OutBack POWER™

member of The alpha Group™

FXR Series Inverter/Charger

FXR2012E	FXR2024E	FXR2348E
VFXR2612E	VFXR3024E	VFXR3048E

Installation Manual

GRIDHybrid™

OPTICS RE Compatible

About OutBack Power Technologies

OutBack Power Technologies is a leader in advanced energy conversion technology. OutBack products include true sine wave inverter/chargers, maximum power point tracking charge controllers, and system communication components, as well as circuit breakers, batteries, accessories, and assembled systems.

Applicability

These instructions apply to OutBack inverter/charger models FXR2012E, FXR2024E, FXR2348E, VFXR2612E, VFXR3024E, and VFXR3048E only.

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Introduction

Audience

This book provides instructions for the physical installation and wiring of this product. These instructions are for use by qualified personnel who meet all local and governmental code requirements for licensing and training for the installation of electrical power systems with AC and DC voltage up to 600 volts. This product is only serviceable by qualified personnel.

Welcome to OutBack Power Technologies

Thank you for purchasing the OutBack FXR Series Inverter/Charger. This product offers a complete power conversion system between batteries and AC power. It can provide backup power, sell power back to the utility grid, or provide complete stand-alone off-grid service.

> ➢ 12-, 24-, and 48-volt models
>
> ➢ Output power from 2.0 kVA to 3.0 kVA
>
> ➢ Designed to be integrated as part of an OutBack Grid/Hybrid™ system using FLEXware™ components
>
> ➢ Battery-to-AC inverting which delivers single-phase adjustable output for such standards as 230 Vac, 220 Vac, or 240 Vac (at 50 or 60 Hz)
>
> ➢ AC-to-battery charging (OutBack systems are battery-based)
>
> ➢ Uses battery energy stored from renewable resources
>
> ~ Can utilize stored energy from PV arrays, wind turbines, etc.
>
> ~ OutBack FLEXmax charge controllers will optimize PV output
>
> ➢ Inverter load support for a small AC source
>
> ➢ Sell-back to utility (grid-interactive function)
>
> ~ Available in 24- and 48-volt models
>
> ➢ Rapid transfer between AC source and inverter output with minimal delay time
>
> ➢ Uses the MATE3™ System Display and Controller or the AXS Port™ SunSpec Modbus Interface (sold separately) for user interface as part of a Grid/Hybrid system
>
> ➢ Supports the OPTICS RE™ online tool[1] for a cloud-based remote monitoring and control application
>
> ~ Requires the MATE3 or the AXS Port
>
> ~ Visit www.outbackpower.com to download
>
> ➢ Uses the HUB10.3™ Communications Manager for stacking as part of a Grid/Hybrid system
>
> ~ Stackable in parallel and three-phase configurations

Figure 1   FXR Series Inverter/Charger

NOTE: This product has a settable AC output range. In this manual, many references to the output refer to the entire range. However, some references are made to 230 Vac or 50 Hz output. These are intended as examples only.

[1]**O**utback **P**ower **T**echnologies **I**ntuitive **C**ontrol **S**ystem for **R**enewable **E**nergy

Models

Vented FXR (VFXR) models are intended for indoor or protected installation only. Vented inverters have an internal fan and use outside air for cooling. On average, the power of the vented models is rated higher than sealed models due to their greater cooling capabilities.

Sealed FXR models are designed for harsher environments and can survive casual exposure to the elements. However, enclosed protection is still recommended. (See page 15.) Sealed inverters have an internal fan, but do not use outside air for cooling. To compensate, sealed models are also equipped with the OutBack Turbo Fan assembly, using external air to remove heat from the chassis. (Vented models are not equipped with the Turbo Fan and cannot use it.)

Table 1   Models

Model	Type	Power	Battery	Application
FXR2012E	Sealed	2.0 kVA	12 Vdc	Off-grid, backup
VFXR2612E	Vented	2.6 kVA	12 Vdc	Off-grid, backup
FXR2024E	Sealed	2.0 kVA	24 Vdc	Off-grid, backup, grid-interactive
VFXR3024E	Vented	3.0 kVA	24 Vdc	Off-grid, backup, grid-interactive
FXR2348E	Sealed	2.3 kVA	48 Vdc	Off-grid, backup, grid-interactive
VFXR3048E	Vented	3.0 kVA	48 Vdc	Off-grid, backup, grid-interactive

Inverter Model Names

FXR series model numbers use the following naming conventions.

➢ The model number includes "FXR" as the inverter series. "R" indicates that the FXR was designed for renewable applications. Off-grid and grid-interactive functions are integrated in the same inverter.

➢ Vented models are preceded with "V", as in "VFXR3048E". If a model number does not begin with "V", it is a sealed model and is equipped with a Turbo Fan. This is not indicated otherwise.

➢ The first two digits show the wattage of that model. For example, "FXR2012E" is 2000 watts.

➢ The second pair of digits shows the inverter's nominal DC voltage. For example, "FXR2024E" is 24 volts.

➢ The model number is followed by "E". This designates the inverter's output as nominally 230 Vac (used in Europe, Africa, and other regions).

Components and Accessories

Table 2   Components and Accessories

Components to be Installed	Accessories Included
Battery Terminal Cover, red	FXR Inverter/Charger Installation Manual (this book)
Battery Terminal Cover, black	FXR Inverter/Charger Operator's Manual
AC Plate	"WARNING ELECTRICAL SHOCK" sticker
DC Cover (DCC) or Turbo Fan	Silicone Grease Packet
Remote Temperature Sensor (RTS)	
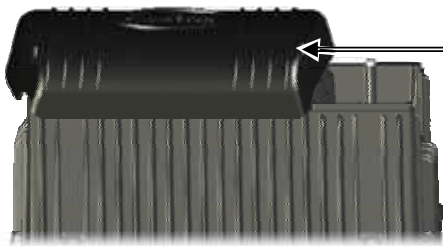
DCC (DC Cover)

This covers the DC terminal area on vented inverters. The DCC provides space to mount other components such as a DC current shunt.

AC Plate

This plate is used for installations which do not utilize OutBack's optional FLEXware conduit boxes. The knockouts are used to install strain relief for flexible cable.

NOTE: This plate is not to be connected to conduit.
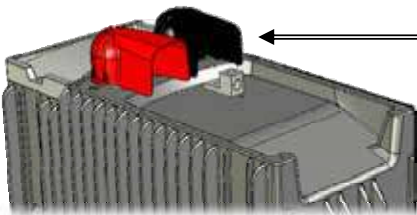
Battery Terminal Cover

These protect the terminals from accidental contact. They are made of stiff plastic with a snap-on design.

Always keep covers installed during normal operation.

Turbo Fan Cover

Included in place of the DCC on sealed inverters. Convectively cools chassis with the external OutBack Turbo Fan to allow maximum power.

NOTE: Do not install the Turbo Fan on a vented inverter.

NOTE: The DC Cover or Turbo Fan does not replace the battery terminal covers. These covers must be installed in addition to the DCC or fan.

Figure 2   Components

NOTES:

Planning

Applications

OutBack inverter/chargers are designed to use a battery bank to store energy. They work together with power from the utility grid or from renewable energy sources, such as photovoltaic (PV) modules, wind turbines, and other renewable sources. These sources charge the battery, which in turn is used by the inverter.

FXR series inverters have been designed to work with all types of renewable systems. These include off-grid, backup, and interactive applications. The inverter's settings can be changed to accommodate many applications. Changes are made with the system display. 📖

The FXR inverter has one set of terminals for a single AC source. However, it can use two different AC sources when an external transfer switch is installed. The inverter can be independently programmed for each source. It is common to use utility grid power and a gas or diesel generator. Other combinations of AC sources are possible.
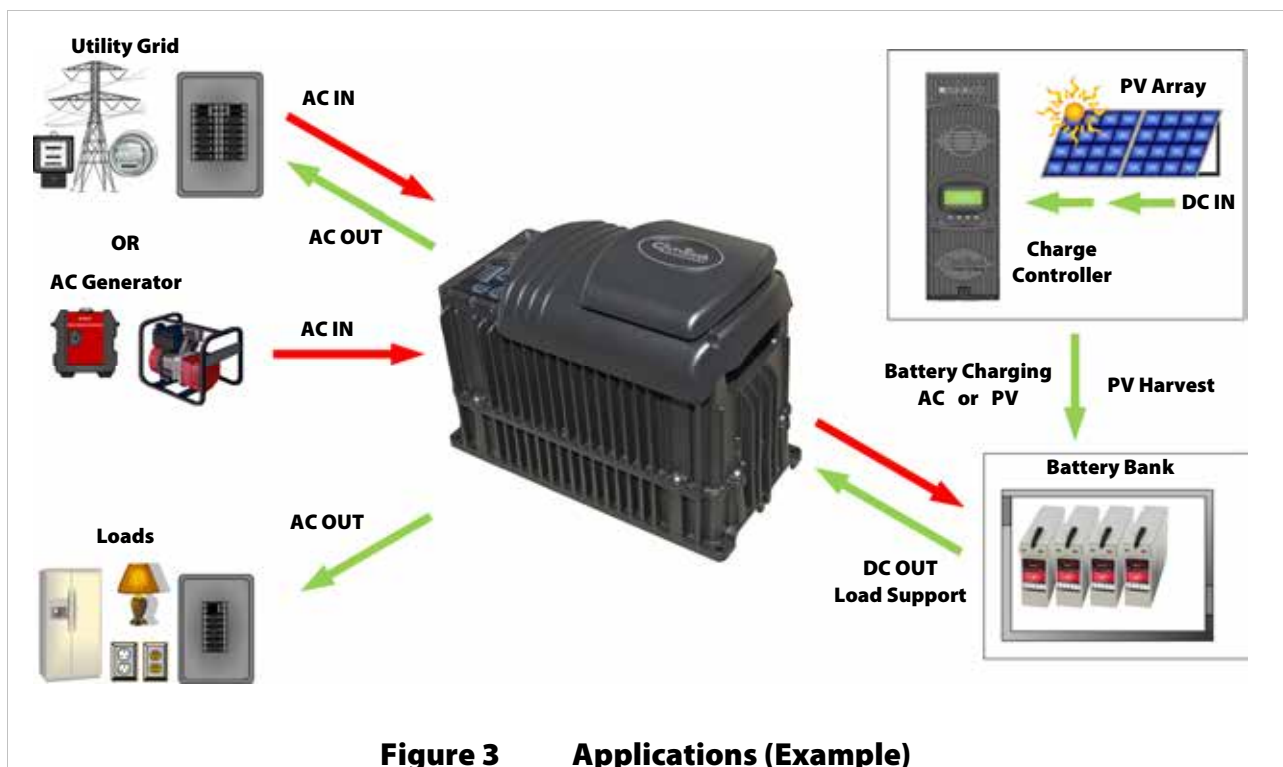
Figure 3   Applications (Example)

In Figure 3, the inverter uses a bidirectional AC input to sell power back to the utility grid. The power being delivered to the grid (labeled "AC Out") is excess AC power not being used by the AC loads. Selling requires an inverter/charger with *Grid Tied* mode available and active.

Input Modes

The FXR inverter has many modes of operation. See the *FXR Series Inverter/Charger Operator's Manual* for additional information on these modes, including reasons and considerations for using each mode.

The modes determine how the inverter interacts with an AC source. Each mode has functions and priorities that are intended for a designated application. Each of the inverter's input selections can be set to a different operating mode to support different applications.

➢ *Generator*: This mode is intended for a wide range of AC sources, including generators with a rough or imperfect AC waveform. The inverter can use generator power even when the generator is undersized or substandard.

➢ *Support*: This mode is intended for systems using the utility grid or a generator. AC source size, wiring, or other limitations may require temporary assistance to run very large loads. The inverter adds renewable or battery power to the AC source to ensure that the loads receive the power they require. This mode can reduce peak load demand from the utility.

➢ *Grid Tied*: This mode is intended for grid-interactive systems.   When renewable energy sources charge the batteries above a selected "target" voltage, the inverter will send the excess energy to any loads. If the loads do not use all the excess energy, then the inverter will send (sell) that energy to the utility grid.

   NOTE: This mode is only available in 24-volt and 48-volt models.

➢ *UPS*: This mode is intended for systems primarily intended to maintain power to the loads with minimal interruption when switching between AC input and batteries. The response speed has been increased so that if an AC disconnect occurs the response time will be minimized.

➢ *Backup*: This mode is intended for systems that have the utility grid or a generator available, but do not have specialty requirements such as selling or support. The AC source will flow through the inverter to power the loads unless power is lost. If power is lost, then the inverter will supply energy to the loads from the battery bank until the AC source returns.

➢ *Mini Grid*: This mode is intended for systems that have the utility grid as an input and a sizable amount of renewable energy. The system will run off the renewable energy until the battery voltage falls to a specified low level. When this occurs, the inverter will connect to the utility grid to power the loads. The inverter will disconnect from the utility grid when the batteries are sufficiently recharged.

➢ *GridZero*: This mode is intended for systems that have the utility grid as an input and a sizable amount of renewable energy. The loads will remain connected to the utility grid, but will restrict the grid use except when no other power is available. The default power sources are the batteries and renewable energy, which attempt to "zero" the use of the AC source. The batteries are discharged and recharged (from renewable sources) while remaining grid-connected. This mode does not allow the inverter to charge batteries or sell.

Programming

Selection of the input modes and all other inverter programming are performed using a system display such as the MATE3. The system display can customize a wide range of parameters.

Renewable Energy

The inverter cannot connect directly to PV, wind turbines, or other renewable sources. The batteries are the inverter's primary source of power. However, if the renewable sources are used to charge the batteries, the inverter can use their energy by drawing it from the batteries.

The renewable source is always treated as a battery charger, even if all of its power is used immediately. The renewable source must have a charge controller, or some other regulation method, to prevent overcharging. OutBack Power's FLEXmax family of charge controllers can be used for this purpose, as can other products.

Battery Bank

When planning a battery bank, consider the following:

➢ **Cables:** Recommendations for battery cable size and length are shown on page 20. The maximum length will determine the placement of the battery bank. Other local codes or regulations may apply and may take priority over OutBack recommendations.

➢ **Battery Type:** The FXR inverter/charger uses a three-stage charge cycle.

