the battery discharges down to 40% the inverter turns on the generator with dry contact. The generator power is used to support the loads and also charge the battery. Since the set Genset Charge Power is 5kW the battery charges with 5kW until it reaches 90%. At that point, the inverter turns off the generator with dry contact. The inverter goes back to using PV and battery only to support the loads.This cycle perpetuates until the grid comes back or the generator runs out of fuel.

6. Commissioning

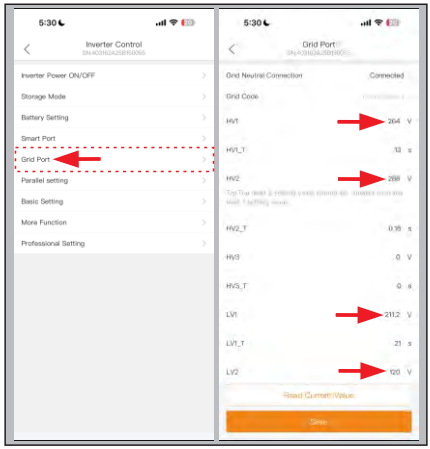
6.4.8 Smart Port Settings (Generator Manual)

If the generator will be started/stopped manually or by an external ATS, then the Mode setting should be set to Manual instead of Automatic. The first few settings will be the same as automatic: changing the Smart Port to Genset input, setting the Genset Rated Power, and the Gen Charge Power.
The Enable/Disable setting allows you to turn the generator on through dry contact by changing the setting to Enable. Changing it to Disable turns the generator off. You may also turn the generator on/off manually without using the enable/disable setting. Lastly, if an external ATS is turning the generator on whenever the grid is down, be sure to connect the 12V grid sense wires. With the mode set to Manual, the inverter will know if the AC power on the grid ports is
coming from the grid or from the generator.



6.4.9 Grid Port (Profile/Standard) Settings When Using a Generator

Generators tend to create a relatively unstable grid compared with the utility. The AC voltage and frequency tend to fluctuate more dramatically than the grid. This can lead to nuisance tripping for over-voltage and over-frequency. The inverter does not suspend the grid profile trip points when the generator becomes the grid source and the inverter just matches it. It is recommended to widen the grid profile trip points manually if nuisance tripping occurs. This can be done by going into the settings of the inverter. Go to Grid Port setting. There you will see all of the trip point parameters:



HV1 = over-voltage 1 (first over-voltage trip point)
HV2 = over-voltage 2 (second over-voltage trip point)
LV1 = under-voltage 1 (first under-voltage trip point)
LV2 = under-voltage 2 (second under-voltage trip point)
HF1 = over-frequency 1 (first over-frequency trip point)
HF2 = over-frequency 2 (second over-frequency trip point)
LF1 = under-frequency 1 (first under-frequency trip point)
LF2 = under-frequency 2 (second under-frequency trip point)

It is recommended to increase the upper voltage/frequency trip points and decrease the lower voltage/frequency trip points. This must only be done in backup/off-grid mode since the grid profile default parameters are required for grid-connected operation. The parameters must be changed back once the system goes back to being grid-connected and not using the generator.

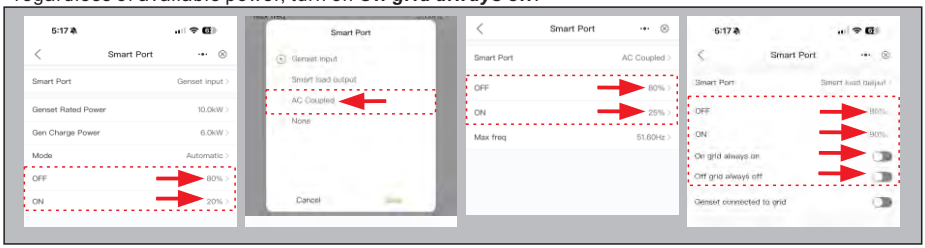
6. Commissioning

6.4.10 Smart Port Settings (AC-Coupled PV System)

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. The maximum size ACPV system that can be connected is the same size as the Solis hybrid. For example, a 16kW ACPV system can be connected to the Solis 16kW mode. When the Smart Port is set for AC Coupled, the Smart Port terminals will be energized with 240V allowing the ACPV system to synchronize and start producing power. The Max. Frequency setting can be adjusted as needed. It should be set to 61.6Hz by default, but if it comes set to 51.6Hz be sure to change it. In backup/off-grid mode as the battery reaches 100% SOC and there becomes more PV power available than load consumption, the Solis hybrid will curtail the ACPV power by increasing the frequency. The max. frequency ("Max freq") setting sets an upper limit for this function.

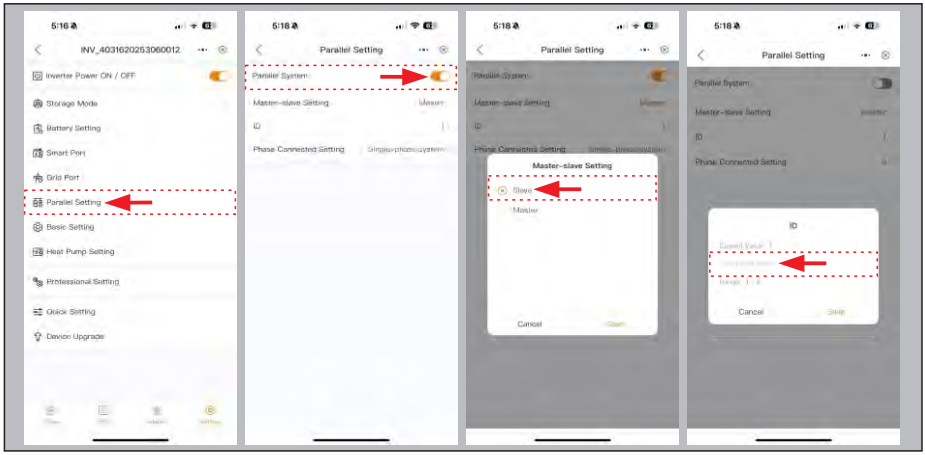
6.4.11 Smart Port Settings (Load Shedding)

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***.



6.4.12 Parallel Inverter Settings

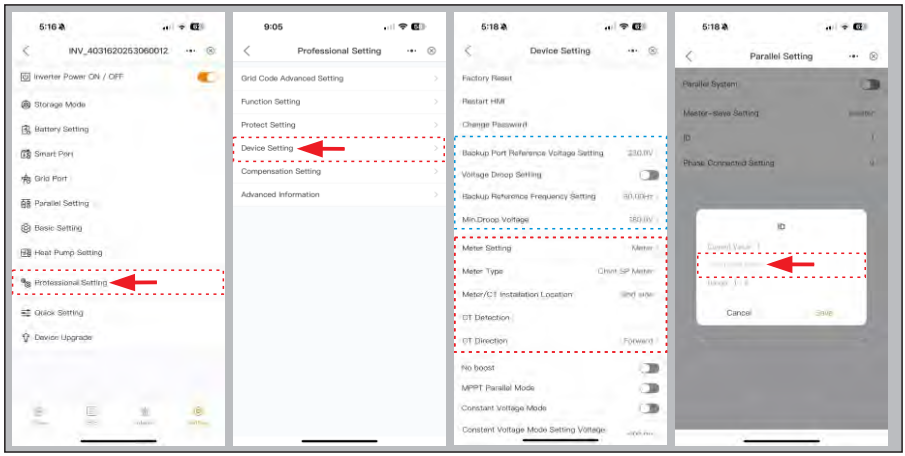
If there are two or more Solis hybrid inverters connected together with communication cables, Tap ***Parallel Setting*** and then turn on the ***Parallel System*** toggle switch. The first inverter should be set to Master and all of the other inverters should be set to Slave. The Leader should have an ID of 1 and the followers should be numbered 2-6. These settings only need to be configured if there are multiple inverters sharing a single logger or if the inverters are being paralleled on the backup side.



