



INTERNATIONAL FX/VFX SERIES INVERTER/CHARGER

**FX2012ET FX 2024ET FX2348ET
VFX2612E VFX3024E VFX3048E**

Installation Manual

Mounting and Installation

Warranty Introduction

Dear OutBack Customer,

Thank you for your purchase of OutBack products. We make every effort to assure our power conversion products will give you long and reliable service for your renewable energy system.

As with any manufactured device, repairs might be needed due to damage, inappropriate use, or unintentional defect. Please note the following guidelines regarding warranty service of OutBack products:

- Any and all warranty repairs must conform to the terms of the warranty.
- All OutBack equipment must be installed according to their accompanying instructions and manuals with specified over-current protection in order to maintain their warranties.
- The customer must return the component(s) to OutBack, securely packaged, properly addressed, and shipping paid. We recommend insuring your package when shipping. Packages that are not securely packaged can sustain additional damage not covered by the warranty or can void warranty repairs.
- There is no allowance or reimbursement for an installer's or user's labor or travel time required to disconnect, service, or reinstall the damaged component(s).
- OutBack will ship the repaired or replacement component(s) prepaid to addresses in the continental United States, where applicable. Shipments outside the U.S. will be sent freight collect.
- In the event of a product malfunction, OutBack cannot bear any responsibility for consequential losses, expenses, or damage to other components.
- Please read the full warranty at the end of this manual for more information.

About OutBack Power Systems

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

Notice of Copyright

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Disclaimer

UNLESS SPECIFICALLY AGREED TO IN WRITING, OUTBACK POWER SYSTEMS:

(a) MAKES NO WARRANTY AS TO THE ACCURACY, SUFFICIENCY OR SUITABILITY OF ANY TECHNICAL OR OTHER INFORMATION PROVIDED IN ITS MANUALS OR OTHER DOCUMENTATION.

(b) ASSUMES NO RESPONSIBILITY OR LIABILITY FOR LOSS OR DAMAGE, WHETHER DIRECT, INDIRECT, CONSEQUENTIAL OR INCIDENTAL, WHICH MIGHT ARISE OUT OF THE USE OF SUCH INFORMATION. THE USE OF ANY SUCH INFORMATION WILL BE ENTIRELY AT THE USER'S RISK.

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www.outbackpower.com

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EU DECLARATION OF CONFORMITY

According to ISO / IEC Guide 22 and EN45014

Product Type: Inverter/Charger

Product Model Numbers:

• FX2012ET • FX2024ET • FX2348ET • VFX2612E • VFX3024E • VFX3048E

The OutBack Power Systems FX Series Inverter/Chargers export ("E") models comply with the following EU directives when installed in off-grid applications only:

- EU Declaration of Conformity regarding Electromagnetic Compatibility 89/336/EEC ("Council Directive of 3 May 1989")
- Low Voltage Directive 73/23/EEC ("Council Directive of 19 February 1973").

The compliance of the above-mentioned products with the directive and the following essential requirements is hereby confirmed:

Emissions Immunity Safety

EN 61000-6-3 (2001) EN 61000-6-1 (2001) EN 61000-3-2 (2000) EN 61000-3-3 (1995)

These inverter/chargers are not to be connected to the mains under any circumstances.

The AC-IN connection on each E model inverter/charger is only approved for connection to an AC generator.

All associated technical files are located in the Engineering Department at OutBack Power Systems, Inc., Arlington, Washington, USA.

As the manufacturer, we declare under our sole responsibility that the above-mentioned products comply with the above-named directives.



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Welcome to the OutBack Power Systems FX Series Inverter/Charger System

The FX Series Inverter/Charger offers a complete power conversion system—DC to AC, battery charging, and an AC transfer relay—and can be used as a stand-alone or back-up application. It is designed for indoor or enclosed locations.

OutBack Power Systems does everything possible to assure the components you purchase will function properly and safely when installed as instructed according to local and national electrical codes. Please read all of the following instructions and the instructions that come with any OutBack components that make up your power system. Further instructions on individual FX set-ups as well as system assemblies are included with the FLEXware manuals.

- The Export FX is CE tested (see “EU Declaration of Conformity” on the previous page).

The *International FX and VFX Series Inverter/Charger Installation Manual* covers the following information:

- Safety
- FX parts, standard and optional
- Initial inspection of the component
- Preparing the mounting surface
- Fastening the FX to the mounting surface
- General electrical information

E Series FX Series Inverter/Charger Models

Sealed Units (designed for harsher environments, but still require enclosed protection)

- FX2012ET (12 VDC/2000 VA) 230VAC/50 Hz
- FX2024ET (24 VDC/2000 VA) 230VAC/50 Hz
- FX2348ET (48 VDC/2300 VA) 230VAC/50 Hz

Vented Units (designed for more protected environments)

- VFX2612E (12 VDC/2600 VA) 230VAC/50 Hz
- VFX3024E (24 VDC/3000VA) 230VAC/50 Hz
- VFX3048E (48 VDC/3000VA) 230VAC/50 Hz

Each model FX has a single phase output marked with this symbol: 
Each inverter puts out a sine wave waveform marked with this symbol: 

Parts Included

- One E Series FX Series Inverter/Charger
- One “WARNING ELECTRICAL SHOCK” sticker to place on the exterior of the FX
- One packet of silicone grease to protect CAT 5 cable connections
- One installation manual
- One programming manual
- One Turbo Kit (sealed units)
- One DC Wiring Cover or DCC (vented units)
- DC terminal covers (one red and one black)
- AC Wire Compartment Plate

READ FIRST!



IMPORTANT SAFETY INSTRUCTIONS **SAVE THESE INSTRUCTIONS**

Read all instructions and cautionary markings on the FX, the batteries and all appropriate sections of this installation and user manual as well as other component manuals before using the system.

Be cautious around electricity, electrical components, and batteries. Shocks, burns, injury, and even death can occur if an installer comes in contact with electricity.

Install all components and wiring according to national and local electrical and building codes. This includes:

- Submitting a plan to the local building department
- Passing inspection
- Requiring a licensed electrician to do the work when mandated

OutBack Power Systems cannot be responsible for system failure, damages, or injury resulting from improper installation of their products.

Use only the recommended DC and AC wire sizes or greater. Be sure all wires are in good condition.

Install the FX in a dry location, preferably indoors.



- Install the FX in a shaded area out of direct sunlight for best operation.
- For installations where the FX may be exposed to water spray, a sealed FX 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 FX's base. There is a drainage system on the base of the FX to dispel condensation. If submerged, water can enter this drain and cause failure.
- The Vented FX (VFX) must be installed in a weather-proof enclosure or enclosed area. It is not designed for exposure to water or excessive wind-blown dust and debris.

INITIAL INSPECTION

Your FX is stoutly packaged for secure shipping. Please inspect the packaging and component for damage prior to installation. Retain this packaging in the unlikely event your FX is ever returned to OutBack for servicing (see page 39).

WARNING: WORKING NEAR LEAD ACID BATTERIES CAN BE DANGEROUS. BATTERIES
GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION.

Design the battery enclosure to prevent accumulation and concentration of hydrogen gas in “pockets” at the top of the enclosure. Vent the battery compartment from the highest point to the outside. A sloped lid can also be used to direct the flow of hydrogen to the vent opening.

CAUTION

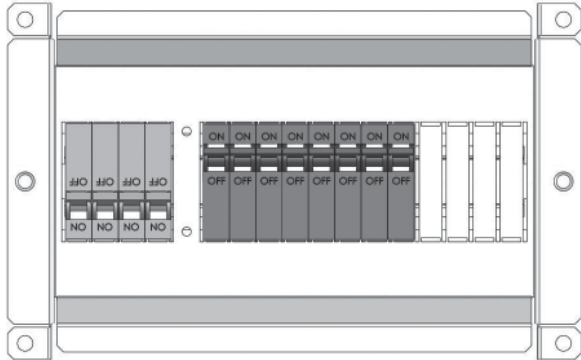
To reduce risk of injury, charge only deep-cycle lead acid, lead antimony, lead calcium, gel cell or absorbed glass mat type rechargeable batteries. Other types of batteries may burst, causing personal injury and damage. Never charge a frozen battery.

PERSONAL PRECAUTIONS

- Someone should be within range of your voice to come to your aid if needed.
- Keep plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
- Wear complete eye protection. Avoid touching eyes while working near batteries. Wash your hands with soap and warm water when done.
- If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters an eye, flood the eye with cool running water at once for at least 15 minutes and get medical attention immediately following.
- Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries.
- NEVER smoke or allow a spark or flame in vicinity of a battery or generator.
- Be extra cautious to reduce the risk of dropping a metal tool onto batteries. It could short-circuit the batteries or other electrical parts which can result in fire or explosion.
- Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery or other electrical current. A battery can produce a short circuit current high enough to weld a ring or the like to metal, causing severe burns.

SYSTEM PROTECTION

Electrical systems are designed to protect you, the wires, the components, and the devices served by the system.



Each FX must be part of a permanently grounded electrical system (see page 9). Grounding protects people and equipment from electrical shock. Grounding must be done according to local and national electrical codes.

OutBack circuit breakers—rated at 100% duty cycle—protect wiring by limiting the amount of current entering a system. All wired electrical systems require circuit breakers or fuses for protection.

OutBack offers both breakers and fuses for over-current protection. If they are provided by other vendors, they must be properly rated.

