



SOLAR STIK®

**SYSTEM SETUP, OPERATION AND  
MAINTENANCE MANUAL  
FOR THE SOLAR STIK  
G-BOSS E LIGHT  
HYBRID POWER SYSTEM**



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## Revision History

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# GENERAL INFORMATION, EQUIPMENT DESCRIPTION, AND THEORY OF OPERATION

The introductory parts of this Manual describe Hybrid Power Systems (HPS) composed of Solar Stik components. However, the Solar Stik architecture is modular and open allowing Operators to integrate non-Solar Stik components as part of a HPS solution. Please contact Solar Stik Technical Support for assistance in optimizing the integration of other components into a Solar Stik HPS.

## Introduction to Hybrid Power Systems

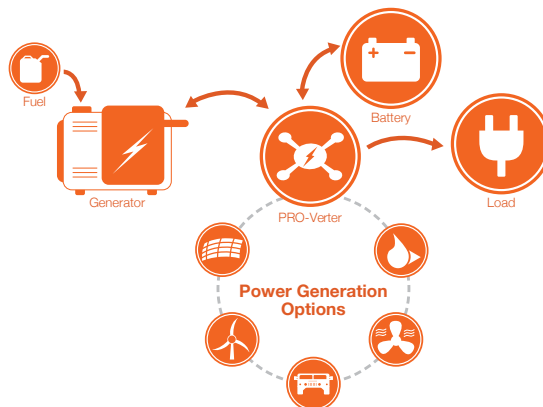
When a portable fuel-driven power generator is the primary source of power for an application, it must operate continuously to provide electricity to the load, even if the power requirements of connected loads are minimal or intermittent. Fuel energy is wasted in the production of electricity because neither the generator nor the load(s) can fully use the fuel's potential energy. This traditional power model is a low-efficiency system.

In the high-efficiency, Hybrid Power System (HPS), a battery bank supports the load. The power for the load is drawn from the batteries only as needed. Multiple sources of power generation can be used simultaneously to support the battery and ensure uninterrupted power to the loads. **The battery becomes the foundation of the HPS and the architecture is opened to allow multiple technologies to operate in concert.**



## The HPS Flexible Open Architecture

The System is comprised of modular components that integrate into a flexible architecture that is configured for an application's specific mission requirements. If the application changes, the modular System architecture can be modified or scaled to meet the new requirements.



HPS with Open Architecture



## Important Safety Information and Instructions

This manual contains important instructions that must be followed during the installation and operation of the System. Read all instructions and information contained in this manual.

Thoroughly read and understand the operator manual for each of the components in this System PRIOR to assembly and use of this System. Important information regarding the safe setup and use of each component and this System is contained in each of the operator manuals. DO NOT begin assembly or use of this System without first reading and understanding the individual operator manuals.

While the System components are designed for indoor/outdoor operation, the user interface (control panels) must not be exposed to rain, snow, moisture, or liquids. Close and latch and/or lock the cases when the components are unattended.

Exercise caution when handling or operating the System. Live power may be present.

### Safety Information Labels

Your safety and the safety of others is very important.

Many important safety messages have been provided in this manual and directly on the System components. Always read and obey all safety messages.



This is the safety alert symbol. This symbol is an alert to potential hazards that can cause death or injury. All safety messages will follow the safety alert symbol and the word “DANGER”, “WARNING”, or “CAUTION”. These words are defined as:



Indicates a hazardous situation which, if not avoided, **will result in death or serious injury**.



Indicates a hazardous situation which, if not avoided, **could result in death or serious injury**.



Indicates a hazardous situation which, if not avoided, **could result in minor or moderate injury**.

All safety messages will describe what the potential hazard is, how to reduce the chance of injury, and what can happen if the instructions are not followed.

## Fire Hazard

### Fire Types

**Class A fire** - Fires in ordinary combustibles such as wood, paper, cloth, trash, and plastics.

**Class B fire** - Fires in flammable liquids such as gasoline, petroleum, oil, and paint.

**Class C fire** - Fires involving energized electrical equipment such as motors, transformers, and appliances. Remove the power source and the class C fire becomes a class A or B fire.

### Recommended Fire Extinguisher

NSN 4210-00-288-7219 Fire Extinguisher, Carbon Dioxide, 10 lb

Carbon dioxide is a liquefied gas, which is highly effective fighting class B and C fires. These extinguishers are ideal for areas where contamination and/or cleanup are a concern, such as data processing centers, labs, and telecommunication rooms.

#### **WARNING**

Only CO<sub>2</sub> (carbon dioxide) fire extinguishers should be used with this equipment.



### Using the Fire Extinguisher

When using the extinguisher on a fire, remember PASS:

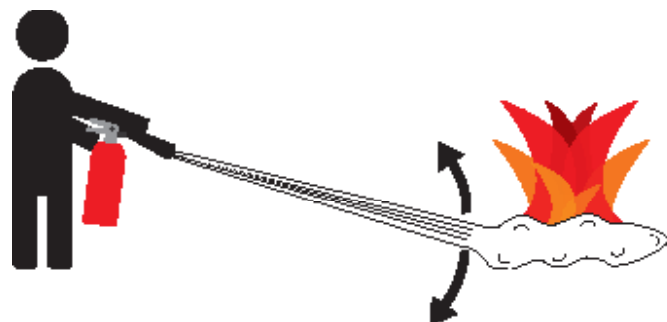
**P**ull the pin.

**A**im the nozzle or hose at the base of the fire from a safe distance.

**S**queeze the operating lever to discharge the fire extinguishing agent.

**S**weep the nozzle or hose from side to side until the fire is out. Move forward or around the fire as the fire diminishes.

Watch the area for reignition until the cause has been fixed.



Use Sweeping Motion

These additional cautionary steps will ensure your safety:

- System components should not be operated in standing water.
- Close and latch the component lids if it is precipitating.
- System cables should not be routed through standing water.
- Cable connections should remain dry.
- Unused ports on System components should be covered when not in use to reduce the possibility of water intrusion.

## Electric Shock Hazard

### ⚠ WARNING

Standing water around the electrical equipment and/or intrusion of water into the System components can increase the risk of electrical shock.



**HIGH VOLTAGE:** System components, PV arrays, and generators may produce lethal line voltages. Extreme care should be taken to protect against electrocution. Always work with another person in case an emergency occurs. Disconnect power before performing maintenance. Wear safety glasses whenever working on any part of a system that requires exposure to mechanical or direct electrical contacts.

### ⚠ WARNING

The System is NOT GFCI protected.

## Grounding the System

Grounding the PRO-Verter at the grounding lug is an important safety measure. The PRO-Verter and the generator (if included) should be bonded to an earth grounding rod. When the generator is running, the AC neutral and equipment ground automatically are bonded internally at the generator. When running off battery, the AC neutral and equipment ground are automatically bonded internally at the PRO-Verter.

If the System is ever connected to grid power, the AC neutral must be bonded to the earth ground at the main breaker panel of the grid power. Any generator connected to the System must have a neutral-to-ground bond.

PRO-Verter Grounding Lug



Figure 1. PRO-Verter grounding lug

## Environmental and Handling Precautions

All Solar Stik components are ruggedized, yet there are a few things the operator can do to prevent failures and prolong the operational life of the Solar Stik System.

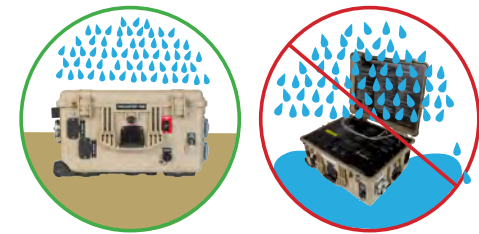
### Wind

It is imperative to properly secure the PV panels to the ground using sandbags so they do not become dangerous projectiles in high winds.



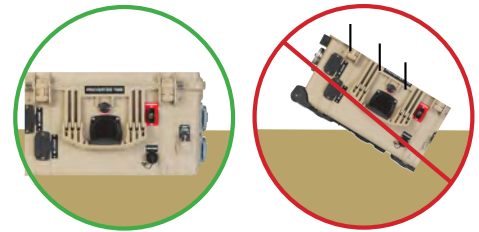
### Water

If outdoor operation is necessary, the lids of all components should be closed and latched. During operation, cases should be placed upright, especially during inclement weather. Lids should be open only to access operator controls and closed at all other times.



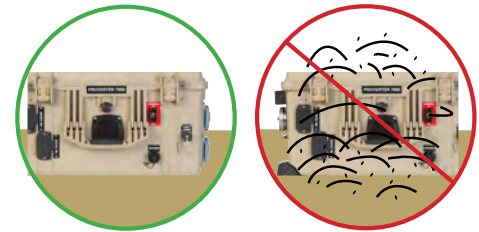
### Impact

Equipment should not be dropped onto hard surfaces at a height greater than one foot when transporting or during operation.



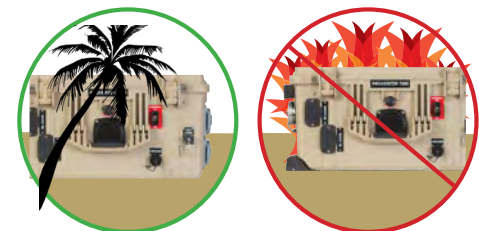
### Dust/Foreign Object Intrusion

Air intake filters should be cleaned once per month, or more frequently when conditions warrant. As a general rule, minimize exposure to high levels of particulates and foreign object debris by exercising common-sense placement and protection during both operation **and** storage.



### Heat

Heat and solar loading reduces efficiency and life expectancy. Shade components (except PV panels) to prevent the negative effects of heat.



# Theory of Operation

## Models of Operation

Depending on the application, there are several operational models that can be configured using a PRO-Verter.

**Note:** The PRO-Verter settings used in each model of operation are unique and not interchangeable. The PRO-Verter must be programmed specifically for the model of operation in which the System is functioning. Damage to System components may occur if a PRO-Verter is not properly programmed for the model of operation in which the System is functioning.

### DC-only/Inverter (Automatic Functions)

Operating conditions: All power generated is from DC generators, and AC loads are supported by the PRO-Verter's Inverter function using energy stored in batteries.

### Hybrid (Automatic Functions)

Operating conditions: The "Continuous Load" AC power requirement is LESS than the individual Inverter or Generator/Grid AC power output ratings.

In the Hybrid model, the PRO-Verter serves as the primary power management device in a System, using either inverter AC power or generator/grid AC power to maintain the load. In the Hybrid Model, the batteries will cycle regularly to mitigate generator runtime and logistical support often associated with operation in remote locations. Hybrid systems also provide the operator with a flexible architecture that allows for the addition of multiple power sources, such as renewable power generation.

### Peak Power Delivery (Manual Functions)

Operating conditions: The "Peak Load" AC requirement is MORE than the PRO-Verter AC continuous output ratings.

In the Peak Power Delivery model, the PRO-Verter combines generator or grid AC power with inverter AC power to support "peak" AC for brief periods. This mode can only be supported for limited durations and is directly dependent on the total battery capacity and state of charge (SOC).

## UPS (Automatic Functions)

Operating conditions: A PRO-Verter connects critical AC loads directly to grid utility or prime AC power when it is available, and provides backup power for the load by supplying inverter AC (using energy from a connected battery bank) when the grid utility or prime AC source is interrupted.

In the UPS Model, “peak shaving” and the use of renewable power sources are also possible by connecting a Power Hub.

**Note about PRO-Verter Model Programming:** The PRO-Verter is programmed at the factory for use in the application in which it is to be used. It is possible for the Operator to alter any of the programmed settings when operating conditions change and/or System architecture changes are necessary. To learn more, contact Solar Stik Technical Support.

## The HPS Architecture, Function, and Operation

The Solar Stik Hybrid Power System (HPS) incorporates three technologies that comprise a network:

- Energy storage
- Power management
- Power generation

The PRO-Verter, Power Hub, and Expander Paks are designed to operate in concert and provide uninterrupted pure sine wave AC and DC power to the loads. It is a powerful solution for the following conditions:

1. The generator requires protection from adverse operating conditions.
2. Grid or generator AC power sources are not present or only intermittently available.
3. Power requirements for the load may exceed an existing power source’s daily power output, requiring multiple power sources to operate in concert to meet the daily demand
4. The reduction of fuel-driven generator “runtime” is necessary, due to logistics concerns or to simply to reduce the cost burdens of operating a generator.

It is important to follow two rules when configuring power generation and energy storage technologies to serve in an application:

1. The power generated over 24 hours must be greater than or equal to the power consumed
2. The energy storage capacity must be able to power the load over 24 hours (with no recharging)

## Energy Storage—The Foundation of the HPS

Operating a generator may have significant cost burdens (logistics, support, etc.). The HPS alleviates those cost burdens by redirecting the financial investment into a battery-based platform.

Batteries in a hybrid system are designed to “cycle”. A full cycle is defined as one complete discharge and recharge over a specific period of time. With every cycle that occurs, the HPS is providing a return on the financial investment.



All batteries have a cycle life and therefore should be considered the “consumable” part of the HPS. The health of the battery can directly affect the function of the HPS over time, so proper cycling and cell-health management practices are strongly encouraged.

See additional information about the Expander Paks: Energy Storage Modules – Supplemental Information.

## Minimum Battery Capacity Required for Optimal System Operation

A HPS will function most efficiently when proper balance is achieved within the System’s architecture (Energy Storage, Power Management, and Power Generation). The central power management device is the PRO-Verter, so any components that are connected to it need to be rated for the amount of power that will be processed by it.

For example, the PRO-Verters can require extremely high current (amperage) **from** the battery bank when AC loads require power from the inverter, but it can also push high current **into** the bank when it is in charge mode.

Each Expander Pak has a built-in circuit breaker that will trip at a value **less than** the maximum rated current to/from the PRO-Verter. For this reason, multiple Expander Paks must be connected to a PRO-Verter for the System to function at its rated power. **The combined values of the Expander Pak circuit breakers must be greater than the rated inverter/charger current required from the PRO-Verter.**

In the HPS, the PRO-Verter 5000 inverter can require up to 200 A from the batteries, and the charger has a rated output of 110 A. Four (4) 24VDC Expander Paks is the MINIMUM number required to support the inverter’s full inverter output and be charged effectively and safely when the PRO-Verter 5000 is in charge mode.

Connecting an insufficient number of Expander Paks (energy storage modules, or ESMs) to a PRO-Verter will result in a situation where the batteries are charged or discharged too quickly:

- Charging  $\text{LiFePO}_4$  Expander Paks too quickly may result in an artificially high battery voltage reading and signal the PRO-Verter to turn off the generator before the batteries are actually charged sufficiently.
- Discharging  $\text{LiFePO}_4$  Expander Paks too quickly may cause the battery temperature to rise to a point that the battery management system (BMS) disconnects the batteries from the whole System.

Refer to the “Minimum Battery Capacity Recommendations” on the PRO-Verter I-Plate to ensure trouble-free operation.

## System Cycling

During normal operation, the generator runs only to charge the ESMs and support the load while doing so; the batteries and generator will cycle 1–2 times daily.

The overall health of the HPS can be determined by the amount of cycling that occurs in a 24-hour period. If the HPS cycles more than twice daily, or is experiencing irregular cycling, there are several factors that may be causing it:

- Excessive load
- Inadequate battery capacity
- Heat-derated performance
- Disparity in battery SOC

Consult the troubleshooting sections for more details on causes of irregular or excessive cycling.

## Load Prioritization

When the HPS is fully functioning, providing power to the load is always prioritized over other functions.

If renewable DC generators (i.e., PV arrays, wind, etc.) are producing power, it is immediately directed to the load once it flows into the HPS. The batteries will ONLY begin to charge once the DC generation exceeds the demand from the load.

During periods of peak renewable DC generation, it may be exclusively used to support the load while excess energy charges the batteries simultaneously. This function reduces the demand on the batteries, prolongs battery-operation time, and promotes healthy cycling of the battery.

This same function also occurs when the HPS is connected to an AC source. If the HPS is connected to an active generator or grid-utility, the load is always supported FIRST before any AC is used for charging the HPS batteries. If the PRO-Verter is controlling a connected generator and the battery bank reaches a low SOC, the PRO-Verter can be programmed to auto-start the generator to keep AC flowing to the load, charging the connected batteries only after the load is fully supported by the generator.

## Real-time Load Management

When connected to an active AC source, the PRO-Verter can automatically adjust (in real time) its battery charging rate to keep the total load value under the AC INPUT setting value.

If the load is dynamic, the PRO-Verter can make immediate adjustments and keep the total load on the AC source from exceeding the value of the AC INPUT setting while still maintaining a 100% load at the external AC source (generator or grid utility).

It is incumbent on the Operator to ensure the sum of all loads does not exceed the limit of the AC source (generator or grid-utility) or the connections or circuit protections in the network. The AC INPUT (FAVS 03) setting should be set to the same value of the maximum AC output rating of the source. For example, if the generator is rated for 3000 W continuous output, then the AC INPUT should be set for 25 Amps\* (25 A @ 120 VAC = 3000 W)

[\\*See Lag Times and Surge Rates](#)



## **“Overload” Conditions**

Overloading of the System can occur under the following conditions:

- Load AC power demand is greater than the inverter’s rated output.
- Load AC and DC power demand is greater than the connected AC source (generator or grid/utility).
- Load AC power demand is greater than the AC INPUT setting, which may cause the PRO-Verter to disconnect from the AC source when in pass-through (charging) mode.
- Load AC and DC power demand is greater than the output of the connected AC source (generator or grid utility), causing it to shut down.

In each of these scenarios, the solution is simply a reduction in the total load demand (AC and DC). Use the AC and DC METERS to confirm the load is reduced to prescribed levels and proceed with normal operation.

## Scaling and Modifying the HPS

When expanding or modifying the HPS architecture, scaling and stacking may be used to provide additional capabilities that may exceed the ability of any one component to handle.

### Scaling

- Power generation and energy storage can be modified in accordance with changes in load requirements. Additional generation sources should be selected based on availability of resources, logistics and the local environment (fuel-driven generator, wind, fuel cell, etc.).
- Additional energy storage modules can be of a different form factor but must be of the same chemistry and voltage and have compatible charge and discharge current capabilities etc.

### Stacking

- Capabilities can be added (or removed), including advanced power distribution and management modules, stacking of generators with PRO-Verters, Power Hubs and more.

Consult the individual product manuals for additional information about scaling and stacking.

**Note:** When scaling or modifying the HPS architecture, it should be done so with all components in the HPS completely inactive and OFF. The Initialization and Calibration step must be repeated once the modifications have been made.

## PRO-Verter Stacking Example

Stacking PRO-Verters, of the same or different types, provides a mechanism to power a wide variety of AC loads from the same system. The dashed-line box surrounds the stacked PRO-Verters.

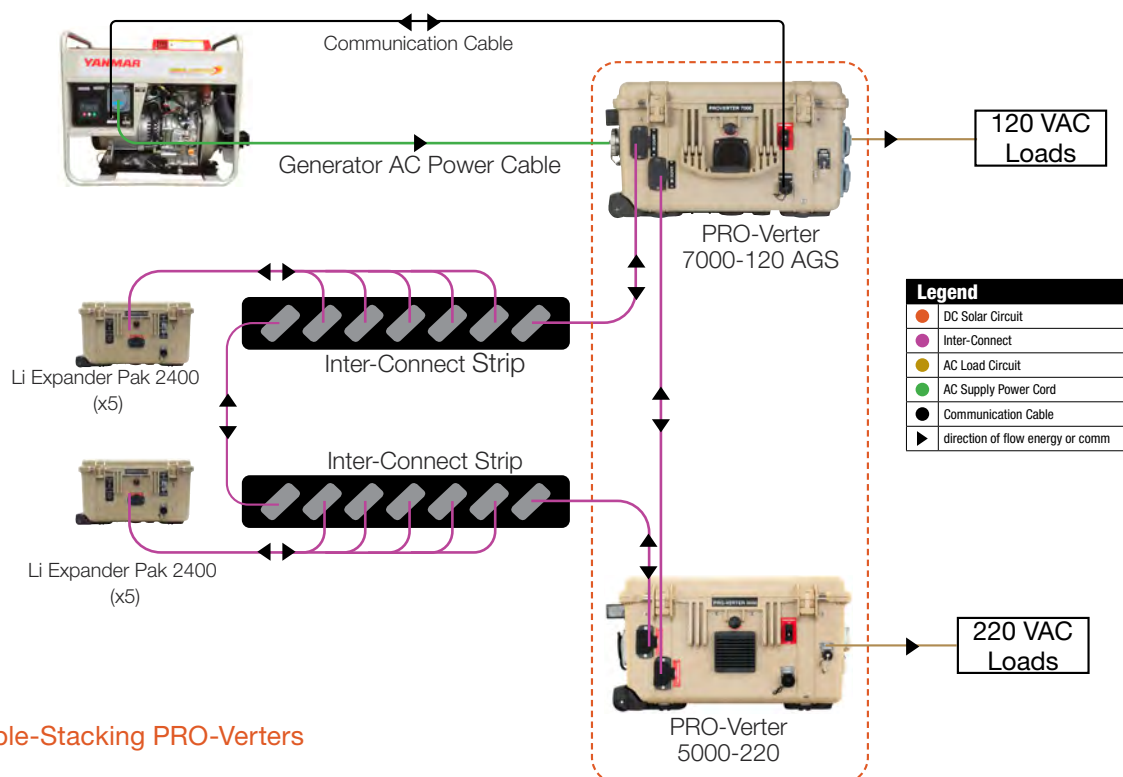


Figure 2. Example-Stacking PRO-Verters

## Power Hub Stacking Example

Stacking Power Hubs, of the same or different types, provides a mechanism to add DC power sources to a system. The dashed-line box surrounds the stacked Power Hubs.

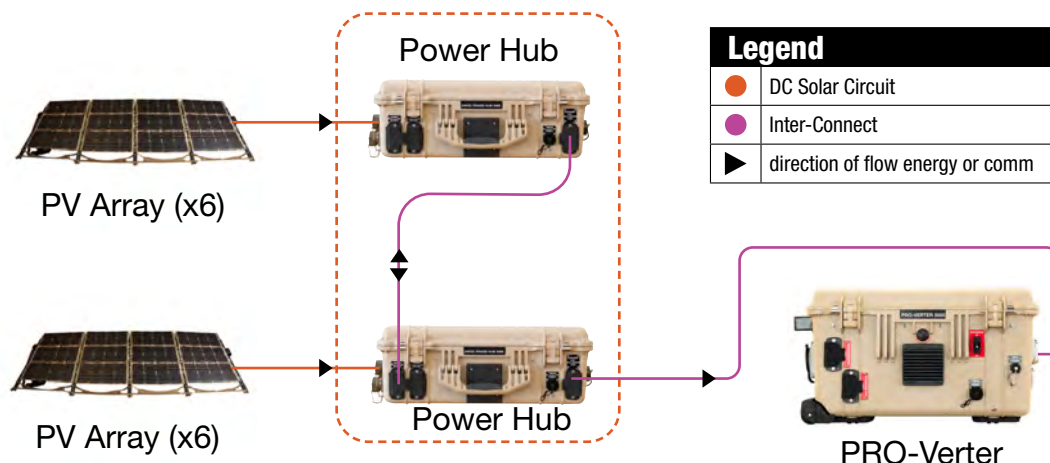


Figure 3. Example-Stacking Power Hubs

## Scaling Energy Storage Capacity Example

Plug & Play architecture allows expansion or contraction of battery capacity when conditions warrant.

Use Inter-Connect Strips and Inter-Connect Cables to create a “bank” of Li Expander Paks (Figure 26). **Note:** Do not mix battery chemistries in a System battery bank.

If a System needs to be downsized, due either to reductions in the load or simply to reallocate energy storage resources to other locations, then Li Expander Paks can be removed from service in accordance with reductions in runtime requirements.

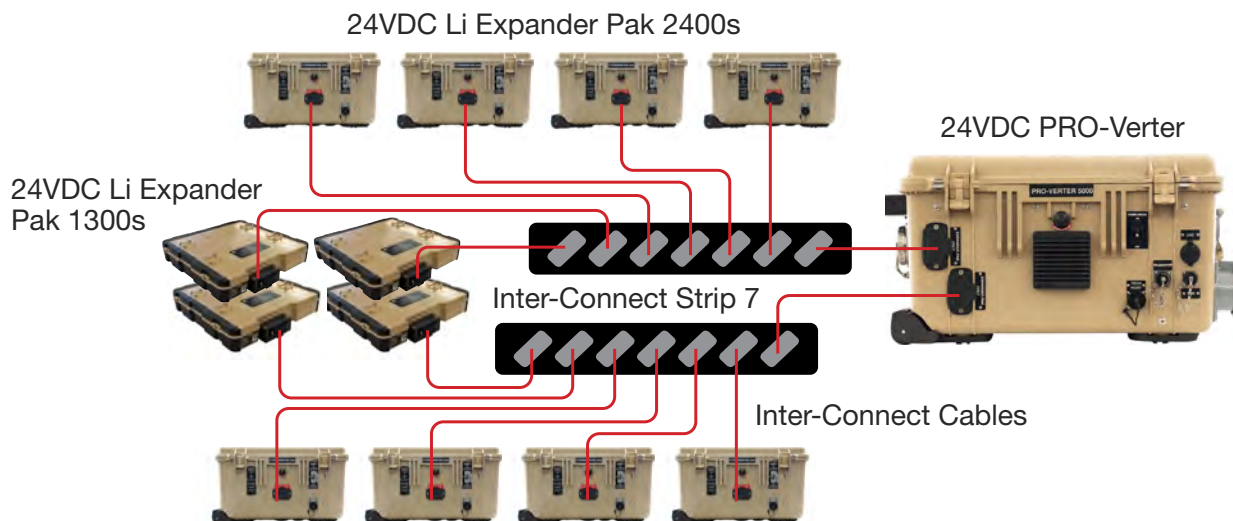


Figure 4. Connecting Li Expander Paks using Inter-Connect Strips and Inter-Connect Cables

# Equipment Description

## The Inter-Connect System

The System is comprised of three (3) distinct types of technologies:

- Energy storage
- Power management
- Power generation

All of the individual components that operate in these categories utilize a unique connection architecture known as the Inter-Connect Circuit.

The Inter-Connect Circuit is the connection framework of the System's DC power network. It uses a simple, polarized, locking connection that is common throughout the architecture. All power management, energy storage, and power generation components are compatible with the Inter-Connect Circuit.

Using a common, polarized connector allows rapid "Plug & Play" scaling of components, adaptation of capabilities within the architecture, technology refreshment, and swapping of components when conditions warrant. It also ensures that there is no unsafe way to make connections.

### Circuit Breaker Protections

The Inter-Connect network is protected from overloads and short circuits through a network of circuit breakers strategically placed throughout the circuit. It ensures the potential for a reverse polarity connection within the circuit is minimized. If a problem occurs in a leg of the Inter-Connect Circuit, the affected leg will disconnect from the primary network, leaving the other circuits functioning. If a major failure occurs in the circuit, then the entire network will shut down for System and Operator protection.

### Operate with Voltage

The Inter-Connect Circuit communicates simple battery voltage to all components on the network, allowing them to independently coordinate their respective functions. Battery voltage is used to trigger actions such as Automatic Generator Start/Stop (AGS) function, power distribution timing, and more. Therefore, the proper setup of the Inter-Connect Circuit is critical to properly communicate voltage to all points in the System and to ensure all of the components operate together to provide seamless power to the load.

### Optimize with Data

Data collection for a System occurs through the Inter-Connect network. Power management devices such as Power Hubs and PRO-Verters meter voltage, current and time through the circuit, providing critical real-time data the operator can use to troubleshoot and verify System performance. Data collection enables programming/architectural changes to optimize performance based on evolving conditions.

## The Standard Inter-Connect Plug

- Polarized
- 200 A maximum current
- 24 VDC connection only
- Mechanically “locks” into place
- Rotate knob clockwise to lock, counterclockwise to release
- Can be repaired or modified in the field



Figure 5. Inter-Connect Plug

## 24 VDC Power Distribution Module (PDM) 3000 Description

The PDM 3000 draws power from the HPS 24 VDC bus and converts it to stable, regulated 28 VDC output. The PDM protects equipment that is sensitive to voltage fluctuations. The case does not open.

