



User Manual

High Voltage Hybrid Single Phase
Residential Energy Storage Inverter



Applicable Models:

SG3.8KHB-HV
SG5KHB-HV
SG7.6KHB-HV
SG10KHB-HV
SG11.4KHB-HV

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1. Introduction

1.1 Inverter Description

The Sun Gold Power Hybrid series is designed for residential applications. The inverter can work with high-voltage lithium ion batteries to maximize self-consumption and provide backup power if the grid fails and there is not enough PV power to cover load demand.

This inverter can operate in both on-grid and off-grid applications.

The hybrid series consists of the following inverter models: 3.8kW, 5kW, 7.6kW, 10kW, and 11.4kW. The 3.8-5K models are of a similar but different hardware platform than the 7.6-11.4K models. The inverter comes with an integrated rapid shutdown transmitter.



Figure 1.1 Frontal View

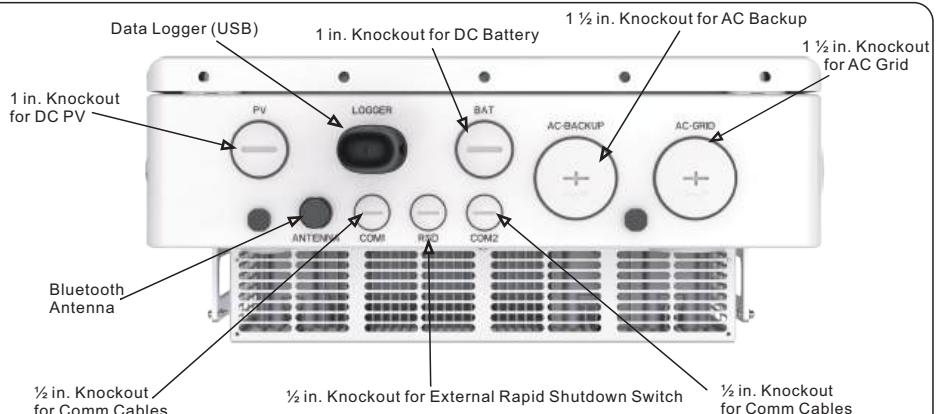


Figure 1.2 Bottom View (Wire Box)

1. Introduction

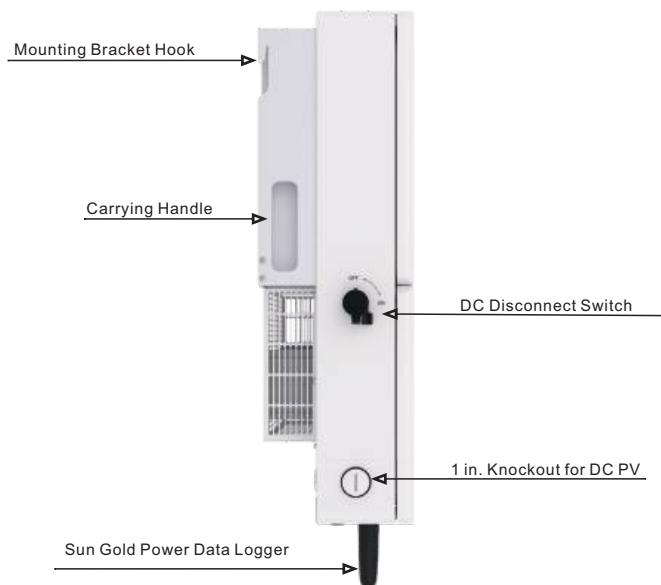


Figure 1.3 Right Side View

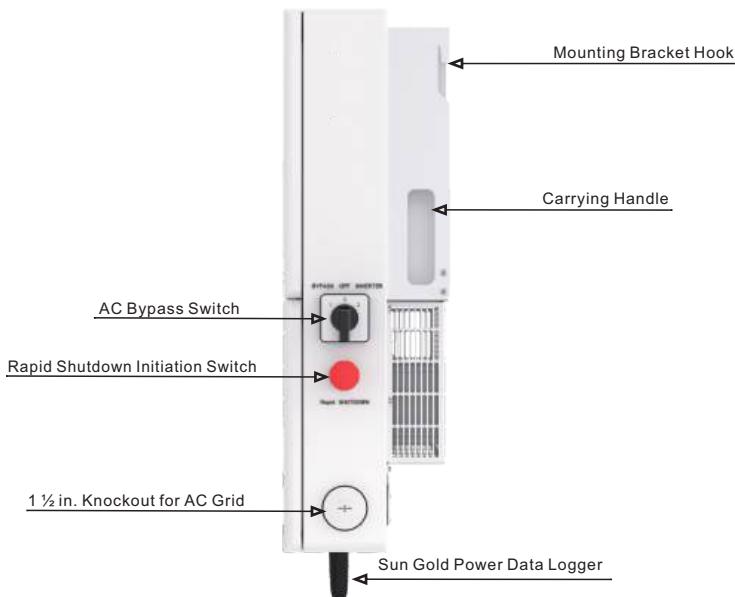


Figure 1.4 Left Side View

1. Introduction

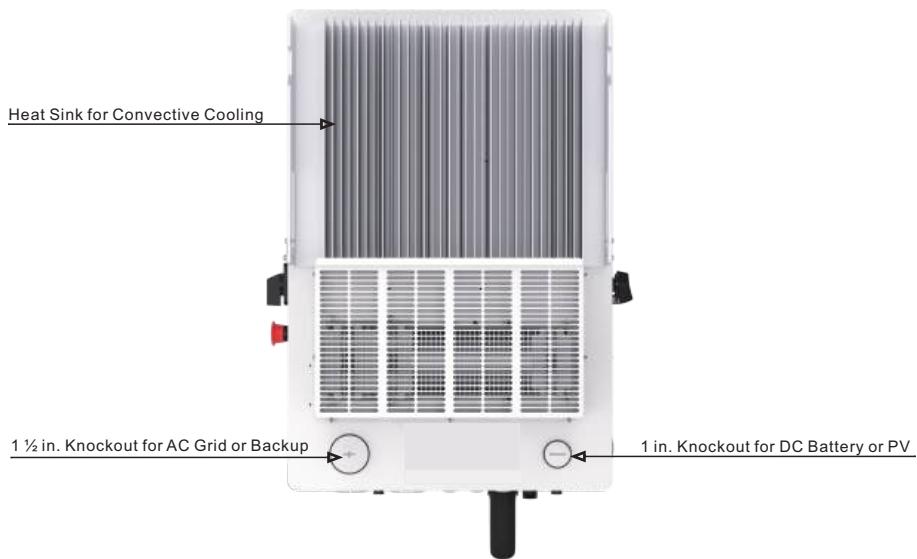


Figure 1.5 Back View

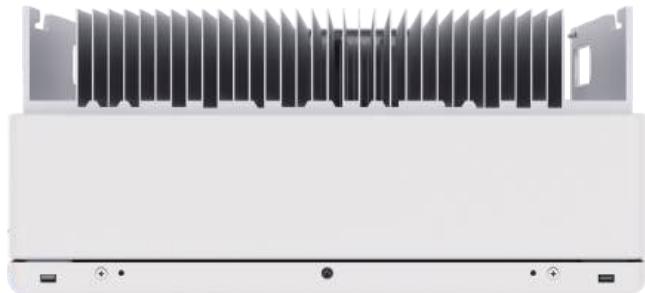


Figure 1.6 Top View

1. Introduction

1.2 Components Included with the Inverter

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



If anything is missing, please contact your local Sun Gold Power distributor.

1.3 Tools Required for Inverter Installation



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 repack the inverter, seal with adhesive tape with the desiccant inside the box.
- Store the inverter in a clean and dry place, free of dust and dirt. The storage temperature must be between -40~158°F and humidity should be between 0 to 100%, non-condensing.
- Do not stack more than two (2) inverters high on a single pallet. Do not stack more than 2 pallets high.
- Keep the box(es) away from corrosive materials to avoid damage to the inverter enclosure.
- Inspect the packaging regularly. If packaging is damaged (wet, pest damages, etc.), repack 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 Sun Gold Power single phase inverters feature an integrated DC disconnect switch.

CAUTION



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

CAUTION



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

CAUTION



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

NOTE



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

WARNING



Operations must be accomplished by a licensed electrician or a person authorized by Sun Gold Power.

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 is to be done in order to avoid negative impacts on the environment and human health.

Local waste management rules shall be observed and respected.

2.5 Protection Circuitry and Controls

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

Arc Fault Circuit Interrupter AFCI:

Edition 2011 of the National Electrical Code®, Section 690.11, requires that all PV plants attached to a building are fitted with a means of detecting and interrupting serial electric arcs in the PV wiring and array. An electric arc with a power of 300W or greater must be interrupted by the AFCI in the time specified by UL 1699B. 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.

3. Overview

3.1 LED Indicator Lights

There are five indicators on the The Inverter(Battery,Power,WiFi,Ethernet and Bluetooth)which indicate the working status of the inverter.

The Bluetooth Antenna or WiFi data logger shall be installed at the Antenna/COM port of the hybrid inverter before local debugging.



Light	Status	Description
	Blue(Flashing every 3s)	Battery discharging.
	Blue(Flashing every 1.5s)	Battery charging.
	Blue(Solid ON)	Idle.
	OFF	No Battery or not working.
	Blue(Solid ON)	Normally Operating.
	Yellow(Solid ON)	Warning.
	Red(Solid ON or flashing every 3s)	Alarm.
	OFF	No Battery or not working.
	Blue(Solid ON)	COM Port is using.
	OFF	COM Port is not used.
	Blue(Solid ON)	RS485 Port is using.
	OFF	RS485 Port is not used.
	Blue(Solid ON)	Bluetooth Port is using.
	OFF	Bluetooth Port is not used.

Turning On the LED Indicator Lights

After a few minutes, the LED indicator lights will turn off to conserve power. To turn the lights back on, short-press the Inverter LED light.



Alarm State

When the inverter has an alarm, the Inverter LED light turns red and starts flashing. It is recommended to connect to the inverter with the Bluetooth tool. Then you can determine what the alarm code is.

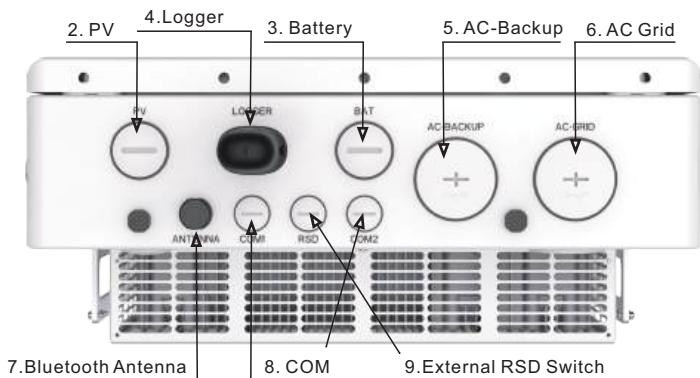


NOTE:

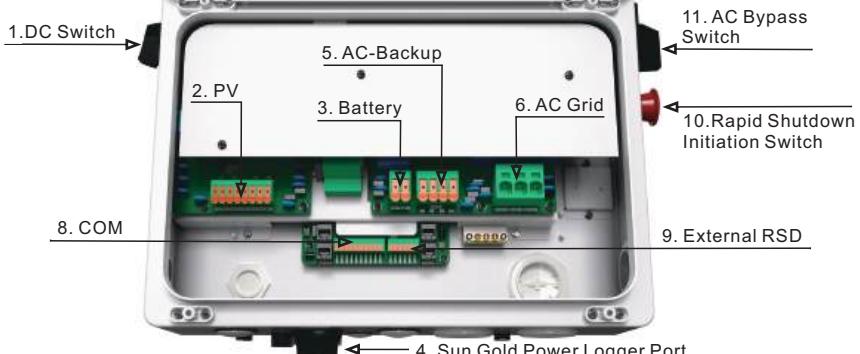
 Battery/WiFi/Ethernet/Bluetooth indicators will automatically turn off after 1 minute. The Power indicator will remain on with lower brightness. Short press the Power indicator can wake up all indicators.

3. Overview

3.2 Inverter Wire Box and Connection Points



Name	Description
1. DC Switch	This is the DC disconnect switch for the inverter
2. PV	Conduit and PV conductors should be connected here
3. Battery	Conduit for battery conductors should be connected here
4. Logger Port	USB data loggers are to be connected here
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. Bluetooth Antenna	Extends the range of the inverter Bluetooth signal (for system commissioning)
8. COM1/COM2	RS 485 and CAN communication cables should use these knockouts and terminals
9. External RSD	An external RSD switch can be added and connected to the inverter here
10. Rapid Shutdown Switch	Turns off the internal transmitter which initiates module level rapid shutdown
11. AC Bypass Switch	Allows the inverter to pass power through from the grid (main service panel) to the backup loads directly in the event of an inverter failure.



4. Operating Modes

4.1 PV-Only

4.1.1 Grid-Tie PV String Inverter

The hybrid can function as a grid-tie PV string inverter with no battery. It will use PV power to supply the home loads while the grid is active. The inverter does have export power control so it can be programmed to sell the excess power back to the grid. Whenever there is not enough PV power to cover the load demand, power will be imported from the utility to cover the deficit. If the grid fails or is inactive, the inverter will not be able to supply any PV power to the home loads.

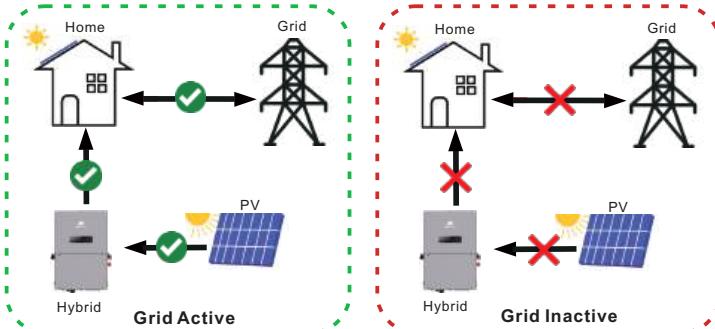


Figure 4.1 Sun Gold Power hybrid as a grid-tie PV string inverter

4.1.2 Export Power Control

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

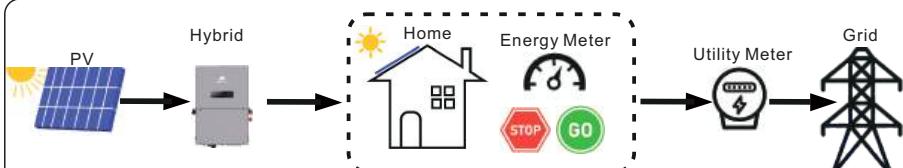


Figure 4.2 Sun Gold Power hybrid with export power control enabled

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

Zero-Net Export

The inverter can be set to not export any 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.

Setting-Grid Feed in Power Limit-Feed in Power Limit Switch-ON. Setting instructions: When the two-phase load is balanced, choose to disable Unbalance Output and set the Feed in Power Limit Value. When the two-phase load is unbalanced, choose to enable Unbalance Output and set Phase A Rated Power Limit and Phase B Rated Power Limit. If Feed in Current Limit Value is set simultaneously with power limit settings, the inverter will restrict according to the minimum value.

4. Operating Modes

4.2 Energy Storage

4.2.1 Overview of Energy Storage Modes

The hybrid is capable of providing AC power to home loads using PV and battery power in the event of a grid failure. This is known as **backup power**. The amount of backup power that each S6 hybrid model can provide is equal to the amount of on-grid power that it can provide. For example, an 11.4K model can provide up to 11.4K of continuous backup power.

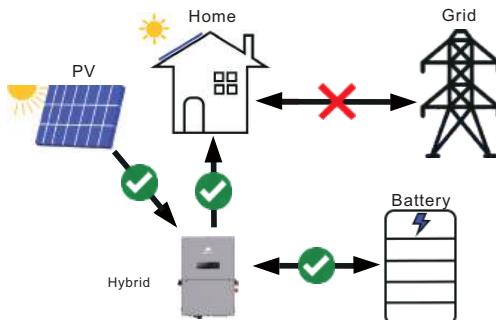


Figure 4.3 Backup power with Sun Gold Power hybrid

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 usage 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 and discharges to cover home load demand.

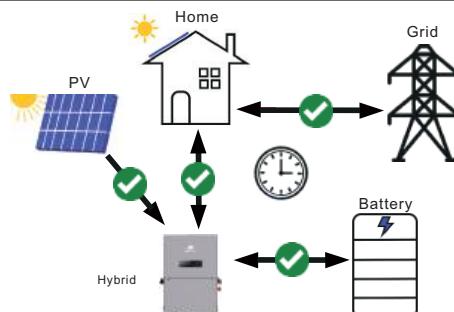


Figure 4.4 Energy arbitrage with Sun Gold Power hybrid

The hybrid can also operate in an entirely remote system where there is no grid present at all. This is called **off-grid** and it is very similar to backup in that the inverter will supply AC power to the loads with PV and battery power only. However, backup mode is only for grid-connected systems. The inverter is not able to provide off-grid/backup power with only PV, a battery is required.

4. Operating Modes

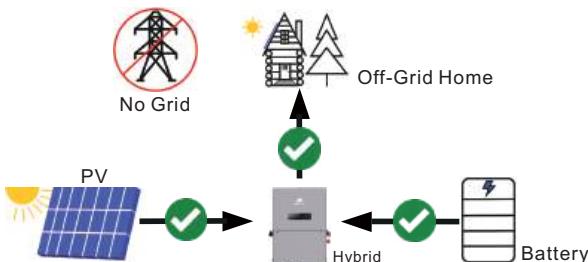


Figure 4.5 Off-grid power with Sun Gold Power hybrid

4.2.2 Backup Power

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

The backup output of the inverter has the ability to handle unbalanced loads, with a load power range of 0-0.5 times the rated output power for each phase. It is recommended to evenly distribute the loads between the two phases during system installation. If a single phase load exceeds 50% of the rated power, an overload alarm will be triggered, and the inverter will stop.