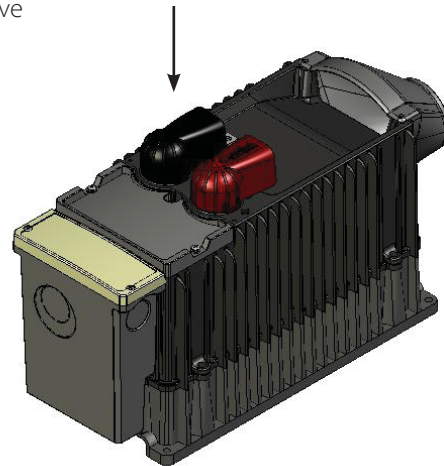
DC WIRING ORIGATION

DC brass battery terminals with 8M x 1.00 stainless steel threaded studs

Red terminal=battery positive

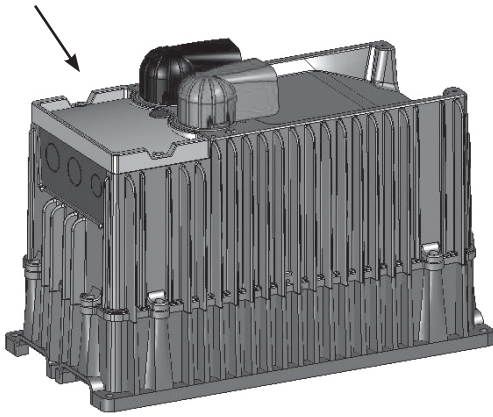
Black terminal = battery negative

Battery terminal covers

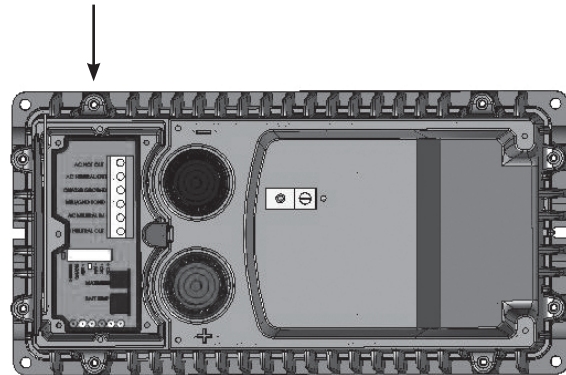


AC WIRING ORIGATION

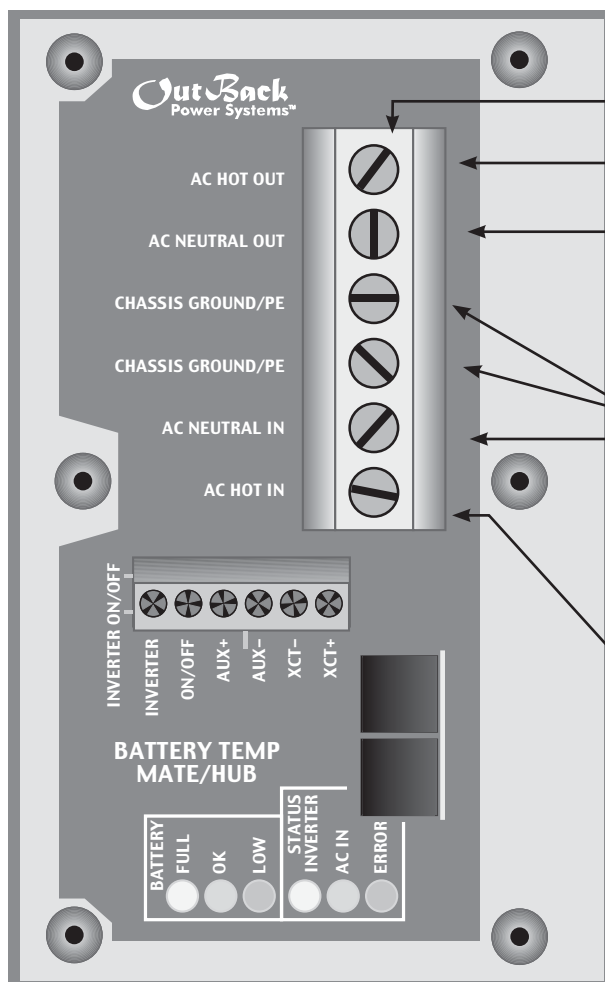
Lexan cover protects AC Wiring
Compartment Board



AC Wiring Board



AC WIRING COMPARTMENT BOARD



AC Terminal Block secures AC connections to the FX using set screws

AC HOT (PHASE) OUT supplies power to the loads.

AC NEUTRAL OUT acts as neutral leg for loads supplied by the FX and is common with the AC NEUTRAL IN.

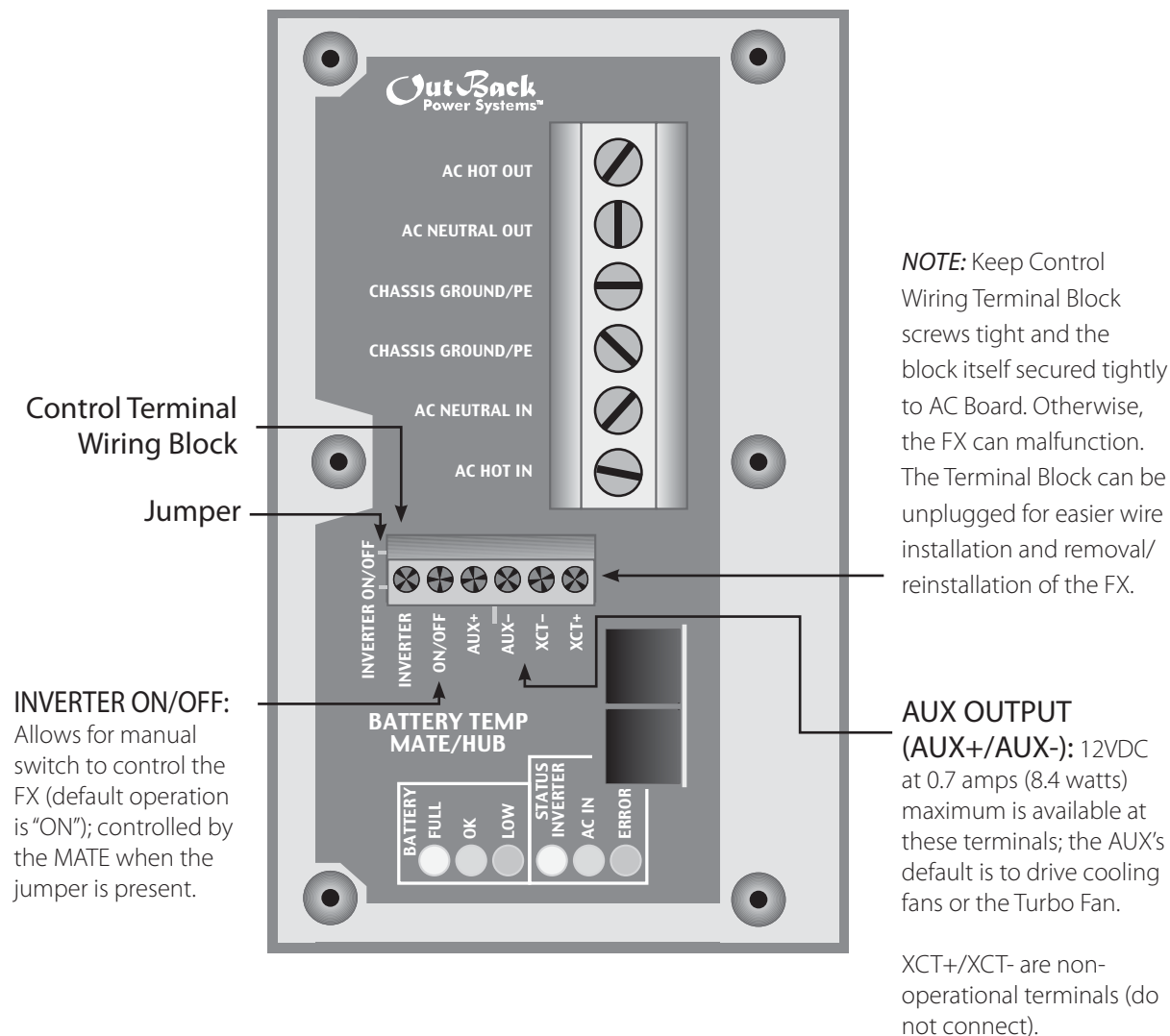
CHASSIS GROUND connections are common and act as grounds for both the incoming and outgoing AC circuits.

AC NEUTRAL IN acts as the neutral leg for AC power supplied by a generator to the FX and is common with the AC NEUTRAL OUT.

AC HOT (PHASE) IN connects incoming AC from the a generator to the FX through an internal AC transfer relay. This AC is used to run loads and recharge batteries.

NOTE: 16.0 mm² (6 AWG) is the largest wire size the AC Wiring Compartment Board can accommodate.

LOW VOLTAGE TERMINALS



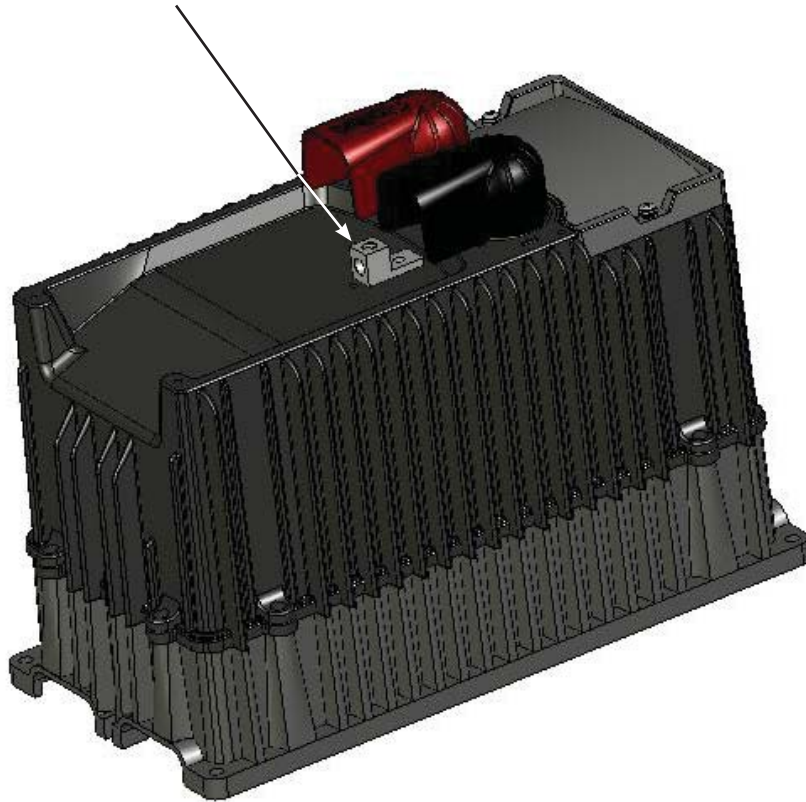
AC AND DC GROUNDING REQUIREMENTS

- Connect only to a grounded, permanent wiring system. Ensure there is only one neutral-ground connection in the system at any time. Some codes require this connection be made at the main panel only.
- Some generators have their own neutral ground connection. If a generator is used, its neutral-ground connection will need to be disengaged for proper system operation.
- For all installations, the negative battery conductor should be bonded to the grounding system at one (and only one) point in the system.
- OutBack products are not designed for use in a positive grounded system. Please contact OutBack Technical Support for further information.

The equipment ground on each is marked with this symbol:



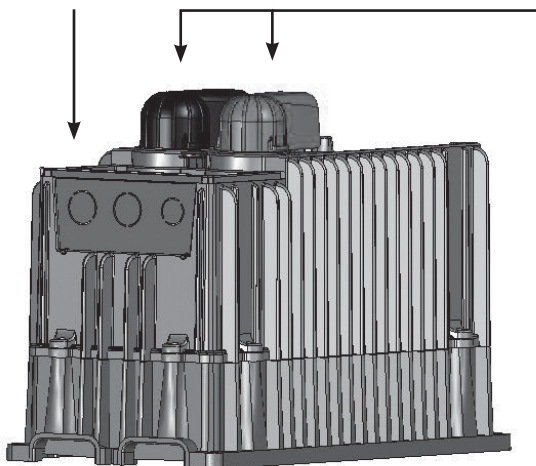
Box lug for grounding the FX chassis



FX PARTS AND ACCESSORIES

AC CONDUIT PLATE*

- AC conduit connects to the AC Conduit Plate for installations which do not utilize an optional ACA.



BATTERY TERMINAL COVERS

- The caps are made of stiff plastic with a snap-on design; remove them carefully using a flat-blade screwdriver inserted into the slots on the sides of each cover.
- DC conduit may be required for exposed installations.
- The DCA cover option (see below) allows conduit connection.
- Always keep the battery terminal covers installed.

DCC (DC COMPARTMENT COVER)

- Covers the DC terminal area and provides space to mount other components such as a DC current shunt
- Can be used with or without the DCA
- This is an optional accessory.

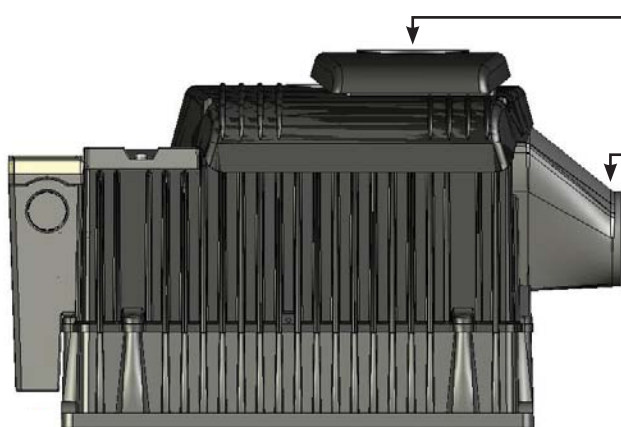


FX-ACA (AC CONDUIT ADAPTER)

- Extends the AC wiring compartment
- Connects to OutBack's FLEXware enclosures
- Protects and secures flexible cable with strain relief
- Houses the OutBack Surge Protector (FW-SP)
- Knockouts are intended for cables/strain relief
- This is an optional accessory.

