



User Manual

Commercial Energy Storage
Three Phase High Voltage
Hybrid Inverter



Applicable Models:

S6-EH3P30K03-LV-YD-H-US(21A)
S6-EH3P30K03-NV-YD-H-US(21A)
S6-EH3P40K04-NV-YD-H-US(21A)
S6-EH3P50K04-NV-YD-H-US(21A)
S6-EH3P60K04-NV-YD-H-US(21A)

Important Notes

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

Table of Contents

1 Introduction

2 Safety

3 Overview

4 Operating Modes

5 Installation

6 Commissioning

7 Troubleshooting

8 Datasheet

9 Appendix

Table of Contents

1. Introduction.....	06
1.1 Inverter Description.....	06
1.2 Included Components	09
1.3 Tools Required for Installation	09
1.4 Inverter Storage	10
2. Safety & Warning.....	11
2.1 Safety	11
2.2 General Safety Instructions	11
2.3 Notice for Use.....	13
2.4 Notice for Disposal	13
2.5 Protection Circuitry & Controls.....	13
3. Overview.....	14
3.1 LCD Display Screen & Indicator Lights.....	14
3.2 Inverter Wire Box & Connection Points.....	15
4. Operating Modes.....	16
4.1 PV-Only.....	16
4.2 Energy Storage.....	17
4.3 DC Coupling & AC Coupling.....	20
4.4 Backup Power Inverter Paralleling.....	22
4.5 External Automatic AC Bypass Switch.....	26
4.6 Wiring Diagrams.....	27
5. Installation.....	28
5.1 Selecting a Location to Install the Inverter.....	28
5.2 Product Handling.....	29
5.3 Inverter Dimensions.....	31
5.4 Mounting the Inverter.....	32
5.5 Maximum Conductor Sizes & Torque Specs.....	35
5.6 Equipment Grounding & Neutrals.....	36
5.7 PV Cable Installation.....	37
5.8 Rapid Shutdown & Emergency Power Off.....	39
5.9 Battery Installation.....	43
5.10 AC Wiring.....	45
5.11 Smart Port: Generator, AC-Coupling, & Load Shed.....	49
5.12 Inverter Communication.....	50
6. Commissioning.....	60
6.1 Pre-Commissioning Steps.....	60
6.2 Solis Loggers.....	60

Table of Contents

- 6.3 SolisCloud.....61
- 6.4 Power ON & OFF Procedures.....62
- 6.5 HMI Commissioning Process.....63
- 6.6 Mobile Application Commissioning.....72
- 7. Troubleshooting.....90
 - 7.1 Inverter Maintenance.....90
 - 7.2 Inverter Alarm Codes.....91
 - 7.3 Service Ticket Information.....95
 - 7.4 Inverter Firmware.....96
- 8. Datasheet.....97
- 9. Appendix.....99
 - 9.1 Default Settings for IEEE1547-2018 (UL-240V-18 Standard).....99
 - 9.2 Default Settings for California Rule 21 (R21P3-24A Standard).....101
 - 9.3 Frequently Asked Questions.....103
 - 9.4 FCC Instructions Page.....104
 - 9.5 UL 1741 SB Certification.....105
 - 9.6 Data Collection & Storage.....108

1. Introduction

1.1 Inverter Description

This Solis hybrid inverter series is designed for commercial solar plus energy storage applications where the power grid is 480V, 240V, 220V or 208V three phase. The inverter is able to maximize self-consumption while also providing backup power whenever grid power is lost. It can also utilize peak-shaving and time charging modes. The inverter is able to connect directly to a generator as well. The Solis S6 series consists of the following inverter models: 30kW, 40kW, 50kW, 60kW, and 30kW-LV (LV = “Low Voltage” 240V, 220V or 208V)

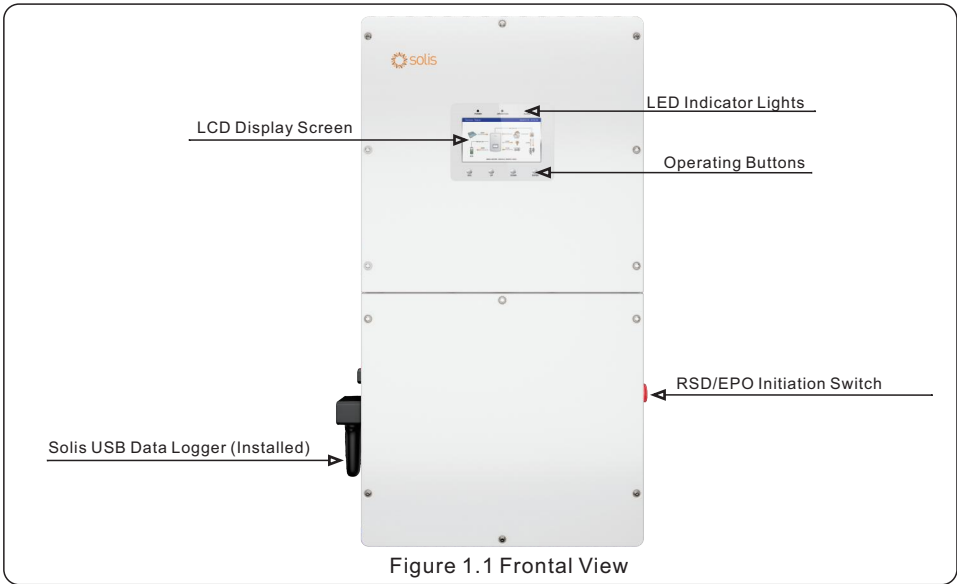


Figure 1.1 Frontal View

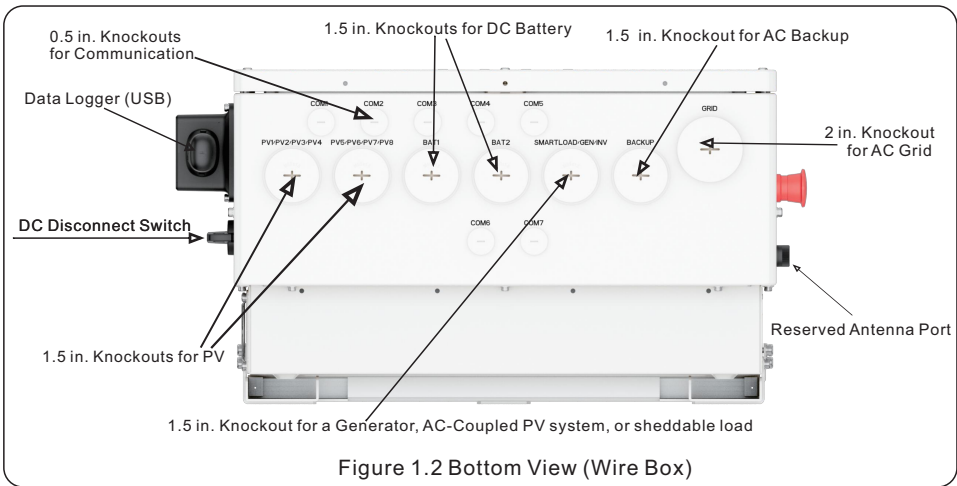


Figure 1.2 Bottom View (Wire Box)

1. Introduction

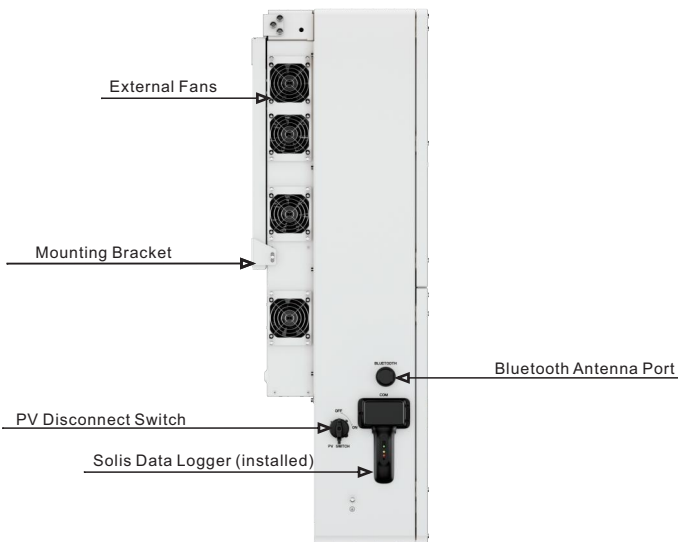


Figure 1.3 Right Side View

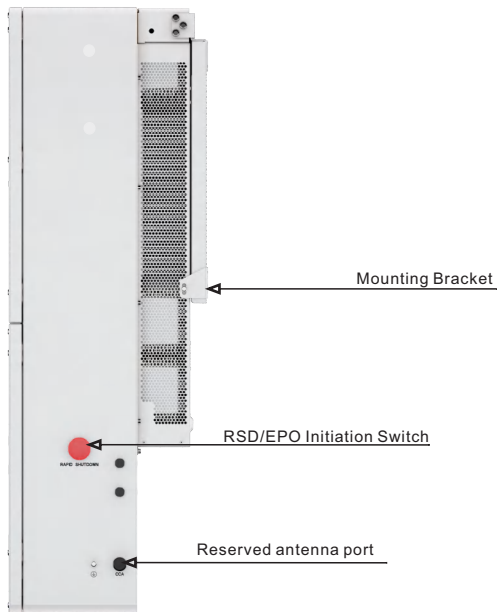


Figure 1.4 Left Side View

1. Introduction

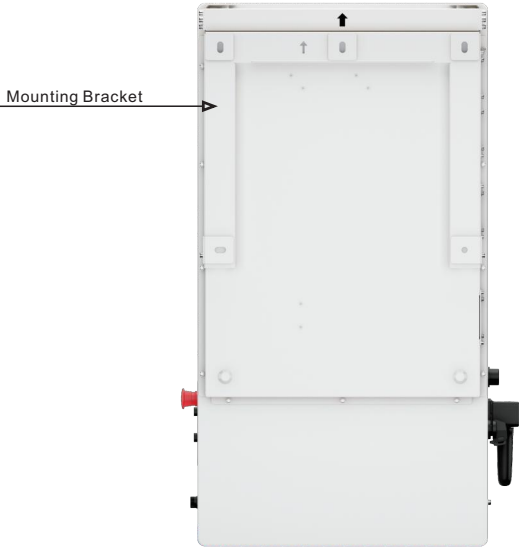


Figure 1.5 Back View

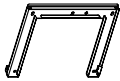
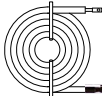


Figure 1.6 Top View

1. Introduction

1.2 Components Included with the Inverter

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

 Inverter x1	 Back plate x1	 Fastening screw x4	 Expansion Bolt x5	 S2-WL-ST Stick x1
 CAN cable(3m) x1	 Handle x2	 Eastron ESCT-T24 Split-Core CTs x3	 RJ45 connector x11	 Meter(SDM630MCT-ETL) x1



NOTE

The CT cable lengths are 4 meters (13.12 ft.) and they cannot be extended.
If the installation requires an extension, an external meter must be installed.

1.3 Tools Required for Inverter Installation

 Technician Screwdriver	 Phillips Screwdriver	 Wire Strippers 12AWG to 6AWG	 Heavy Duty Wire Stripper	 Ferrule Crimping Tool
 Channel Locks	 Multimeter (AC/DC amps)	 Hex Screw Tips: 3MM, 5MM, 7MM, 8MM	 Torque Wrench Screwdriver	 Smart Phone (for commissioning)
 SZF 3-1,0X5,5-Screwdriver				

1. Introduction

1.4 Inverter Storage

- If the inverter is not installed immediately, please abide by the storage instructions and environmental conditions listed below.
- Use the original box to repackage the inverter, seal with adhesive tape with the desiccant inside the box.
- Store the inverter in a clean and dry place, free of dust and dirt. The storage temperature must be between -22~158°F and humidity should be between 0 to 100%, non-condensing.
- Do not stack more than two (2) inverters high on a single pallet. Do not stack more than 2 pallets high.
- Keep the box(es) away from corrosive materials to avoid damage to the inverter enclosure.
- Inspect the packaging regularly. If packaging is damaged (wet, pest damages, etc.), repackage the inverter immediately.
- Store inverters on a flat, hard surface -- not inclined or upside down.
- Do not remove the desiccant packet that is included with the inverter. It is included to ensure that any residual moisture is absorbed quickly.
- Restarting after a long period of non-use requires the equipment be inspected and, in some cases, the removal of oxidation and dust that has settled inside the equipment will be required.
- Perform an annual visual inspection of the inverter box for signs of damage
- If the inverter has been removed from the box and then replaced, put desiccant packets in the inverter wire box to ensure the internal components stay dry
- Do not store the inverter outside or in a place that does not have environmental controls.