### PDM Connections

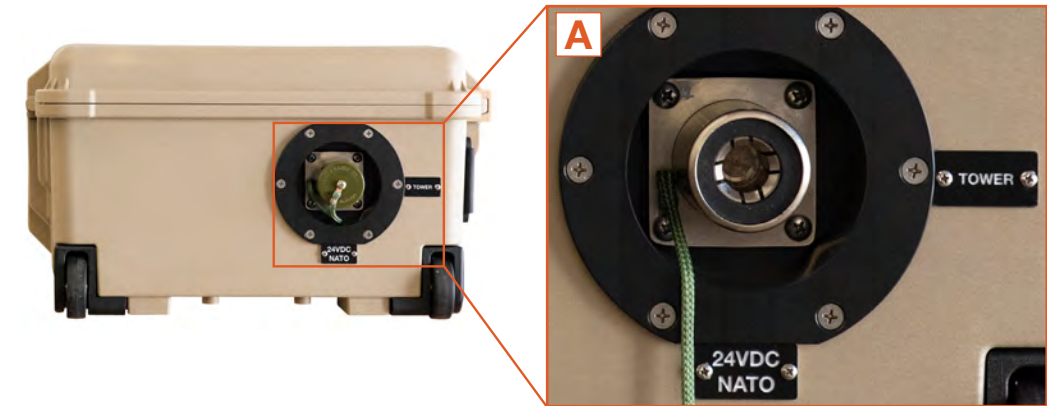
The Inter-Connect port connects the PDM 3000 to the HPS DC bus.



	Description	Connector	Voltage	Amps
A	Battery Connection (metered port)	Inter-Connect Port	24 VDC	100

Figure 6. PDM front

The NATO Port provides 24 VDC power to the G-BOSS tower.



	Description	Connector	Voltage	Amps
A	24 VDC NATO Slave (unmetered)	NATO Slave	24 VDC	100

Figure 7. PDM left side



The 2-pin connector on the right side of the PDM 3000 provides regulated 28.0 VDC power to the G-BOSS Power Distribution Unit (PDU). The 100 A breakers on the right side also serve as power switches for engaging and disengaging power circuits to the tower and the PDU.

⚠ CAUTION

Do NOT connect a battery directly to the regulated 28 VDC output port because this will damage the PDM 3000.



	Description	Connector	Voltage	Amps
A	28.0 VDC regulated output	Amphenol?	28.0 VDC	75
B	Regulated 28 VDC Output to PDU	N/A	N/A	100
C	24 VDC Output to Tower	N/A	N/A	100

Figure 8. PDM right side

The bottom of the PDM 3000 case is cut away to facilitate heat dissipation. The internal components are sealed from exposure to the environment by a gasket.

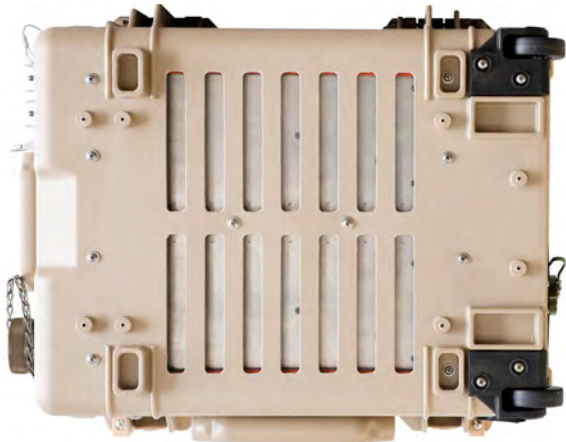


Figure 9. PDM bottom

## PDM Information Plate (I-Plate)



Figure 10. PDM top, I-Plate, specs, and cautions



# 24VDC Power Hub 3500 Description

## Power Hub Connection Ports and Vents

Port placards assist in making the correct connections between components. Please review the information on all of these plates and labels, as they contain the basic information required to set up and operate the Power Hub.

### Overview

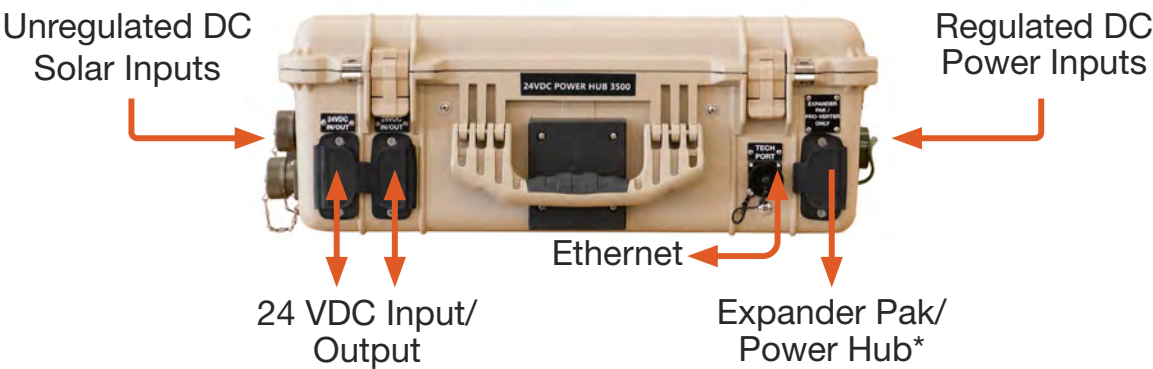


Figure 11. Overview of Power Hub connections



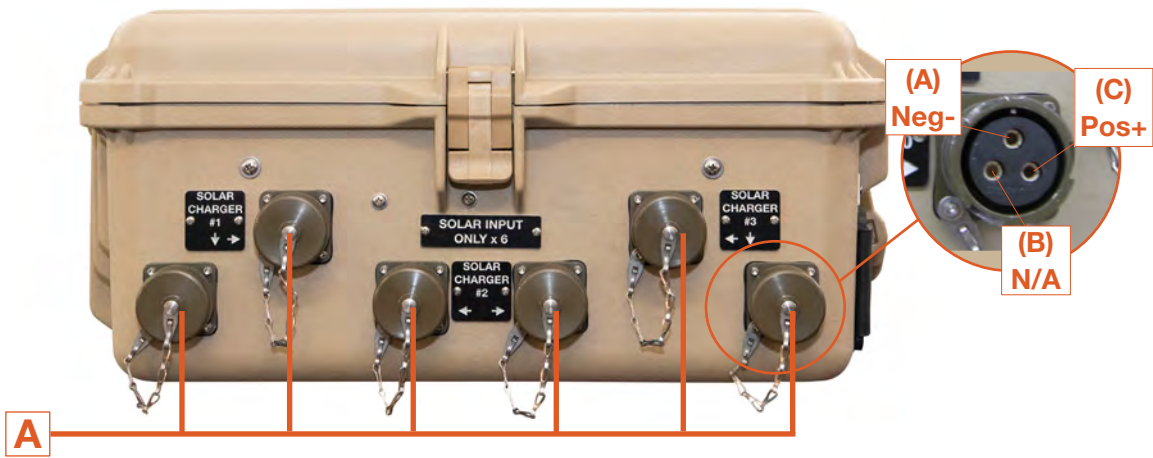
	Description	Connector	Voltage
A	24VDC Load Port (unmetered)	Inter-Connect Port	24 VDC
B	24VDC Battery/Power Hub Port (metered)	Inter-Connect Port	24 VDC
C	Ethernet Port	Ethernet - RJF21B	-
D	Exhaust Vent	-	-

Figure 12. Power Hub front—DC output and communications



Description		Connector	Amps	Voltage
A	24 VDC NATO Slave (unmetered)	NATO Slave	100	24 VDC
B	Regulated 24 VDC Input Only (unmetered)	Inter-Connect Port	100 total	24 VDC

Figure 13. Power Hub right side—Regulated 24 VDC input and NATO connector



Description		Connector	Watts	Amps
A	Solar Input	Cannon Bayonet Receptacle CB2-22-2SC	1166 W Max/Solar Charger 3500 W Total	60 A @ 58 VDC 11.7 A @ 100 VDC*

Figure 14. Power Hub left side—Solar-only ports

## Power Hub Internal Cooling

Thermostatically-controlled, internal cooling fans turn on at 104 °F (40 °C) and turn off when the internal temperature drops to 90 °F (32 °C). There is a filter behind the louvered vent cover. Keep this filter clean. Maximum airflow is critical to maintain cooling.



Figure 15. Power Hub rear side—Air intake vent

## Power Hub I-Plate

The Power Hub I-Plate provides concise, abbreviated information for setting up and running a Power Hub as part of a System (Quick-start Guide and Operating Information). All System components should be connected as described on the I-Plate. The Warning and Notices are important lists of things to do and not to do. Be familiar with their content before operating the Power Hub. An I-Plate is (usually) tailored to a customer's specific application. Contact Solar Stik Tech Support for details.

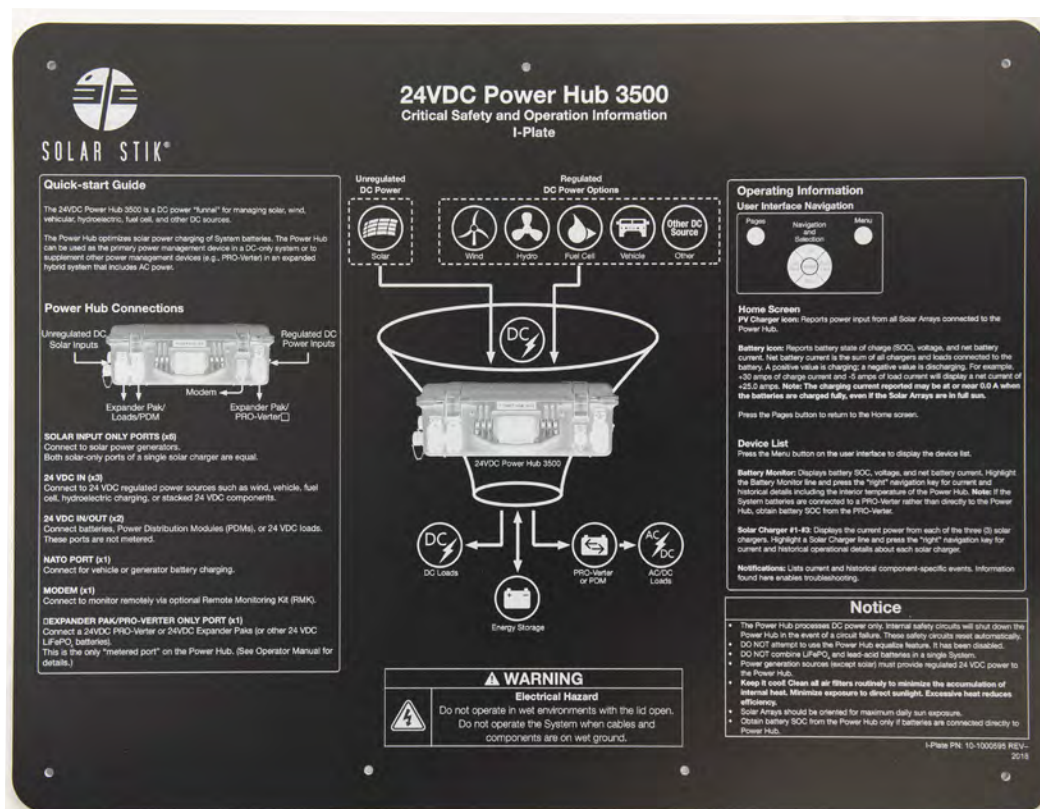


Figure 16. Power Hub I-Plate



## Power Hub Faceplate

The Faceplate provides support for the user interface and the Inter-Connect Cable storage ports. Recommended safety equipment, PV charging specifications, compatible battery chemistries, environmental operating conditions and Solar Stik Technical Support contact information are provided in the center of the Faceplate.

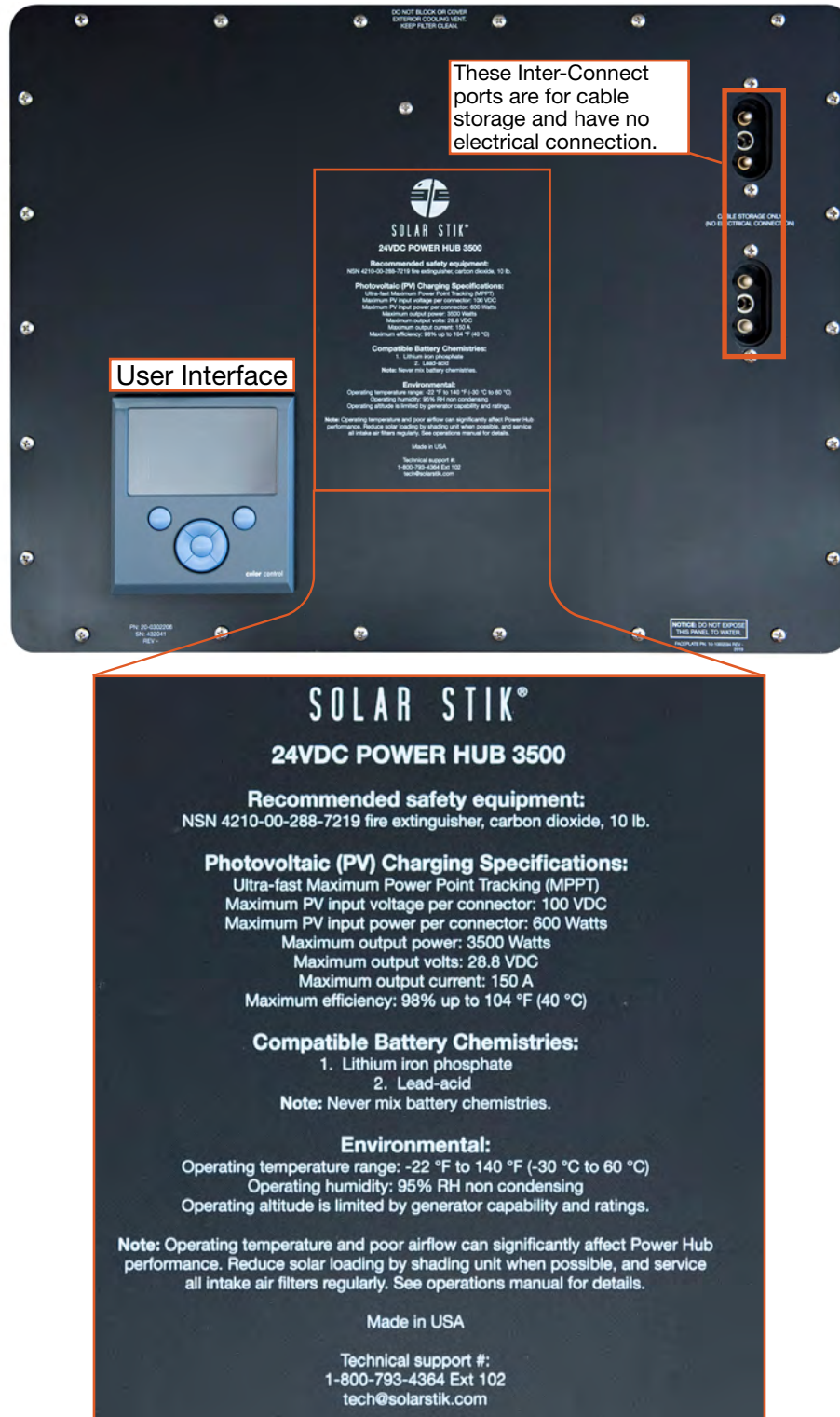
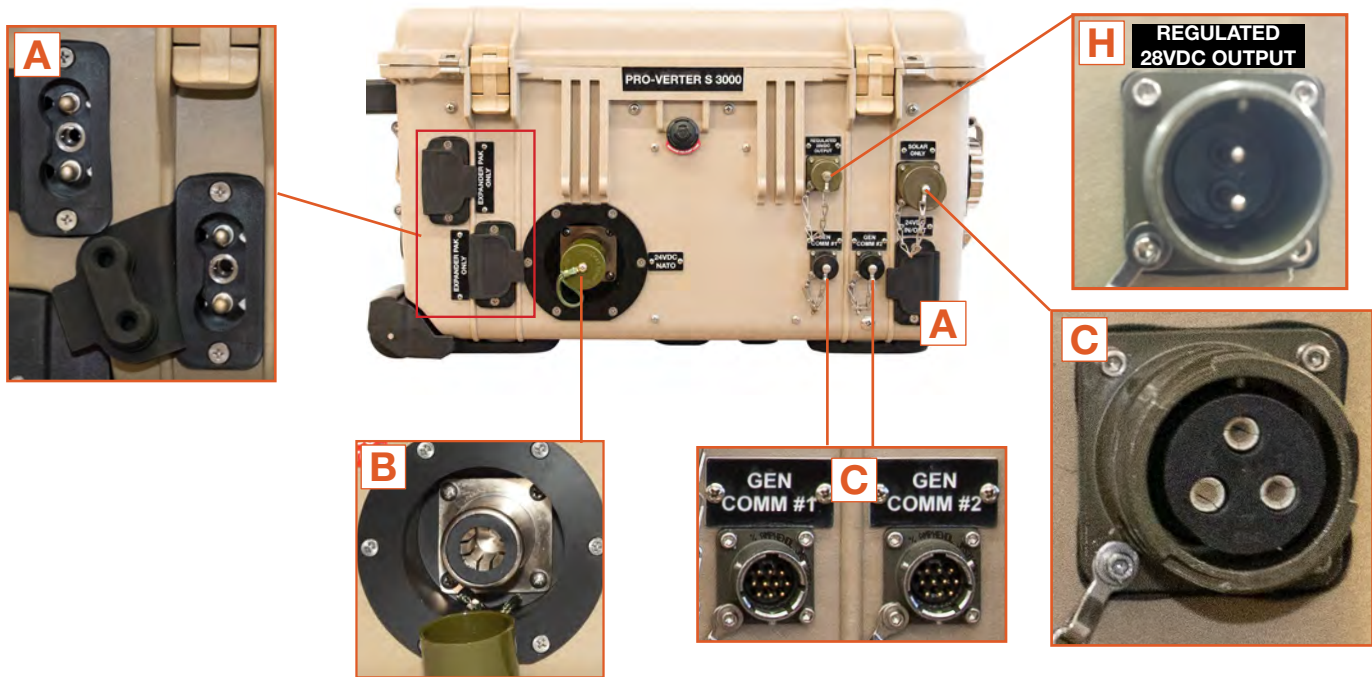


Figure 17. Power Hub Faceplate

# PRO-Verter S 3000 AGS Description

## PRO-Verter Connection Ports and Vents



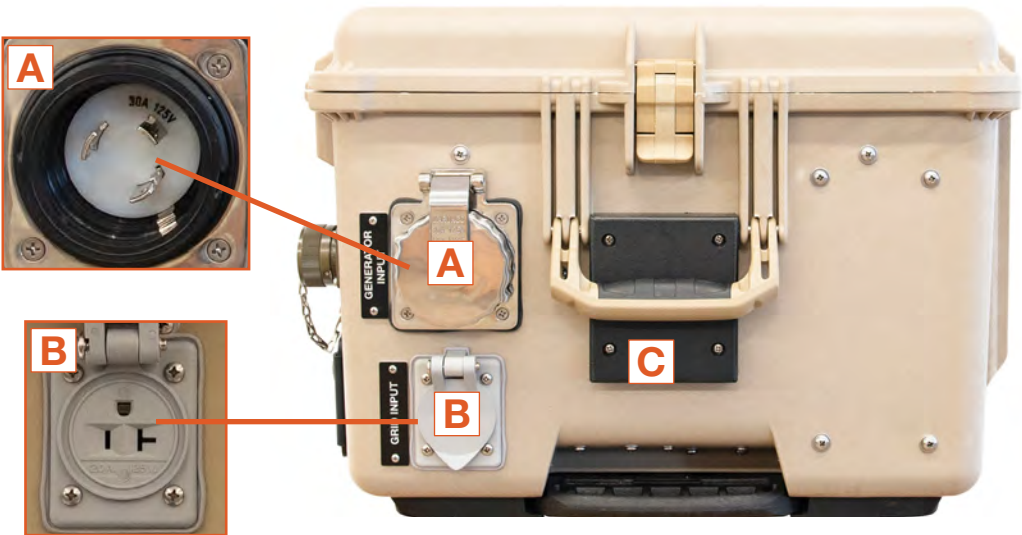
Description		Connector	Voltage	Amps
A	24 VDC IN/OUT	Inter-Connect Port	24 VDC	200
B	24 VDC NATO Slave (unmetered)	NATO Slave	24 VDC	100
C	GEN Comm Ports #1, #2	Amphenol HA100001-02-36	-	-
C	Solar Only Port	Cannon Bayonet Receptacle CB2-22-2SC		
H	Regulated DC Output	Amphenol 2-pin	28.0	7.8

Figure 18. PRO-Verter front side



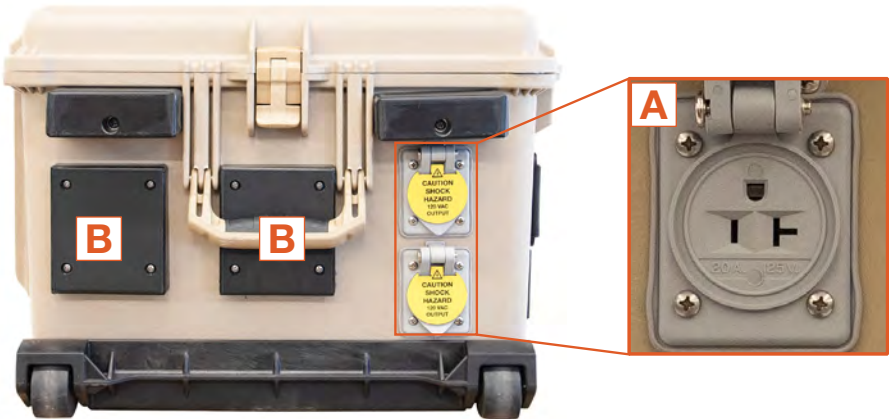
Description		Connector	Voltage	Amps
A	Air Intake	-	-	-

Figure 19. PRO-Verter rear side



	Description	Connector	Voltage	Amps
A	120 VAC GENERATOR Input Connection	Marinco	125	30
B	120 VAC GRID Input Connection	HBL61CM65	125	20
C	Exhaust Vent Cover	-	-	-

Figure 20. PRO-Verter right side



	Description	Connector	Voltage	Amps
A	120 VAC Output	HBL61CM65	125 VAC	20
B	Air Intake	-	-	-

Figure 21. PRO-Verter left side



## PRO-Verter Faceplate

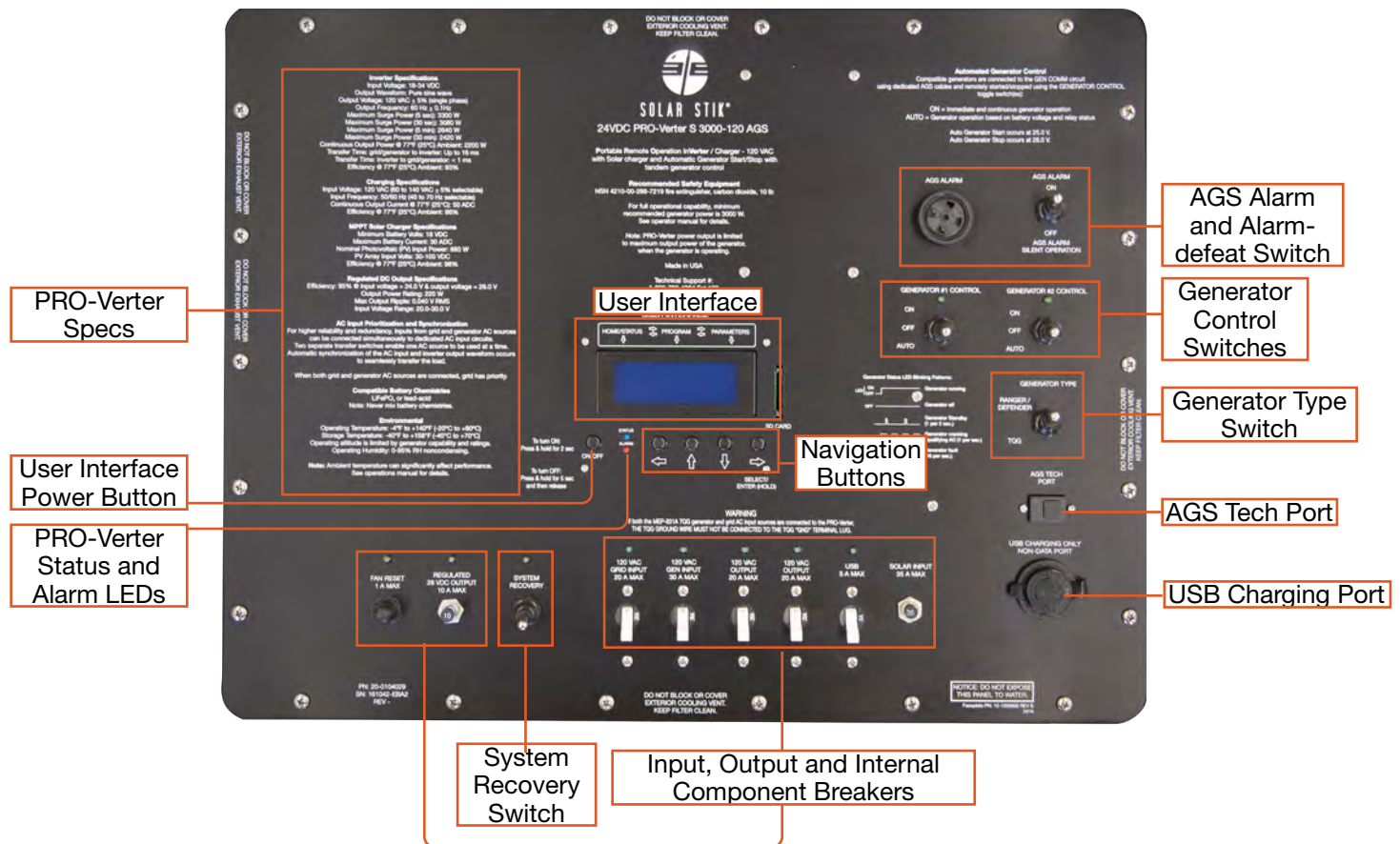


Figure 22. PRO-Verter Faceplate features

**User Interface** – The user interface is used to program and control the PRO-Verter and to monitor System status. The PRO-Verter is programmed at Solar Stik to meet the specifications of a specific application. Programming mode can be accessed if reprogramming is required. Contact Solar Stik Technical Support.

**System Recovery Switch** – Provides a method to start the PRO-Verter when the System batteries have been overdischarged. Connect the PRO-Verter to a 120 VAC power source. Press and hold the System Recovery button. Turn on the PRO-verter user interface. Continue pressing the System Recovery button until the user interface reports “Charging”.

**Generator Type Selection Switch** – Choose “RANGER/DEFENDER” if the PRO-Verter is connected to either of these gensets. Choose “OTHER” if connected to other gensets (e.g., MEP-802A or MEP-831A) that have been equipped with auto start/stop functionality. \

**Auto Generator Start/Stop (AGS) Switches** – The “ON” position manually turns on a generator; the “AUTO” position automatically starts and stops the connected generator based on programmed, battery voltage values. The “OFF” position defeats AGS communication with any connected genset.

**AGS Alarm and Defeat Switch** – Audible indication that a connected generator is in the process of starting. Alarm may be defeated (toggle switch) when silent operation is required.

**USB Charging Ports and 5 A Breaker** – For charging only. No data are transmitted via these ports. Push to reset the breaker if either of the USB ports is not operating while the PRO-Verter is turned on.

**IN/OUT Breakers/Switches** – The breakers serve as switches to activate circuits and to turn off circuits not in use. Circuit breakers protect against overcurrent conditions in dedicated circuits. If too much amperage flows due to short-circuit, inadequate or improper loading, or component failure, these will protect the system and operator. The green LED over each breaker will be lit if the circuit is active and the breaker is not tripped.