6. Commissioning

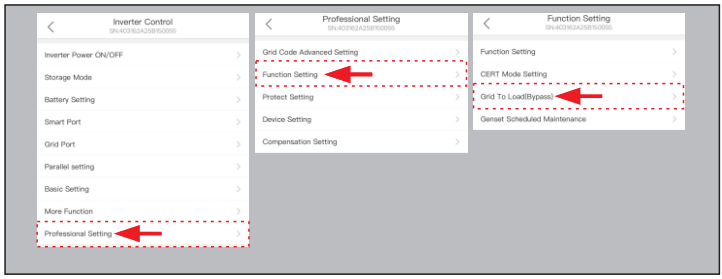
6.4.13 Professional Settings: Device Settings: Backup & Meter/CT Settings

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.



6.4.14 Professional Settings: Function Setting: Automatic Bypass (Grid Power to Load)

The automatic bypass setting should come enabled by default but it is recommended to check it. From the main Inverter Control menu tap Professional Setting. Then tap Function Setting. Next, tap Grid to Load(Bypass) setting. If the setting does not appear, then it is enabled by default. If it does appear, be sure that it says “Enable”. If it says “ Disable” then change it to Enable and then tap Save. If this setting is set to Disable, then the inverter will not automatically pass power through from the grid to the loads. This setting is crucial for systems that have loads connected to the backup ports of the inverter. Be sure to check this setting during each commissioning. This is specifically for scenarios where the inverter shuts down due to a soft failure.



6. Commissioning

6.4.15 Professional Settings: Device Settings: Factory Reset, Password Reset

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.

6.4.16 Battery Settings: Open-Loop Settings

Lithium-Ion Battery Open Loop Settings

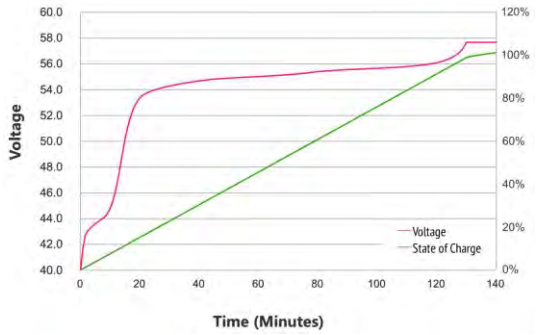
First go to the inverter control settings menu. Tap Battery Setting, then tap Battery Type at the top. There are two profiles for lithium-ion battery open loop: (1) **48V Lithium Battery (Without COMM)** & (2) **51.2V Lithium Battery (Without COMM)**. Select the best profile for you and then tap Save in the top right corner. The open loop settings will be configured by default based on the profile selected.
Max. Charge and **Max. Discharge Current**. set how much current the battery is allowed to charge and discharge with. The range for these two settings is 0A-290A.
Over Discharge voltage setting determines when discharging stops. The range is 45-52V.
Recovery voltage is the voltage at which the inverter allows the battery to be used again after it first reaches an overdischarged state and then force charges. The range is 49-54V.
Force Charge voltage is a panic mode threshold where the inverter forces power into the battery from any source it can to prevent deep discharge damage to the battery. The range is 44-50V.
Battery Saving should be set to enable always
Battery Capacity is set in amp-hours (Ah) and the range is 0-9999Ah.
Equalizing Charge Voltage, also known as *absorption voltage*, is the maximum charge voltage the inverter allows. Once reached, the inverter switches from push current to hold voltage. This determines how full the battery gets. Higher voltage means a fuller battery but more stress on the cells. Lower voltage yields a longer cycle life. This is where the battery safely stops charging and the inverter does not report an overvoltage fault.

Lithium-Ion
Open Loop Settings

IMPORTANT:

Consult the warranty documentation of the battery manufacturer. Some manufacturers do not allow their battery to be used in open-loop and require closed-loop communications with the inverter. Solis is not responsible for any damage that occurs to the battery when it is used in open-loop.

6. Commissioning



Lead-Acid Battery Open Loop Settings

Most of the lead-acid categories are the same as the lithium-ion. This section will only go over the settings that are different for lead-acid. Please see the previous page lithium-ion settings for details on the first eight settings.

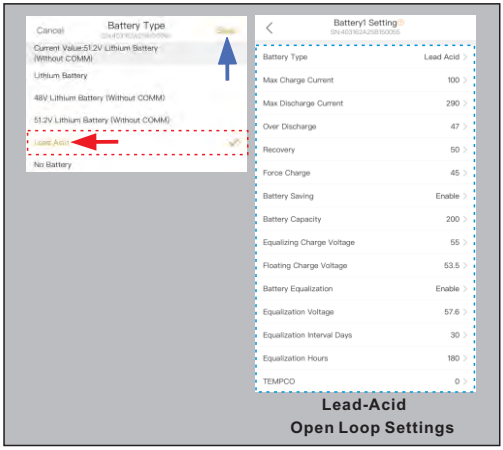
Floating Charge Voltage is a maintenance voltage used after charging is complete. It is the constant holding voltage applied after charging is complete. It offsets self-discharge and keeps the battery at or near full without actively charging. For lead-acid it is required and for LFP it is optional. The range for this setting is 40-60V.

Equalization Voltage is a setpoint that determines when the equalization process should be initiated. The range for this setting is 55-59.5V.

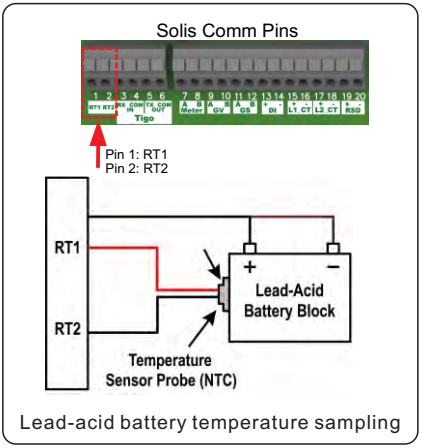
Battery Equalization enable/disable setting determines whether equalization is done or not.

Equalization Interval Days and **Equalization Hours** settings correlate with the Equalization Voltage setting. The days range is 20-180 days and the hours range is 5-900 minutes. These time settings determine how long the equalization process goes for.

TEMPCO setting tells the inverter how much to adjust the charging voltage as the battery temperature changes. Lead-acid chemistry is very temperature--sensitive. Cold batteries need higher voltage to charge fully. Hot batteries need lower voltage to avoid overcharge, gassing, and damage. The inverter dynamically shifts the charging voltage using this parameter. The setting is given in millivolts per degree C for the entire battery bank, not per cell. Example: 120 mV/°C means for every 1°C change the charge voltage shifts by 0.12V and the direction of the change depends on whether the temperature increases or decreases. The range for this setting 0 mV/°C to 180 mV/°C.



Lead-Acid Open Loop Settings



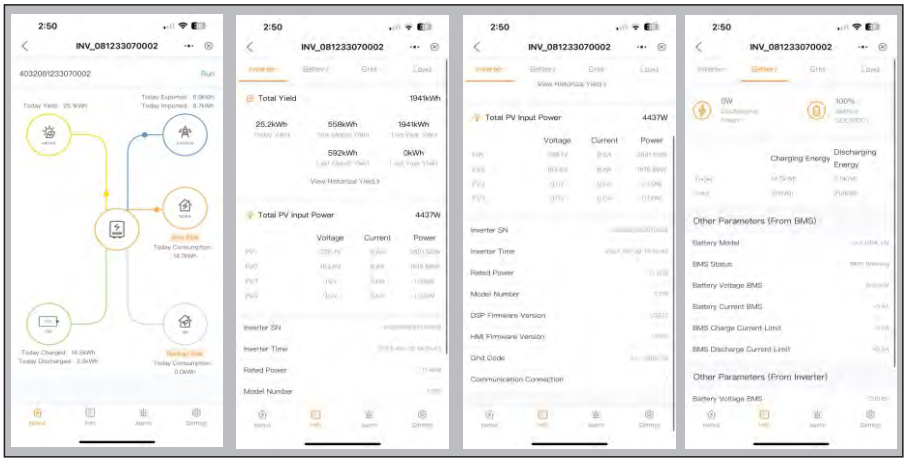
Lead-acid battery temperature sampling

6. Commissioning

6.4.17 Info Tab: Inverter, Battery, Grid, and Load Details

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, status, battery voltage, current, SOC, state-of-health (SOH), & 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



6.4.18 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.