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

Whole-home backup systems can have all home loads backed up, including the **heavy loads**.

However, enough PV, battery, and (or) generator power must be available to meet the high current demand of the heavy loads. It is recommended to oversize the system for the needs of the owner.

NOTE:

If you need to meet the low voltage ride-through requirements, please disable IG follow.

If you disable IG follow, the inverter will not support seamless on-grid and off-grid switching.

Step: Tool-local configuration - connect with Bluetooth - select the inverter - Advanced setting - Special Functions Setting 1- Ig follow

NOTE:

When remote DSP program upgrades, the inverter will stop outputting. If the datalogger is connected to the SolarEnergy via WiFi, it is recommended to connect the router on the grid side to ensure smooth signal communication during remote maintenance.

4. Operating Modes

The homeowner will need to be consulted to understand why they are installing a battery. It should also be determined how much power is consumed, how much power the PV will generate, how much storage power there will be, and which loads are to be backed up in the event of a power outage (grid failure). If the homeowner says that they want mostly everything backed up, this is considered **whole-home backup**. If they are willing to live with just a few key things such as the fridge, lights, and outlets, this is **partial-home backup**. Examples are shown in the pages ahead. For a whole-home backup system, the average daily power consumed should be less than or equal to the average daily PV power produced over the span of a year. Otherwise, it is suggested to add additional PV or exercise load control (load shedding).

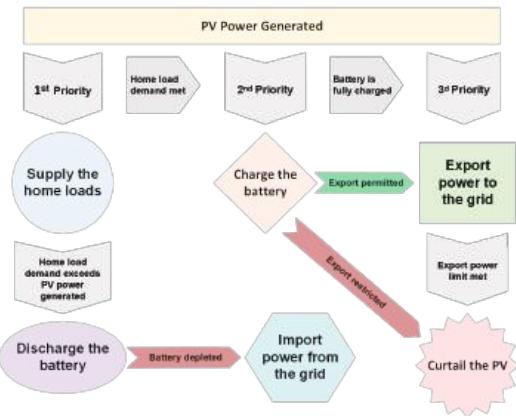
4.2.3 Energy Arbitrage

The 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. The inverter provides three operating modes for energy arbitrage:

- (1) Self-Use
- (2) Peak-Shaving
- (3) Feed-in-Priority

Self-Use

Self-Use is the default mode for this inverter. The system will first supply the home loads. 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. Self-consumption is optimal for those who want independence from the grid and to be as self-sufficient as possible. Adequate PV and storage should be installed for this mode to be most effective.

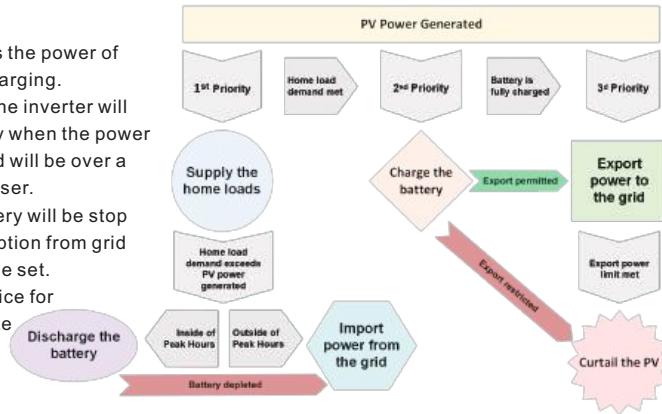


Peak-Shaving

Peak-shaving Mode limits the power of grid and the battery discharging. With this working mode, the inverter will discharge the battery only when the power consumption from the grid will be over a certain value, set by the user.

The discharge of the battery will be stopped any time the power absorption from grid will be lower than the value set.

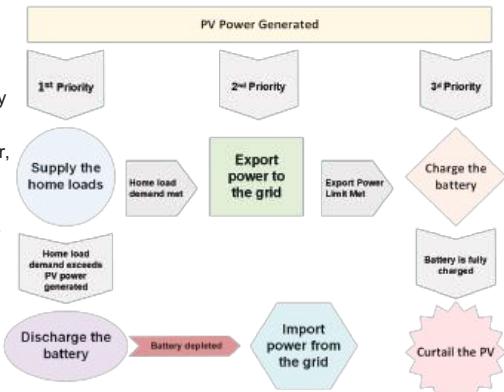
This mode is the best choice for those who want to stabilize the amount of electricity from the grid and save electricity costs.



4. Operating Modes

Feed-in-Priority

This mode can be thought of as export priority mode. The system will first supply the home 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.



4.2.4 Off-Grid

There is a dedicated mode specifically for off-grid remote systems which 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 mode, which occurs only for grid-connected systems.

The logic for Off-Grid mode is the same as Self-Use mode. However, there is no export power control and a generator is often used in place of the grid to supplement the PV and batteries. When the generator is turned on by the generator, the PV production is temporarily suspended as to not backfeed the generator. The inverter will use generator power to supply loads and recharge the battery.

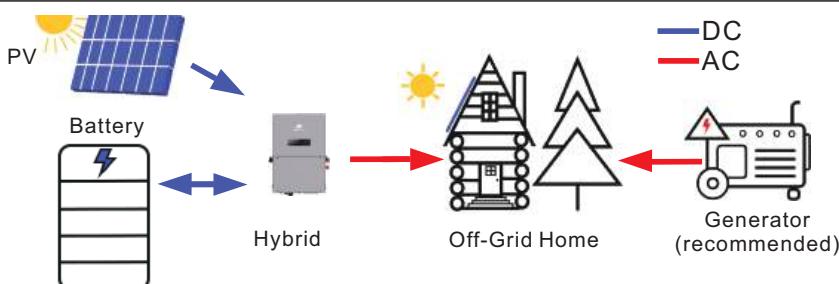
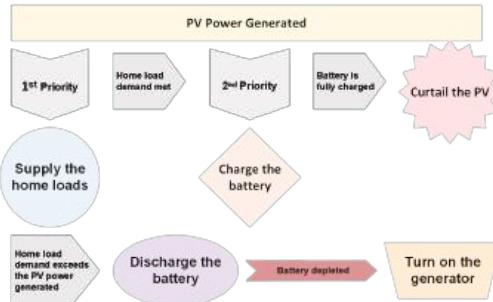


Figure 4.6 AC-coupled Sun Gold Power hybrid system

4. Operating Modes

4.2.5 AC-Coupling

The Sun Gold Power hybrid can be AC-coupled or DC-coupled to a home. AC-coupled means that the energy storage is connected to the AC-side of the system. Typically, the battery and inverter pair are connected in parallel with an existing PV system. The battery will charge with PV power that gets converted from DC, to AC, and then back to DC again. When AC-coupling with the hybrid, new PV can either be added or not be added to the hybrid, it is up to the system designer. The hybrid would just need to be installed with a compatible high-voltage battery and then be connected to the home load center in parallel with the existing PV system.

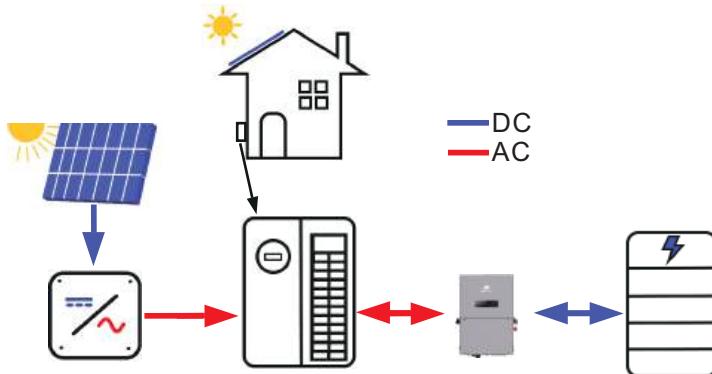
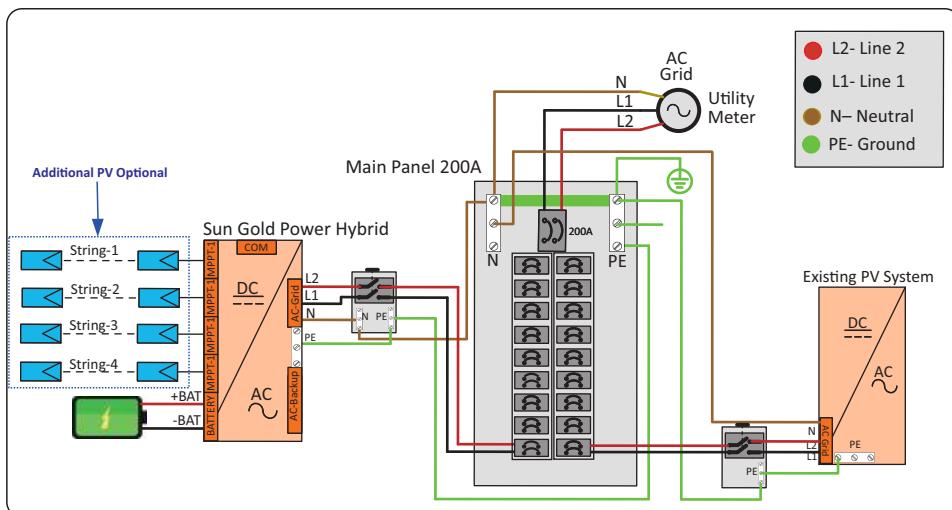


Table 4.6 AC-coupled Sun Gold Power hybrid system

AC-Coupling for Energy Arbitrage (No Backup Power)

The inverter with a compatible battery can be installed on a home with or without an existing PV system. The system can be programmed to charge during the day with AC power from the PV and then during peak hours or whenever there is not enough PV, the battery will discharge to cover the load demand and reduce the amount of power imported from the utility. In this case, the backup and PV functions of the inverter would not be used. Additional PV can be added to the home and then connected to the hybrid inverter, but it is not required for this type of AC-coupled application.



4. Operating Modes

AC-Coupling for Backup Power & Energy Arbitrage

The hybrid is able to provide backup power when AC-coupled. However, an additional load center will need to be installed and connected to the backup ports of the hybrid. Then, loads will be need to be relocated from the existing main load center into the backup load center. *The backup ports of the hybrid cannot be connected to the main service panel because this would violate the anti-islanding requirement.* Please see the diagram on Figure 4.7 for more details. In this case, the system will perform energy arbitrage and provide backup power if grid power is lost.

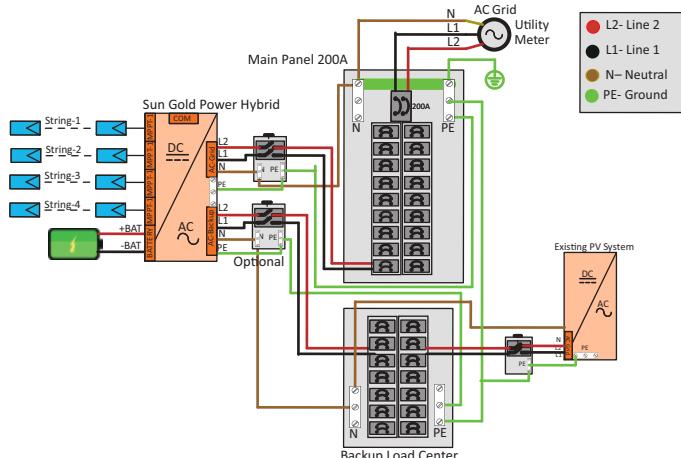
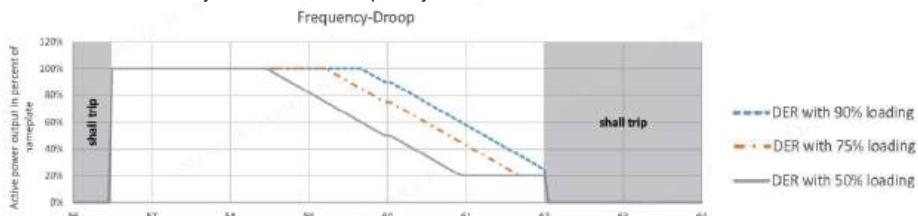


Figure 4.7 AC-coupling with an existing PV system for backup power & energy arbitrage

Frequency-Watt Shifting

Another PV system can be AC-coupled in parallel on the backup side. If the grid fails, the hybrid will act as the grid to keep the AC-coupled PV system operating. If the amount of available PV power exceeds the amount of power consumed in backup mode, the hybrid will shift the AC frequency just enough to turn off the AC-coupled PV system. This is frequency-watt shifting.

The inverter uses frequency-watt shifting in order to modulate the output power of AC-coupled PV systems. **The frequency derating (droop) curve is based on the IEEE 1547-2018 standard.** The AC-coupled PV system must also support frequency-watt shifting based on IEEE 1547-2018. If the AC-coupled PV system cannot or does not support this function, then the system will shut off as the Sun Gold Power hybrid shifts the frequency.



NOTE:

In the AC coupling system, the maximum output power of the PV inverter must be less than the maximum output power of the energy storage inverter. Otherwise, during off-grid state, the energy from the PV inverter may impact the energy storage inverter, causing the energy storage system to stop working. Currently, AC coupling function is only supported for a single hybrid system.



4. Operating Modes

4.2.6 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.

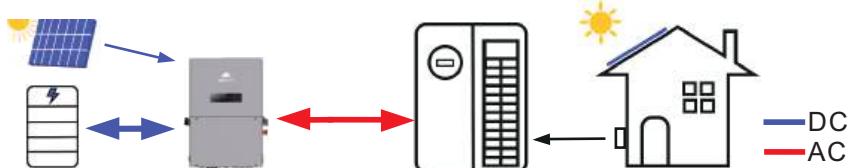


Table 4.8 DC-coupled Sun Gold Power hybrid system

Whole-home and partial-home back up can be achieved with DC Coupling. Depending on the battery model, the hybrid can connect with between 10 and 150kWh of stored power to provide in backup mode or for energy arbitrage. It is recommended to determine how much average PV power will be available and what the average power consumption is to understand how long the battery will last in the event of a grid outage. The battery discharge power can be limited to ensure the battery drains more slowly. If the backup power demanded exceeds what is available, the inverter will display an alarm code and will shut down for a few minutes.

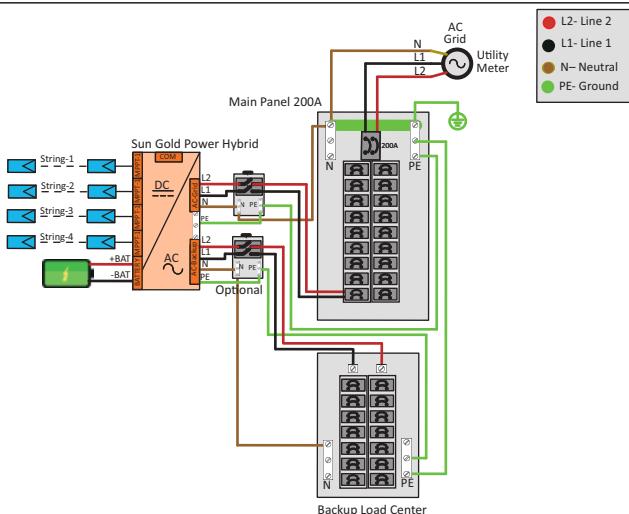


Figure 4.9 Partial-home backup with one hybrid inverter

Warranty Warning:

Installations that fail to comply with the wiring method shown in wiring box will void the Sun Gold Power US warranty and any damage caused by improper wiring will not be covered.



4. Operating Modes

Whole-Home Backup

To achieve whole-home backup, the system must be configured such that all of the home loads are backed up in the event of a grid failure. It must be determined what the maximum continuous current should be in order to meet the needs of the home. Two hybrid inverters can be installed in parallel with PV and batteries to provide even more continuous backup power. This may be enough for whole-home backup but it might not be, every home will have different needs.

A generator can also be added in order to supplement power and so can an AC-coupled PV system. All of the home load breakers will need to be located in a load center that is electrically isolated from the grid-side of the system. This may mean relocating breakers into a new load center.

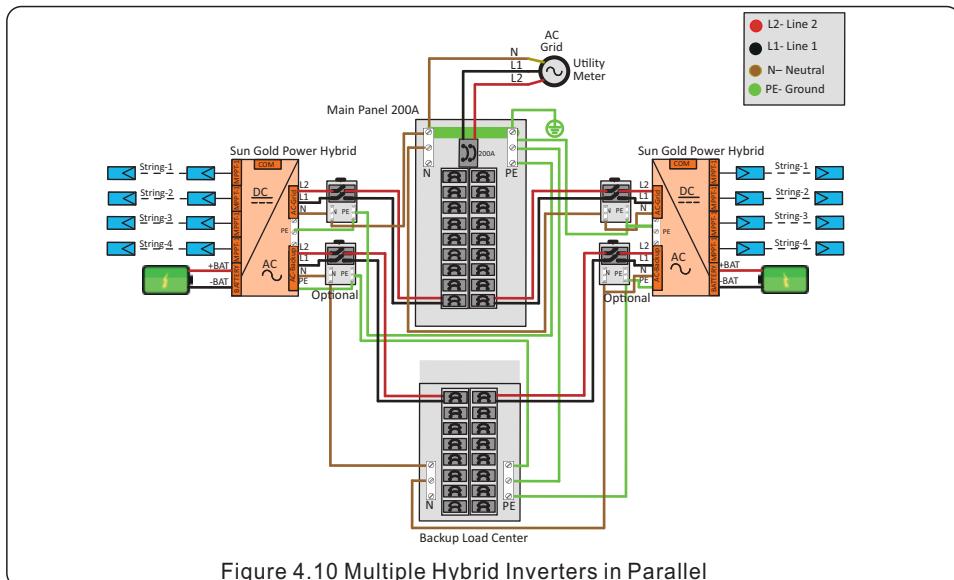


Figure 4.10 Multiple Hybrid Inverters in Parallel

Retrofitting an Existing PV System for Energy Storage

The hybrid inverter could be used to retrofit an older PV system with energy storage. The old PV inverter would need to first be removed. The Sun Gold Power hybrid would then be installed in place of the old inverter. The PV would connect to the inverter directly, provided the specifications of the PV strings are within the tolerance ranges of the Sun Gold Power hybrid inverter.