**Cooling Fan 1A Breaker** – The internal cooling fans are audible when Push to reset the breaker if the AC Input or AC Output port is not operating while the PRO-Verter is turned on.

**AGS Tech Port** – Used to program the Auto Generator Start/Stop module. Please contact Solar Stik Technical Support for further information.





# OPERATOR INSTRUCTIONS

## 1. Identify Location for System Components

Survey the area where the System will be deployed. The PV arrays should be located in an unshaded area while all other System components should be located in a shaded area.

### a. Component Shading

It is critically important to shade all of the components (except the PV arrays) as much as possible to reduce heat buildup inside the components (solar loading). Higher temperatures will result in derating, or diminished capacity and efficiency, of the components.

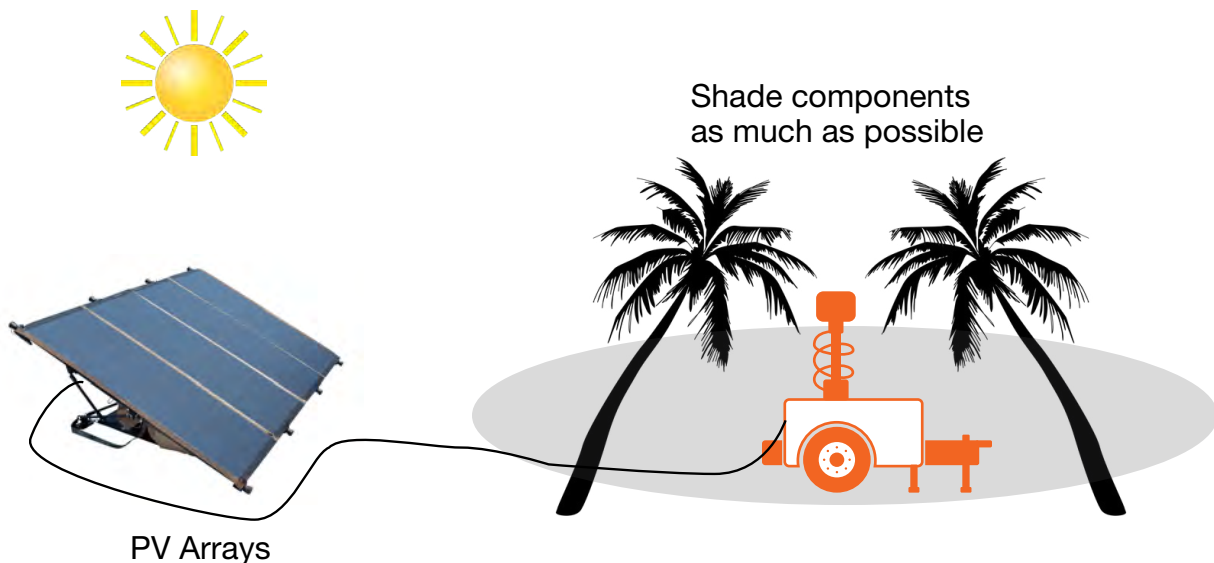


Figure 24. Working-space distance for the PV Array and the PRO-Verter

### b. Minimize Potential for Water and Dust Intrusion

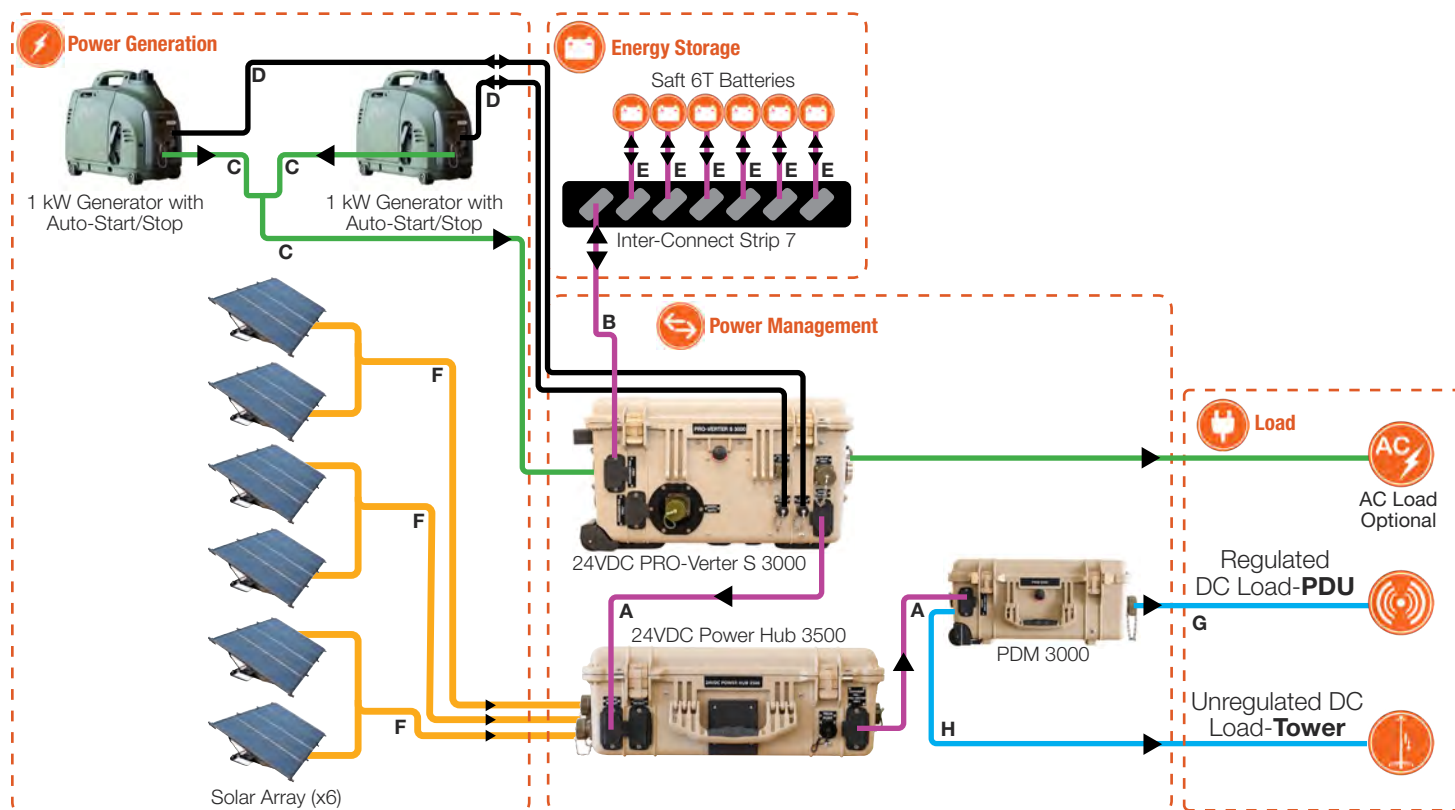
ALL Solar Stik equipment is designed for operation in adverse conditions, however, certain rules apply:

1. If operating in wet environments, use common-sense placement to avoid water intrusion by either flooding or precipitation.
2. If operating in dusty environments, ensure good airflow by keeping air filters clean and placing unit in a location that minimizes exposure to particulates.

Direct ground placement of any power management or energy storage component is generally not recommended, but possible if no other option is available. If it is necessary, preventative measures for water and dust should be taken. Consult the [Maintenance Instructions](#) section of this manual for additional details and component-specific preventive maintenance checks and service (PMCS).

## 2. Connect System Components

### G-BOSS E Light System Connection Diagram



#### Inventory: Light System

Cable	Item #	Cable Name	QTY
A	13-1000292	24VDC 5' INTERCONNECT CABLE (0 AWG)	2
B	13-0000032	24VDC 5' INTERCONNECT CABLE (2AWG)	2
C	13-1000293	NOVATIO PARALLEL CABLE	1
D	13-1000187	10' GENERATOR COMMUNICATION CABLE	1
E	13-1000294	24VDC 5' INTERCONNECT CABLE	6
F	13-1000298	24VDC SOLAR Y-CABLE	3
G		AIB2-32-5SS	
H		NATO Cable	
	13-1000160	24VDC INTERCONNECT STRIP 7	1
Item #	Component		
20-0104029	24VDC PRO-VERTER S 3000-120 EBA2		1
20-0002510	DC POWER DISTRIBUTION MODULE 28V-REG		1
20-0302206	24VDC POWER HUB 3500		1
20-0702604	PRO-Verter RMK (AGS)		1

Figure 25. G-BOSS E Light connection diagram and kit inventory

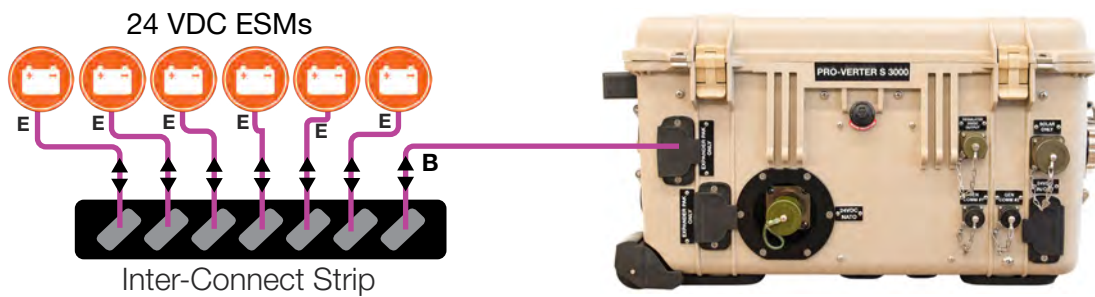
## a. Connect PRO-Verter to Energy Storage Modules

**Note:** A variety of energy storage modules (ESMs) may be connected to the PRO-Verter. Never mix battery chemistries in a System.

### i. More than two (2) EMSs

Use 5' Inter-Connect Cables (E) to connect ESMs to Inter-Connect Strip.

Use 5' Inter-Connect Cable(s) (B; 2 AWG) to connect the Inter-Connect Strip(s) to the PRO-Verter.



### ii. Two (2) or fewer ESMs

Use 5' Inter-Connect Cables (E) to connect Expander Paks to PRO-Verter.

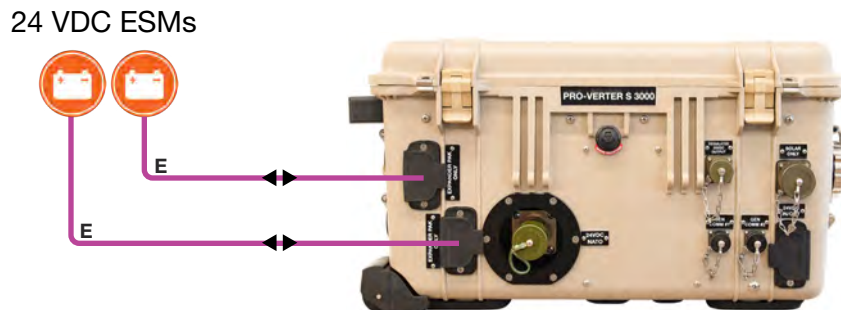


Figure 26. PRO-Verter to ESM connections for G-BOSS E Light

## b. Connect PRO-Verter to AC Power Source(s)

- **AC Input Power Cable:** Connect AC power output port on the generator to the “AC Input” port on the right-hand side of the PRO-Verter S 3000.
- **Grid Power Cable:** Connect AC power from the grid to the “AC Input” port on the right-hand side of the PRO-Verter S 3000. A custom cable may be required, depending on the grid power outlet.

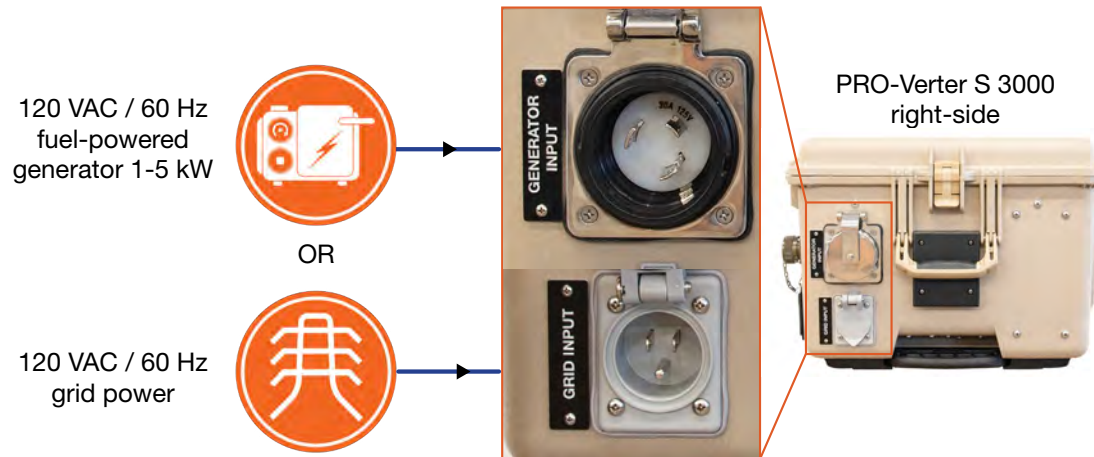


Figure 27. PRO-Verter(s) to AC power input connections

### Compatible Generator Options

The PRO-Verter S 3000 can remotely start/stop TQGs that have been modified with a Solar Stik Remote-start Enabling Kit (RsEK) and the 1 kW and 2 kW Man Portable Generators (MPGs) (Figure 28).

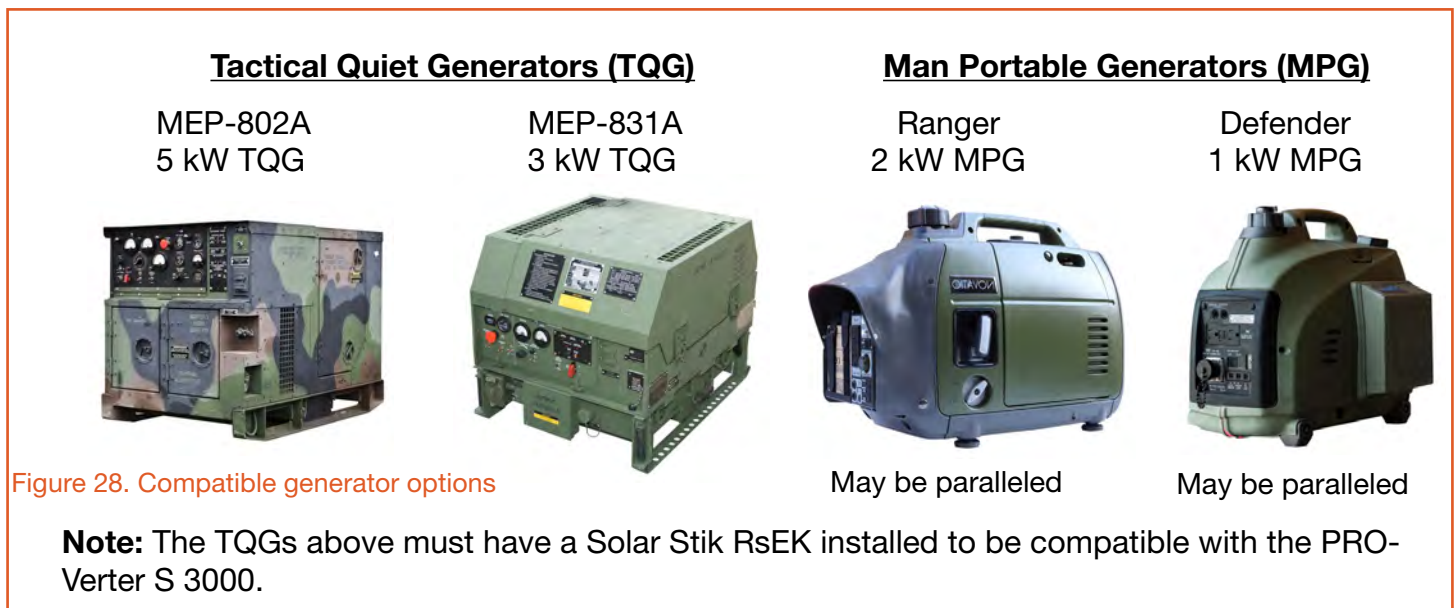


Figure 28. Compatible generator options



## c. Connect PRO-Verter to Generator Comms Cables

### PRO-Verter GEN COMM port specificity

- **Defender/Ranger MPG single operation** – Connect to Gen Comm #1 or #2 port.
- **Defender/Ranger MPG tandem operation** – Connect to Gen Comm #1 and #2 ports. (Use 120 VAC Parallel Power Cable.)
- **Tactical Quiet Generator (TQG; optional)** – Connect ONLY to Gen Comm #1 port.

### i. MEP-802A and MEP-831 TQG

Connect ONLY to Gen Comm #1 port on the front of the PRO-Verter and the Auto Generator Control port on the TQG using the 25' TQG Gen Comm Cable.



Figure 29. MEP-831A and MEP-802A Gen Comm Cable connections

## ii. Defender 1 kW and Ranger 2 kW MPGs

Use Gen Comm ports #1 and/or #2 on the front of the PRO-Verter and the communication port on the generator using the 25' Ranger/Defender Gen Comm Cable.

Generator Type  
Selection Switch



PRO-Verter S 3000



Gen Comm Ports



Defender 1 kW



Ranger 2 kW

Figure 30. Defender 1 kW and Ranger 2 kW Gen Comm Cable connections

## How to Connect two (2) MPGs in parallel to the PRO-Verter

The PRO-Verter S 3000 has the ability to receive power from two (2) MPGs simultaneously. The power output from each of two generators is merged into a single “Y” cable that is connected to a single power input port on the left side of the PRO-Verter (Figure 27). The mode of each generator is controlled independently and each has its own communication cable to the PRO-Verter. The LED over each Generator Control switch blinks slowly when functioning in Auto mode, more rapidly when manual On mode, and very rapidly when there is a generator fault. The LED does not blink when the switch is in the Off position.

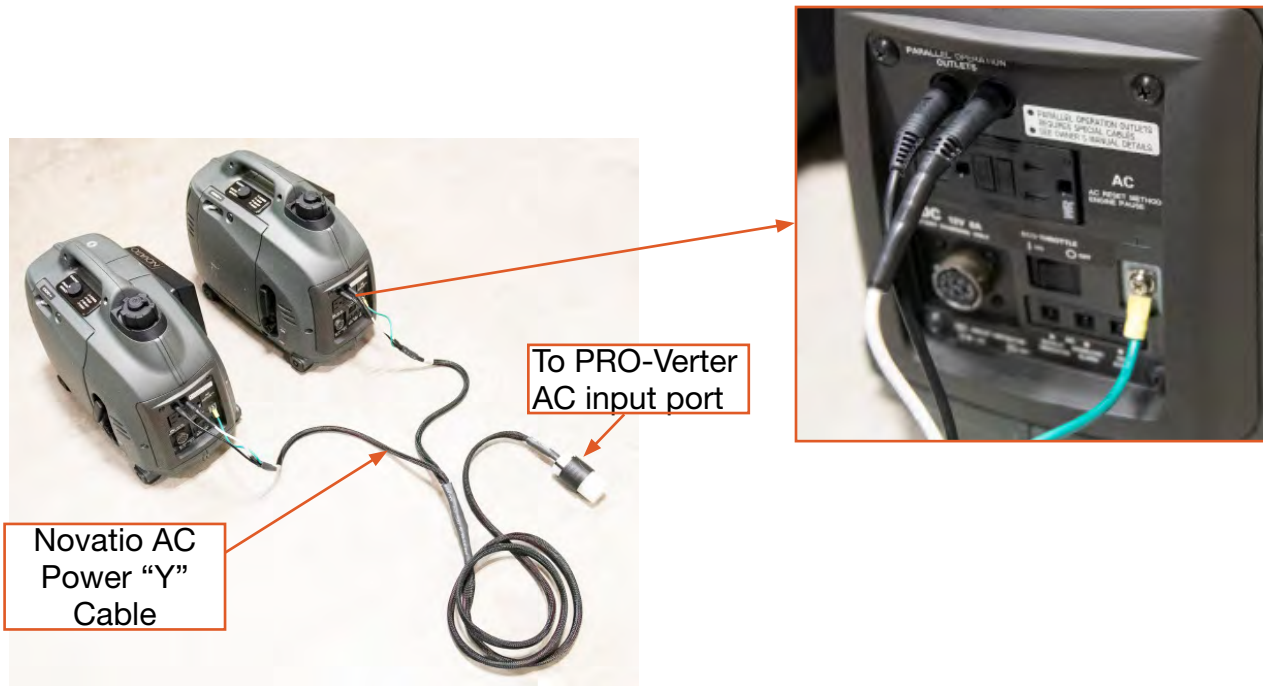


Figure 31. Connecting two 1 kW generators in parallel with the “Y” AC power cable.



## d. Connect PRO-Verter to Power Hub 3500

Use a 5' Inter-Connect Cable (A) to connect the PRO-Verter to the Power Hub 3500 using the ports illustrated in Figure 32.

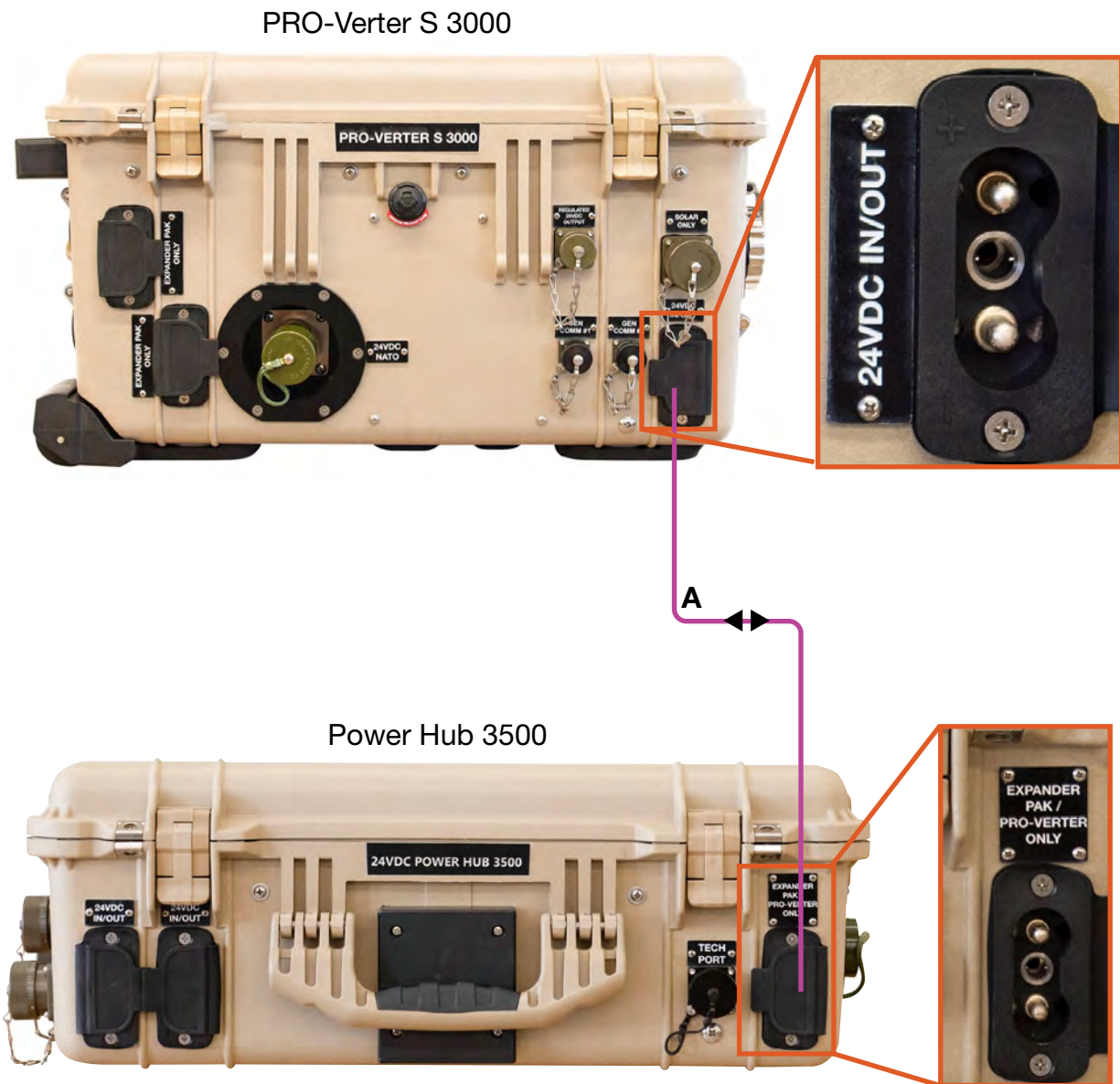


Figure 32. PRO-Verter to Power Hub connection

## e. Connect Power Hub 3500 to PDM 3000

Use an Inter-Connect Cable (A) to connect the Power Hub 3500 to the PDM 3000 using the ports illustrated in Figure 33. The Inter-Connect ports on the left front of the Power Hub are equal; use either one.

**Note:** The Power Hub Inter-Connect port labeled “Expander Pak/PRO-Verter Only” is an appropriate connection point for the PDM 3000 regardless of the name on the label.

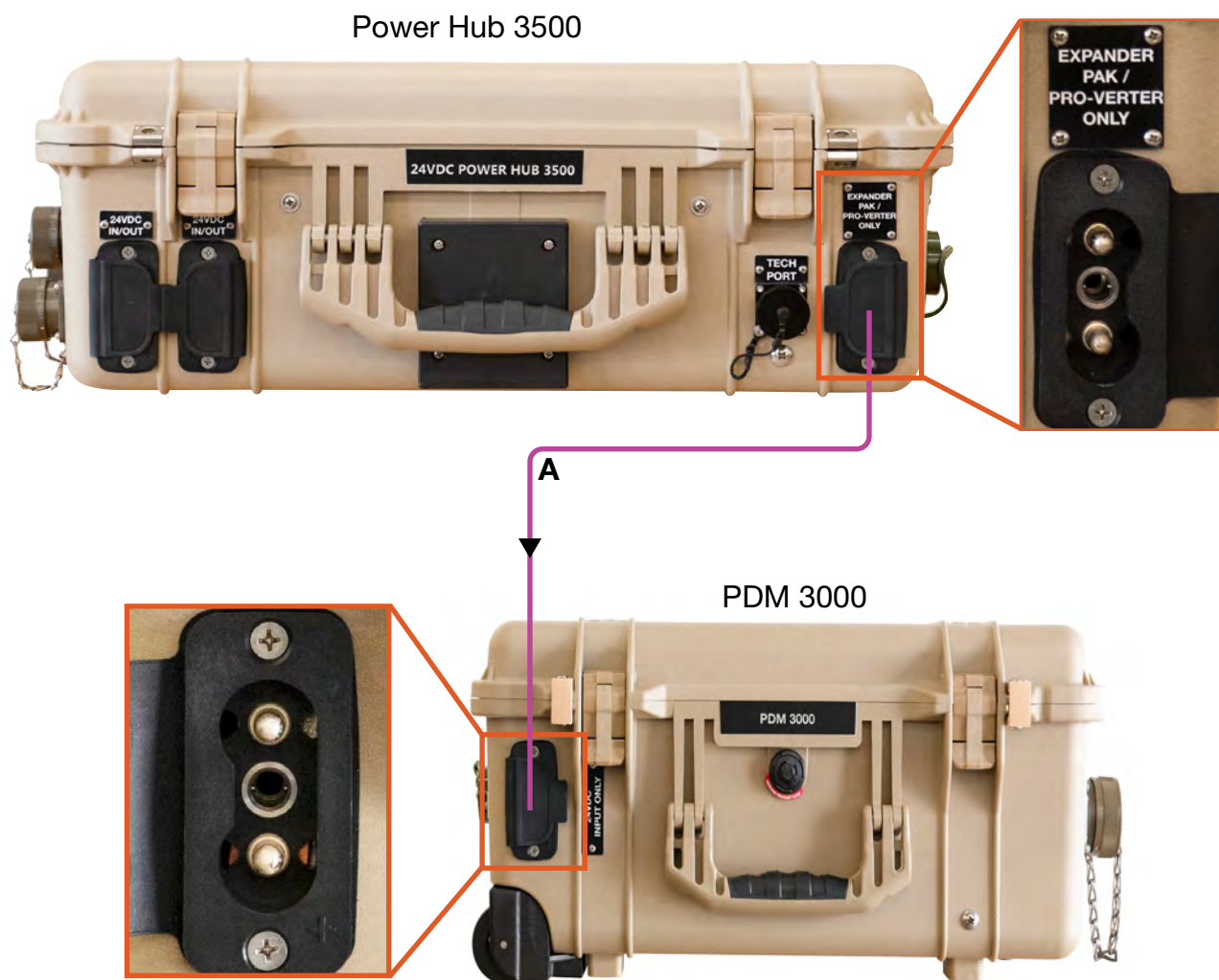


Figure 33. Power Hub to PDM connection

## f. Connect PDM 3000 to PDU and Tower

Use cables F and G to connect the PDM 3000 to the Tower and PDU respectively. These cables are not supplied by Solar Stik.