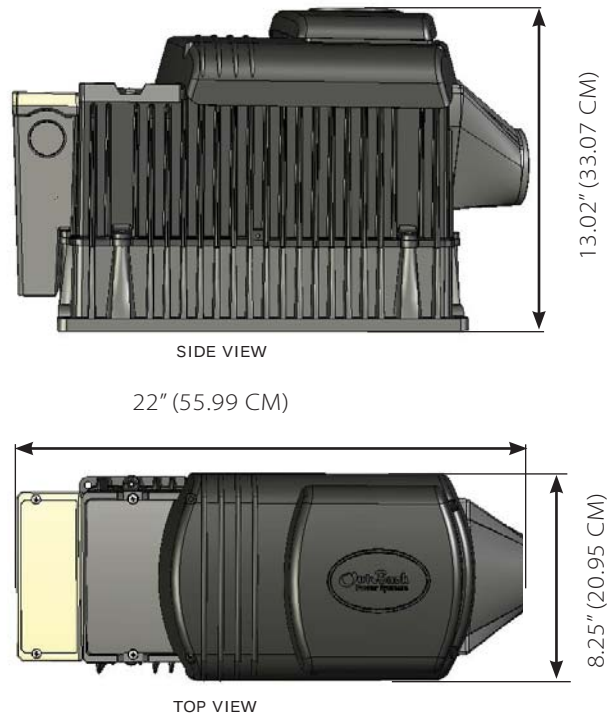
TURBO FAN COVER

- Included in place of a DCC on sealed FXs



DCA (DC CONDUIT ADAPTER)

- Allows the connection of two-inch TSC (Trade Size Conduit) to the FX
- Connects to OutBack's FLEXware enclosures



Weight is approximately 56 lbs (25.40 kg)

MOUNTING

- The E Series FX Series Inverter/Charger is approved for indoor or enclosed protected mounting only.
- An FX weighs approximately 56 lbs (25.40 kg) and must be secured with appropriate fasteners to a sturdy mounting surface capable of supporting its weight. It is easier for two people to install the FX due to its weight.
- OutBack FXs can be mounted in any position, but they perform better in locations offering plenty of air circulation.
- **NOTE:** If using an OutBack FLEXware Mounting Plate, avoid large air gaps behind the plate which can result in louder mechanical noise during inverting/charging under heavy loads.
- Due to the variance in other mounting methods, OutBack only endorses the use of FLEXware or previous versions of its mounting plate for installing the FX and associated system components using M6 X 20 mm machine screws (stainless steel for FLEXware and self-tapping for older mounting plates), one per corner. Follow the instruction manual that comes with each mounting system.
- If mounting the FX on other surfaces such as plywood, wall studs, or masonry, use appropriate fasteners to support approximately its weight. OutBack cannot be responsible for damage to the FX if it is attached with inadequate fasteners.
- Install and secure each FX before attaching any wiring.

WIRE CONNECTIONS

NOTE: A system's individual voltage requirements (230 or 3-phase) as well as how each FX is to function all determine how the FXs are wired. Each FX must be wired to the logical leg or phase of the system. Each FX must be programmed or "stacked" according to this phase. Please see the *International FX and VFX Series Inverter/Charger Programming Manual* before connecting any wires to or from the FX.

AC

Follow these steps to wire the FX to your system:

1. Shut all AC breakers off or remove any fuses before connecting any wiring.
2. Shut off all DC breakers, including the PV breakers.
3. With all power off, run lengths of 6 AWG (16.0 mm²) wire between the AC Wiring Compartment Board AC out terminals and sufficient over current protection via an AC circuit breaker whose ampacity matches or exceeds the maximum AC input current of the FX model used in the system (see FX product specifications). The breaker should be installed inside of a metal chassis such as OutBack's FLEXware series or an existing panel.
4. With the over current protection connected, run lengths of 6 AWG (13.3 mm²) wire between the AC Wiring Compartment Board AC IN terminals and the AC input breaker. The breaker should be installed inside of a metal chassis such as OutBack's FLEXware series or an existing panel. The AC input hot conductor must be supplied through an AC branch-rated circuit breaker whose ampacity matches or exceeds the maximum AC input current of the FX model used in the system (see FX product specifications)

DC

- Use crimped and sealed copper ring terminal lugs with 5/16" (8 mm) hole or compression-type lug to connect battery cables to DC terminals. Soldered cable lugs are also acceptable.
- Use recommended cable sizes (see page 36) to reduce losses and ensure high performance of FX (smaller cables can reduce performance and possibly damage the unit).
- Keep cables together (e.g., using a tie-wrap) as much as possible.
- Ensure cables pass through the same knockout and conduit fittings to allow inductive currents to cancel.

TORQUE REQUIREMENTS

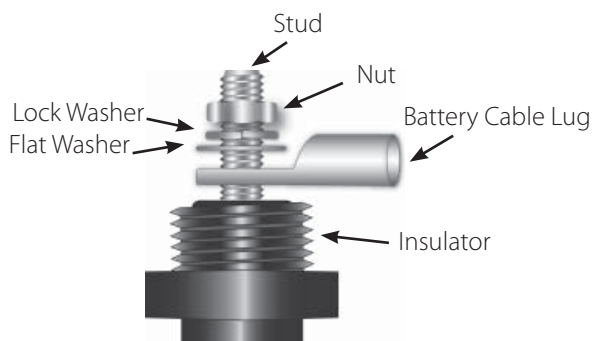
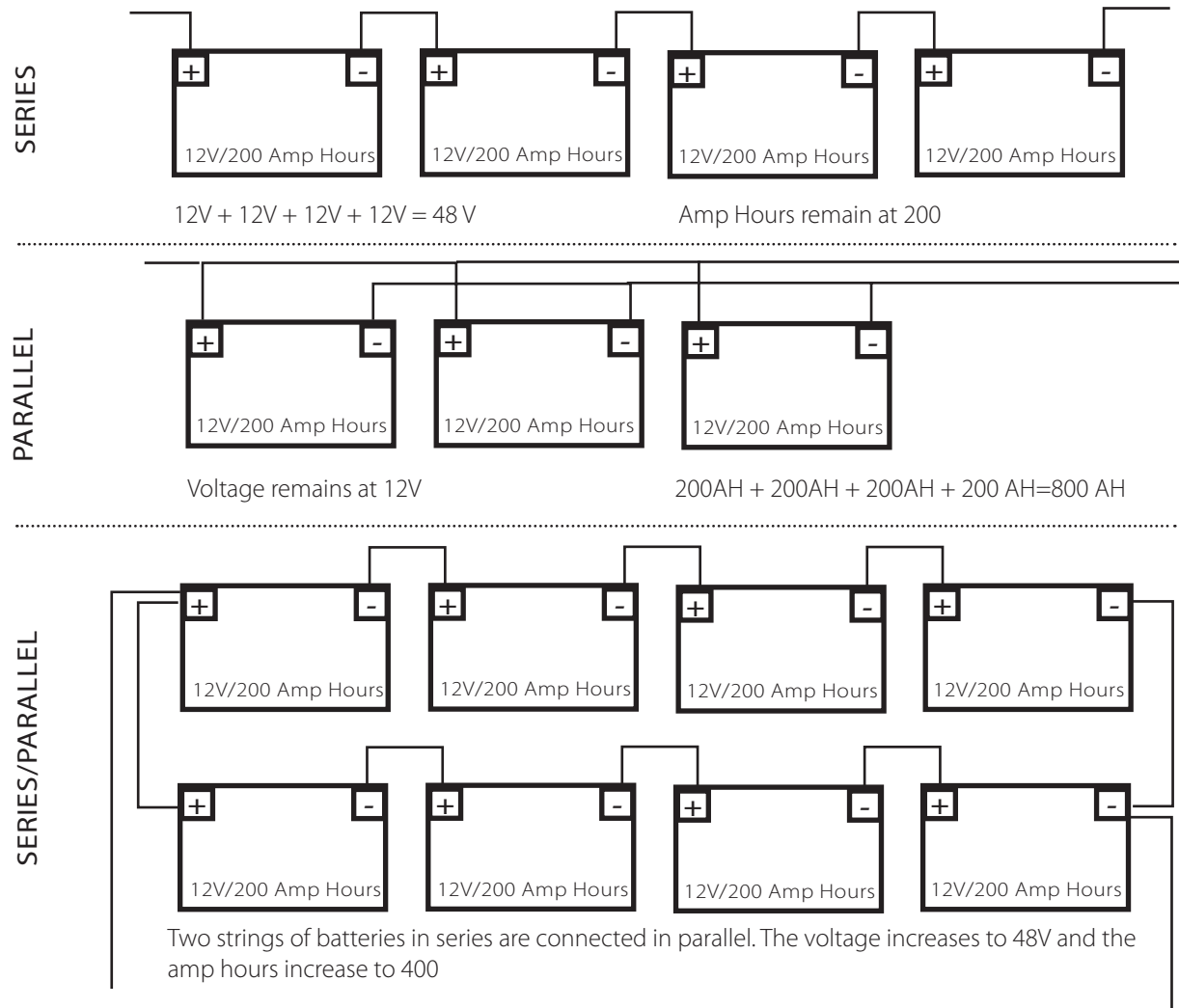
CONNECTION	TORQUE IN POUND MEASURES
AC and PV breakers	to 22 inch-lbs = 2.5 Nm
DC shunt	to 15 foot-lbs = 20.4 Nm
DC battery connections	to 10 foot-lbs = 13.6 Nm
FX's DC Terminals	to 10 foot-lbs = 13.6 Nm
FX's AC Terminals	to 30 inch-lbs = 3.38 Nm