Overcurrent protection device and load center sizing shall be done in accordance with the NEC and local electrical codes and standards.

Backup Power with PV Only:



A battery is required for backup power. If only PV is installed, this inverter is not able to provide backup power when the grid is down. However, the inverter is able to supply backup power with a battery only and no PV. The inverter with a battery can be AC-coupled to an existing system without directly connecting any PV to the inverter. The inverter can serve as the grid to keep the existing PV system operating, only if paralleled on the backup side.

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.

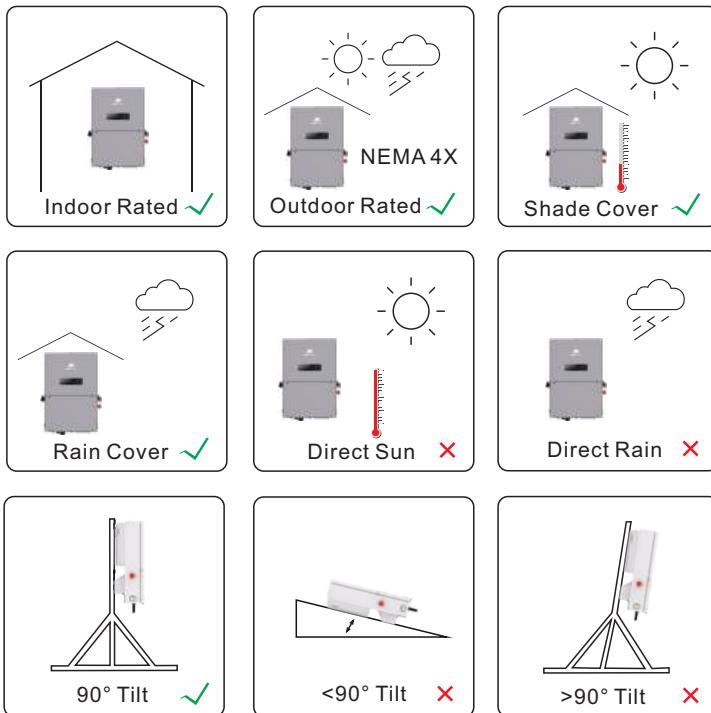


Figure 5.1 Recommended Installation locations



WARNING: Risk of fire

Despite careful installation, electrical equipment can cause fires.

- Do not install the inverter in an area containing flammable materials or gases.
- Do not install the inverter in a potentially explosive environment.
- The structure where the inverter is being mounted must be fireproof.

5. Installation

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

WARNING: Risk of fire

Despite careful construction, electrical devices can cause fires.

- Do not install the inverter in areas containing highly flammable materials or gases. Keep the inverter out of reach of children if children may be present.
- Do not install the inverter in potentially explosive environments.



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 should meet the following requirements:

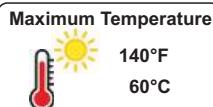


Figure 5.2 Installation environment conditions

Load bearing structure requirements:



Made of nonflammable materials



Max. load bearing capacity \geq 4 times of inverter weight

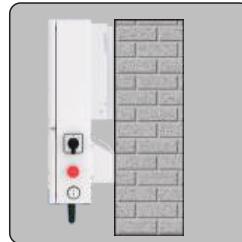


Figure 5.3 Load bearing structure

5.1.1 Clearances

- If multiple inverters are installed on site, a minimum clearance of 12 inches should be kept between each inverter and all other mounted equipment. The bottom of the inverter should be at least 20 inches above of the ground or floor (see Figure 5.5 on page 23).
- The LED status indicator lights located on the inverter's front panel should not be blocked
- Adequate ventilation must be present if the inverter is to be installed in a confined space.

5.1.2 Consult technical data

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

5.1.3 Angle of installation

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

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 Product 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.

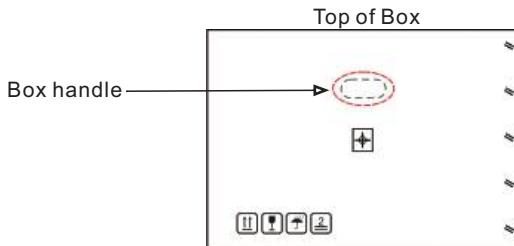


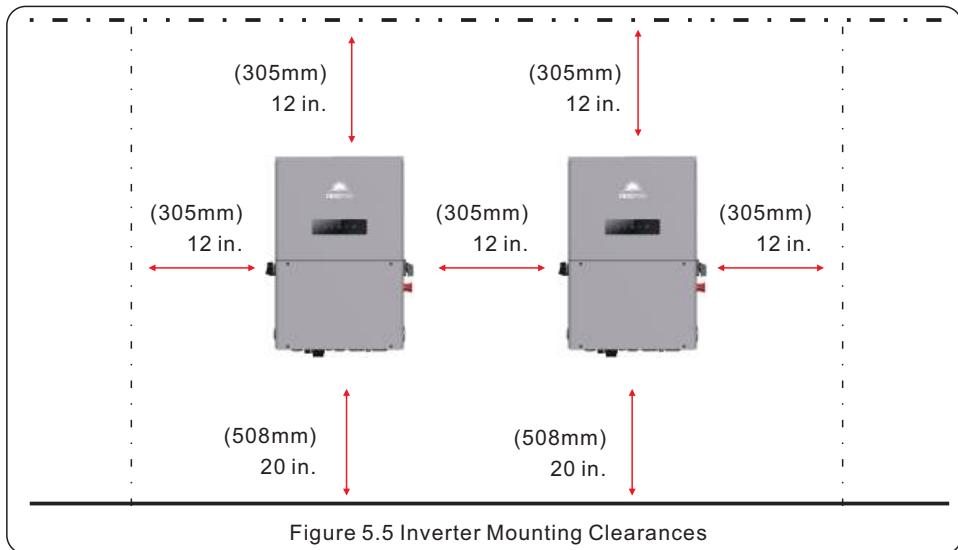
Figure 5.4 Handles for moving the inverter shown circled in red - one per side

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. (see Figures 1.3 and 1.4 on page 2)
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.

5. Installation

5.3 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 12 inches (305mm) should be kept between inverter & other equipment.
- 20 inches (508mm) of clearance between the bottom of the inverter and the ground.



- Visibility of the LED indicator lights should be considered. Ideally, the indicator light should 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 9.5 inches. 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.



NOTE:

The inverter does not come with any fasteners. You must provide your own hardware for securing the mounting bracket to the mounting structure.

5. Installation

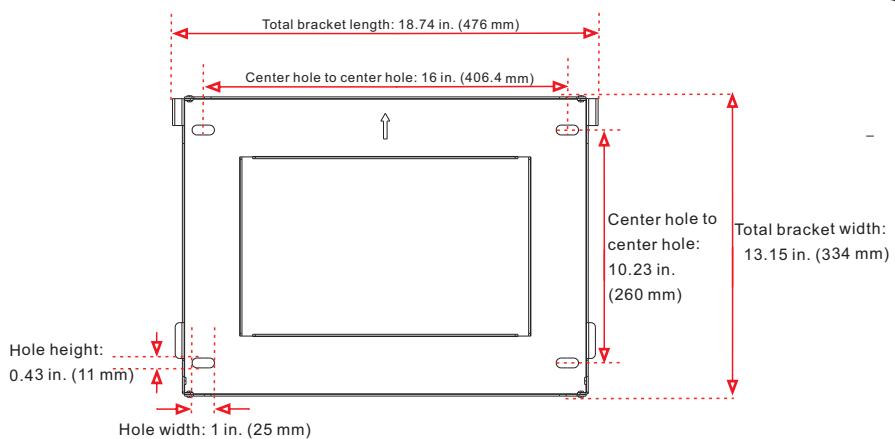
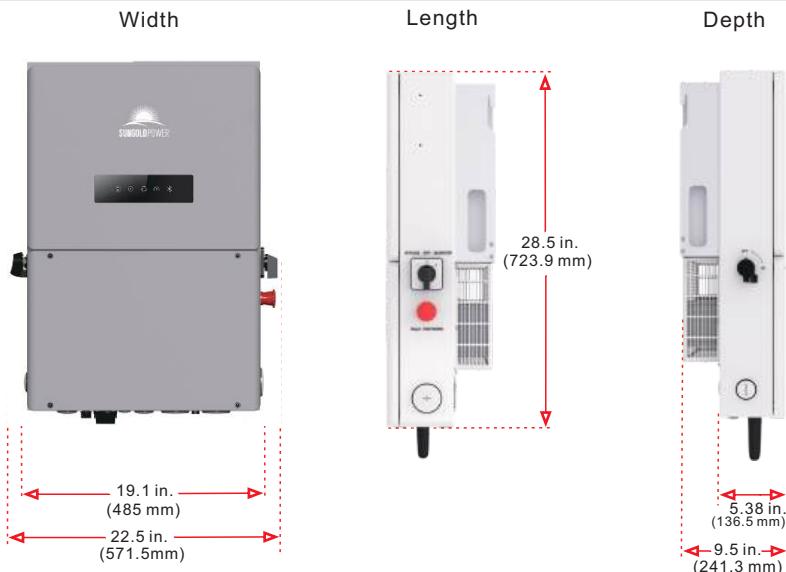


Figure 5.7 Inverter Bracket Dimensions

Once a suitable location has been found according to 5.2 and 5.3, use figures 5.6 and 5.7 to mount the bracket to the wall. You may drill additional holes in the bracket if you need to.

The steps to mount 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.

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.

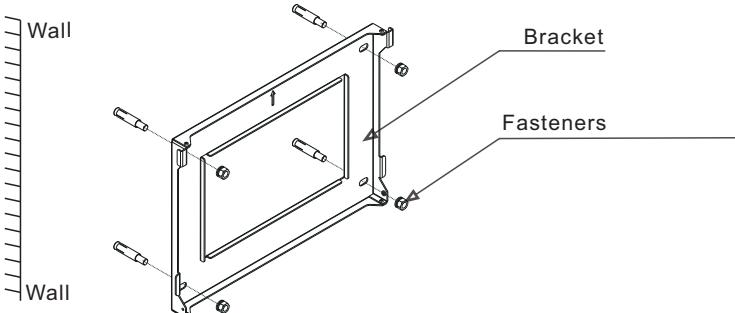


Figure 5.8 Fix the bracket to the wall

2. Lift up the inverter and align the 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.

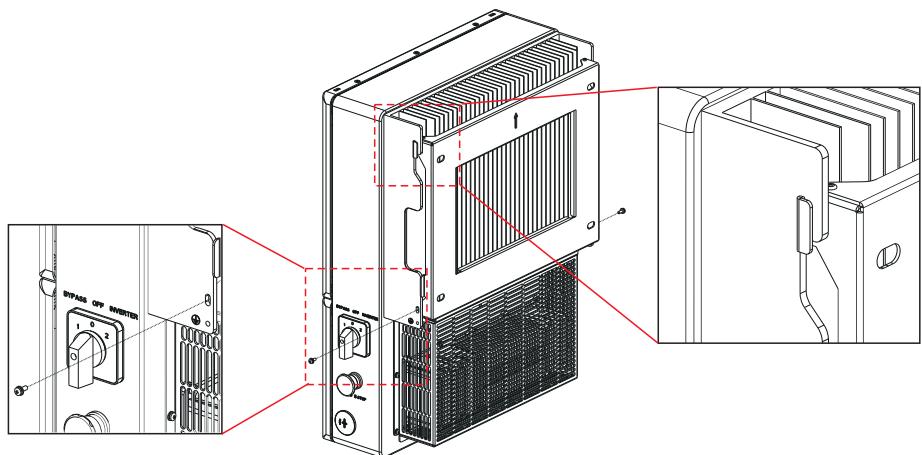


Figure 5.9 Inverter on mounting bracket and set screws



WARNING:

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

5. Installation

5.4 Inverter Wiring Overview

	Purpose	Connection Points
PV Cables	PV DC connection to the inverter	From the PV array to the DC+ and DC- terminals in the inverter
Battery Cables	Battery DC connection to the inverter	From the battery (+) and (-) terminals to the inverter BAT+ and BAT- terminals
AC Grid Cables	Inverter AC connection to the main service panel	From the OCPD in the main service panel to the AC-GRID L1 and L2 terminals
AC Backup Cables	Inverter AC connection to the backup subpanel	From the backup loads subpanel OCPD to the inverter AC-BACKUP L1 and L2 terminals
Ground Cables	Grounding conductors for the system	From the main service panel ground bar to the ground bar inside the inverter wire box
Meter RS 485 cable	Communication between inverter & meter	From meter to terminal Meter_A and Meter_B. For more details, refer to figure 4.2.2 Installing the energy meter
Battery CAN cable	Communication between the inverter & the battery	From battery to terminal CAN-L and CAN-H. For more details, refer to figure 4.2.3 Installing the battery
Data Logger (Optional)	Monitoring of the system on SolarEnergy	USB COM port at the bottom of the inverter (For more details, please refer to the data logger product manual)

Table 5.1 System Cable Connections



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

The Appendix section of this manual contains single-line wire diagrams that show how the equipment interconnects. Please use the single-line diagram when planning the conduit paths and determining the wire requirements.

5. Installation

5.5 Wiring Diagram Overview

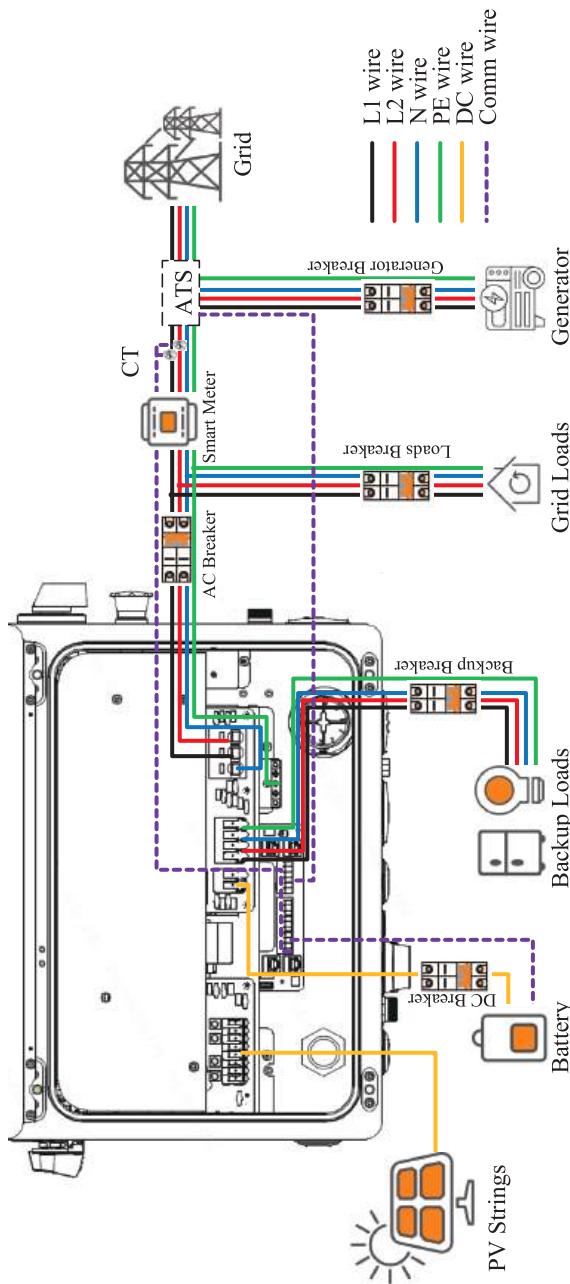


Figure 5.10

5. Installation

5.6 External Grounding

An optional external ground connection point is available on the right side of inverter.

The internal ground bar is grounded to the inverter chassis.

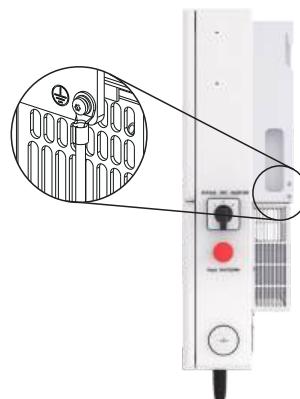


Figure 5.11 External Grounding Conductor Terminal Location

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

1. It is recommended to use copper wire for the chassis ground. Either solid conductor or stranded wire is acceptable. Refer to local code standard for wire sizing.
2. Strip $\frac{1}{2}$ inch of insulation off the end of the ground cable.

Important:

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

3. Crimp a ring terminal onto the ground cable with a ratcheting crimp tool
4. Connect the cable to the ground terminal screw and then tighten it with a torque wrench/screwdriver to 2N.m.

