



Power. On Your Terms.



SimpliPhi Outback AccESS

INSTALLATION MANUAL

Optimized Energy Storage & Management for Residential & Commercial Applications Utilizing Efficient, Safe, Non-Toxic, Energy Dense Lithium Ferrous Phosphate (LFP) Chemistry

SimpliPhi Your Energy Security and Independence

and gain control of your own power.

SimpliPhi Power helps you manage your power as a personal resource. Anytime. Anywhere. SimpliPhi energy storage optimizes integration of any power generation source – solar, wind, generator – on or off grid and protects your home and mission-critical business functions from power outages and intermittency. SimpliPhi storage technology eliminates operating temperature constraints, toxic coolants and the risk of thermal runaway. Safe lithium ferrous phosphate. No cobalt. No hazards.

SimpliPhi's battery technology utilizes the industry's most environmentally benign chemistry combined with proprietary architecture and power electronics (BMS) that eliminate the need for cooling or ventilation to create products that provide energy security and resiliency – all with a 98% efficiency rate.

SimpliPhi Power offers proprietary, commercially available energy storage and management systems that are safe, non-toxic, reliable, durable, efficient, highly scalable, and economical over the lifetime of the AccESS.

Table of Contents

1.0 – Important Safety Information	4
1.1 – Safety Instructions	4
1.3 – Limitations of Use	7
1.5 – Explosive Gas Precautions	7
1.6 – Regulatory Specifications	7
2.0 – Product Description	8
2.1 – Overview	8
2.2 – Specifications	8
2.3 – Inside the AccESS NEMA-3R Rated Cabinet.....	10
3.0 – Pre-Installation	11
3.1 – PHI 3.8 Battery Performance Parameters and	11
Sizing Calculations	11
3.2 – System Sizing for Your Installation	11
3.3 – Installation Tools and Materials.....	12
3.4 – Installation Site Location	12
3.5 – Clearance Requirements	13
3.6 – Knock Out Locations.....	14
3.7 – Pad Mounting	14
4.0 – Installation & Wiring	16
4.1 – Basic System Configuration Concepts	16
4.2 – PHI 3.8 Battery Installation within the AccESS.....	16
4.4 – Communications and Network Preparation	17
4.5 – Wiring the AccESS	17
5.0 – Programming	18
5.1 – Depth of Discharge	18
5.2 – Configuring the Outback Radian GS8048	18
5.3 – Operating Parameters Per Warranty.....	18
6.0 – SimpliPhi Technical Support	25
Appendix A – OutBack Radian GS8048 Modes of Operation	26

1.0 – Important Safety Information



1.1 – Safety Instructions

1. Before using the unit, read all instructions and cautionary markings on the unit, the PHI 3.8 Batteries, and all appropriate sections of this manual.
2. PHI 3.8 Batteries must be fully charged before commissioning the AccESS unit (i.e. before turning on connected loads). Failure to do so will void the Warranty.
3. Use of accessories not recommended or sold by the manufacturer may result in a risk of fire, electric shock, or injury to persons and will void the Warranty.
4. Verify system settings are in compliance with the Battery Warranty and Battery Installation Manual (which take precedence). Violating Warranty conditions specified in these documents will void the Warranty on the PHI Batteries.
5. Consult the Integration Guide for Inverter and Charge Controller programming settings for relevant warnings and notices. All Integration Guides are posted on SimpliPhi's Product Documentation web page (simpliphipower.com/product-documentation). Violating Warranty conditions specified in those Integration Guides will void the Warranty on the whole AccESS unit, not just the Outback Power equipment. Contact SimpliPhi Power Technical Support (techsupport@simpliphipower.com) regarding any inconsistencies with other referenced documents.
6. Each AccESS unit contains four PHI 3.8 Batteries. Although each PHI 3.8 Battery contains both a circuit breaker and an internal BMS with circuitry that protects the PHI 3.8 Battery cells from overcharge, over-discharge and extreme load amperage, the PHI 3.8 Batteries must always be installed with appropriate inverter charge controller settings and power electronics to protect the PHI 3.8 from open PV voltage and other high voltage charging sources. Do not attempt to replace existing power electronics without SimpliPhi's written approval. Failure to adhere to installation protocol will void the Warranty.
7. Verify polarity at all connections with a standard voltmeter before 1) energizing the system and 2) turning the PHI 3.8 circuit breaker "ON/OFF" switch to the "ON" position. Reverse polarity at the PHI 3.8 Battery terminals will void the Warranty and destroy the PHI 3.8 Batteries.
8. PHI 3.8 Batteries pose some risk of shock or sparking during the installation and initial wiring and connection process. This is consistent with all other battery-based storage formats. Be sure to turn the built-in circuit breaker to the "OFF" position to minimize the risk of shock or sparks during the installation and commissioning of the system. Refer to the PHI 3.8 Manual for details regarding SimpliPhi-approved ancillary charging equipment.
9. To avoid a risk of fire and electric shock, make sure that existing wiring is in good condition and that wire is not undersized. Do not operate the AccESS unit with damaged or substandard wiring.
10. Do not operate the AccESS unit if it has been damaged in any way during shipping or otherwise.
11. Only use a SimpliPhi approved LFP battery charger if ancillary charging is required before installation, testing or troubleshooting. Failure to use a SimpliPhi approved LFP battery charger will damage the PHI 3.8 Battery and void the Warranty.
12. To reduce the chance of short-circuits, always use insulated tools when installing or working with this equipment.
13. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with electrical equipment.
14. The AccESS unit does not have any user-serviceable parts. Do not disassemble the inverter except where noted for connecting wiring and cabling. See your Warranty for instructions on obtaining service. Attempting to service the components inside the AccESS unit yourself may result in a risk of electrical shock or fire and void the Warranty. Internal capacitors remain charged after all power is disconnected – wait 10 minutes before servicing.
15. To reduce the risk of electrical shock, disconnect both AC and DC power from the AccESS unit before attempting any maintenance or cleaning or working on any components connected to the inverter. Putting the AccESS unit in Standby mode will not reduce this risk.



1.2 – Safety & Protective Features

1.2.1 – 80A Breaker

All PHI 3.8 Batteries within the AccESS unit are outfitted with an 80A hydraulic/magnetic circuit breaker. This breaker increases safety during shipping and installations and allows the PHI 3.8 Battery to effectively be turned “OFF” or “ON.” The breaker works in conjunction with the built-in battery management system (BMS) and creates additional safety, efficiency and functionality to the overall power storage system.

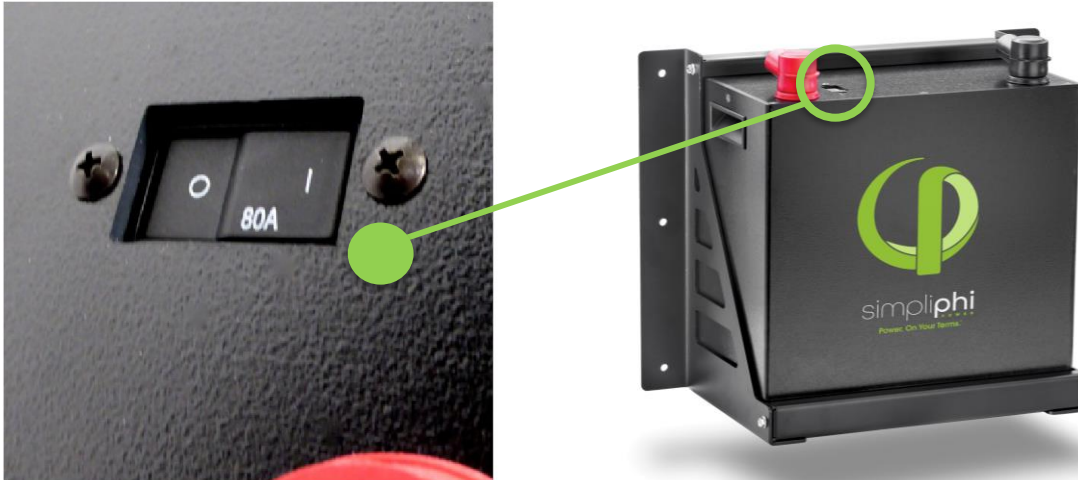


Figure 1.0 - PHI 3.8 kWh 48V Circuit Breaker



CAUTION: Circuit Breakers, Disconnects and Fuses should be employed throughout several points of a power storage and generation installation to effectively isolate and protect all components of the system to safeguard against faults, short circuits, polarity reversals or a failure of any component in the overall system. Fuses, breakers, wiring ratings and values should be determined by established standards and evaluated by certified electricians, licensed installers, and regional code authorities. Although each PHI 3.8 Battery contains both a circuit breaker and an internal BMS with circuitry that protects the Lithium Ferrous Phosphate cells from overcharge, over-discharge and extreme load amperage, the PHI 3.8 Batteries must always be installed with a charge controller and the appropriate settings to protect the PHI 3.8 Battery from open PV voltage and other high voltage charging sources. The PHI 3.8 Battery Management System (BMS) and internal circuit breaker alone will not protect the PHI 3.8 Batteries from these extreme electrical phenomena. Failure to adhere to installation protocol will void the Warranty.



CAUTION: Verify polarity at all connections with a standard volt meter before 1) energizing the system and 2) turning the PHI 3.8 circuit breaker “ON/OFF” switch to the “ON” position. **Reverse polarity** at the battery terminals will void the Warranty and destroy the PHI 3.8 Batteries.

PHI 3.8 Batteries pose some risk of shock or sparking during the installation and initial wiring and connection process. This is consistent with all other battery-based storage formats. Be sure to turn the built-in breaker to the “OFF” position to minimize the risk of shock or sparks during the installation and commissioning of the system. Use of insulated gloves, clothing and footwear is always recommended when working in close proximity to electrical devices. Cover, restrain or remove jewelry or conductive objects (metal bracelets, rings, belt buckles, metal snaps, zippers, etc.) when working with any electrical or mechanical device. Cover or restrain long hair and loose clothing when working with any electrical or mechanical device.