**DO NOT STACK
MORE THAN 2 HIGH**

2. Safety & Warning

2.1 Safety

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



DANGER

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



WARNING

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



CAUTION

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



NOTE

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



WARNING: Risk of fire

Despite careful construction, electrical devices can cause fires.

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

2.2 General Safety Instructions



WARNING

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



WARNING

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



WARNING

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



WARNING

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

2. Safety & Warning



WARNING

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

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

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



CAUTION

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



CAUTION

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



CAUTION

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



NOTE

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



WARNING

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



WARNING

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



WARNING

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



WARNING

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



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

2. Safety & Warning

2.3 Notice for Use

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

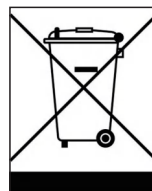
1. Permanent installation is required.
2. The electrical installation must be compliant with all local and national regulations & standards.
3. The inverter must be installed according to the instructions stated in this manual.
4. The inverter must be installed according to the inverter technical specifications.

2.4 Notice for Disposal

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

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

Local waste management rules shall be observed and respected.



2.5 Protection Circuitry and Controls

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

Arc Fault Circuit Interrupter AFCI:

Edition 2011 of the National Electrical Code®, Section 690.11, requires that all PV plants attached to a building are fitted with a means of detecting and interrupting serial electric arcs in the PV wiring and array. An electric arc with a power of 300W or greater must be interrupted by the AFCI in the time specified by UL 1699B. After five arc fault detections in 24 hours, an AFCI-induced shutdown will be triggered. If this event occurs, the inverter must be manually reset. After clearing the source of the fault, the inverter can be powered back on and allowed to resume normal operation.

Anti-Islanding Protection:

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

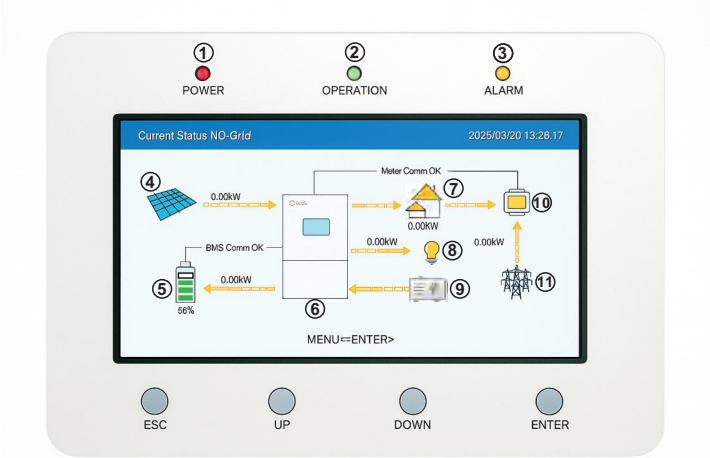


NOTE:

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

3. Overview

3.1 LCD Display Screen and Indicator Lights



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

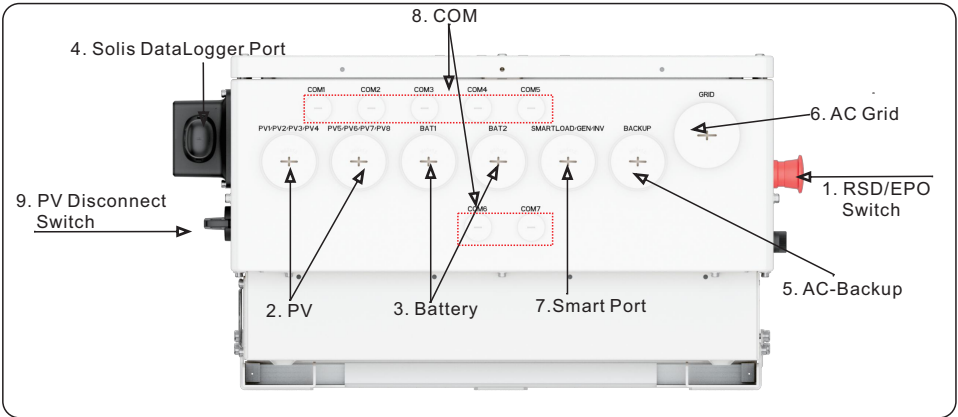


NOTE:

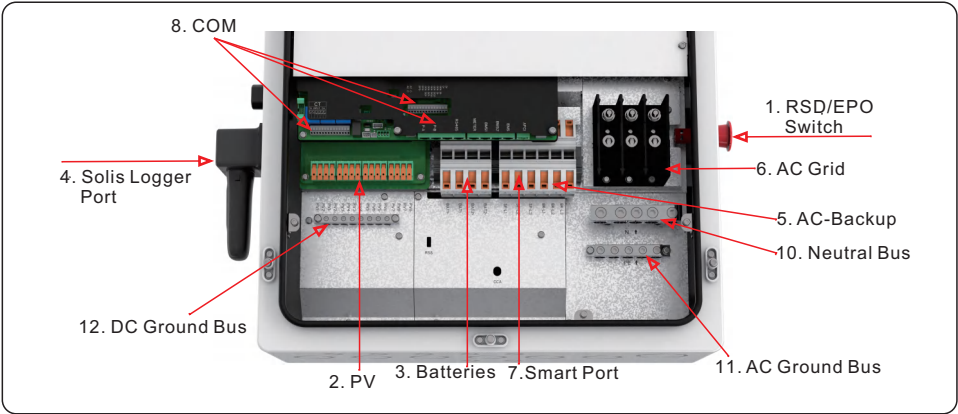
The screen will turn off after a few minutes to conserve energy. Press any button to wake the screen up. Press the Enter button to access the main menu.

3. Overview

3.2 Inverter Wire Box and Connection Points



Name	Description
1. RSD/EPO Initiation Switch	Disables the internal rapid shutdown (RSD) transmitter, initiating rapid shutdown. Engaging this switch disables all AC output from the inverter. Does not turn off battery.
2. PV	PV string conductors should be connected here
3. Battery	Battery conductors should be connected here
4. Solis Datalogger Port	Port (USB) for connecting Solis data loggers only
5. AC-Backup	AC conductors to backup loads panel should be connected here
6. AC-Grid	AC conductors to the main service panel should be connected here
7. Smart Port	AC conductors to a generator, AC-coupled PV system, or sheddable load connect here
8. Communication (COM)	RS485, CAN, parallel inverter, and other communication cables get connected here
9. PV Disconnect Switch	Disconnects the PV array to the inverter power train. Does not turn off battery.
10. Neutral Bus Bar	Common bus bar for all neutral conductors to terminate (not grounded)
11. AC Ground Bus Bar	Common bus bar for all AC ground conductors to terminate
12. DC Ground Bus Bar	Common bus bar for all DC ground conductors to terminate

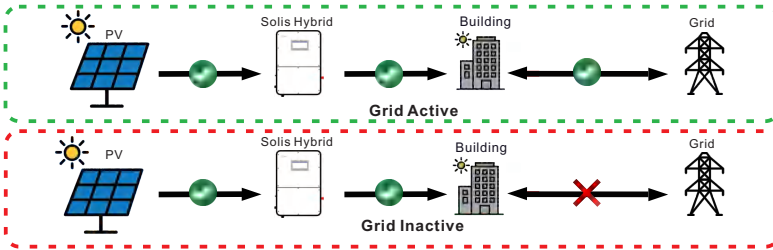


4. Operating Modes

4.1 PV-Only

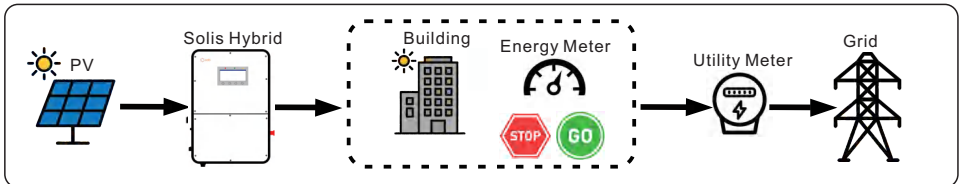
4.1.1 Grid-Tie PV String Inverter

This inverter can be as a PV-only grid-tied string inverter. Only the PV/backup/ grid ports would be utilized. The inverter does have a feature allowing it to provide backup power with only PV. However, an overload condition will occur if load consumption exceeds the available power from the PV. This feature is great for short-duration (1-2) hour outages during the day with load consumption kept low. Batteries can always be added in the future, keeping the initial installation cost low. Overload faults occurrences and recover times are as follows: First - 30 seconds, Second - 3 minutes, Third, Fourth, Fifth - 10 minutes, Sixth - hard reset is required, no automatic recovery.



4.1.2 Export Power Control

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



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

Zero-Net Export

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

NOTE:



The exported power cannot be kept to exactly zero. Solis export power control function is based on the measurements taken by the provided CTs or an external energy meter. Due to the sampling interval limitation, when there are sudden changes in load consumption small amounts of power will be exported. For stricter zero export applications, it is recommended to install an external backflow trip device. Solis does not sell this device.

4. Operating Modes

4.2 Energy Storage

4.2.1 Overview of Energy Storage Modes

The S6 hybrid is capable of providing AC power to loads using PV and battery power in the event of a grid failure. This is known as **backup power**. The amount of backup power that each S6 hybrid model can provide is equal to the amount of on-grid power that it can provide. For example, an 60K model can provide up to 60kW of continuous backup power.

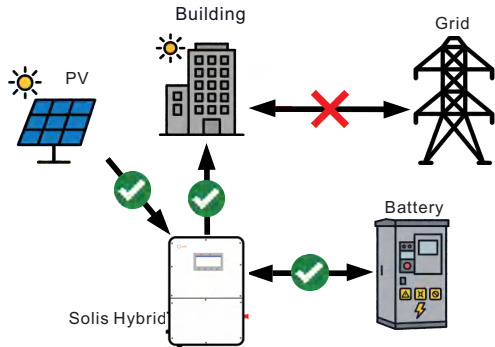


Figure 4.1 Backup power with Solis S6 hybrid

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

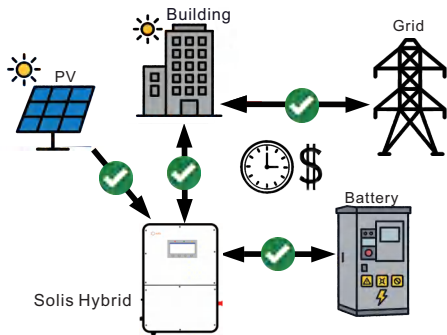


Figure 4.2 Energy arbitrage with Solis S6 hybrid

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



NOTE:

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

4. Operating Modes

4.2.2 Energy Arbitrage

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

Self-Use Mode(Self-Consumption)

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

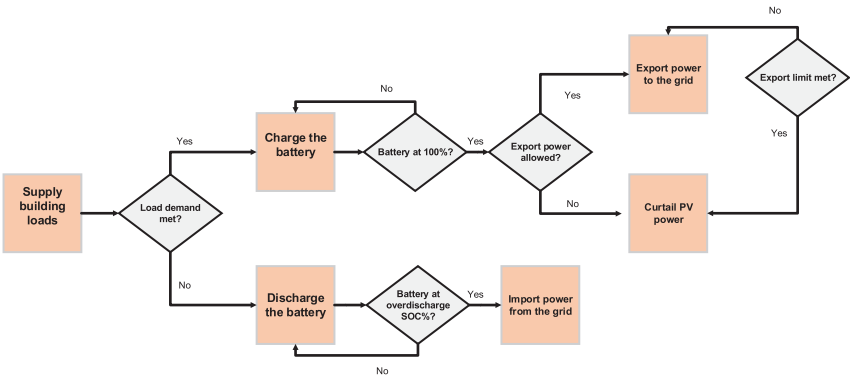


Figure 4.3 Self-Use Mode logic diagram

Selling First Mode(Export Priority)

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

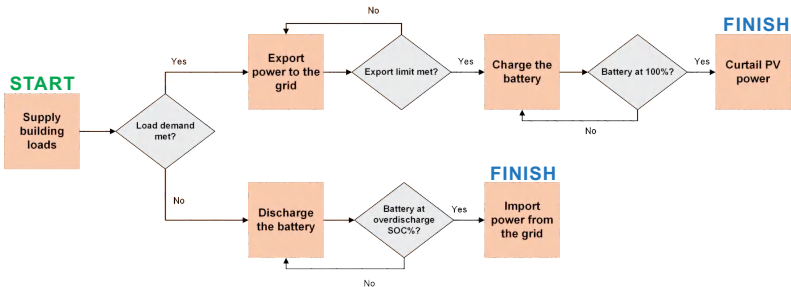


Figure 4.4 Selling first Mode logic diagram

4. Operating Modes

Off-Grid Mode

There is a dedicated mode specifically for 100% off-grid systems which are not electrically connected to the grid at all. This mode should not to be confused with backup mode, which occurs only for grid-tied systems. The logic for Off-Grid mode is the same as Self-Use mode. However, there is no export power control since there is no grid and a generator is often used in place of the grid to supplement the PV and batteries. When PV meets the load and there is still excess energy, this portion of PV charges the battery. If the battery has not reached the generator's "Off SOC" setting, the generator will continue to charge it. Furthermore, the battery must be connected to the inverter when the generator function is in use.