   ~   The cycle was designed for lead-chemistry batteries intended for deep discharge. These include batteries for marine, golf-cart, and forklift applications. They also include gel-cell batteries and absorbed glass-mat (AGM) batteries. OutBack Power recommends the use of batteries designed specifically for renewable energy applications. Automotive batteries are strongly discouraged and will have a short life if used in inverter applications.

   ~   Using OutBack's Advanced Battery Charging (ABC), most charging stages can be reconfigured or omitted from the cycle if necessary. The charger can be customized to charge a wide range of battery technologies including nickel, lithium-ion, and sodium-sulfur batteries. This programming is performed using the system display.

➢ **Nominal Voltage:** These inverters are designed to work with specific battery bank voltages, which are different depending on inverter model. Before constructing a battery bank, check the inverter model and confirm nominal battery voltage.

➢ **Charger Settings and Maintenance:** A vented battery enclosure may be required by electric code and is usually recommended for safety reasons. It may be necessary to use a fan to ventilate the battery enclosure.

Batteries must be regularly maintained according to the instructions of the battery manufacturer.

⚠	**IMPORTANT:** Battery charger settings need to be correct for a given battery type. Always follow battery manufacturer recommendations. Making incorrect settings, or leaving them at factory default settings, may cause the batteries to be undercharged or overcharged.
⚠	**CAUTION: Hazard to Equipment** Batteries can emit vapors which are corrosive over long periods of time. Installing the inverter in the battery compartment may cause corrosion which is not covered by the product warranty. (Sealed batteries may be an exception.)

➢ **Bank Size:** Battery bank capacity is measured in amp-hours. Determine the required bank specifications as accurately as possible, beginning with the items below. This avoids underperformance or wasted capacity.

These ten items are obtainable in different places, summarized in Table 3 on the next page. Some of the information is specific to the site or application. Some can be obtained from the battery manufacturer. Information on OutBack products is available from OutBack Power Technologies or its dealers.

   A.   Size of load:

   B.   Daily hours of use: These are the most basic and essential factors used to determine bank size.

   C.   Days of autonomy:

   D.   Application: This often helps define or prioritize the previous three items. Off-grid systems often require enough capacity to last for an extended period before recharging. Grid-connected systems frequently need only enough capacity for short-term backup during outages.

   E.   Conductor efficiency: Wire size and other factors will waste power due to resistance and voltage drop. Typical acceptable efficiency is 96 to 99%.

           Any losses are essentially amp-hour capacity that the system cannot use. The battery bank size can be increased to account for losses.

   F.   Inverter efficiency: FXR specifications list "Typical Efficiency" to help estimate operating loss.

G. System DC voltage: Each inverter model requires a specific DC voltage to operate.

H. Battery voltage: Most individual battery voltages are less than the system DC voltage. The batteries may need to be placed in series to deliver the correct voltage.

I. Capacity: Battery capacity, which is measured in amp-hours, is not usually a fixed number. It is specified based on the rate of discharge. For example, the OutBack EnergyCell 200RE is rated at 154.7 Ahr when discharged at the 5-hour rate (to terminal voltage 1.85 Vpc). This is a high rate of discharge that would hypothetically drain the battery in 5 hours. The same battery is rated at 215.8 Ahr when used at the 100-hour rate. Use the appropriate discharge rate (correlated to the expected loads) to measure the capacity of a battery. Use battery specifications for terminal voltage 1.85 Vpc whenever possible.

NOTE: Capacity ratings are for batteries at 25°C. Capacity is reduced at cooler temperatures.

J. Maximum depth of discharge (DoD): Most batteries cannot be discharged below a certain level without damage. The bank requires enough total capacity to keep this from happening.

Table 3   Battery Bank Elements

Item	Source of information
A. Load Size	Site-specific
B. Daily Hours	Site-specific
C. Days of Autonomy	Site-specific
D. Application	Site-specific
E. Conductor Efficiency	Site-specific
F. Inverter Efficiency	Inverter manufacturer
G. System Vdc	Inverter manufacturer
H. Battery Vdc	Battery manufacturer
I. Capacity	Battery manufacturer
J. Maximum DoD	Battery manufacturer

To Calculate Minimum Battery Bank Size (refer to Table 3 for letter designations):

1. The load size, item A, is measured in watts. Compensate this figure for efficiency loss. Multiply the conductor efficiency by the inverter efficiency (E x F). (These items are represented as percentages, but may be displayed as decimals for calculation.) Divide item A by the result.

2. Convert the compensated load into amperes (Adc). Divide the step **1** result by the system voltage (item G).

3. Determine the daily load consumption in ampere-hours (amp-hours, or Ahr). Multiply the step **2** result by the daily usage hours (item B).

4. Adjust the total for required days of autonomy (the days the system must operate without recharging) and the maximum DoD. Multiply the step **3** result by C and divide by J.

   The result is the total amp-hour capacity required for the battery bank.

5. Determine the number of parallel battery strings required. Divide the Ahr figure from step **4** by the individual battery capacity (I). Round the result to the next highest whole number.

6. Determine the total number of batteries required. Divide the system voltage by the battery voltage (G ÷ H). Multiply the result by the step **5** result.

   The result is the total required quantity of the chosen battery model.

EXAMPLE #1

A. Backup loads: 1.0 kW (1000 W)

B. Hours of use: 8

C. Days of autonomy: 1

D. Grid-interactive system (FXR2348E inverter)

E. Conductor efficiency: 98% (0.98)

F. Inverter efficiency: 93% (0.93)

G. System voltage: 48 Vdc

H. Batteries: OutBack EnergyCell 220GH (12 Vdc)

I. Capacity at 8-hour rate: 199.8 Ahr

J. Maximum DoD: 80% (0.8)

1) A ÷ [E x F]   1000 ÷ (0.98 x 0.93) = 1097.2 W

2) **1** ÷ G   1097.2 ÷ 48 = 22.9 Adc

3) **2** x B   22.9 x 8 = 182.9 Ahr

4) [**3** x C] ÷ J   [182.9 x 1] ÷ 0.8 = 228.6 Ahr

5) **4** ÷ I   228.6 ÷ 199.8 = 1.14 (rounded to 2)

6) [G ÷ H] x **5**   [48 ÷ 12] x 2 strings = 8 batteries

EXAMPLE #2

A. Backup loads: 720 W)

B. Hours of use: 3

C. Days of autonomy: 2

D. Off-grid system (VFXR3024E inverter)

E. Conductor efficiency: 97% (0.97)

F. Inverter efficiency: 92% (0.9)

G. System voltage: 24 Vdc

H. Batteries: OutBack EnergyCell 200RE (12 Vdc)

I. Capacity at 8-hour rate: 167.5 Ahr

J. Maximum DoD: 50% (0.5)

1) A ÷ [E x F]   720 ÷ (0.97 x 0.9) = 801.8 W

2) **1** ÷ G   824.7 ÷ 24 = 34.4 Adc

3) **2** x B   34.4 x 3 = 103.1 Ahr

4) [**3** x C] ÷ J   [103.1 x 2] ÷ 0.5 = 412.4 Ahr

5) **4** ÷ I   412.4 ÷ 167.5 = 2.5 (rounded to 3)

6) [G ÷ H] x **5**   [24 ÷ 12] x 3 strings = 6 batteries

Generator

➤ FXR inverters can accept power from a single-phase generator that delivers clean AC power in the range of voltage and frequency specified for that model.

  ~ Inverters stacked for three-phase output can work with three-phase generators.

➤ The inverter/charger can provide a start signal to control an automatic start generator. If automatic generator starting is required, the generator must be an electric-start model with automatic choke. It should have two-wire start capability. For other configurations, additional equipment may be required.

➤ In any configuration, the inverter may need to be specifically programmed using the system display. Perform all programming according to the specifications of the generator and the required operation of the inverter. Parameters to be program med may include generator size, automatic starting requirements, and potential fluctuations in generator AC voltage.

➤ A generator that is to be installed in a building usually should **not** have a bond between the neutral and ground connections. The generator should only be bonded if there is a specific need. Local or national codes may require the neutral and ground to be bonded at the main electrical panel. See page 18 for more information on neutral-ground bonding.

Generator Sizing

A generator should be sized to provide enough power for all the loads and the battery charger. The generator size should assume maximum loads and maximum charging at the same time.

➤ Available generator power may be limited by ratings for circuit breakers and/or generator connectors.

➤ The generator must be able to provide current to all inverters on a given phase or output. Minimum generator size[2] is recommended to be twice the power of the inverter system. For example, a 2 kVA inverter should have a 4 kVA generator. Many generators may not be able to maintain AC voltage or frequency for long periods of time if they are loaded more than 80% of rated capacity.

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2 This is the generator size after derating for environment, use, and other factors.

NOTES:

Installation

Location and Environmental Requirements

Sealed (FXR) models are resistant to water and other elements but are not designed for permanent outdoor installations. If outdoor installation is required, the FXR inverter must be installed under cover and protected from direct exposure to the environment. Vented (VFXR) models are not resistant to water and other elements. They must be installed indoors.

➢ The inverter can often be mounted in any position or orientation. If there is any exposure to moisture or condensation, the inverter must not be mounted upside-down. This ensures that water will not accumulate under the DC cover. However, it can still be mounted in other positions or orientations.

➢ For installations where the inverter may be exposed to water spray, a sealed model must be used and mounted either with the base down (shelf mounting) or with the AC wiring compartment facing down (wall mounting). If mounted with the base down, water cannot be allowed to accumulate around the inverter's base. There is a drainage system on the base of the inverter to dispel condensation. If submerged, water can enter this drain and cause failure.

➢ Vented inverters must be installed in a weather-proof enclosure or enclosed area. These models are not designed for exposure to water or excessive wind-blown dust and debris.

➢ When inverters are installed with an OutBack FLEXpower system, the system must be installed in the upright orientation due to the requirements of the circuit breakers.

➢ Any inverter will perform more efficiently in locations offering plenty of air circulation. The recommended minimum clearance is 5 cm (2 inches) on all sides of the inverter.

➢ Any inverter will function to all of its specifications if operated in a range of –20°C to 50°C (–4°F to 122°F).

➢ The inverter will function, but will not necessarily meet its specifications, if operated in a temperature range of –40°C to 60°C (–40°F to 140°F). This is also the allowable temperature range for storage.

➢ The FXR series of inverters carry an Ingress Protection (IP) rating of 20 and a Relative Humidity (RH) rating of 93% (non-condensing).

➢ Inverter specifications are listed in the *FXR Series Inverter/Charger Operator's Manual*.

Tools Required

➢ Wire cutters/strippers

➢ Torque wrenches

➢ Assorted insulated screwdrivers

➢ DVM or standard voltmeter

Mounting

➢ One person can install the FXR inverter, but installation may be easier with two people.

➢ The unit has four mounting holes, one in each corner. Use fasteners in all corners for a secure installation.

	IMPORTANT:
	Use correct fasteners to secure the inverter to the mounting surface, regardless of the type of surface. OutBack cannot be responsible for damage to the product if it is attached with inadequate fasteners.

➢ Due to the variance in other mounting methods, OutBack only endorses the use of FLEXware mounting products or previous versions of OutBack mounting plates. Use M6 x 20 mm machine screws, one per corner, to attach the inverter to the mounting plate. Follow the instructions with each mounting system.

➢ Mount and secure each component before attaching any wiring.

➢ When the inverter is used with other metal chassis, make sure that all chassis are grounded appropriately. (See the grounding instructions on page 18.) Grounding other chassis may involve metal-to-metal contact, or separate ground wires.

If using an OutBack FLEXware Mounting Plate, avoid large air gaps behind the plate. These can result in louder mechanical noise during heavy inverting or charging. Mount the plate on a flat, solid mounting surface.

Dimensions

Length 41 cm (16.25")

Width 21 cm (8.25")

Height without Turbo 30.5 cm (12")

Height with Turbo 33 cm (13")

Figure 4   Dimensions

Terminals and Ports

DC TERMINALS

These terminals connect to the battery cables and the DC system. See page 20 for instructions.

DC and AC GROUND TERMINALS

These terminals connect to a grounding system for both batteries and AC. See page 17 for instructions.

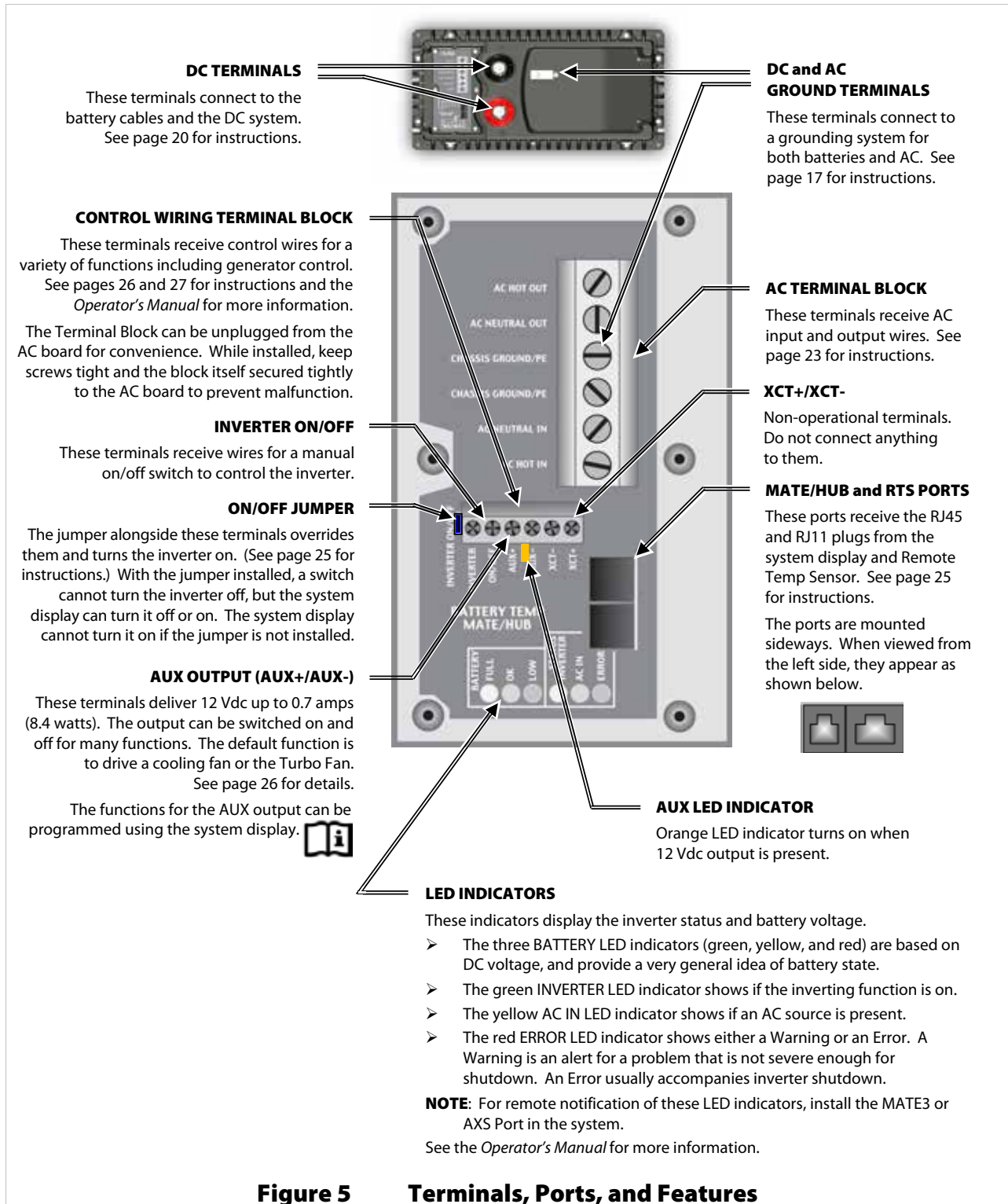**CONTROL WIRING TERMINAL BLOCK**

These terminals receive control wires for a variety of functions including generator control. See pages 26 and 27 for instructions and the *Operator's Manual* for more information.