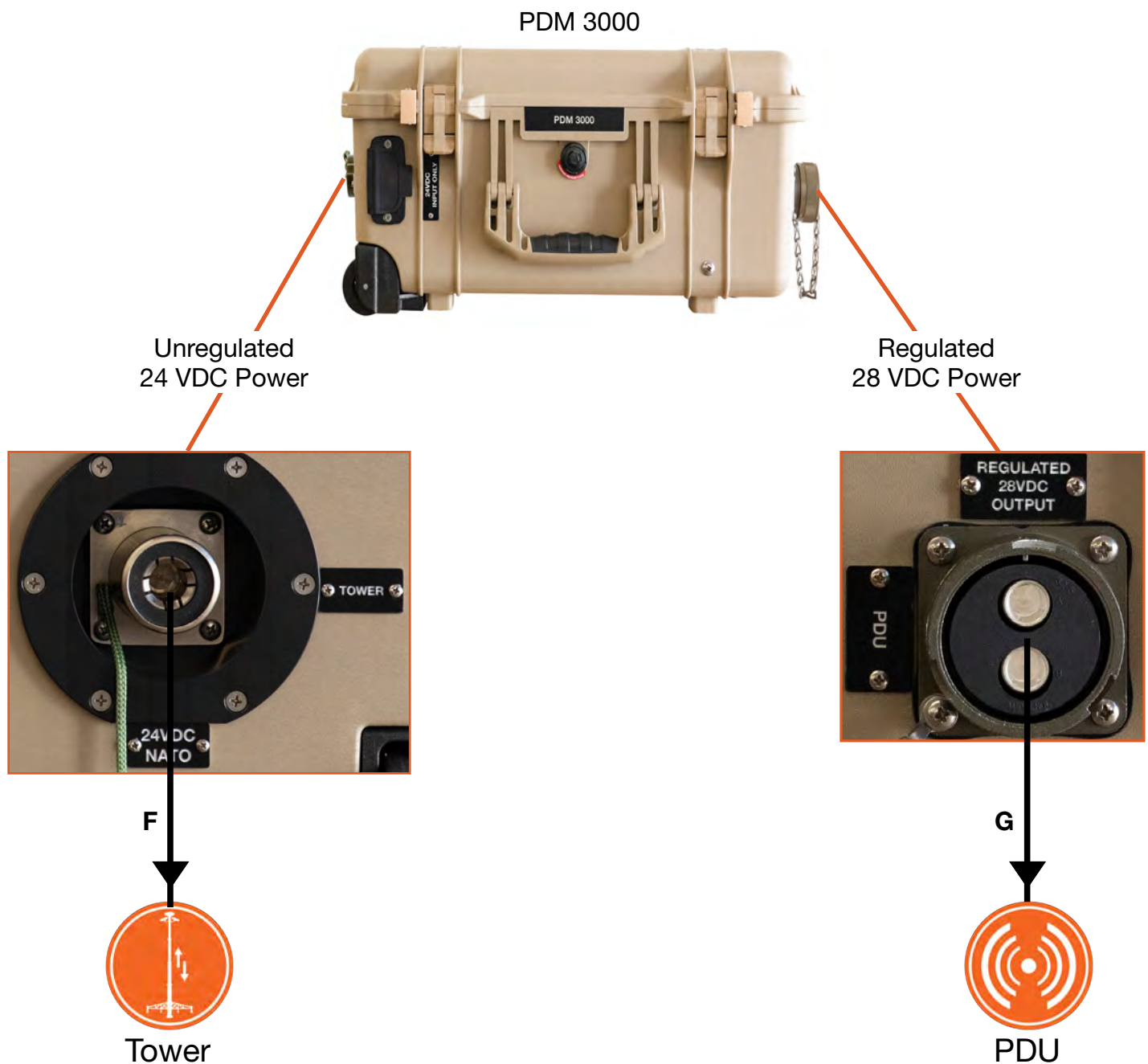
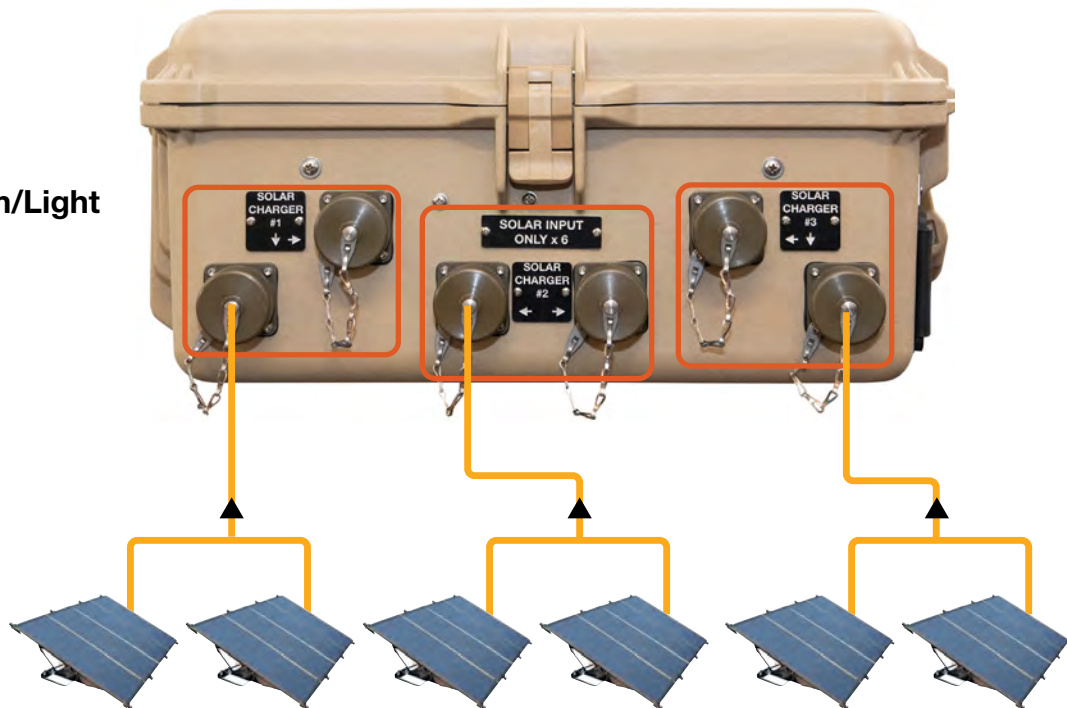


Figure 34. PDM to tower and PDU connections

## g. Connect PV arrays to Power Hub 3500

Use a Solar “Y” Cable to connect up to two (2) PV arrays to a single (1) Solar Input Only port. Note there are three (3) solar chargers in the Power Hub 3500. Both ports of a single charge controller are equal. Distribute the power from PV arrays equally among the three (3) solar chargers when connecting fewer than six (6) Solar Cables, as shown in Figure 35 for G-BOSS Medium. Up to twelve (12) PV arrays may be connected as shown in Figure 35 for G-BOSS Heavy.

**G-BOSS Medium/Light**



**G-BOSS Heavy**

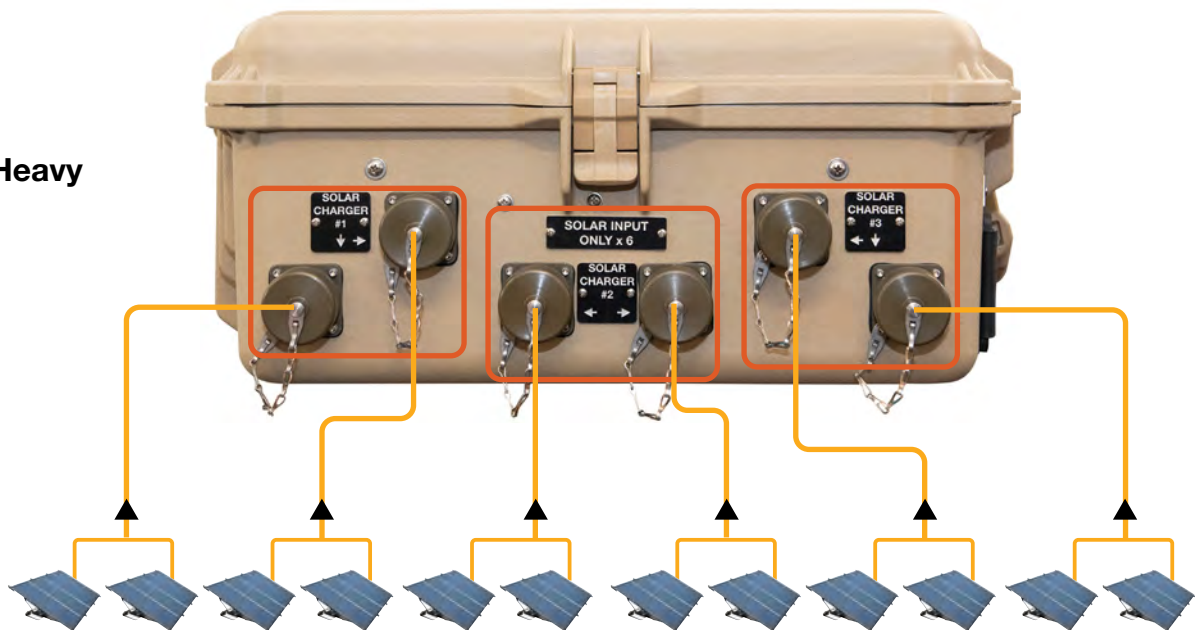


Figure 35. Connect PV arrays to Power Hub

## h. Secure PV Arrays to the Ground

### **WARNING**

Failure to properly secure the PV arrays to the surface with sandbags could result in PV panel damage, injury, or death in high winds. Tent stakes should be used in addition to sandbags when possible. Wind damage can render panels nonfunctional or significantly reduce their functional life expectancy.

The PV arrays must be properly secured to the ground even in low-wind environments. The methods used for ground securing are determined by two (2) factors:

1. The type of surface upon which the PV arrays are to be deployed—“hard” surface (such as pavement) or “soft” surface (such as dirt or sand)
2. The environmental conditions—wind conditions that the PV arrays might encounter

**Detailed instructions for securing the PV arrays are found in the 450W Expedition PV Array Operator Manual and the Solar Stik 400 Operator Manual. Read and follow these instructions.**



## i. Connect PRO-Verter to 120 VAC Loads (Optional)

Connect 120 VAC loads to the PRO-Verter AC outputs on the right side of the PRO-Verter. Connect loads of no more than 20 A for one (1) outlet and no more than 25 A total between the two (2) outlets. Turn off load power switches to prevent power draw during System setup.

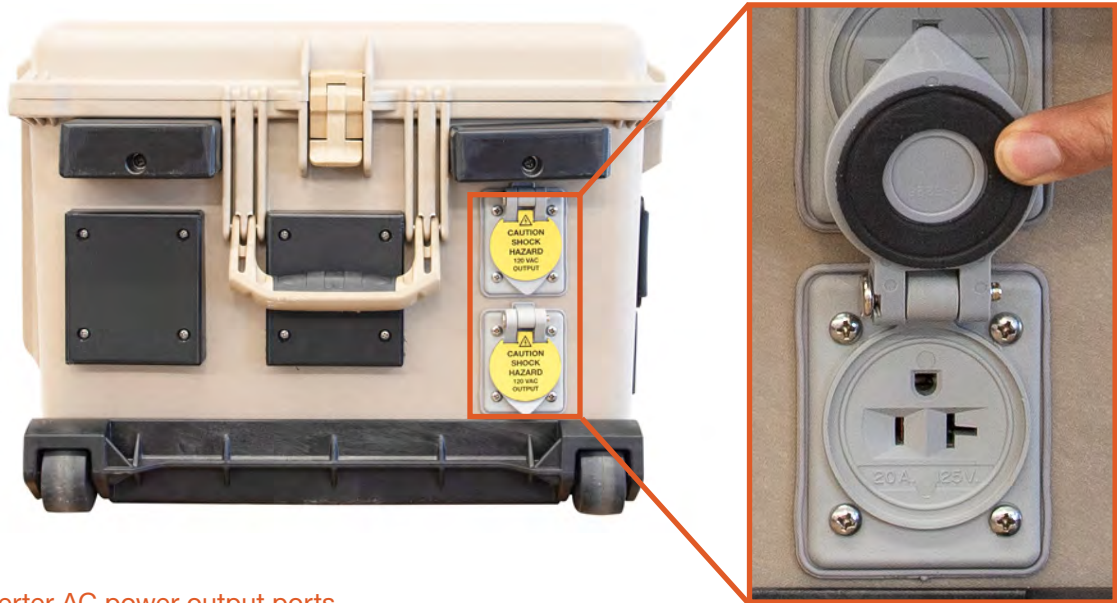


Figure 36. PRO-Verter AC power output ports

## j. Connect Loads Requiring Regulated 28 VDC Output (Optional)

Connect loads that require regulated 28 VDC output. The maximum output from this connection is 7.8 A or 220 W. A custom cable is required; contact Solar Stik for details. Turn off load power switches to prevent them from drawing power during System setup. Do not attempt to power the PDU or Tower from this connection.



Figure 37. PRO-Verter Regulated DC power output port

## k. Connect PV Array(s) to PRO-Verter (Optional)

Connect the PV array(s)/Solar Cable to the PRO-Verter Solar Only port on the front of the PRO-Verter.

**Note:** PV arrays up to 880 W can be connected to the PRO-Verter\*.

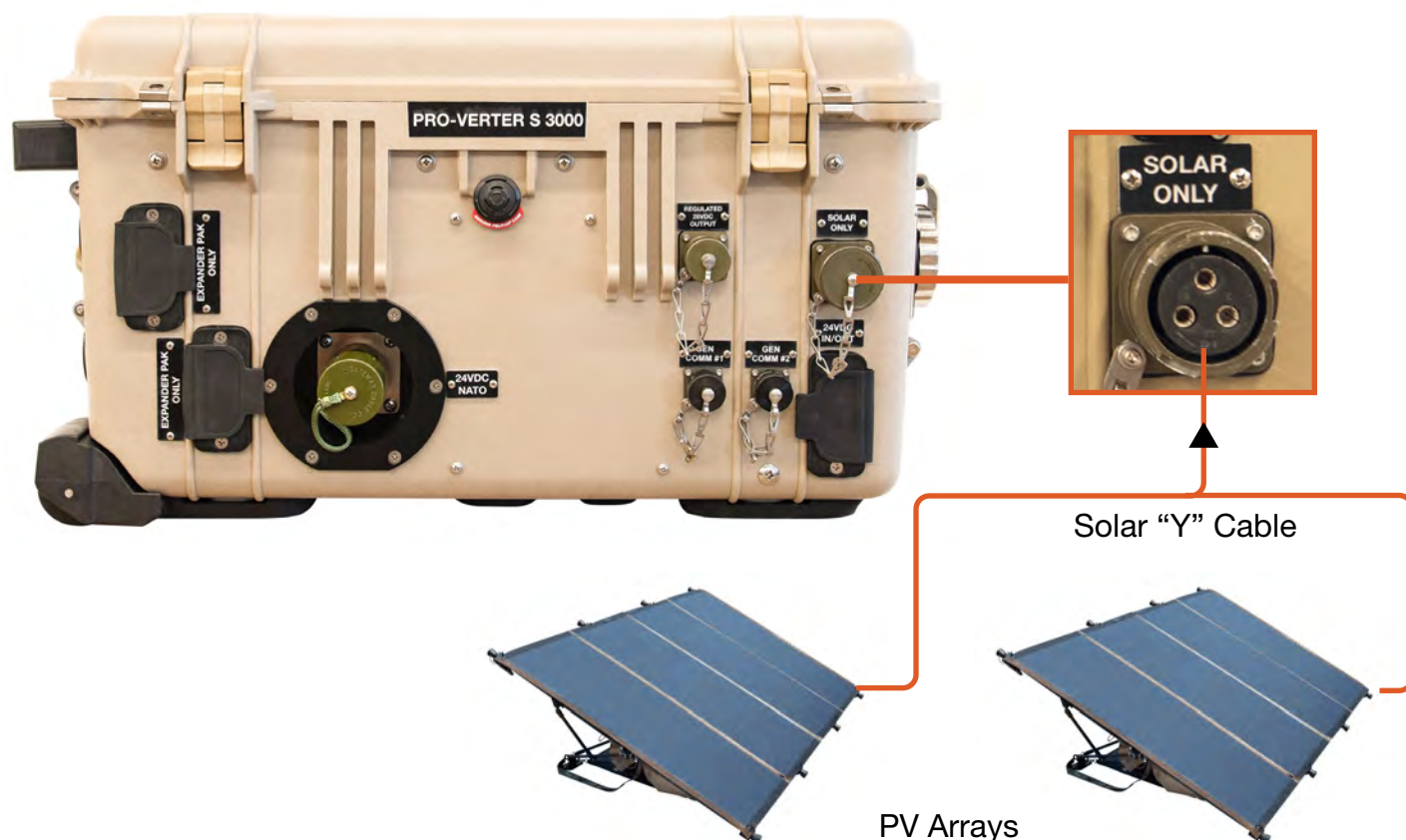


Figure 38. PV array to PRO-Verter connection

### \*System PV arrays: General Rules and Requirements

PV arrays, other than the ones provided in the kit, can be connected to the PRO-Verter as long as the power specifications for the arrays do not exceed the specifications listed on the Faceplate.

Input Frequency: 50/60 Hz (40 to 70 Hz selectable)
Continuous Output Current @ 77°F (25°C): 50 ADC
Efficiency @ 77°F (25°C) Ambient: 86%
<b>MPPT Solar Charger Specifications</b>
Minimum Battery Volts: 18 VDC
Maximum Battery Current: 30 ADC
Nominal Photovoltaic (PV) Input Power: 880 W
PV Array Input Volts: 30-100 VDC
Efficiency @ 77°F (25°C) Ambient: 98%
<b>Regulated DC Output Specifications</b>
Efficiency: 95% @ Input voltage = 24.0 V & output voltage = 28.0 V
Output Power Rating: 220 W

Figure 39. PRO-Verter Power specifications for PV arrays

## 3. System Activation and Initialization

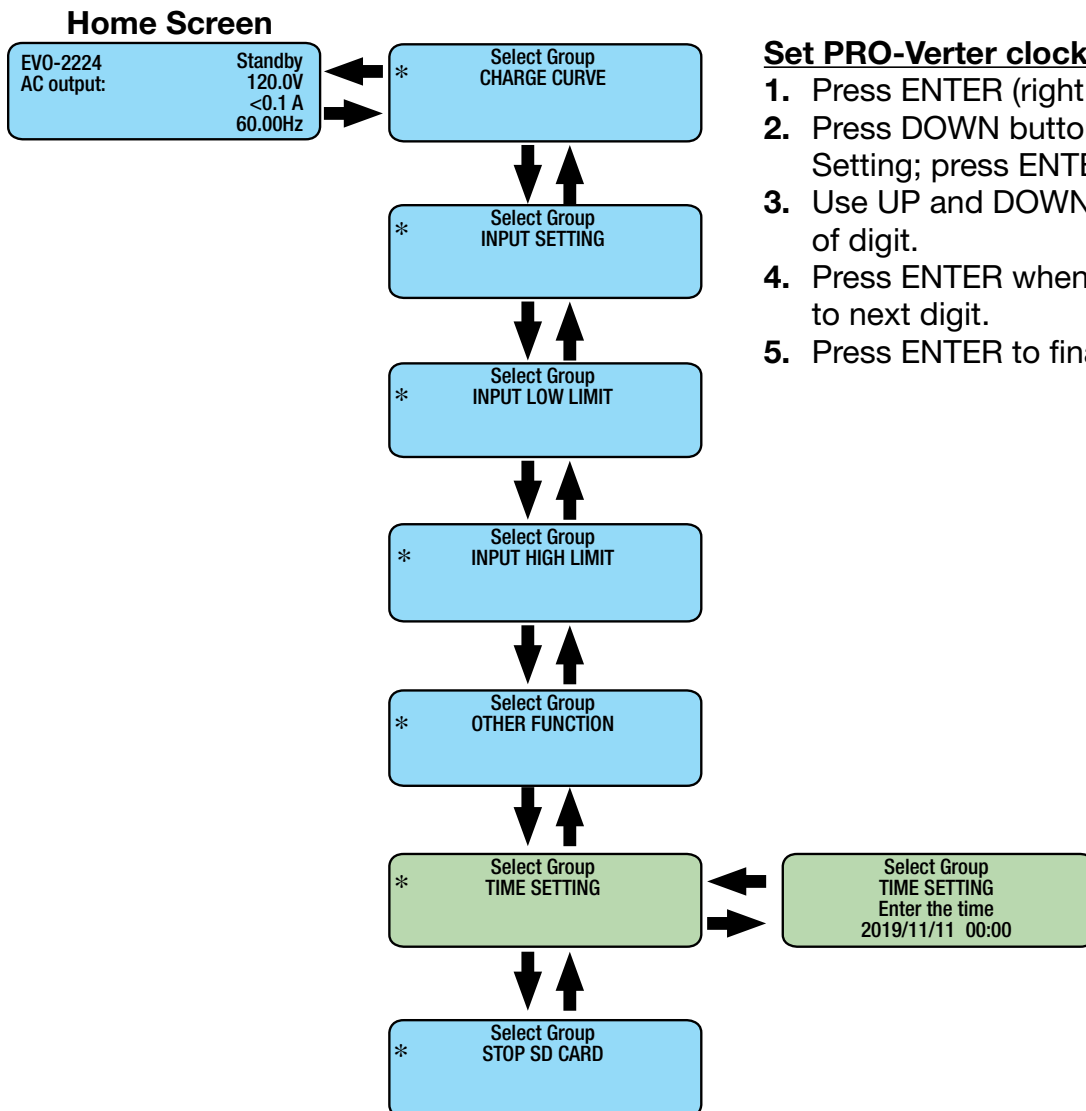
### a. Activate the HPS

- i. Turn on ESM main power switches.
- ii. Turn on PRO-Verter user interface.
- iii. Turn on the appropriate AC input breakers on the Faceplate.
- iv. Ensure proper generator-type selection (Faceplate switch).

### b. Set PRO-Verter Date and Time

The date and time format is Year/Month/Day Hour:Minute (24-hour clock).

**Note:** Password is not required for setting this parameter.



#### Set PRO-Verter clock

1. Press ENTER (right arrow) button.
2. Press DOWN button to arrive at Time Setting; press ENTER.
3. Use UP and DOWN buttons to change value of digit.
4. Press ENTER when value is correct to move to next digit.
5. Press ENTER to finalize setting procedure.

## c. Program PRO-Verter to Match AC Source Output Current

Set the “Grid Max Current” setting to the same value as the maximum continuous output current of the AC grid power source connected to the PRO-Verter. Set “Gen Max Current” value using the recommended settings in Table 1 below. These settings are required to optimize generator/PRO-Verter interactions and System performance. If the PRO-Verter current setting is greater than the power source, the source will be overloaded and fault. If the PRO-Verter current setting is lower than the power source, System performance will be reduced or not be able to support loads that fall within the rated performance of the PRO-Verter.

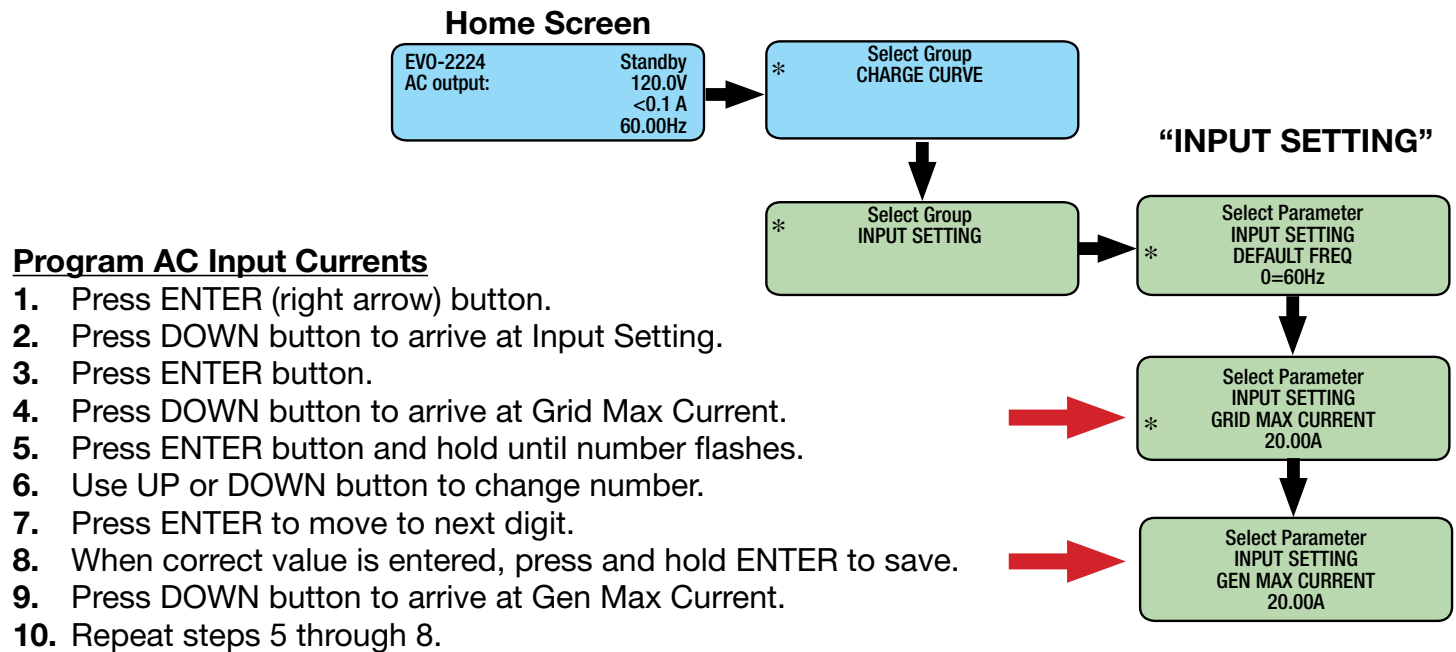


Table 1. AC Power input settings for generators

### Recommended generator AC Input Settings and Loads

#### Hybrid System Configuration Chart

Generator Configuration	Generator Output (W) <sup>1</sup>	AC Input Setting (A) <sup>2</sup>	Max Recommended Load-Hybrid (W) <sup>3</sup>	Minimum Energy Storage (kWh) <sup>4</sup>
1 x 1 kW	~600	5–7.5	300	3.9
2 x 1 kW	~1200	10–15	600	5.2
1 x 2 kW	~1500	12.5–15	750	4.9
2 x 2 kW	~3000	25–30	1500	9.8
3 kW TQG	~2800	25	1400	9.2

<sup>1</sup> Power output for reliable and efficient generator operation

<sup>2</sup> Programmable range for AC input MAX current

<sup>3</sup> The recommended load for cycling System 1–2 times per day

<sup>4</sup> Minimum energy storage requirement for recommended loads



## d. Initiate System Cycling

1. Toggle Generator Control switch(es) to ON position to start generator(s). Once generator has run for two(2) minutes, AC input should be qualified.
2. When PRO-Verter enters charging mode, rapidly toggle Generator Control switch(es) to AUTO position to allow charging cycle to complete automatically.