6.4.19 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.

Inverter settings configuration are now complete

6. Commissioning

6.5 Inverter Startup Procedure

Step 1: After completing the settings configuration, turn off all power sources to the inverter. Wait for the LCD and LEDs to go dark.

Step 2: Turn on AC power to the inverter from the grid. This may entail turning on a circuit breaker, flipping on an AC disconnect switch, etc. Be sure the inverter is getting 240V at the Grid ports.

Step 3: Turn on the inverter DC disconnect switch. This is the black switch on the left side of the inverter as you are facing it. Also, give the red E-stop button a clockwise twist. If it is engaged, it will pop out.

Step 4: Turn on the battery breaker(s). There is a breaker inside the inverter wire box for the battery. Push that breaker switch so that it is in the up (on) position. If the battery BMS has a breaker, be sure that is also turned on.

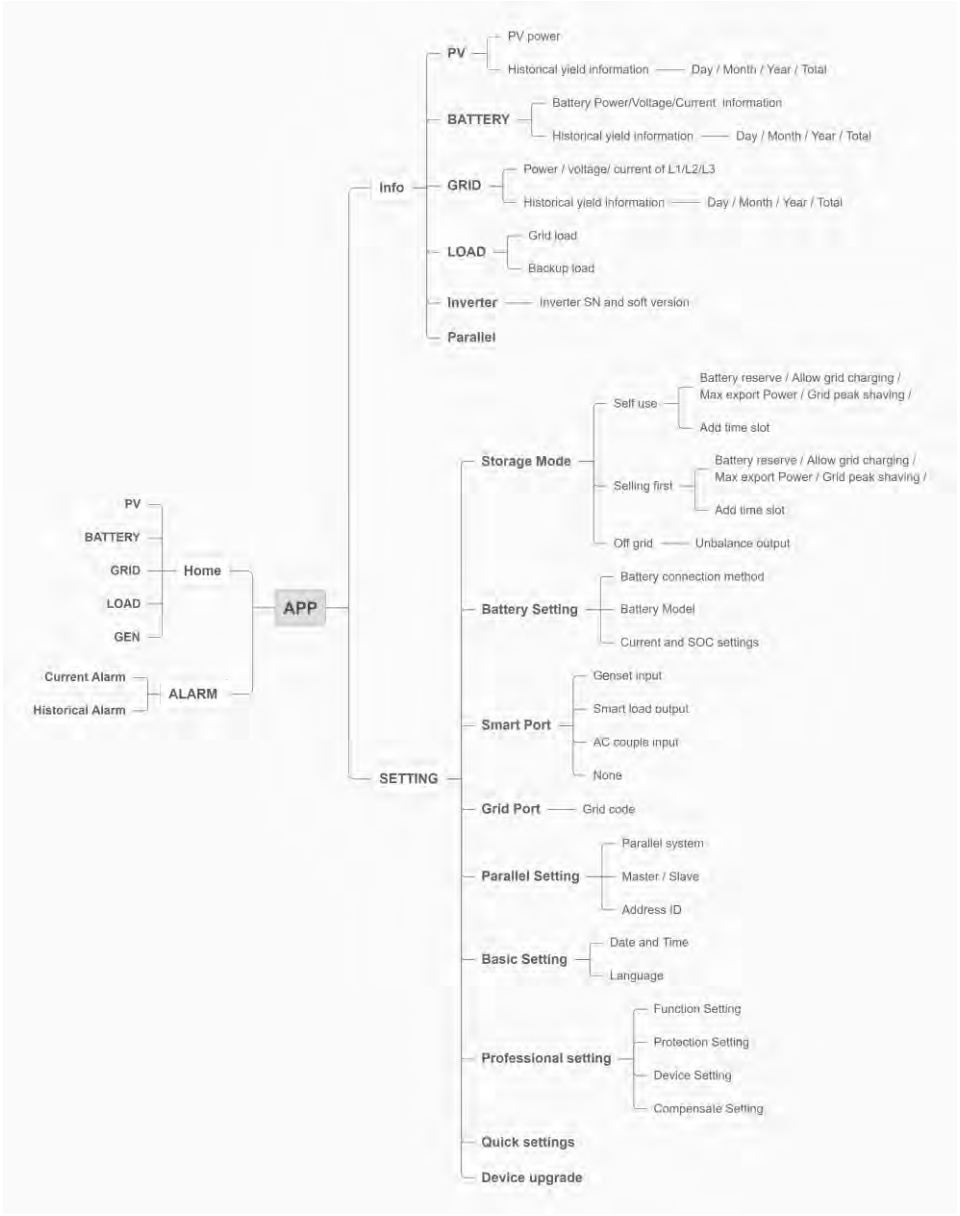
Step 5: Wait five minutes for the inverter to fully turn on. Check the LCD screen. The status in the top left corner may start with an alarm, but it should recover within a few minutes and then change to “Waiting”. It will display “Waiting” for five minutes and then it will begin to generate power from PV. At that point, the Backup Port and Smart Port should definitely be energized with 240 if configured for load ouput or ACPV.

Step 6: Connect to the inverter with your phone using the SolisCloud app or use the inverter LCD screen to verify that the system is behaving normally.

Step 7: If you are having issues with the system such as persistent alarms or other operating problems, please contact Solis support. The details can be found in the next section.