The Terminal Block can be unplugged from the AC board for convenience. While installed, keep screws tight and the block itself secured tightly to the AC board to prevent malfunction.

AC TERMINAL BLOCK

These terminals receive AC input and output wires. See page 23 for instructions.

INVERTER ON/OFF

These terminals receive wires for a manual on/off switch to control the inverter.

XCT+/XCT-

Non-operational terminals. Do not connect anything to them.

ON/OFF JUMPER

The jumper alongside these terminals overrides them and turns the inverter on. (See page 25 for instructions.) With the jumper installed, a switch cannot turn the inverter off, but the system display can turn it off or on. The system display cannot turn it on if the jumper is not installed.

MATE/HUB and RTS PORTS

These ports receive the RJ45 and RJ11 plugs from the system display and Remote Temp Sensor. See page 25 for instructions.

The ports are mounted sideways. When viewed from the left side, they appear as shown below.

AUX OUTPUT (AUX+/AUX-)

These terminals deliver 12 Vdc up to 0.7 amps (8.4 watts). The output can be switched on and off for many functions. The default function is to drive a cooling fan or the Turbo Fan. See page 26 for details.

The functions for the AUX output can be programmed using the system display.

AUX LED INDICATOR

Orange LED indicator turns on when 12 Vdc output is present.

LED INDICATORS

These indicators display the inverter status and battery voltage.

➢ The three BATTERY LED indicators (green, yellow, and red) are based on DC voltage, and provide a very general idea of battery state.

➢ The green INVERTER LED indicator shows if the inverting function is on.

➢ The yellow AC IN LED indicator shows if an AC source is present.

➢ The red ERROR LED indicator shows either a Warning or an Error. A Warning is an alert for a problem that is not severe enough for shutdown. An Error usually accompanies inverter shutdown.

NOTE: For remote notification of these LED indicators, install the MATE3 or AXS Port in the system.

See the *Operator's Manual* for more information.

Figure 5   Terminals, Ports, and Features

NOTE: The INVERTER ON/OFF Jumper is installed to the ON position during manufacture, but the FXR inverter is given an external OFF command at the same time. Its initial state is OFF.

Wiring

It will be necessary to remove knockouts from the AC Plate to run wires. The AC Plate has one knockout of ½" size and two knockouts of ¾" size. Install appropriate bushings to protect the wires.

Use copper wire only. Wire must be rated at 75°C or higher.

Grounding ⏚

⚠	**WARNING: Shock Hazard** ➢ This unit meets the IEC requirements of Protection Class I. ➢ The unit must be connected to a permanent wiring system that is grounded according to the IEC 60364 TN standard. ➢ The input and output circuits are isolated from ground. The installer is responsible for system grounding according to all applicable codes. ➢ For safety, the neutral and ground conductors should be mechanically bonded. OutBack does not bond these conductors within the inverter. Some codes require the bond to be made at the main panel only. Make sure that no more than one bond is present in the AC system at any time.
⚠	**WARNING: Shock Hazard** For all installations, the negative battery conductor should be bonded to the grounding system at only one point. If the OutBack GFDI is present, it can provide the bond.
⚠	**IMPORTANT:** Not all OutBack products can be used in a positive-ground system. If it is necessary to build a positive-ground system with OutBack products, contact OutBack Technical Support at **+1.360.618.4363** before proceeding. Additionally, consult the online forum at www.outbackpower.com/forum/, where this subject has been discussed extensively.

### Table 4   Ground Conductor Size and Torque Requirements

Terminal Location	Minimum Conductor Size	Torque Requirements
Central AC Terminals	6 mm² or #10 AWG (0.009 in²)	2.8 Nm (25 in-lb)
DC Box Lug	16 mm² or #6 AWG (0.025 in²)	5.1 Nm (45 in-lb)

Table 4 contains OutBack's recommendations for minimum safe cable sizes. Other codes may supersede OutBack's recommendations. Consult applicable codes for final size requirements.

The inverter's DC ground is a box lug located next to the negative DC battery terminal. This lug accepts up to 70 mm² (1/0 AWG or 0.109 in²) wire. Local codes or regulations may require the DC ground to be run separately from the AC ground. Also, if present, it will be necessary to remove the DC Cover or Turbo Fan before making the ground connection. (See page 22.)

Box Lug
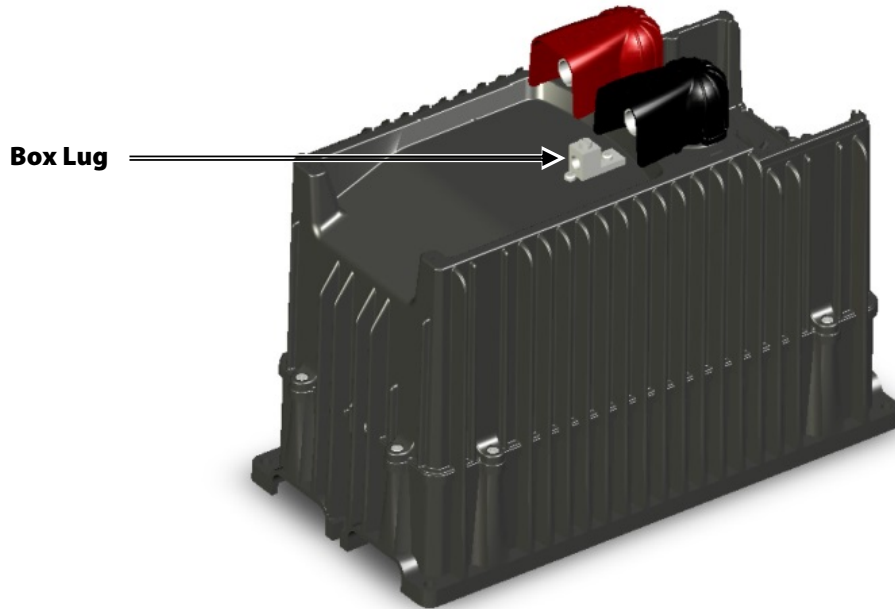
Figure 6   DC Ground Lug
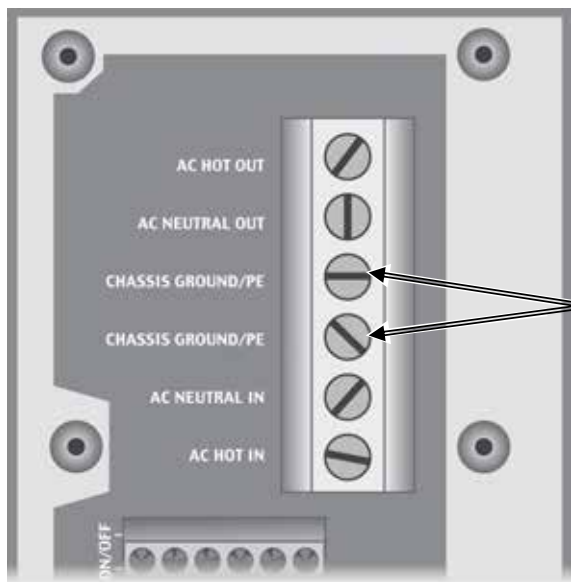
CHASSIS GROUND/PE

The two CHASSIS GROUND/PE terminals are electrically common. If connecting to an external ground bus, only one terminal needs to be used. The other terminal may be used if connecting to a device with its own ground wire, such as a generator.

Figure 7   Chassis Ground/PE

DC Wiring ᅳ ᅳ

	WARNING: Shock Hazard
⚡	Use caution when working in the vicinity of the inverter's battery terminals.

	CAUTION: Equipment Damage
⚠	Never reverse the polarity of the battery cables. Always ensure correct polarity.

	CAUTION: Fire Hazard
⚠	➤ The installer is responsible for providing overcurrent protection. Install a circuit breaker or overcurrent device on each DC positive (+) conductor to protect the DC system.
	➤ Never install extra washers or hardware between the mounting surface and the battery cable lug. The decreased surface area can build up heat. See the hardware diagram on page 21.

	IMPORTANT:
☞	➤ The DC terminals must be encased in an enclosure to meet the requirements of some local or national codes.
	➤ Table 5 contains OutBack's recommendations for minimum safe cable sizes. Other codes may supersede OutBack's recommendations. Consult applicable codes for final size requirements.

Table 5   DC Conductor Size and Torque Requirements

Inverter (Wattage/Voltage)	Nominal DC Amps (Derated 125%)	Conductor Size[3] (Minimum)	Breaker Size (Minimum)
FXR2012E	200	120 mm² (4/0 AWG) or 0.186 in²	250 Adc
VFXR2612E	260	120 mm² (4/0 AWG) or 0.186 in²	250 Adc
FXR2024E	100	70 mm² (2/0 AWG) or 0.109 in²	175 Adc
VFXR3024E	150	120 mm² (4/0 AWG) or 0.186 in²	250 Adc
FXR2348E	57.5	70 mm² (1/0 AWG) or 0.109 in²	125 Adc
VFXR3048E	75	70 mm² (1/0 AWG) or 0.109 in²	125 Adc
Terminal Location		**Torque Requirements**	
Inverter DC Terminals		6.9 Nm (60 in-lb)	
Battery Terminals		See battery manufacturer's recommendations	

When installing DC cables:

➤ Battery positive and negative cables should be no longer than 3 meters (10 feet) each, to minimize voltage loss and other possible effects.

➤ Turn off DC circuit breakers or remove fuses before proceeding.

➤ Tie, tape, or twist cables together to reduce self-inductance. Run positive and negative cables through the same knockouts and conduit.

➤ The inverter's battery terminal is a threaded stud which accepts a ring terminal lug. Use crimped and sealed copper ring lugs with 0.79 cm (5/16 inch) holes, or use compression lugs.

➤ Install all overcurrent devices on the positive cable.

---

[3] Cable sizes are for each inverter in a system. In a system with multiple inverters, each inverter requires its own cables and overcurrent devices of the size indicated.

To install DC cables and hardware:

1. Install all DC cables.

   Do not install hardware in a different order from Figure 8. The battery cable lug should be the first item installed on the stud. It should make solid contact with the mounting surface.

   Do not close the main DC disconnect until wiring is complete and the system is prepared for commissioning.


13 mm Nut

Flat Washer

Mounting Surface

Insulator

M8 x 1.25 Stud

Lock Washer
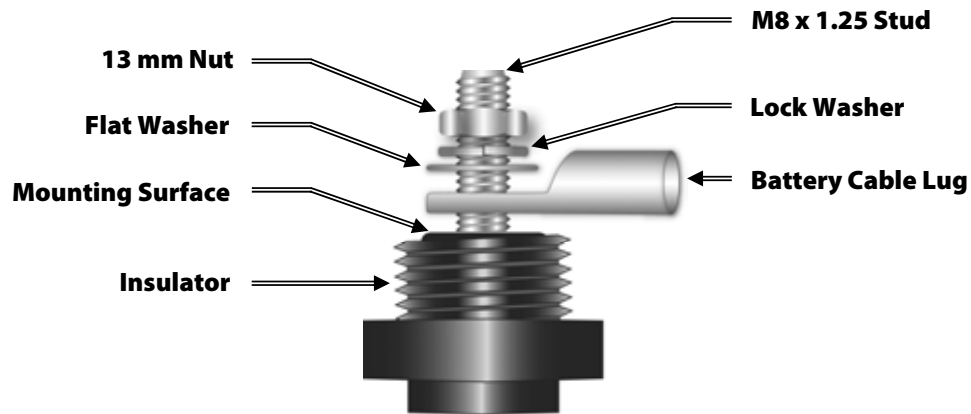
Battery Cable Lug

Figure 8   Required Order of Battery Cable Hardware
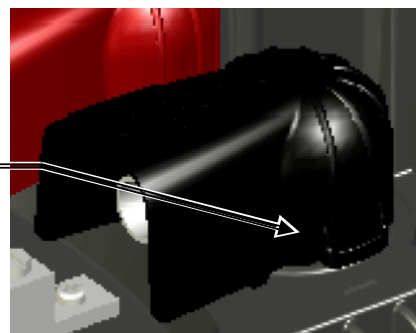
⚠	**CAUTION: Fire Hazard**
	Never install extra washers or hardware between the mounting surface and the battery cable lug. The decreased surface area can build up heat.