PHI 3.8 Batteries do not vent any harmful gasses, and do not require special ventilation or cooling.

PHI 3.8 Batteries are not capable of thermal runaway. As with any battery, if the cells are severely damaged due to physical abuse incurred outside of warranted specifications, it can cause electrolyte leakage and other failures. The electrolyte can be ignited by an open flame. However, unlike other lithium ion batteries (e.g. LCO, NCM, and NCA), the PHI 3.8 Batteries' electrolyte and other material components generate a limited amount of heat.

1.2.2 – Charging at Temperatures Below Freezing

It is important to take necessary steps to determine the temperature of the PHI 3.8 Battery prior to charging the battery, as the battery may otherwise be adversely impacted.



CAUTION: Do not attempt to charge the PHI 3.8 Battery below 32° F (0° C). Although cold temperatures do not harm PHI 3.8 Batteries, attempts to charge at subfreezing temperatures can adversely affect SOH and cycle life, and will void the Warranty. If the PHI 3.8 Battery must be charged below 32° F (0° C), the rate of charge must be at no more than 5% of the PHI 3.8 Battery's rated capacity (C/20).



CAUTION: Only use a SimpliPhi approved LFP charger if ancillary charging is required before installation, testing or troubleshooting. Failure to use a SimpliPhi approved LFP charger will damage the PHI 3.8 Battery and void the Warranty. Refer to the PHI 3.8 Manual for details regarding SimpliPhi-approved ancillary charging equipment.

1.2.3 – Battery Management System (BMS)

The PHI 3.8 Batteries within the AccESS unit are manufactured utilizing Lithium Ferrous Phosphate (LFP) cells, which are produced under exclusive patented licensed technologies, as well as proprietary materials, architecture, manufacturing processes and battery management system (BMS). This assures the highest grade and quality, longest cycle-life, greatest efficiency and freedom from material impurities, toxicity and hazardous risk.

Each PHI 3.8 Battery within the AccESS unit contains circuitry that protects the Lithium Ferrous Phosphate cells from overcharge, over-discharge and extreme load amperage. If the values specified are exceeded, the protective circuitry will shut down the flow of electricity to/from the PHI 3.8 Batteries. In some cases, this will result in the need to re-initialize an inverter charger. Often, inverter system settings will be saved within the inverter memory storage and will not need to be reset. This is not an absolute standard but is common amongst most inverter chargers and should be anticipated if the PHI 3.8 Batteries go into a state of self-protection and shut down the flow of electricity. Refer to SimpliPhi's inverter integration guides for inverter charge controller settings or contact the inverter manufacturer.

1.2.4 – PHI 3.8 Battery Connection Terminals

The PHI 3.8 Batteries are equipped with two 3/8" threaded studs with a lock washer and nut. The red colored high temperature molded insert connection is for the positive lead. The black colored high temperature insert connection is for the negative lead.



CAUTION: Do not attempt to loosen the large brass nut at the base of the terminals.



CAUTION: Do not reverse polarity. It will void the Warranty. Use a volt meter to check polarity before connecting terminals.

Water Resistant Cable Boots are also included and will be in place when your units arrive. The boots are to be placed over the cable terminations and will stretch to form a water-resistant seal around the base of the molded inserts and terminal connections.

1.3 – Limitations of Use

The Radian GS8048A Inverter/Charger built into the SimpliPhi Power AccESS is not intended for use in connection with life support systems or other medical equipment or devices.

1.5 – Explosive Gas Precautions

This equipment is not ignition protected. To prevent fire or explosion, do not install this product in locations that require ignition-protected equipment. This includes any confined space containing vented batteries, or flammable chemicals such as, natural gas (NG), liquid petroleum gas (LPG) or gasoline (Benzine/Petrol).

Do not install in a confined space with machinery powered by flammable chemicals, or storage tanks, fittings, or other connections between components of fuel or flammable chemical systems.

1.6 – Regulatory Specifications

Outback Inverters intended for grid-interactive use in the United States and Canada must comply with the established standards of UL 1741 and IEEE 1547 and 1547.1. These standards provide regulation for acceptable output voltage ranges, acceptable output frequency, total harmonic distortion (THD) and anti-islanding performance when the inverter is exporting power to a utility source. The OutBack grid-interactive models are tested using the procedures listed in IEEE 1547.1 to the standards listed in both UL 1741 and IEEE 1547.

2.0 – Product Description

2.1 – Overview

The SimpliPhi AccESS offers industry leading renewable energy storage technology to provide energy security and power resiliency into a pre-assembled, pre-programmed system that is suitable for installation inside and outside. The AccESS serves all of the common residential scale renewable energy applications: Off Grid, Grid Tied Back Up, Self-Consumption – with Zero Export.

2.2 – Specifications

Please review Table 1.0 below for AccESS unit specifications, including physical dimensions, Warranty period, and technical data.

Table 1.0 – AccESS Specifications

APPLICATIONS		
SIA (Standard Interconnection Agreement) customers: ESS allows for solar PV power to be self-consumed in a DC Coupled system. AC Coupled systems provide only a backup power source and are compatible with both string inverters and micro-inverters.		
NEM (Net Energy Metering) customers: add standby power to an existing net-metered solar array or peak-shaving to a new net-metered solar array.		
Off-grid customers: ESS with 8 kW Solar MPPT combines power generation and energy management in a single package.		
Disaster recovery customers: reliable, 98% efficient, non-toxic backup power in the event of a power outage.		
SPECIFICATIONS	AC COUPLED ACCESS	DC COUPLED ACCESS
General		
Dimensions	29.5" W x 76"H (w/feet) x 20" D / 75 cm W x 193 cm H x 51 cm D	29.5" W x 76"H (w/feet) x 20" D / 75 cm W x 193 cm H x 51 cm D
Weight	600 lbs. (272.16 kg.) w/o batteries	600 lbs. (272.16 kg.) w/o batteries
Enclosure Rating	NEMA 3R Outdoor Rated	NEMA 3R Outdoor Rated
Operating Temperature	-4°F to 122°F (-20°C to 50°C)	-4°F to 122°F (-20°C to 50°C)
Mounting	Free-standing or Pad-mounted	Free-standing or Pad-mounted
Warranty Period	2 years	2 years
Inverter		
OutBack Power	Radian GS 8048A	Radian GS 8048A
Application	On or Off-Grid	On or Off-Grid
AC Connections	1 Grid Port, 1 Generator Port	1 Grid Port, 1 Generator Port
AC Output	33.3 A (240 VAC), 60 Hz	33.3 A (240 VAC), 60 Hz
Rated Output Power	8 kW Continuous	8 kW Continuous
Max Output Charging Current	115 ADC	115 ADC
CEC Weighted Efficiency	92.5%	92.5%
OutBack GS Load Center	GSLC175-PV-120/240	GSLC175-AC-120/240

Battery		
SimpliPhi Power	(x4) PHI 3.8 kWh-48V	(x4) PHI 3.8 kWh-48V
UL Rating	ETL Certified to UL 1973 Standard	ETL Certified to UL 1973 Standard
Rated kWh Capacity	15.2 kWh	15.2 kWh
Usable kWh Capacity @ 80% DoD	12.16 kWh	12.16 kWh
Max Combined Output Power	7.6 kW DC	7.6 kW DC
Max Combined Charge Current	150 ADC	150 ADC
Charging Temperature	32°F to 120°F (0°C to 49°C)	32°F to 120°F (0°C to 49°C)
Depth of Discharge	Up to 100% DoD	Up to 100% DoD
Round Trip Efficiency	98%	98%
Cycle Life	10,000+ cycles (@ 80% DoD)	10,000+ cycles (@ 80% DoD)
Warranty Period	10 years	10 years
Solar PV		
	Select Grid-Tie Inverter(s)	(x2) FLEXmax 80 charge controllers
Max Connected PV Power	6 kW	8 kW
Max Output / Charge Current	25 AAC @ 240 VAC	160 ADC
Max Operating PV Array Voltage	240 VAC	145 VDC
Max Open Circuit PV Array Voltage		150 VDC
Other Features		
Internet Connected Monitor/Command	Optics RE	Optics RE
Automatic Generator Start	Two-wire automatic generator start; safety relay must be used	Two-wire automatic generator start
System Display & Controller	MATE3s	MATE3s

2.3 – Inside the AccESS NEMA-3R Rated Cabinet

The AccESS system is enclosed within a NEMA-3R rated cabinet. Within, the internal layout provides easy access to clearly labeled wiring points and includes the necessary overcurrent devices, breakers and disconnects. See Figures 2.0 & 3.0 below for detail.