Table 1 Torque Values for Installation

Battery Wiring Examples

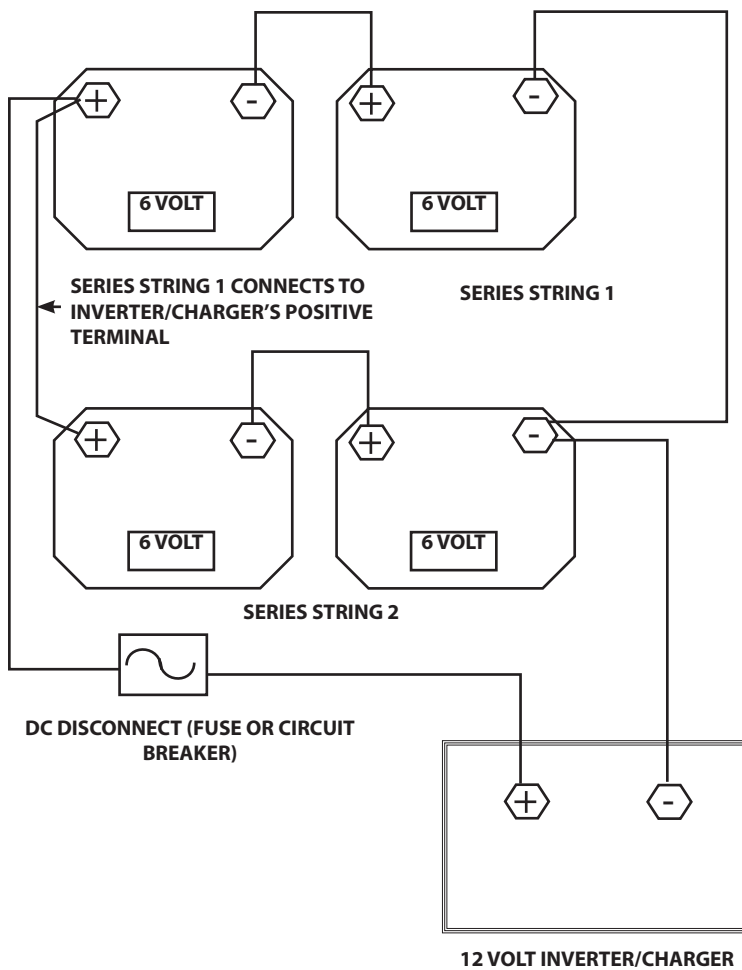
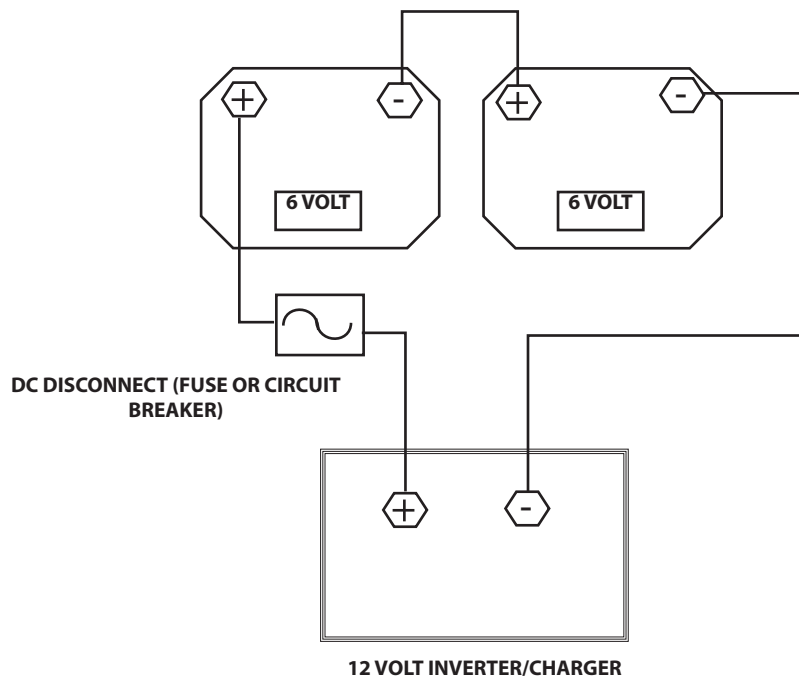
In renewable energy systems, batteries are connected to each other in one of three ways:

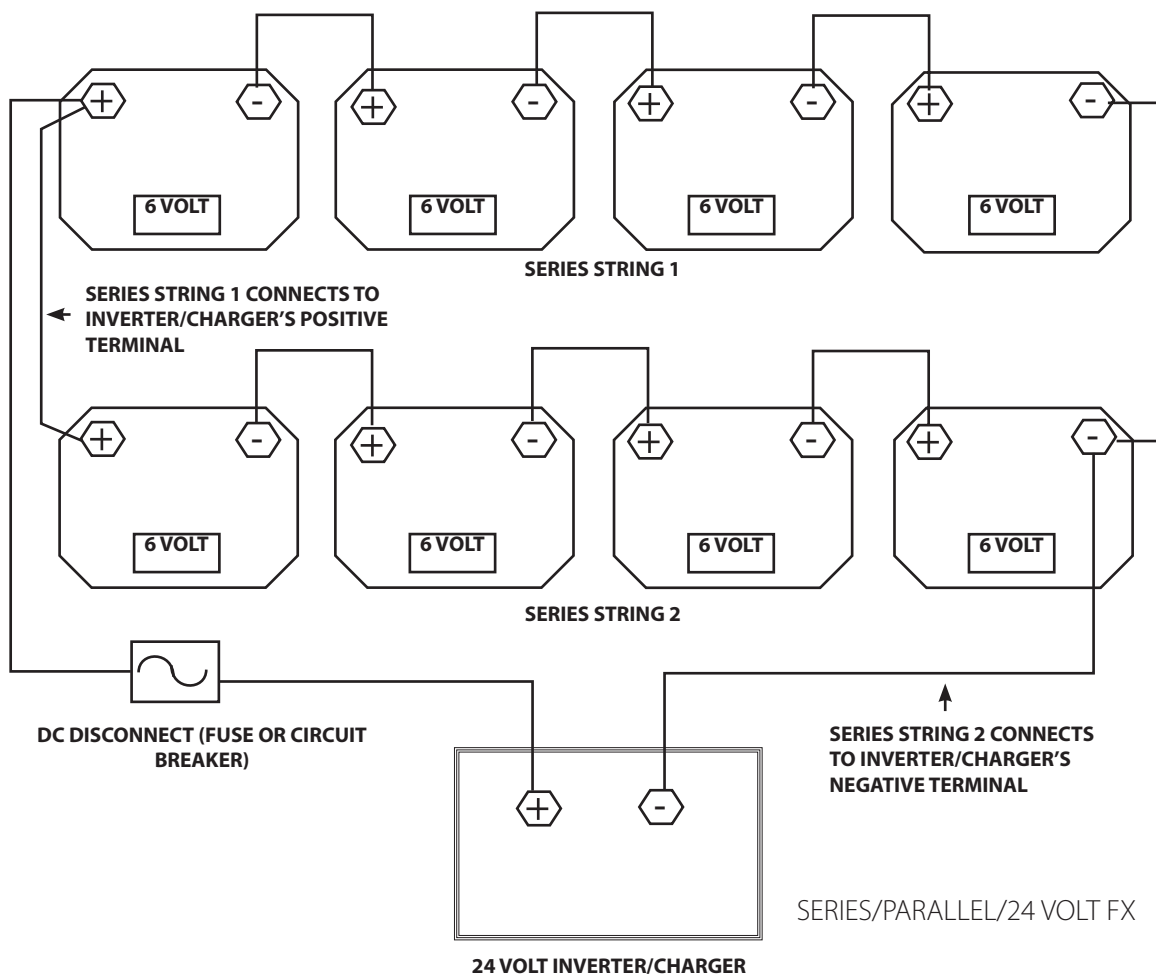
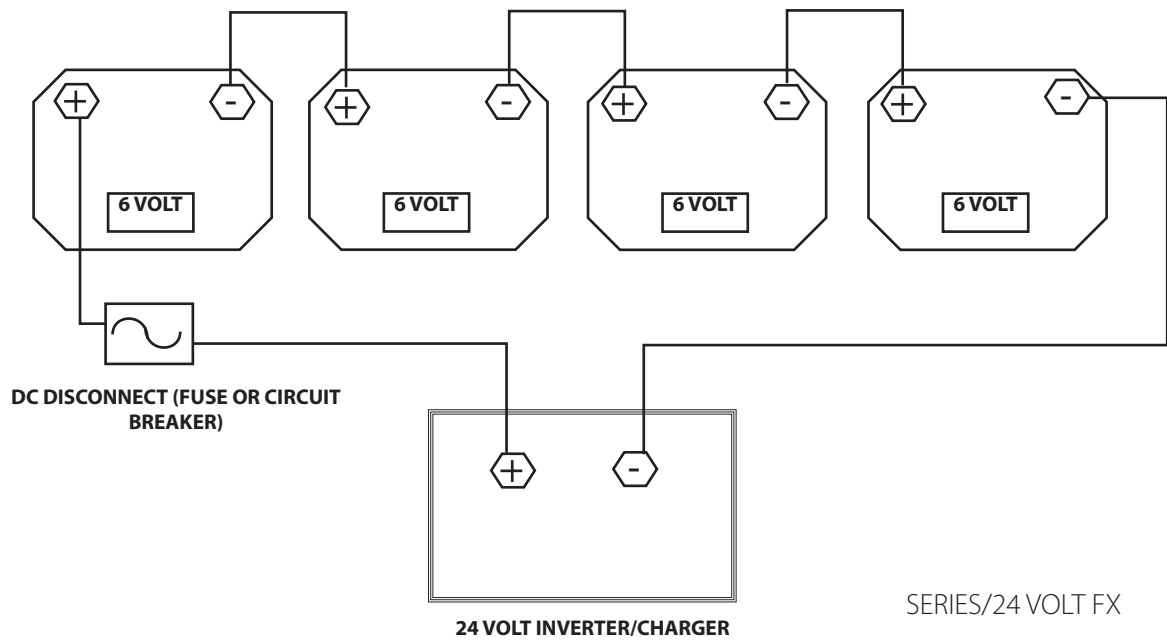
- Series (voltage increases, amperage stays the same as a single battery)
- Parallel (voltage stays the same as a single battery, amperage increases)
- Series/Parallel (both voltage and amperage increase)

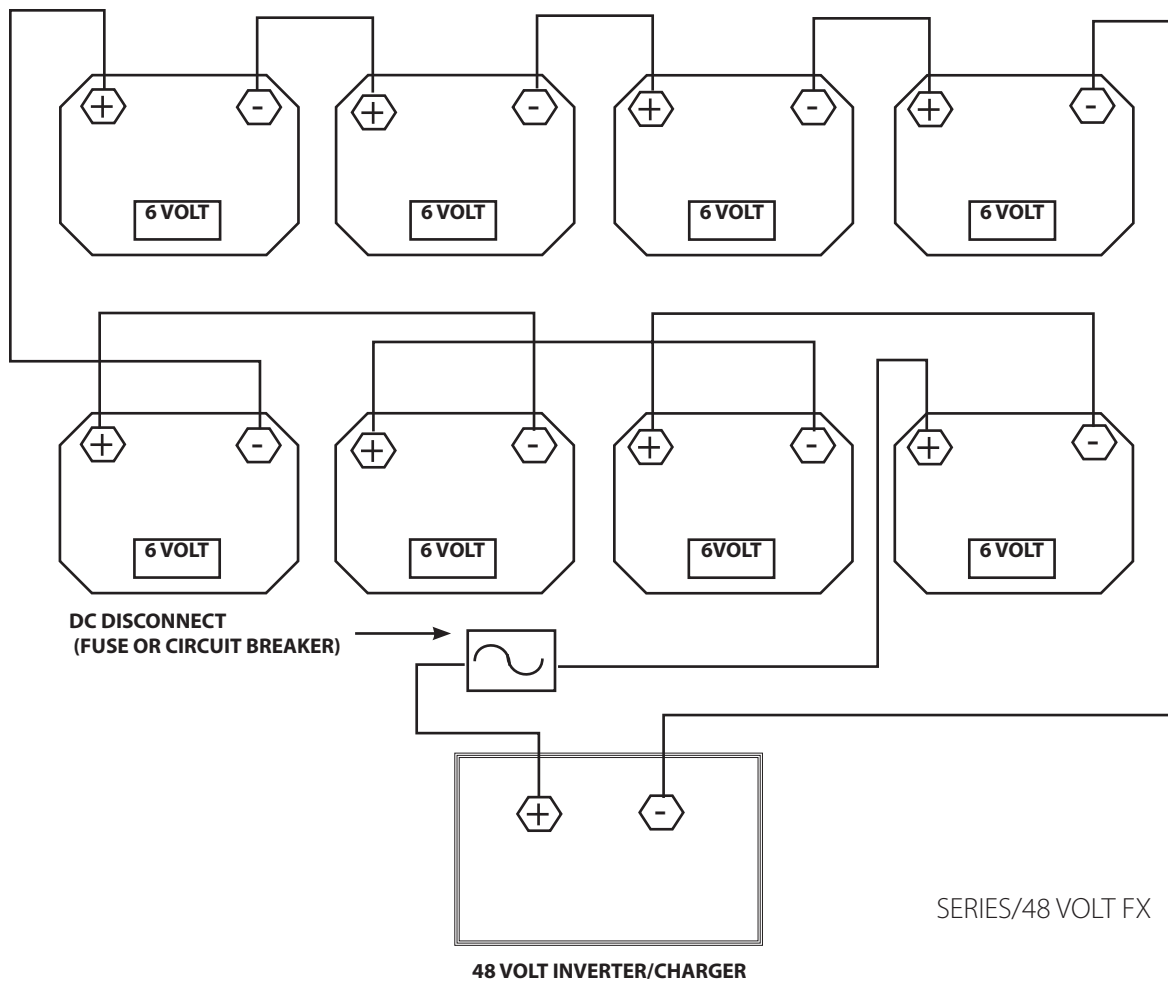


- Never install extra washers between the terminal mounting surface and the battery cable lug—the connection must be direct and secure.
- Always install breakers or fuses within the positive battery cable.
- Torque 2/0, (67.4 mm²) 4/0 (107 mm²), or larger code-approved cables rated 75°C or higher to 60-inch pounds/6.77Nm.