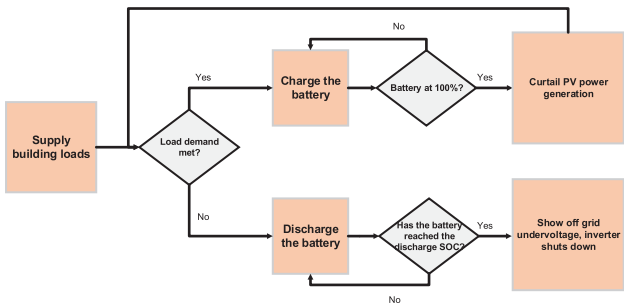


Figure 4.5 Off-Grid Mode logic diagram



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

Peak-Shaving Mode

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

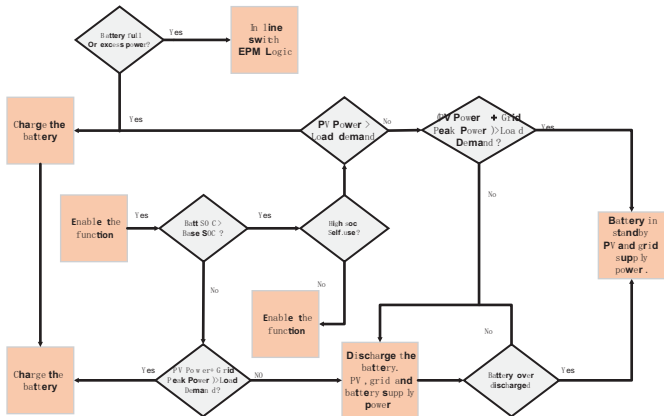


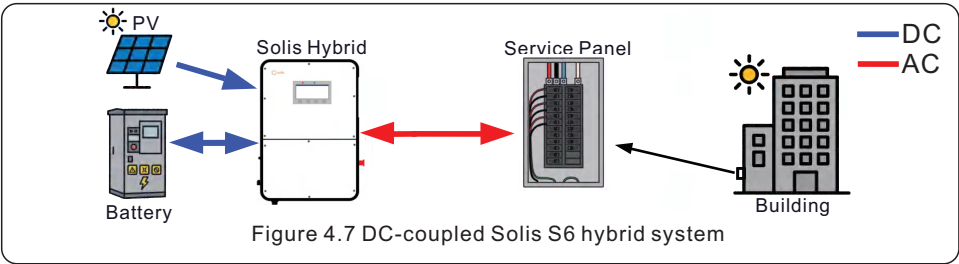
Figure 4.6 Peak-Shaving Mode logic diagram

4. Operating Modes

4.3 DC Coupling vs AC Coupling

4.3.1 DC-Coupling

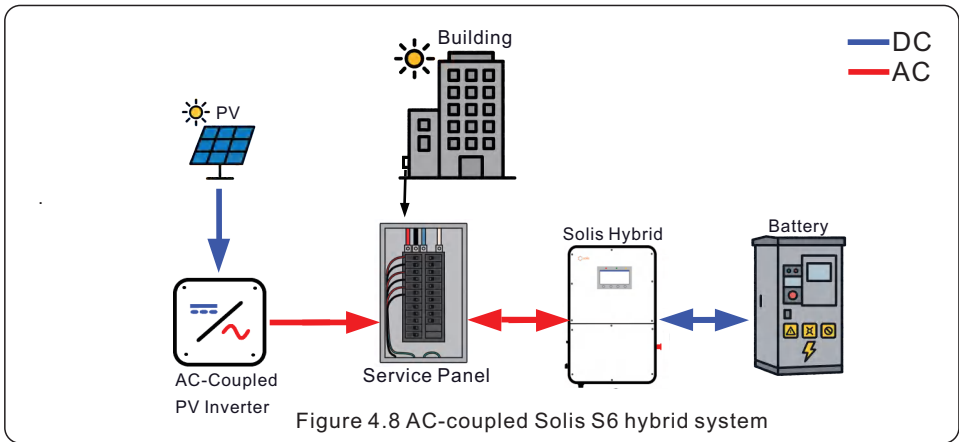
DC-coupling is the recommended configuration for this inverter. This is because DC-coupling allows the full potential of this inverter to be utilized, maximizing the efficiency of the PV-to-battery charging. In a DC-coupled system, the PV also gets connected to the inverter in addition to the battery.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



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

4.3.2 AC-Coupling at Grid Port

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



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

4. Operating Modes

4.3.3 AC-Coupling at the Smart Port

An existing PV system can be AC-coupled (ACPV) to the Smart Port for backup support during outages. ACPV output must be less than the Solis hybrid inverter's rated power. "ACPV" refers to any AC-coupled PV system, while "PV" refers to DC-side connections on the S6. The ACPV breaker must be relocated into the backup load center so it remains energized during outages. When grid-connected, monitor grid-side consumption: if combined Solis + ACPV power exceeds the inverter rating, an overload alarm may occur.

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.



60kW
Solis Hybrid

+



30kW
ACPV



Export Power
Set to 60kW
Energy
Meter



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.



40kW
Solis Hybrid

+



50kW
ACPV



It is recommended to install an external contactor switch in series between the Smart Port and the ACPV when connecting the grid-tied inverter to the Smart Port of the inverter. The Smart Port relay cannot be turned off at zero current, which will affect the relay's lifespan.

Suggested Specifications:
Circuit breaker/contact, three-phase four-wire, rated current above 100A, supporting internal DO control turn-off of the inverter). When it is necessary to stop the AC couple function, first control the external switch to be disconnected, and then cut off the smartload port relay at zero current."

```
graph TD
    subgraph ON_grid [ON grid]
        S1[Supply loads] --> D1{Load demand met?}
        D1 -- Yes --> O1[The grid-tied operates at full power with a load]
        D1 -- No --> O2[Discharge the battery]
    end

    subgraph Off_grid [Off-grid]
        S2[Supply loads] --> D2{Load demand met?}
        D2 -- Yes --> O3[Charge the battery]
        D2 -- No --> O4[The grid-tied is operating at full power and the battery is discharging]
        O3 --> D3{Battery at 100%?}
        D3 -- Yes --> O5[Adjust the output frequency of the Hybrid]
        O5 --> D4{ACPV supports frequency-watt shifting?}
        D4 -- Yes --> O6[ACPV curtails according to the IEEE 1547-2018 frequency-watt curve]
        D4 -- No --> O7[ACPV turns off]
    end
```

Figure 4.9 AC-Coupling (ACPV) with Backup Operating Logic

21

4. Operating Modes

Frequency Shifting

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



NOTE:

The maximum output power of the existing PV inverter must be less than the maximum output power of the Solis hybrid inverter. AC coupling can be done on either the grid side or the smart port side. However, if it is on the smart port side, then the max. output power of the existing PV inverter must be less than the maximum output power of the Solis hybrid inverter.

4.4 Backup Power Inverter Paralleling

Up to six hybrid inverters can be installed together in parallel on the backup side of the system. The backup ports of each inverter would terminate in separate overcurrent protection devices within the backup load center.

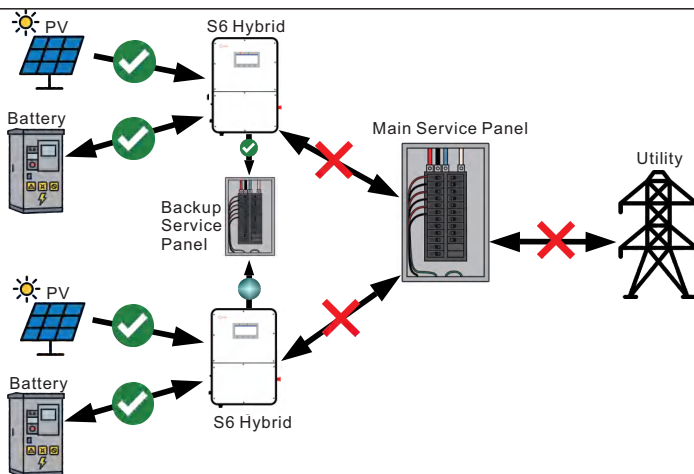


Figure 4.10 Backup with paralleled Solis hybrids

It should first be determined what the maximum continuous current needs to be in order to meet the energy demand of the home. Up to six S6 hybrid inverters can be installed in parallel with PV and batteries to provide continuous backup power. For example, three 60kW hybrids in parallel can provide up to 216.6A (72.2A x 3) of power to the loads in backup mode.

For a system with backup, the average daily power consumed should be less than or equal to the average daily PV power produced on any given day of the year. Otherwise, an overload condition may occur, causing the system to go down temporarily. The chart in Figure 4.16 shows how much continuous backup power can be produced depending on how many inverters are installed in parallel and what size they are.

4. Operating Modes

Solis Model	Total Maximum Continuous Backup Current					
	1 unit	2 units	3 units	4 units	5 units	6 units
30kW	36.1A	72.2A	108.3A	144.4A	180.5A	216.6A
30kW (208V)	72.2A	144.4A	216.6A	288.8A	361A	433.2A
40kW	48.1A	96.2A	144.3A	192.4A	240.5A	288.6A
50kW	60.1A	120.2A	180.3A	240.4A	300.5A	360.6A
60kW	72.2A	144.4A	216.6A	288.8A	361A	433.2A

Figure 4.11 Backup power chart based on Solis model and number of paralleled units

Surge Capacity & Passthrough Power

The **surge capacity** is how much power the inverter can generate for a small amount of time, usually one hundred milliseconds to ten seconds maximum. Each Solis model has different ratings for passthrough power and surge capacities. Installing multiple inverters in parallel increases the surge capacity and passthrough power. The chart in Figure 4.13 shows the surge capacities and passthrough power ratings for each model. The surge capacity for 10 Second is 150% of the rated continuous output current. For example, 72.2A x 150% = 108.8A for 100 milliseconds. The surge capacity for 10 seconds is 150% of the rated continuous output current.

There will be times when the loads on the backup side consume more power than the inverter is able to provide with PV and battery power. The **passthrough power** is the amount of power that the can pass through the inverter from the grid to the loads when there is not enough PV and battery power available. The passthrough current rating of the 30kW is 72.2A and the rating for both the 60kW and 30kW 208V models is 142.2A. In the event of an inverter failure, the backup loads will lose power. **It is strongly recommended to install an external bypass switch to protect the loads from this type of event. The inverter does not automatically bypass and there is no integrated bypass switch.**

Solis Model	600s Surge Current	60s Surge Current	10s Surge Current	2s Surge Current
30kW	43.32A	50.54A	54.15A	57.76A
30kW (208V)	86.64A	101.84A	108.3A	115.54A
40kW	57.72A	67.34A	72.15A	76.96A
50kW	72.12A	84.14A	90.15A	96.16A
60kW	86.64A	101.84A	108.3A	115.54A

Figure 4.12 Surge Current Ratings based on Surge Duration

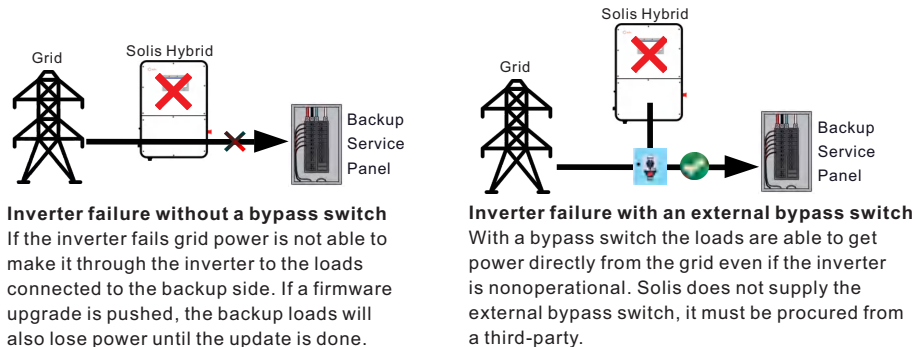


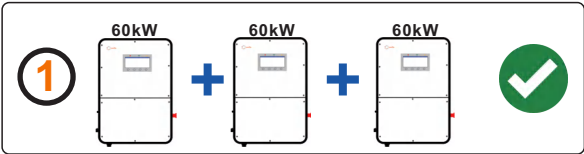
Figure 4.13 Passthrough Power with and without an External Bypass Switch

4. Operating Modes

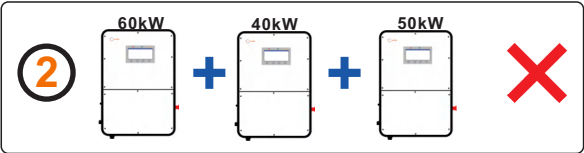
4.4.1Paralleling Limitations and Restrictions

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

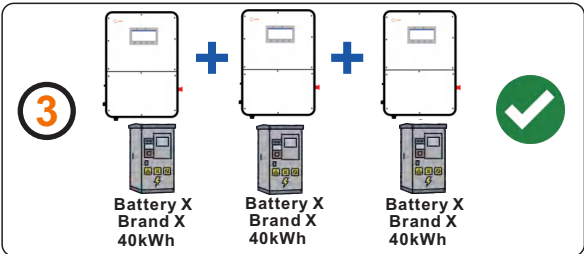
1. Paralleled inverters must be the same size (model number).