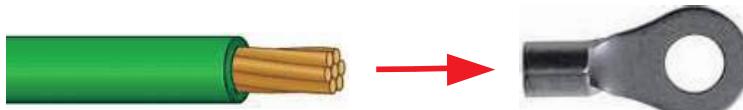


Figure 5.12 External Grounding Conductor Ring Terminal

5. Installation

5.7 PV Cable Installation

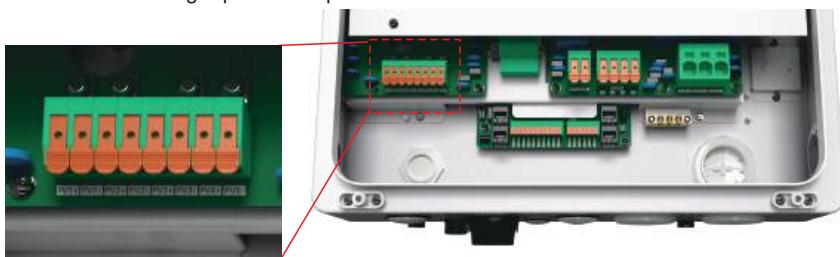
**DANGER:**

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

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

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

Note: Each PV string input is a separate MPPT



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 5.13 PV Cable Connection

CAUTION:

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

The steps for corrective actions are as follows:

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



5. Installation

5.8 Rapid Shutdown

5.8.1 Integrated Rapid Shutdown



Important Note

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

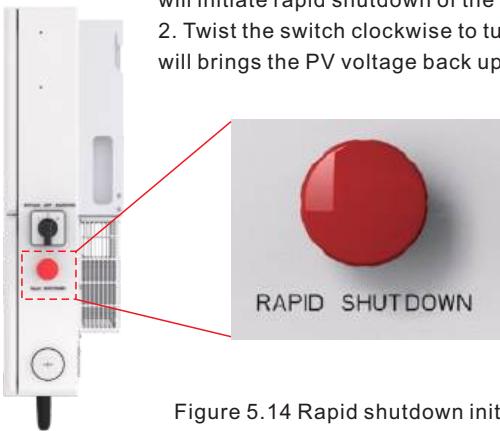
How the inverter achieves module-level rapid shutdown:

The internal transmitter generates a PLC signal when it receives AC power. This signal travels up the PV strings to the receivers that are connected to the PV modules. When the receivers get this signal, they turn on and allow the string voltage to ramp up. When the receivers lose this signal, they turn off. When the receivers are off, each PV module only puts out around 0.6Vdc.

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

Rapid Shutdown Initiation Process

1. Press the switch button in to turn off the internal transmitter. This will initiate rapid shutdown of the PV (ramps the PV voltage down)
2. Twist the switch clockwise to turn the transmitter back on. This will bring the PV voltage back up to normal.



Note:

Rapid shutdown will only initiate if receivers have been installed on the PV modules. Without the receivers, rapid shutdown is not possible.

Figure 5.14 Rapid shutdown initiation switch and process

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 measuring 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 it is popped out.
3. The DC switch does not have to be turned on for the receivers to receive 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

5.8.2 External Rapid Shutdown

If the inverter is being installed where it is inaccessible to first responders, an external rapid shutdown switch must be installed somewhere it is accessible.

Steps for Installing an External Rapid Shutdown Initiation Switch

1. Install the external RSD switch and run two wires between it and the inverter
2. Remove the red jumper from the RSD_IN and RSD_OUT terminals (see Figure 5.15)
3. Connect one end of the two wires to the RSD_IN and RSD_OUT terminals
4. Connect the other end of the two wires to the external RSD 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.



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

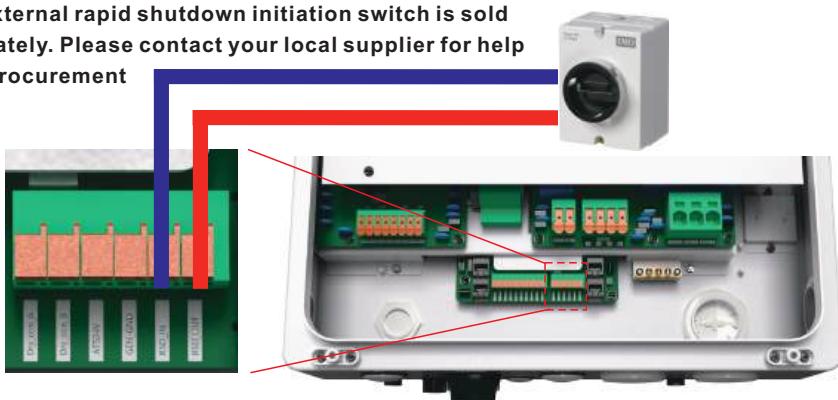


Figure 5.15 External RSD Initiation Switch

External Rapid Shutdown Transmitter Guidance

An external transmitter can be installed, but the internal transmitter must be disabled so there is no cross-talk between the two transmitters. And, the transmitter must have PVRSS with hybrid.

1. Make sure the inverter is completely off. Both DC and AC disconnect switches must be opened prior to proceeding any further. Use a multimeter to verify that the AC voltage is 0V at the inverter terminals.
2. No tools are required. Pull down on the small black terminal block indicated in the photo below.
3. With the block removed, the transmitter will not receive any power and will become disabled.

Leave the terminal block hanging, this will not cause any damage to equipment.

4. For the PV to generate power in backup mode, the external transmitter must get power from the inverter backup circuit. You can also take the 12Vdc from the internal transmitter.

Note: the red jumper completes the 12Vdc circuit by closing the positive + side



Please consult the RSD user manuals when installing any RSD components

5. Installation

5.9 Battery Installation

DANGER:

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

1. The battery (+) and (-) cables shall only be connected to the inverter BAT terminals.
2. Run the cables into the wire box. Strip $\frac{1}{2}$ inch off the ends of each cable.
3. Insert a technician screwdriver into the slots of the squares below the BAT terminals
4. Push in with the screwdriver, insert the cable, and release the screwdriver
5. Give the battery a gentle tug test to ensure the connection is tight
6. If the connection feels loose, repeat steps 1-5



Figure 5.16 Battery Cable Connection

Additional Notes on Batteries:

For instructions on how to turn the battery on, please consult the battery user manual and be sure to wait until the system is fully installed before turning the battery on.

This inverter only works with specific battery models. Please consult the Battery Compatibility sheet for specifics on which battery models this inverter will support.

NOTE:

The battery fuse in the inverter wire box is replaceable.

The replacement can only be done by a technician authorized by Sun Gold Power. Fuse specification: 750V, 63A.

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

Model	SG(3.8-5)KHB-HV	SG(7.6-11.4)KHB-HV
Battery Cable Max. Wire Size Accepted by Terminal	8 AWG	6 AWG

Table 5.2 Battery cable size limitations

5. Installation

5.10 AC Wiring

5.10.1 AC Terminals



Figure 5.17 AC output terminals

The inverter has two AC outputs: (1) to a backup service panel and (2) to the main service panel which is connected to the utility grid. 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 on the Backup-side. The inverter can be connected to other hybrids in parallel to provide additional support to the backup loads. Generator support will be available in Summer 2023.

Model	SG(3.8-5)KHB-HV	SG(7.6-11.4)KHB-HV
AC Grid Cable Max. Wire Size Accepted by Terminal	6 AWG	4 AWG
AC Backup Cable Cross Sectional Area	8 AWG	6 AWG

Table 5.3 AC cable size limitations

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

To protect the inverter, we recommend installing a device for protection against over-current and leakage, based on the following current ratings noted in Table 4.4:

Inverter Model	Grid Max Output Current	Grid Max Input Current	Backup Rated Output Current	Backup Max Output Current (10 sec)
SG3.8KHB-HV	15.8A	23.8A	15.8A	25.4A
SG5KHB-HV	20.8A	31.2A	20.8A	33.3A
SG7.6KHB-HV	31.7A	47.6A	31.7A	50.7A
SG10KHB-HV	41.7A	62.6A	41.7A	66.7A
SG11.4KHB-HV	47.5A	71.3A	47.5A	76A

Table 5.4 Current ratings for sizing the OCPD

5. Installation

5.10.2 Installing the AC cables

WARNING:

Conductors terminated in the backup ports of the inverter must be connected to an isolated load center that is not directly connected to the utility. This ensures that the system complies with anti-islanding requirements.

Steps for installing the AC grid and backup conductors

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 $\frac{1}{2}$ inch of insulation from the ends of each cable
3. Insert a technician screwdriver into the small hole above the wire terminal
4. Push in with the screwdriver and insert the wire into the terminal
5. Release the screwdriver and the terminal clamp will bite down on the wire 6
6. Give the wire a gentle tug test to ensure it is tight
7. If the wire feels loose, repeat steps 3-6
8. Connect the other ends of the AC cables in the main service panel to a breaker and neutral bus
9. Connect the other ends of the AC cables in the backup service panel to the panel lugs or to a breaker
10. Keep the breakers and AC bypass switch OFF for now, turn them on when doing commissioning.

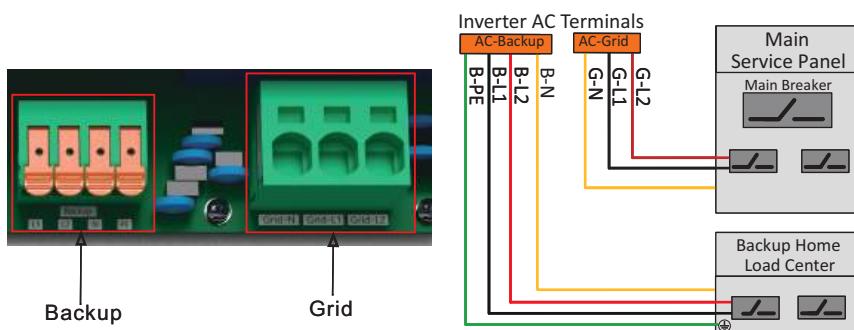


Figure 5.18 Simplified AC wiring diagram

5.10.3 Steps for Installing the Backup Home Load Center

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

5. Installation

5.10.4 AC Bypass Switch

This failsafe switch determines the power source for the inverter backup circuit. If the inverter fails or has a critical alarm, the backup circuit will shut off. Should this occur, the switch set to 1 allows power to pass through the inverter to the backup from the grid.



The switch settings operate as follows:

BYPASS (1) the backup circuit is powered by the grid directly. If the inverter fails, the backed up loads will shut lose power. The bypass switch should be set to (1) until the issue is resolved.

OFF (0) the backup circuit is disconnected from the inverter. Switching to OFF will de-energize the backed up loads

INVERTER (2) the backup circuit is powered by the inverter directly. If the grid fails, the inverter will continue to supply the backed up loads with power from the PV and battery

This is the setting for normal operation.



NOTE:

The AC bypass switch is not the AC disconnect switch for the inverter. The backup circuit will be isolated from the inverter on the OFF position.

Unstable Grid

Systems that experience frequent grid blackouts, or have an overall unstable grid in general should the Inverter (2) setting of the bypass switch. This ensures that the backed up loads remain energized regardless of the grid quality and presence.

- Supports backup power
- Supports faulting equipment



Unstable Equipment

For systems that have problematic equipment resulting in shutdowns, the Bypass (1) setting should be used. When set to Bypass (1), the inverter will pass power through to the backed up loads from the grid directly even if it cannot produce power itself with PV and battery.

- Supports backup power
- Supports faulting equipment



Pass-Through Power

The 3.8-5kW models can pass through 7.6kW maximum from the grid to the loads.

The 7.6-11.4kW models can pass through 11.4kW maximum. Do not set the bypass switch to bypass position when overload faults occur.



NOTE:

If the system breaker in either service panel trips, do not use the bypass switch. First troubleshoot the on-site fault. Be sure the breaker is not being overloaded.

5. Installation

5.10.5 Paralleling Multiple Hybrid Inverters

Up to **three** 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. The three inverters get connected together with ethernet cables.

Backup Combiner Load Center

In the diagrams of this manual a Backup Combiner Load Center is often shown that is additional to the Backup Home Load Center. The Combiner is not required, but it does provide additional breaker slots to host multiple inverter breakers and a generator breaker if one is installed.

A single backup load center can be installed if there is adequate space to host all of the home load breakers in addition to the inverter breakers, provided that it is compliant with the NEC.

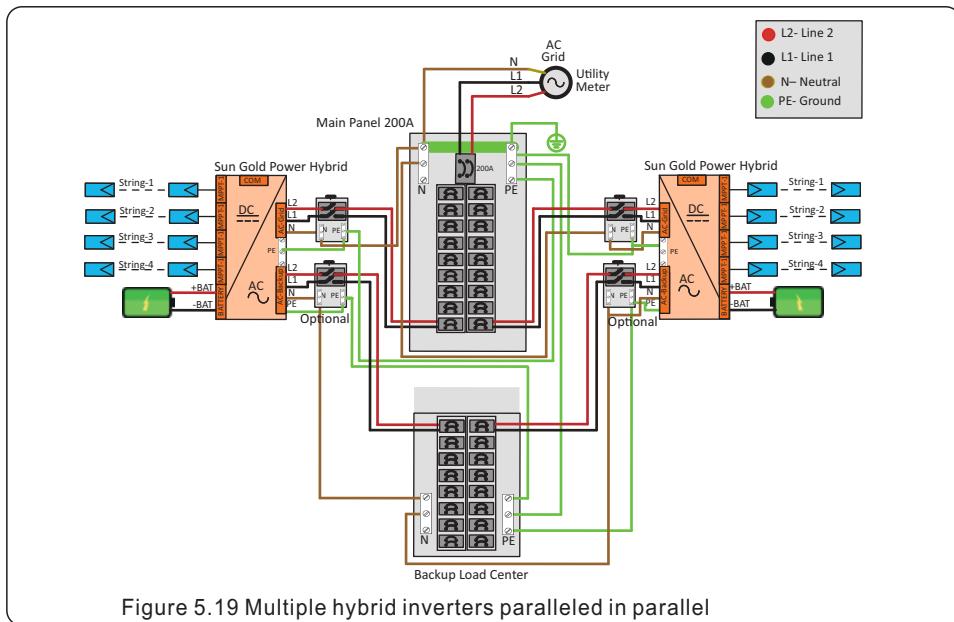


Figure 5.19 Multiple hybrid inverters paralleled in parallel

During the commissioning, one inverter gets designated as the master. The two inverters will then operate in tandem, with each one modulating the output power to match the home loads demand. If one inverter stops, the other one will continue to operate normally. The maximum backup output current is the sum of the two inverters together. For example, two 11.4K inverters could provide up to 95A ($47.5A \times 2$) of continuous backup power with up to 152A of surge current for ten seconds.

5. Installation

5.10.6 Generator Integration

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

Connect the generator dry contact to pins **Dry_con_A** and **Dry_con_B** of the inverter.

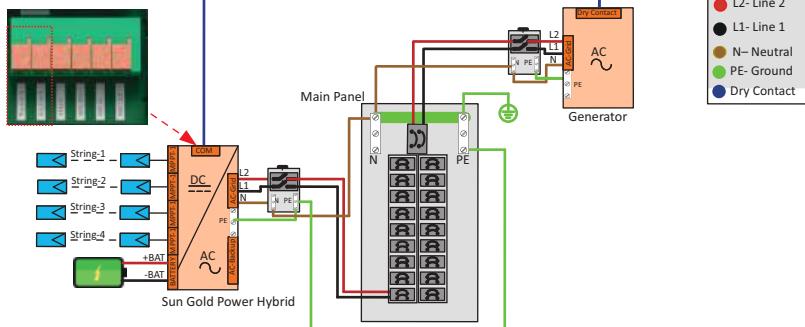


Figure 5.20 Off-grid system with a generator and hybrid inverter

An on-grid system using an ATS and generator can also support a Sun Gold Power hybrid inverter. The ATS connects to the inverter using a 12-24V start wire. When the grid is lost the ATS will disconnect from the grid but not start the generator until the inverter sends the start signal. The inverter will send the start signal once the battery SOC reaches the specified start SOC.

Connect the ATS to the **ATS12V** port of the inverter.

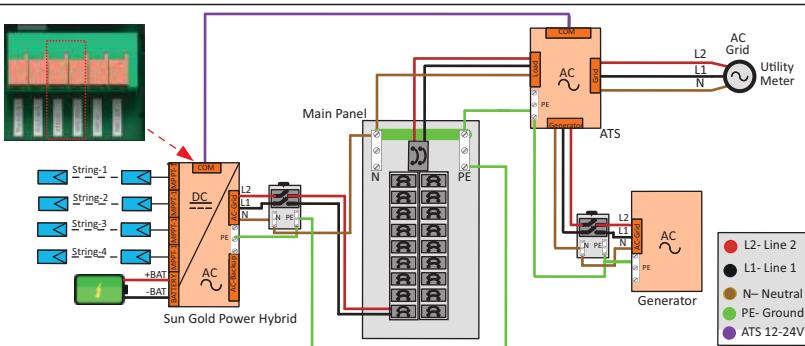


Figure 5.21 On-grid system with an ATS, generator, and hybrid inverter

NOTE:

The generator must be connected to the grid side of the inverter. Do not allow the backup side of the inverter to be connected to the generator.

NOTE:

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

5. Installation

5.10.7 AC-Coupled PV for Backup

An existing PV system can be AC-coupled to the backup side so that it can be supported when the grid is down. The acronym "ACPV" will be used to generically describe any existing PV system that will be AC-coupled with the energy storage and backup. This is to distinguish it from "PV", which is connected on the DC-side of the energy storage system alternatively. The breaker for the ACPV system will need to be relocated into the backup load center so that it can remain energized during a grid outage.

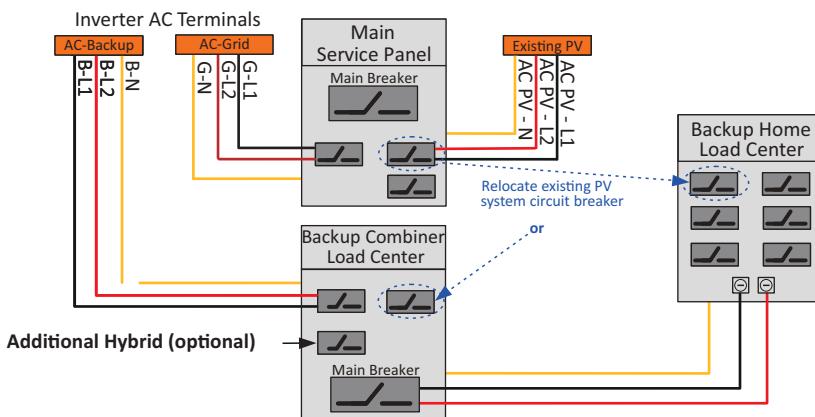


Figure 5.22 Backup with an AC-Coupled PV System

There is no direct communication between the Sun Gold Power 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 hybrid corrects the frequency.