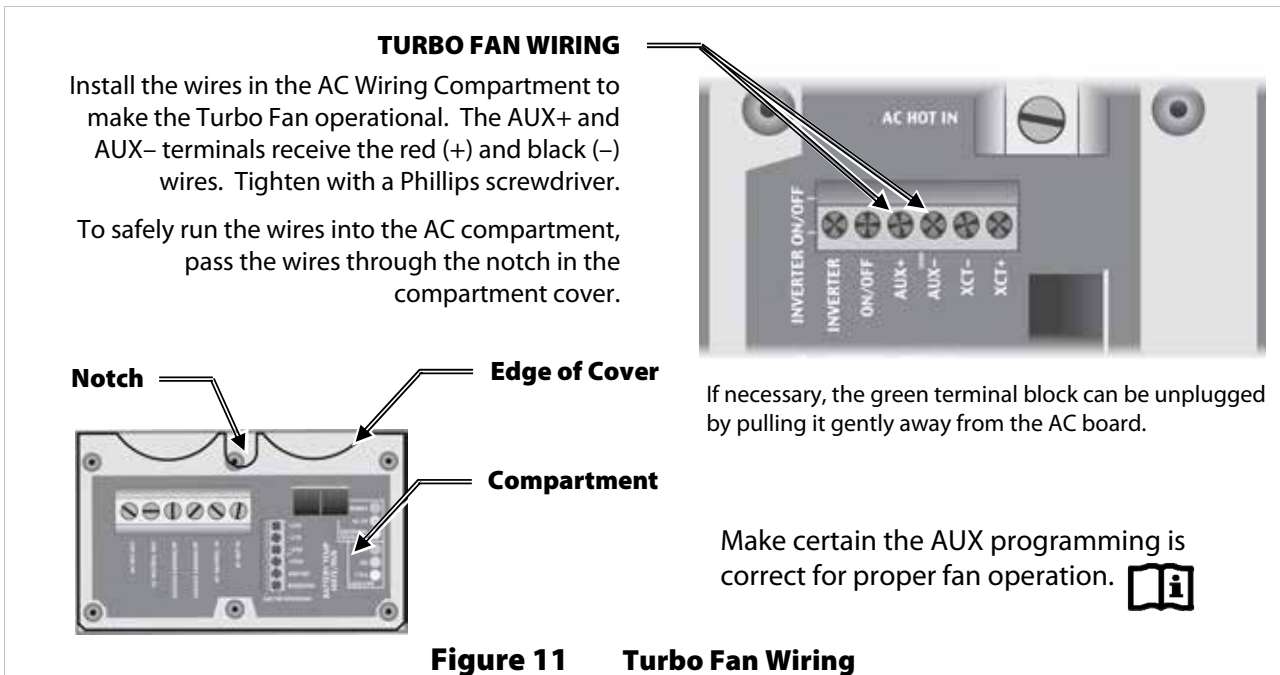2. Install the battery terminal covers. These are made of stiff plastic with a snap-on design.
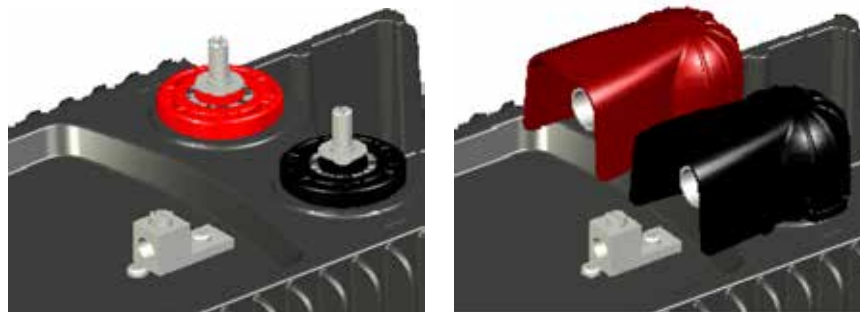
REMOVAL SLOT

If it is necessary to remove the covers, remove carefully using a flat screwdriver.
Insert the screwdriver into the slot on the side of each cover and unsnap the cover.

Figure 9   Battery Terminal Covers

DC Cover or Turbo Fan Attachment

COVER ATTACHMENT

FXR inverters are equipped with either the DC Cover or the Turbo Fan. To attach either cover, put the cover in place and insert a screw at each corner using a Phillips screwdriver.

As part of attaching the Turbo Fan, follow the wiring instructions in Figure 11.

Figure 10   DC Cover Attachment

TURBO FAN WIRING

Install the wires in the AC Wiring Compartment to make the Turbo Fan operational. The AUX+ and AUX– terminals receive the red (+) and black (–) wires. Tighten with a Phillips screwdriver.

To safely run the wires into the AC compartment, pass the wires through the notch in the compartment cover.

Notch

Edge of Cover

Compartment

If necessary, the green terminal block can be unplugged by pulling it gently away from the AC board.

Make certain the AUX programming is correct for proper fan operation.

Figure 11   Turbo Fan Wiring

If it is necessary to remove the Turbo Fan:

1. Remove the compartment cover.
2. Unscrew the AUX+ and AUX– terminal screws.
3. Remove the wires.
4. Remove the screws at the four corners of the Turbo Fan.
5. Remove the Turbo Fan.

AC Wiring 〜

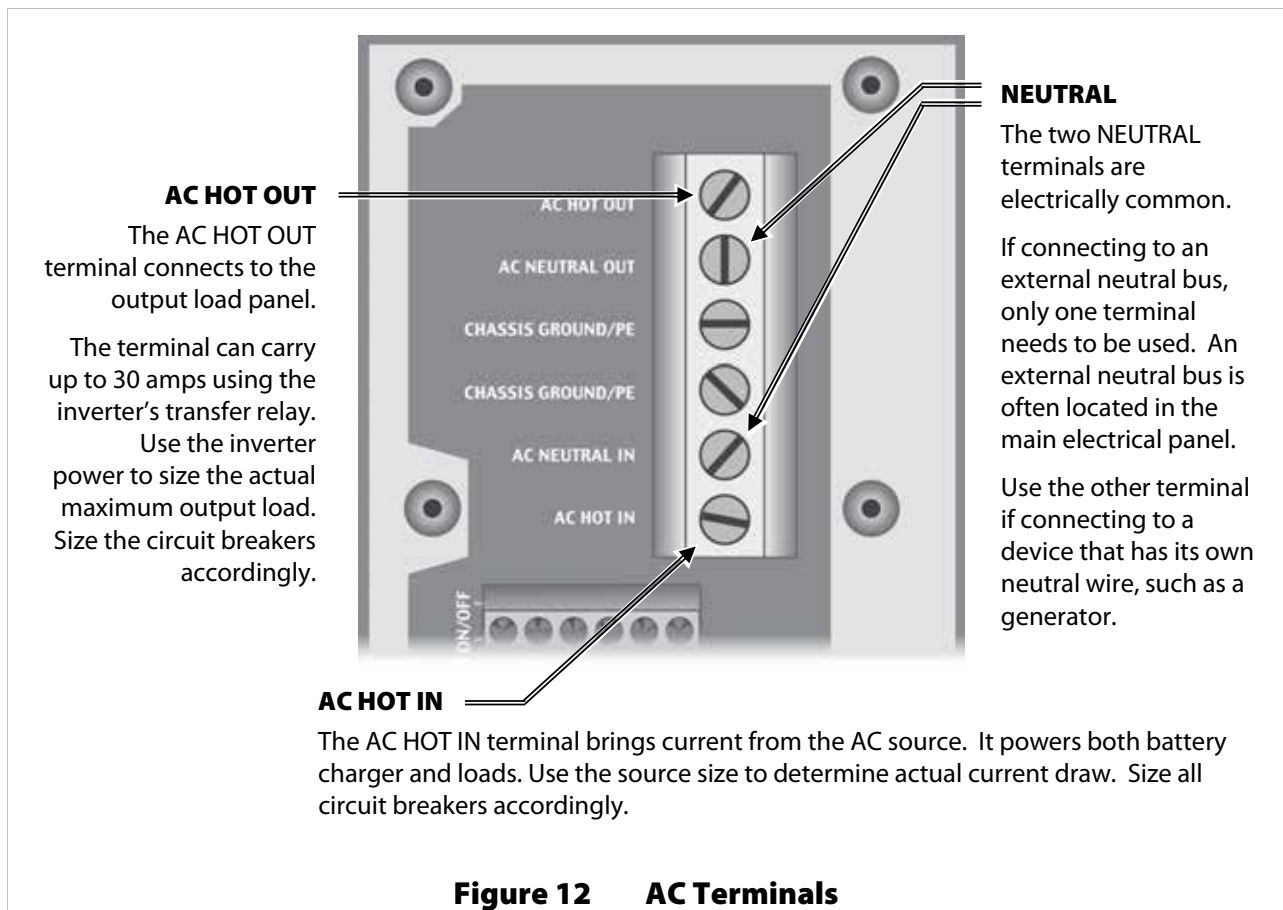|	
⚡	**WARNING: Shock Hazard** ➤ The neutral and ground conductors should be mechanically bonded. Ensure there is no more than one AC neutral-ground bond at any time. ➤ Local or national codes may require the bond to be made at the main panel only.
☝	**IMPORTANT:** This page contains OutBack's recommendations for minimum safe cable sizes. Other codes may supersede OutBack's recommendations. Consult applicable codes for final size requirements.

All system wiring must comply with national and local codes and regulations.

The FXR inverter's AC terminal block has six positions for AC wires. The minimum recommended wire size is 6 mm² (#10 AWG) or 0.008 in². Larger wire gauges may be required for specific conditions. The largest size that can be used with the terminals is 16 mm² (#6 AWG) or 0.021 in² wire.

AC HOT OUT

The AC HOT OUT terminal connects to the output load panel.

The terminal can carry up to 30 amps using the inverter's transfer relay. Use the inverter power to size the actual maximum output load. Size the circuit breakers accordingly.

NEUTRAL

The two NEUTRAL terminals are electrically common.

If connecting to an external neutral bus, only one terminal needs to be used. An external neutral bus is often located in the main electrical panel.

Use the other terminal if connecting to a device that has its own neutral wire, such as a generator.

AC HOT IN

The AC HOT IN terminal brings current from the AC source. It powers both battery charger and loads. Use the source size to determine actual current draw. Size all circuit breakers accordingly.

Figure 12   AC Terminals

AC Sources

The inverter has a single set of AC terminals which are intended to connect to a single AC source. **It cannot be directly wired to more than one AC source at the same time.** If multiple sources are used, it is usually required to have a selector switch that changes from one to the next. The switch should be the "break before make" type which disconnects from one source before contacting another. This prevents the risk of connecting to two out-of-phase sources at the same time or connecting them to each other.
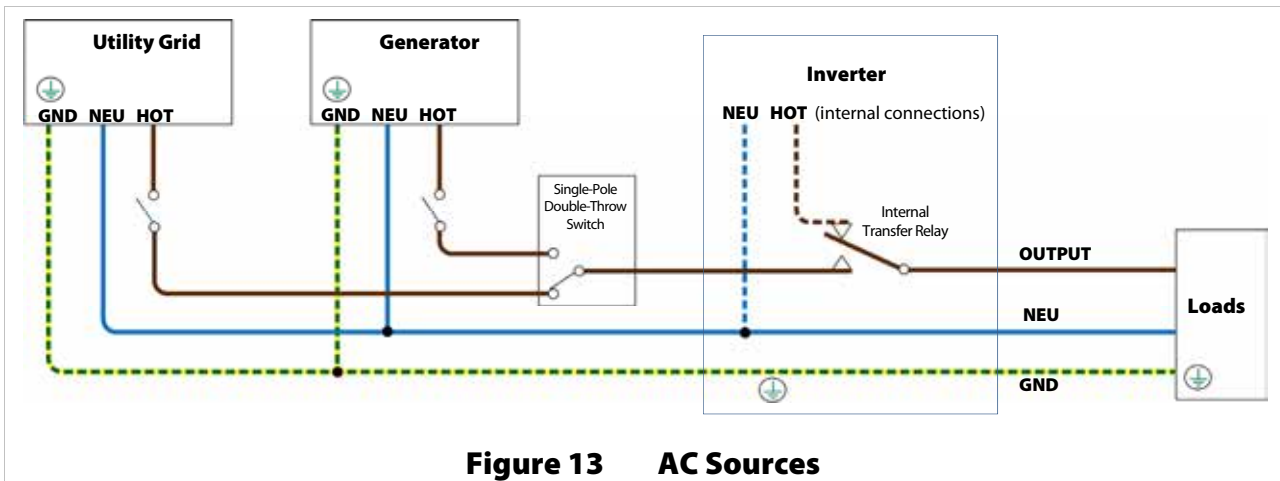
Figure 13   AC Sources

The inverter's transfer relay is normally set to provide inverter power to the output. This is shown in Figure 13, where the internal transfer relay is switched to the inverter function.
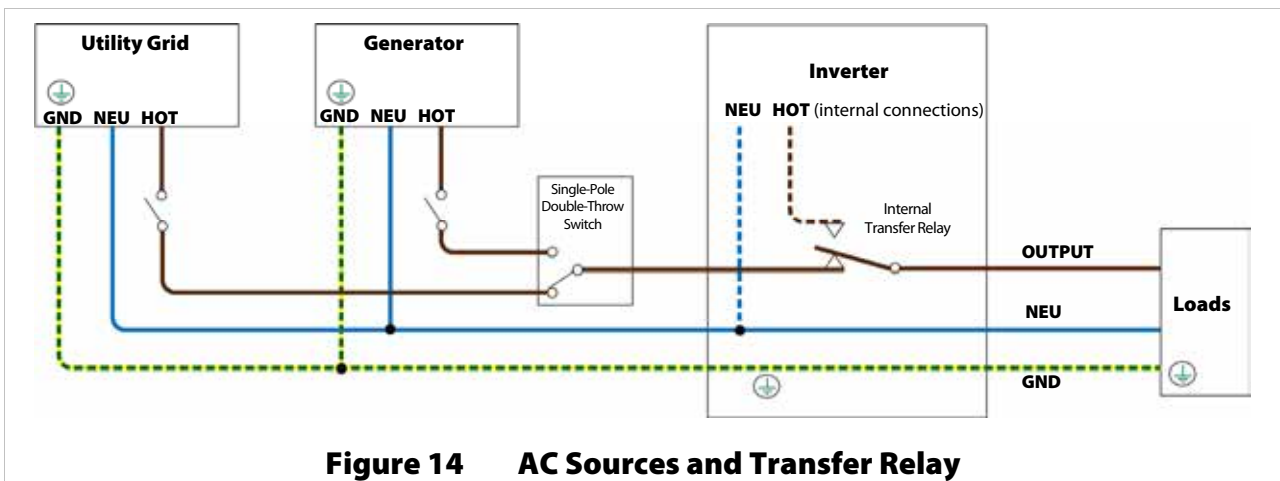
Figure 14   AC Sources and Transfer Relay

When an AC source is connected and accepted, the internal transfer relay switches to transfer the AC source power to the loads. Figure 14 shows the utility grid switch closed. The internal transfer relay has switched accordingly so that the loads receive utility power. (See the *Operator's Manual* for the inverter's acceptance criteria.)