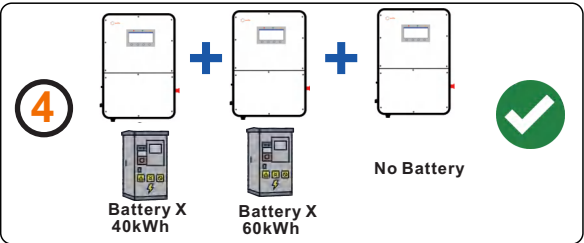
2. Do not parallel inverters that are different sizes. Again, this rule only applies to systems with backup power.



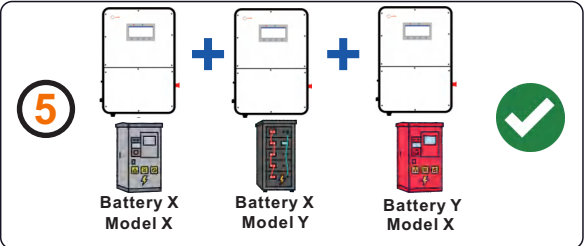
3. Paralleled inverters should have the same capacity (kWh), brand, and model of battery connected for maximum system efficiency. However, mixing and matching different batteries in the same system is acceptable.



4. Supports different capacities, but the capacity difference should be within 50% range. To ensure balanced charging and discharging in parallel, it is recommended that the battery capacity remain consistent.



5. Supports different brands, different models of the same brand, and different batteries connected to the same inverter.



NOTE:

CTs can be connected directly to the inverter without needing to install an energy meter. This only works for 1 inverters. When three or more inverters are being installed, the Easton energy meter must be installed. The hardware limit for CT mode is set at 300A.

4. Operating Modes

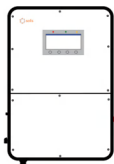


NOTE:

In an off grid parallel system, if the battery capacity is limited and some are connected to the battery while others are not, it is recommended that the battery be connected to the host

4.4.2 Power Control System (PCS)

The Solis S6 hybrid inverter is UL 3141 PCS certified. Its type is multisource PCS. This means that the inverter is able to regulate the current and limit the loading on the bus bars and conductors. The PCS can limit the power flow as to not exceed any busbar rating limits. With PCS, the 120% rule for breaker sizing becomes irrelevant, you can go up to the busbar rating. For the S6-EH3P(30-60)K04-NV-YD-H-US(21A) model, the maximum controlled current on the busbar is 72.2A (30kW).



S6-EH3P(30-60)K04-NV-YD-H-US(21A)
Solis Hybrid Inverter



Easton ESCT-T24
Split-Core CTs

Figure 4.14 Components of a Solis commercial PCS system



NOTE:

Every S6 hybrid comes with a set of three Easton Split-Core CTs. The Rogowski Coils are optional accessory components that must be purchased separately with Easton SDM630-MCT-OCS.



CAUTION:

Risk of Loss of Power. If the setting of the PCS is lower than the sum of all loads or sources connected to, but not controlled by the PCS, overcurrent protective devices in the controlled conductors may open resulting in a loss of power to all circuits connected to the PCS.

PCS function: Power Import and/or Export Limiting, Busbar Overload Control (BBOC)

Power Import Limiting (PIL) Range of adjustment for the function: 72.2~144.4A

Power Export Limiting (PEL) Range of adjustment for the function: 0~72.2A

Busbar Overload Control (BBOC) Range of adjustment for the function: 0~72.2A

"The PIL setting shall not be lower than the uncontrolled load determined by a load calculation using one of the methods required in NFPA-70 based on the PCS application."

"CAUTION: Risk of Loss of Power. If the setting of the PCS is lower than the sum of all loads or sources connected to, but not controlled by the PCS, overcurrent protective devices in the controlled conductors may open resulting in a loss of power to all circuits connected to the PCS."

4. Operating Modes

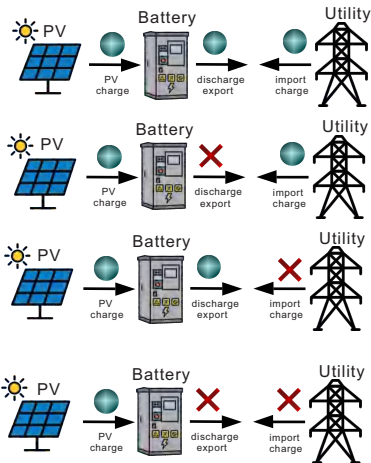
Solis Power Control System (PCS) Operating Modes

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

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

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

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



4.5 External Automatic AC Bypass Switch

This Solis hybrid does not have the ability to automatically bypass the inverter should the inverter fail. To ensure protection of the loads connected to the backup side, it is strongly advised to install a third-party external AC bypass switch. These switches can be expensive, but it is essential to install one so that the loads are never without power should there be an equipment failure.

4.5.1 Requirements for an External Automatic AC Bypass Switch

Any AC bypass switch that meets the following criteria is compatible with this inverter:

- 1. Must be rated for at least 200A since the passthrough power goes up to 144.4A
- 2. Must have UL 98 certification for spring-loaded transfer
- 3. Must be rated for 480VAC or 208VAC depending on the model of Solis inverter installed

4.5.2 Examples of Compatible Automatic AC Bypass Switches

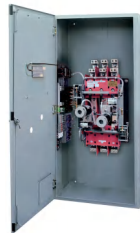
**ASCO (Schneider Electric)
Series 7000 ATS(600A, 480V)
Bypass-Isolation Switch**



**Eaton –
Contactor-based ATS
(400A, 277/480V)**



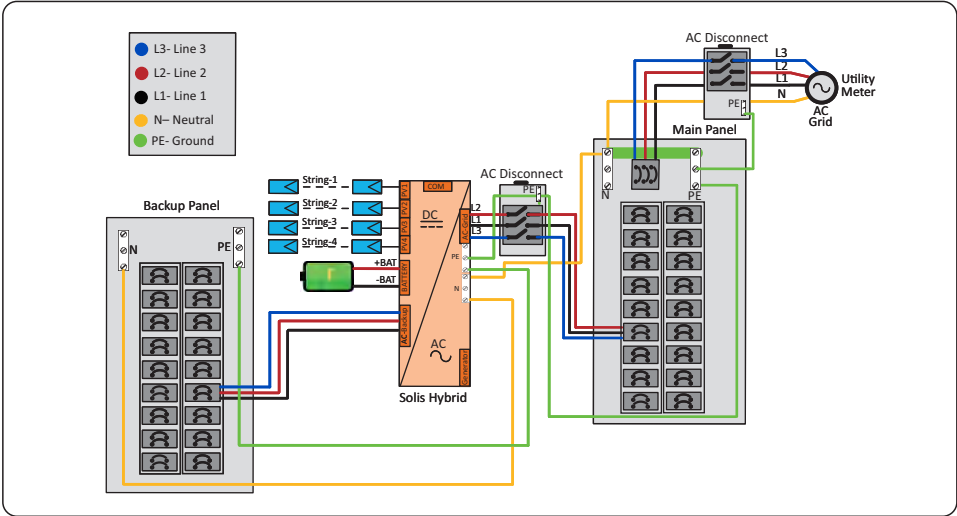
**Russelectric (Siemens)
RTS03 (400 A, 277/480 V)**



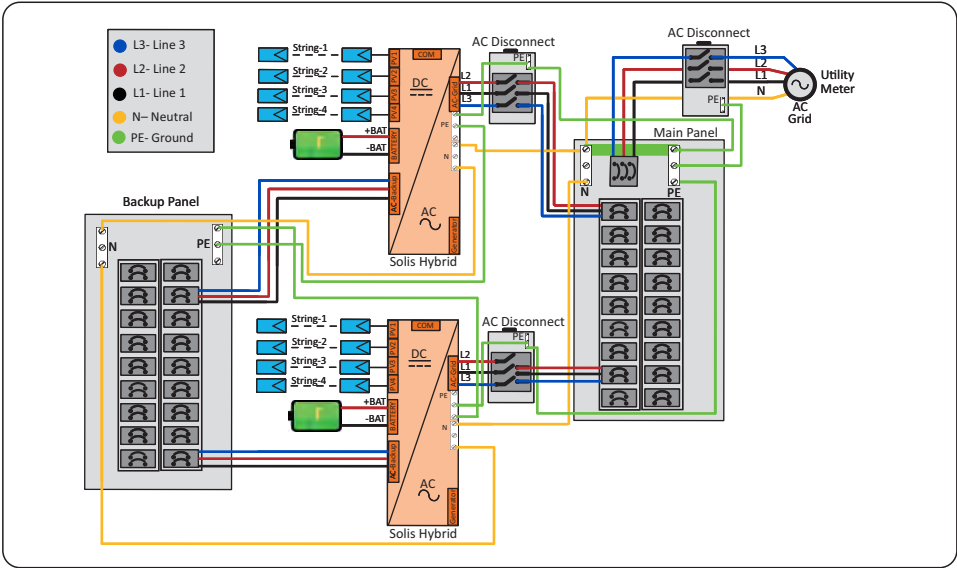
4. Operating Modes

4.6 Wiring Diagrams

4.6.1 Backup System with One Solis Hybrid Inverter



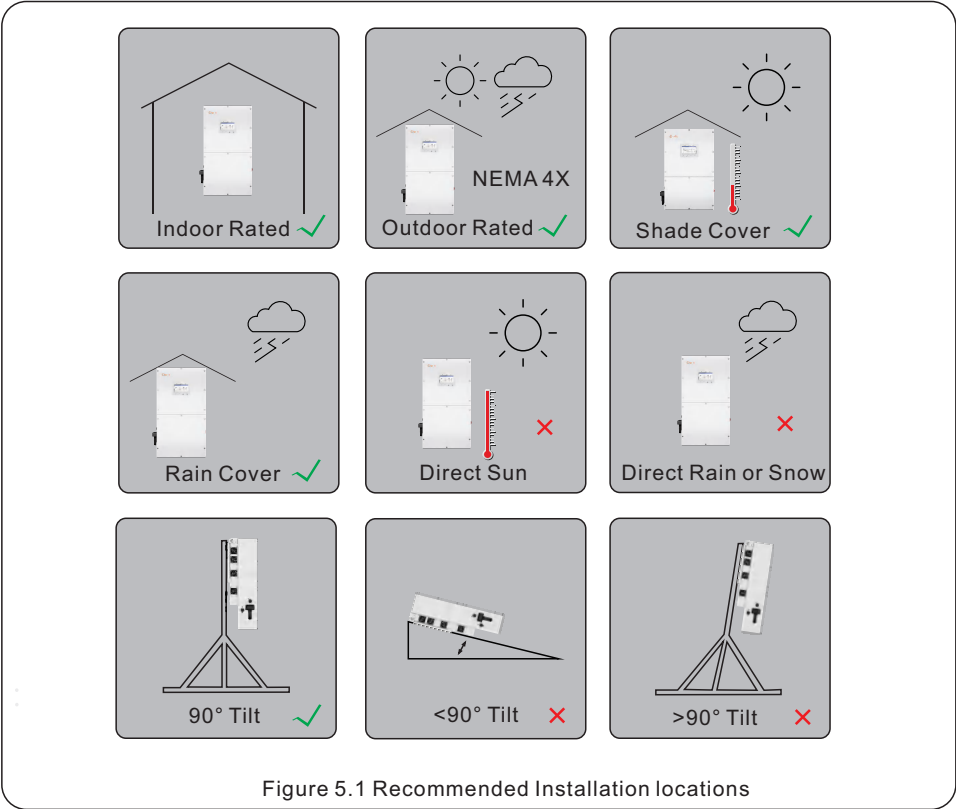
4.6.2 Backup with Multiple Solis Hybrid Inverters



5. Installation

5.1 Select a Location to Install the Inverter

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



WARNING: Risk of Fire

Despite careful installation, electrical equipment can cause fires.