### What to watch for as the System is starting

The Generator Status LED blinking pattern indicates the current state of the generators(s). The graphic below the generator control switches is a key to understanding the blinking pattern.



Figure 40. Generator Mode Control Switches and LEDs

### Generator Control Switches

**ON** – When the Generator Control switch is in the ON position, the AGS system is activated/ enabled. The PRO-Verter will signal the generator to start. Placing the Generator Control Switch in the ON position “manually” signals the generator to start using the PRO-Verter AGS controls. The green status LED will be steady ON.

**OFF** – When the AGS switch is placed in the OFF position, the LED status indicator will be off and all AGS functions are disabled. The green status LED will be steady OFF.

**AUTO** – When the Generator Control switch is in the AUTO position, the AGS will start and stop the generator based on programmed values for battery voltage. When the generator is running, the status LED will be steady ON.

**Note:** Move quickly when switching between ON and AUTO; do not hesitate on the OFF position. Pausing in the OFF position will inadvertently turn off the generator.



## 4. PDM 3000: PDU and/or Tower Operation

- After the Hybrid Power System is cycling, turn on PDM 3000 breaker(s) to support required circuit(s) (Tower and/or PDU).
- Turn off PDM 3000 breaker(s) when circuit(s) not in use.

## System Deactivation

Power down PRO-Verter user interface before disconnecting batteries. Press and hold user interface ON/OFF button for five (5) seconds, then release. The user interface will turn off.

## PRO-Verter Operating Modes

When the PRO-Verter is operating normally, the user interface will display the name of the operating mode and values of operating parameters. Because all the operating parameters associated with a particular operating mode cannot be displayed in one screen, multiple screens are available that can be accessed using the UP and DOWN keys. Table 2 provides names and descriptions of the operating modes and Figure 41 provides System metrics available in three operating modes.

The user interface will automatically display the current mode in which the PRO-Verter is operating. Use the UP and DOWN buttons to view the values of parameters associated with the current mode.

The operating modes windows and subwindows are READ ONLY.

Table 2. Operating Modes: Descriptions

Operating Mode Display	Description
<b>Standby</b>	In <b>Standby mode</b> there is no output, no AC bypass, and no charging. The parameters available for viewing when the PRO-Verter is in standby mode are shown in this map.
<b>Inverting</b>	In <b>Inverting mode</b> , the PRO-Verter is supporting the load by converting energy stored in the batteries into AC power. The batteries are not being charged when the PRO-Verter is in Inverter mode.
<b>Charging</b>	In <b>Charging mode</b> , the PRO-Verter is charging the batteries and supporting the AC load. The degree to which the batteries are charged will depend on the demand of the AC load; supporting the load is prioritized over charging the batteries.
<b>Power Save</b>	The PRO-Verter enters Power Save mode when demand from the PRO-Verter inverting and charging functions drop below programmed thresholds.
<b>Online</b>	This option is also called “On-Line UPS Mode”. In this mode, the Inverter is the primary source of power to an AC load, drawing energy stored in the batteries. The AC power input source is the back up power source to support AC loads.
<b>Chrg Only <sup>1</sup></b>	Under “ONLINE MODE” only (Option 2=Charger Only). Provides charging and pass-through when the AC input is available. The PRO-Verter inverter is inactive when AC input is not available.

<sup>1</sup> It is not recommended to put the PRO-Verter into charge-only mode when the PRO-Verter is part of a functioning HPS with both AC and DC loads. AC loads connected to the PRO-Verter will not be supported if the AC power source connected to the PRO-Verter fails. Charge-only mode may be used in an HPS with DC-only loads. **The PRO-Verter S 3000 has been programmed for charge-only mode per customer request.**

## Monitor System Activity

The System will be in standby, charging or inverting mode most of the time it is in operation. Scrolling down through the windows below the home screen provides additional, helpful, System status information.

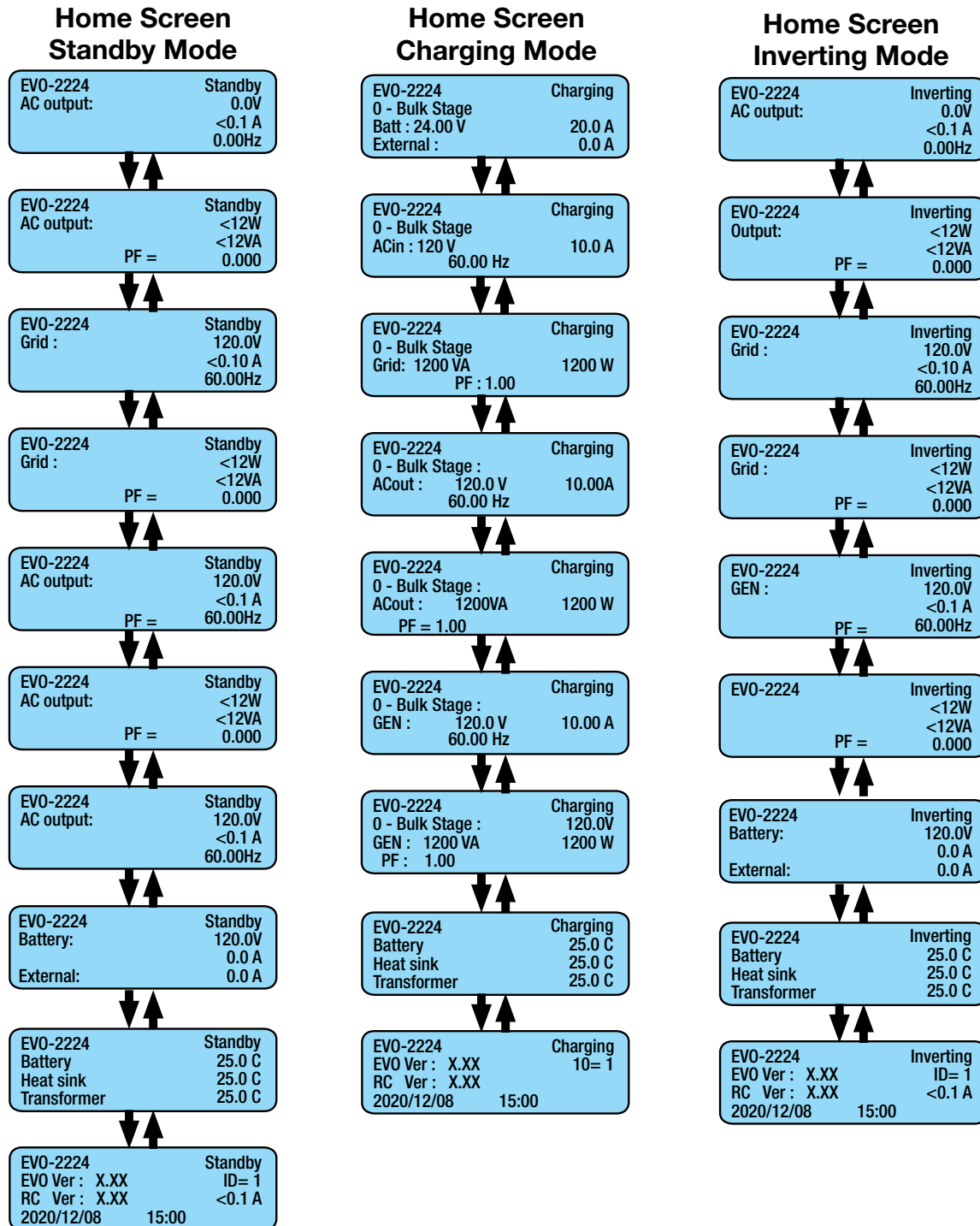


Figure 41. System metrics available in standby, charging and inverting modes

## User Interfaces and Settings

### Operating the PRO-Verter User Interface

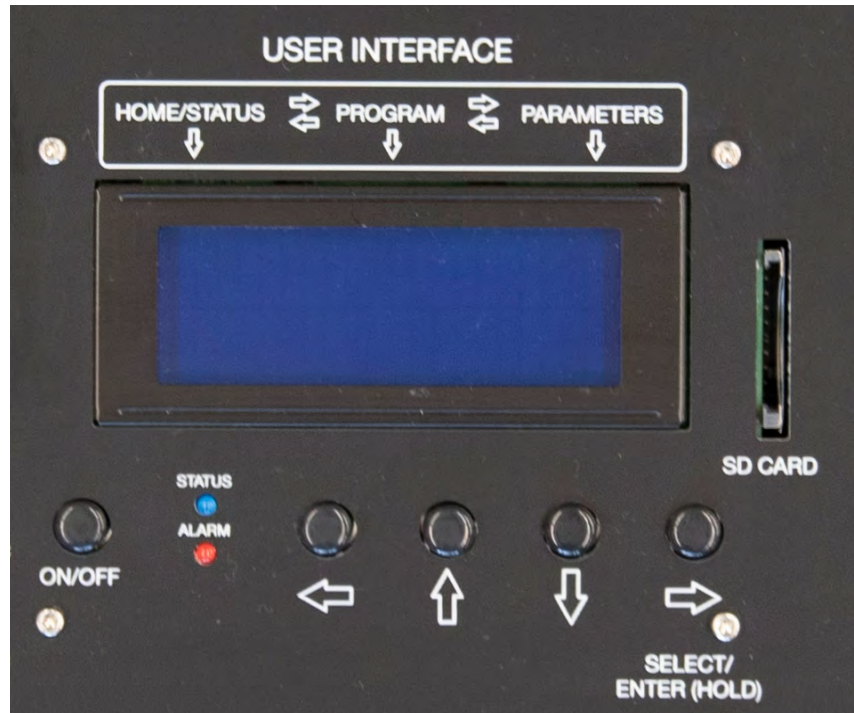


Figure 42. PRO-Verter user interface power and navigation buttons

- **On/Off Key**—The On/Off Key is used for switching on/off the PRO-Verter and also to enter/exit Standby mode.
- **Navigation Keys**—These four keys allow simple access to menu items that assist in configuring, monitoring, and troubleshooting the PRO-Verter.

#### Navigation Key Functions

- **Back** (left arrow)—Return to previous selection
- **Up**—Move from lower to upper menu screen in various menu maps
- **Down**—Move from upper to lower menu screen in various menu maps
- **Enter** (right arrow)—Select/write a particular value or option. Access programmable settings.
- **Status LED**—Blue LED indicator for indicating operating status
- **Fault LED**—Red LED indicator for indicating fault conditions
- **SD Card Slot**—This slot supports SD memory card (up to 16GB, FAT16/32). The SD card is used for data logging of PRO-Verter operational statistics and events and saving and uploading of programmed parameters.

## PRO-Verter Status and Alarm LEDs

The Status LED indicates the operating status of the PRO-Verter; the Alarm LED indicates a fault has occurred; specific information about the fault is reported on the user interface LCD screen. To clear faults see [Clearing PRO-Verter Faults](#). The table below explains the meaning tied to each state for both LEDs.



Figure 43. PRO-Verter S 3000 user interface

Table 3. User Interface LED Indicators

LED INDICATIONS		
Status	STATUS LED	ALARM LED
Seen during power-on sequence Indicates completion of power-on sequence after power On/Off button is pressed for 2 seconds (sec)	Flash 3 times	Off
Seen during power-off sequence Indicates completion of power-off sequence after power On/Off button is pressed for 5 s	On	On
Normal charging	Flash 1 time/sec	Off
Equalization charging	Flash 2 times/sec	Off
Inverting (discharging) Alarm beep/3 sec (default off)	On	Off
Low battery alarm Alarm beep/1 sec	On	Flash 1/sec
Power saving	Flash 1 time/3 sec	Off
Standby	Flash 1 time/5 sec	Off
Fault	Off	On



# PRO-Verter Programmable Settings

## Navigating “Select Group” and “Select Parameter” Menu Maps

The ENTER key is used to enter “Select Group” menu map from any operating mode screen.

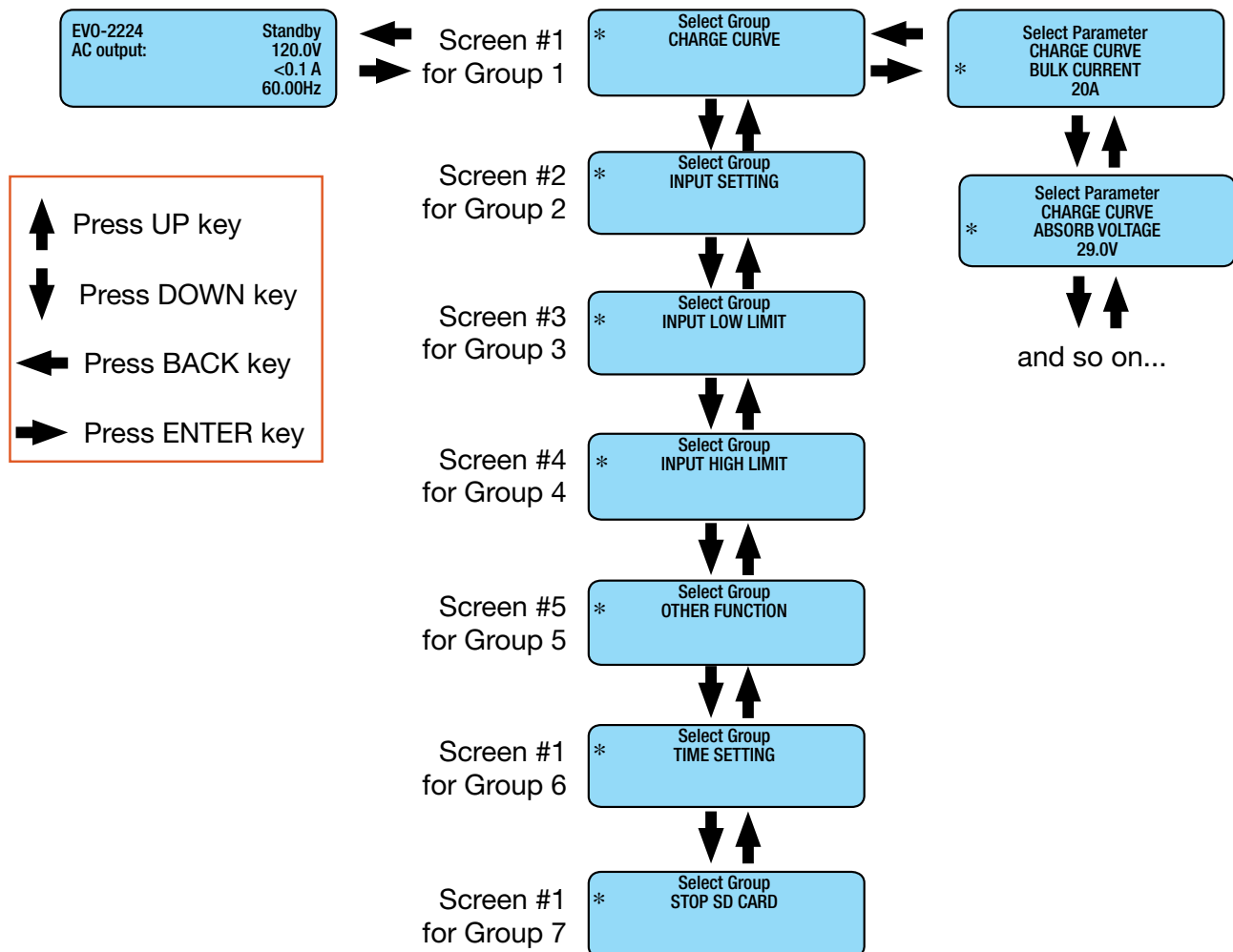
After the ENTER key is pressed, the UP/DOWN keys are used to navigate to one of the seven (7) “Select Group” screens.

When the group for the desired setting is displayed on the LCD, the ENTER key is used again to select this group. The UP and DOWN keys are used to move to the individual screens within the group.

The third line shows the name of the parameter that can be varied with an asterisk sign “\*” next to it. The asterisk sign \* indicates this parameter will be selected when the ENTER key is pressed and the associated value can be changed.

Pressing the BACK key will exit to the previous level.

There is a 30-second time-out for setting parameters; after 30 seconds, the setting mode will be cancelled and the display will revert to the operating mode screen associated with current operation.



## Parameter Groups: PRO-Verter Programmable Settings

Parameter groups are the top-level categories of PRO-Verter programming.

Table 4. Programmable Parameter Groups: Descriptions

List of Parameter Groups 1 to 7		
Parameter	Group Name	Description
Group 1	CHARGE CURVE	Parameters for battery charging/battery protection.
Group 2	INPUT SETTING	Parameters for grid/generator input current level, frequency range.
Group 3	INPUT LOW LIMIT	Parameters for grid/generator input low voltage level.
Group 4	INPUT HIGH LIMIT	Parameters for grid/generator input high voltage level.
Group 5	OTHER FUNCTION	Power Saving/Alarm/Remote Switch/Multi-function Relay/etc.
Group 6	TIME SETTING	Local time clock setting.
Group 7	STOP SD CARD	Shown only when SD card is inserted. To stop SD card accessed and to remove the SD card.

Please contact Solar Stik Technical Support before changing settings other than the clock or the AC Input settings. These settings are highlighted orange in the tables that follow.

## Charge Curve Programmable Settings

Parameters in this group define System battery charging protocols.

Table 5. Parameters for Battery Charging/Battery Protection

GROUP 1: CHARGE CURVE		
Parameter	Parameter Value	Description
BULK CURRENT	70 A	Sets the maximum charging current during the Bulk Charging Stage.
ABSORP VOLTAGE	29.0 V	Sets the charging voltage in the Constant Voltage Absorption Stage.
EQUALIZE VOLTAGE	29.0 V	Not applicable when using LiFePO <sub>4</sub> batteries.
FLOAT VOLTAGE	29.0 V	Sets the charging voltage in the Constant Voltage Float Stage.
COMPENSATE	-3mV /°C/Cell	Sets the temperature compensation for the battery.
BATT OVER VOLT (Shut Down)	32.0 V	Sets the upper battery voltage threshold at which inverting/charging operations are switched off to protect the PRO-Verter.
RESET VOLTAGE (Low Voltage Reset)	29.0 V	The PRO-Verter inverter will restart when the battery voltage rises to this set value or above after “Battery low voltage!” shutdown occurs.
LOW VOLT ALARM	25.6 V	Battery voltage at which the “Alarm” triggers AGS to start generator.
BATT LOW VOLTAGE	24 V	Sets the battery low voltage threshold at which the PRO-Verter inverter will shut down to protect the battery from overdischarge.
LV DETECT TIME	60 sec	This is the timer for shutting off the inverter. Battery voltage must be at the low voltage set point for this period of time before the inverter shuts off.
LV CUT OFF TIME	3600 sec	This timer shuts off everything including the charger. (The load on the inverter will already be cut off during this time.)
EQUALIZE-4STAGES	0=NO	Equalize disabled with LiFePO <sub>4</sub> batteries.
ONLINE MODE	0 = Option 1 (Default) Offline	
RESET TO BULK	25.6 V	Sets battery voltage at which the charger will terminate current charging stage of the selected Charging Profile and restart charging from the beginning.
GS DETECT TIME	60 sec	A timer that sets the duration the battery voltage has to remain at threshold of Low Volt Alarm or lower before generator auto start/stop.
GEN ON TIME	30 minutes	N/A as programmed
GEN OFF DELAY	1 minute	Must be in the generator-stop condition for 1 minute before opening the relay
ABSORP TIME	10 min	
ABSORP EXIT AMPS	6 A	Set to ~1-% of battery bank capacity.) Value not in play with 2 Stage Type 1 charging
CHARGING PROFILE	3 = 2 Stage Type 1	(mimics CC/CV-type charging)

Continued on following page.

**GROUP 1: CHARGE CURVE (Continued from previous page)**

Parameter	Parameter Value	Description
BATTERY TYPE	1 = lithium iron phosphate	N/A. A CC/CV charging profile appropriate for LiFePO <sub>4</sub> batteries has been programmed. Do not change.
SAFE CHARGING	0 Min	This timer, if set, will protect a depleted battery from being exposed to potentially heavy load if AC input is intermittent when first reacquired.
EXTERNAL CHARGER	1 = NOT AFFECT	The “external charger” is PV.

## Input Setting Programmable Settings

Table 6. Parameters for Grid/Generator Input Current Level, Frequency Range

**GROUP 2: INPUT SETTING**

Parameter	Setting Value	Description
DEFAULT FREQ	60 Hz	Default frequency sets the Inverter frequency, which is also the standard frequency for AC input.
GRID MAX CURRENT	15 A	Value set to rated output current of grid power source.
GEN MAX CURRENT	13 A	Value must be set to match generator(s) output. See I-Plate.
HIGH CUT OFF	65 Hz	If the AC input frequency is over the value of High Cut Off when in Charging mode, the PRO-Verter will transfer to Inverting mode.
HIGH RESET	64 Hz	This is the reset frequency at which the unit will revert to Charging mode after it has switched over to Inverting mode due to input frequency rising above High Cut Off.
LOW CUT OFF	55 Hz	If the AC input frequency is below Low Cut Off value when in Charging mode, the PRO-Verter will transfer to Inverting mode.
LOW RESET	56 Hz	This is the reset frequency at which the unit will revert to Charging mode after it has switched over to Inverting mode due to input frequency falling below Low Cut Off.
SYNC GRID	0 = Fine	Sets “syncing” algorithm for AC input 0 = Stable AC Input; 1 = not Stable AC input
SYNC GEN	0 = Fine	Sets “syncing” algorithm for AC input 0 = Stable AC Input; 1 = not Stable AC Input
INPUT OC PROTECT	0 = INVMODE	If the AC input current is 1 A more than the programmed value of Grid Max Current/Gen Max Current for more than 5 sec, the PRO-Verter will switch over to Inverting mode to ensure that AC power to the load is maintained. If the load reduces to 1 A less than the programmed value of Grid Max Current/Gen Max Current for 5 sec, the PRO-Verter will switch back to Charging mode.
INPUT RECOVERY	DIRECT	Option 1 = Direct: The PRO-Verter will start in Charging mode.

## Input Low Limit Programmable Settings

Table 7. Parameters for Grid/Generator Input Low Voltage Level

GROUP 3: INPUT LOW LIMIT		
Parameter	Setting Value	Description
RESET VOLTAGE	105.0 V	This is the reset voltage at which the PRO-Verter will revert to Charging mode after it has switched over to Inverting mode due to input voltage falling to Cut Off Volt 1/Cut Off Volt 2/Cut Off Volt 3.
CUT OFF VOLT 1	100.0 V	If during Charging mode, the AC input voltage falls below Cut Off Volt 1 for period > Detect Time 1, the PRO-Verter will transfer to Inverting mode from Charging mode.
DETECT TIME 1	300 Cycles	This is the time limit in cycles up to which low AC input voltage Cut Off Volt 1 is allowed.
CUT OFF VOLT 2	95.0 V	If during Charging mode the AC input voltage falls below Cut Off Volt 2 for period > Detect Time 2, the PRO-Verter will transfer to Inverting mode.
DETECT TIME 2	60 Cycles	This is the time limit in cycles up to which low AC input voltage Cut Off 2 is allowed.
CUT OFF VOLT 3	90.0 V	If during Charging mode, the AC input voltage falls below Cut Off Volt 3 for period > Detect Time 3, the PRO-Verter will transfer to Inverting mode.
DETECT TIME 3	1 Cycle	This is the time limit in cycles up to which the low AC input voltage Cut Off 3 is allowed.

## Input High Limit Programmable Settings

Table 8. Parameters for Grid/Generator Input High Voltage Level

GROUP 4: INPUT HIGH LIMIT		
Parameter	Setting Value	Description
RESET VOLTAGE	125.0 V	This is the reset voltage at which the PRO-Verter will revert to Charging mode after it has switched over to Inverting mode due to input voltage falling to Cut Off Volt 1/Cut Off Volt 2/Cut Off Volt 3.
CUT OFF VOLT 1	135.0 V	If during Charging mode the AC input voltage falls below Cut Off Volt 1 for period > Detect Time 1, the PRO-Verter will transfer to Inverting mode from Charging mode.
DETECT TIME 1	60 Cycles	This is the time limit in cycles up to which low AC input voltage Cut Off Volt 1 is allowed.
CUT OFF VOLT 2	140.0 V	If during Charging mode the AC input voltage falls below Cut Off Volt 2 for period > Detect Time 2, the PRO-Verter will transfer to Inverting mode.
DETECT TIME 2	15 Cycles	This is the time limit in cycles up to which low AC input voltage Cut Off Volt 2 is allowed.
CUT OFF VOLT 3	145.0 V	If during Charging mode the AC input voltage falls below Cut Off Volt 3 for period > Detect Time 3, the PRO-Verter will transfer to Inverting mode.
DETECT TIME 3	1 Cycle	This is the time limit in cycles up to which the low AC input voltage Cut Off Volt 3 is allowed.



## Other Functions Programmable Settings

Table 9. Power Saving/Alarm/Remote Switch/Multi-function Relay/etc.

GROUP 5: OTHER FUNCTIONS		
Group	Setting Value	Description
POWER SAVING	0 = Disable	Enable or disable Power Saving mode when in Inverting mode.
ENTER POINT	6 W	If the value of power drawn by AC load falls to the Enter Point value for 5 sec, the unit will enter Power Save mode.
WAKE UP POINT	7 W	If the unit is in Power Save mode and the value of the AC power of the load rises to Wake Up Point, the unit will quit Power Save mode and will start operating in full voltage Inverting mode.
REMOTE SWITCH	0 = Button	This selection is used when On/Off control of PRO-Verter is desired through external 12 VDC signal. Contact Solar Stik Technical Support.
RELAY FUNCTION	2 = Generator	Ties battery voltage-related settings to generator autostart/stop.
COMM ID (ID for user interface)	1	Communication ID: This sets the ID number for the Comm port and user interface.
BUZZER	OFF	Set the buzzer On/Off.
DISCHARGE BEEP	0 = NO	To select the buzzer On/Off while in Inverting mode.
DEFAULT RESET	0 = NO	This is to reset all of the parameters to the factory values. The factory values are not the program values set by Solar Stik.
DATA LOG TIME	2 = 10 sec	A real time clock inside the user interface records timing. The time interval between recordings is programmable. Events and Errors are recorded as soon as they are sensed.
PARAMETER SAVE	0 = NO	Save all parameters/program settings to SD card.
TEMP UNIT	1 = deg F	Temperature display can be selected in °C or °F.
PASSWORD DISABLE	1 = Yes	The default password (8052). Password may be disabled.

## PRO-Verter Clock Time Setting

Table 10. Local Time Clock Setting

GROUP 6: TIME SETTING		
Group	Setting Value	Description
TIME SETTING	Local Current Time	24-hour clock set to local time for accurate time stamps on logged events. Password not required.

## Stop SD Card Command

Shown only when SD Card is inserted. To stop SD Card accessed and to remove the SD Card.