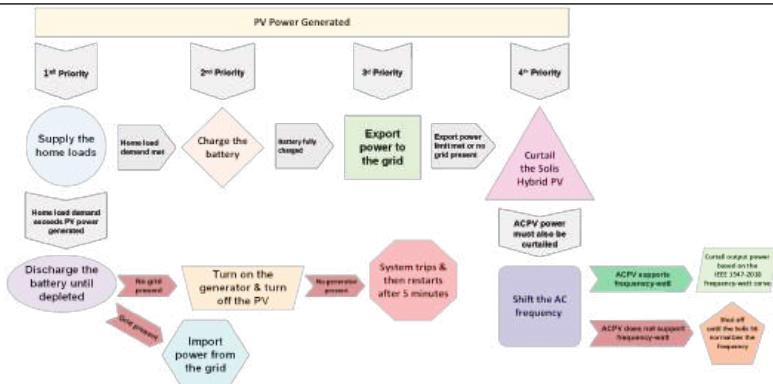


Figure 5.23 Logic table of system operation with ACPV

5. Installation

5.11 Inverter Communication

5.11.1 Communication Terminals Overview

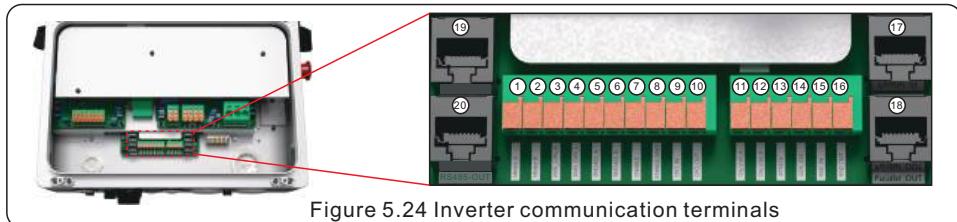


Figure 5.24 Inverter communication terminals

The inverter communication terminal block consists of 16 ports.

From left to right, the chart below explains what purpose of each port is.

NO.	Port	Function	Acceptable Wire Size Range
1	Meter_A	Used for RS485 communication between the inverter and the external energy meter. This is required in order to have full functionality of the hybrid inverter.	22-16 AWG
2	Meter_B		
3	BMS_CAN_H		
4	BMS_CAN_L		
5	BMS485_A		
6	BMS485_B		
7	ENABLE		
8	Enable_GND		
9	EPO_IN		
10	EPO_OUT	Emergency Power Off signal.	
11	Dry con_A		
12	Dry con_B	Dry contact for generator connection.	
13	ATS24V		
14	GEN GND	For Supplementary ATS connection.	
15	RSD_IN		
16	RSD_OUT	For each side of the external rapid shutdown initiation switch. (optional)	
17	Parallel_IN	For parallel hybrid daisy-chaining.	RJ45
18	Parallel_OUT		
19	RS485-IN	1. For RS485 communication, and it is default. These two RS485 are internally connected in parallel.	
20	RS485-OUT		

Table 5.5 Inverter communication terminals explained

NOTE:

 COM1 and COM2 conduit knockouts are for 1/2 inch cable glands or conduit fittings. Please be sure to not run com cables in the same conduit as high voltage conductors. Doing this could cause communication issues.

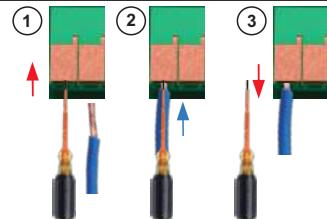
5. Installation

Installing the communication wires:

First, strip $\frac{1}{4}$ inch off the end of the com wire.

1. Insert a technician screwdriver into the slot the orange tab and gently pull up with it.
2. Insert the stripped com wire into the 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.



5.11.2 External Energy Meter Communication

The Acrel AGF-AE-D energy meter comes with the inverter. Please use the diagram below to connect the meter RS485 communication wires to the Meter_A and Meter_B pins on the inverter communication terminal block.

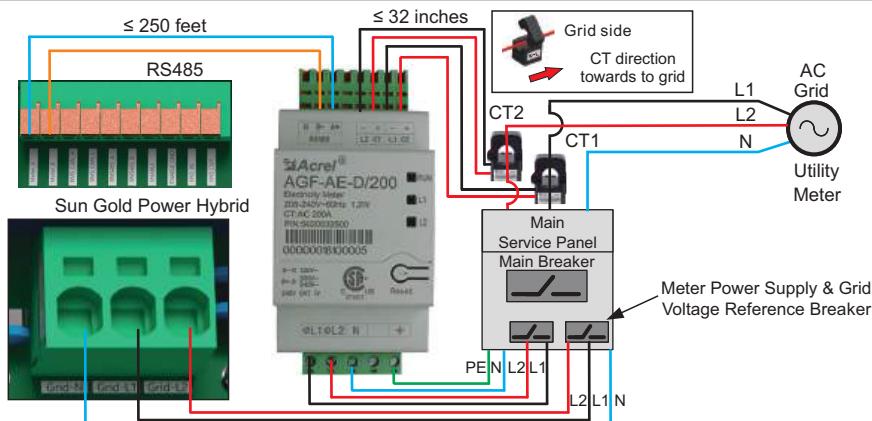


Figure 5.25 Acrel Meter Wiring Diagram (Acrel AGF-AE-D)

The Acrel meter must be installed in order to have a fully-functioning system. If the meter is not installed, key functions such as export power control and default energy storage modes will not be available. It is possible for the system to function without the meter. In the meter-select menu choose "No Meter".

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 not, please check if the wiring is correct.

Please use the provided Acrel meter manual for instructions on how to install it.

NOTE:

 If both phase imbalance and anti backflow are enabled, and it is found that one phase is exporting power while the other is importing power, it indicates the wiring error in the meter. Please check the meter wiring. If the power direction at the power grid port is opposite to the actual logic, please check if the CT direction is correct.

5. Installation



NOTE:

Export power shows as a positive value and import power shows as a negative value.

5.11.3 Battery Communication

• CAN Communication

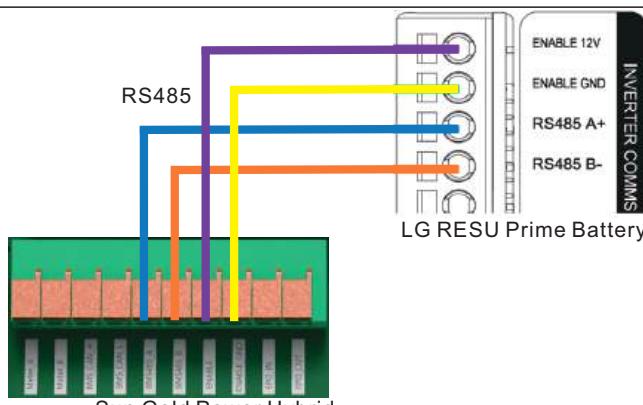
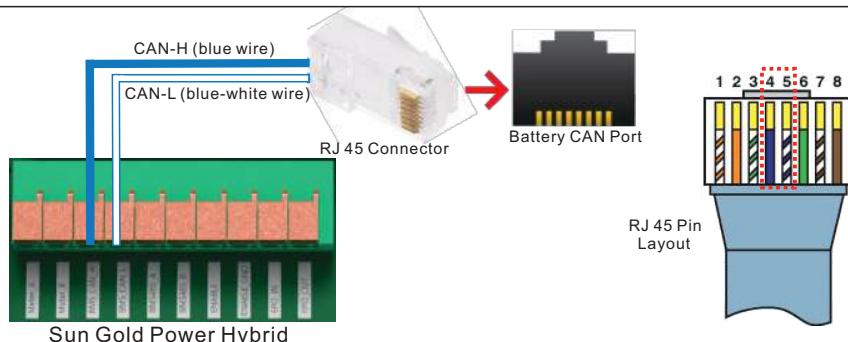
Connect a CAT5 cable to the battery CAN port and run the cable to the inverter.

Split the cable at the inverter end, then connect the blue wire (pin #4) to

BMS_CAN_H and the blue-white wire to BMS_CAN_L (pin #5)

• RS485 Communication (LG batteries only)

Run a CAT5 cable between the battery and the inverter. Split the cable at both ends and then use the diagram in Figure 5.26 to connect the four wires on both the battery and inverter ends.



5. Installation

Note:

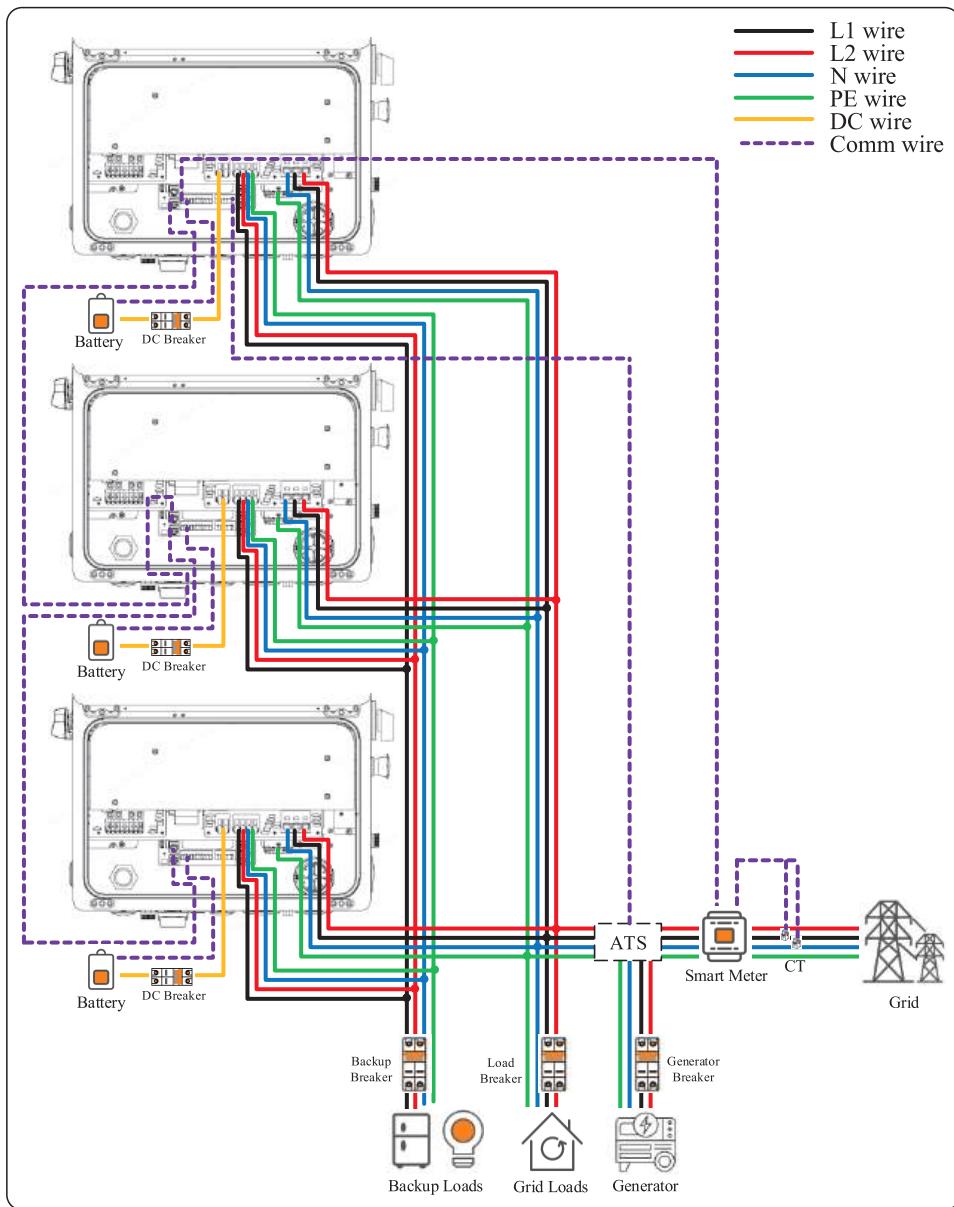


Some alarm codes are being relayed from the battery. These alarms are caused by an issue with the battery itself. The troubleshooting section of this manual explains how to diagnose and treat each alarm. If the alarm says the battery is having a malfunction, please contact the battery manufacturer.

5.11.4 Parallel Inverter Installation

1. When connecting inverters in parallel, it is crucial to match their sizes; for instance, pair a 11.4KW inverter with another 11.4KW inverter. Do not parallel inverters of different sizes.
2. Before parallel connection, verify that both inverters are operating on the same firmware version.
3. Up to three hybrid inverters can be installed together in parallel.
4. The meter and data logger only need to be connected to the master. But to update the FW, each inverter needs to have its own data logger.
5. For multiple inverters in parallel, all inverters should be connected to the same ground point to eliminate the possibility of a voltage potential existing between inverter grounds.
6. PV input: Each inverter will have its own PV strings connected to it, as per the DC input PV specifications of the inverter.
7. Battery input: each inverter is separately connected to the 120-500V battery system.
8. Power grid output and backup output from the inverter should be connected in parallel as per the diagram given below.

5. Installation



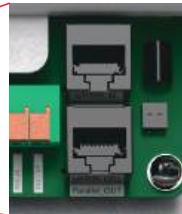
Prior to doing the parallel setup, it is essential to verify the individual normal functioning of each inverter. By this way you can avoid parallel inverter anomalies caused by the original parameter settings of a single inverter.

Set each inverter one by one and make sure they work fine and there are no alarms and then connect the parallel cable as explained above.

5. Installation

5.11.4.1 Parallel Inverter Communication

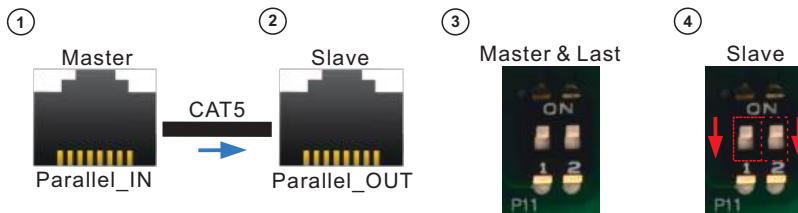
There are two RJ45 ports reserved for communication between Sun Gold Power hybrids only. The communication is CAN and the ports are not able to be used for any other purpose besides daisy-chaining Sun Gold Power hybrids together.



Steps for connecting daisy-chaining two inverters together:

Use a double-ended CAT5 networking cable with a reinforced shielding layer.

1. Plug one end of the cable into the Parallel_IN port of the master inverter
2. Plug the other end of the cable into the Parallel_OUT port of the slave inverter
3. Set both of the DIP switches 1 and 2 to ON (up position) for the master inverter
4. Set both of the DIP switches 1 and 2 to OFF (down position) for slave inverters
5. Set both of the DIP switches 1 and 2 to ON (up position) for the last inverter



Before operating both inverters, it is recommended to first finish the system commissioning steps including checking all connections, polarities, and voltages. This helps to avoid anomalies caused by individual inverter parameter settings.



Note:

The DIP switch is ON upward and OFF downward.



Note:

The BYPASS switch status in the parallel system must be consistent, otherwise it may cause system malfunctions.

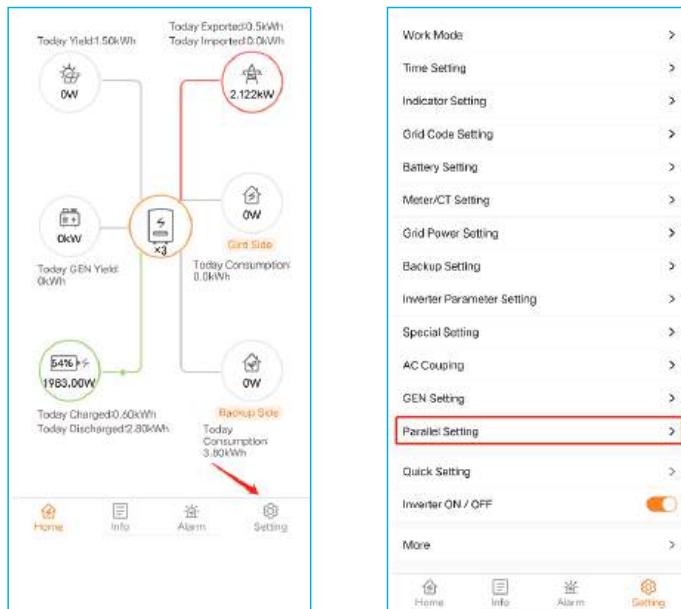
Note:

The master inverter will manage the output power of the slave inverter. If the master inverter has a fault, the slave inverter will automatically take over as the master so that it can continue to operate. When the master is restored, the slave will automatically revert back to being a slave.

5. Installation

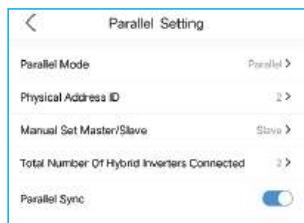
5.11.4.2 Parallel parameter setting

Step1: Enter Solicscloud APP and click the "Setting" interface, then go to "Parallel Settings".



Step2: Set the slave to the following parameters.

Step3: Set the master to the following parameters.



Step2



Step3

Note:

When the system is operating in parallel, then working modes and other Settings can be synchronously set through the Master, rather than setting them separately for each slave inverters. Also, the grid and load data of the master are considered as parallel system data.



5. Installation

5.11.5 Emergency Power Off (EPO)

An external emergency power off switch can be added to the system. There are two pins on the communication terminal block designated for such a switch.

When this switch is engaged, the inverter will cease to operate and it will also turn off the AC backup.

After installing an external switch, run a 2-core cable between it and the inverter. Connect the two cores from the switch to the EPO_IN and EPO_OUT ports of the inverter.