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

5. Installation

5.1.4 Avoiding direct sunlight

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

Direct exposure to sunlight could cause:

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

5.1.5 Air circulation

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

5.1.6 Flammable substances

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

5.1.7 Living area

Do not install in a living area where the prolonged presence of people or animals is expected.

Depending on where the inverter is installed (for example: the type of surface around the inverter, the general properties of the room, etc.) and the quality of the electricity supply, the sound level from the inverter can be quite high.

5.2 Inverter Handling

Please review the instruction below for handling the inverter:

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

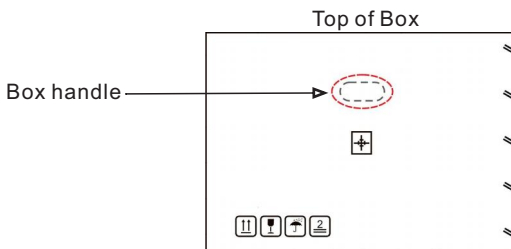


Figure 5.2 Handles for moving the inverter shown circled in red - one per side

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

5. Installation

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

WARNING: Risk of Shock



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

CAUTION: Hot Surface



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

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

Maximum Temperature



140°F
60°C

Minimum Temperature



-13°F
-25°C

Max. Relative Humidity



100%
Non-Condensing

Maximum Altitude



8202 feet
2500 meters

Figure 5.3 Installation environment conditions

Load bearing structure requirements:



Made of nonflammable materials

Max. load bearing capacity ≥ 4
times of inverter weight of **195.8 lbs**



Figure 5.4 Load bearing structure

5.2.1 Clearances

- If multiple inverters are installed on site, a minimum clearance of 31.5 inches should be kept between each inverter and all other mounted equipment. The bottom of the inverter should be at least 20 inches above of the ground or floor (see Figure 5.5 on page 23).
- The LED status indicator lights located on the inverter's front panel should not be blocked
- Adequate ventilation must be present if the inverter is to be installed in a confined space.

5.2.2 Consult technical data

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

5.2.3 Angle of installation

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

5. Installation

5.3 Inverter Dimensions & Weight

The inverter weighs about **195.8 pounds (88.8Kg)** outside of the box.

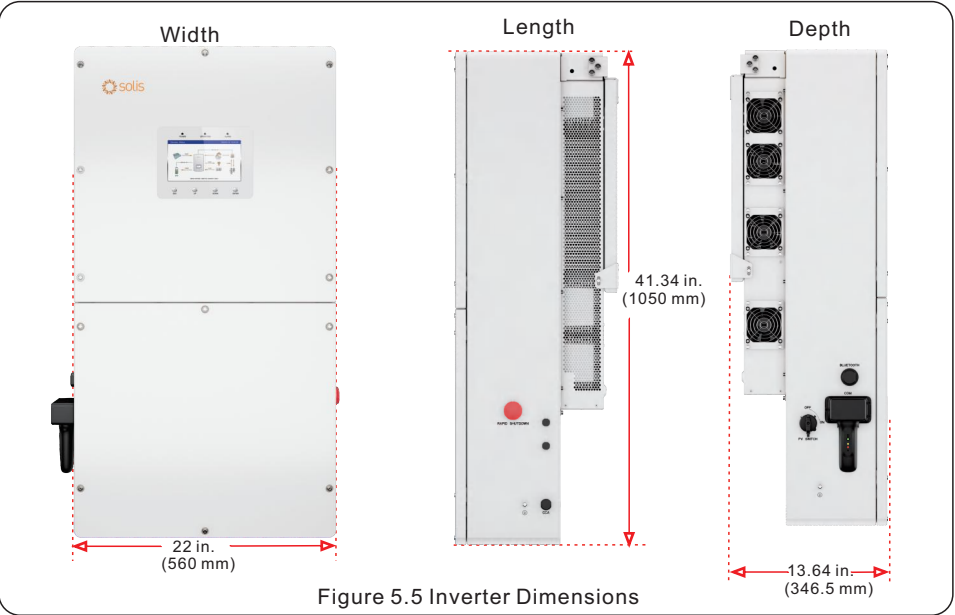


Figure 5.5 Inverter Dimensions

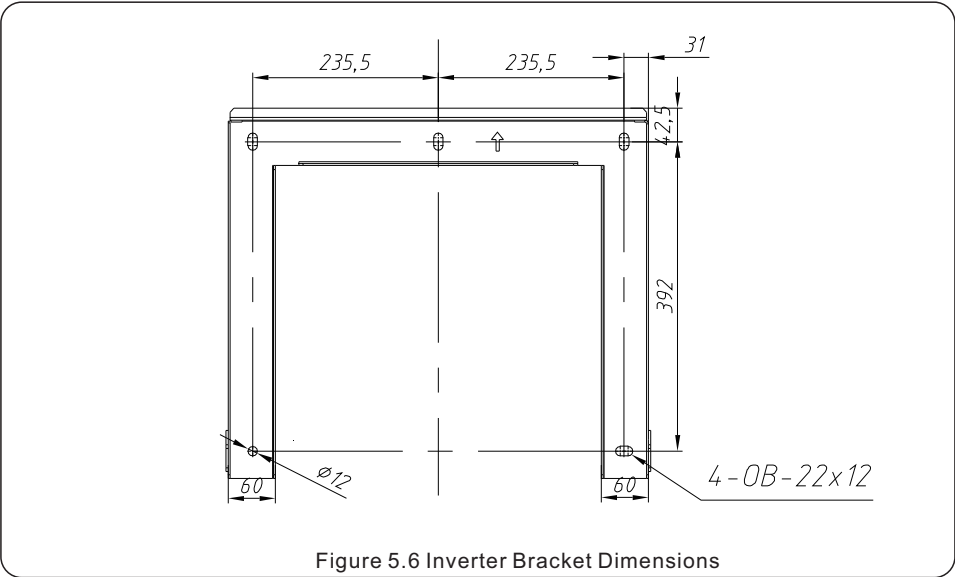
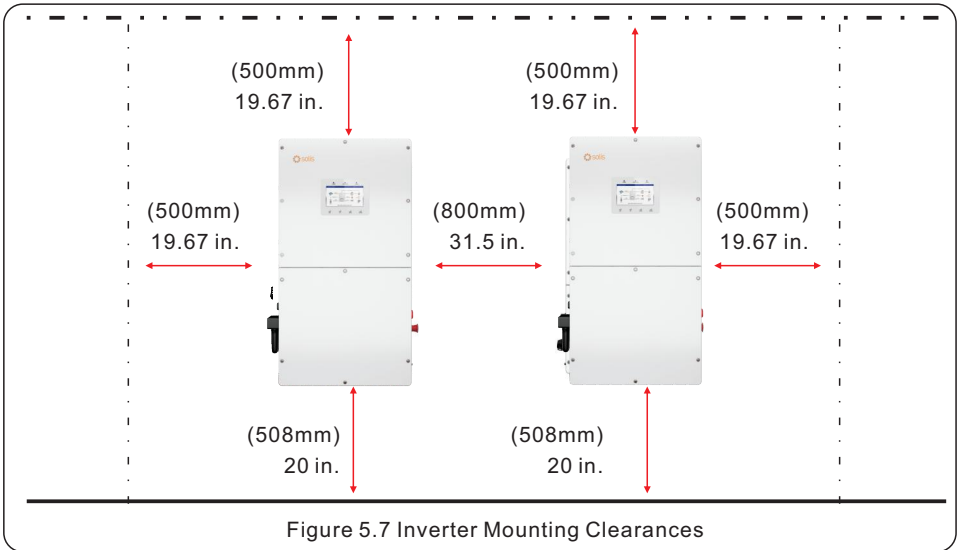


Figure 5.6 Inverter Bracket Dimensions

5. Installation

5.4 Mounting the Inverter

- Mount the inverter on a wall or structure capable of bearing the weight of the machine
- The inverter must be mounted upright on a vertical structure with a tilt of 90°. A tilt greater or less than 90° may cause the inverter output power to derate.
- To prevent overheating, be sure that the inverter has adequate air flow around it. A minimum clearance of 31.5 inches (800mm) should be kept between inverter & other equipment. There must be 20 inches (508mm) of clearance between the bottom of the inverter and the ground. Between the sides of the inverter and everything else, there must be a minimum of 19.67 inches of clearance.



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



NOTE:

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

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

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

1. Place the bracket on the wall or inverter rack. The arrow in the middle of the bracket points up. With a pencil or marker, mark the mounting holes. Fasten the bracket to the wall. **If you are mounting the inverter to a wall, be sure the fasteners go into 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.

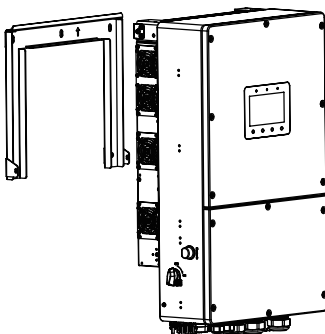


Figure 5.8 Wall mount bracket

2. Lift up the inverter and align the back two hooks on the heat sync with the two tabs on the inverter mounting bracket. Lower the inverter hooks down onto the mounting bracket tabs and ensure the hooks have a solid bite before releasing the inverter. Then install the two set screws that are included with the inverter for stabilization.

Inverter handles

1. The inverter comes with two black handles that are removable and only required for safely lifting the inverter.
2. The position of handrails installation as the red mark in figure 3.3.
3. Whenever lifting the inverter or setting it down, do so slowly and gently. This ensures that the internal components and the outer chassis do not take any damage.
4. Two people are required to remove the inverter as it is very heavy. Be sure to use the black handles.
5. Remove the handles by unscrewing them once the inverter has been mounted.



Figure 5.9 Inverter handle

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.

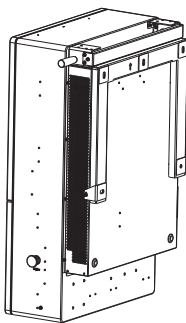


Figure 5.11 Inverter on mounting bracket and set screws



WARNING:

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

5. Installation

5.5 Maximum Conductor Sizes & Torque Specs

5.5.1 Max. Conductor Sizes and Torque Specifications

Terminal	Conductor Size Range	Torque Specifications
PV	10-8 AWG	N/A Spring Clamp
Battery	12-2 AWG	
Backup	12-2 AWG	
Smart Port	12-2 AWG	
AC Ground	2-2/0 AWG	6.5-8 N.m. (4.8-5.9 ft-lbs)
DC Ground	6-1 AWG	6.5-8 N.m. (4.8-5.9 ft-lbs)
Grid	2-2/0 AWG	13-15 N.m. (8-11 ft-lbs)
Neutral	6-2/0 AWG	10-12 N.m. (7.4-8.9 ft-lbs)

Figure 5.12 Max. Conductor Size and Torque Spec Chart

Inverter Terminal Operation Tool Guide

The inverter Grid terminals require a 8mm Hex tip with torque wrench. The AC ground terminals require an 5mm Hex, the PE ground terminals require an 3mm Hex, and the neutral bus uses a 7mm Hex. The PV terminals can be operated with fingers only. The battery, backup, and smart port terminals require a Phillips screwdriver. The communication terminals require a small flathead screwdriver.



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

5. Installation

5.6 Equipment Grounding & Neutrals

Within the inverter wire box there are two ground bars for the equipment grounding conductors to terminate. The bar under the PV terminals is the DC ground bus. The bar under the grid terminals is the AC ground bus. All equipment grounding conductors (EGCs) must be terminated in these bars.

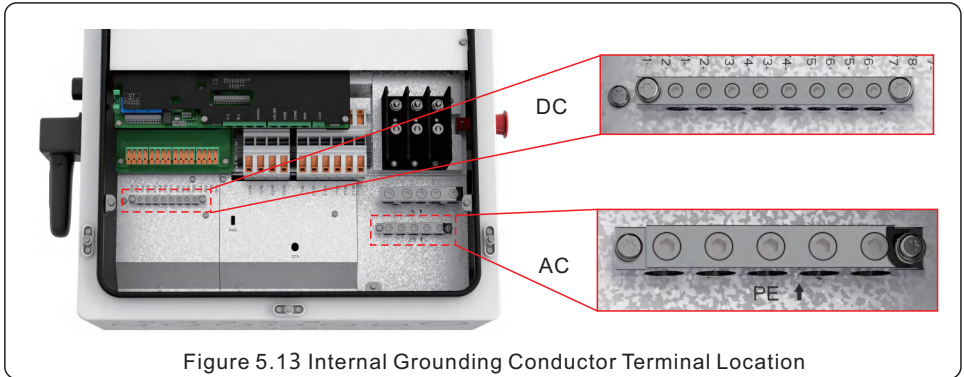


Figure 5.13 Internal Grounding Conductor Terminal Location

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

1. Strip ½ inch of insulation off the end of the ground conductor.
2. Use an 8mm Hex tip 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 to a torque of 6.5-8 N.m. (4.8-5.9 ft-lbs). Do not over tighten the screw.
5. Give the conductor a gentle tug test.
6. Follow the same steps for connecting the neutral conductors to the neutral bar. Use the same torque value of 10-12 N.m. (7.4-8.9 ft-lbs). The neutral bus requires a 7mm hex tip instead.