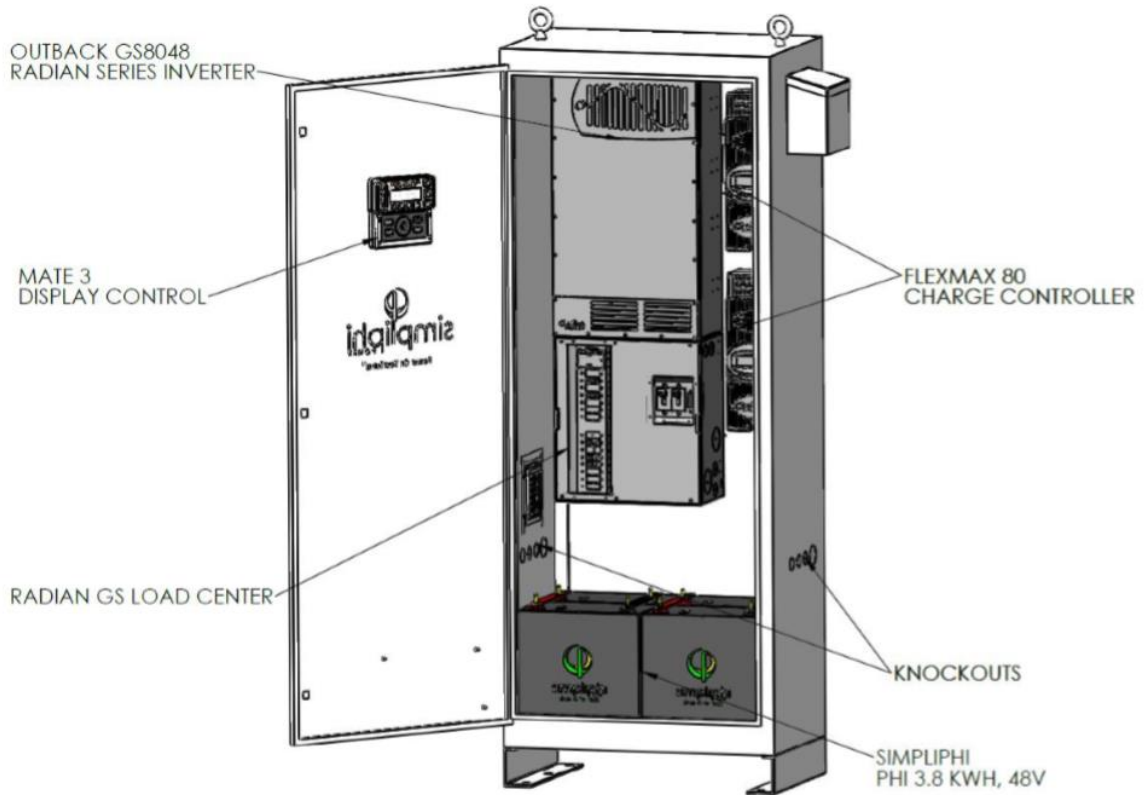


Figure 2.0 – AccESS Unit Components

The heart of the AccESS is the SimpliPhi Power PHI 3.8 kWh 48V 75Ah power storage modules. The power storage is modular and expandable. The base level energy storage is 15.2 kWh at 100 percent state of charge. This is provided by four PHI 3.8 kWh 48V 75Ah modules – combined in parallel.

The power storage is paired with industry leading battery inversion and charging technology by Outback Power, capable of serving useful household loads. Additional storage capacity can be achieved by adding another AccESS Energy Storage Cabinet in parallel, side by side, with up to 12 of the PHI 3.8 kWh 48V batteries.

Accessories allow for a DC connected PV system up to 8 kW or an AC Coupled system of up to 6kW, remote system monitoring, automatic generator start and cellular uplink for wireless, long range monitoring/programming.

2.3.1 – AccESS Core Components

The core components within the AccESS unit include the below listed products. See Figures 2.0 & 3.0 for detail.

- Outback Radian GS8048A inverter/charger
- OutBack Radian GS Load Center (Model GSLC175-PV-120/240 in a DC Coupled configuration / Model GSLC175-AC-120/240 in an AC Coupled configuration)

- 4 x SimpliPhi 3.8kWh 48V Batteries
- * See specification sheet (Table 1.0) for full list of included products

2.3.2 – AccESS Optional Accessories

- 2 x Outback FM80 MPPT charge controllers (in a DC Coupled configuration)

3.0 – Pre-Installation

The information within this section covers pre-installation procedures & considerations, namely, PHI 3.8 Battery performance parameters to be aware of during the design process, guidance on system sizing, as well as installation site requirements and pad mounting.

3.1 – PHI 3.8 Battery Performance Parameters and Sizing Calculations

The PHI 3.8 Batteries within the Outback AccESS are rated at the above listed specifications (see Table 1.0) across a large operating temperature range. The SimpliPhi AccESS needs no increase in sizing and no special compensations when determining the size of the energy storage and management system under the circumstances and conditions seen in Table 1.0 above. Each AccESS unit comes pre-programmed to maximize the performance of the PHI 3.8 Battery bank. Additional programming (such as System Information and the inverter's mode of operation) is to be completed by the installer.

PHI 3.8 Batteries within the AccESS unit do not need to be de-rated unless running continuously at more than 90% capacity, at temperatures below 0° C, or above 49° C. To achieve the greatest warrantied cycle life of 10,000 cycles, the PHI 3.8 Batteries are typically operated at 80% maximum Depth of Discharge. The AccESS comes pre-programmed for 80% depth of discharge. Please contact SimpliPhi Power Technical Support if alternative settings are desired. Please also refer to operating temperatures and inverter settings in Programming section.

3.1.1 – Design Parameters: Maximum Sizing Guidelines

Below are the maximum sizing guidelines for installations of the AccESS:

- Maximum AC input = 50A at 240 Vac
- Maximum utility interactive current = 30A
- Maximum DC coupled PV array = 8 kW
- Maximum AC coupled PV array = 6 kW
- Maximum AccESS units combined in parallel: **None**. The AccESS unit is designed as a single stand-alone unit. Stacking multiple AccESS units voids the AccESS Warranty.

3.2 – System Sizing for Your Installation

The number of PHI 3.8 Batteries within the AccESS unit should be specified in terms of total storage capacity before the initial installation based on the goals and objectives of the project. All PHI 3.8 Batteries are balanced during final production and testing stages. Following proper wiring guidelines ensures that a system will not require any manual balancing processes.



CAUTION: Do not combine PHI 3.8 Batteries with other brands or chemistries. This will void the Warranty.



CAUTION: Do not mix PHI 3.8 Batteries from different installations, clients or job sites. This will void the Warranty.

3.3 – Installation Tools and Materials

- Digital Multi Meter
- AC/DC Clamp-On Current Meter
- Wire Stripper
- Impact Driver
- Masonry Bolts

3.4 – Installation Site Location

The AccESS may be installed indoors, such as a garage, or outdoors mounted onto a concrete pad. The cabinet is rated for NEMA-3R use. Please see Figure 3.0 below for physical AccESS dimensions, as this may impact the site location.

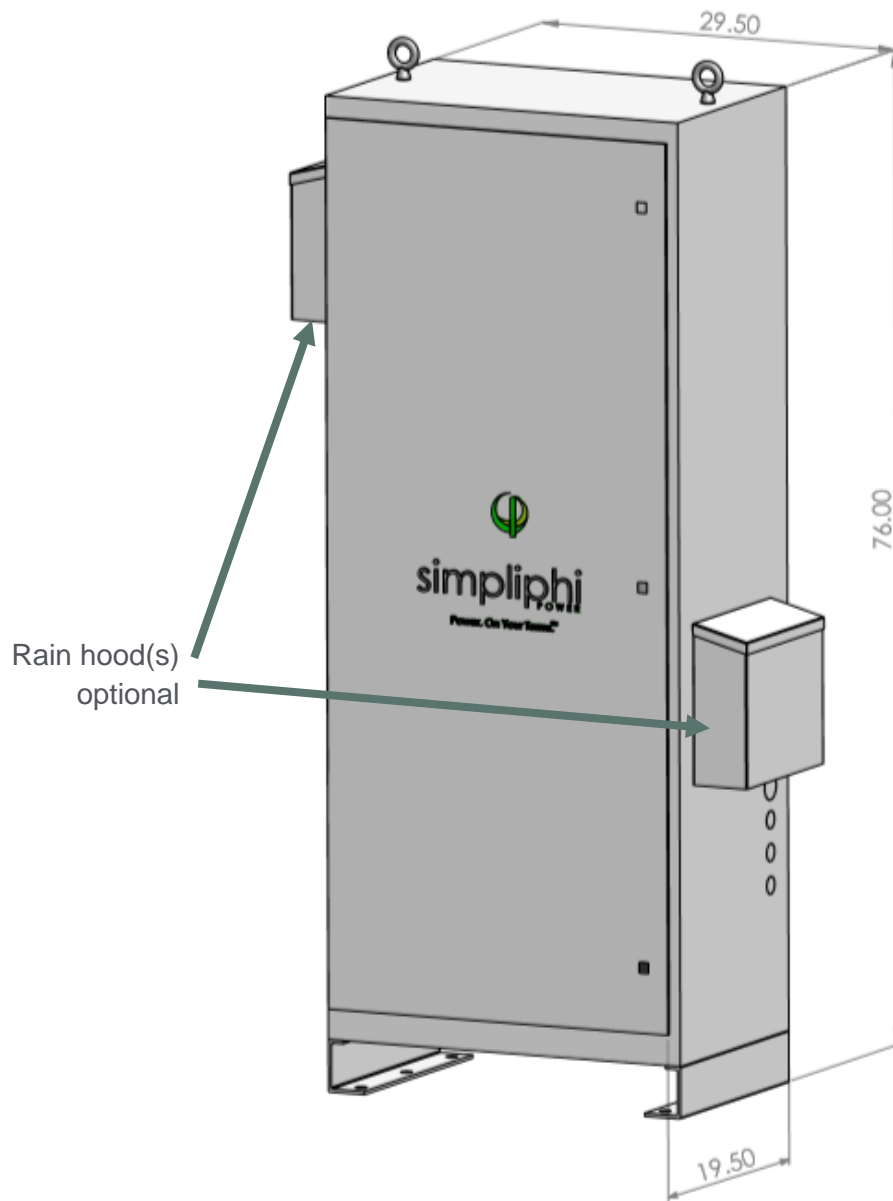


Figure 3.0 – AccESS Unit Dimensions

3.5 – Clearance Requirements

The AccESS should be installed with 3-inch (7.62 cm) clearance to the sides and 3-feet (0.91 m) clearance to the front. Please see Figure 4.0 for details. All installations should comply with local code requirements and/or the local AHJ, which may exceed the requirements shown.