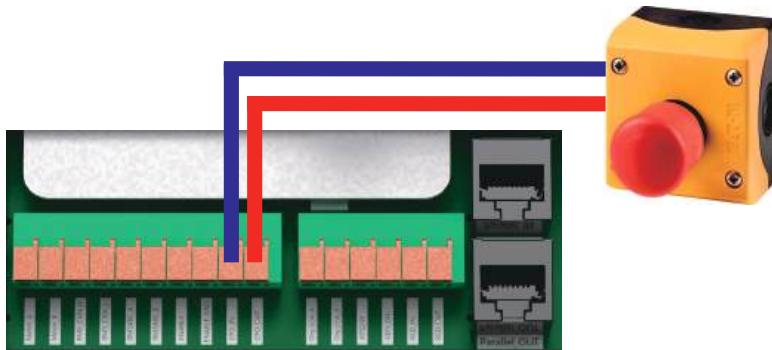


Figure 5.28 External emergency power off switch

5.11.6 Inverter Bluetooth Network

The Sun Gold Power hybrid generates a Bluetooth network which allows technicians to directly interface with the inverter using a smart phone or tablet. The accessory kit will include a Bluetooth antenna. Remove the black protective cap from the "Antenna" port on the bottom of the inverter. Attach the Bluetooth antenna to the port by rotating it *counter-clockwise* until it feels tight. Please note, the antenna simply extends the range of the inverter Bluetooth network, but it is not required for the Bluetooth network to function normally. The range with the antenna is about ten feet and the range without the antenna is about three feet.

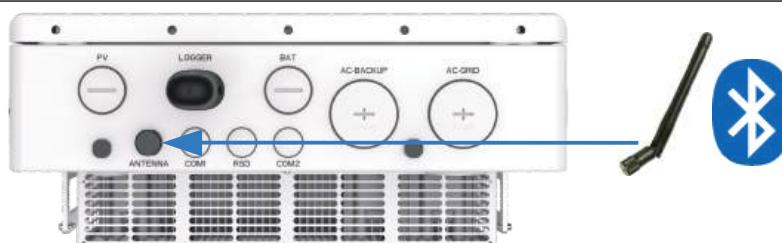


Figure 5.29 External emergency power off switch

5. Installation

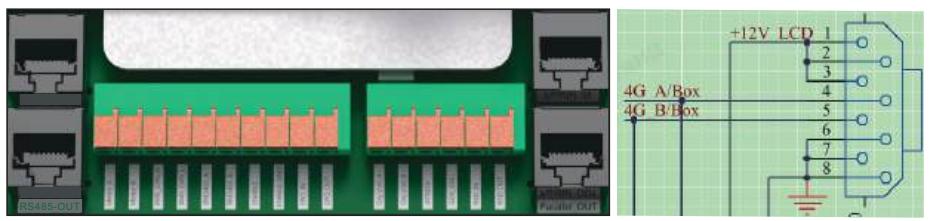
5.11.7 RS485 Connection

The inverter RS485 can be accessed in one of three ways.

Firstly, RS485 IN/OUT can be used for external 485 communication.

RJ45 4PIN and 5PIN are used for external 485 communication wiring.

RS485 IN and RS485 OUT are connected in parallel internally, and can be connected to any interface.



Second, the Logger USB port provides direct connection to RS485. If an internal connection is required, there is a 4 Pin plug which can be accessed to the left of the SPH RJ45 ports.

Step 1: Plug the male end of a USB cable into the same port used by the Sun Gold Power logger.

Note: Sun Gold Power monitoring cannot be used when the RS485 is being connected to.

Step 2: Split the female end of the USB cable. There will typically be four wires: red, green, black, and white.

Step 3: Measure the DC voltage between the pins. RS485A to RS485B will have a DC voltage of around 1.6VDC. RS485A is positive and RS485B is negative. For the cable shown below, green is RS485B and white is RS485A.



Logger USB port



Split USB cable

Figure 5.30 Connecting RS485 through the external USB port

5. Installation

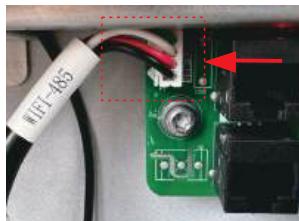
An internal connection to the inverter RS485 can be made. However, it requires the procurement of a 4-pin male JST connector. Please see the figure below for the RS485 pinout of the inverter.

Step 1: Connect the male end of a 4-pin JST connector to the end of an RS485 cable

Step 2: Unplug the RS485 cable that is currently going into the “WIFI-485” port shown in Figure X.

Step 3: Plug the JST connector RS485 cable into the WIFI-485 port.

Note: A female JST connector could be used instead. Unplug the RS485 cable from the top of the logger port and then plug the female end into it.



RS485 Pinout
Green - RS485B
White - RS485A
Red - Enable
Black - Ground

Install a 4-pin JST connector



Figure 5.31 Connecting RS485 through the WIFI-485 port

6. Commissioning

6.1 Pre-Commissioning Steps

- Visually inspect each piece of equipment in the system closely.
- Check all conduit and cable connection points to ensure they are tight.
- Verify that all system components have adequate space for ventilation.
- Follow each cable to ensure that they are all terminated in the proper places.
- Ensure that all warning signs and labels are affixed on the system equipment.
- Verify that the inverter is secured to the wall and is not loose or wobbly.
- Prepare a multimeter that can do both AC and DC amps
- Have an Android or Apple mobile phone with Bluetooth capability
- There are three ways to download and install the latest APP.
 1. You can visit www.solarenergycloud.com.
 2. You can search "SolarEnergy" in Google Play or APP Store.
 3. You can scan this QR code to download SolarEnergy.
- Register a new account with SolarEnergy if you have not done so already. There are two account types available:



Organization: for installers, technicians, and any third-party that is not the direct owner of the home where the system is installed. This is for fleet management. Organization accounts are able to remotely control systems through SolarEnergy.

Owner: for homeowners who typically only have a small number of sites and are only looking to monitor their system(s).

6.2 Commissioning Procedure

Step 1: With the DC switch off, energize the PV strings and then measure DC voltage of the PV strings to verify that the voltage and polarity are correct. Turn on the battery, then check the battery voltage and polarity as well. If RSD is being used, the PV strings will be within safety range (~0.6-0.9VDC per module in the string depending on the RSD brand).

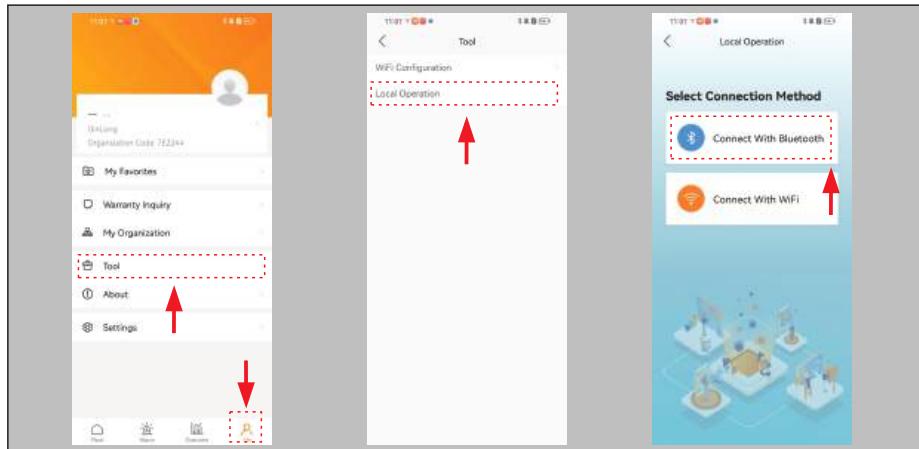


Step 2: Turn on the OCPD for the system and then measure the AC voltages line to line and line to neutral. The backup side of the system will be off until commissioning is complete.

Step 3: Turn the DC switch on. If you are using rapid shutdown, the PV string voltages should increase after a few seconds. If it does not increase, give the rapid shutdown initiation switch a clockwise turn so that it pops out.

6. Commissioning

Step 4: Turn your phone Bluetooth on and then open the SolarEnergy app. Tap “Service”, then tap “Local Operation”, and then tap “Connect with Bluetooth”.

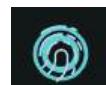


The name of the inverter Bluetooth network will display as “INV_” and then the inverter serial number. Tap on inverter in order to connect to it. The next screen will prompt you to create a six-character password. The password must be exactly six characters. Once you set the password, tap Set Password. It is highly recommended to save this password in case anyone comes back to the site in the future, they will need it. You should then see the message “Connection succeeded” and then be taken to the main interface page.

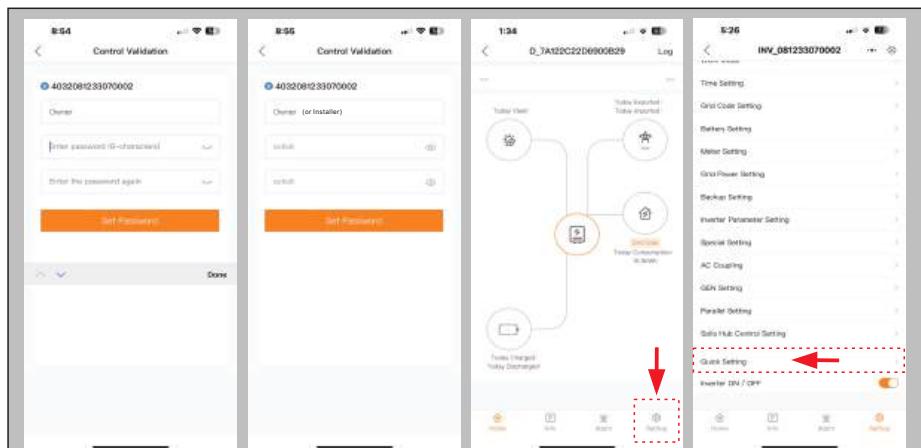


NOTE:

If the password is forgotten, it can be reset by pressing and holding the Inverter LED down for ten seconds.

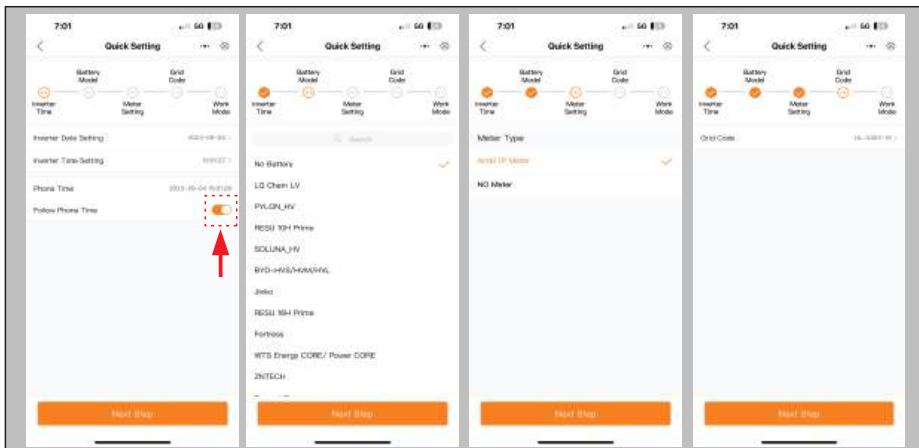


Step 5: Tap on Setting in the bottom right corner and then tap Quick Setting at the bottom.

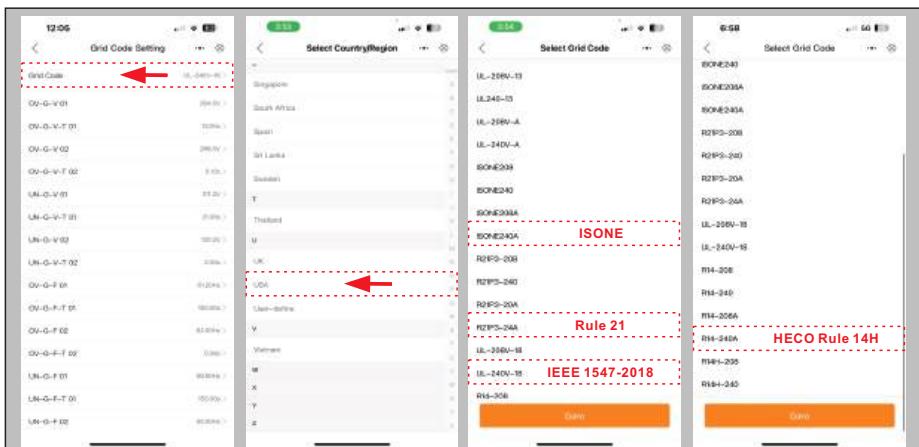


6. Commissioning

Tap the toggle switch for Follow Phone Time to match the inverter time to your phone time, or manually set the time yourself, then tap Next Step. **Select** the battery that is installed, and if no battery is installed, then tap No Battery. Tap Next step, and then verify that Acrel 1P Meter is selected. If a meter is not installed, tap NO meter and then tap Next Step.



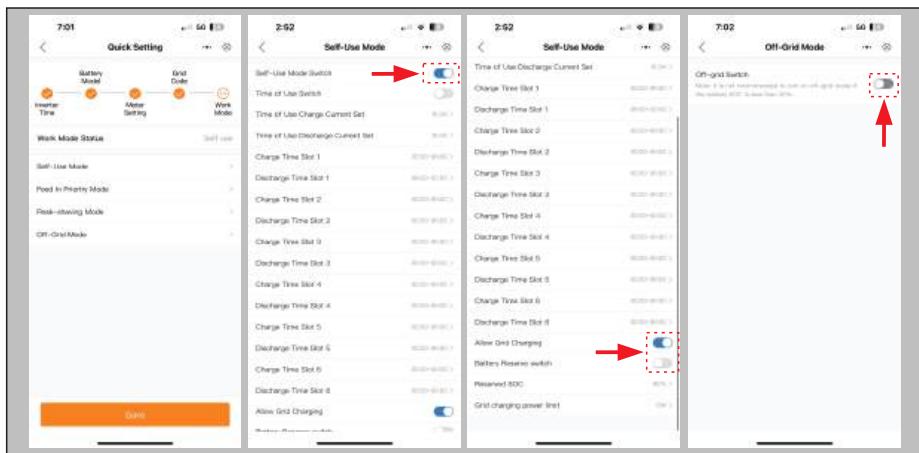
The inverter Grid Code is the grid interconnection profile by which the inverter will operate when it is connected to the grid. For systems installed in the United States, the base (default) profile is **UL-240V-18**. This grid profile is based on the IEEE 1547-2018 standard and is compliant with UL 1741 SA/SB. The grid profile for California Rule 21 is R21P3-24A, the ISONE240A profile is for ISONE, and the R14H-240A profile is for Hawaii's HEKO Rule 14H. Tap the standard at the top first to bring up the list of regions. Scroll to the bottom and then tap USA. Then select the standard you would like. You can then alter the parameters by tapping the parameter, entering the desired value, and then tapping Save when you are done.



6. Commissioning

The Work Mode is the energy storage operating mode of the inverter. Please see the logic tables on pages 14 through 15 for explanations on how the modes operate to determine which one you should select for each system. Upon selecting the mode, you will need to toggle the on switch for that mode. If backup is being installed with the system, then you will need to decide if the Reserve SOC should be set or not.

Toggling on the Battery Reserve switch and then setting a **Reserve SOC** ensures that the battery never discharges below the Reserve SOC. The battery will cycle between 100% full charge and the Reserve SOC %. This guarantees that the battery will have the Reserve SOC to carry the home through a potential grid failure.



Time of Use Switch is for customizing when the battery is allowed to charge and discharge power and at what rate, established by a current (amperage) setting. If this slider switch is turned on, the inverter will only use this schedule to determine when to charge and discharge the battery. If **Allow Grid Charging** is turned on, the inverter will use grid power to charge the battery only under two circumstances: (1) the battery drains to the Force Charge SOC 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: Time of Use is for manual control of the battery charging/discharging. If Time of Use is turned off, charging/discharging is automatically regulated by the inverter.

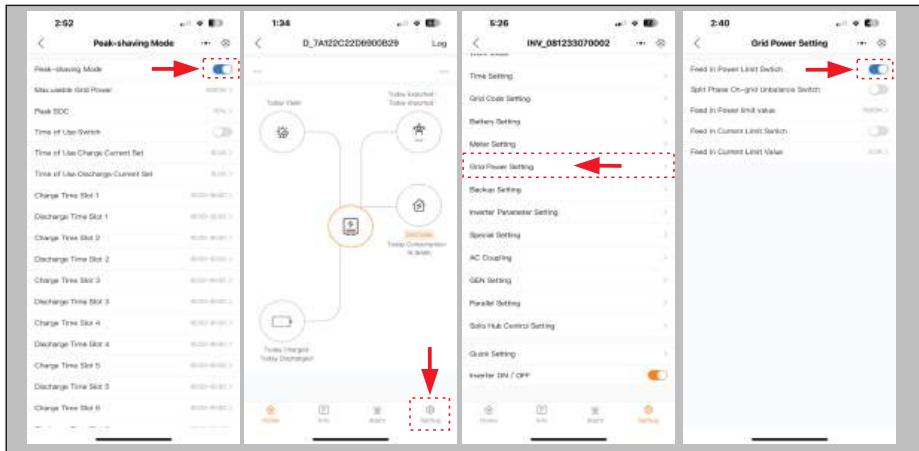
Off-Grid mode should only be enabled for systems that are perpetually isolated from the grid such as a cabin in the woods. Do not enable this mode otherwise.

NOTE:

 Allow Grid Charging should be enabled for every system. The inverter will only use a small amount of grid power to float the battery when there is not enough PV power available. This ensures the battery never drains past the point-of-no-return SOC.