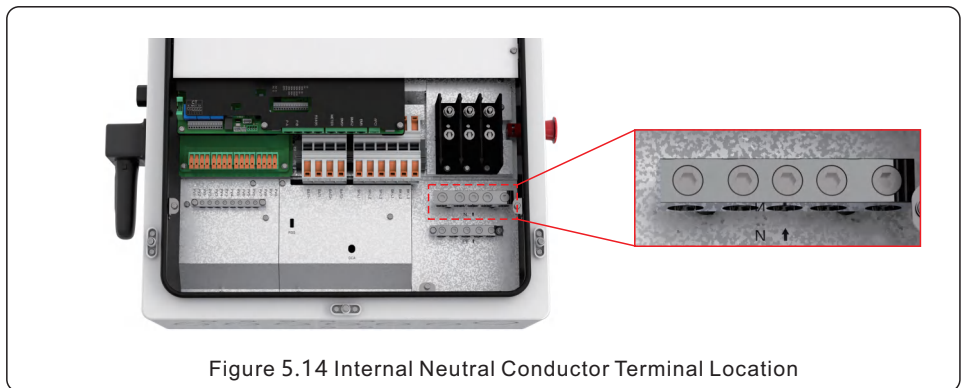


Figure 5.14 Internal Neutral Conductor Terminal Location



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

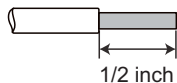


DANGER:
Before installing the PV cables, be sure that the PV array is disconnected.
Use a multimeter to verify that the PV string voltages are low before proceeding.

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 (1000Vdc). Violating this condition will void the inverter warranty.
- Ensure the polarity of the PV strings are correct (ex: positive is positive).
- Ensure the PV string voltages going to the same MPPT are equal or within 10VDC.
- Ensure the PV resistance to ground is higher than 20K ohms.
- Ensure that the Isc of the strings will not exceed the maximum DC input current.

Select a suitable PV cable and remove 1/2 inch of insulation from the ends of each wire using wire strippers. Please refer to the table below for specific specifications.



Cable type	Cross section (AWG)	
	Range	Recommended value
Industry generic PV cable	12~8 AWG (4.0~8.0mm²)	10AWG (6.0mm²)

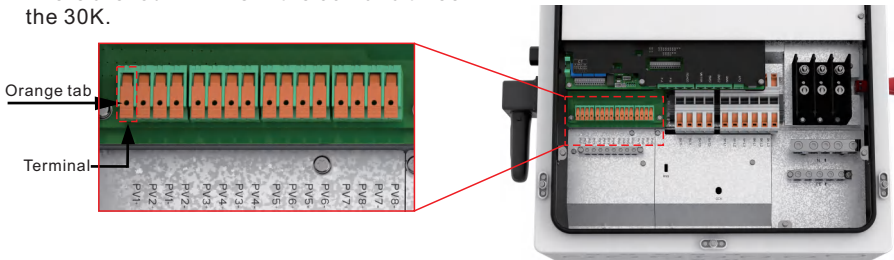
Tubular Crimp Terminals

It is recommended to use European-style tubular crimp terminals on the conductor ends. The crimping length of the tubular terminal should be about 1/2 inch (12–14 m)
If using tubular terminals with insulated caps, ensure there is no interference between adjacent terminals. Otherwise, the selected terminal type may not be compatible.



5. Installation

Note: Each MPPT has two PV string inputs. For example, MPPT1 is PV1 and PV2. There are four MPPTs in the 60K and three in the 30K.



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

Figure 5.15 PV Cable Connection

CAUTION:

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

The steps for corrective actions are as follows:

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



5. Installation

5.8 Rapid Shutdown & Emergency Power Off

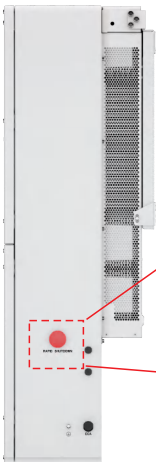
5.8.1 Integrated Rapid Shutdown Transmitter & Switch



Important Note

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

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. Pressing in this switch cuts power to the internal RSD transmitter. Engaging the switch will also cause the inverter to stop producing power. The inverter will enter a standby state in which it will not energize the backup ports or connect to the grid. It will not generate any power at all or interact with the battery until the switch is disengaged.



Rapid Shutdown & Emergency Power Off Initiation Process

1. Press the switch button in to turn off the internal transmitter. The PV string DC voltages will ramp down to safety-level within 30 seconds.
2. The inverter will also stop all AC power output to both grid and backup.
3. Twist the switch clockwise to turn the internal transmitter back on and bring the inverter back into a state of normal operation.

Note:

Rapid shutdown will only initiate if receivers have been installed in the PV array connecting to the PV modules directly.

Without the receivers the inverter can achieve emergency power off but it cannot achieve rapid shutdown..

Figure 5.16 Rapid Shutdown & Emergency Power Off Initiation Switch

Additional Details About Rapid Shutdown

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

5. Installation

Please see the Master Compatibility sheet on the Solis US website for details on which internal transmitter options are available for this Solis hybrid inverter.

5.8.2 Photovoltaic Rapid Shutdown System (PVRSS) Certification

The Solis S6 hybrid is PVRSS-certified with several brands that manufacture rapid shutdown equipment. The certification includes the inverter, the PLC transmitter, and the receivers. The transmitter is located within the inverter, the receivers are installed with the PV modules. To avoid violating the PVRSS certification, the same brand of receivers must be installed as the internal transmitter. (Ex: Tigo transmitter with Tigo TS4-A-F receivers). There can be no mixing of different brands without violating both the PVRSS certification and the rapid shutdown equipment warranty. For this reason, please be sure to check the Compatibility Sheet and only install equipment that is matched under the same brand. The only exception to this is Midnite Solar receivers, which can be used with either Tigo or APS transmitters.

Solis S6 Hybrid Inverter



Rapid Shutdown PLC Transmitter



Rapid Shutdown PLC Receiver



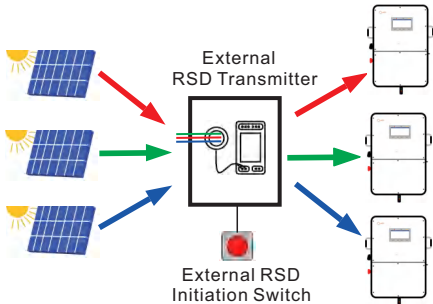
Figure 5.17 Components Listed in a Photovoltaic Rapid Shutdown System (PVRSS) Certification

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.

Serial Number	Brand	Transmitter	Receiver
1	Tigo	RSS Transmitter Din Rail	TS4-A-2F
2			TS4-A-F
3	APS	Transmitter-PLC-1P	RSD-D-15
4			RSD-S-PLC

5.8.3 Multiple Inverters with One External Transmitter

If multiple inverters will be installed in parallel, it is ideal to use a single external rapid shutdown transmitter. This prevents cross-talk from occurring because there will only be one transmitter for all of the PV strings in the system. Run all of the strings through the external rapid shutdown enclosure first and then to each inverter.



Note: Hybrid inverters shown here do not have internal transmitters.

5.18 Multiple Inverters with a Single External RSD Transmitter

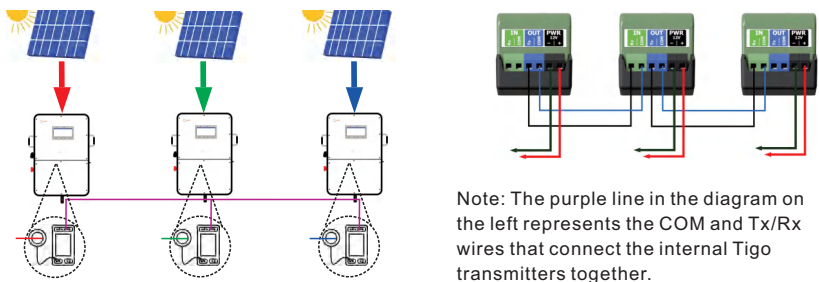
5. Installation

5.8.4 Cross-Talk

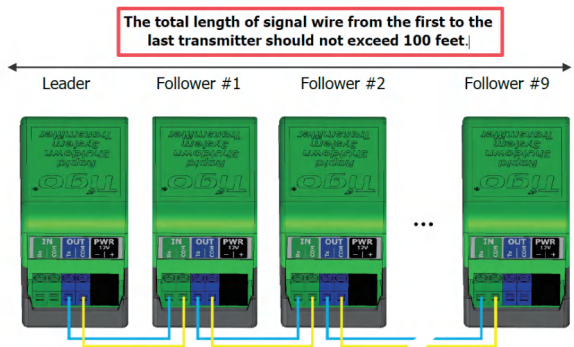
Cross-talk occurs when competing PLC signals sent from different transmitters reach the same RSD receivers. This causes the receivers to randomly cycle on and off at various times. Cross-talk must be avoided to ensure proper inverter operation and to eliminate risk of damage to the system components.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

5.8.5 Multiple Inverters with Multiple Integrated Tigo Transmitters

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



5.19 Multiple Inverters with Multiple Internal Tigo Transmitters



5.20 Transmitter daisy-chaining cable length limitation



IMPORTANT:

Tigo TS4-A-O optimizer has not been tested and certified with this inverter.

5. Installation

5.8.6 External Rapid Shutdown & Emergency Power Off Switch

If the inverter is being installed where it is inaccessible to first responders, an external rapid shutdown switch must be installed somewhere accessible. Any 2-wire normally closed switch will work.

Steps for Installing an External RSD & EPO Initiation Switch

- 1. Install the external RSD switch and run two wires between it and the inverter
 - 2. Connect one end of the two wires pins 7 (RSD+) and 8 (RSD-)
 - 3. Connect the other end of the two wires to the external RSD switch
 - 4. This is a normally-closed set of terminals. Be sure to use a normally closed switch.
- Note:** the RSD switch on the inverter wire box will still initiate rapid shutdown. Be sure the transmitter is on by giving the switch a clockwise twist when you are ready to energize the system.



IMPORTANT:

Installing module-level power electronics (MLPE) not listed on Compatibility List will void the inverter warranty and the MLPE warranties. The external switch does not require compatibility matching, any normally closed switch will work with this inverter to initiate rapid shutdown.



NOTE:

Only remove the jumper when installing an external rapid shutdown switch. In all other cases, do not remove the jumper, as it may cause the inverter to stop.

The external rapid shutdown initiation switch is sold separately. Please contact your local supplier for help with procurement. Solis recommends using an IMO switch.

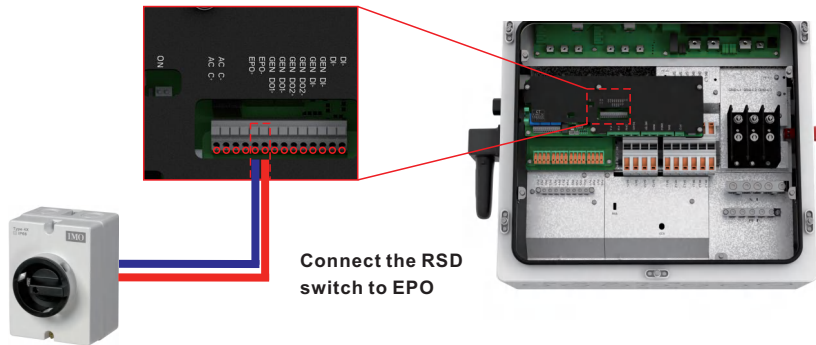


Figure 5.21 External RSD Initiation Switch

5. Installation

5.9 Battery Installation



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



NOTE:
The condition for battery fully charging:
For this series of product, the compatible battery voltage should from 150-800V, but if you want the battery fully charging, you should know the condition(as the below table) for that. When the battery voltage between 400V-500V, the charging current can reach to the maximum value: 70A, and when battery voltage between 500V-800V, the single channel charging capacity can reach to the 35KW. For an example. for 60K model, two batteries charging power can reach to 60kw.