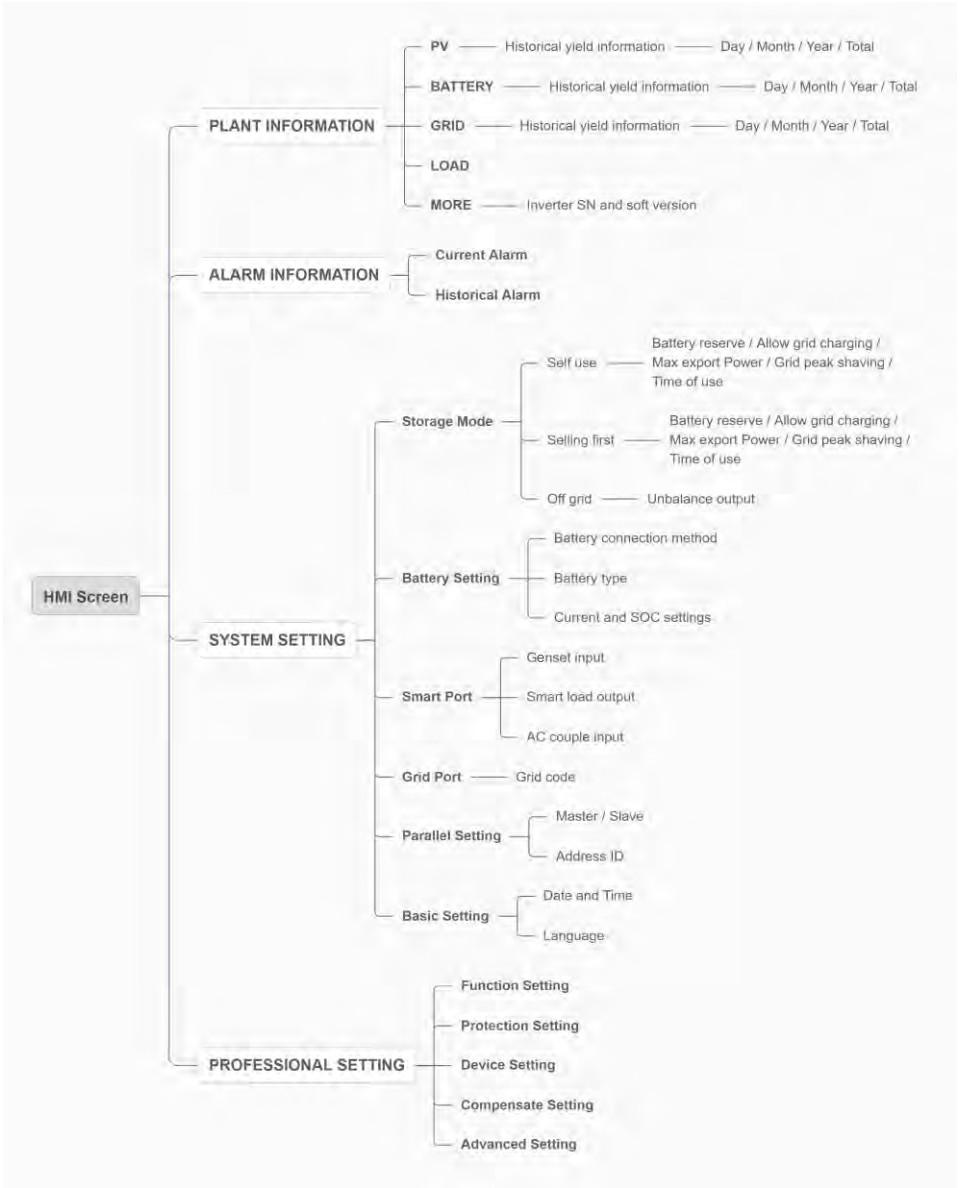
6. Commissioning

6.6 SolisCloud Bluetooth Tool Settings Tree



6. Commissioning

6.7 LCD Screen 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. Push in the RSD Initation Switch and then turn off the DC switch of the inverter
Step 2. Turn off the AC disconnect or circuit breaker connecting the grid side of the inveter
Step 3. Turn off the battery breaker in the inverter wire box and 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. Example: PV string 1 voltage is 480V when the string is landed and the transmitter is on. After RSD has been initated or the string is unlanded (Voc) then the string voltage would be about 7-11V.

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 dirtyto 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 periodically releases new firmware versions to optimize performance, add new features, repair bugs, etc. These new firmware versions are not automatically pushed to inverters. For an inverter to get the new firmware, it must be pushed manually to the inverter.

Solis inverter firmware is comprised of three parts: **DSP**, **HMI**, and **LCD**.
If one site has several inverters installed, they must all be on the same versions to prevent errors.

Solis Firmware Types:
DSP: Digital Signal Processor
HMI: Human-Machine-Infterface
LCD: Liquid Crystal Display

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 two methods for updating the inverter firmware: (1) remotely (2) locally with Bluetooth

7.4.1 Remote Firmware Upgrading

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.

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 (Technical Specifications)

9.6-16K

SOLARATOR SERIES

Operates Seamlessly with Generators: Experience Uninterrupted Power, Even in Areas with Grid Instability

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

Split Phase | Low Voltage

- 48V Hybrid can function on-grid, off-grid or act as a Microgrid
- High input current (20A) supports larger modules, improving power density and eliminating clipping
- Integrated 200A pass-through and bypass function fully integrated to limit external hardware, save costs and streamline storage
- The battery's DC side can handle a maximum charge/discharge current of up to 290A, allowing it to store more surplus energy generated by PV systems for better efficiency
- Smart port for supporting flexible configurations like AC coupling or generators

USA
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e: ussales@solisinverters.com
usservice@solisinverters.com

8 Inverter Datasheet

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

Models	9.6K	11.4K	12K	14K	16K
Input DC (PV side)					
Recommended max. PV power	15.36 kW	18.24 kW	19.2 kW	22.4 kW	25.6 kW
Max. input voltage	550 V				
Rated voltage	380 V				
Start-up voltage	100 V				
MPPT voltage range	100-450 V				
Full load MPPT voltage range	160-450 V			186-450 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	200 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 **& 2 times of rated power, 10 s**				
Back-up switch time	< 10 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	80 A	95 A	100 A	116.7 A	133.3 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	30 kW				
Max. input current	125 A				
Rated input frequency	60 Hz				
Efficiency					
Max. efficiency	96.02%				
CEC efficiency	95.45%				
Battery charged by PV max. efficiency	96.21%				
Battery charged / discharged to AC max. efficiency	94.16%/94.22%				
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)	21.02 × 36.61 × 11.69 in (534 × 930 × 297 mm)				
Weight	142.86 lbs (64.8 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	IEEE 1547-2018, IEEE1547.1-2020, CA Rule 21, SRD 2.0				
Safety Certifications	UL 1741 PVRSS, UL 1699B, UL 1998 (US), UL 1741, UL 1741 SB, CSA C22.2107.1-1				
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				

9. Appendix

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

9.1.1 DER response (shall trip) to abnormal voltages for DER of abnormal operating performance Category III

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
	GRID CODE	33092		IEEE1547-18	Set grid code standard
OV1_TRIP_V-AS	OV-G-V 01	43090	1.10≤V≤1.21	**1.10Vn**	Set grid over-voltage protection 01 value
OV1_TRIP_T-AS	OV-G-V-T 01	43091	0.1≤t≤13 S	13 S	Grid over-voltage protection 01 trip time
OV2_TRIP_V-AS	OV-G-V 02	43092	1.10≤V≤1.30	1.20Vn	Set grid over-voltage protection 02 value
OV2_TRIP_T-AS	OV-G-V-T 02	43093	0.1≤t≤5 S	0.16 S	Grid over-voltage protection 02 trip time
UV1_TRIP_V-AS	UN-G-V 01	43094	0.05≤V≤0.90	0.88Vn	Set grid under-voltage protection 01 value
UV1_TRIP_T-AS	UN-G-V-T 01	43095	0.16≤t≤50 S	21 S	Grid under-voltage protection 01 trip time
UV2_TRIP_V-AS	UN-G-V 02	43096	0.05≤V≤0.90	0.5Vn	Set grid under-voltage protection 02 value
UV2_TRIP_T-AS	UN-G-V-T 02	43097	0.16≤t≤21 S	2 S	Grid under-voltage protection 02 trip time
UV3_TRIP_V-AS	UN-G-V03	43427	0.05≤V≤0.50	0.5Vn	Set grid under-voltage protection 03 value
UV3_TRIP_T-AS	UN-G-V03-T	43428	0.16≤t≤21 S	2 S	Grid under-voltage protection 03 trip time
OV3_TRIP_V-AS	OV-G-V 03	43452	1.10≤V≤1.30	1.2Vn	Set grid over-voltage protection 03 value
OV3_TRIP_T-AS	OV-G-V-T 03	43453	0.1≤t≤5 S	0.16 S	Grid over-voltage protection 03 trip time

9.1.2 DER response (shall trip) to abnormal frequencies for DER of abnormal operating performance Category III

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
OF1_TRIP_F-AS	OV-G-F 01	43098	60.5≤f≤66 Hz	61.2 Hz	Set grid over-frequency protection 01 value
OF1_TRIP_T-AS	OV-G-F-T 01	43099	0.16≤t≤1000 S	300 S	Set grid over-frequency protection 01 trip time
OF2_TRIP_F-AS	OV-G-F 02	43100	60.5≤f≤66 Hz	62 Hz	Set grid over-frequency protection 02 value
OF2_TRIP_T-AS	OV-G-F-T 02	43101	0.16≤t≤1000 S	0.16 S	Set grid over-frequency protection 02 trip time
UF1_TRIP_F-AS	UN-G-F 01	43102	50≤f≤59.5Hz	58.5 Hz	Set grid under-frequency protection 01 value
UF1_TRIP_T-AS	UN-G-F-T 01	43103	0.16≤t≤1000 S	300 S	Set grid under-frequency protection 01 trip time
UF2_TRIP_F-AS	UN-G-F 02	43104	50≤f≤58 Hz	56.5 Hz	Set grid under-frequency protection 02 value
UF2_TRIP_T-AS	UN-G-F-T 02	43105	0.16≤t≤600 S	0.16 S	Set grid under-frequency protection 02 trip time