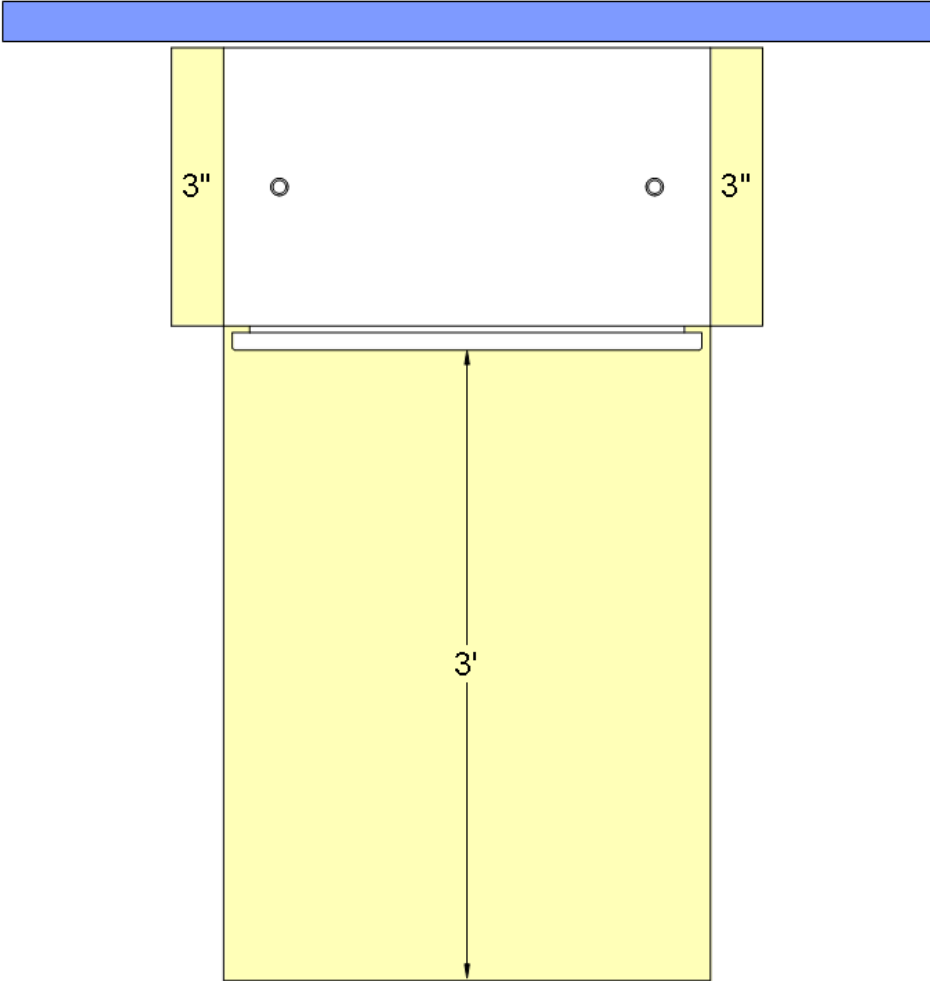


Figure 4.0 – AccESS Unit Clearances

3.6 – Knock Out Locations

Three 1.375-inch OD knockouts and one 2-inch OD knockout are located on both sides of the AccESS cabinet. They can be used for AC or DC inputs. Not all knockouts must be used.

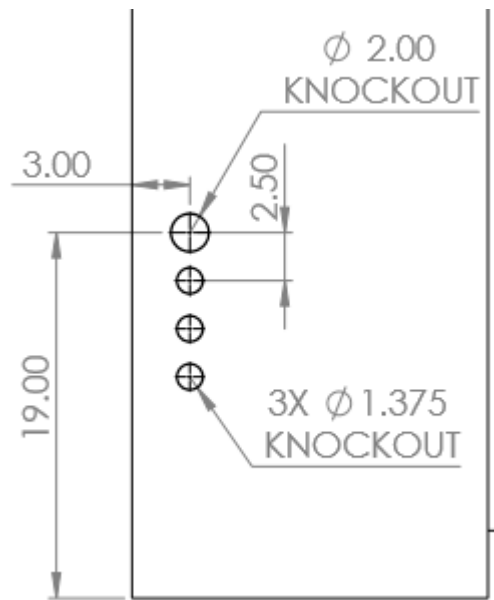


Figure 5.0 – AccESS Cabinet Knock-Outs (sides)

3.7 – Pad Mounting

3.7.1 – Pad Requirements

The AccESS must be installed and secured on level concrete. For a pre-cast concrete pad, a 4" minimum thickness is required. The pad should be 3" wider than the AccESS on all sides (34" x 22" x 4").

The AccESS is not suited for wall mounting. Any attempt to wall mount the AccESS unit will void the Warranty.

3.7.2 – Pad Mounting the SimpliPhi AccESS

Six 1-inch knockouts are located in the base of the AccESS for tool accessibility when mounting the AccESS to the concrete pad. Cover knockout holes with sealing tape after pad mount installation, and prior to installing the PHI 3.8 Batteries into the base of the cabinet. Any attempt to wall mount the AccESS unit will void the Warranty.

Secure the AccESS to the concrete with concrete anchors, such as threaded rods, masonry bolts, or carriage bolts, minimum ½" diameter. See Figure 6.0 below for details.

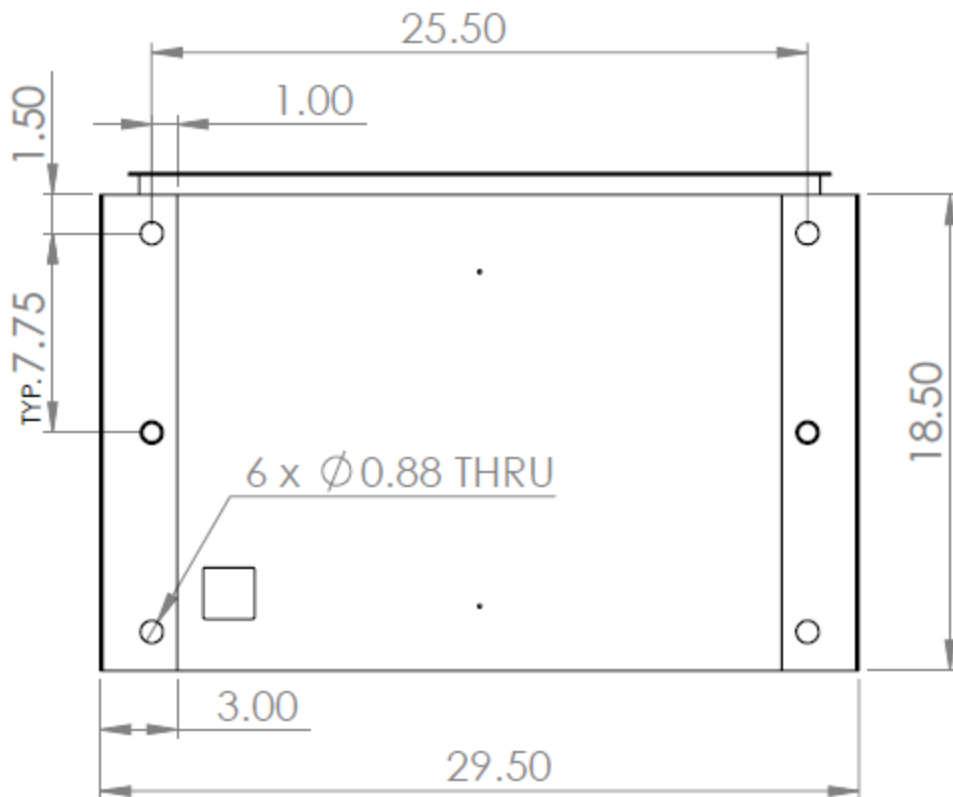
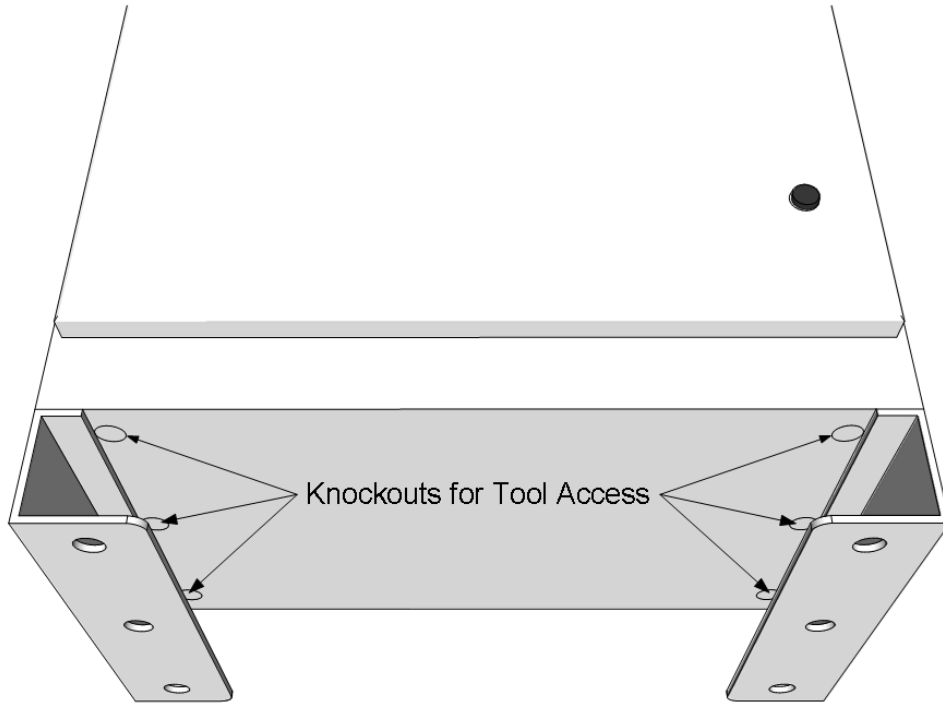


Figure 6.0 – AccESS Unit Knockouts (Bottom)

4.0 – Installation & Wiring

This section covers how to install the PHI 3.8 Batteries within the AccESS unit, torque values, communications and network preparation and how to wire the AccESS unit. It also provides guidance on how to install optional AccESS unit components/accessories.