S6-EH3P60K04-NV-YD-H-US(21A)			
NO.	Battery voltage(V)	Battery Current(A)	Battery Power(KW)
1	150	30	5
2	215	70	15
3	288	70	20
4	324	84	27
5	330	84	28
6	400	84	33.6
7	500	70	35
8	550	64	35
9	600	58	35
10	700	50	35
11	800	44	35

5.9.1 Location of Battery Terminals

The inverter has two sets of inputs for two different batteries. The ports are labeled BAT1+ (battery 1 positive), BAT1- (battery 1 negative), BAT2+ (battery 2 positive), and BAT2- (battery 2 negative). It is crucial to not accidentally reverse polarity and connect a positive cable to a negative port or vice versa. These terminals can be a bit tricky to operate. The next page explains the correct process in detail.

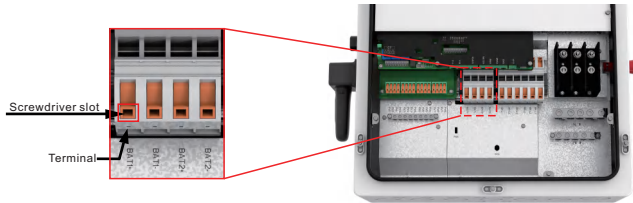


Figure 5.22 Location of the battery terminals

5. Installation

5.9.2 How to Operate the Battery Terminals

First, run the battery conductors into the inverter wire box. Strip 0.5" of insulation from the ends of each conductor. Use a small Phillips screwdriver to operate the terminals. You will insert the screwdriver into the screwdriver slot. Pulling up on the screwdriver until you feel a click opens the terminal. Pulling down on the screwdriver until you feel a click closes the terminal.

Tubular Crimp Terminals

It is recommended to use European-style tubular crimp terminals with a crimping length of 25 mm. Please reference page 37 for details.

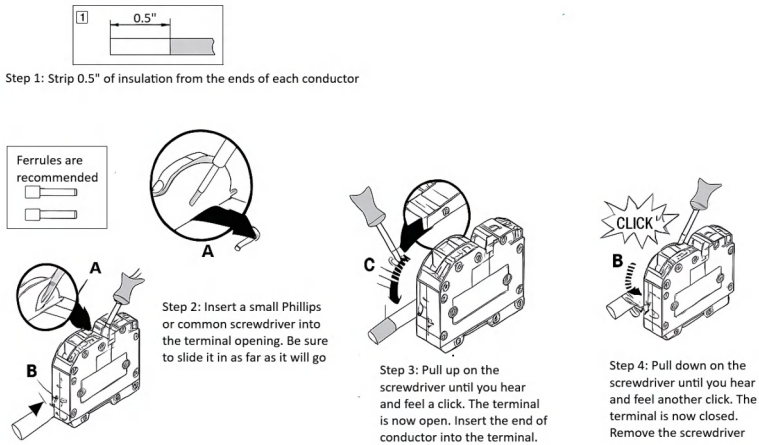


Figure 5.23 How to operate the Battery, Backup, and Smart Port terminals

Battery Compatibility

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



NOTE:

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



NOTE:

The suggested specification of the external battery circuit breaker for each battery is 100A. Ensure that the battery has an integrated breaker or install one.

5. Installation

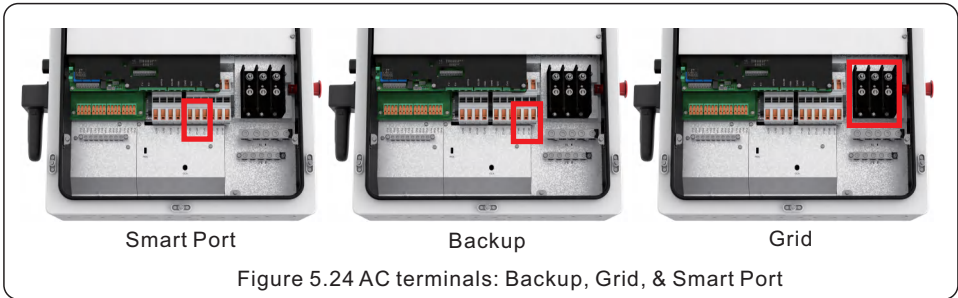
5.10 AC Wiring

The inverter has two AC outputs: (1) to a backup distribution panel and (2) to the main service panel that is connected directly to the utility. In normal grid-tied operation, the inverter can export excess PV power to the grid (sell back). Or, it can be configured for zero export. If utility power fails 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 Solis hybrids in parallel to provide additional support to the backup loads. The smart port is an optional port only to be used with either (1) a generator (2) an AC-coupled PV system or (3) a sheddable load while in backup mode.

Tubular Crimp Terminals

It is recommended to use European-style tubular crimp terminals with a crimping length of 25 mm. Please reference page 37 for details.

5.10.1 AC Terminals



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

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

To protect the inverter, we recommend installing a device for protection against over-current and leakage, based on the following current ratings noted in Figure 5.23

Inverter Model	Grid/Backup Max. Output Current	Grid Max. Pass-through Current	Max. Smart Port Input Current	Backup Max Surge Current (2 seconds)
S6-EH3P30K-NV-YD-H-US(21A)	72.2A	144.4A	72.2A	115.5A
S6-EH3P30K-LV-YD-H-US(21A)	36.1A	72.2A	36.1A	57.7A
S6-EH3P40K-NV-YD-H-US(21A)	48.1A	96.2A	48.1A	78A
S6-EH3P50K-NV-YD-H-US(21A)	60.1A	120.2A	60.1A	96.1A
S6-EH3P60K-NV-YD-H-US(21A)	72.2A	144.4A	72.2A	115.5A

Figure 5.25 Current ratings AC inputs/outputs

5. Installation

5.10.2 How to Operate the AC terminals: Backup, Smart Port, and Grid Conductors

Follow the same steps outlined on page 43 for instructions on how to operate the Backup and Smart Port terminals. The Grid terminals are a little bit different. Use the neutral bus bar for all neutrals cables.

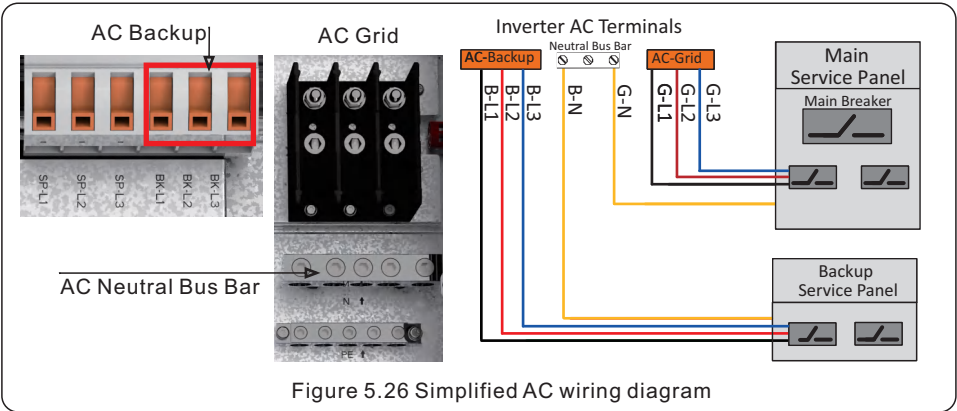
Backup

Install a dedicated loads panel or reroute an existing panel to the backup terminals of the inverter. Any breakers in this panel will be backed up when the grid fails. It is also essential to install an external AC automatic bypass switch to protect the loads from equipment failure. Without this switch, the loads connected to the backup side of the inverter will lose power if the inverter fails or shuts off.

Grid

The grid ports allow the inverter to become grid-tied by connecting to the utility side of the system. The max. conductor size that will fit in the Grid terminals is 2/0.

- 1. Use a 8mm Allen key torque wrench to loosen the Grid terminals
- 2. Insert the stripped ends of the conductors into the terminals
- 3. Tighten the grid terminals to between 13-15 N.m. (8-11 ft-lbs)



5.10.3 CT Direct Connection (for 1-2 inverters)

The split-core CTs provided with the inverter must be installed for full functionality. The CTs are used to measure import/export/consumption power so the inverter can balance energy properly. Contact your Solis sales representative if you need to procure Rogowski coils.

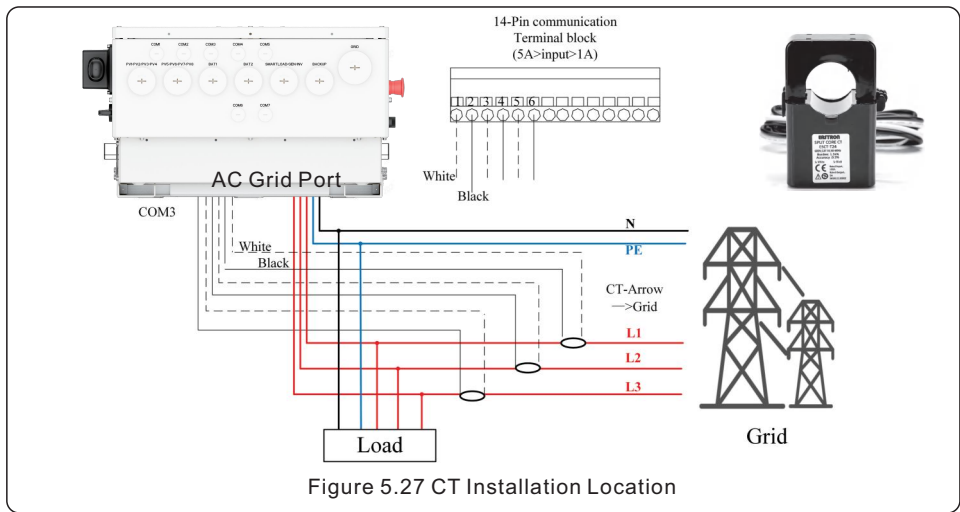
Included CT Model: ESCT-T50-300A/5A

CT Cable: Size – 2 .3mm2 , Length - 4m

Install the CTs on the L1/L2/L3 conductors at the utility interconnection point. The arrows on the CTs must point towards the grid. Open the CT and fit it around the conductor with the arrow pointing towards the grid. Close the CT and then run the black and wires to the inverter comm pin 1 to 6 . Insert the wires into the appropriate terminals as shown below.

CT Wire	14 PIN Communication Terminal Block
White	Pin 1 (From Left to Right)
Black	Pin 2 (From Left to Right)
White	Pin 3 (From Left to Right)
Black	Pin 4 (From Left to Right)
White	Pin 5 (From Left to Right)
Black	Pin 6 (From Left to Right)

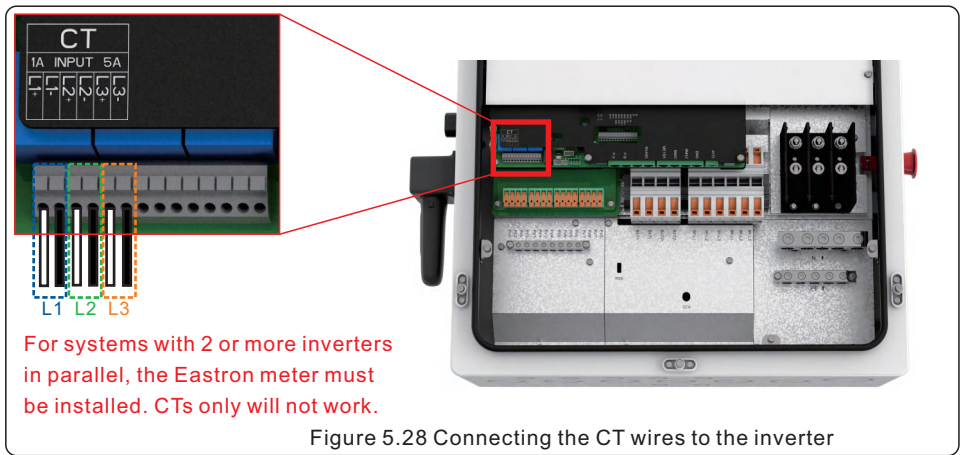
5. Installation



Rogowski Coil CT Option

Rogowski coils can be purchased separately with SDM630-MCT-OCS. Compatible coils are shown in the table below, other coils are not supported.

Coil code	Reference Rated Current	Class	Window Size (mm)	Coil Length (mm)
ESCT-RC60	500A	0.5	50	200



To remove the CT wire, use a small flathead screwdriver to push in the button above the CT wire terminal. While holding the screwdriver with the button pressed in remove the wire.

5. Installation

Load Requirements for the Backup Side and Smart Port

These requirements apply to loads being connected to the backup side of the inverter or to the Smart Port when using it for load shedding.