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9.1.3 Enter service criteria for DER of Category III

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
ES_V_LOW-AS	Recover-VL	43083	0.88≤V≤0.95	0.917Vn	Set grid recovery minimum voltage range after grid fault
ES_V_HIGH-AS	Recover-VH	43082	1.05≤V≤1.06	1.05Vn	Set grid recovery maximum voltage range after grid fault
ES_F_LOW-AS	Recover-FL	43085	59≤f≤59.9	59.5Hz	Set grid recovery minimum frequency range after grid fault
ES_F_HIGH-AS	Recover-FH	43084	60.1≤f≤61	60.1Hz	Set grid recovery maximum frequency range after grid fault
ES_DELAY-AS	Recover-T	43107	0-600 S	300 S	Set re-connection time after a fault is cleared
ES_RAMP_RATE-AS	Ramp-up Slew Rate	43430	0.1-100%	100%Pn/S	Set Ramp-up power slew rate during start-up

9.1.4 Constant power factor mode

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
CONST_PF_MODE_ ENABLE-AS	Fixed PF	43451	Enable/Disable	Disable	Fixed Power Factor mode Enable/Disable
CONST_PF-AS	Power Factor Setting Value	43054	-1 ~ -0.8 +0.8 ~ +1	1	Set Fixed Power Factor limit

9.1.5 Constant reactive power mode

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
CONST_Q_MODE_ ENABLE-AS	Fixed Reactive	43451	Enable/Disable	Disable	Fixed Reactive Power mode Enable/Disable
CONST_Q-AS	Reactive Power Setting Value	43051	-60 ~ 60 %	0	Set Reactive Power level

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9.1.6 Voltage-reactive (Volt-Var) power settings

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
QV_MODE_ ENABLE-AS	Volt-Var	43451	Enable/Disable	ENABLE	Voltage-Reactive power mode enable
QV_VREF-AS	Vref	43423	0.95 - 1.05	1	Per unit value based on the nominal grid voltage
QV_VREF_AUTO_ MODE-AS	Vref-Autonomous	43221 BIT01	Enable/Disable	DISABLE	Autonomous Vref adjustment enable
QV_VREF_OLRT-AS	Vref- Time	43415	300 - 5000 S	300 S	Vref adjustment time constant in seconds as specified by the area EPS operator
QV_CURVE_V2-AS	V2Set	43209	0.92≤V≤1.05	0.98Vn	Set grid voltage V2 limit for Volt-Var control
QV_CURVE_Q2-AS	Q2Set	43406	-60~60% Sn	0% Sn	Set reactive power Q2 for Volt-Var control
QV_CURVE_V3-AS	V3Set	43210	0.95≤V≤1.08	1.02Vn	Set grid voltage V3 limit for Volt-Var control
QV_CURVE_Q3-AS	Q3Set	43407	-60~60% Sn	0% Sn	Set reactive power Q3 for Volt-Var control
QV_CURVE_V1-AS	V1Set	43208	0.77≤V≤1.03	0.92Vn	Set grid voltage V1 limit for Volt-Var control
QV_CURVE_Q1-AS	Q1Set	43212	0~60% Sn	+44% Sn	Set reactive power Q1 for Volt-Var control
QV_CURVE_V4-AS	V4Set	43211	0.97≤V≤1.23	1.08Vn	Set grid voltage V4 limit for Volt-Var control
QV_CURVE_Q4-AS	Q4Set	43213	-60~0% Sn	-44% Sn	Set reactive power Q4 for Volt-Var control
QV_OLRT-AS	3Tau(Q)Setting	43217	0≤t≤180 S	5 S	Volt-Var - Open loop response time

9.1.7 Voltage-active (Volt-Watt) power settings

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
PV_MODE_ ENABLE-AS	Volt-Watt	43451	Enable/Disable	ENABLE	Voltage-Active power mode enable
	V1	43200	0.90≤V≤1.3	1.00Vn	Set grid voltage V1 limit for Volt-Watt control
	P1	43204	100-100 % Pn	100% Pn	Set power P1 for Volt-Watt control
	V2	43201	1.0≤V≤1.35	1.00Vn	Set grid voltage V2 limit for Volt-Watt control
	P2	43205	0-100 % Pn	100% Pn	Set power P2 for Volt-Watt control
PV_CURVE_V1-AS	V3	43202	1.05≤V≤1.09	1.06Vn	Set grid voltage V3 limit for Volt-Watt control
PV_CURVE_P1-AS	P3	43206	0-100 % Pn	100% Pn	Set power P3 for Volt-Watt control
PV_CURVE_V2-AS	V4	43203	1.06≤V≤1.10	1.10Vn	Set grid voltage V4 limit for Volt-Watt control
PV_CURVE_P2-AS	P4	43207	0-100 % Pn	20%Pn	Set power P4 for Volt-Watt control
PV_OLRT_AS	3Tau(P)Setting	43403	0≤t≤180 S	10 S	Volt-Watt - Open loop response time

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9.1.8 Active power-reactive (Watt-Var) power settings

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
QP_MODE_ ENABLE-AS	Power-Q	43451	Enable/Disable	DISABLE	Active power-Reactive power mode enable
QP_CURVE_P3_ GEN-AS	P3Set	43420	0.5 - 1.0 Pn	1.0	Watt-VAr point P3 setting (generating active power). Per unit value based on NP_P_MAX.
QP_CURVE_P2_ GEN-AS	P2Set	43419	0.4 - 0.8 Pn	0.5	Watt-VAr point P2 setting (generating active power). Per unit value based on NP_P_MAX.
QP_CURVE_P1_ GEN-AS	P1Set	43418	0.0 - 0.7 Pn	0.2	Watt-VAr point P1 setting (generating active power). Per unit value based on NP_P_MAX.
QP_CURVE_P1_ LOAD-AS	P1'Set	43463	0 ~ - 0.7 Pn	-0.2	Watt-VAr point P1 setting (absorbing active power). Per unit value based on NP_P_MAX_CHARGE.
QP_CURVE_P2_ LOAD-AS	P2'Set	43464	-0.4 ~ - 0.8 Pn	-0.5	Watt-VAr point P2 setting (absorbing active power). Per unit value based on NP_P_MAX_CHARGE.
QP_CURVE_P3_ LOAD-AS	P3'Set	43465	-0.5 ~ - 1.0 Pn	-1.0	Watt-VAr point P3 setting (absorbing active power). Per unit value based on NP_P_MAX_CHARGE.
QP_CURVE_Q3_ GEN-AS	Q3Set	43465	-60~60% Sn	-44% Sn	VArs at point P3 setting (generating active power). Per unit value based on NP_VA_MAX.
QP_CURVE_Q2_ GEN-AS	Q2Set	43410	-60~60% Sn	0% Sn	VArs at point P2 setting (generating active power). Per unit value based on NP_VA_MAX.
QP_CURVE_Q1_ GEN-AS	Q1Set	43409	-60~60% Sn	0% Sn	VArs at point P1 setting (generating active power). Per unit value based on NP_VA_MAX.
QP_CURVE_Q1_ LOAD-AS	Q1'Set	43412	-60~60% Sn	0% Sn	VArs at point P1 setting (absorbing active power). Per unit value based on NP_VA_MAX.
QP_CURVE_Q2_ LOAD-AS	Q2'Set	43413	-60~60% Sn	0% Sn	VArs at point P2 setting (absorbing active power). Per unit value based on NP_VA_MAX.
QP_CURVE_Q3_ LOAD-AS	Q3'Set	43414	-60~60% Sn	44% Sn	VArs at point P3 setting (absorbing active power). Per unit value based on NP_VA_MAX.
QP_OLRT-AS	3Tau(Q)Setting	43217	0≤t≤180 S	5 S	Watt-Var - Open loop response time