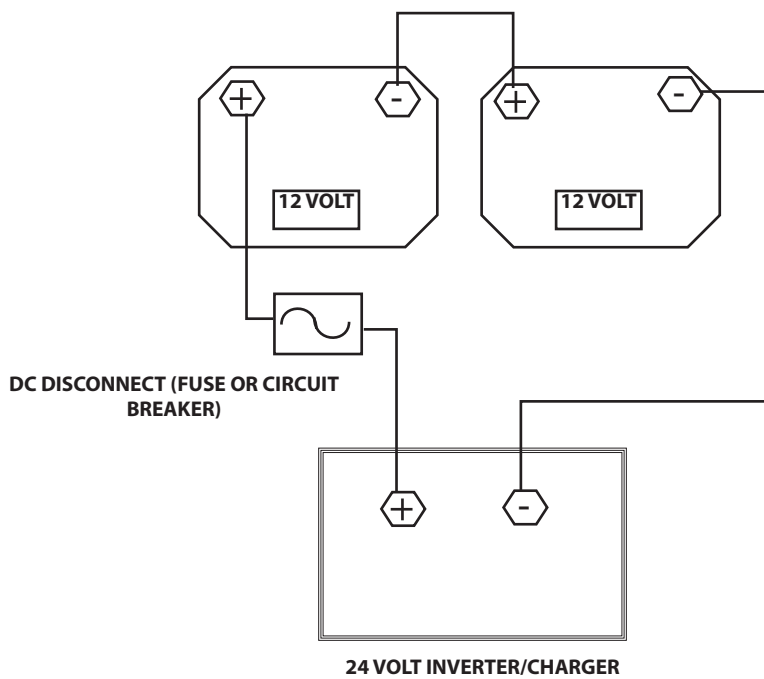
6V Battery Wiring Examples



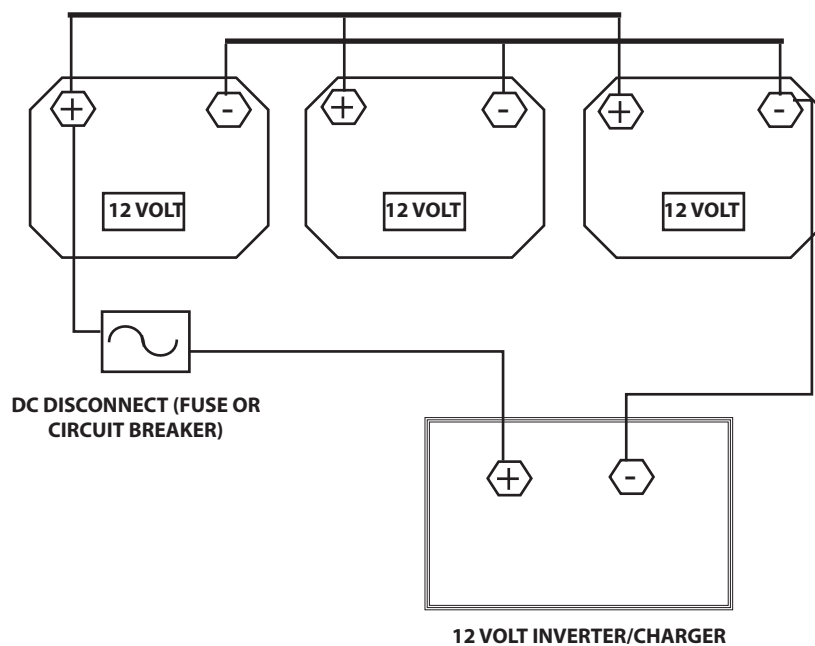




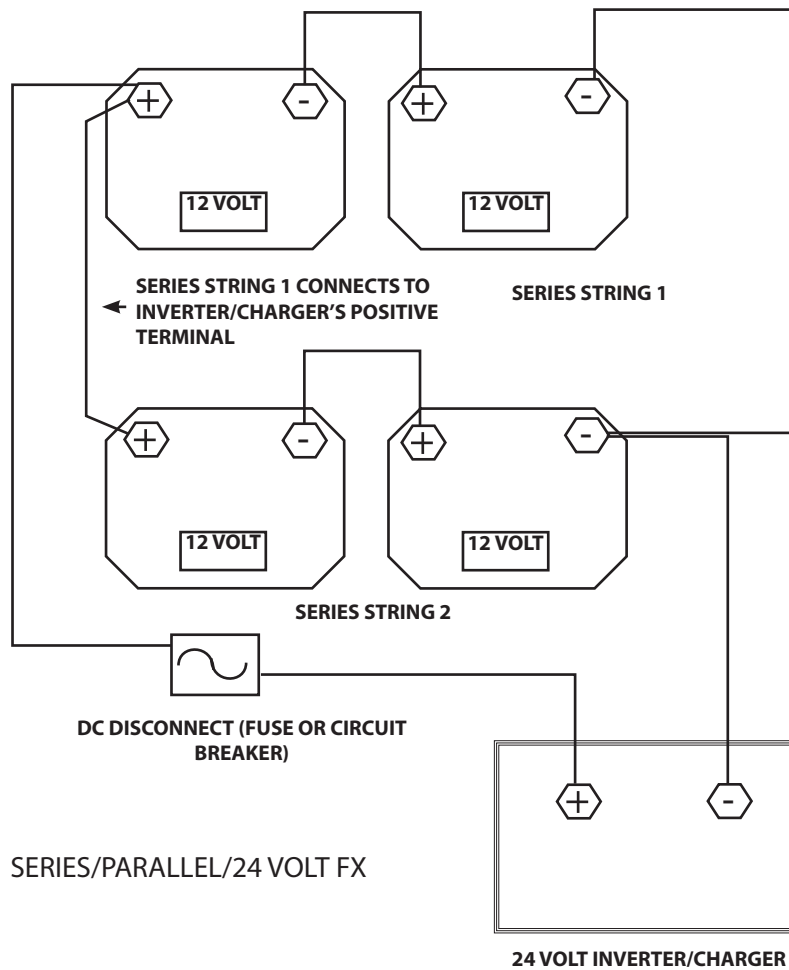
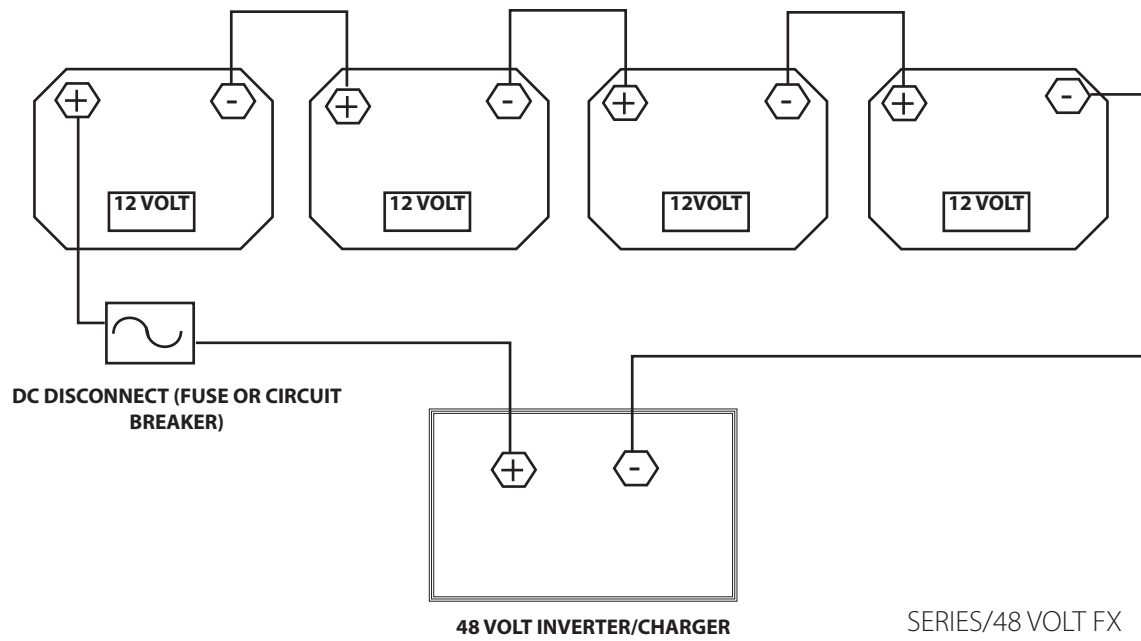
12V Battery Wiring Examples