ON and OFF Wiring

The INVERTER ON/OFF jumper bridges two pins. The ON/OFF jumper parallels the two INVERTER ON/OFF terminals on the Control Wiring Terminal Block. If either connection is closed, the inverter is ON. The jumper is installed in the factory, but the inverter is given an external OFF command at the same time. Its initial state will be OFF. (An inverter in the OFF state will not invert. However, it may still transfer power to loads and charge batteries from an AC source.)
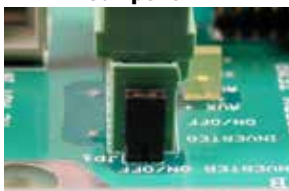
To turn the inverter initially ON, remove the jumper briefly and then replace it. This requires long-nose pliers or a similar tool.

After this, removing the jumper will immediately turn the inverter OFF.

Jumper Off

Jumper On

Once the jumper has been removed, the INVERTER ON/OFF terminals on the Control Wiring Terminal Block can be used to wire a manual on/off switch. These terminals can also be used to control an Emergency Power Off (EPO) device instead of a standard switch.
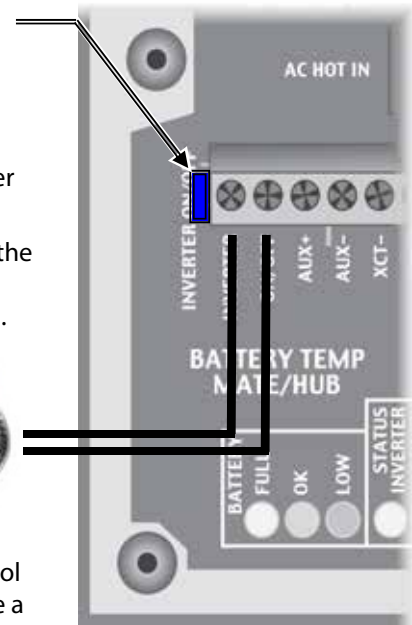
Figure 15   ON/OFF Jumper and Connections

Accessory Wiring

The AC Wiring Compartment Board has ports for both the Remote Temperature Sensor (RTS) and the system display. The system display port is labeled MATE/HUB.

If a HUB Communications Manager is in use, it occupies the inverter's MATE/HUB port.

RTS cable
RJ11,
4-conductor,

MATE cable
RJ45, 8-conductor,
CAT5 non-crossover

RTS port

MATE/HUB port

See the *Operator's Manual* for more information on the RTS.

Additional ports   **MATE port**

When a HUB product occupies the inverter's MATE/HUB port, the system display connects directly to the HUB product.

Inverters plug into ports 1 and above. Charge controllers and other devices plug into unassigned ports not used by inverters.

See Stacking on page 30 for information on connecting inverters. See the HUB product literature for other devices.
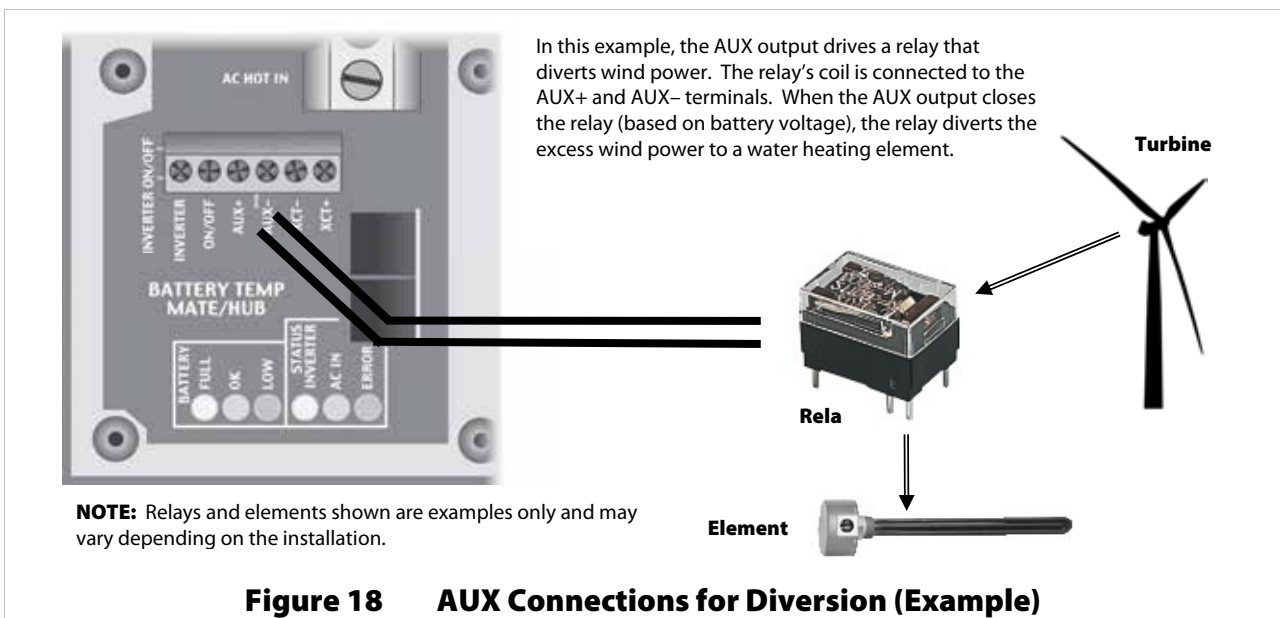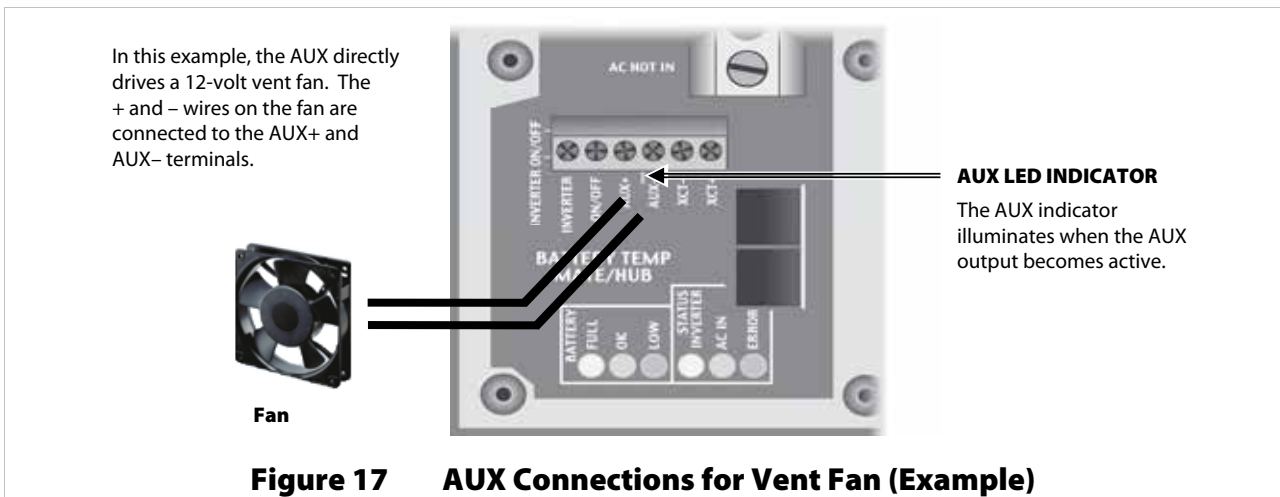
Figure 16   Accessory Connections

AUX Wiring

The **AUX+** and **AUX–** terminals are a switched 12 Vdc supply. The **AUX** can respond to different criteria and control many functions. These include cooling fans, vent fans, load diversion, fault alarms, and the *Advanced Generator Start* (AGS) function.

The terminals can supply up to 0.7 amps at 12 Vdc (8.4 watts). This is sufficient to drive a small fan or a relay controlling a larger device. The terminals accept wire up to 2.5 mm² (#14 AWG). The **AUX** circuit contains electronic overcurrent protection, which resets after being overloaded. No additional fuses are required for the **AUX** terminals.

The default setting for the **AUX** output is to control the Turbo Fan included with sealed models. (See Figure 17.) The **AUX** output can only control one function at a time. It cannot be used for anything else if the Turbo Fan is connected.

The control logic for the **AUX** output is not always located in the same device. Inverter **AUX** functions are located within the inverter itself and are described accordingly. Although inverter-based functions require the system display for programming, they will function even if the display is removed. However, AGS programming is located within the system display and will not work if the display is removed. Other devices may also be able to control the terminals. For generator control, see page 27.

In this example, the AUX directly drives a 12-volt vent fan. The + and – wires on the fan are connected to the AUX+ and AUX– terminals.

AUX LED INDICATOR

The AUX indicator illuminates when the AUX output becomes active.

Fan

Figure 17   AUX Connections for Vent Fan (Example)

In this example, the AUX output drives a relay that diverts wind power. The relay's coil is connected to the AUX+ and AUX– terminals. When the AUX output closes the relay (based on battery voltage), the relay diverts the excess wind power to a water heating element.

Turbine

Rela

NOTE: Relays and elements shown are examples only and may vary depending on the installation.

Element

Figure 18   AUX Connections for Diversion (Example)

900-0168-01-00 Rev C

Generator Control

The AUX terminals can provide a signal to control an automatic-start generator. The control function can be *Advanced Generator Start* (AGS), which is situated in the system display. AGS can start the generator using settings from the system display, or it can use battery readings from the FLEXnet DC battery monitor. Alternately, the control function can be *Gen Alert*, which is a simpler function based directly in the FXR inverter. The choice of control function depends on system needs and the capabilities of each device.

The generator must be an electric-start model with automatic choke. It is recommended to have "two-wire" start capability. A two-wire-start generator is the simplest type, where the cranking and starting routine is automated. It usually has a single switch with two positions that is turned ON to start, OFF to stop.

Two-Wire-Start

The 12 Vdc signal provided by the **AUX** output can be switched on and off to provide a start signal. It is possible to send a 12-Vdc signal directly to the generator. However, this should never be done if it connects the **AUX** output directly to the generator's own battery. It is more common to use the **AUX** terminals to energize the coil of a 12 Vdc automotive or similar relay.

The OutBack FLEXware Relay Assembly depicted in Figure 19 is sold for this purpose. The relay contacts can serve in place of the generator's start switch. The battery shown below is depicted for clarity. In most cases, it is part of the generator's internal starting circuit and is not an external component.

The drawing below is one example of a possible arrangement. Specific arrangements, relays, and other elements depend on the requirements of the installation and of the generator.


Figure 19   Two-Wire Generator Start (Example)
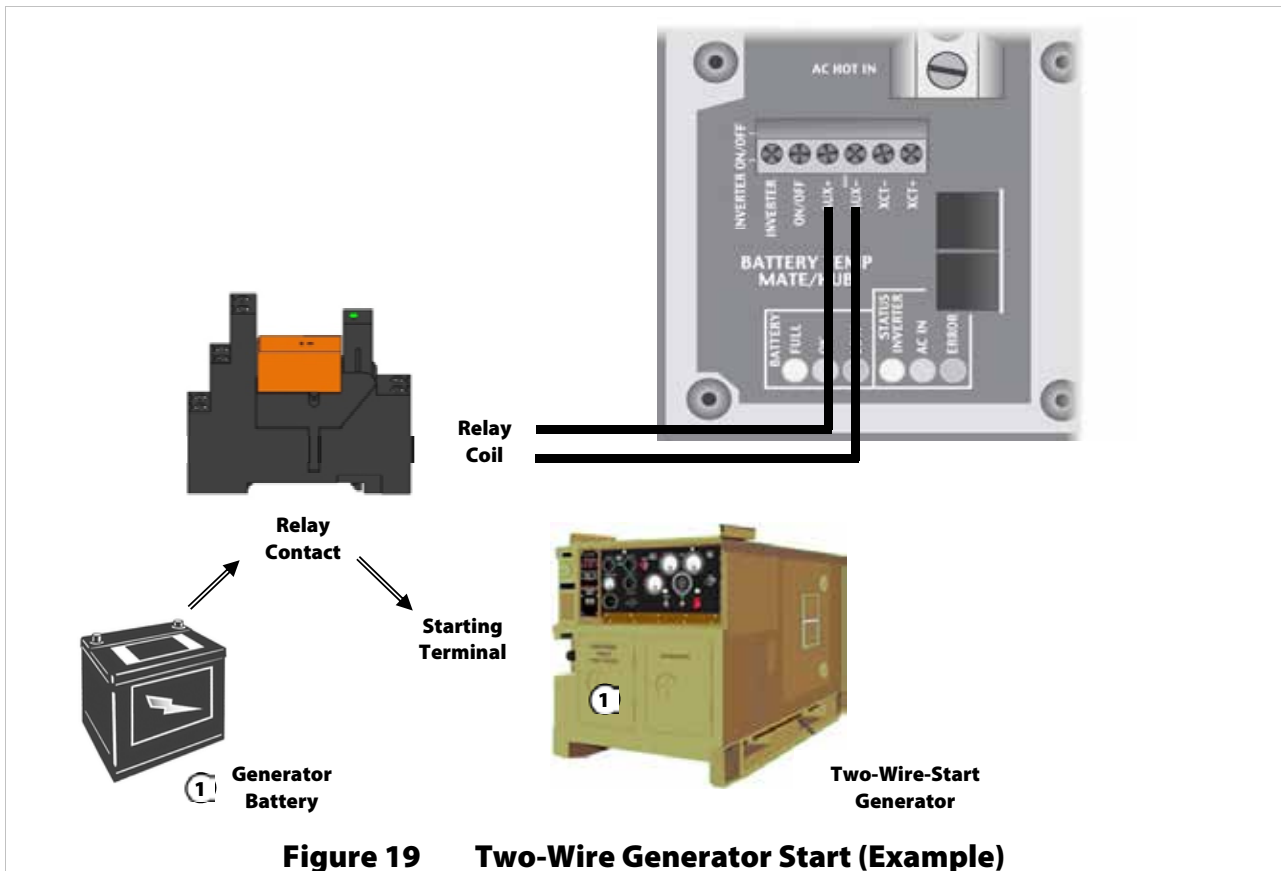
Three-Wire-Start

A "three-wire-start" generator has two or more starting circuits. It usually has a separate switch or position for cranking the generator. A three-wire generator has fewer automated functions than a two-wire. It usually requires multiple controls for starting, running, or stopping. The AUX terminals cannot control this type of generator without using a three-wire to two-wire conversion kit.