4.1 – Basic System Configuration Concepts

Safe and reliable installation requires trained and certified technicians. The following discussion is a basic primer. Due to the variety of systems and components in the field, all possible scenarios are not covered. This is not the purpose of this section of the manual. Refer to professional installers regarding your system and its components and specifications. We encourage you or your installer to contact us with any specific questions for technical support. We are committed to working with you and your installation team to achieve a safe, reliable storage system that will provide years of maintenance free service.

4.2 – PHI 3.8 Battery Installation within the AccESS

1. Mount the AccESS unit on level concrete.

2. **Make sure all PHI battery module circuit breakers are in the OFF position.** Prepare the battery modules for installation by removing all plastic terminal covers, 11/16" stainless steel hex nuts and 3/8" lock washers from the batteries' terminals and set aside.



CAUTION: Do not attempt to loosen the large brass nuts at the base of the battery terminals.

3. Place four PHI 3.8 Batteries in the bottom of the cabinet. Orient the four batteries two wide, two deep, as illustrated below:

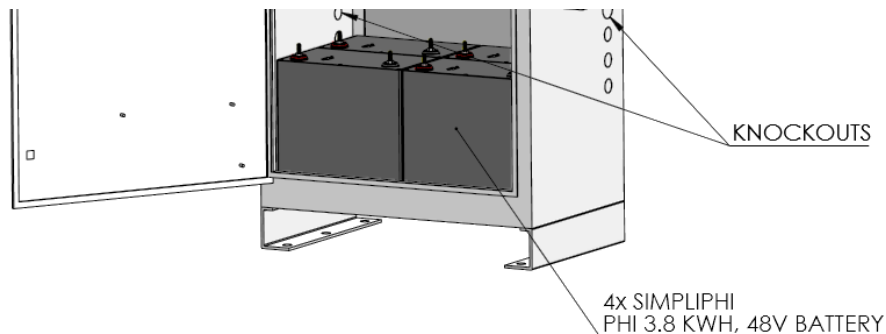


Figure 7.0 – 4 Battery Orientation in the AccESS

4. Attach interconnecting busbars onto the batteries' terminals. Each positive busbar parallels one set of two batteries (positive to positive), and each negative busbar parallels one set of two batteries (negative to negative).



Figure 8.0 – Interconnecting Busbars Parallel the Batteries in Sets of Two

5. Secure the busbars to the batteries' terminals using a 11/16" wrench socket to tighten the 3/8" lock washers and 11/16" stainless steel hex nuts (originally included on the batteries). Tighten the nuts to 160 in-lbs.

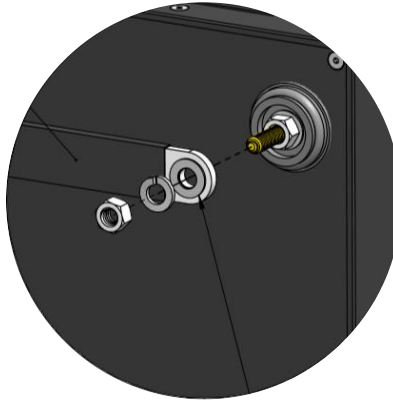


Figure 9.0 – Interconnecting Busbars Secure to the Batteries' Terminals

6. Connect the battery cables that are pre-wired into the GS Load Center to the positive and negative interconnecting busbars secured to the batteries. All connections are in parallel: each positive cable connects to each positive busbar, and each negative cable connects to each negative busbar (refer to Figure 8.0 above).

7. Leave the PHI 3.8 Batteries' built-in breakers in the "OFF" position until the basic functional test.



CAUTION: Adhere to all battery installation instructions as outlined in the PHI Battery Installation Manual; this manual does not substitute the PHI Battery Installation Manual.



CAUTION: PHI 3.8 Batteries must be fully charged before commissioning the AccESS unit. Failure to do so will void the Warranty.

4.4 – Communications and Network Preparation

Communication and Monitoring is available via the included MATE3s through the Optics RE network. A wireless router as well as onsite internet/Wi-Fi is required.

Optics RE is the web-based remote monitoring and control application for Outback devices.

- The Optics RE menu item enables or disables the application.
- It is also possible to communicate with OutBack devices using the Modbus protocol and SunSpec client software as described in *Outback AXS Port Owner's Manual*. The SunSpec Interface menu item enables or disables this type of data stream from the MATE3s.
- The Modbus Port menu item is the Modbus TCP/IP port number. The default settings are the standard internet designation. The port number can be changed if necessary.
- Optics RE allows you to view system health, settings, and make adjustments to programming within the connected devices

For Optics RE configuration, please see the Outback Power's documentation on MATE 3s configuration.

4.5 – Wiring the AccESS

For Wiring information please refer to the Outback GS Load Center installation manual http://www.outbackpower.com/downloads/documents/inverter_chargers/radian_gs_load_center/gs_loadcenter_install.pdf

For AC Coupled wiring information please refer to the OutBack AC Coupling Application Note http://www.outbackpower.com/downloads/documents/appnotes/acc_freq_app_note.pdf

For FM80 MPPT Wiring information please refer to Outback FM80 installation manual http://www.outbackpower.com/downloads/documents/charge_controllers/flexmax_6080/owner_manual.pdf

5.0 – Programming

5.1 – Depth of Discharge

The AccESS comes pre-programmed for 80% depth of discharge (DoD). This qualifies for the 10-year / 10,000 cycle Warranty on the PHI 3.8 Batteries.

To change the DoD to the 5,000 cycle Warranty or 3,500 cycle Warranty, modify the voltages in the Basic Settings and Advanced Settings per the Programming section. Refer to the PHI 3.8 Battery Warranty.

If a firmware update is executed on the AccESS, please verify all PHI custom settings are still in place. These settings can be found at the end of this manual in Section 7.0: Operating Parameters.

5.2 – Configuring the Outback Radian GS8048A

The Outback Radian is capable of many different modes of operation via configurable settings. These settings can be modified to support the function the owner would like to achieve with the AccESS unit. To configure the AccESS, please refer to [Outback Radian GS8048A manual](#). Excerpts from this manual pertaining to the inverter's different modes of operation are outlined in Appendix A.

The Outback Owner's Guide contains information and procedures necessary for configuring, operating, maintaining, and troubleshooting the Outback Radian Inverter/Charger. The guide is intended for anyone who needs to operate, configure, and troubleshoot the inverter. Certain configuration tasks should only be performed by qualified personnel.

Proper system configuration involves setting the **System Information** in the MATE3s's **Settings > System** menu to include a basic profile of the system:

System Information	Parameter
Type	Off Grid, Grid Tied, or Backup
Nominal voltage of the battery bank	48V
Array wattage (PV)	Set to system's PV array wattage
Battery Amp-hours	300 Ah (75Ah per PHI 3.8)
Generator kW rating	Set to generator specs, if applicable
Generator type	
Max Inverter kW	8 kW
Max Charger kW	8 kW

5.3 – Operating Parameters Per Warranty

Although the PHI 3.8 Batteries within the AccESS unit are capable of performing at very high rates and depths of discharge within a very wide temperature range, in order to achieve extended life cycles and to comply with the Warranty, the operating parameters, indicated in Tables 3.0 and 4.0 below, must be adhered to. The parameters shown in Table 3.0 below must be applied based on desired Warranty/cycle life. The AccESS comes pre-programmed for 80% depth of discharge.

5.3.1 – Inverter Programming Settings

Inverter Settings	10k Cycles (80% DOD)	5k Cycles (90% DOD)	3.5k Cycles (100% DOD)
Absorb Voltage (V), Time	27.2 / 54.4, 1 hour	27.2 / 54.4, 1 hour	28 / 56, 1 hour
Float Voltage and Time	N/A (disable float by setting Float Time to 0)		
Refloat Voltage	N/A (disable float)		
Re-Bulk Voltage	25.6 / 51.2		
AC Input Mode ³	Grid Tied (default, adjust as needed)		
SellRE (Offset) Voltage (V)	27 / 54		
AC Charger Limit in AC Amps ^{1,2}	24V = 5A (240V), 10A (120V)		
	48V = 8A (240V), 17A (120V)		
Low Battery Cut-Out Voltage (V)	25 / 50	24.8 / 49.6	24 / 48
Low Battery Cut-Out Delay	130 seconds		
Low Battery Cut-In Voltage (V)	26 / 52	26 / 52	26 / 52

Notes:

- 1. Per PHI 3.8 kWh battery – Refer to the "AC Input Charger Limit" section for conversion method of DC to AC limits.
- 2. Per PHI 3.8 kWh battery – These settings are calculated by multiplying the nominal per battery value times the # of batteries. Refer to Charge Controller Bank Sizing under the "Battery Bank Sizing" section.
- 3. Refer to Appendix A for descriptions of the various programmable AC Input Modes.
- Levels are typical @ 25C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles the battery should be allowed to "rest" 15 minutes in between.



CAUTION: When PHI battery quantities change, the capacity & charge/discharge current settings must be reassessed. Failure to do so will void the Warranty.

5.3.2 – Charge Controller Settings

Charge Controller Settings	10k Cycles (80% DoD)	5k Cycles (90% DoD)	3.5k Cycles (100% DoD)
Absorb Voltage (V), Time	27.4 / 54.8, 2 hours	27.4 / 54.8, 2 hours	28.2 / 56.4, 1 hour
Float Voltage	27 / 54 (default)		
Rebulk Voltage (V)	25.6 / 51.2		
DC Current Limit ¹	45A / 37.5A		
Absorb End Amps	0 (default)		

Notes:

- 1. Per PHI 3.8 kWh battery – These settings are calculated by multiplying the nominal per battery value times the # of batteries. Refer to Charge Controller Bank Sizing under the "Battery Bank Sizing" section.
- Levels are typical @ 25C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles the battery should be allowed to "rest" 15 minutes in between.



CAUTION: When PHI battery quantities change, the capacity & charge/discharge current settings must be reassessed. Failure to do so will void the Warranty.