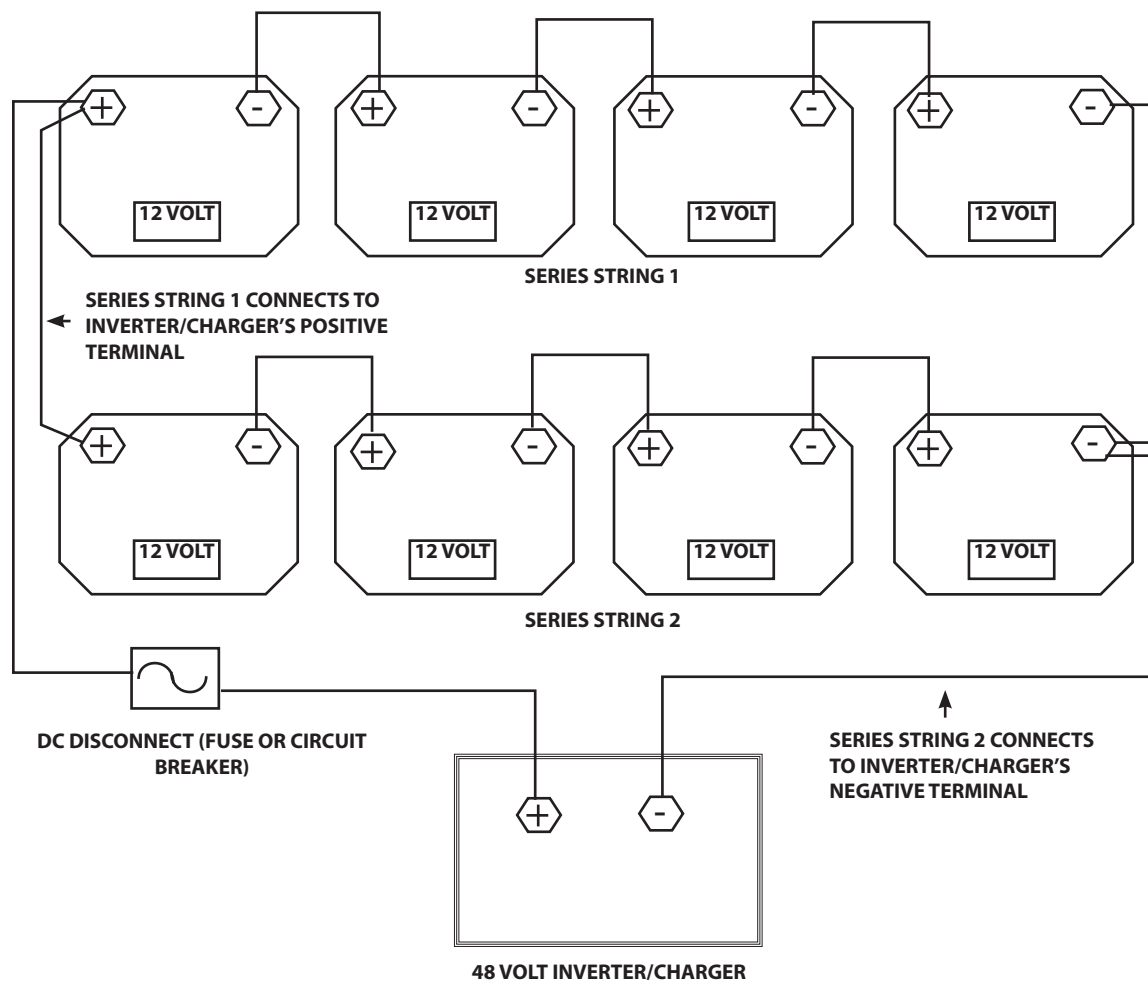


SERIES/24 VOLT FX



PARALLEL/12VOLT FX





SERIES/PARALLEL/48 VOLT FX

AC WIRING NOTES

AC HOT (PHASE) OUT

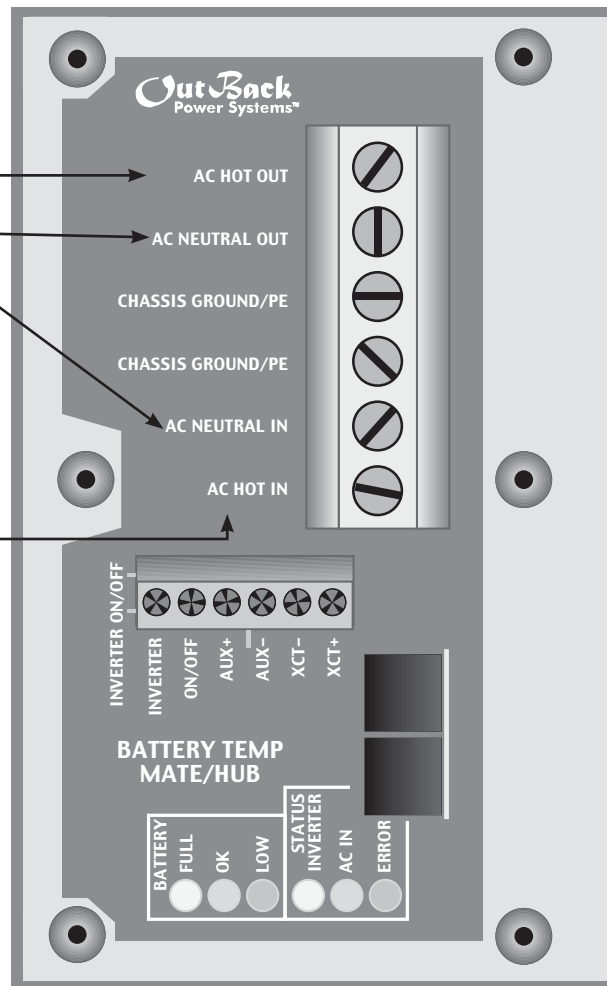
- Supplies the AC hot output conductors through a 30 amp maximum AC branch rated circuit breaker using 6 AWG (16.0 mm²) wire and connect to the AC

AC NEUTRAL OUT/AC NEUTRAL IN

- Connects the AC neutral input conductor to the AC NEUTRAL IN terminal.
- Connects the AC neutral output conductor to the AC NEUTRAL OUT terminal.

AC HOT (PHASE) IN

- The AC hot input conductor (brown) must be supplied through a 30 amp maximum AC branch rated circuit breaker and connected to the AC HOT IN.
- 6 AWG (16.0 mm²) wire is required for the FX's AC transfer relay.



LOW-VOLTAGE WIRING

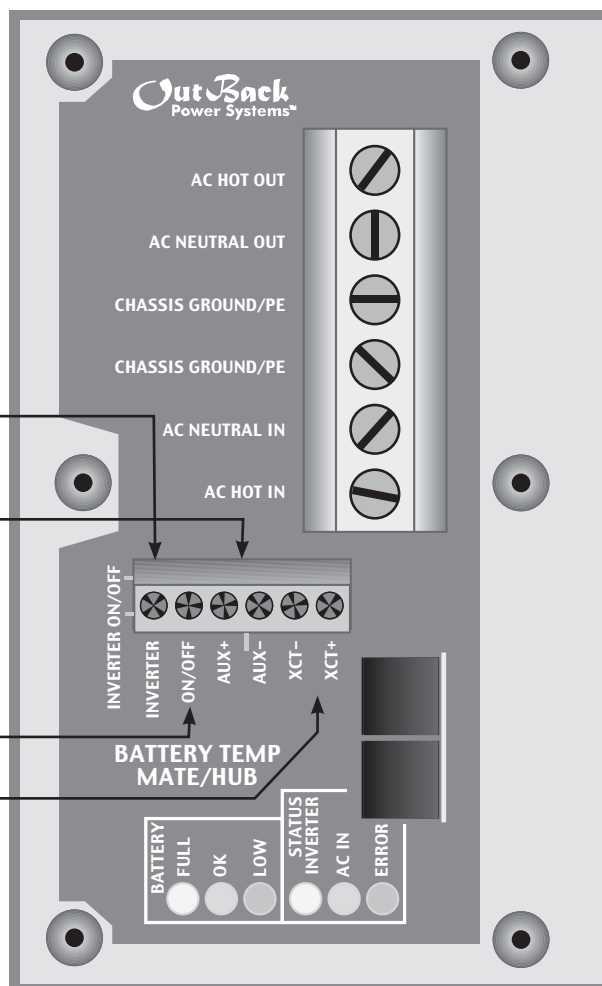
This six-position terminal block can be unplugged to make wiring easier and to simplify the removal and reinstallation of an FX. It must be securely and completely plugged in for proper FX functioning. Otherwise, operational errors can occur.

Control Wiring Terminal Block

12 VDC at 0.7 amps (8.4 w) is available at the AUX+/AUX- terminals

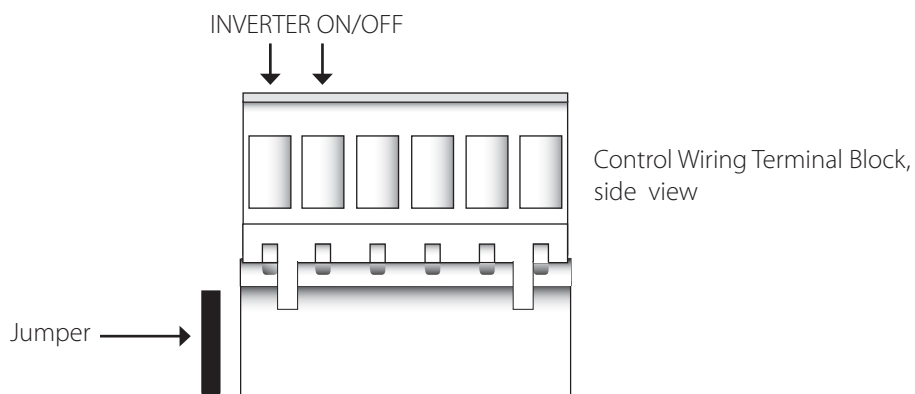
A switch can be wired to the INVERTER and ON/OFF terminals to manually control the FX

XCT+/XCT- are not operational



INVERTER and ON/OFF

- Replacing the pre-installed jumper connecting the ON/OFF terminals with a switch allows manual control of the FX.
- Without an ON/OFF switch, the inverter(s) will always be ON due to a factory-installed, removable jumper.
- Cycling the switch again returns the inverter to the ON mode.





Prior to installing an ON/OFF switch, if the FX's AC output is off, check that the jumper is present and well-connected before installing a switch. You want to confirm the system is in good working order. Suggested switches include push on/push off style.

Should you decide to install an OutBack MATE at a later date, bear in mind the installed switch overrides the control provided by the MATE if the switch is set to OFF. If the switch is set to ON, the MATE will function normally and control the inverter(s).

- When a system is ordered with a MATE, the MATE handles all FX ON/OFF functions.

AUXILIARY OUTPUT (AUX + / AUX -)

The Auxiliary output system uses the AUX + and AUX – terminals. It is programmed through the MATE to do a variety of tasks:

- The default use for these terminals drives the OutBack FX Turbo Kit or DC12-FAN fan for external cooling.

NOTE: These terminals should not be connected to any type of DC load greater than .7 amps.

- The FX includes internal electronic over-current protection for the AUX 12 VDC output circuit which auto resets if it is short-circuited. No additional fuses are required.
- For automatic or advanced generator start functions, the Auxiliary Output can drive a 12V relay for the two-wire starting circuitry of a generator. OutBack recommends a good quality gold-plated relay.

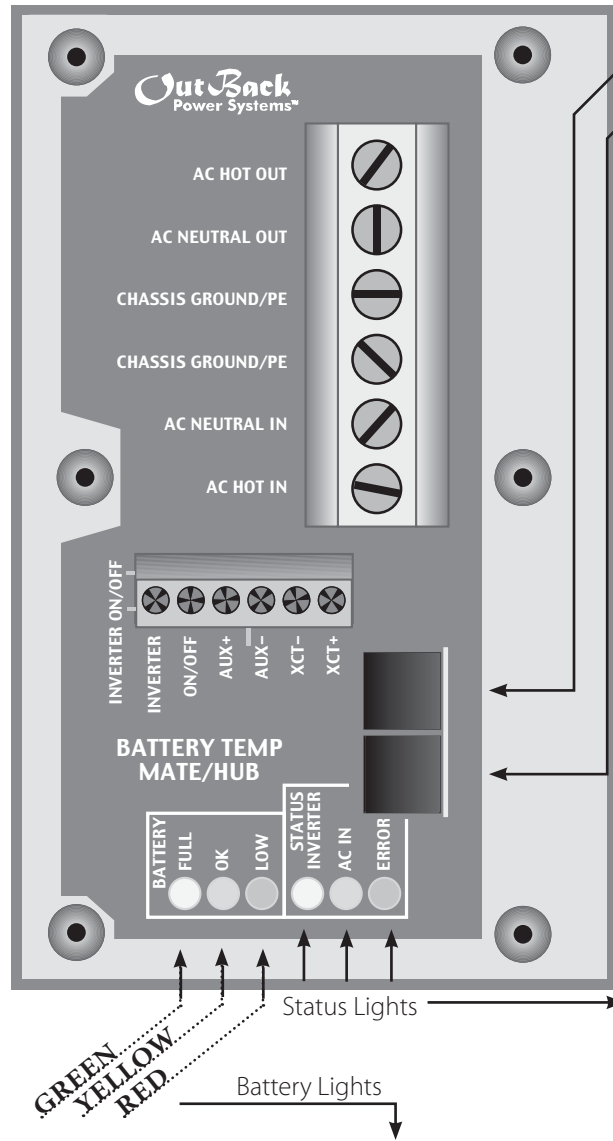
NOTE:

- (1) The FLEXnet DC comes with an internal relay for this use.
- (2) OutBack Power Systems does not support three-wire start generators; however, a three-wire to two-wire conversion kit is available from an electronic control manufacturer such as Atkinson Electronics (www.atkinson.com)
- (3) Either the MATE or the FLEXnet DC can be programmed for Auto-GenStart (please refer to component manuals for more information).