9.1.9 Parameters of frequency-droop (frequency-power) operation

IEEE 1547 Parameter	Parameter	MODBUS Register	Adjustment Range (pu)	Default (pu)	Description
PF_MODE_ ENABLE-AS	Frequency Derating Mode	43226	Enable/Disable 13H-IEEE1547-18	13H-IEEE1547 -18	Frequency Droop power mode enable
PF_DBOF-AS	13H-Over Freq. Derating Fstart	43227	60.017≤f≤61	60.036Hz	Set OF frequency start dead band for power derate
PF_DBUF-AS	13H-Under Freq. Derating Fstart	43233	59≤f≤59.983	59.964 Hz	Set UF frequency start dead band for power derate
PF_KOF-AS	13H-Over Freq. Derating Slope	43228	2-5 %	5 %	Set OF frequency derate droop slope
PF_KUF-AS	13H-UnderFreq. Derating Slope	43234	2-5 %	5 %	Set UF frequency derate droop slope
PF_OLRT-AS	13H-Freq. Droop Response Time	43229	0.2≤t≤10 S	5 S	Set frequency derate response time
	13H-Droop Pmin	43445	0 - 100% Pn	0 %	Set frequency droop P minimum

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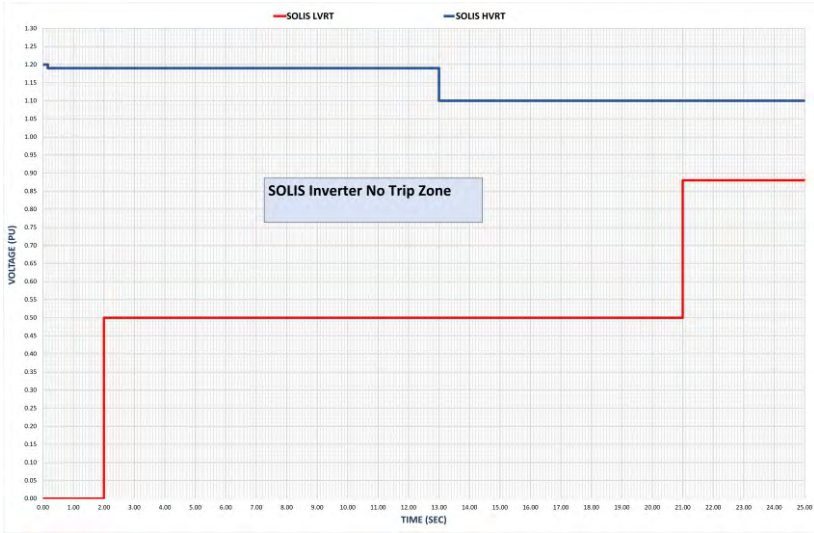
9.1.10 Nameplate Data

IEEE 1547 Parameter	Parameter	MODBUS Register	Units	Default (pu)	Description
NP_P_MAX-AS	Inverter rated apparent power	33067	kW	Pn	Active power rating in watts at unity power factor.
NP_VA_MAX-AS	Inverter rated apparent power	33067	kVA	Pn	Maximum apparent power rating in volt-amperes.
NP_Q_MAX_INJ-AS	Injected max. reactive power	33725	kVAR	0	Maximum injected reactive power rating in volt-amperes reactive .
NP_Q_MAX_ABS-AS	Absorbed max. reactive power	33727	kVAR	0	Maximum absorbed reactive power rating in volt-amperes reactive.
NP_P_MAX_CHARGE-AS		33731	kW	NA	Maximum active power charge rating in watts.
NP_APPARENT_POWER_CHARGE_MAX-AS		33731	kVA	NA	Maximum apparent power charge rating in volt-amperes.
NP_AC_V_NOM-AS	AC rated voltage	33718	Vac	Vn	Base nominal AC voltage rating in RMS Vac.
NP_AC_V_MAX-AS	AC overvoltage upper limit	33719	Vac	1.1 x Vn	Maximum output RMS AC voltage (VH) in the continuous operating region.
NP_AC_V_MIN-AS	AC under voltage low limit	33720	Vac	0.88 x Vn	Minimum output RMS AC voltage (VL) in the continuous operating region.
NP_SUPPORTED_MODES-AS	Standard operating modes	33123	Text	NA	Indication of support for each control mode function separated by dashes.
NP_MANUFACTURER-AS	Manufacturer	33723	Text	Solis	Manufacturer
NP_MODEL-AS	Product model	35000	Text	NA	Model
NP_SERIAL_NUM-AS	Inverter serial number	33004	Text	NA	Serial number
NP_FW_VER-AS	DSP software HMI software	33001 33002	Text	NA	Firmware version - DSP HMI
NP_MAX_P-AS	Power limitation	43052	kW	100%	Active power limit setting. Per unit value based on NP_P_MAX or NP_P_MAX_CHARGE.

9.1.11 Voltage Ride-Through Settings



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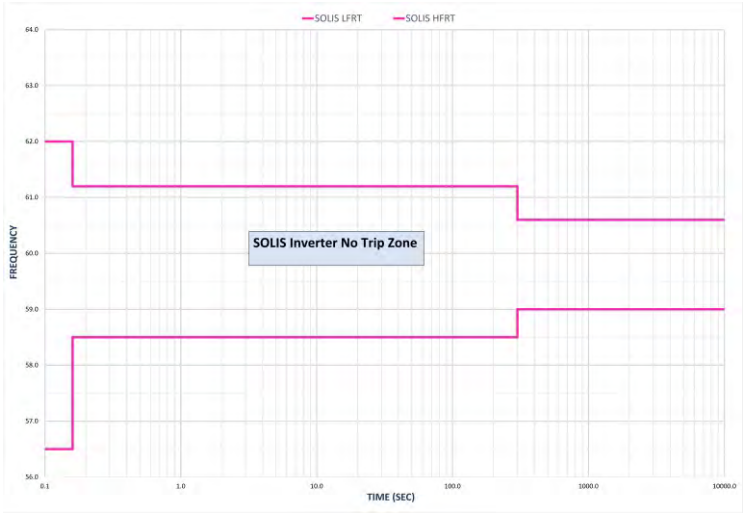
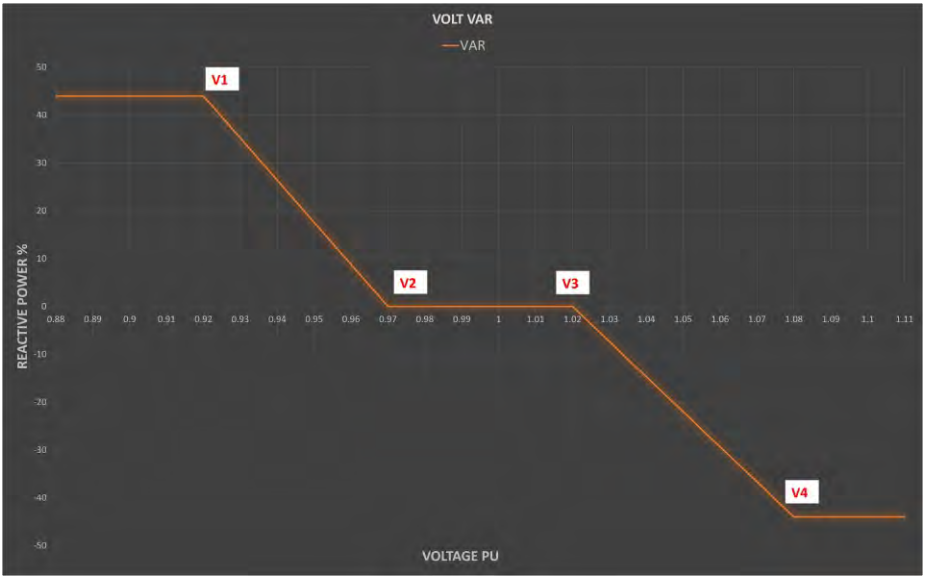