5.3.3 – Battery Monitor

FLEXnet DC Settings	10k Cycles (80% DoD)	5k Cycles (90% DoD)	3.5k Cycles (100% DoD)
FNDC Battery Ah ¹	151Ah / 75Ah		
FNDC Charge Voltage (V)	27.0 / 54.0	27.0 / 54.0	27.8 / 55.6
FNDC Charged Return Amps ¹	8A / 4A		
FNDC Battery Charge Factor	98%		
FNDC Relay Invert Logic	No		
FNDC Relay Voltage High/Low	High = 26.5/53, Low = 24.8/49.6		
FNDC Relay SOC High/Low	SOC High = 0%, SOC Low = 0%		
FNDC Relay Delay	High = 1, Low = 0		

Notes:

- 1. Per PHI 3.8 kWh battery – These settings are calculated by multiplying the nominal per battery value times the # of batteries. Refer to Charge Controller Bank Sizing under the “Battery Bank Sizing” section.
- Levels are typical @ 25C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles the battery should be allowed to "rest" 15 minutes in between.

5.3.4 – Mate3/Mate3S Settings

MATE3 / MATE3s Settings	10k Cycles (80% DoD)	5k Cycles (90% DoD)	3.5k Cycles (100% DoD)
FLEXnet DC Advanced Control	Low SOC Warning = 20%		
FLEXnet DC Advanced Control	Critical SOC Warning = 10%		

Notes:

- Levels are typical @ 25C and may need adjusting at temperature extremes.
- When performing rapid deep charge/discharge cycles the battery should be allowed to "rest" 15 minutes in between.



CAUTION: When PHI battery quantities change, the capacity & charge/discharge current settings must be reassessed. Failure to do so will void the Warranty.

While the FLEXnet DC Battery Monitor provides State of Charge (SoC) readings, the PHI batteries' more accurate SoC gauge is according to Voltage:

SoC	48V PHI Battery Voltage
100%	> 52.5 VDC
95%	51.7 VDC
90%	51.65 VDC
75%	51.4 VDC
50%	51.0 VDC
20%	50.2 VDC
10%	49.5 VDC
0%	48.0 VDC

*Levels typical @ C/2

5.3.4 – PHI 3.8 Voltage Reference of Battery State of Charge

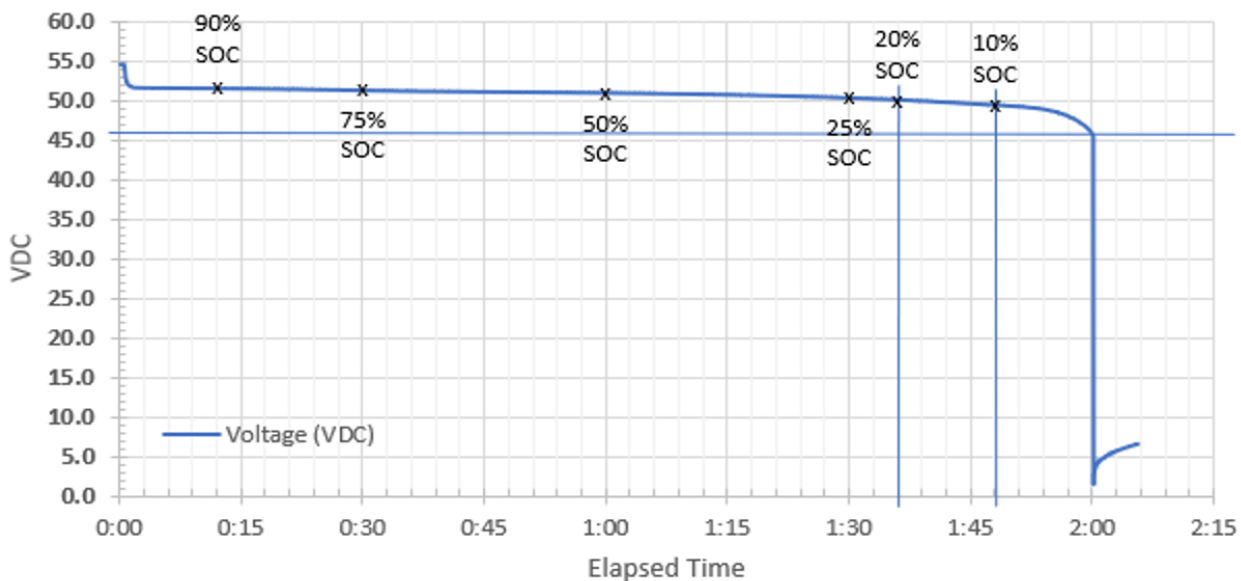


Figure 16.0 and Table 5.0 below depict the typical voltage levels (VDC) for the PHI 3.8 Battery at various states of charge.

5.3.6 – AC Coupling

The SimpliPhi Outback AccESS can also be used in an AC Coupled application for **Grid Tied with Battery Backup systems only** (the only other permissible AC Coupled application is entirely off-grid). A generator protection relay is pre-wired into the OutBack AccESS unit for AC Coupling. Refer to Figure 8 in OutBack’s AC Coupling Application Note when wiring the Grid Tie Inverter Output, AC In (Grid), AC Out and Generator connections.

TO RADIAN INVERTER

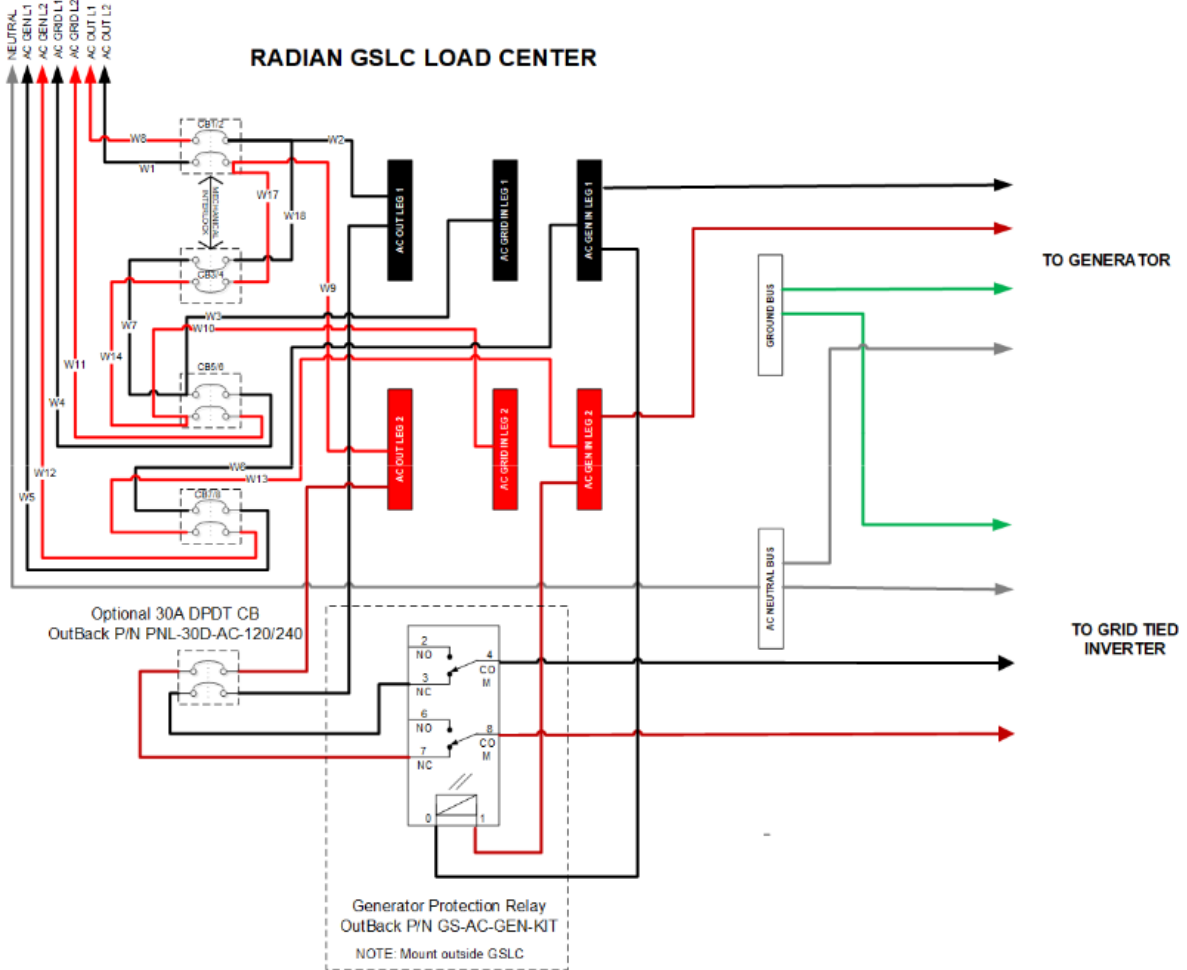
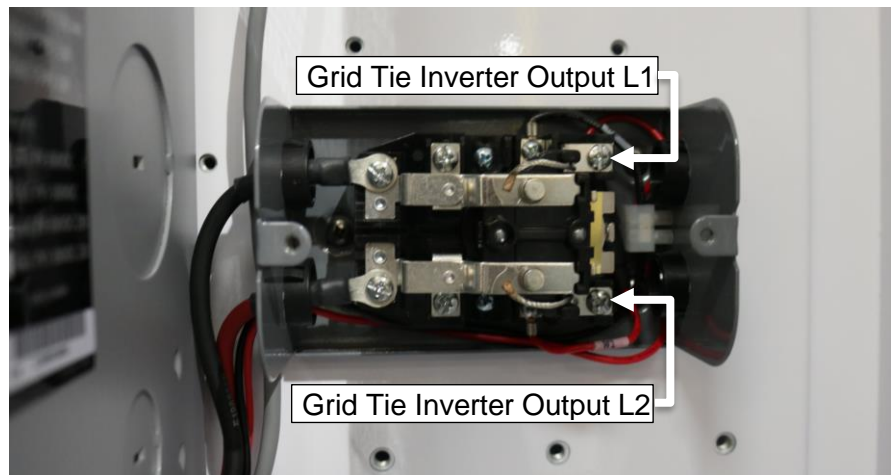
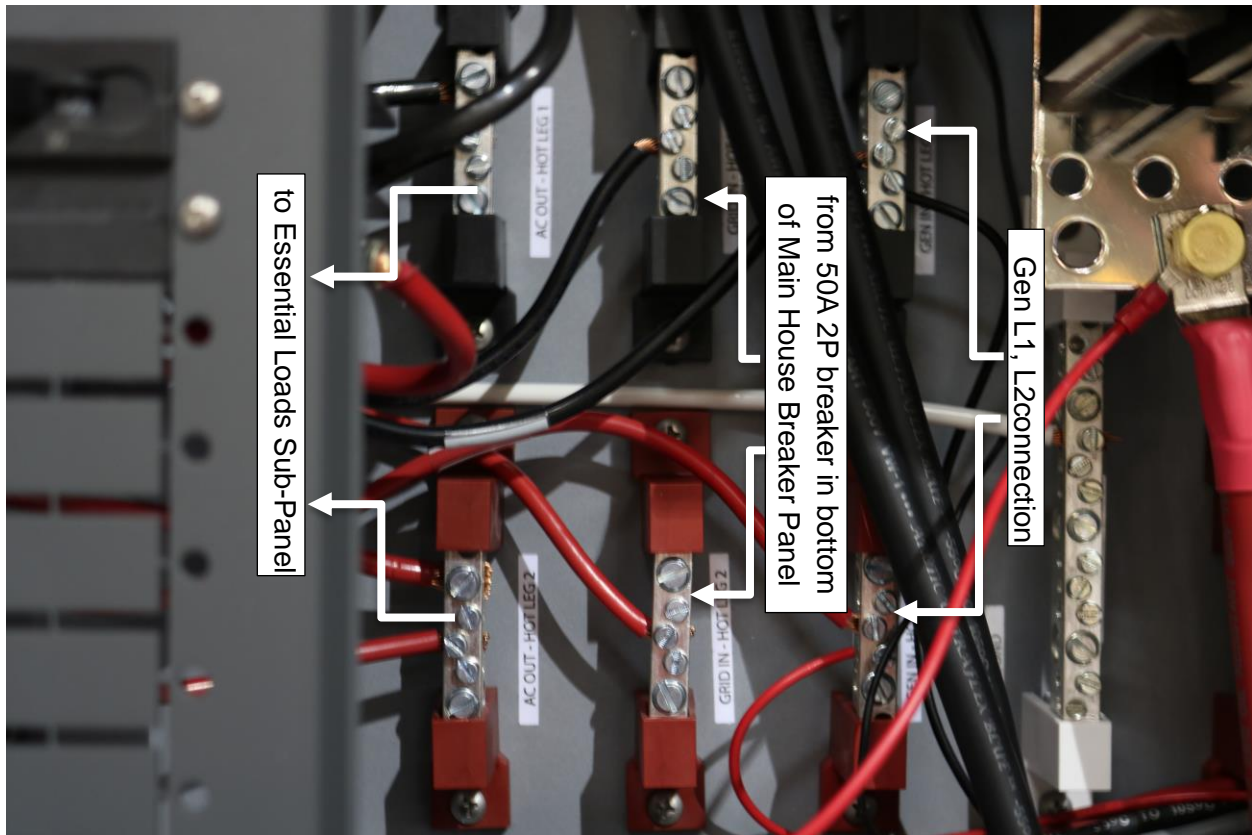