Atkinson Electronics **(http://atkinsonelectronics.com)** is one company that makes these kits. The Atkinson GSCM-Mini is intended to work with OutBack inverters.

The drawing below is one example of a possible arrangement. Specific arrangements, relays, and other elements depend on the requirements of the installation and of the generator.
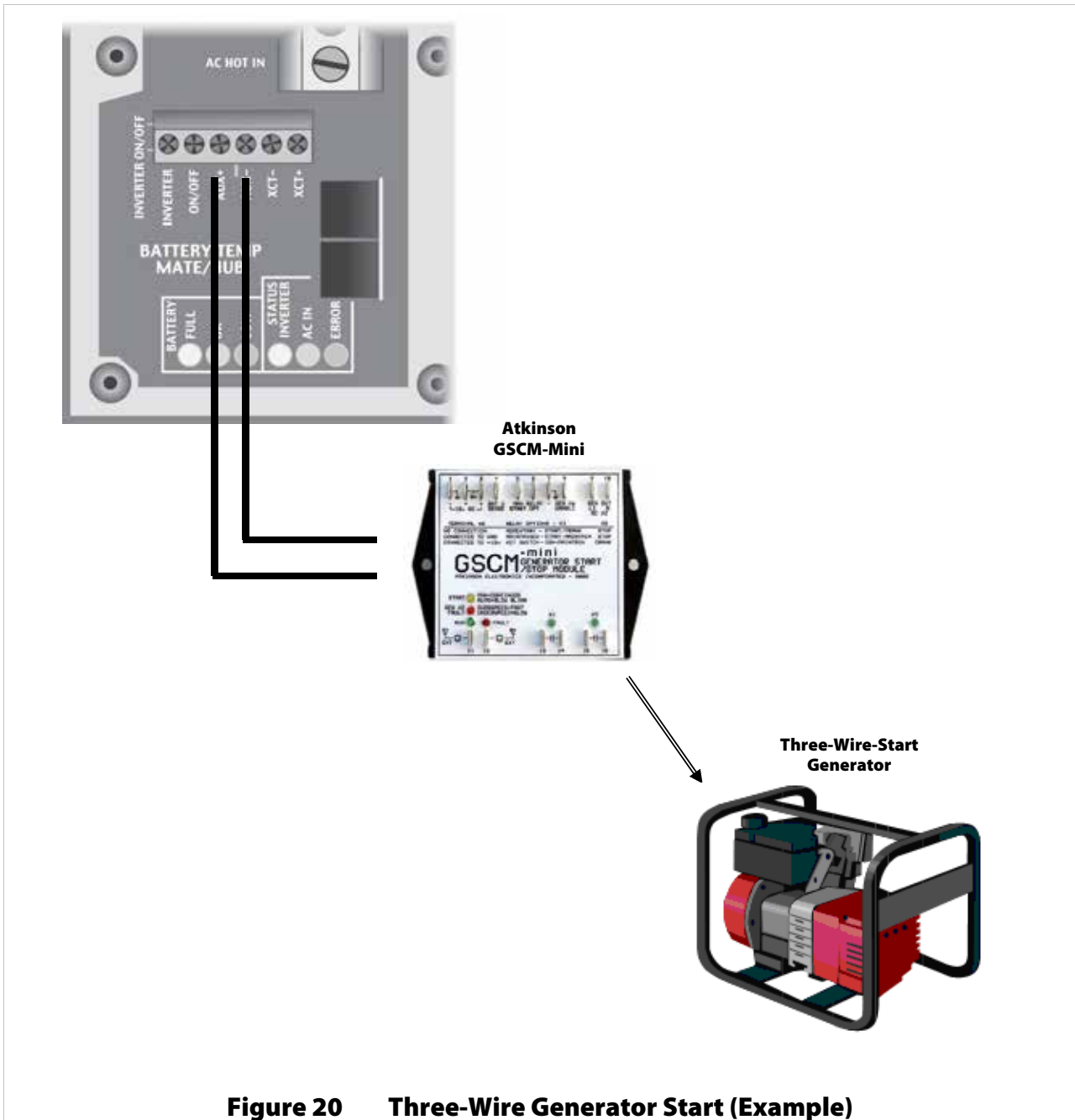
Figure 20   Three-Wire Generator Start (Example)

AC Configurations

Single-Inverter

When installing an inverter AC system, the following rules must be observed.

➢ All overcurrent devices for must be sized for 30 Aac or less.

➢ All wiring must be sized for 30 Aac or more.

➢ All output circuit breakers must be sized appropriately for loads and inverter power.

➢ The AC input (generator or utility grid) must be a single-phase source of the proper voltage and frequency.

Figure 21   Single-Inverter Wiring
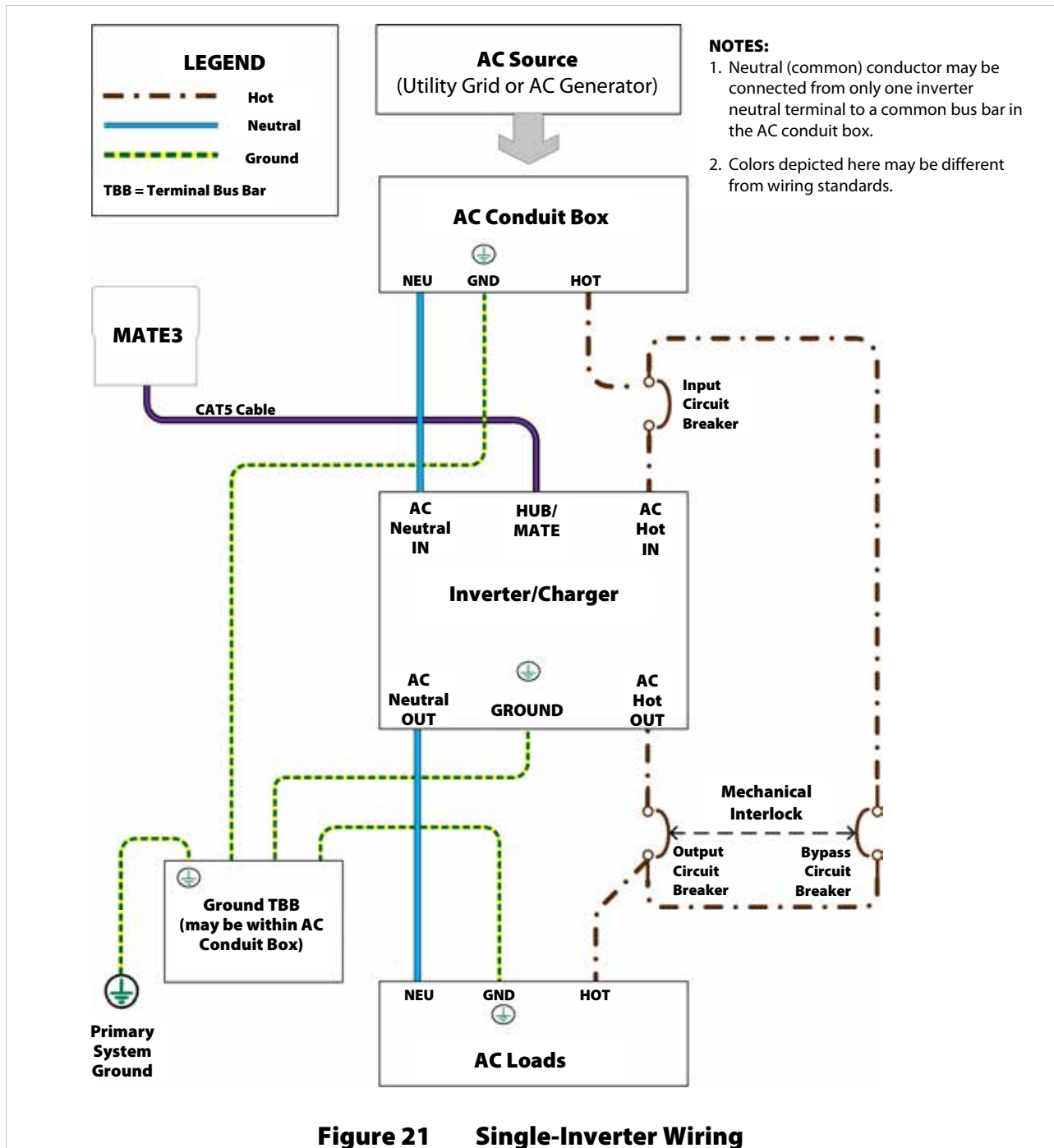
Multiple-Inverter AC Installations (Stacking)

Installing multiple inverters in a single AC system allows larger loads than a single inverter can handle. This requires stacking. Stacking inverters refers to how they are wired within the system and then programmed to coordinate activity. Stacking allows all units to work together as a single system.

Examples of stacking configurations include "parallel" and "three-phase" configurations.

Stacking Connections

Stacking requires an OutBack HUB10.3 communications manager and a system display.
All interconnections between the products are made using CAT5 non-crossover cable.

HUB10.3   Additional Ports   Port 1   MATE3 Port   MATE3
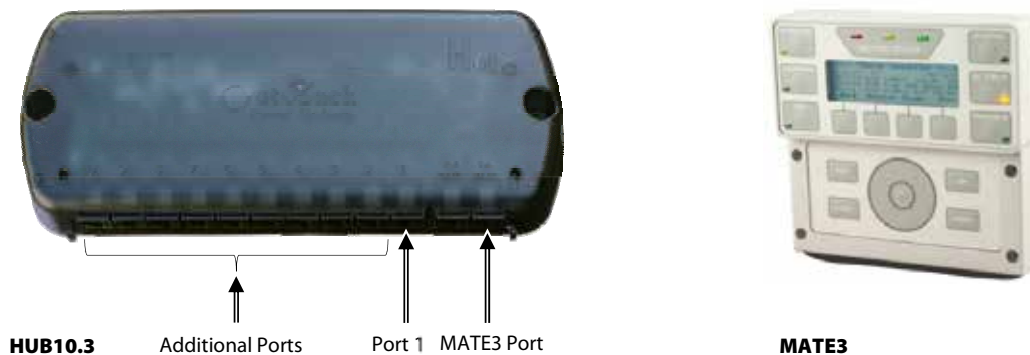
Figure 22   OutBack HUB10.3 and MATE3

Each inverter must be assigned a stacking mode, "master" or "slave", depending on the configuration.

➢   The master provides the primary output phase. Other inverters in the system base their phase on that of the master. If the master shuts off, all other inverters also shut off. The master must sense and connect to an AC source before other inverters can connect.

In a parallel-stacked system, the master tends to be the most heavily used unit.

"Subphase master" inverters are used in three-phase systems. A subphase master inverter operates semi-independently of the master inverter. Although the master inverter sets the phase relationship, the subphase master creates an output independent of the master.

The master on the A phase output cannot measure loads and voltages on any other output. Subphase masters are required to perform monitoring and regulation on the B and C phase outputs.

➢   A slave inverter does not create an independent output. It simply assists the master or subphase master by adding power to the output as needed.

~   The Power Save function can place slave inverters in "Silent" mode when not in use. They are activated by the master or subphase master when required.

Each inverter is assigned to a particular phase when assigned a port on the HUB10.3 communications manager. Port assignments will vary with the system. The master must be plugged into port 1. In parallel stacking, any slave inverter can use any other port, beginning with port 2. In three-phase stacking, the port assignments are very specific. See the HUB10.3 literature for more information. Regardless, it is important to keep track of units and ports for programming purposes.

Programming uses the system display to assign a status and stacking value to the inverter on each port. As long as the master is plugged into port 1, these assignments can be changed as needed.

⚠️ **IMPORTANT:**

➢ The master inverter must always be connected to port 1 on the communications manager. Connecting it elsewhere, or connecting a slave to port 1, will result in backfeed or output voltage errors which will shut the system down immediately.

➢ Installing multiple inverters without stacking them (or stacking them incorrectly) will result in similar errors and shutdown.

➢ Although stacking allows greater capacity, the loads, wiring, and overcurrent devices must still be sized appropriately. Overloading may cause circuit breakers to open or the inverters to shut down.

Stacking Configurations

Parallel Stacking (Dual-Stack and Larger)

In parallel stacking, two or more inverters create a single, common 230 Vac[4] bus.

➢ The slave outputs are controlled directly by the master and cannot operate independently.

➢ All inverters share a common input (AC source) and run loads on a common output.

➢ Slave inverters can go into Silent mode when not in use. The master will activate individual slaves based on load demand. This reduces idle power consumption and improves system efficiency.

➢ Up to ten inverters may be installed in a parallel arrangement. The example on this page shows three inverters. The wiring diagram on the next page shows four. All inverters must be the same model.
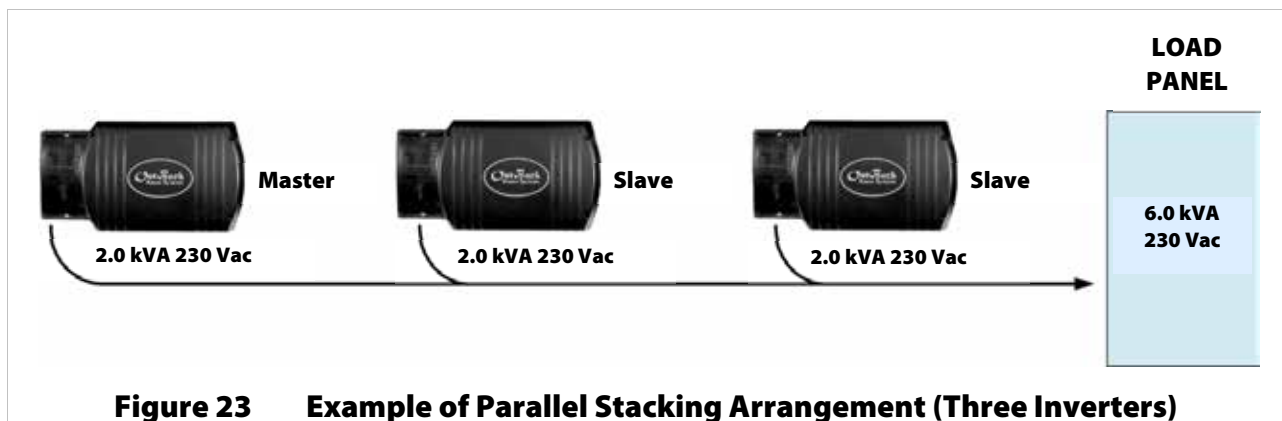
Figure 23 Example of Parallel Stacking Arrangement (Three Inverters)

When installing a parallel inverter system, observe the following rules.