1. Resistive and RCD loads

- a. For single-phase resistive loads, it should not exceed 100% of the single-phase power
- b. For RCD loads, it should not exceed 60% of the inverter's rated power.

2. Motor-based load

- a. When directly driving a motor load, it is necessary to pay attention to whether the starting impact power does not exceed the power and time limit of the inverter's overload curve.
- b. When using a frequency converter or soft-start type motor load, the power should not exceed 60% of the inverter's rated power.

3. RLC load

- a. The total load capacity shall not exceed the rated power of the inverter, the peak current at the moment of load switching (peak inrush current) shall not exceed twice the rated current of the inverter, and the minimum power factor shall not be less than 0.8.
- b. If a mixed load is adopted, apart from the RLC load, the motor load and the RCD load need to be proportionally reduced.

4. Isolation transformer

- a. If starting with a transformer, it is necessary to pay attention to the inrush current not exceeding 1.6 times the rated current and the inrush power not exceeding the overload curve limit requirements. Otherwise, a soft starter needs to be added to the transformer.

5. Installation

5.11 Smart Port: Generator, AC-Coupling, Load Shed

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 that can be controlled while in backup mode. The smart port input for the 60kW and 30kW 208V model is rated for 72.2A max. The input for the 30kW model is 36A.

5.11.1 Smart Port Location

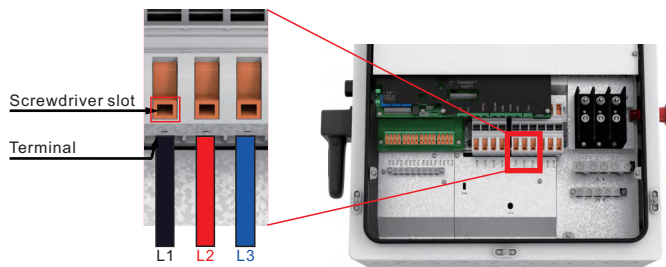


Figure 5.29 Inverter smart ports

5.11.2 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. Insert a Phillips screwdriver into slot above the smart port terminal. Pull up on the screwdriver until you feel a click, the terminal is now open.
 4. Insert the stripped end of each conductor into the correct terminal. Pull down on the screwdriver until you feel another click, the terminal is now closed (locked).
 5. Connect a neutral conductor to the neutral bus bar and a ground conductor to the ground bus bar. Use the hex tool to tighten the terminal to between 13 and 15 N.m.
 6. Give each cable a gentle tug test to ensure they are not loose.
- The wiring diagrams in Figure 5.27 show the three different uses for the smart port.

The smart port is rated for 72.2A (60kW & 30kW-LV models) and 36A (30kW model).

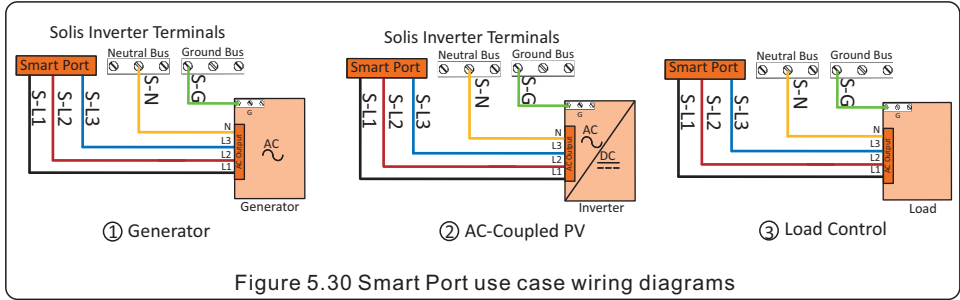


Figure 5.30 Smart Port use case wiring diagrams



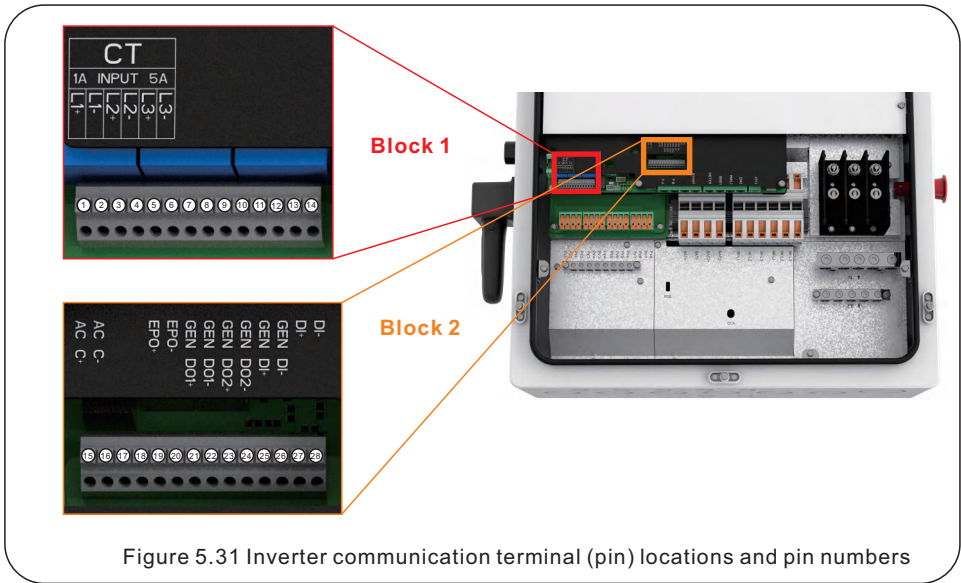
NOTE:

Can't connect to the generator when connected to the power grid, and cannot connect to the power grid when connected to the generator.

5. Installation

5.12 Inverter Communication

5.12.1 Communication Terminal Blocks



There are two blocks each consisting of 14 pins for inverter communication. Also, there are nine RJ45 ports for communication. There are pins and ports for battery, RS485, meter CTs, external rapid shutdown, generator start/stop, emergency power off, and parallel inverter comms. The tables on the next page explain the purpose of each pin and port.

Communication Block 1

NO.	Port	Function	Acceptable Wire Size Range
1	CT_L1+	L1 (Phase A) CT	22-16 AWG
2	CT_L1-		
3	CT_L2+	L2 (Phase B) CT	
4	CT_L2-		
5	CT_L3+	L3 (Phase C) CT	
6	CT_L3-		
7	Reserved	Not for use	
8			
9	Reserved		
10	Reserved		
11	Reserved		
12	Reserved		
13	Reserved		
14	Reserved		

5. Installation

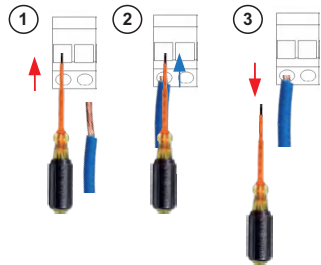
Communication Block 2

NO.	Port	Function	Acceptable Wire Size Range
15	AC+	The DO port requires an external contactor to control the switching of an external circuit.	22-16 AWG
16	AC-		
17	Reserved	Not for use	
18	Reserved		
19	EPO+	Emergency stop external switch	
20	EPO-		
21	GEN DO1+	Generator dry contact start/stop	
22	GEN DO1-		
23	GEN DO2+		
24	GEN DO2-		
25	GEN DI+	Dry contact open: Connect to the generator. Dry contact closed: Connect to the grid.	
26	GEN DI-		
27	DI+	With a low-level external signal (0V): Connect to the generator.	
28	DI-	With a high-level external signal (5V/ 12V): Connect to the grid.	

Installing the communication wires:

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

1. With a technician screwdriver push and hold the small grey block above the terminal hole to open the terminal.
2. Insert the stripped com wire into the open terminal.
3. Release pressure on 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.



IMPORTANT:

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

5. Installation

5.12.2 RJ45 Communication Ports

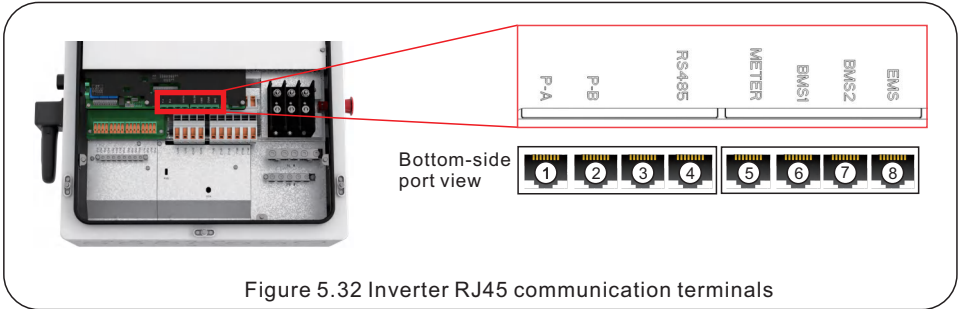
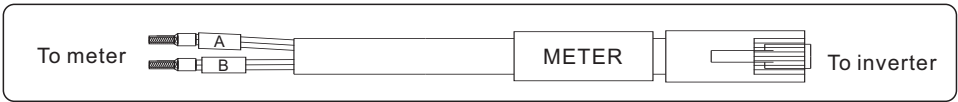


Figure 5.32 Inverter RJ45 communication terminals

NO.	Port	Function
1	P-A	Parallel inverter comms in
2	P-B	Parallel inverter comms out
3	Reserved	Not for use
4	RS485	RS485 third-party gateway comms
5	METER	External energy meter comms
6	BMS1	Battery BMS1 CAN comms
7	BMS2	Battery BMS2 CAN comms
8	EMS	Energy management system comms

5.12.3 External Energy Meter Communication

If the inverter is to be installed far from the CTs, an external energy meter must be installed. The compatible meter is ESCT-T50-300A/5A. To procure a meter, please contact your Solis Sales rep to order the energy meter with corresponding CTs. Run the Meter RS485 cable through one of the COM ports of the inverter and then connect it to the **METER** port with an RJ45 connector.



NOTE:

Pin definition of the Meter Terminal is following EIA/TIA 568B.

RS485A on Pin 1 and Pin4: Orange/white

RS485B on Pin 2 and Pin5: Orange

NOTE:

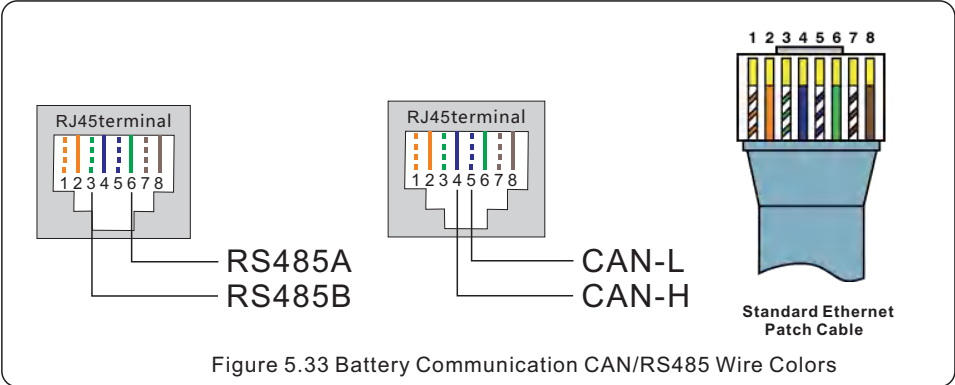
Compatible Smart Meter Pin Definition.

ESCT-T50-300A/5A– Pin 9 is RS485B & Pin 10 is RS485A

5. Installation

5.12.4 Battery Communication Wiring Table

The BMS1 and BMS2 ports are for communication between the battery and the inverter. The Figure below shows which pins on the inverter are for battery communication: CAN-H, CAN-L, RS485A, and RS485B. A standard ethernet patch cable can be used to connect the battery to the inverter. If the battery has pins instead of an RJ45 port, please cut one end off a standard ethernet patch cable and then connect it to the battery according to the pinout shown in Figure 5.33.



IMPORTANT:

Solis cannot guarantee normal operation with any battery that is not on the approved battery list. Please only install batteries from this list.

Installing a battery that is not on the list will void the inverter warranty.

Battery Manual and Battery Firmware

Please be sure to read through the battery manual for proper installation steps. The battery manual should be provided with the battery or it can be downloaded from the battery manufacturers website directly. It is very important to update the firmware of the battery during the installation and commissioning of the system. **Failing to update both the inverter and battery firmware will lead to communication issues** and the 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. If the alarm says the battery is having a malfunction, please contact the battery manufacturer.

5.12.5 Parallel Inverter Communication

There are two RJ45 ports reserved for communication between Solis S6 hybrids only. The communication is CAN and the ports are not able to be used for any other purpose besides daisy-chaining multiple Solis S6 hybrids together.