Table 11. Instructions to Remove SD Card from PRO-Verter User Interface

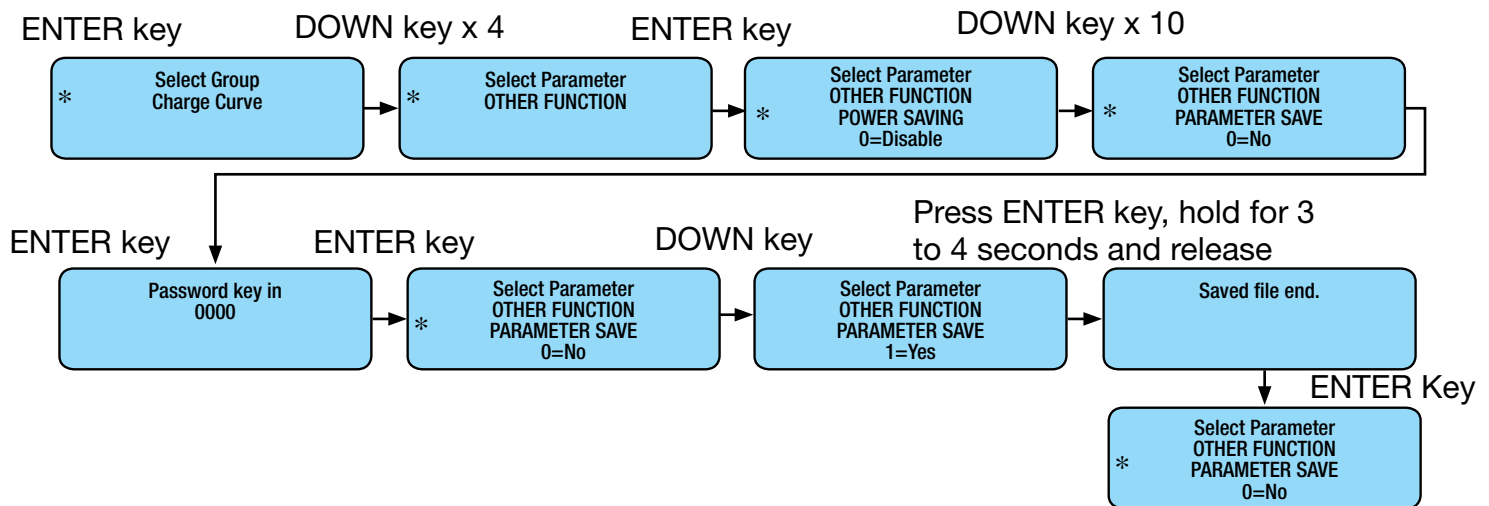
GROUP 7: STOP SD CARD		
Group	Setting Value	Description
STOP SD CARD	1 = YES to remove	Remove/eject SD card only after the operation of the card has been stopped.

## Saving/Uploading Programmed Parameters

### Saving Programmed PRO-Verter Parameters to SD Card

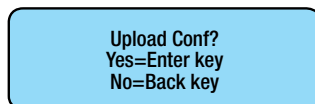
All the programmed parameters can be saved on an SD card (FAT 16/FAT 32 format, up to 16 GB capacity). The parameters will be saved in File named “xxxx\_yyy.cfg”, where the first group of 4 digits xxxx is the model number of the inverter charger and the second group of 3 digits yyy is the Revision #. for that model, e.g., 074.

- For saving, first insert the SD card into the SD card slot.
- Then, go to “Parameter Save” screen . Steps are given below:

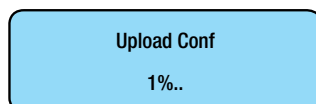


### Uploading Saved PRO-Verter Parameters from SD Card

If there is an “xxxx\_yyy.cfg” file in the SD card with stored programmed parameters, then upon inserting the card, the remote control will ask to upload the Config file. Press the ENTER key to confirm or the BACK key to cancel.



- Asks to confirm or cancel uploading of saved parameters.
- Choose Yes by pressing ENTER key.



Configuration uploading.

## PRO-Verter S 3000 Data Logging

An SD card may be used to log operating information.

- When the SD card is inserted into the SD card slot, data logging is activated automatically (it will be disabled only if programmable setting has been changed to “0 = Disable”). Time interval between recordings (called “Data Log Time”) is programmable. Time stamps for each event are provided by the user interface’s internal, real-time clock.

Available options for Data Log Time are:

- 0 = Disable; 1 = 1 sec (default); 2 = 10 sec; 3 = 30 sec; 4 = 60 sec; 5 = 5 min; 6 = 10 min
- “Events” and “Error Codes” are recorded as soon as they are sensed.

The following 25 data fields include System electrical parameters, events, and error codes:

Date	Time	Grid status	Grid freq	Grid volt	Input current	Input VA	Input watt	Output freq	Output Volt	Output current		
<div>→</div> <div>←</div> <div>↓</div>												
Output VA		Output watt		Battery volt		Battery current		External current		Battery temperature (C)	Transformer temperature (C)	
<div>↓</div> <div>→</div>												
Heat sink temperature 1 (C)			Heat sink temperature 2 (C)			Fan speed		Mode		Error code	Charge stage	Event

### Data Log Files: Viewing Data Log Files Using Excel

The Data Log files are written as text files (.txt) in the DATALOG folder on the SD card’s root directory. Below is an image of the DATALOG folder showing example of the Data Log Files. The file name format is month/day/hour/minute.txt (MMDDhhmm.txt). Each file has 512 rows of records. (Each row has multiple data fields.) Each file size is 128 KB.

10141103.TXT	2014/10/14 AM 11:03	Text Document	128 KB
10141228.TXT	2014/10/14 PM 12:28	Text Document	128 KB
10141353.TXT	2014/10/14 PM 01:53	Text Document	128 KB
10141518.TXT	2014/10/14 PM 03:18	Text Document	128 KB
10141643.TXT	2014/10/14 PM 04:43	Text Document	128 KB
10141808.TXT	2014/10/14 PM 06:08	Text Document	128 KB
10141933.TXT	2014/10/14 PM 07:33	Text Document	128 KB
10142058.TXT	2014/10/14 PM 08:58	Text Document	128 KB
10142223.TXT	2014/10/14 PM 10:23	Text Document	128 KB
10142348.TXT	2014/10/14 PM 11:48	Text Document	128 KB

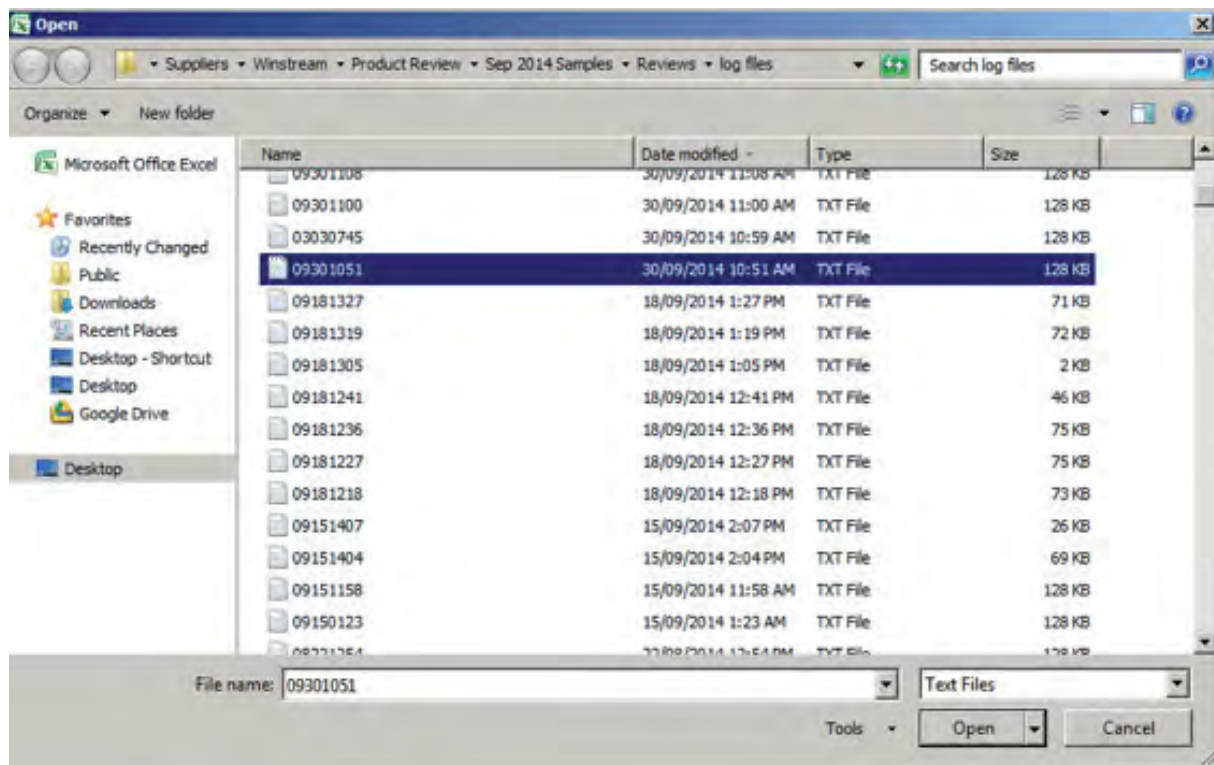
The figure below shows an example of one of the file's contents opened with a general purpose text reader. The second row shows data fields separated by semicolon (";"). The third row onwards shows the status of the data fields at time interval equal to the programmed value of Data Log Time.

**Note:** Event / Error Codes will be logged as soon as they occur.

```
Date:Time:Gen status:Gen freq:Gen volt:Grid status:Grid freq:Grid volt:Input current:Input VA:Input watt:Output freq:Output volt:Output current:Output VA:Output watt:Battery ve
2014/10/14;12:28:32;33340;000.00;000.62;33341;000.00;000.42;<00.10;<0012;<0012;060.00;000.42;<00.10;<0012;<0012;25.002;0000.0;0000.0;0025.0;0026.0;0026.7;0027.1;0;0;00000;0;
2014/10/14;12:28:42;33340;000.00;000.62;33341;000.00;000.42;<00.10;<0012;<0012;060.00;000.43;<00.10;<0012;<0012;25.002;0000.0;0000.0;0025.0;0026.0;0026.7;0027.1;0;0;00000;0;
2014/10/14;12:28:52;33340;000.00;000.62;33341;000.00;000.41;<00.10;<0012;<0012;060.00;000.42;<00.10;<0012;<0012;25.002;0000.0;0000.0;0025.0;0026.0;0026.7;0027.1;0;0;00000;0;
2014/10/14;12:29:02;33340;000.00;000.62;33341;000.00;000.42;<00.10;<0012;<0012;060.00;000.43;<00.10;<0012;<0012;25.002;0000.0;0000.0;0025.0;0026.0;0026.7;0027.1;0;0;00000;0;
2014/10/14;12:29:12;33340;000.00;000.62;33341;000.00;000.42;<00.10;<0012;<0012;060.00;000.43;<00.10;<0012;<0012;25.002;0000.0;0000.0;0025.0;0026.0;0026.7;0027.1;0;0;00000;0;
2014/10/14;12:29:22;33340;000.00;000.62;33341;000.00;000.41;<00.10;<0012;<0012;060.00;000.42;<00.10;<0012;<0012;25.002;0000.0;0000.0;0025.0;0026.0;0026.8;0027.1;0;0;00000;0;
```

**Follow procedure given below to open Data Log Files in Excel:**

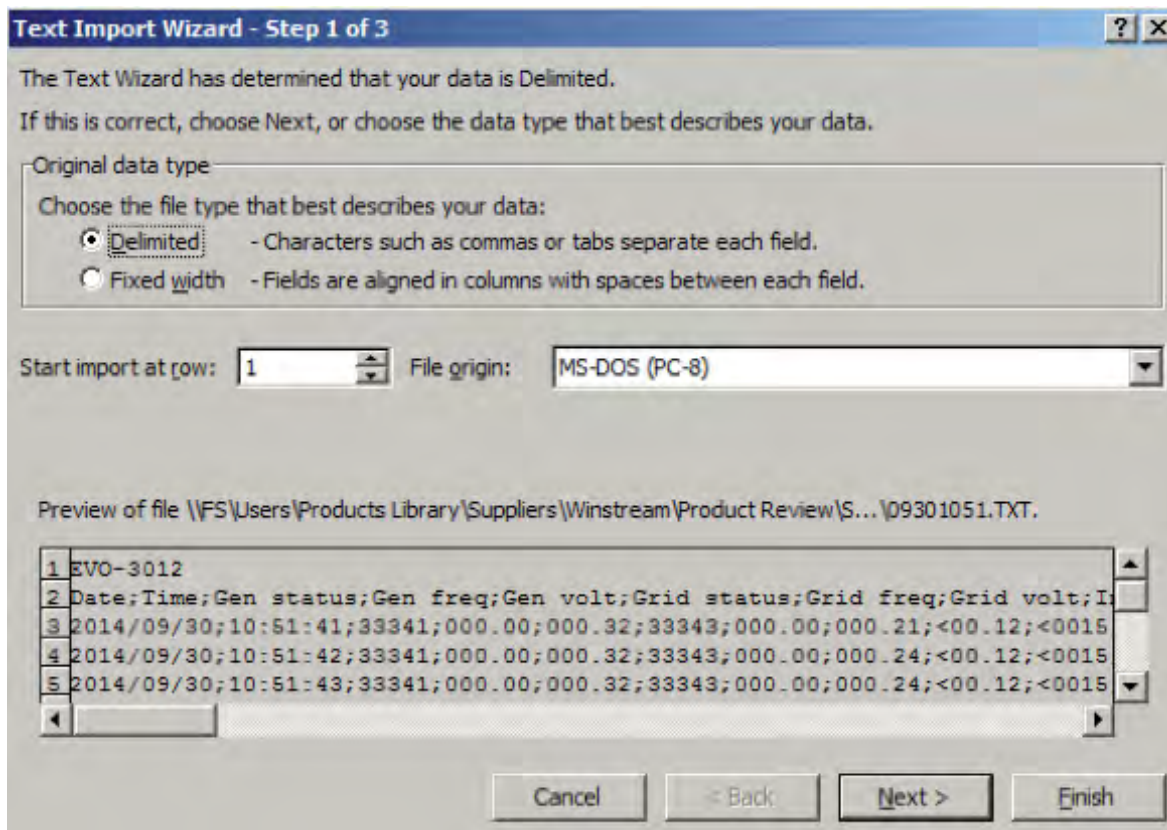
- Start Excel.
- Click File Microsoft Office Button on the top left hand corner.
- Click “Open” from the drop-down menu.
- Navigate to the directory where the Log files downloaded from the SD card are located.
- Click on “File Types” selection button at the bottom right corner (shows “All Excel Files” as default) and select text files from the drop-down menu.
- All text files (.txt) will be displayed.



Click “Open” button



Text Import Wizard – Step 1 will be shown. Choose “Delimited” file type.



**Text Import Wizard - Step 1 of 3**

The Text Wizard has determined that your data is Delimited.  
If this is correct, choose Next, or choose the data type that best describes your data.

Original data type

Choose the file type that best describes your data:

☒ **Delimited** - Characters such as commas or tabs separate each field.

☐ Fixed width - Fields are aligned in columns with spaces between each field.

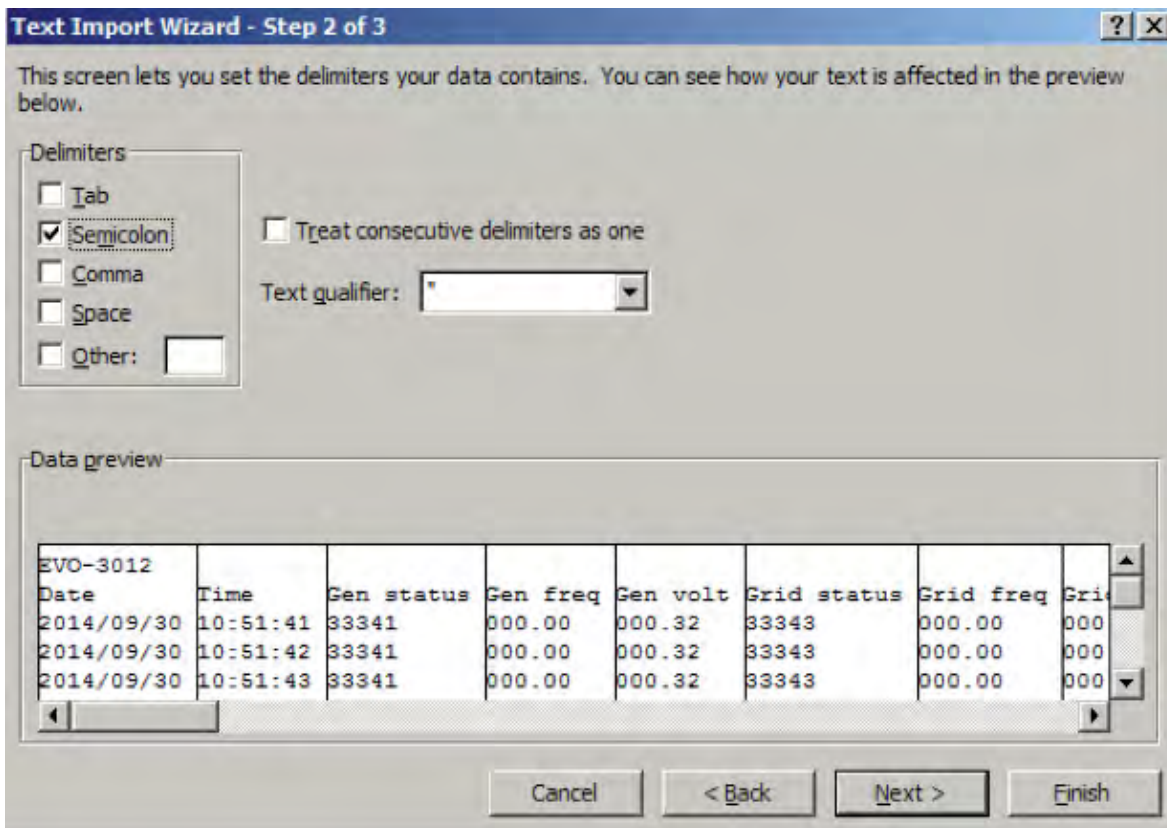
Start import at row:  File origin:

Preview of file \\FS\Users\Products Library\Suppliers\Winstream\Product Review\S... \09301051.TXT.

1	EVO-3012
2	Date;Time;Gen status;Gen freq;Gen volt;Grid status;Grid freq;Grid volt;I
3	2014/09/30;10:51:41;33341;000.00;000.32;33343;000.00;000.21;<00.12;<0015
4	2014/09/30;10:51:42;33341;000.00;000.32;33343;000.00;000.24;<00.12;<0015
5	2014/09/30;10:51:43;33341;000.00;000.32;33343;000.00;000.24;<00.12;<0015

Buttons: Cancel, < Back, Next >, Finish

Text Import Wizard – Step 2 will appear. Choose “Semicolon” and click Finish button.



**Text Import Wizard - Step 2 of 3**

This screen lets you set the delimiters your data contains. You can see how your text is affected in the preview below.

Delimiters

☐ Tab

☒ **Semicolon**

☐ Comma

☐ Space

☐ Other:

☐ Treat consecutive delimiters as one

Text qualifier:

Data preview

EVO-3012							
Date	Time	Gen status	Gen freq	Gen volt	Grid status	Grid freq	Grid
2014/09/30	10:51:41	33341	000.00	000.32	33343	000.00	000
2014/09/30	10:51:42	33341	000.00	000.32	33343	000.00	000
2014/09/30	10:51:43	33341	000.00	000.32	33343	000.00	000

Buttons: Cancel, < Back, Next >, Finish



Data will be displayed on a worksheet, with the log data stored in columns and rows.

AI		EVO-2224																									
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z		
EVO-2224																											
Date	Time	Gen status	Gen freq	Gen volt	Grid status	Grid freq	Grid volt	Input curve	Input VA	Input watt	Output freq	Output volt	Output cur	Output VA	Output watt	Battery vol	Battery cur	External cur	Battery temp	Transformer	Par bar	Watt	Watt	Watt	Watt	Watt	
2014/10/14	12:29:32	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27.1	0	0	0	0	
2014/10/14	12:29:42	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27.1	0	0	0	0	
2014/10/14	12:29:52	33340	0	0.62	33341	0	0.41	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27.1	0	0	0	0	
2014/10/14	12:29:02	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27.1	0	0	0	0	
2014/10/14	12:29:12	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27.1	0	0	0	0	
2014/10/14	12:29:22	33340	0	0.62	33341	0	0.41	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:29:32	33340	0	0.62	33341	0	0.41	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27	0	0	0	0	
2014/10/14	12:29:43	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27	0	0	0	0	
2014/10/14	12:29:53	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27	0	0	0	0	
2014/10/14	12:30:03	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27	0	0	0	0	
2014/10/14	12:30:13	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.7	27	0	0	0	0	
2014/10/14	12:30:23	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27	0	0	0	0	
2014/10/14	12:30:33	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:30:43	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.2	0	0	0	0	
2014/10/14	12:30:53	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:31:03	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:31:13	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:31:23	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:31:33	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:31:43	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:31:53	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:32:03	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.9	27.2	0	0	0	0	
2014/10/14	12:32:13	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.9	27.2	0	0	0	0	
2014/10/14	12:32:23	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.9	27.3	0	0	0	0	
2014/10/14	12:32:33	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.2	0	0	0	0	
2014/10/14	12:32:43	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.9	27.2	0	0	0	0	
2014/10/14	12:32:53	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:33:03	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:33:13	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:33:23	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27	0	0	0	0	
2014/10/14	12:33:33	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.43	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.9	27.1	0	0	0	0	
2014/10/14	12:33:43	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:33:53	33340	0	0.62	33341	0	0.42	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	
2014/10/14	12:34:03	33340	0	0.62	33341	0	0.41	-0.10	-0.012	-0.012	60	0.42	-0.10	-0.012	-0.012	25.002	0	0	25	26	26.8	27.1	0	0	0	0	

## The Power Hub 3500 User Interface

The user interface consists of an LCD screen and buttons for navigating Pages, Menu, and submenu items. Using the buttons and navigating the contents is simple and highly intuitive.

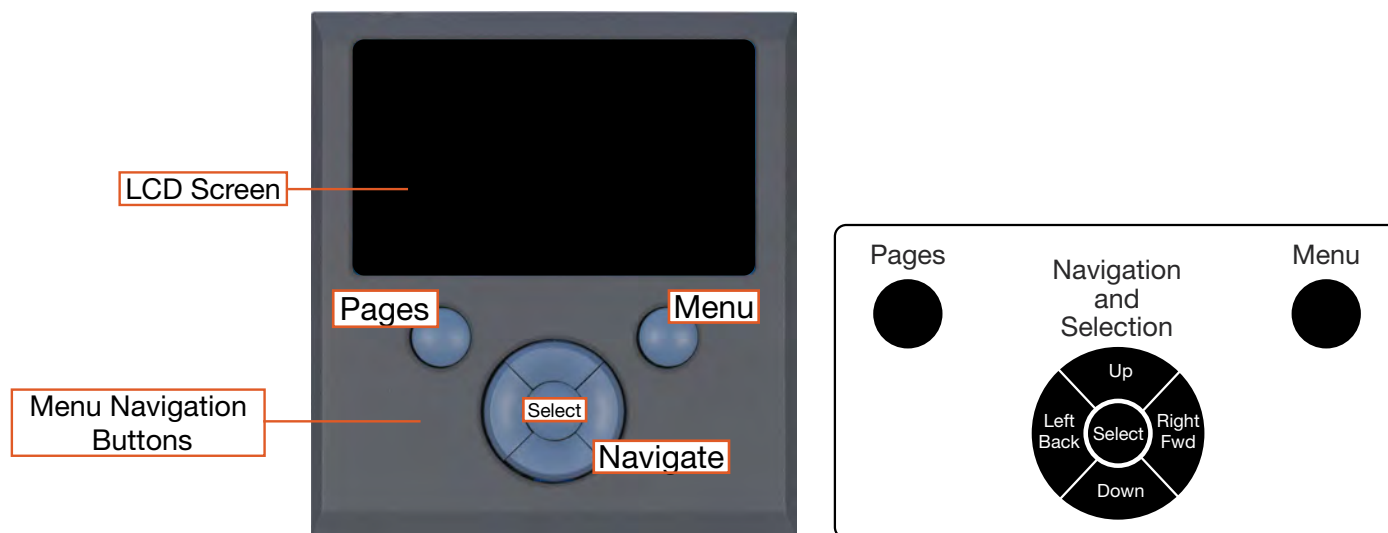


Figure 44. LCD user interface and navigation guide

### Pages Button

At the basic level, the information available from the user interface is as follows:

- Power from the PV arrays
- System battery bank voltage
- Net current flowing to or from the System batteries.

Depending on how the System is configured, the LCD shows capabilities that may or may not be utilized by the Power Hub, so icons and windows are visible but may contain "--", indicating no data. Consult the System Manual for additional information about available data and configuring for an application.



Figure 45. Data views displayed in "Pages"

**PV Charger Icon:** Reports the cumulative power from the PV arrays connected to the Power Hub. Specific information regarding the power being process by each of the two (2) solar charge controllers is reported in the device list displayed when pressing the Menu Button. Access to this information is described in the [Monitoring PV Power: Current and Historical](#) section.

**Battery Icon:** Reports battery SOC, voltage, and net current to/from the System battery. The SOC may be reported as “--” until the System batteries cycle enough to “learn” how to calculate accurately the SOC. Net battery current is the sum of all chargers and loads connected to the System batteries. A positive value is net charging; a negative value is net discharging. For example, +30 amps of charge current and -5 amps of load current will display a net current of +25.0 amps.

**Note:** The net negative current will be observed when the Power Hub is the primary power management device in the System. If the Power Hub is not the primary power management device in the System, obtain the battery SOC from the primary power management device instead.

**Status Icon:** Reports the time of day and “alarms”. A list of the alarms/notifications that may occur, their meanings, and their solutions is provided in subsequent sections of the manual.

**Note:** The charging current reported may be at or near 0.0 A when the batteries are charged fully, even if the PV arrays are in full sun.

## Menu Button

The Menu button provides access to more detailed information from the solar charge controllers and notifications (information about alarms if they occur). Push the Menu button once and the device list appears. This is the starting point for the detailed information about the solar chargers, System batteries (DC bus), notifications, and System settings. Use the navigation buttons of the user interface to navigate submenus under the menu items on the device list.

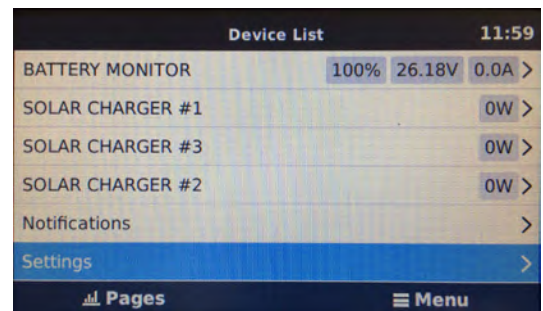


Figure 46. Device list on user interface

## Device List: Power Hub Circuits

The Device List is populated automatically by detecting the internal components of the Power Hub and as such is a list of the major functional circuits of the Power Hub.

### Battery Monitor Circuit

The battery monitor circuit reports the flow of power from the solar chargers, and other DC power sources onto the DC bus (batteries/Expander Paks) by measuring the DC bus current and voltage. More details about this circuit are in the [Monitoring System Batteries: Current and Historical](#) section.

### Solar Charger Circuits

The PV controls convert the higher voltage of the PV arrays so it is compatible with other 24 VDC components including batteries and power management. This circuit also uses an MPPT algorithm to extract maximum available power from PV arrays regardless of environmental conditions.