XCT + / XCT -

These terminals are not operational at this time.

RTS, MATE/HUB WIRING



RJ-11 modular jack connects the RTS, the external battery temperature sensor.

RJ-45 jack is used for external communications.

- RJ-11 modular jack connects RTS, the optional external battery temperature sensor.*
- RJ-45 jack connects MATE or HUB to FX using CAT5 cable.**

*When a HUB is used, plug the RTS into the Master FX, which should be plugged into HUB's Port 01. The RTS cable is folded and routed under the AC Wiring Compartment's Lexan cover, fitting into a small indentation in the aluminum casting between the battery terminals. ONLY USE THE OUTBACK RTS; OTHER BRANDS YIELD INCORRECT READINGS.

** If the system has multiple FXs and/or OutBack Charge Controllers, a HUB is required.

LED Color	LED Action	LED indicates
GREEN	GREEN	Inverter ON
	Flashing GREEN	Search mode or Slave power
	Off	Inverter OFF
YELLOW	Solid YELLOW	AC source is connected
	Flashing YELLOW	AC input live, waiting to connect to OBX-IC
	Off	No AC input present
RED	Solid RED	Fatal Error, contact OutBack Power Systems
	Flashing RED	Warning, a non-critical error has occurred

LED Color		12 VDC	24 VDC	48 VDC
GREEN	(FULL)	12.5 or higher	25.0 or higher	50.0 or higher
YELLOW	(OK)	11.5 to 12.5	23.0 to 25.0	46.0-49.6
RED	(LOW)	11.5 or lower	23.0 or lower	46.0 or lower

WARN(ING) Screens

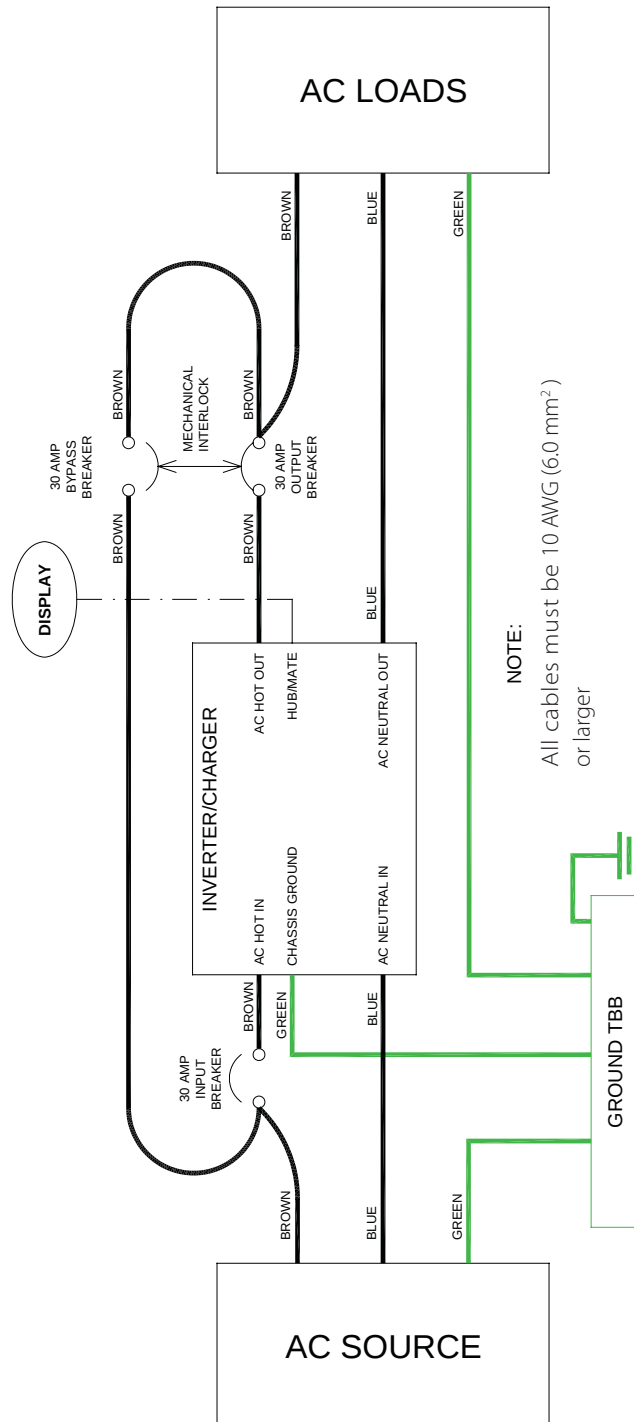
- acin freq too high: AC source is above 56 Hz (upper limit) and will be dropped if frequency gets much higher
- acin freq too low: AC source is under 44 Hz (lower limit) and will be dropped if frequency gets much lower
- acin voltage too high: AC source's voltage is over 270 VAC (default limit) and risks loss of FX connection
- acin voltage too low: AC source's voltage is under 207 VAC (default limit) and risks loss of FX connection
- acin input current exceeds max: AC loads are drawing more current than the rating of the FX allows
- temperature sensor fault: an internal FX temperature sensor is malfunctioning
- internal comm. error detected: there is a communication problem between the MATE and the FX
- internal fan failure detected: the FX's internal cooling fan is not operating properly
- airtemp: displays a numeric value representing the air temperature around the FX*
- fettemp: displays a numeric value representing the temperature of the FETs (Field Effect Transistors)*
- captemp: displays a numeric value representing the temperature of the ripple capacitors*

*These values are used for troubleshooting purposes. The higher the numerical value, the cooler the temperature.

SAMPLE INSTALLATIONS

SINGLE FX SYSTEM

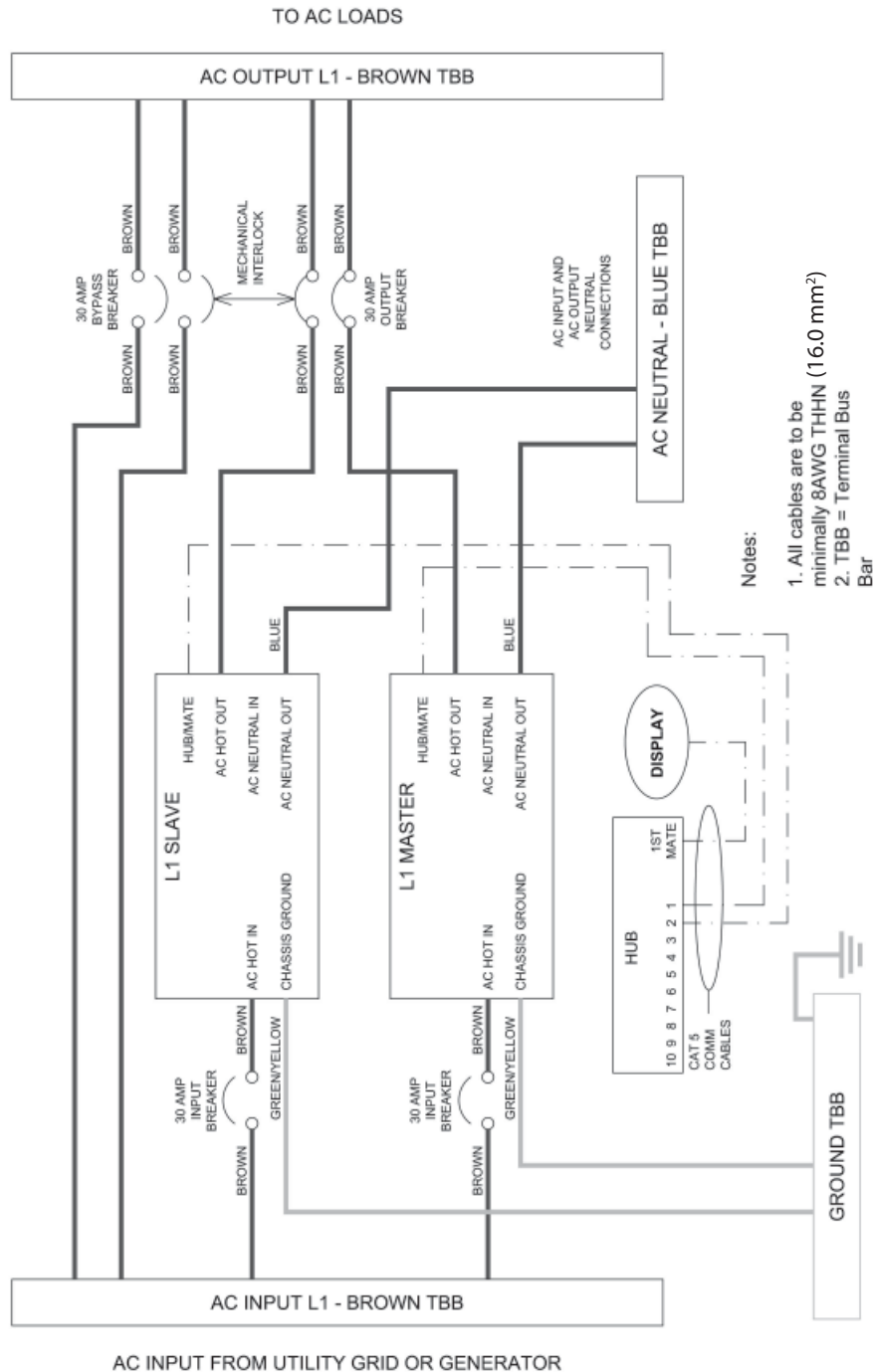
- All E Series FX AC wiring must handle 30 amps AC or more.
- A 30A input breaker (maximum) must be used.
- A single FX can continuously power two to three KW of loads depending on which model is used.



PARALLELED DUAL FX SYSTEM

- All AC wiring from the AC source and to the AC loads must collectively handle 60 amps AC or more.
- All other AC wiring capacity must equal 30 amps AC.
- A paralleled dual FX system can continuously power 4-6kW of loads depending on which model is used.

NOTE: Program the lowest-installed FX as Master (1-2ph MASTER) and the second FX as an OutBack L1 Slave (OB SLAVE L1). The Master FX must be plugged into Port 1 of the HUB.