6. Commissioning

The Peak-shaving Mode has additional settings for **Max. useable Grid Power** and **Peak SOC**. Max. useable Grid Power is the most amount of power that the inverter can import from the grid to cover load demand. The Peak SOC is the target state-of-charge percentage that the system will try to reach by the time the peak window starts. The system will import power to cover load demand in excess of PV power generation outside of the established peak window.



Step 6: Once you complete the Quick Settings, you will be at the main screen. To finish commissioning, tap Setting in the bottom right corner. Tap Grid Power Setting, which is the export power management setting for the system. If you would like to regulate export power, toggle on the **Feed in Power Limit Switch**. Leaving this setting off will result in the system exporting as much as it can depending on which work mode has been set.

After toggling the switch to on, set the **Feed in Power Limit Value** (kWh) to the maximum amount of power that the system is to be permitted to export (sell) back to the utility.

Alternatively, the **Feed in Current Limit Value** (A) can be set as the limiting value for power being exported. If values are entered into both the Feed in Current Limit Value and the Feed in Power Limit Value, the system will enforce the lower of the two values.

Turning on the Split-Phase On-Grid Unbalance Switch allows the system to support up to 100% phase-imbalance. It is recommended to toggle this mode on if there are heavy 120V loads such as air conditioners, heaters, pumps that all plug into a standard outlet.

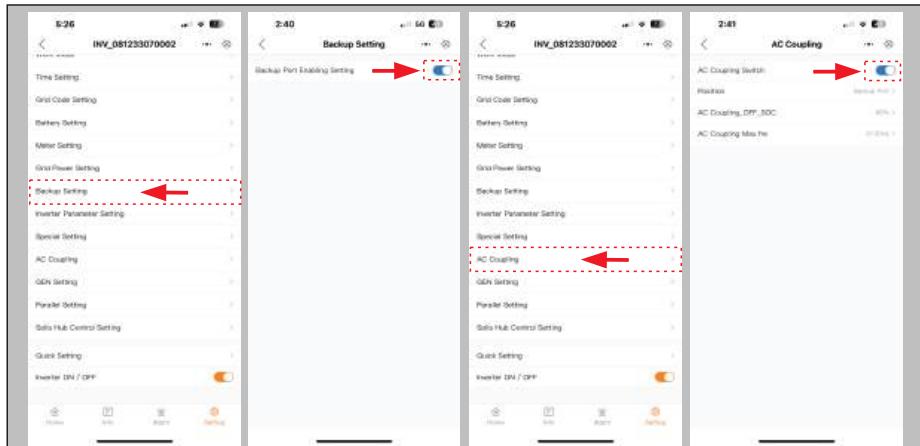
NOTE:

The external Acrel energy meter must be installed in order for the system to be able to perform export power management. If it is not possible to install the Acrel meter for whatever reason, please keep the Feed in Power Limit Switch set to the off position.



6. Commissioning

Step 7: Next, tap Backup Setting from the main Setting menu. If Backup is being installed, toggle on the Backup Port Enabling Setting switch. Keep this setting turned off if there is not going to be any backup for this system.



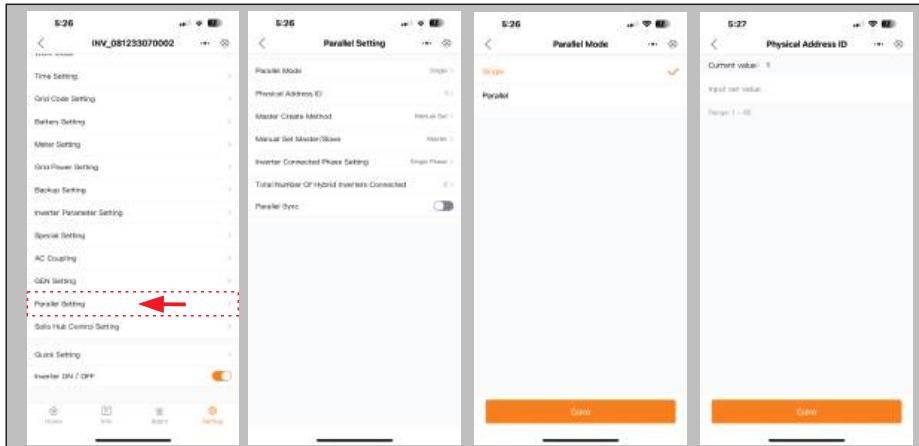
Step 8: If there is an existing PV system being AC-coupled to the Sun Gold Power, please follow this next step, and if not then skip this step. Tap AC Coupling in the main Setting menu.

Toggle on the **AC Coupling Switch**. Then set whether the other PV system is being connected to the backup-side or the grid-side of the inverter. This comes down to where the breaker for the existing PV system is going to be located.

The **AC Coupling_OFF_SOC** is the battery state-of-charge % at which the Sun Gold Power will shut off the existing PV system using AC frequency-shifting. The max AC-coupling frequency can be set as well as.

6. Commissioning

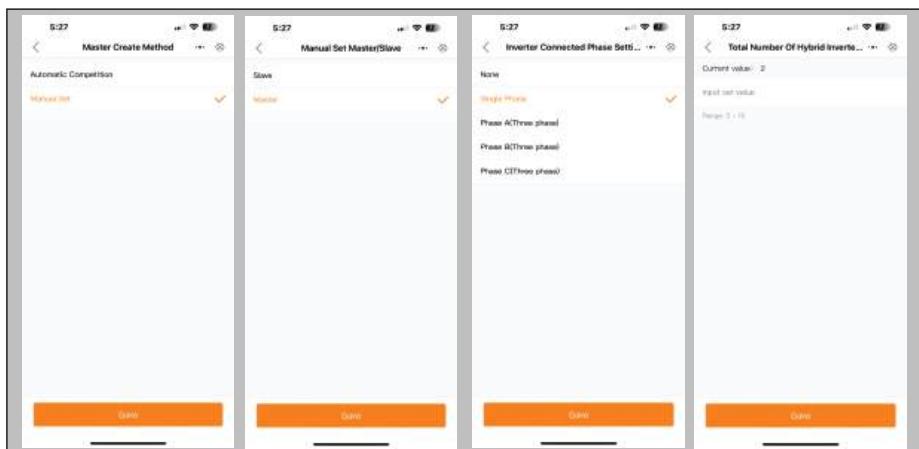
Step 9: If there are multiple Sun Gold Power hybrid inverters connected in parallel, please follow this step. If there is only one hybrid in the system, this step can be skipped. Tap Parallel Setting and then tap Parallel Mode. Change this from Single to Parallel, then tap Save. Next, change the **Physical Address ID** of the slave inverter(s) to 2, 3,.. etc. but leave the address of the master inverter set to 1.



Manual Set/Master Slave allows you to manually determine which slave inverter becomes the master in the event that the original master has a fault. Set to Automatic Competition, the inverter will do this automatically.

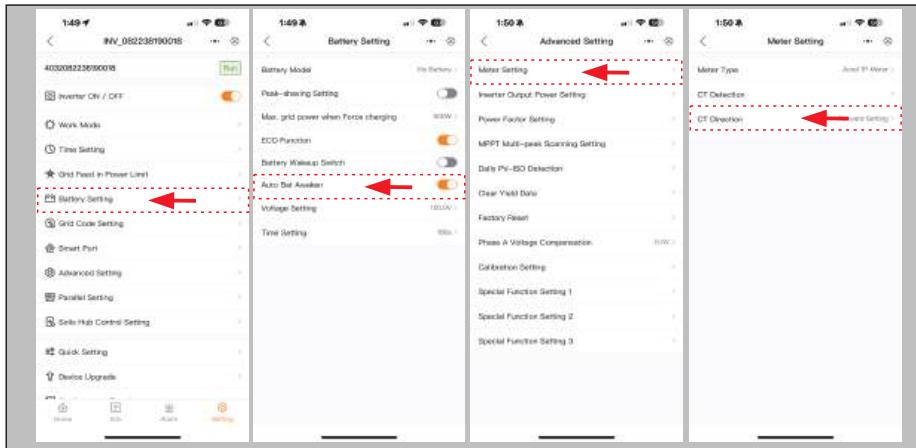
If three inverters are being connected in a high-leg delta configuration, the **Inverter Connected Phase Setting** will allow each inverter to be set as a phase. The **Total Number of Hybrid Inverters Connected** should be set to reflect the number of Sun Gold Power hybrids installed in the system.

The **Parallel Sync** toggle switch will match the settings of the master and slave(s) inverters. If different batteries are installed on each inverter, this setting must remain disabled. Please verify the settings of each inverter before proceeding any further.



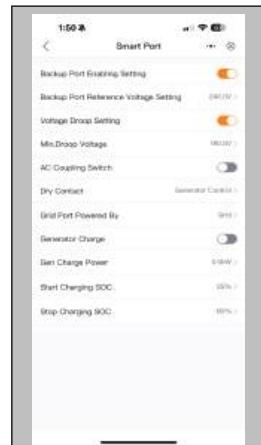
6. Commissioning

Step 10: The battery settings can be adjusted by tapping on Battery Settings from the main settings screen. **Peak-shaving setting** should be enabled if the peak-shaving mode is being used. **Max. grid power when Force charging** determines how much power the battery will be float-charged with if the battery SOC reaches the Force Charge SOC. The **Auto Bat Awaken** switch should be enabled to ensure the inverter will automatically turn on the inverter after a system hard reset. The **Voltage Setting** does not need to be adjusted.



The **Meter Settings** can be found in the **Advanced Setting** menu. If the meter is not going to be used but was configured for a meter, it can be set to No Meter here. Should the consumption data be reading inversely, the **CT Direction** can be flipped from forward to backward so that the data reads correctly.

Step 11: The final settings to be checked are for Backup and Generator. Tap on Smart Port, If Backup is to be used, then toggle on the **Backup Port Enabling Setting** switch. If a generator is being installed on the grid side, toggle on **Generator Charge**. Should the system be fully off-grid where a generator is used in place of grid power, tap **Grid Port Powered By** and then change Grid to Generator. You can set the amount of power that the system will use from the generator to charge the battery by adjusting the **Gen Charge Power**. The **Start Charging SOC** determines the point at which the generator will be turned on to charge the battery and feed the home loads. The **Stop Charging SOC** will set the point at which the generator will be turned off so that the system will run on PV and battery only. These SOC values can be adjusted as well.



6. Commissioning

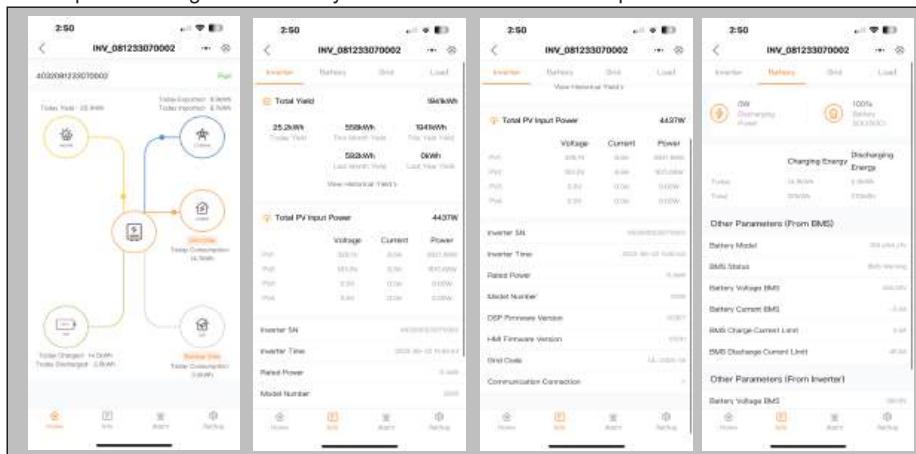
Step 12: Now that the settings are done, the system will begin to generate after about five minutes. The main screen, or homepage provides an overview of the system. It can quickly be determined if the battery is communicating normally or not and what the SOC is. The image below explains what each icon represents. At the bottom of the 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 information (serial number, model number, and firmware version), grid code, and alarm code history

Battery: battery model and status, battery voltage and current

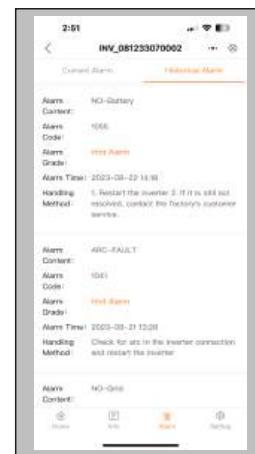
Grid: power imported and exported, AC grid voltage, frequency, and amperage

Load: power being consumed by the home loads and backup loads



Step 13: It is recommended to check the alarm history as the final step of the commissioning process, excluding creating a site on SolarEnergy 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 Sun Gold Power USA technical support with any questions or concerns.

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 Sun Gold Power data logger manual for assistance with registering a new plant on SolarEnergy.



7. Troubleshooting

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 SolarEnergy 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.

Inverter Shutdown Procedure

Step 1. Turn off the AC breaker or AC disconnect switch to disable AC power to the inverter

Step 2. Push in the RSD Initiation Switch and then turn off the DC switch of the inverter

Step 3. Turn off the battery breaker on the BMS

Step 4. Use a multimeter to verify that the battery and AC voltages are 0V. If RSD is being used, the voltages should be at safety levels

Inverter Maintenance

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



CAUTION:

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

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



Note:

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

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

If you are not able to resolve the alarm code using the troubleshooting steps, or if the alarm code you are seeing is not listed, please contact Sun Gold Power 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

Alarm Message	Failure description	Solution
ARC-FAULT	ARC detected in DC circuit	1. Check if there is an arc in the PV connection and restart inverter.
AFCI Check FAULT	AFCI module self check fault	1. Restart inverter or contact installer.
DCinj-FAULT	High DC injection current	1. Restart inverter or contact installer.
DSP-B-FAULT	Comm. failure between main and slave DSP	1. Restart inverter or contact installer.
DC-INTF	DC input overcurrent	1. Restart inverter. 2. Identify and remove the string related to the faulty MPPT. 3. Change power board.
G-IMP	High grid impedance	1. User design function allows the protection limit to be adjusted if it is allowed by electrical company.
GRID-INTF01/02	Grid interference	1. Restart inverter. 2. Change power board.
IGBT-OV-I	Over IGBT current	
IGFOL-F	Grid current tracking fail	1. Restart inverter or contact installer.
IG-AD	Grid current sampling fail	
ILeak-PRO 01/02/03/04	leakage current protection	1. Check AC and DC connection. 2. Check inverter inside cable connection.
INI-FAULT	Initialization system fault	1. Restart inverter or contact installer.
LCD show initializing all the time	Can not start-up	1. Check if the connectors on the main board or power board are secure. 2. Check if the DSP connection to the power board is secure.
NO-Battery	Unconnected battery	1. Ensure the battery is connected properly. 2. Verify the output battery voltage is correct.
No power	Inverter no power on LCD	1. Check PV input connections. 2. Check DC input voltage (single phase >120V, three phase >350V). 3. Check if PV+/- is reversed.
NO-GRID	No grid voltage	1. Check connections and grid switch. 2. Verify the grid voltage is correct on the AC Terminals inside the inverter wiring box.
OV-BUS	Over DC bus voltage	1. Check inverter inductor connection. 2. Check driver connection.

7. Troubleshooting

Alarm Message	Failure description	Solution
OV-DC01/02/03/04	Over DC voltage	1. Reduce the module number in series.
OV-DCA-I	DC input overcurrent	1. Restart inverter. 2. Identify and remove the string of the faulted MPPT. 3. Change power board.
OV-G-V01/02/03 /04/05	Over grid voltage	1. Resistance of AC Cable is too high. Increase the gauge of grid cables. 2. Adjust the protection limit if it is permitted by electrical company.
OV-G-I	Over grid current	1. Restart inverter. 2. Change power board.
OV-G-F01/02	Over grid frequency	1. User design function allows the protection limit to be adjusted if it is permitted by electrical company.
OV-IgTr	AC side transient overcurrent	1. Restart inverter. 2. Return-factory repair.
OV-ILLC	LLC hardware overcurrent	
OV-VBackup	Backup overvoltage fault	
OV-TEM	Over Temperature	1. Check inverter surrounding ventilation. 2. Determine if there is direct sunlight on the inverter during hot weather.
OV-Vbatt1	The detection of battery overvoltage	1. Verify the protection point for over voltage is set correctly. 2. Restart inverter.
OV-Vbatt-H	Battery overvoltage hardware fault	1. Check if any part of the battery input circuit is tripped, ie. battery fuses, battery circuit breaker. 2. Restart inverter.
Over-Load	Backup overload fault	1. Check the load of Backup port is over rating output power or not. 2. Reduce the load of Backup port, then restart inverter.
PV ISO-PRO01/02	PV isolation protection	1. Remove all DC input, reconnect and restart inverter one by one. 2. Identify which string cause the fault and check the isolation of the string.
RelayChk-FAIL	Relay check fail	1. Restart inverter or contact installer.

7. Troubleshooting

Alarm Message	Failure description	Solution
UN-BUS01/02	Under DC bus voltage	1. Check inverter inductor connection. 2. Check driver connection.
UN-G-F01/02	Under grid frequency	1. Use user define function to adjust the protection limit if it's allowed by electrical company.
UN-G-V01/02	Under grid voltage	
12Power-FAULT	12V power supply fault	1. Restart inverter or contact installer.