Figure 8 Generator Protection Relay and GTI Disconnect

In the OutBack AccESS for AC Coupled systems, the connection points appear as follows:



For installations that do not include a generator, the Generator Protection Relay may be circumvented, in which case the Grid-Tie Inverter's Output is wired to the AC Out Leg 1 and AC Out Leg 2 busbars (labeled "to Essential Loads Sub-Panel" in the above photo).

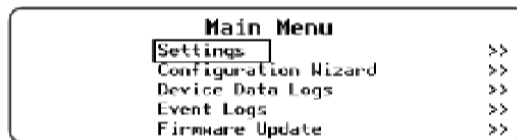
For further information regarding AC Coupling with the Outback Radian series read the full application note: http://outbackpower.com/downloads/documents/appnotes/acc_freq_app_note.pdf

Procedure for Programming the MATE3s and Radian Inverter

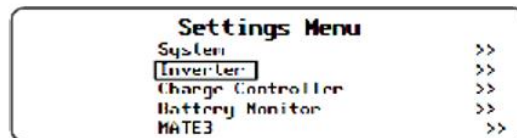
1. Download the MATE3s and Radian AC Coupling firmware from the OutBack Power website.

- <http://www.outbackpower.com/resources-mobile/technical-support/firmware-updates/item/mate3s-firmware-updates>
 - <http://www.outbackpower.com/resources-mobile/technical-support/firmware-updates/item/radian-series-firmware-updates>
2. Copy the firmware files to the SD card and install from the MATE3s **Main Menu**.
 3. Enter the Installer password.
 - The default installer password is **1732**. This password can be changed (refer to page 81 of the [MATE3 Manual](#)).
 4. Select Settings from the MATE3s **Main Menu**.

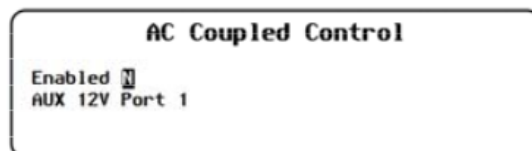
Main Menu Screen



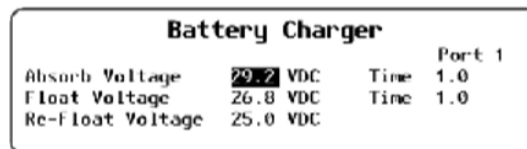
5. Select **Inverter** menu and scroll down to the **AC Coupling** settings.



6. Change **AC Coupling** from **N** to **Y**, and change the **Freq Shift Response Time** (0.02 to 5.0 seconds) if desired. This setting adds/subtracts delay in the frequency steps between 60.0 and 64.5 Hz.



7. Press the **UP** key to move back to the **Inverter** menu and program the Absorb and Float charger settings according to the battery manufacturer's specifications.



- Absorb Voltage = 54.4V / Time = 1.0
- Float Voltage = 54V / Time = 0.0
- Re-Float Voltage = 48V

8. Move to the **Grid Tied** settings in the **Inverter** menu to ensure the **SellIRE** setting is set to 54V.

NOTE: the **SellIRE** setting does not affect the exporting of GTI current back to the main service panel. The GTI current moves from the AC output to the AC input through a relay so the **SellIRE** setting has no affect. However, the **SellIRE** setting becomes the active voltage target during frequency shift operation when the Absorb and Float timers have been zeroed. A higher setting from 52.0 to equal the **Float** setting may allow the GTI to operate over a wider battery voltage range when the Backup Load panel is lightly loaded. If using lead-acid batteries, most can operate safely at Float voltages for extended periods.

The screenshot shows the 'AC Input' settings menu. At the top, there are navigation tabs: Status, Battery Charging, Search, AC Input (selected), AC Output, Aux Control, Stacking, and Calibrate. Below the tabs is a 'Grid' section with a dropdown menu set to 'Grid Tied'. A 'Grid-Tie' toggle switch is turned 'Yes'. The settings are as follows:

Setting	Default	Current Value	Unit
Sell Voltage	52 VDC	54	VDC
Grid Input AC Limit	60 AAC	7.5	AAC
Grid Lower Voltage Limit	108 VAC	108	VAC
Grid Upper Voltage Limit	132 VAC	132	VAC
Grid Transfer Delay	1000 msec	1000	msecs
Grid Connect Delay	0.2 Minutes	0.2	Minutes

6.0 – SimpliPhi Technical Support

For technical support related to your AccESS, please contact us as follows:

805.640.6700

techsupport@simpliphipower.com

Appendix A – OutBack Radian GS8048A Modes of Operation

Grid Tied

Grid Tied



IMPORTANT:

Selling power to the utility company requires the authorization of the local electric jurisdiction. The method used by the local utility company to accommodate this will depend on their policies on this issue. Some may pay for power sold; others may issue credit. Some policies may prohibit the use of this mode altogether. *Please check with the utility company and obtain their permission before using this mode.*

The **Grid Tied** mode allows the Radian inverter to become grid-interactive. This means that in addition to using power from the utility grid for charging and loads, it can also convert excess battery power and sell it to the utility grid. Excess battery power usually comes from renewable energy sources, such as PV arrays, hydroelectric turbines, and wind turbines.

In this mode, the inverter will offset the loads with excess renewable energy if it is available from the batteries. (See page 19 for more information on the Offset function.) If additional energy is available beyond what is consumed by the loads, the energy will be sold to the utility grid.

The grid-interactive function is referenced heavily in the Battery Charging section, as it is integrally tied with the battery charger. Where the charger draws power from the AC input and puts it into the batteries, the grid-interactive function removes power from the batteries (or the DC system) and returns it to the AC input. When a renewable source of energy raises the batteries above a designated reference point (or “target”), the inverter exports power in order to bring the voltage back down or to prevent it from rising further.

- The inverter uses several set points as targets for selling, particularly the battery charger settings. In the MATE3, the **Absorb Voltage**, **Float Voltage**, and **Equalize Voltage** settings are all used as target voltages.
- If the battery charger is not active, the target voltage used by the Radian inverter is **Sell Voltage** in the **Grid-Tie Sell** menu. (See page **Error! Bookmark not defined.** for more information on charging and selling. See the *MATE3 Owner's Manual* to change any of these settings.)
- Unlike the other target voltages, the Radian inverter cannot import AC power to raise the batteries to the **Sell Voltage** set point. It can only use excess DC power, if it is available, and export it as AC power.