➢ Parallel stacking requires both the system display and the communications manager. See the HUB10.3 literature for any required jumper configurations.

➢ The inverter that is mounted physically lowest is always the master and is programmed as *Master.* 📖 Mounting below the other inverters allows the master to avoid heat buildup and remain relatively cool as it sees the greatest duty cycle.

➢ The master must be connected to port 1 of the communications manager. Other inverters must not be selected as master.

➢ All slave inverters, regardless of number, should be selected as *Slave* during programming. Slaves can be connected to any port numbered 2 and above.

➢ All overcurrent devices must be sized for 30 Aac or less. All wiring must be sized for 30 Aac or more.

➢ All output circuit breakers must be sized appropriately for loads and inverter wattage.

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[4] Output voltages may vary with regional voltage standards.

Installation

➢ The AC input (generator or utility grid) must be a single-phase source of the proper voltage and frequency.

➢ When wiring the AC source to the inverters, local codes may require the inverter circuits to be located at the opposite end of the panel from the main circuit breaker. This prevents overloading of the AC bus.
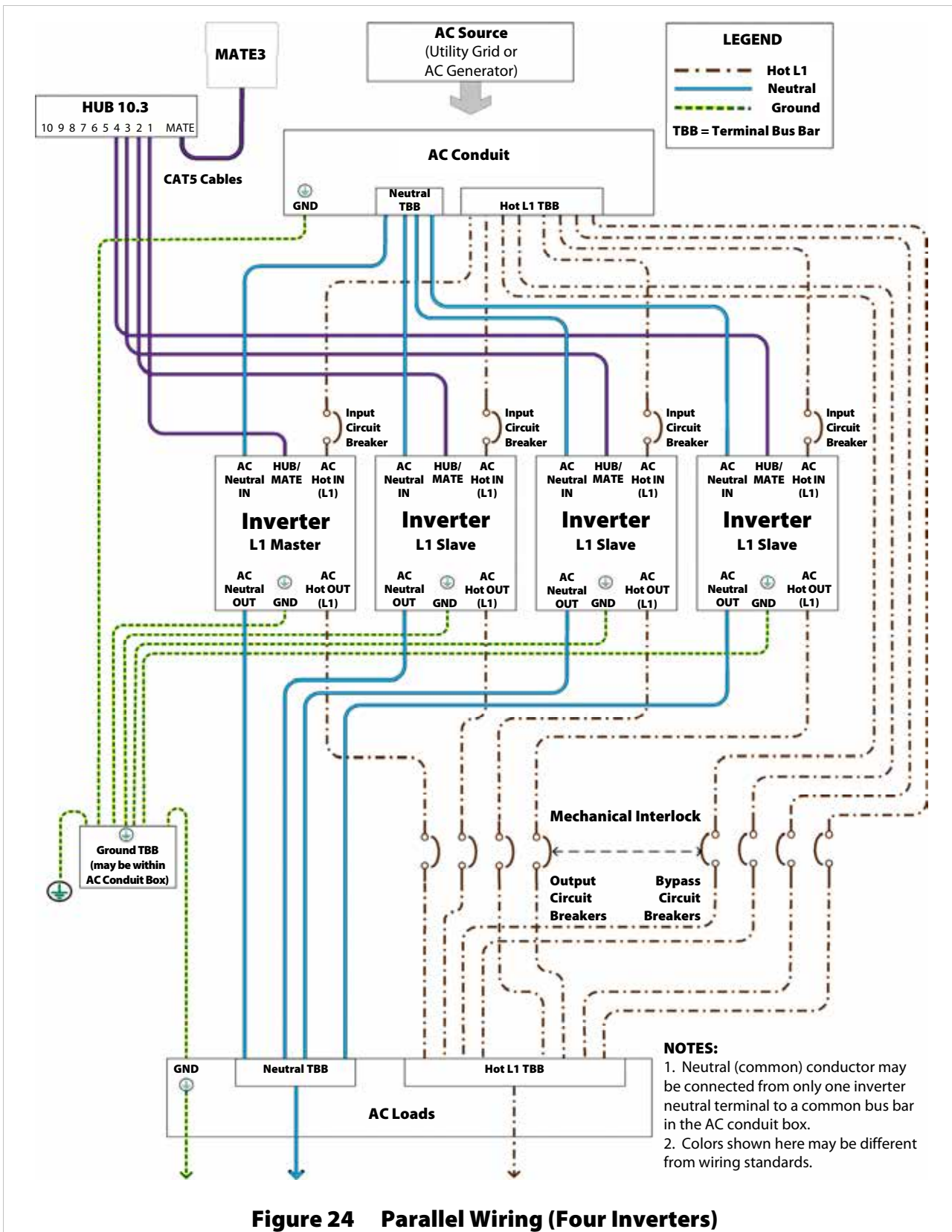

**Figure 24   Parallel Wiring (Four Inverters)**

Three-Phase Stacking

In three-phase stacking, inverters create three separate 230 Vac[5] outputs in a wye configuration.

➢ The three outputs operate independently of each other. The inverters on one output cannot assist another. Several inverters can be installed in parallel to power all 230 Vac loads on that output.

➢ The output of each inverter is 120° out of phase from the others. Any two outputs produce 400 Vac between them. The outputs can be used to power three-phase loads when all inverters work together.

➢ Up to nine inverters, three per phase, may be installed in a three-phase arrangement. (The wiring drawing on the next page shows only one inverter per phase.) All inverters must be the same model.
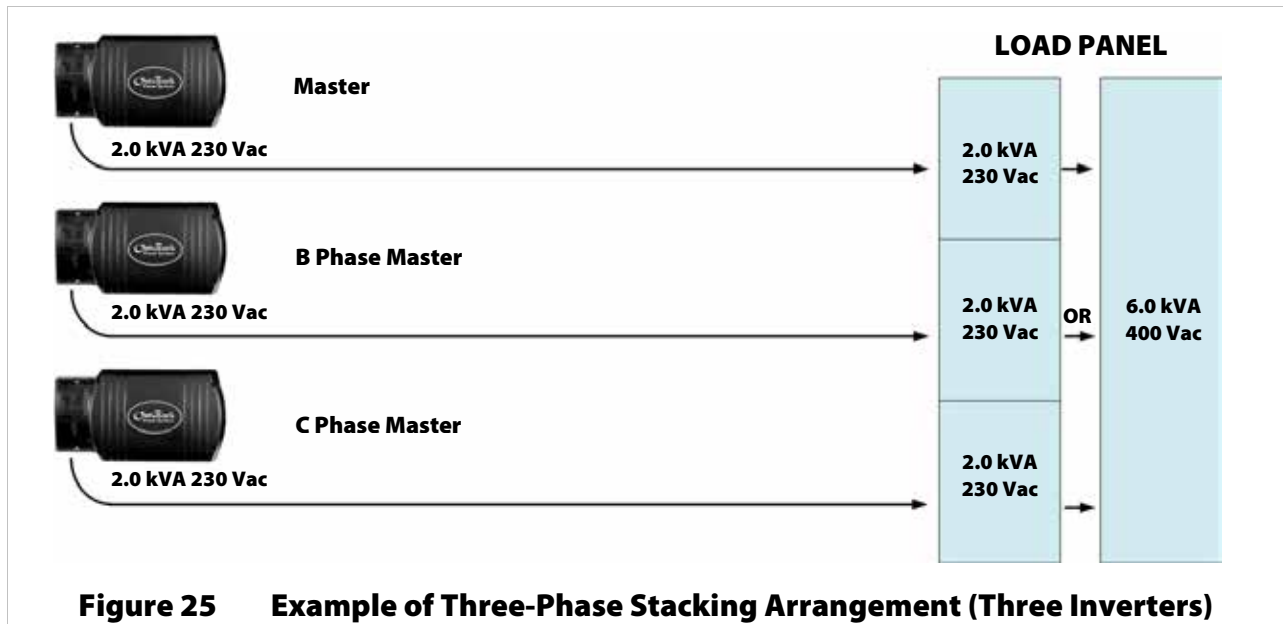
Figure 25   Example of Three-Phase Stacking Arrangement (Three Inverters)
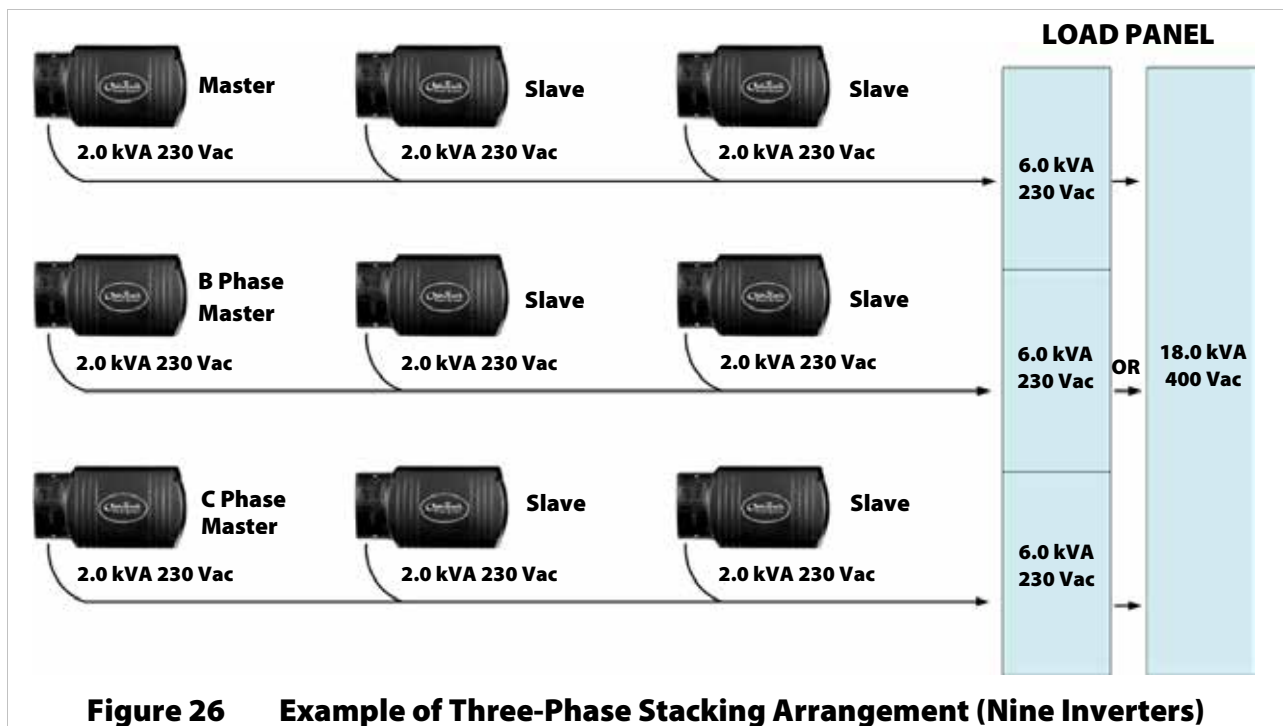
Figure 26   Example of Three-Phase Stacking Arrangement (Nine Inverters)

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[5] Output voltages may vary with regional voltage standards.

Installation

When installing a three-phase inverter system, observe the following rules.

➢ Three-phase stacking requires both the system display and the communications manager. See the HUB10.3 literature for any required jumper configurations.

➢ The inverter that is mounted physically lowest is always master and is programmed as **Master**. Mounting below the other inverters allows the master to avoid heat buildup and remain relatively cool as it sees the greatest duty cycle.

➢ The master must be connected to port 1 of the communications manager. Other inverters must not be selected as master.

➢ Any other inverter on the Phase A output (parallel with the master) should be selected as **Slave** during programming. These can be connected to ports 2 or 3. Phase A inverters cannot use other ports.

➢ The subphase master for the Phase B output must be programmed as **B Phase Master**. It must be connected to port 4.

➢ Any other inverter on the Phase B output (parallel with the B subphase master) should be selected as **Slave** during programming. These can be connected to ports 5 or 6. Phase B inverters cannot use other ports.

➢ The subphase master for the Phase C output must be programmed as **C Phase Master**. It must be connected to port 7.

➢ Any other inverter on the Phase C output (parallel with the C subphase master) should be selected as **Slave** during programming. These can be connected to ports 8 or 9. Phase C inverters cannot use other ports.

➢ All overcurrent devices must be sized for 30 Aac or less. All wiring must be sized for 30 Aac or more.

➢ All output circuit breakers must be sized appropriately for loads and inverter wattage.

➢ The AC input (generator or utility grid) must be a three-phase wye configuration source of the proper voltage and frequency.