9.1.12 Volt-Var



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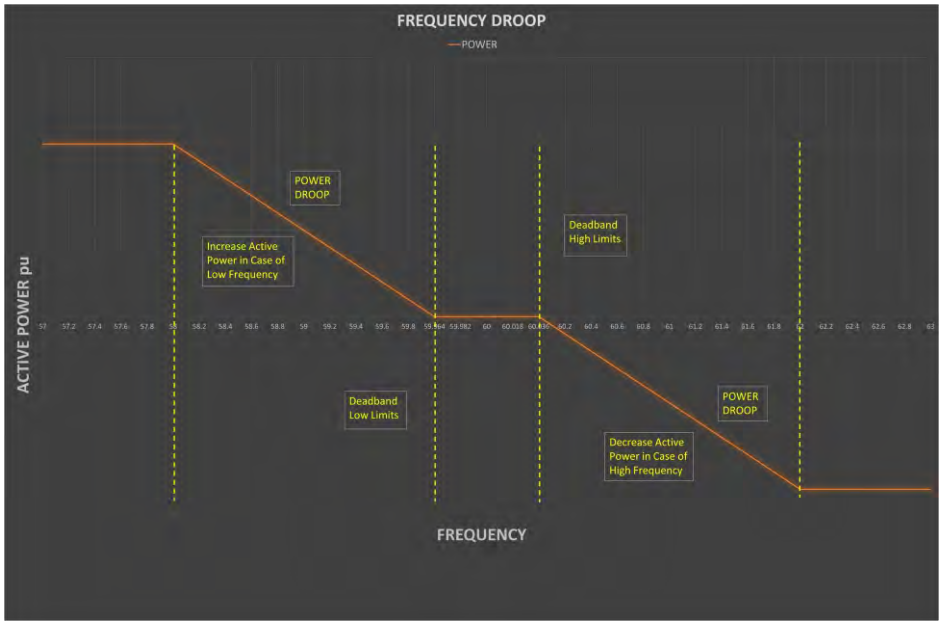
9.1.13 Volt-Watt

9.1.14 Frequency-Droop



9. Appendix

9.2 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.

9.3 UL 1741 SB Certification

CERTIFICATE OF COMPLIANCE

Certificate Number: **SGSNA/25/GZ/00140**

Contract Number: 802208
Certificate Project Number: GZ-CERT250401122

Certified Product: Hybrid Inverter
Trademarks: solis

Model(s): S6-EH2P16K03-SV-YD-L-US, S6-EH2P16K03-SV-YD-L-US-E, S6-EH2P14K03-SV-YD-L-US, S6-EH2P12K03-SV-YD-L-US, S6-EH2P12K03-SV-YD-L-US-E, S6-EH2P11.4K03-SV-YD-L-US, S6-EH2P10K03-SV-YD-L-US, S6-EH2P9.6K03-SV-YD-L-US

Technical Data: See Page 2 and page 3

Certificate Holder: Ginlong Technologies Co., Ltd.
No. 57, Jintong Road, Seafront (Binhai) Industrial Park, Xiangshan, Ningbo, 315712, Zhejiang, China

This certificate supercedes previous certificates issued with the same certificate number. Certification is valid when products are indicated on the SGS directory of certified products at www.sgs.com or using the QR code below. The product is certified according to ISO/IEC Guide 17067, Conformity assessment - Fundamentals of product certification, System 3, and in accordance with:

UL 1741, Third Edition, Dated September 28, 2021
CSA C22.2 No. 107.1:16 (reaffirmed 2021)
UL 1741, Third Edition, Dated September 28, 2021 (including UL 1741 Supplement SB)
UL 1699B, 1st Ed. August 22, 2018

Authorized by:

Jason Wei
Certifier

Effective date: 30 April 2025

Certification Body

Connectivity & Products, a division of SGS North America Inc.
620 Old Peachtree Road, Ste. 100, Suwanee, GA 30024, USA
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CERTIFICATE OF COMPLIANCE

Certificate Number: **SGSNA/25/GZ/00140**

Contract Number: 802208
Certificate Project Number: GZ-CERT250401122

Additional Information:

Compliance with

- IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces – IEEE Std 1547:2018 (Revision of IEEE Std 1547:2003), approved 15 February 2018; IEEE Std 1547a™-2020 Approved 9 March 2020. (Refer to IEEE Std 1547.1:2020, approved 5 March 2020.)

- IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems - IEEE Std 1547-2003 (R2008); IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems - IEEE Std 1547.1-2005.

- Hawaiian Electric Companies, IEEE 1547.1-2020 Source Requirements Document Version 2.0 (“SRD V2.0”), effective on July 1st, 2020

- UL1741 SECTION 92 TO SECTION 99, SEPTEMBER 28, 2021 - PHOTOVOLTAIC RAPID SHUTDOWN SYSTEMS

- Photovoltaic rapid shutdown systems CSA C22.2 NO. 330-23 (2023)

Technical Data:

S6-EH2P16K03-SV-YD-L-US
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 290A/290Amax
AC output (Back-up): 16000W, 220Vac/240Vac, 55-65Hz, 72.7A /66.7A,
AC output (Grid side): 16000VA, 220Vac/240Vac, 60Hz, 72.7A /66.7A, -0.8~+0.8

S6-EH2P16K03-SV-YD-L-US-E
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 290A/290Amax
AC output (Back-up): 16000W, 220Vac/240Vac, 55-65Hz, 72.7A /66.7A,
AC output (Grid side): 16000VA, 220Vac/240Vac, 60Hz, 72.7A /66.7A, -0.8~+0.8

S6-EH2P14K03-SV-YD-L-US
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 290A/290Amax
AC output (Back-up): 14000W, 220Vac/240Vac, 55-65Hz, 63.6A/58.3A,
AC output (Grid side): 14000VA, 220Vac/240Vac, 60Hz, 63.6A/58.3A, -0.8~+0.8

Certification Body

Connectivity & Products, a division of SGS North America Inc.
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CERTIFICATE OF COMPLIANCE

Certificate Number: **SGSNA/25/GZ/00140**

Contract Number: 802208
Certificate Project Number: GZ-CERT250401122

Technical Data:

S6-EH2P12K03-SV-YD-L-US
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 250A/250Amax
AC output (Back-up): 12000W, 220Vac/240Vac, 55-65Hz, 54.4A/50A,
AC output (Grid side): 12000VA, 220Vac/240Vac, 60Hz, 54.4A/50A, -0.8~+0.8

S6-EH2P12K03-SV-YD-L-US-E
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 250A/250Amax
AC output (Back-up): 12000W, 220Vac/240Vac, 55-65Hz, 54.4A/50A,
AC output (Grid side): 12000VA, 220Vac/240Vac, 60Hz, 54.4A/50A, -0.8~+0.8

S6-EH2P11.4K03-SV-YD-L-US
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 237.5A/237.5Amax
AC output (Back-up): 11400W, 220Vac/240Vac, 55-65Hz, 51.8A/47.5A,
AC output (Grid side): 11400VA, 220Vac/240Vac, 60Hz, 51.8A/47.5A, -0.8~+0.8

S6-EH2P10K03-SV-YD-L-US
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 208A/208Amax
AC output (Back-up): 10000W, 220Vac/240Vac, 55-65Hz, 45.5A/41.7A,
AC output (Grid side): 10000VA, 220Vac/240Vac, 60Hz, 45.5A/41.7A, -0.8~+0.8

S6-EH2P9.6K03-SV-YD-L-US
PV side: 100-450V(550Vmax), 40A
Batteries side: 40-60V, 200A/200Amax
AC output (Back-up): 9600W, 220Vac/240Vac, 55-65Hz, 43.6A/40A,
AC output (Grid side): 9600VA, 220Vac/240Vac, 60Hz, 43.6A/40A, -0.8~+0.8