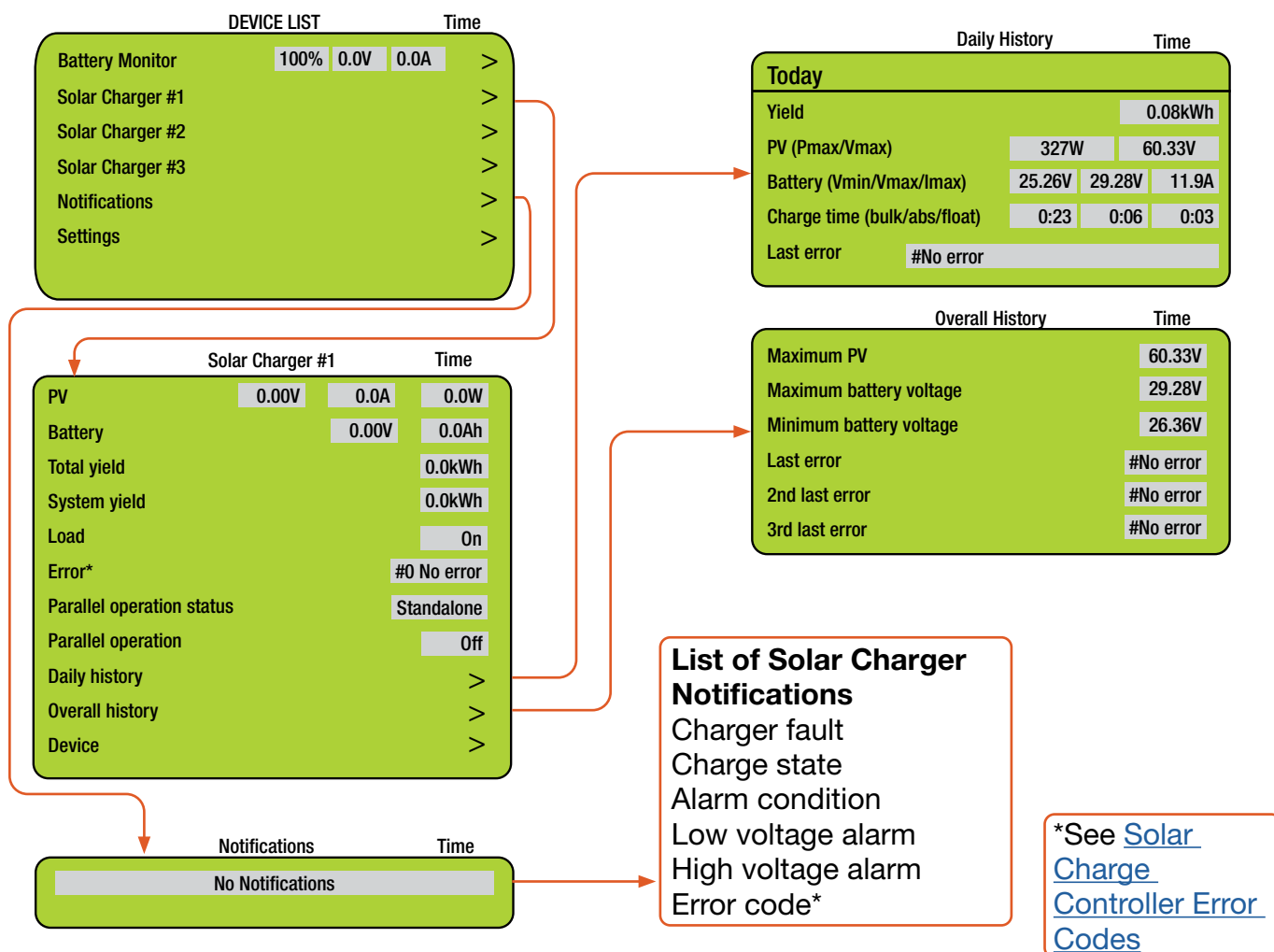
## Power Hub Local Time and Date

Set the Power Hub to the local time and date prior to operating or collecting any data to ensure all events are associated with accurate time stamps. To find the time and date settings, press the Menu button to display the device list. Use the down button to highlight the settings line then press Select. Use the down button to scroll to the “Date and Time” (see [User Interface Settings Menus](#)) and press Select. Change the values in the submenu windows to reflect the correct local time and date.

## Monitoring PV Power: Current and Historical

Press the Menu button one time to display the device list. The window that will appear is illustrated below. Solar Charger #1 and #2 will appear in lines 2–3. Use the Up/Down navigation buttons to highlight any of the solar chargers. Press Right or Select to open the menu windows specific for that solar charger. The window that appears (Solar Charger #1 in the illustration below) provides an extensive report of the current status for that solar charger. Historical reports for Solar Charger #1 can be displayed by navigating down to the “Daily History” and “Overall History” lines then pressing Right or Select. Data reported in those windows are displayed in the illustration below. Notifications and errors related to solar chargers are found in the Notifications and History Menus.

**Note:** Values shown in all of the menu windows will vary.



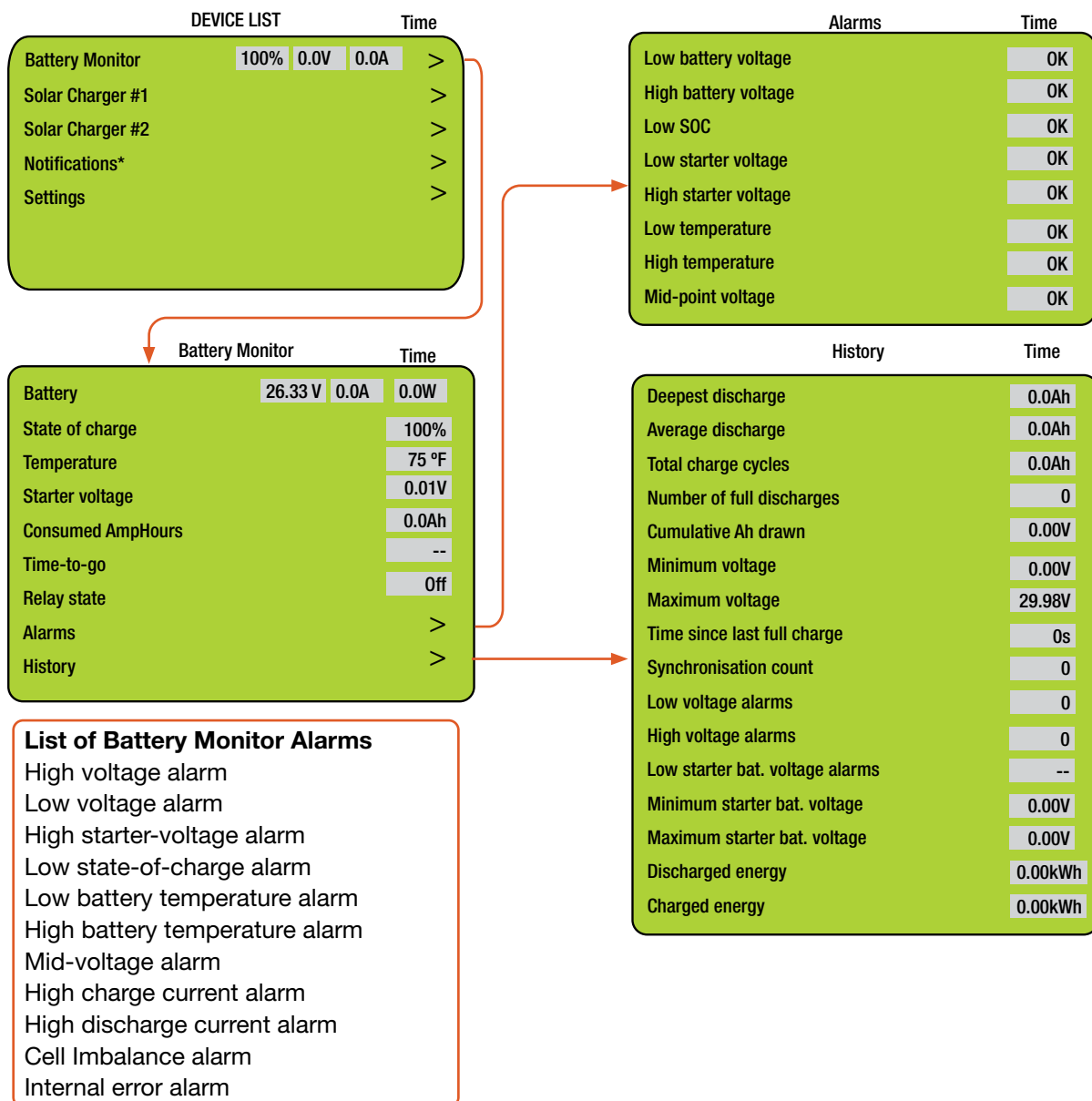
## PV Power: Understanding Reported Values

The Power Hub solar charge controllers report the power they process to the user interface. Checking these readings often, over extended periods of time, will establish what is “normal” in the system and give the operator a greater ability to identify and correct deviations from “normal”.

## Monitoring System Batteries: Current and Historical

Press the Menu button one time to display the device list. The window that will appear is illustrated below. The Battery Monitor will be the first device listed. Values for the current battery SOC, DC bus voltage, and current (amps) will appear in the fields on that line. Press the Select or Right button to open the Battery Monitor window to display current details about the batteries connected to the System. The temperature displayed here is the Power Hub internal temperature, not the temperature of the System batteries. Alarms and historical data related to the System batteries are found in the Alarms and History Menus.

As the System batteries approach a fully charged state, the charging current will approach zero (0) amps even if the sun is shining brightly and/or the generator is running. If this occurs, check the battery SOC to confirm that the batteries are nearing a full charge. If not approaching 100%, ensure the PV arrays are connected and functioning properly. Charging parameters can be changed if necessary. Please contact Solar Stik Technical Support for assistance.





## Heat and Derating

The function and efficiency of all electronic equipment is related to and dependent upon the temperature at which it is operating. All equipment performs optimally within a narrow temperature range and less so as the temperature exceeds the upper end of that range. PV panel output drops off significantly in high heat as well. The Power Hub generates heat as a by-product of processing incoming PV power. Under normal circumstances, the amount of heat generated in this way will not exceed the rated temperature for the Power Hub to function at its rated capacity.

## Causes of Overheating

The two (2) most common reasons for the Power Hub to overheat are high ambient temperature and solar loading (heat accumulation due to the sun shining directly the Power Hub). These two factors work together to elevate the internal operating temperature to the point where the solar chargers may automatically derate or even temporarily suspend output to prevent damage to their internal electronics. The solar chargers are rated to provide full power up to 104 °F (40 °C). Performance of the Power Hub will decline (charging current reduced) as the temperature increases or is sustained above this value.

**Note:** The charging current reported by the Power Hub battery monitor will also approach zero (0) A as the batteries approach a fully-charged state.

## Power Hub Internal Cooling

Thermostat-controlled, internal cooling fans turn on at ~104 °F (40 °C) to maintain the internal temperature within the optimal operating range. The fans are audible when operating. Clogged air intake filters can significantly exacerbate heat-related problems, so they should be cleaned as often as necessary to maintain maximum airflow. [Clean or replace the air filter](#) monthly, or more frequently if operating in very dusty environments. Do not operate the Power Hub in direct sunlight or directly on the ground. It should be placed in a shaded, well-ventilated location. Proper air filter maintenance and shading the Power Hub will help to ensure that the internal temperature does not reach critical levels.

## Power Hub Internal Temperature Report

The Power Hub has a sensor that measures and reports the internal temperature. The internal temperature of the Power Hub (NOT the batteries) is reported in the Battery Monitor menu page. To access this and other battery-related data, press the Menu button to show the device list. Select/highlight “Battery Monitor” and either right-click or press the Select button to display.

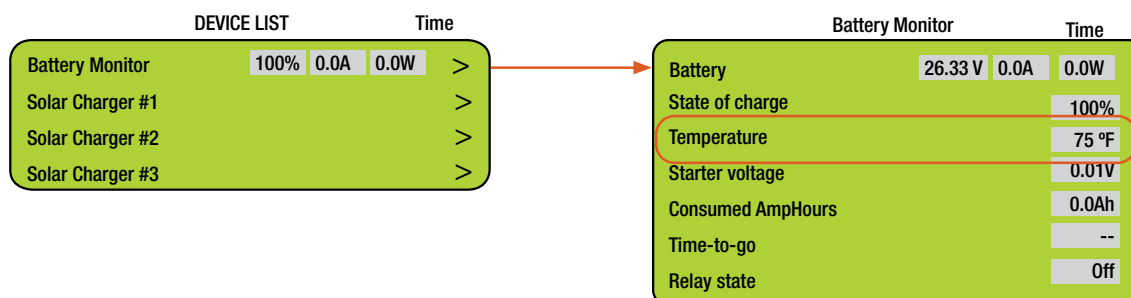
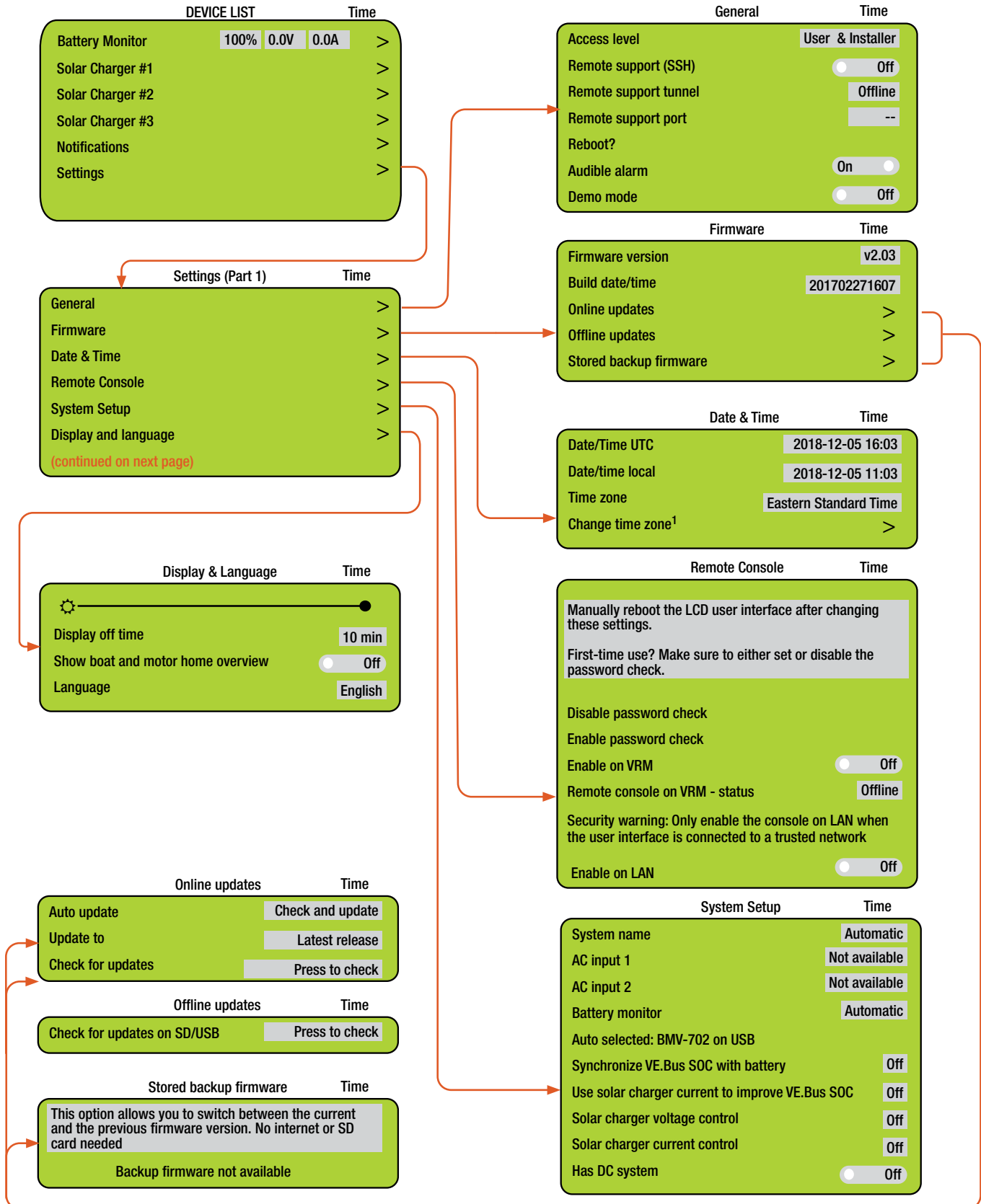
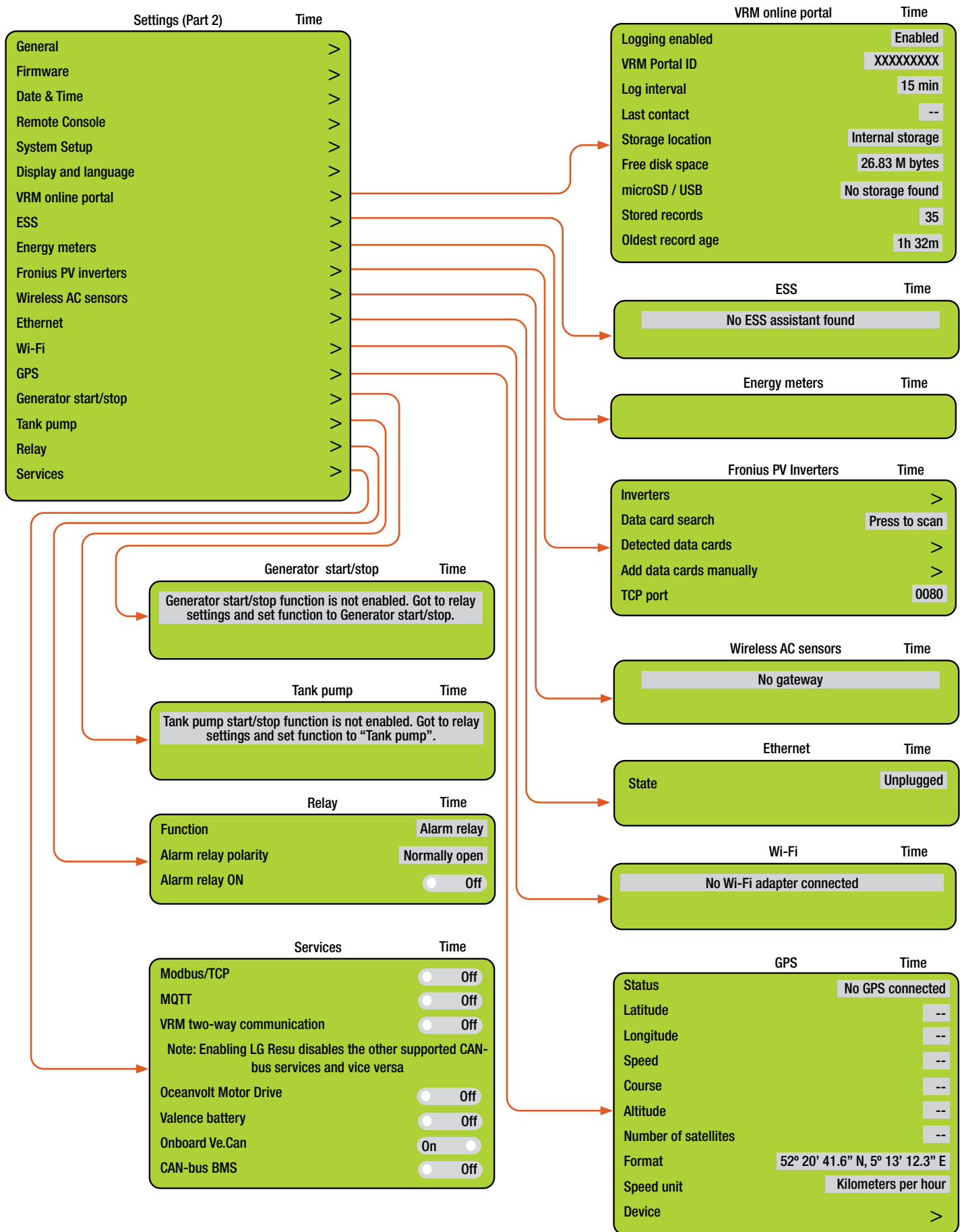


Figure 47. Power Hub internal temperature report on user interface

# Power Hub User Interface Settings Menus

Settings are accessed from the device list. The settings menus contain several parameters that may need to be changed during the course of normal operation. Many of the options are not relevant to the Power Hub.





# TROUBLESHOOTING PROCEDURES

## PRO-Verter/System Troubleshooting

### Generator Fault/Failure

If one (1) of two (2) generators running in tandem fails:

- Restart the generator or
- If the generator will not restart immediately, reprogram the PRO-Verter AC input setting to half the value for two (2) generators in tandem.

To reprogram generator AC Input.

1. Press ENTER button.
2. Press DOWN button to arrive at INPUT SETTING.
3. Press ENTER button.
4. Press DOWN button to arrive at GRID MAX CURRENT.
5. Press ENTER button and hold until number flashes.
6. Use UP or DOWN button to change number.
7. Press ENTER to move to next digit.
8. When correct value is entered, press and hold ENTER to save.

### Clearing PRO-Verter Faults

If any fault occurs, the user interface will display the Fault Message and the Red “Fault” LED will be lighted. Remove cause of the fault. The unit will remain in Fault Mode until the fault is cleared. A short press (0.1 seconds) of the On/Off key will clear the Fault Message and the PRO-Verter will return to the operational status (if the reason for the fault condition has been corrected). Refer to the section on [“Fault Messages”](#).

## System Recovery with Overdischarged Batteries

If batteries are discharged to a “critical-low” level, the system may cease to function. There are two (2) methods to restore a System with overdischarged batteries:

1. Connect an active 120 VAC power source to the PRO-Verter “Generator Input” connector. Turn on the 120 VAC generator input breaker on the Faceplate. When the LED over the System Recovery switch illuminates, toggle the recovery switch while pressing the user interface On/Off button. After the user interface powers up, release the System Recovery switch and the user interface On/Off button. The System will begin charging the batteries within two (2) minutes
2. Connect an active PV array (exposed to sun) to the PRO-Verter (or Power Hub 3500). Turn on the PRO-Verter user interface. Charging will begin when the PV input voltage is 5.0 VDC higher than the battery voltage.

## PRO-Verter Fault Messages and Troubleshooting Guides

Table 12. Fault Messages Symptoms and Troubleshooting

Fault Messages and Troubleshooting Guide	
Fault Message	Symptoms and Troubleshooting
Battery low voltage!	<p>PRO-Verter is in Fault mode because the battery voltage has dropped to the set lower threshold of Batt Low Voltage.</p> <ul style="list-style-type: none"> <li>When the battery voltage drops to the set lower threshold of Batt Low Voltage, activation of this fault protection is initiated. The red Fault LED will flash once per second and the alarm in PRO-Verter will beep once per second. The inverter will continue to operate normally and the blue Status LED will continue to be on steady. (<b>Note:</b> Fault message “Battery low voltage!” will not be displayed during this time.)</li> <li>If the battery voltage stays at or below the threshold setting for a duration equal to the set LV Detect Time, only the inverter will be switched off and fault message “Battery low voltage!” will be displayed. The red Fault LED will now change to steady on, the blue Status LED will switch off and the alarm in PRO-Verter will now beep steady. If the “Battery low voltage!” fault condition is not reset within the LV Cut Off Time, the PRO-Verter will shut down completely after the LV Cut Off Time (LCD screen/LED/Alarm will be off) has expired.</li> <li>If the batteries are being charged by the PV array and the battery voltage recovers to the set Reset Voltage before LV Cut Off Time time expires while in “Battery low voltage!” fault condition, the inverter will restart and “Battery low voltage!” fault condition will be cleared.</li> <li>While in “Battery low voltage!” fault condition, if AC input is made available before the expiration of LV Cut Off Time, the “Battery low voltage!” fault condition will be cleared. The PRO-Verter will restart in Inverting mode, synchronize with the AC input, and then transfer to the AC input at zero crossing. It will now operate in Charging mode.</li> </ul>
Battery ultra low voltage!	<p>The PRO-Verter is in Fault mode because the battery voltage has dropped to 18 V or lower. (<b>Note: A voltage this low will not be encountered when using LiFePO<sub>4</sub> batteries because the battery's own BMS will disconnect the output terminals before the voltage drops that low.</b>)</p>

Continued on next page



Fault Messages and Troubleshooting Guide	
Fault Message	Symptoms and Troubleshooting
<b>Battery over voltage!</b>	<p>The PRO-Verter is in FAULT MODE because the battery voltage has risen to the programmed upper threshold of “BATT OVER VOLTAGE”.</p> <p><b>(a) AC input is not available and PRO-Verter is operating in Inverting Mode:</b></p> <ul style="list-style-type: none"> <li>There will be no AC output because the Inverter will be switched OFF. The Blue “Status” LED will be switched OFF and the Red “Fault LED” will be steady ON. The alarm will beep steady.</li> <li>The fault will be cleared automatically when the battery voltage drops to 0.5V below the set upper threshold of “BATT OVER VOLT”.</li> </ul> <p><b>(b) AC input is available and PRO-Verter is operating in Charging Mode:</b></p> <ul style="list-style-type: none"> <li>There will be no AC output or charging because the Transfer Relay will be de-energized and PWM drive to the Inverter will be switched OFF.</li> <li>The fault will be cleared automatically when the battery voltage drops to 0.5V below to the set upper threshold of “BATT OVER VOLT”. The PRO-Verter will restart in Inverting Mode, synchronize with the AC input and then, the Transfer Relay will be energized to transfer to AC input at zero crossing. The PRO-Verter will, thus, resume operation in “Charging Mode”.</li> </ul>
<b>Input over current!</b>	<p>The PRO-Verter is in FAULT MODE because the input current being drawn from the AC input source (Input current = Charging Current + Pass Through Current to the load) is 1A more than the set threshold of “ GRID MAX CURRENT” / “GEN MAX CURRENT” for 5 seconds (current is sampled every 33.3 <math>\mu</math>s).</p> <ul style="list-style-type: none"> <li>There will be no AC output because the Transfer Relay will be de-energized, charging will be stopped and PWM drive to the Inverter Section will be switched OFF. The Blue LED marked “Status” will be switched OFF and the Red LED marked “Fault” will be steady ON. The alarm in PRO-Verter will beep steady.</li> <li>PRO-Verter will be turned off and will require manual reset by turning OFF the main breaker, waiting for 1 minute and then turning ON the main breaker.</li> <li>The set threshold of “ GRID MAX CURRENT” / “GEN MAX CURRENT” should match the breaker capacity of the AC input source / AC input Branch Circuit. If AC input current capacity cannot be increased, reduce the AC load / “BULK CURRENT” accordingly.</li> </ul>
<b>Output over current!</b>	<p>The PRO-Verter is in FAULT MODE because the instantaneous output current being drawn from the PRO-Verter inverter by the AC load is 330% of the rated value of the PRO-Verter for 2 samples (current is sampled every 33.3 <math>\mu</math>s).</p> <ul style="list-style-type: none"> <li>There will be no AC output because the PRO-Verter inverter will be switched OFF. The Blue LED marked “Status” will be switched OFF and the Red LED marked “Fault” will be steady ON. The alarm will beep steady.</li> <li>PRO-Verter will be OFF and will require manual reset by powering OFF, waiting for 1 minute and then powering ON again.</li> <li>Ensure that the maximum, instantaneous surge current of the load is NOT more than 300% (30 A) of the rated current (10 A) of the inverter for more than 1 millisecond.</li> </ul>

Continued on next page

Fault Messages and Troubleshooting Guide	
Fault Message	Symptoms and Troubleshooting
<b>Output over load!</b>	<p>The PRO-Verter is in Fault mode because of overload to the inverter:</p> <ul style="list-style-type: none"> <li>There will be no AC output because the Inverter will be switched off. The blue Status LED will be switched off and the red Fault LED will be steady on. The alarm in PRO-Verter will beep steady.</li> <li>PRO-Verter will shut down and will require manual reset by turning off the main power switch, waiting for 1 minute, and then turning on the main power switch.</li> </ul>
<b>Output over load 1!</b>	Output voltage is less than $96 V_{rms}$ for 300 cycles (5 seconds at 60 Hz).
<b>Output over load 2!</b>	Output power demand is over the rated output by 110% for 30 min.
<b>Output over load 3!</b>	Output power demand is 120% of rated output for 10 min.
<b>Output over load 4!</b>	Output power demand is 140% of rated output for 1 min.
<b>Output short circuit!</b>	<p>Output power demand is 150% of rated output for 30 sec.</p> <p>The PRO-Verter is in Fault mode because there is a short circuit on the output side in Inverting mode. Short circuit protection is activated when: Output voltage <math>&lt; 15 V_{rms}</math> for 6 cycles and output current is more than the rated output current of <math>10.00 A_{rms}</math>.</p> <ul style="list-style-type: none"> <li>There is no AC output because the inverter has been switched off. The blue Status LED will be switched off and the red Fault LED will be steady on. The alarm will beep steady.</li> <li>The PRO-Verter will be turned off and will require manual reset by powering off, waiting for 1 minute, and then powering on again.</li> </ul> <p><b>Note:</b> If there is short circuit condition in Charging mode, i.e., when AC input is available, short circuit condition on the output side will trip the AC input breaker. The load will be transferred to the inverter and the inverter will then see short circuit condition and will shut down as described above.</p>
<b>Output failure!</b>	<p>The PRO-Verter is in Fault mode because AC input from grid/generator has been connected to the AC output terminals by mistake. 10 VAC or above detected at the AC output terminals when the PRO-Verter boots up will activate this protection.</p> <ul style="list-style-type: none"> <li>The blue Status LED will be switched off and the red Fault LED will be steady on. The alarm in will beep steady.</li> <li>The PRO-Verter will be turned off and will require manual reset by powering off, waiting for 1 minute, and then powering on again. Check the connection. If there is 10 VAC or over at the output terminal, remove the connection and connect to the input terminals.</li> </ul>
<b>Transformer over heat!</b>	<p>The PRO-Verter is in Fault mode because the bidirectional transformer in the PRO-Verter has overheated to <math>150^{\circ}\text{C}</math>.</p> <ul style="list-style-type: none"> <li>The blue Status LED will be switched off and the red Fault LED will be steady on. The alarm will beep steady.</li> <li>If in Inverting mode, inverter will be switched off. If in Charging mode, the transfer relay will be de-energized and the inverter will be switched off.</li> <li>Ensure the fans are working properly, there is no blockage of air flow, there is adequate airflow, and the ambient temperature is within the limits. Reduce the load/Bulk Current.</li> <li>The fault will clear when the transformer has cooled down to <math>80^{\circ}\text{C}</math>.</li> </ul>

Continued on next page

Fault Messages and Troubleshooting Guide	
Fault Message	Symptoms and Troubleshooting
<b>Heat sink over heat!</b>	<p>The PRO-Verter is in Fault mode because the internal heat sink in the PRO-Verter has overheated to 70°C.</p> <ul style="list-style-type: none"> <li>The blue Status LED will be switched off and the red Fault LED will be steady on. The alarm will beep steady.</li> <li>If in Inverting mode, the inverter will be switched off. If in Charging mode, the transfer relay will be de-energized and the inverter will be switched off.</li> <li>Check that the fans are working properly, there is no blockage of air suction and discharge vents, adequate cool replacement air is available, and the ambient temperature is within the limits. Reduce the load and Bulk Current.</li> <li>The fault will be cleared when the heat sink has cooled down to 40°C.</li> </ul>
<b>SD card unusable!</b>	<ul style="list-style-type: none"> <li>Data logging will not start.</li> <li>Check that the format is FAT16/FAT32.</li> <li>Check that the capacity is less than 16 GB.</li> <li>Reformat the card.</li> </ul>
<b>SD card read error!</b>	<ul style="list-style-type: none"> <li>Data logging stops.</li> <li>Remove and reinsert the card.</li> </ul>
<b>SD card write error!</b>	<ul style="list-style-type: none"> <li>Data logging stops.</li> <li>Remove and reinsert the card.</li> </ul>
<b>SD card full!</b>	<ul style="list-style-type: none"> <li>Data logging stops.</li> <li>Move or delete files or reformat the card.</li> </ul>
<b>WRITE FAILURE!</b>	The entered value of programmable parameter could not be written.
<b>OUT OF RANGE!</b>	The entered value of programmable parameter is out of the programmable range. Change parameter value to within the specified range.