➢ When wiring the AC source to the inverters, local codes may require the inverter circuits to be located at the opposite end of the panel from the main circuit breaker. This prevents overloading of the AC bus.
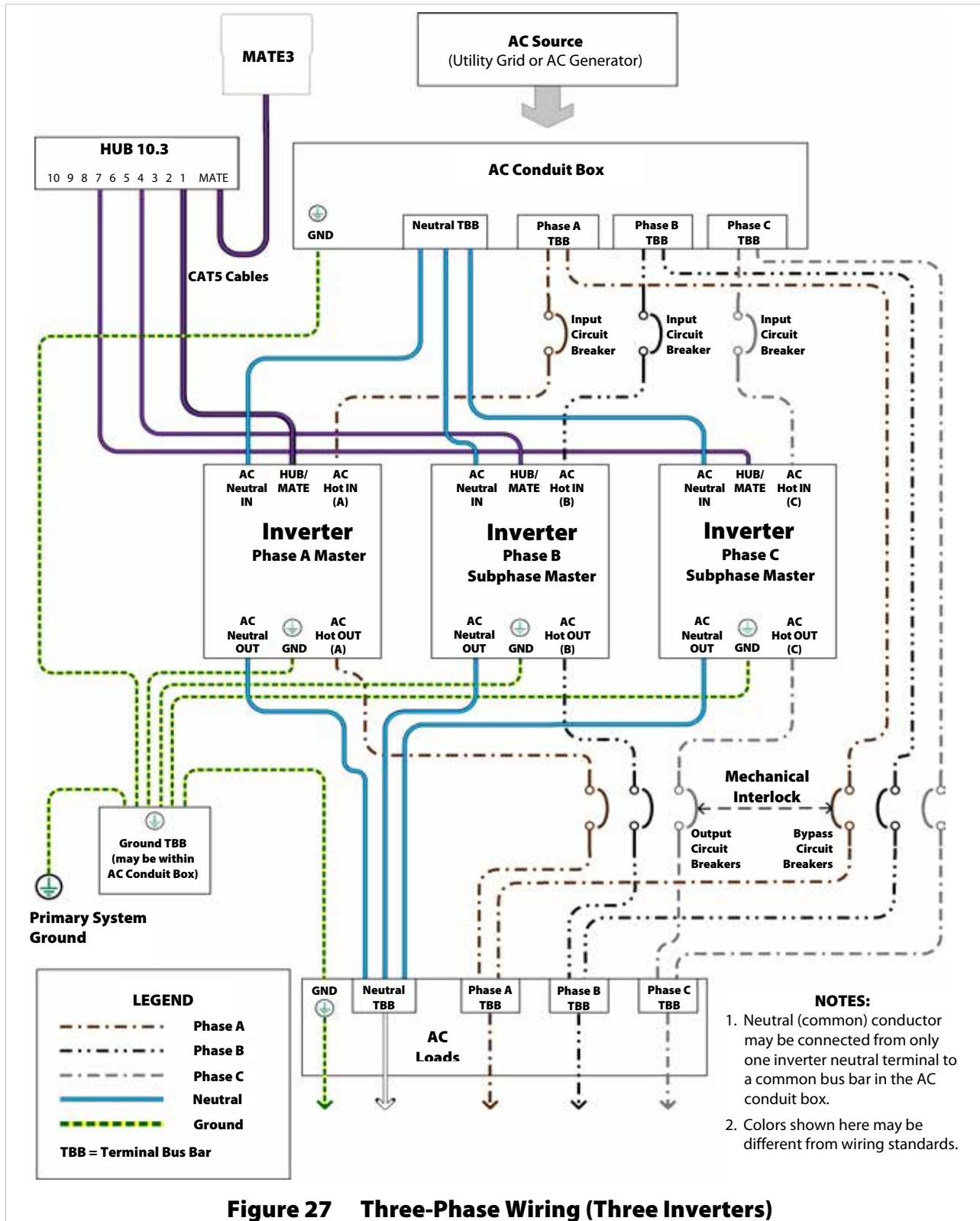
Figure 27   Three-Phase Wiring (Three Inverters)

NOTES:

1. Neutral (common) conductor may be connected from only one inverter neutral terminal to a common bus bar in the AC conduit box.

2. Colors shown here may be different from wiring standards.

LEGEND

— · — · — · —	Phase A
— ·· — ·· — ·· —	Phase B
— · — · — · —	Phase C
————————	Neutral
■ ■ ■ ■ ■ ■	Ground

TBB = Terminal Bus Bar

NOTES:

Commissioning

Functional Test

	WARNING: Shock Hazard and Equipment Damage
	The inverter cover must be removed to perform these tests. The components are close together and carry hazardous voltages. Use appropriate care to avoid the risk of electric shock or equipment damage.

It is highly recommended that all *applicable* steps be performed in the following order. However, if steps are inapplicable, they can be omitted.

If the results of any step do not match the description, see the Operator's Manual for troubleshooting.

Pre-startup Procedures

1. Ensure all DC and AC overcurrent devices are opened, disconnected, or turned off.

2. Double-check all wiring connections.

3. Confirm that the total load does not exceed the inverter's wattage.

4. Inspect the work area to ensure tools or debris have not been left inside.

5. Using a digital voltmeter (DVM) or standard voltmeter, verify battery voltage. Confirm the voltage is correct for the inverter model. Confirm the polarity.

6. Connect the system display, if present.

	CAUTION: Equipment Damage
	Incorrect battery polarity will damage the inverter. Excessive battery voltage also may damage the inverter. This damage is not covered by the warranty.

	IMPORTANT:
	Prior to programming (see Startup), verify the operating frequency of the AC source. This is necessary for correct AC operation. The default setting is 50 Hz, but this can be changed to 60 Hz.

Startup

To start a single-inverter system:

1. Close the main DC circuit breakers (or connect the fuses) from the battery bank to the inverter. Confirm that the system display is operational, if present.
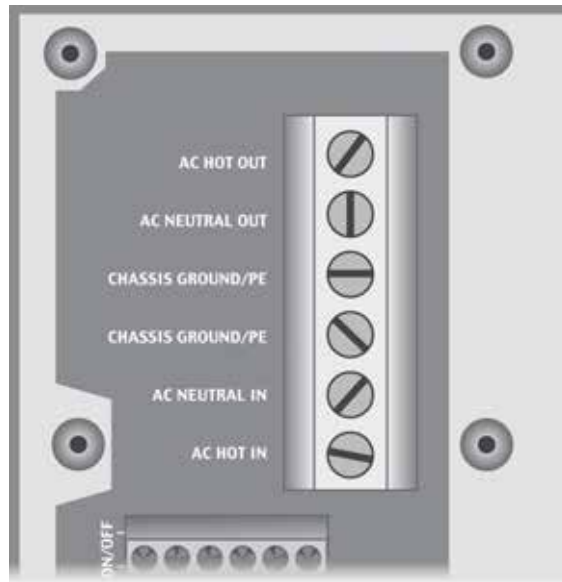
Figure 28   AC Terminals

2. If a system display is present, perform all programming for all functions. 📖
    These functions may include AC input modes, AC output voltage, input current limits, battery
    charging, generator starting, and others.

3.   Turn on the inverter using the system display (or external switch, if one has been installed).
    The inverter's default condition is Off. Do not turn on any AC circuit breakers at this time.

4. Using a DVM or voltmeter, verify 230 Vac (or appropriate voltage) between the AC HOT OUT
    and AC NEUTRAL OUT terminals. (See Figure 28 for AC terminals.) The inverter is working
    correctly if the AC output reads within 10% of 230 Vac or the programmed output voltage.

Proceed past the items below to Step 5 on the next page.

To start a multiple-inverter (stacked) system:

1. Close the main DC circuit breakers (or connect the fuses) from the battery bank to the inverter.
    Repeat for every inverter present. Confirm that the system display is operational.

    With the system display, perform any programming for stacking and all other functions. 📖
    These functions may also include AC input modes, AC output voltage, input current limits,
    battery charging, generator starting, and others. When stacking in parallel, all slave inverters
    will observe the programming settings for the master. They do not need to be programmed
    individually.   The MATE3 Configuration Wizard may be used to assist programming.

2. Turn on the master inverter using the system display (or external switch, if one is installed).
    The inverter's default condition is Off. Do not turn on any AC circuit breakers at this time.

3. Using the system display, temporarily bring each slave out of Silent mode by raising the Power
    Save Level of the master.

    ➢   As each slave is activated, it will click and create an audible hum.

    ➢   Confirm that the system display shows no fault messages.

4. Using a DVM or voltmeter, verify appropriate voltage between the AC HOT OUT terminal on the master inverter and the AC HOT OUT terminal on each slave. Parallel inverters should read close to zero. Three-phase inverters should read within 10% of 400 Vac or the designated output voltage.

➢ When this test is finished, return the master to its previous settings.

After output testing is completed, perform the following steps:

5. Close the AC output circuit breakers. If AC bypass switches are present, place them in the normal (non-bypass) position. *Do not connect an AC input source or close any AC input circuits.*

6. Use a DVM to verify correct voltage at the AC load panel.

7. Connect a small AC load and test for proper functionality.

8. Close the AC input circuit breakers and connect an AC source.

➢ Using a DVM or voltmeter, check the AC HOT IN and AC NEUTRAL IN terminals for 230 Vac (or appropriate voltage) from the AC source.

➢ If a system display is present, confirm that the inverter accepts the AC source as appropriate for its programming. (Some modes or functions may restrict connection with the source. If one of these selections has been used for the system, it may not connect.) Check the system display indicators for correct performance.

9. If the charger is activated, the inverter will perform a battery charging cycle after powering up. This can take several hours. If restarted after a temporary shutdown, the inverter may skip most or all of the charging cycle. Confirm that it is charging as appropriate by using the system display.

10. Test other functions which have been enabled, such as generator start, selling, or search mode.

11. Compare the DVM's readings with the system display meter readings. If necessary, the system display's readings can be calibrated to match the DVM more accurately. Calibrated settings include AC input voltage for the AC input voltage, AC output voltage, and battery voltage.

Powering Down

These steps will completely isolate the inverter.

To remove power from the system:

1. Turn off all load circuits and AC input sources.

2. Turn off all renewable energy circuits.

3. Turn each inverter OFF using the MATE3 system display or external switch.

4. Turn off the main DC overcurrent devices for each inverter.

Adding New Devices

When adding new devices to the system, first turn off the system according to the Power Down instructions. After adding new devices, perform another functional test, including programming.

Compliance

➤ Compliance with the EMC directive for emissions is achieved with installation of EMC kit FXR-FILTER or equivalent. Installation instructions for FXR-FILTER are available.

➤ Compliance with the requirement of IEC 62109-2 for remote fault indication is achieved with installation of the MATE3 or AXS Port in the system.

➤ Compliance with the requirement of IEC 62109-2 for identification of firmware version is achieved with installation of the MATE3 or AXS Port in the system.

Firmware Updates

IMPORTANT:

All inverters will shut down during firmware updates. If loads need to be run while updating the firmware, bypass the inverter with a maintenance bypass switch. Communication cables must remain connected and DC power must remain on. Interrupted communication will cause the update to fail and the inverter(s) may not work afterward. Inverters automatically update one at a time beginning with the highest port. Each requires about 5 minutes.

Updates to the inverter's internal programming are periodically available at the OutBack website *www.outbackpower.com*. If multiple inverters are used in a system, all units must be upgraded at the same time. All units must be upgraded to the same firmware revision.

IMPORTANT:

All stacked FXR inverters must have the same firmware revision. If multiple stacked inverters are used with different firmware revisions, any inverter with a revision different from the master will not function. (See the stacking section on page 30.) The MATE3 will display the following message:

> **An inverter firmware mismatch has been detected. Inverters X, Y, Z [6] are disabled. Visit www.outbackpower.com for current inverter firmware.**

Operation

Once the mounting, wiring, and other installation steps are completed, proceed to the *FXR Series Inverter/Charger Operator's Manual*.

Refer to the system display manual for programming instructions and menus.

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[6] The port designations for the mismatched inverters are listed here.

Definitions

The following is a list of initials, terms, and definitions used with this product.

Table 6   Terms and Definitions

Term	Definition
AC	Alternating Current; refers to voltage produced by the inverter, utility grid, or generator
AC Plate	Inverter accessory to accommodate flexible cable when conduit is not used
AGS	Advanced Generator Start
AUX	Inverter's 12-volt auxiliary output
Communications manager	Multi-port device such as the OutBack HUB10.3; used for connecting multiple OutBack devices on a single remote display; essential for stacking inverters
DC	Direct Current; refers to voltage produced by the batteries or renewable source
DCC	DC Cover; shields the DC terminal area on vented FX-class inverters
DVM	Digital Voltmeter
GFDI	Ground Fault Detector Interruptor; a safety device for PV systems
GND	Ground; a permanent conductive connection to earth for safety reasons; also known as Chassis Ground, Protective Earth, and PE
Grid-interactive, grid-intertie, grid-tie	Utility grid power is available for use and the inverter is a model capable of returning (selling) electricity back to the utility grid
HUB10.3	An OutBack communications manager product; used for system stacking and coordination
Invert, inverting	The act of converting DC voltage to AC voltage for load use or other applications
IEC	International Electrotechnical Commission; an international standards organization
LED	Light-Emitting Diode; refers to indicators used by the inverter and the system display
Master	An inverter which provides the primary output phase of a stacked system; other stacked inverters base their output and on/off state on the master
MATE3	An OutBack system display product, used for monitoring, programming and communicating with the inverter
NEU	AC Neutral; also known as Common
Neutral-to-ground bond	A mechanical connection between the AC neutral (Common) bus and the ground (PE) bus; this bond makes the AC neutral safe to handle
Off-grid	Utility grid power **is not** available for use
On-grid	Utility grid power is available for use (does not imply grid-interactive capability)
PV	Photovoltaic
RE	Renewable Energy
RTS	Remote Temperature Sensor; accessory that measures battery temperature for charging
Slave	An inverter which adds additional power to the master or subphase master in a stacked system; a slave does not provide an output of its own

Table 6   Terms and Definitions

Term	Definition
Subphase Master	An inverter which provides the output for additional phases of a stacked system; the output of a subphase master is based on the output of the master
System display	Remote interface device (such as the MATE3), used for monitoring, programming and communicating with the inverter; also called "remote system display"
Three-phase, 3-phase	A type of utility electrical system with three "hot" lines, each 120° out of phase; each carries the nominal line voltage with respect to neutral; each carries voltage with respect to each other equaling the line voltage multiplied by 1.732
Transformer	This inverter is provided with an internal isolation transformer with a class N insulation system
Turbo Fan	External cooling fan used in place of the DCC on sealed FXR inverters
Utility grid	The electrical service and infrastructure supported by the electrical or utility company; also called "mains", "utility service", or "grid"

Symbols Used

WARNING: Hazard to Human Life

This type of notation indicates that the hazard could be harmful to human life.

CAUTION: Hazard to Equipment

This type of notation indicates that the hazard may cause damage to the equipment.

IMPORTANT:

This type of notation indicates that the information provided is important to the installation, operation and/or maintenance of the equipment. Failure to follow the recommendations in such a notation could result in voiding the equipment warranty.

MORE INFORMATION

When this symbol appears next to text, it means that more information is available in other manuals relating to the subject. The most common reference is to the *Operator's Manual* for the appropriate inverter model. Another common reference is the system display manual.

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