Table 7.1 Fault message and description

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 you have any technical problems with the hybrid system, please contact Sun Gold Power 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 SolarEnergy?	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

8. Specifications

Technical Data	SG3.8KHB-HV	SG5KHB-HV
Input DC (PV side)		
Recommended max. PV power	6,080W	8,000W
Max. input voltage	600V	
Rated voltage	380V	
Start-up voltage	80V	
MPPT voltage range	80-520V	
Full load MPPT voltage range	140-450V	
Max. input current per string	16A	
Max. short circuit current per string	25.6A	
Number of MPPTs/Number of strings per MPPT	2/1	3/1
Energy Storage		
Battery type	Lithium-ion	
Battery voltage range	120 - 500V	
Maximum charge/discharge current	25A	
Battery Communication	CAN/RS485	
Number of batteries per inverter	See the Compatibility List	
AC Output (Grid)		
Rated output power	3.8kW	5kW
Max. apparent output power	3.8kW	5kW
Rated output voltage	240 V	
Rated frequency	60 Hz	
Rated output current	15.8A	20.8A
Max. output current	15.8A	20.8A
THDi	<3%	
AC Input (Grid)		
Input voltage range	211-264V	
Max. input current	23.8A	31.2A
Frequency range	58.8-61.2 Hz	

8. Specifications

Technical Data	SG3.8KHB-HV	SG5KHB-HV
AC Output (Backup and Off-grid)		
Rated output power	3.8kW	5kW
Max. apparent output power	6.1 kVA, 10 sec	8 kVA, 10 sec
Back-up switch time	< 10 ms	
Phase Power	240V Split-Phase	
Rated output voltage(L1-L2)/(L1/L2-N)	240 V	
AC output voltage range	211-264 V	
Rated grid frequency	60 Hz	
Rated AC output current (continuous)	15.8A	20.8A
Max. output current for 10 seconds	25.4A	33.3A
Max. output current for 300 milliseconds	28.62A	37.44A
Max. allowable phase imbalance	100%	
Backup support configurations	Dedicated loads and whole-home	
Power Factor	> 0.99 (0.8 leading - 0.8 lagging)	
THDv(@linear load)	<3%	
Efficiency		
PV Max. efficiency	97.0%	
PV CEC efficiency	96.5%	
BAT charged by PV Max. efficiency	98.5%	
BAT charged/discharged to AC Max. efficiency	97.0%	
Protection		
Ground fault detection	Yes	
Residual (leakage) current detection	Yes	
Integrated AFCI (DC arc-fault protection)	Yes	
DC reverse-polarity protection	Yes (PV only)	
Rapid Shutdown NEC 2017	Integrated SunSpec-certified Transmitter	
Compatible Rapid Shutdown Receivers	See the Compatibility List	
Protection class/Over voltage category	II/II	

8. Specifications

Technical Data	SG3.8KHB-HV	SG5KHB-HV
General data		
Dimensions(H/W/D)	28.35*19.21*8.66 in (720*490*220mm)	
Weight	59.52 lbs (27 kg)	
Topology	Transformerless	
Operation temperature range	-25~+60 °C/-13~+140 °F	
Ingress protection	TYPE 4X(IP66)	
Noise emission (Typical)	<30 dB (A)	
Cooling method	Natural convection	
Max. operating altitude	13120 ft (4000 m)	
Compliance	UL 1741 SB, UL 1741 SA, IEEE1547.1-2020,UL 1699B, UL 1998, FCC Part 15 Class B, California Rule 21, HECO Rule 14H (pending), NEC 690.12-2020,CAN/CSA C22.2107.1-1	
Generator support	Yes; up to 25 kW (with a Solis Power Hub)	
Features		
DC connection	1 in. knockouts for conduit (x2) on the side and bottom; Spring clamp terminals	
AC connection	1.5 in. knockouts for conduit (x3) on the side and bottom; Spring clamp terminals	
Interface	LED indicator lights, Bluetooth/Phone app	
Monitoring Platform	SolisCloud (modbus map and API sharing available upon request)	
Communication	RS485, Optional: Cellular, Wi-Fi, LAN	
Warranty	10 years standard (Extendable to 20 years)	

8. Specifications

Technical Data	SG7.6KHB-HV
Input DC (PV side)	
Recommended max. PV power	12160W
Max. input voltage	600V
Rated voltage	380V
Start-up voltage	80V
MPPT voltage range	80-550V
Full load MPPT voltage range	175-450V
Max. input current per string	16A
Max. short circuit current per string	25.6A
Number of MPPTs/Number of strings per MPPT	4/1
Energy Storage	
Battery type	Lithium-ion
Battery voltage range	120 - 500V
Maximum charge/discharge current	50A
Battery Communication	CAN/RS485
Number of batteries per inverter	See Battery Compatibility Sheet
AC Output (Grid)	
Rated output power	7.6kW
Max. apparent output power	7.6kW
Rated output voltage	240 V
Rated frequency	60 Hz
Rated output current	31.7A
Max. output current	31.7A
THDi	<3%
AC Input (Grid)	
Input voltage range	211-264V
Max. input current	47.6A
Frequency range	58.8-61.2 Hz

8. Specifications

Technical Data	SG7.6KHB-HV
AC Output (Backup and Off-grid)	
Rated output power	7.6kW
Max. apparent output power	12.2 kVA, 10 sec
Back-up switch time	< 10 ms
Phase Power	240V Split-Phase
Rated output voltage(L1-L2)/(L1/L2-N)	240 V
AC output voltage range	211-264 V
Rated grid frequency	60 Hz
Rated AC output current (continuous)	31.7A
Max. output current for 10 seconds	50.7A
Max. output current for 300 milliseconds	57.06A
Max. allowable phase imbalance	100%
Backup support configurations	Dedicated loads and whole-home
Power Factor	> 0.99 (0.8 leading - 0.8 lagging)
THDv(@linear load)	<3%
Efficiency	
PV Max. efficiency	97.6%
PV CEC efficiency	97.0%
BAT charged by PV Max. efficiency	98.5%
BAT charged/discharged to AC Max. efficiency	97.0%
Protection	
Ground fault detection	Yes
Residual (leakage) current detection	Yes
Integrated AFCI (DC arc-fault protection)	Yes
DC reverse-polarity protection	Yes (PV only)
Rapid Shutdown NEC 2017	Integrated SunSpec-certified Transmitter
Compatible Rapid Shutdown Receivers	See MLRSD compatibility sheet
Protection class/Over voltage category	II/II

8. Specifications

Technical Data	SG7.6KHB-HV
General data	
Dimensions(H/W/D)	29.53*22.05*8.66 in (750*560*220mm)
Weight	71.74 lbs (32.54 kg)
Topology	Transformerless
Operation temperature range	-25~+60 °C/-13~+140 °F
Ingress protection	TYPE 4X(IP66)
Noise emission (Typical)	<30 dB (A)
Cooling method	Natural convection
Max. operating altitude	13,120 ft (4000 m)
Compliance	UL1741 SB, UL1741 SA, IEEE1547.1-2020, UL1699B, UL1998, FCC Part 15 Class B, California Rule 21, HECO Rule 14H (pending), NEC 690.12-2020,CAN/CSA C22.2107.1-1
Generator support	Yes; up to 25 kW (with a Solis Power Hub)
Features	
DC connection	1 in. knockouts for conduit (x2) on the side and bottom; Spring clamp terminals
AC connection	1.5 in. knockouts for conduit (x3) on the side and bottom; Spring clamp terminals
Interface	LED indicator lights, Bluetooth/Phone app
Monitoring Platform	SolisCloud (modbus map and API sharing available upon request)
Communication	RS485, Optional: Cellular, Wi-Fi, LAN
Warranty	10 years standard (Extendable to 20 years)

8. Specifications

Technical Data	SG10KHB-HV
Input DC (PV side)	
Recommended max. PV power	16,000W
Max. input voltage	600V
Rated voltage	380V
Start-up voltage	80V
MPPT voltage range	80-550V
Full load MPPT voltage range	230-450V
Max. input current per string	16A
Max. short circuit current per string	25.6A
Number of MPPTs/Number of strings per MPPT	4/1
Energy Storage	
Battery type	Lithium-ion
Battery voltage range	120 - 500V
Maximum charge/discharge current	50A
Battery Communication	CAN/RS485
Number of batteries per inverter	See Battery Compatibility Sheet
AC Output (Grid)	
Rated output power	10kW
Max. apparent output power	10kW
Rated output voltage	240 V
Rated frequency	60 Hz
Rated output current	41.7A
Max. output current	41.7A
THDi	<3%
AC Input (Grid)	
Input voltage range	211-264V
Max. input current	62.6A
Frequency range	58.8-61.2 Hz

8. Specifications

Technical Data	SG10KHB-HV
AC Output (Backup and Off-grid)	
Rated output power	10kW
Max. apparent output power	16 kVA, 10 sec
Back-up switch time	< 10 ms
Phase Power	240V Split-Phase
Rated AC output voltage	240 V
AC output voltage range	211-264 V
Rated frequency	60 Hz
Rated AC output current (continuous)	41.7A
Max. output current for 10 seconds	66.7A
Max. output current for 300 milliseconds	75.06A
Max. allowable phase imbalance	100%
Backup support configurations	Dedicated loads and whole-home
Power Factor	>0.99 (0.8 leading - 0.8 lagging)
THDv(@linear load)	<3%
Efficiency	
PV Max. efficiency	97.6%
PV CEC efficiency	97.0%
BAT charged by PV Max. efficiency	98.5%
BAT charged/discharged to AC Max. efficiency	97.0%
Protection	
Ground fault detection	Yes
Residual (leakage) current detection	Yes
Integrated AFCI (DC arc-fault protection)	Yes
DC reverse-polarity protection	Yes (PV only)
Rapid Shutdown NEC 2017	Integrated SunSpec-certified Transmitter
Compatible Rapid Shutdown Receivers	See the Compatibility List
Protection class/Over voltage category	II/II

8. Specifications

Technical Data	SG10KHB-HV
General data	
Dimensions(H/W/D)	29.53*22.05*8.66 in (750*560*220mm)
Weight	71.74 lbs (32.54 kg)
Topology	Transformerless
Operation temperature range	-25~+60 °C/-13~+140 °F
Ingress protection	TYPE 4X (Ip66)
Noise emission (Typical)	<30 dB (A)
Cooling method	Natural convection
Max.operation altitude	13,120 ft (4000 m)
Compliance	UL1741 SB, UL1741 SA, IEEE1547.1-2020, UL1699B, UL1998, FCC Part15 Class B, California Rule 21, HECO Rule 14H (pending), NEC 690.12-2020,CAN/CSA C22.2107.1-1
Generator support	Yes; up to 25 kW (with a Solis Power Hub)
Features	
DC connection	1 in. knockouts for conduit (x2) on the side and bottom; Spring clamp terminals
AC connection	1.5 in. knockouts for conduit (x3) on the side and bottom; Spring clamp terminals
Interface	LED indicator lights, Bluetooth/Phone app
Monitoring Platform	SolisCloud (modbus map and API sharing available upon request)
Communication	RS485, Optional: Cellular, Wi-Fi, LAN
Warranty	10 years standard (Extendable to 20 years)

8. Specifications

Technical Data	SG11.4KHB-HV
Input DC (PV side)	
Recommended max. PV power	18,240W
Max. input voltage	600V
Rated voltage	380V
Start-up voltage	80V
MPPT voltage range	80-550V
Full load MPPT voltage range	245-450V
Max. input current per string	16A
Max. short circuit current per string	25.6A
Number of MPPTs/Number of strings per MPPT	4/1
Energy Storage	
Battery type	Lithium-ion
Battery voltage range	120 - 500V
Maximum charge/discharge current	50A
Battery Communication	CAN/RS485
Number of batteries per inverter	See Battery Compatibility Sheet
AC Output (Grid)	
Rated output power	11.4kW
Max. apparent output power	11.4kW
Rated output voltage	240 V
Rated frequency	60 Hz
Rated output current	47.5A
Max. output current	47.5A
THDi	<3%
AC Input (Grid)	
Input voltage range	211-264V
Max. input current	71.3A
Frequency range	58.8-61.2 Hz

8. Specifications

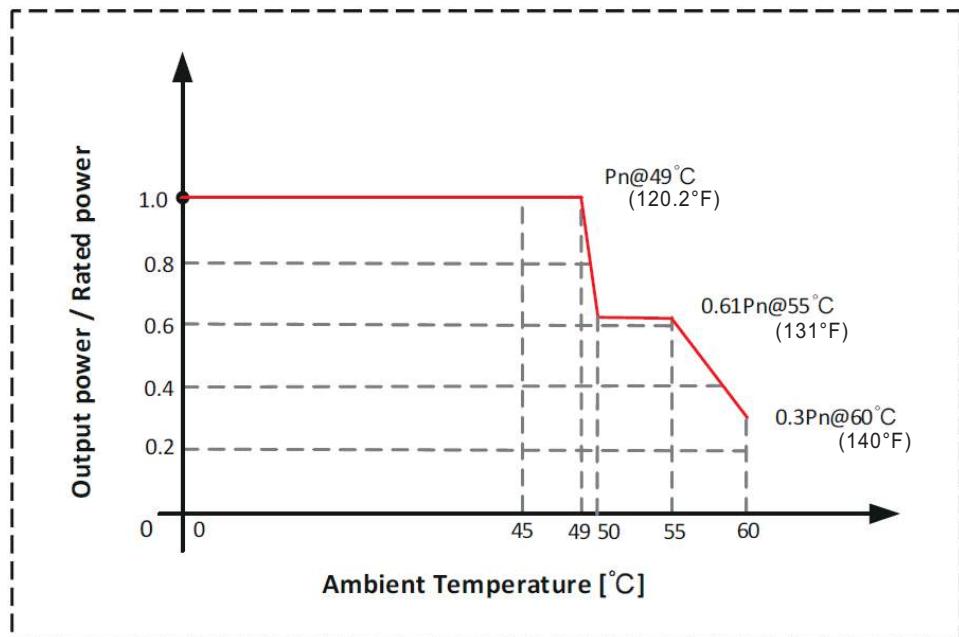
Technical Data	SG11.4KHB-HV
AC Output (Backup and Off-grid)	
Rated output power	11.4kW
Max. apparent output power	18.2 kVA, 10 sec
Back-up switch time	< 10 ms
Phase Power	240V Split-Phase
Rated AC output voltage	240 V
AC output voltage range	211-264 V
Rated frequency	60 Hz
Rated AC output current (continuous)	47.5A
Max. output current for 10 seconds	76A
Max. output current for 300 milliseconds	85.5A
Max. allowable phase imbalance	100%
Backup support configurations	Dedicated loads and whole-home
Power Factor	>0.99 (0.8 leading - 0.8 lagging)
THDv(@linear load)	<3%
Efficiency	
PV Max. efficiency	97.6%
PV CEC efficiency	97.0%
BAT charged by PV Max. efficiency	98.5%
BAT charged/discharged to AC Max. efficiency	97.0%
Protection	
Ground fault detection	Yes
Residual (leakage) current detection	Yes
Integrated AFCI (DC arc-fault protection)	Yes
DC reverse-polarity protection	Yes (PV only)
Rapid Shutdown NEC 2017	Integrated SunSpec-certified Transmitter
Compatible Rapid Shutdown Receivers	See the Compatibility List
Protection class/Over voltage category	II/II

8. Specifications

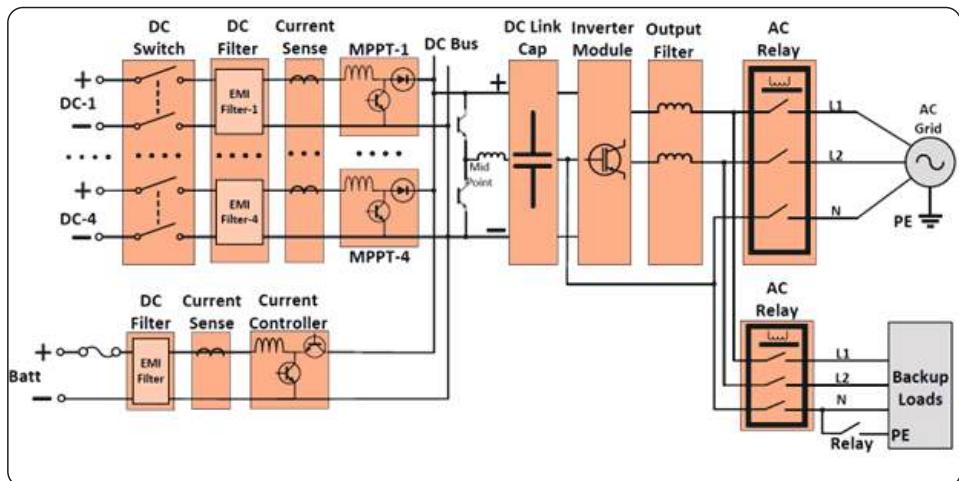
Technical Data	SG11.4KHB-HV
General data	
Dimensions(H/W/D)	29.53*22.05*8.66 in (750*560*220mm)
Weight	71.74 lbs (32.54 kg)
Topology	Transformerless
Operation temperature range	-25~+60 °C/-13~+140 °F
Ingress protection	TYPE 4X (Ip66)
Noise emission (Typical)	<30 dB (A)
Cooling method	Natural convection
Max.operation altitude	13,120 ft (4000 m)
Compliance	UL1741 SB, UL1741 SA, IEEE1547.1-2020, UL1699B, UL1998, FCC Part15 Class B, California Rule 21, HECO Rule 14H (pending), NEC 690.12-2020,CAN/CSA C22.2107.1-1
Generator support	Yes; up to 25 kW (with a Solis Power Hub)
Features	
DC connection	1 in. knockouts for conduit (x2) on the side and bottom; Spring clamp terminals
AC connection	1.5 in. knockouts for conduit (x3) on the side and bottom; Spring clamp terminals
Interface	LED indicator lights, Bluetooth/Phone app
Monitoring Platform	SolisCloud (modbus map and API sharing available upon request)
Communication	RS485, Optional: Cellular, Wi-Fi, LAN
Warranty	10 years standard (Extendable to 20 years)

9. Appendix

9.1 Temperature Derating Curve



9.2 Inverter Internal Topology Overview



9. Appendix

9.3 Default Grid Setting for IEEE1547-2018

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

9. Appendix

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

9. Appendix

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC warning:

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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



SunSpec
Certified



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