## Power Hub 3500 Troubleshooting Procedures

### Power Hub Will Not Power Up

If the Power Hub 3500 is not powered up, it probably is not connected to an active 24 VDC battery and/or there is no PV input. The LCD user interface will power up and be navigable when connected to either of these power sources. Power from PV arrays will charge batteries once the voltage from the arrays is 5 volts greater than the battery voltage then continue charging as long as the voltage from the PV arrays is 1 volt higher than that of the batteries.

## Performance Issues, Causes, and Solutions

Table 13. Symptoms and Solutions for the Most Common Power Hub Issues

Symptom	Possible Cause(s)	Solution
Battery SOC displays "--".	Battery not fully charged for an extended period or has not been cycled enough times for the user interface to calculate SOC.	Try to charge the battery fully often. Refer to the setup diagram to make sure that the System is assembled correctly.
Battery SOC seems inaccurate	Power Hub is not the primary power management device.	Normal operation. Read battery SOC from primary management device (e.g., PRO-Verter)
Not registering charge current with panels operating in sun	1. Power Hub overheated  2. Batteries fully charged (29.0 VDC or near to that)	1. Check internal temperature and "battery" temperature on user interface. Derating begins at 104 °F; diminishing power as temp approaches 140 °F. Check for dirty, blocked air filters. Shade the Power Hub to reduce solar loading. Ensure that the internal cooling fans are operating (audible when operating).  2. Normal operation.
LCD inoperative	1. No power to the Hub  2. The LCD screen is overheated/sunlight exposure	1. Check connections and make sure batteries are active.  2. Close lid and allow Power Hub to cool down.

**Note:** The battery SOC and related readouts on the Power Hub 3500 LCD user interface are precise ONLY if the batteries are connected directly to the Power Hub 3500. If the batteries are connected to the PRO-Verter (indirectly to the Power Hub 3500), then information about the battery SOC and other parameters should be obtained from the PRO-Verter user interface or the optional RMK.

## Step 1. Create a user account

1. Go to <https://vrn.victronenergy.com>.
2. Click 'Register for Free'.
3. Complete all the requested information.
4. A confirmation email will arrive to the registered account with a link to activate your account.

Account creation is now finished. Click 'Add Installation' to continue pairing the Power Hub to this user account. Each step will be prompted.

## Step 2. Add the Power Hub to the user account

**Note:** Make sure the Power Hub has already started communicating with the VRM Portal. Or, in case it is an off-grid installation where an SD card is used, first upload the data file.

Adding a Power Hub "Installation" is only possible after the VRM Portal has received the first data transmission from the Power Hub user interface.

Steps to add an installation:

1. Select the product you want to add.
2. Enter the IMEI or MAC Address number for the color control/user interface.
3. Click 'Add' and your device is now paired with your VRM user account.

**Note:** In case you are the first user to add this installation to your account, you will automatically have Admin rights for this installation. Any subsequent users who add this installation to their account will become a normal user without the ability to change any settings. An Admin user can assign Admin rights to other users on the Settings page.

The Dashboard screen will appear with intuitive, interactive elements.



# Power Hub 3500 Data Logging and Remote Monitoring

## Performance and Troubleshooting

The Power Hub user interface monitors and reports Power Hub-,PV-, and battery-related data in real time. These data are also stored in the user interface and provide a historical record of these events over time.

A complete list of the historical information available for PV power performance is found in [Monitoring PV Power: Current and Historical](#). The list for battery-related information is found in [Monitoring System Batteries: Current and Historical](#). Understanding the battery-related information will depend on how the Power Hub is being used. Please see the [Battery Monitor: Understanding Reported Values](#) section. [Error codes](#) related to the solar charge controllers and notifications are accessed in: Menu > Device List > [Notifications](#).

These historical records can assist in troubleshooting and maintaining peak performance of the Power Hub and connected components such as PV arrays and batteries.

Performance, both current and historical can be monitored offline or online using a third-party application called the Victron Remote Monitoring (VRM) Portal. These methods are described in the following sections.

## Data Storage and Retrieval

The built-in nonvolatile storage can contain 48 hours worth of data. To extend this period, insert a micro SD card into the port on the bottom side of the user interface (Figure 27). The user interface will automatically transfer any data that may reside on the internal storage to it and will start using this external memory as backlog buffer.

A data logging interval of once per minute, will require about 25 MB per month, depending on the number of connected products. So with a 1 GB micro SD card, about 3 years of data can be stored. In other words, any micro SD card should be sufficient to store the 6 months of data.



Figure 48. Micro SD card port location

When the storage device is full, no more data will be logged. This is due to the nature of Sqlite (a software library and file type) files. Removing data from the Sqlite database doesn't free up usable disk space, and because of internal fragmentation, it doesn't guarantee more data storage.

If the Power Hub is connected to the internet (Tech Port) past and current data stored on a microSD card can be uploaded to VRM Portal. If the internet connection is intermittent data stored on the microSD card can be automatically uploaded to the VRM Portal each time the connection is reestablished. Instructions for accessing the VRM Portal are provided in Remote Monitoring below.

If the Power Hub is not connected to the internet, the user can upload the data backlog manually to the VRM Portal by using the following protocol. The first step is to use the Settings window to eject the storage; don't just remove the SD card (Settings > VRM online portal > Micro SD / USB). The storage device can then be removed from the user interface and inserted into a computer or laptop; the data file on it can be uploaded on the VRM Portal with the 'Upload CCGX File' option.

It's important to know that when the micro SD card is reinserted, the existing buffer—including its data—is used again. This allows for removing the micro SD card temporarily for whatever reason, but this also means when the data file has been uploaded to VRM, it needs to be renamed or cleared from the micro SD card before reinserting, otherwise the data will be transmitted again, sooner or later, online or offline.

## MicroSD Card Formatting

Micro SD cards must be formatted as FAT12, FAT16, or FAT32 file systems—not as exFAT or NTFS.

SD- and SDHC-type micro SD cards of 32 GB capacity and smaller are sold containing FAT12, FAT16, or FAT32. They can be used without a problem, unless they are subsequently reformatted to a different file system.

SDXC-type micro SD cards with greater than 32 GB capacity are often formatted with exFAT and therefore cannot be used with the user interface without reformatting and possibly repartitioning.

## Power Hub Remote Monitoring

When the Power Hub is connected to the internet using the Tech Port, both current and historical performance data from the Power Hub can be monitored remotely. The information provide by the VRM Portal and how to use that information is describe in Performance Remote monitoring requires access to the VRM Portal. Instructions for accessing the VRM Portal are provided below.

### Getting Started

The process is straight forward and self guiding. First, create a VRM user account. And after that the installation, needs to be paired with that user account. It is possible to pair one installation to multiple user accounts.

### Requirements

- A computer connected to the internet
- The VRM Portal ID, which uniquely identifies your system
- Power Hub LCD user interface: The VRM Portal ID can be found in the menu Settings > VRM Logger. It looks like this: be300d83ff04.

## Solar Charge Controller Error Codes

Detailed error codes can be read with a user interface. **The vast majority of these errors will not be encountered when the Power Hub is operating in concert with other HPS components.**

### Err 2 - Battery voltage too high

This error will auto-reset after the battery voltage has dropped. This error can be due to other charging equipment connected to the battery or a fault in the solar charge controller. This error can also occur if the battery voltage is set to a lower voltage than the actual battery voltage (e.g., 12 VDC for a 24 VDC battery).

### Err 3, Err 4 - Remote temperature sensor failure

Check if the T-sense connector is properly connected to a remote temperature sensor. Most likely cause: the remote T-sense connector is connected to the BAT+ or BAT- terminal. This error will auto-reset after proper connection.

### Err 5 - Remote temperature sensor failure (connection lost)

Check if the T-sense connector is properly connected to a remote temperature sensor. This error will not auto-reset.

### Err 6, Err 7 - Remote battery voltage sense failure

Check if the V-sense connector is properly connected to the battery terminals. Most likely cause: the remote V-sense connector is connected in reverse polarity to the BAT+ or BAT- terminals.

### Err 8 - Remote battery voltage sense failure (connection lost)

Check if the V-sense connector is properly connected to the battery terminals.

### Err 17 - Controller overheated despite reduced output current

This error will auto-reset after the solar charge controller has cooled down. Check the ambient temperature and check for obstructions in the ventilation filters. Shade the Power Hub.

### Err 18 - Controller over-current

This error will auto-reset. If the error does not auto-reset disconnect the solar charge controller from all power-sources, wait 3 minutes, and power up again. If the error persists the solar charge controller is probably faulty. A cause for this error can be switching on a very large load on the battery side.

### Err 20 - Maximum Bulk-time exceeded

This error can only occur when the maximum bulk-time protection is active. This error will not auto-reset. This error is generated when the battery-absorption-voltage is not reached after 10 hours of charging.

**Note:** This protection is default disabled in all solar charge controllers. Do not enable it.

### Err 21 - Current sensor issue

This error will not auto-reset. Disconnect all wires, and then reconnect all wires. Also, make sure the minus on the MPPT solar charge controller (PV minus/Battery minus) is not bypassing the solar charge controller.

If the error remains, please contact Solar Stik Technical Support.

### Err 26 - Terminal overheated

Power terminals overheated, check wiring, including the wiring type and type of strands, and/or fasten bolts if possible. This error will auto-reset.

### Err 28 - Power stage issue

This error will not auto-reset. Disconnect all wires, and then reconnect all wires. If the error persists the solar charge controller is probably faulty. Contact Solar Stik Technical Support.

### Err 33 - PV over-voltage

This error will auto-reset after PV voltage has dropped to safe limit. This error is an indication that the PV-array configuration with regard to open-circuit voltage is critical. Check the PV panel spec, configuration, and if required, reorganize panels.

### Err 34 - PV over-current

The current from the PV-panel array has exceeded 75 A. This error could be generated due to an internal system fault. Disconnect the Power Hub from all power-sources, wait 3 minutes, and power-up again. If the error persists the controller is probably faulty, contact Solar Stik Technical Support.

### Err 38, Err 39 - PV Input shutdown

To protect the battery from over-charging the panel input is shorted. Possible reasons for this error to occur:

- There is another device connected to the battery, which is configured to a higher voltage.
- The battery is disconnected using a manual switch. Ideally the charger should be switched off before disconnecting the battery to avoid a voltage overshoot on the charger output. If necessary the voltage trip-level for the PV short protection can be increased by raising the equalization voltage set-point. (**Note:** Equalization does not have to be enabled in this case.)

Error recovery:

- **Error 38:** First disconnect the PV panels and disconnect the battery. Wait for 3 minutes, then reconnect the battery first and next the panels.
- **Error 39:** The Power Hub will automatically resume operation once the battery voltage drops below the max charge level for 1 minute.

If the error persists the one or more solar charge controller is probably faulty. Contact Solar Stik Technical Support.

### Err 65 - Communication warning

Communication with one of the paralleled controllers in the Power Hub was lost. To clear the warning, cycle the power to the Power Hub.

### Err 114 - CPU temperature too high

This error will reset after the CPU has cooled down. If the error persists, check the ambient temperature and check and or clean the air filters. Shade the Power Hub to reduce solar loading.

### Err 116 - Calibration data lost

If the unit does not work and error 116 pops up as the active error, the unit is faulty. Contact Solar Stik Technical Support.

If the error is only present in the history data and the unit operates normally this error can be ignored safely. **Explanation:** When the units power up for the very first time, it does not have calibration data and an error 116 is logged.

### Err 119 - Settings data lost

The Power Hub cannot read its configuration, and stopped. This error will not auto-reset. To get it working again:

1. Restore it to factory defaults. Contact Solar Stik Technical Support for the values.
2. Disconnect the Power Hub from all power-sources, wait 3 minutes, and power up again.
3. Reconfigure the Power Hub.



# MAINTENANCE INSTRUCTIONS

## 24VDC PRO-Verter S 3000 PMCS

Table 14. 24VDC PRO-Verter S 3000-120 PMCS

Item #	Item to be Inspected	Interval	Procedures	Non-mission Capable
1	Visual inspection of 24VDC PRO-Verter S 3000	M	<ol style="list-style-type: none"> <li>1. Inspect case for visible damage and missing items.</li> <li>2. Clean excessive dust or dirt accumulation from the exterior, interior and connectors.</li> <li>3. Close all unused port covers.</li> </ol>	~If the case is broken or split or if connectors are damaged, do not place into service.
2	Air Intake Filters	M <sup>1</sup>	<ol style="list-style-type: none"> <li>1. Remove the three (3) air intake vent covers to expose the filter material. (See PRO-Verter Manual for location of air intake filters.)</li> <li>2. Wash with water and dry the filter. Reinstall.</li> <li>3. If the filter is damaged or cannot be cleaned replace.</li> </ol>	~If the filter cannot be cleaned, is too damaged to function properly and a replacement is not immediately available, the unit is partially mission capable. Replace the filter as soon as possible to restore the unit to fully mission capable.

<sup>1</sup>Clean or replace more frequently when the System is operating in dusty, windy environments

## PRO-Verter Filter Removal and Cleaning or Replacement

1. Use a #2 cross-tip screwdriver to remove the four (4) fasteners from the vent shroud and remove the louvered vent cover to access the filter.

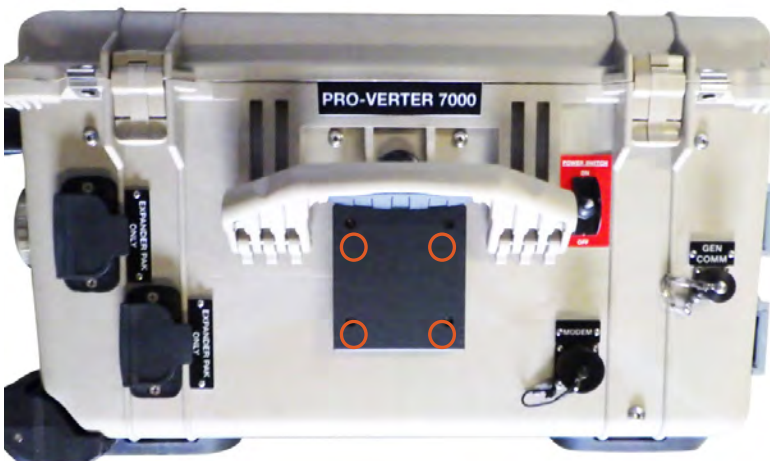


Figure 49. Fastener locations on vent shroud (upgraded/new version)



Figure 50. Removed vent shroud to access the louvered vent cover

2. Remove and inspect the filter. Replace the filter if it is damaged (arrows in Figure 51). If the filter is in good shape, clean it by rinsing it with water to remove the particulate matter and dry it. Replace the filter if it is crushed, rotted, or cracked as illustrated in the left column of Figure 51. Spare filters may be stored behind the PRO-Verter I-Plate.



Figure 51. Replacing PRO-Verter filter (left); cleaning a PRO-Verter filter (right)

3. Reinstall the clean, dry filter or install the new filter. Secure the vent shroud with the four (4) fasteners.

## 24VDC Power Hub 3500 PMCS

Table 15. 24VDC Power Hub 2400 PMCS

Item #	Item to be Inspected	Interval	Procedures	Non-mission Capable
1	Visual inspection of 24VDC Power Hub 2400	M	<ol style="list-style-type: none"> <li>1. Inspect case for visible damage and missing items.</li> <li>2. Clean excessive dust or dirt accumulation from the exterior, interior and connectors.</li> <li>3. Close all unused port covers.</li> </ol>	~If the case is broken or split or if connectors are damaged, do not place into service.
2	Air Intake Filters	M <sup>1</sup>	<ol style="list-style-type: none"> <li>1. Remove the air intake vent covers to expose the filter material. (See Power Hub Manual for location of air intake filters.)</li> <li>2. Wash with water and dry the filter. Reinstall.</li> <li>3. If the filter is damaged or cannot be cleaned replace.</li> </ol>	~If the filter cannot be cleaned, is too damaged to function properly and a replacement is not immediately available, the unit is partially mission capable. Replace the filter as soon as possible to restore the unit to fully mission capable.

<sup>1</sup>Clean or replace more frequently when the System is operating in dusty, windy environments

## Power Hub Filter Removal and Cleaning or Replacement

The air intake vent and filter are on the back of the Power Hub. The louvered vent cover is secured by two (2) cross tip screws, one on each side. A fine cross tip screwdriver or angle driver will be required to remove the screws (Figure 52A). After exposing the filter (Figure 52B), lift it from the vent and wash thoroughly with water, dry thoroughly and reinstall (Figure 52C). IF THE FILTER IS DAMAGED REPLACE IT INSTEAD. Spare filters may be stored behind the Power Hub I-Plate. Ensure the leading edge of the louvers are facing downward.



Figure 52. Cleaning the air intake filter

# PDM 3000 PMCS

The PDM 3000 case is sealed. No maintenance of internal parts is required or advised.

Table 16. PDM 3000 PMCS

Item #	Item to be Inspected	Interval	Procedures	Non-mission Capable
1	Visual inspection of PDM 3000	M	<div>1. Inspect case for visible damage and missing items.</div> <div>2. Clean excessive dust or dirt accumulation from the exterior, interior and connectors.</div> <div>3. Close all unused port covers.</div>	<div>~If the case is broken or split or if connectors are damaged, do not place into service.</div> <div>~Clean any dirt or debris that has accumulated in the cutouts on the bottom.</div>

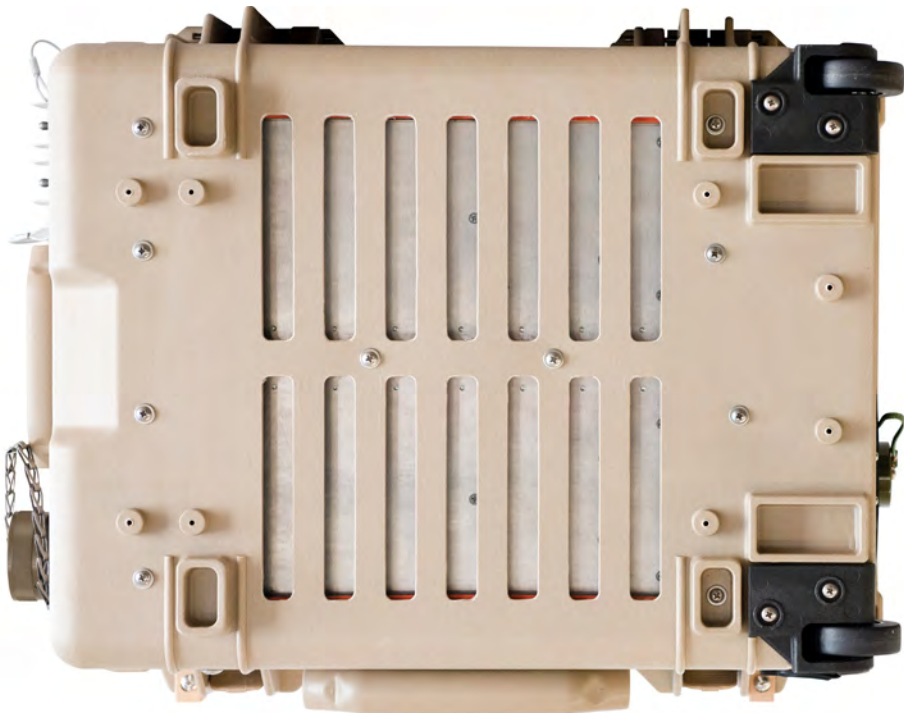


Figure 53. PDM 3000 bottom side



## Locking Component Cases to Prevent Tampering

The Power Hub 3500 can be secured with a padlock to deter tampering. Four (4) latches allow the case to be sealed to prevent damage to the internal components from environmental factors. Additionally, two (2) sets of steel-reinforced holes, one (1) in the lid and one (1) in the base of the case, flank the latches on the front of the case. A lock similar to the one shown in Figure 55 is recommended; not all locks are compatible.

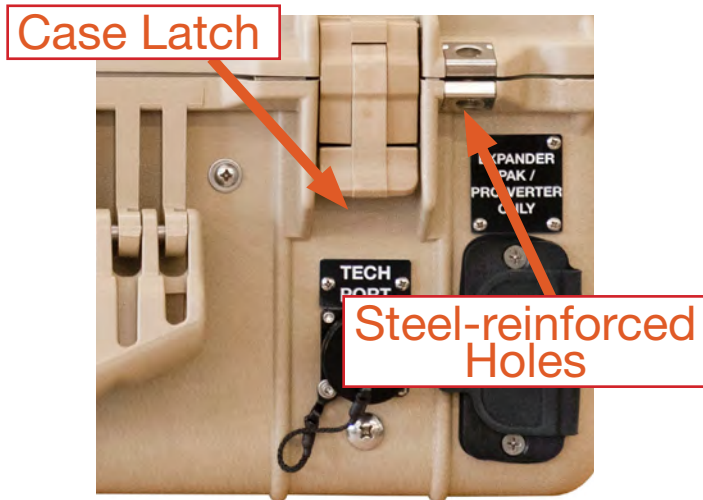


Figure 54. Steel-reinforced padlock holes



Figure 55. Lock securing Power Hub lid



## Transporting Components

The Power Hub and PDM transport like a briefcase using the case handles (arrows). The PRO-Verter has wheels and an extendible pull handle, enabling it to roll easily on appropriate surfaces. There are no transport restrictions for these components, which are safe for all modes of transportation, including land, sea, and air.



Figure 56. Component transportation—Wheels and handles

# Warranty and Returns

## Return Material Authorization

If Customer believes a Product is defective, a Return Material Authorization (RMA) number must be obtained from Solar Stik prior to shipment of such Product back to Solar Stik. The RMA number must appear on all packages returned to Solar Stik and be referred to in all related correspondence. Return shipment of the Product for which damages are claimed shall be at Customer's expense, and such Products shall not be returned, repaired, or discarded without Solar Stik's written consent. Returned Products will be subject to inspection and final determination as to whether or not any adjustment is due. If the inspection shows the warranty for the Product is breached, the provision of WARRANTY (below) will apply. Solar Stik advises that Customer order recommended spares and maintenance parts, especially for critical OCONUS operations. Otherwise Customer may experience system downtime during the return and inspection of nonworking components.

## Warranty

1. Solar Stik warrants, unless otherwise agreed to between buyer and seller (Solar Stik, Inc.), for a period of one (1) year from Solar Stik's delivery of such Products, the Products shall be free from defects in materials and workmanship and shall conform to the contractual specifications or to specification sheet of the Product. This warranty does not cover defects or failure caused by improper handling, storage, maintenance, or repair or by any modification, misconnection, abuse, abnormal use of such Products (inter alia, overloading or overcharging) or use not complying with Solar Stik's user manual provisions if any.
2. Warranty claims must be made to Solar Stik immediately after discovering the defect and within the warranty period or are forever waived.
3. The foregoing warranty is exclusive of any other warranties, express, implied or statutory. In particular, this warranty shall not apply to failure arising from defect in design when the design has been completed in part by the Customer or a third party. Unless otherwise agreed, the warranty shall not apply to the compliance of Products to Customer's needs. Should the Products warranty be breached, Customer's exclusive remedy against Solar Stik, and Solar Stik's sole obligation, shall be limited to, at Solar Stik's option, repairing or replacing the defective Products.
4. The Product shall be considered defective if the failure may be duplicated by Solar Stik, it being understood nonconformity shall be determined by reference to the contractual specifications applicable to the allegedly defective Products.

## ABOUT SOLAR STIK, INC.



### **Mission Statement**

Using American-made components and constant innovation, Solar Stik creates portable power solutions that enable self-sufficiency for the soldier, the sailor, and beyond. In doing so, we save lives, change lives, and help revive American manufacturing.

### **STIKopedia**

[STIKopedia](#) is a compilation of everything you would ever want to know about portable Hybrid Power Systems, including the philosophy and mechanics of high-efficiency circuits, and the individual technologies used to create them.

### **Solar Stik Training and Education**

- **Solar School (St. Augustine, FL)** provides an introduction to the design and support of small-scale, renewable-energy, power generation systems, with detailed explanation of system components. Advanced configuration options with hands-on deployment of actual systems will enhance student understanding.
- **Solar Stik New Equipment Training (on site)** teaches Hybrid System configuration options with hands-on deployment of actual systems to enhance student understanding.

Solar Stik Training Courses are tailored to the specific needs of the students. To schedule Solar Stik Training or to learn more about the curriculum, please contact us.

## **Contact**

### **Technical Support Line**

800-793-4364 Ext. 102

(24 hours a day, 365 days a year)

### **Address**

Solar Stik, Inc.

226 West King Street

Saint Augustine, Florida 32084

### **Website**

[www.solarstik.com](http://www.solarstik.com)

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