Certification Body

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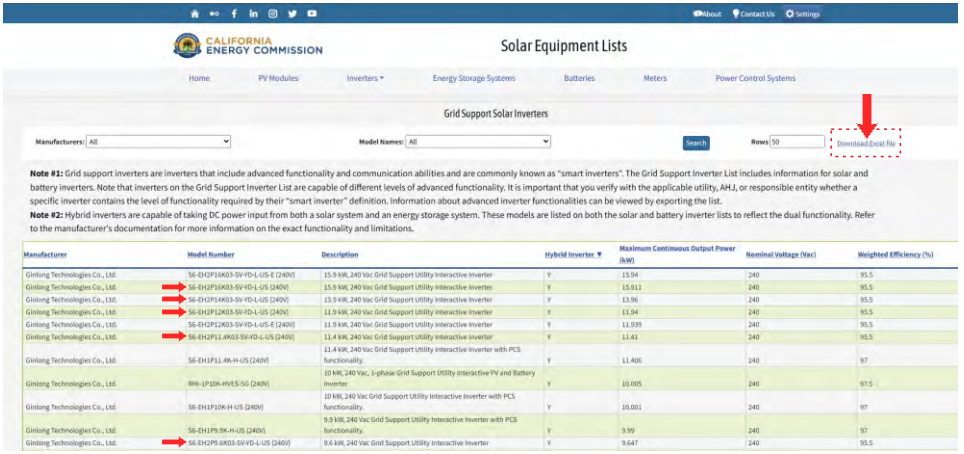
9. Appendix

9.4 California Energy Commission (CEC) Approval

The Solis S6-EH2P(9.6-16)K-SV-YD-L-US residential low-voltage energy storage inverter series was reviewed and approved by the California Energy Commission. The inverter models can be found on the CEC list of approved Grid Support PV Inverters and the list of approved Battery Inverters.



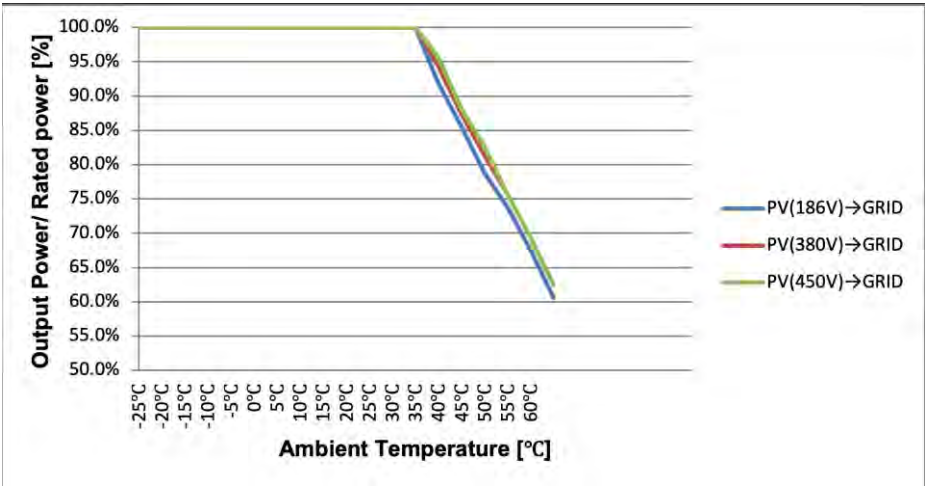
Solis inverter models can all be found listed under the manufacturer name "Ginlong Technologies Co., Ltd." not under the name "Solis". The Excel version of the list is easier to navigate. If you click "Download Excel File" in the top right corner, scroll down to rows 682-770 which contain the approved Solis models as of August 11th, 2025. The models belonging to the S6-EH2P(9.6-16)K-SV-YD-L-US series can also be found on the Battery Inverters list rows 243-253.

Scan for the most current CEC approved inverter list

Or go to the following website for the CEC list:
https://solarequipment.energy.ca.gov/home/invertersolarlist

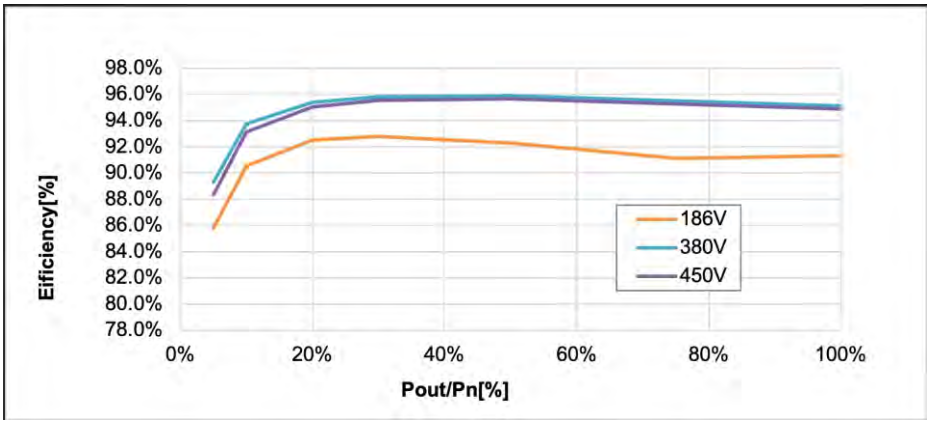
9. Appendix

9.5 Temperature Derating Curve



9.6 Efficiency Curves

PV to Grid



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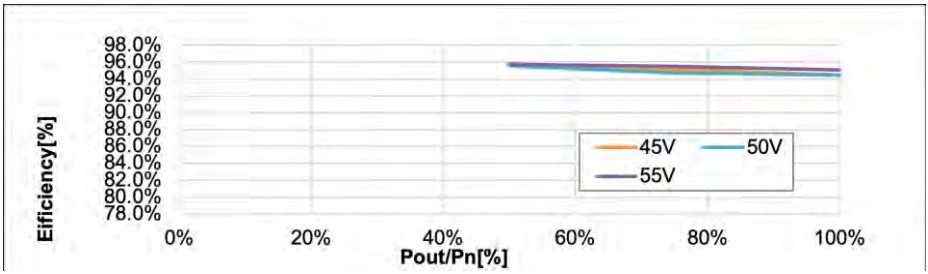
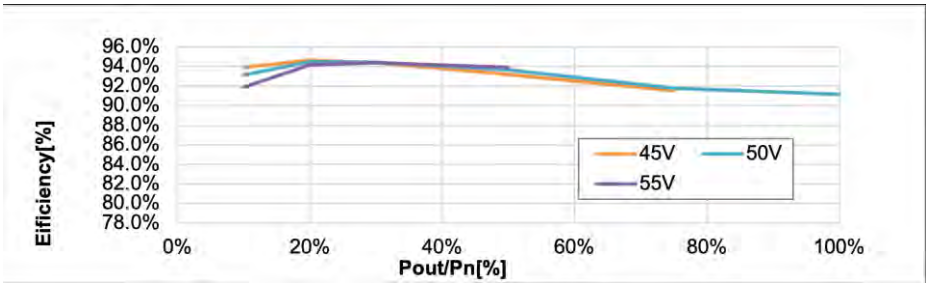
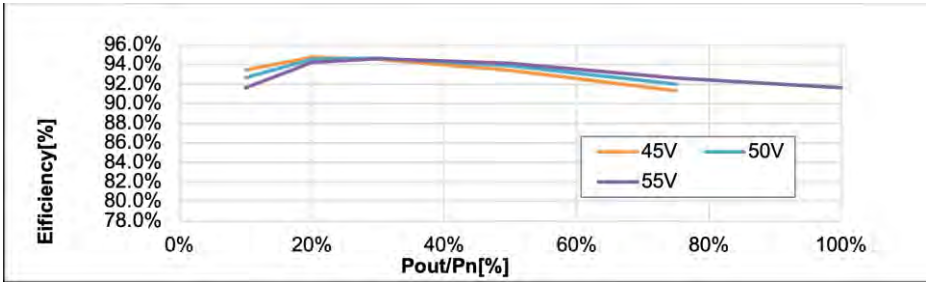
PV to Battery (Charging)



Grid to Battery (Charging)



Battery to Grid (Discharging)



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Houston, TX, 77080
Tel: +1(866)438-8408
Email: usservice@solisinverters.com
Web: www.solisinverters.com/us

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.

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