CHARGING:

In this mode, when the charger is enabled, the Radian will use the AC source to charge the battery bank. (See page 20.) It will proceed through the entire battery charging cycle. After the end of the Float timer, it will continue to alternate between Silent and Re-Float stages, entering the Selling stage as appropriate.

BENEFITS:

- Excess power is returned to the utility grid.

NOTES:

- The Support function of the Radian inverter is unavailable in this mode.

- The inverter has a minimum five-minute delay before selling will begin. Upon initial connection to the utility grid, the inverter may be required to perform a full battery charge. This may delay the operation of the grid-interactive feature.
- The grid-interactive function only operates when excess DC (renewable) power is available.
- The grid-interactive function can only operate while the utility grid power is stable and within specific limits.
 - ~ If the AC voltage or frequency vary outside these limits, the inverter will stop selling. If the inverter stops selling, the MATE3 will show the reason. **Sell Status** messages are listed on page 44.
 - ~ If the AC voltage or frequency vary outside the maximum limits, the inverter will also disconnect from the utility grid. The Radian inverter's grid-interactive limits are specified on page 46. The AC source acceptance limits are specified on page 17. These numbers are not necessarily the same.
- When power is returned to the utility grid, it may possible to make the utility meter run backwards. The net result would be to sell power to the utility company. However, this depends on whether there are other loads in the system. Loads on the main panel (not on the inverter's output) may consume this power as fast as it is generated, preventing the meter from running backwards. In this case, the result of selling would be to reduce the consumption of AC power, not reverse it.
- The amount of power an inverter can sell is not equal to its specified output wattage. Its maximum selling output is 7.68 kW. However, output will vary with inverter temperature, battery type, and other conditions.
 - ~ A good guideline is that the renewable source should be sized to continuously deliver no more than 85% of the inverter's specified wattage (per inverter, in a multi-inverter system).
 - ~ This recommendation is specifically for the inverter's grid-interactive feature. In some cases, the source may be sized larger to account for environmental conditions or the presence of DC loads. This depends on individual site requirements.

Mini Grid

Mini Grid

The Radian inverter can be programmed to automatically reject an AC source and run solely from battery (and renewable) energy. In **Mini Grid** mode, the inverter only connects to the AC source (usually the utility grid) when the batteries run too low.

In this mode, the Radian inverter runs on battery-supplied power for as long as the batteries can be sustained. It is expected that the batteries will also be charged from renewable sources such as PV. When the batteries become depleted, the system reconnects to the utility grid to operate the loads.

The inverter will reconnect to the utility grid if the battery voltage decreases to either the **Re-Float Voltage** set point (see page 22), or the Rebulk voltage (see page 23). Once it reconnects to the utility grid, if the charger is turned off, the Radian will use its transfer circuit to send grid power to the loads. If the charger is turned on, it will use the grid to charge the battery, as well as powering the loads.

While connected to the utility grid, any excess energy from the renewable source will be sent to the loads and used to "offset" the use of grid power. When the renewable energy is equal to or greater than the load demand, the utility grid will no longer be required. The Radian inverter will then disconnect from the utility grid and begin running from batteries again. It will not disconnect until these conditions are met.

CHARGING:

In this mode, the Radian inverter will wait for the batteries to pass through the charging stages until certain internal charger settings are met (see below). This is true regardless of whether the Radian or

the renewable source is charging. This means that the regulator for the renewable source must be set to the same settings as the Radian (or higher). See the *MATE3 Owner's Manual* to locate the exact settings of the Radian inverter.

If the reconnection was triggered by the **Re-Float Voltage** set point, the inverter will only require the batteries to pass through the **Float Voltage** and **Float Time** settings (as well as Offset.) The inverter

will then enter Silent (see page 22) and continue repeating this part of the charging cycle until it disconnects from the utility grid.

If the reconnection was triggered by the Rebulk voltage setting, the inverter will require the charger to pass through the entire charge cycle, including the **Absorb Voltage**, **Absorb Time**, **Float Voltage**, and **Float Time** settings (as well as Offset). The inverter will continue repeating the Float part of the charging cycle until it disconnects from the utility grid.

See page 20 for more information on the battery charging cycle.

BENEFITS:

- **Mini Grid** mode allows a system to take full advantage of renewable energy. Dependence on the utility grid can be minimized or eliminated.
- In this mode, the inverter will offset the loads with excess renewable energy if it is available from the batteries. (See the previous page and page 19 for more information on the Offset function.)
- This mode is similar to the high-battery transfer (HBX) mode used by the MATE3 system display, but it has several differences (see below).

NOTES:

- The Support and grid-interactive functions of the Radian inverter are unavailable in this mode.
- This mode has similar priorities to the high-battery transfer (HBX) mode used by the MATE3 system display. However, it is not compatible with HBX mode and cannot be used at the same time. When using **Mini Grid** mode, HBX mode should be disabled to prevent conflicts.
- When deciding whether to use **Mini Grid** mode or HBX, the user should consider various advantages of each.
 - ~ **Mini Grid** logic is based in the Radian inverter and can function in the absence of the MATE3. HBX logic is based in the MATE3 and cannot function unless the MATE3 is installed and operating.
 - ~ **Mini Grid** can use utility grid power to fully recharge the batteries on reconnection. HBX can only do so under specific circumstances.
 - ~ HBX set points have a wide range of settings. **Mini Grid** uses settings which tend to prevent the batteries from excessive discharge; however, most of its settings are automatic and do not allow customization.
 - ~ HBX works more efficiently when the renewable source is larger, but there is no specific requirement for renewable size. **Mini Grid** is unable to work properly unless the renewable source is larger than the size of the loads. (See previous page.) If this condition is not met, **Mini Grid** will not disconnect the inverter from the utility grid.
 - ~ HBX can be combined with the settings of any other Radian input mode (**Generator**, **UPS**, etc.). The **Mini Grid** input mode is naturally limited to its own settings and does not have access to certain functions of other modes. (See the first bullet above.)
 - ~ See page 33 and the *MATE3 Owner's Manual* for more information on HBX.

Backup

Backup

This mode is intended for systems that have utility grid available as the primary AC source. This source will pass through the Radian inverter's transfer circuit and will power the loads unless utility power is lost. If utility grid power is lost, then the Radian inverter will supply energy to the loads from the battery bank. When the utility power returns, it will be used to power the loads again.

CHARGING:

In this mode, when the charger is enabled, the Radian will use the AC source to charge the battery bank. (See page 20.) It will proceed through the entire battery charging cycle. After the end of the Float timer, it will continue to alternate between Silent and Re-Float stages.

BENEFITS:

- In this mode, the inverter will offset the loads with excess renewable energy if it is available from the batteries. (See page 19 for more information on the Offset function.)
- This mode will continuously maintain the batteries in a fully-charged state, unlike the Support mode, and does not have the overhead consumption of the UPS mode.

NOTES:

- The Support and grid-interactive functions of the Radian inverter are unavailable in this mode.

UPS

UPS (Uninterruptible Power Supply)

In **UPS** mode, the Radian's parameters have been optimized to reduce the response and transfer times. If the utility grid becomes unstable or is interrupted, the Radian can transfer to inverting in minimal time. This allows the system to support sensitive AC loads without interruption.

CHARGING:

In this mode, when the charger is enabled, the Radian will use the AC source to charge the battery bank. (See page 20.) It will proceed through the entire battery charging cycle. After the end of the Float timer, it will continue to alternate between Silent and Re-Float stages.

BENEFITS:

- This mode will maintain constant power to the loads with virtually no drop in voltage or current.
- In this mode, the inverter will offset the loads with excess renewable energy if it is available from the batteries. (See page 19 for more information on the Offset function.)

NOTES:

- The Support and grid-interactive functions of the Radian inverter are unavailable in this mode.
- Due to the need for the Radian inverter to react quickly to AC source fluctuations, it must remain fully active at all times. The inverter requires a continuous consumption of 42 watts.
- For this reason, the Search function does not operate in this mode. (See page 16.)

Support Support

The **Support** mode is intended for systems that use the utility grid or a generator. In some cases, the amount of current available from the source is limited due to size, wiring, or other reasons. If large loads need to be run, the Radian inverter augments (supports) the AC source, adding inverter and battery power to ensure that the loads receive the power they demand.

In the MATE3 system display, the **Grid Input AC Limit** dictates the maximum AC draw for the Grid input. The **Gen Input AC Limit** sets the maximum draw for the Gen input. This function takes effect if the AC draw on the appropriate input exceeds its setting.

CHARGING:

In this mode, when the charger is enabled, the Radian will use the AC source to charge the battery bank. (See page 20.) It will proceed through the entire battery charging cycle. After the end of the Float timer, it will continue to alternate between Silent and Re-Float stages.

BENEFITS:

- The large loads on the system can be powered while staying connected to the input, even if the input is limited. Battery power prevents overload of the input source, while at the same time limiting the amount of battery power used.
- In this mode, the inverter will offset the loads with excess renewable energy if it is available from the batteries. (See page 19 for more information on the Offset function.)
- This mode has a programmable delay time which will allow an AC source to stabilize before connection. In the MATE3, this menu item is **Connect Delay**. It is available in either the **Grid AC Input Mode and Limits** or the **Gen AC Input Mode and Limits** menu, depending on which input is being programmed.

NOTES:



IMPORTANT:

If the AC loads exceed the amperage limit setting, the inverter will draw energy from the batteries. If the loads are sustained, the batteries may discharge to the point of Low Battery Cut-Out and the inverter may shut down with a Low Battery error. (See pages 15 and 40.) To prevent the loss of backup power, load use should be planned accordingly.

- The grid-interactive function of the Radian inverter is unavailable in this mode.
- Because the inverter limits the current draw from the AC source, it will reduce the charge rate as necessary to support the loads. If the loads equal the amperage setting, the charge rate will be zero.
- If the AC loads **exceed** the amperage setting, the charger will begin operating in reverse. It will take power **from** the batteries and use it to support the incoming AC current.