Parallel/Dual System with Two FXs

PARALLELED QUAD FX SYSTEM

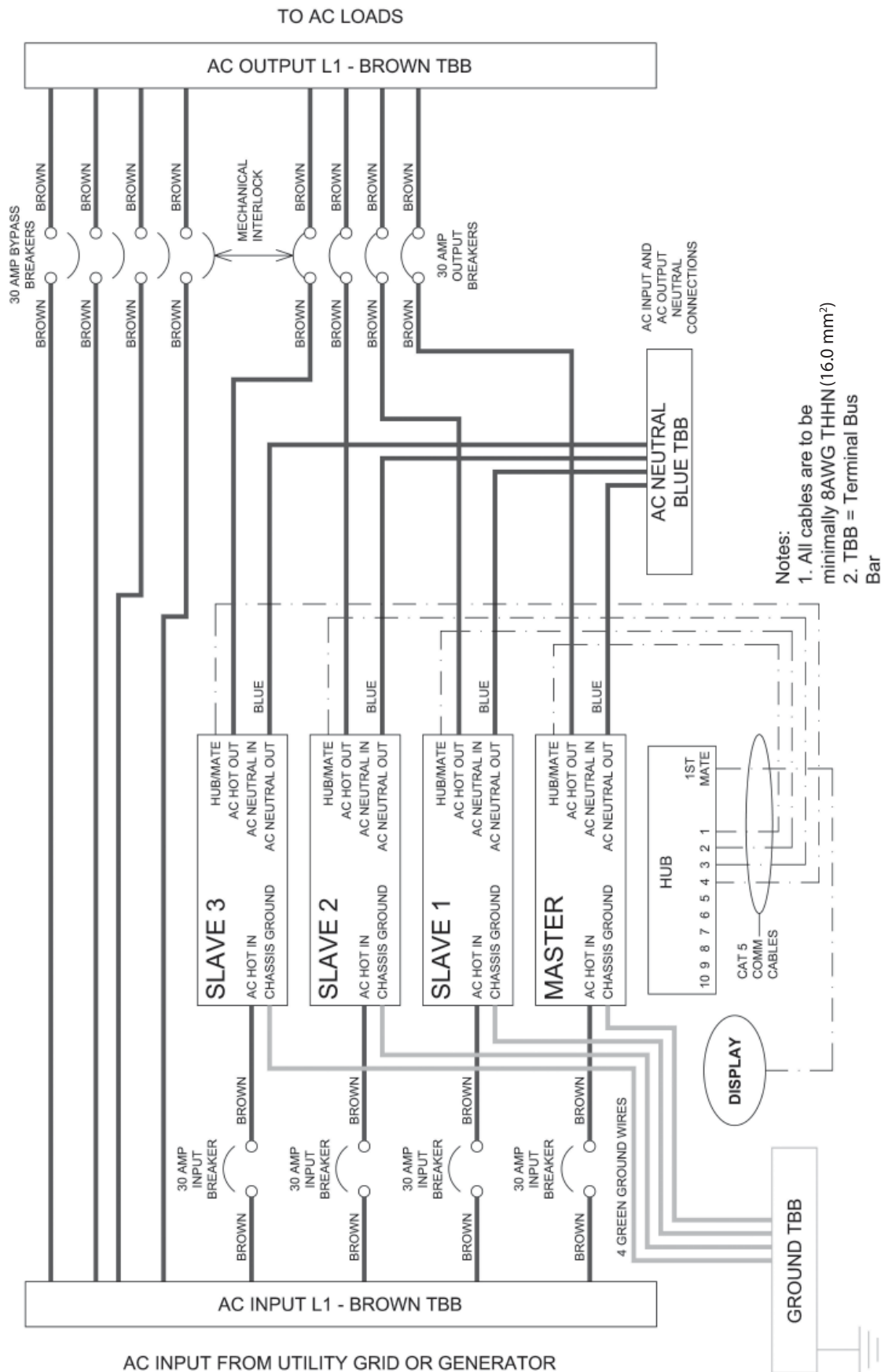
- All AC wiring from the AC source and to the AC loads must collectively handle 100 amps AC or more.
- All other AC wiring must handle a capacity of 30 amps AC.
- This system can continuously power 8-12kW of loads depending on which model is used.
- Connecting more load than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output.

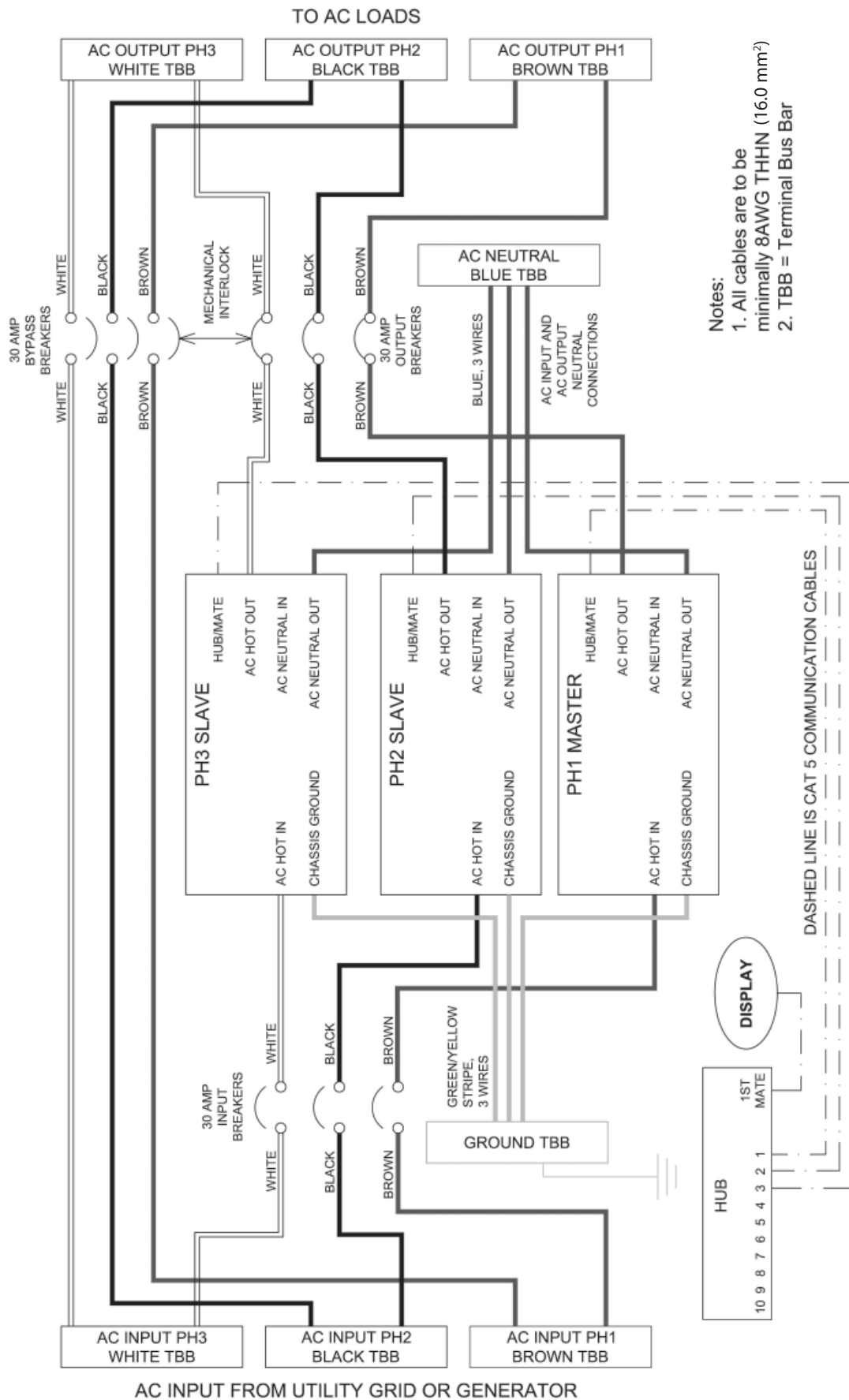
NOTES: Program the lowest-installed FX as Master (1-2ph MASTER) and the three remaining FXs as OutBack L1 Slaves (OB SLAVE L1). The Master FX must be plugged into Port 1 of the HUB.

3-PHASE FX SYSTEM

- This system produces 230VAC per phase and 400VAC from phase to phase. There can only be one FX per phase on a 3-phase system for a maximum of three FXs total.
- The AC wiring from the AC source and to the AC loads must handle 30 amps AC.
- All AC wiring must handle a capacity of 30 amps AC.
- This system can power continuously up to 6-9kW of loads depending on which model is used.
- Connecting more load than the continuous rating of the FX may cause breakers to trip or the FX to shut off its AC output.
- The jumper in the HUB must be moved for 3-phase configuration (please see the HUB Installation and User Guide). The Master FX must be plugged into Port 1 of the HUB.

NOTE: Program the bottom FX as Master (3ph MASTER) and the upper two FXs as 3-phase Slaves (3ph SLAVE). Keep the phases in order: phase one is connected to the FX programmed L1; phase two is connected to L2; and phase three to L3 (or phases A, B, and C to inverters A, B, and C) as shown in the diagram on the following page.





Notes:

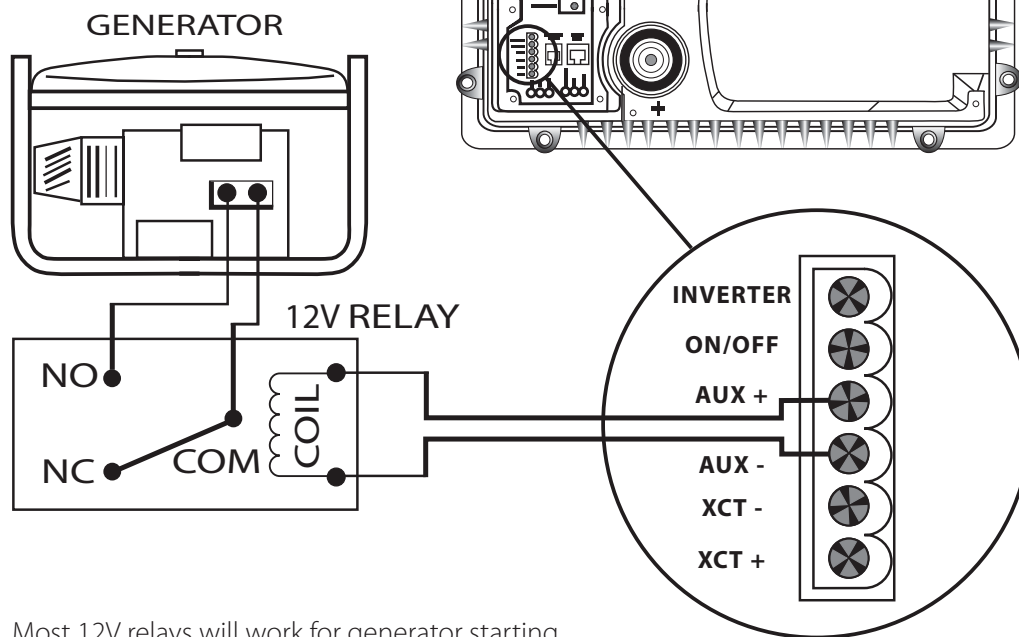
1. All cables are to be minimally 8AWG THHN (16.0 mm²)
2. TBB = Terminal Bus Bar

Three-Phase System

GENERATOR AUTO START

The following schematic shows how to hook up a relay that interfaces with the two-wire start generator. Three-wire start generators require an adapter like the Atkinson GSCM available at www.atkinsonelectronics.com.

TWO WIRE START GENERATOR HOOK UP



Most 12V relays will work for generator starting. Select one between 5 and 30 amp contacts. Relays with gold-plated contacts are recommended.

INSTALLATION CHECK LIST

<i>ITEM</i>	<i>YES</i>	<i>NO</i>
All manuals read and reviewed?		
▶ FX		
▶ OutBack Charge Controller		
▶ MATE		
▶ HUB		
System mounted with the recommended number and sized fasteners?		
System installed according to local codes?		
System inspected?		
System permanently grounded?		
Did the installer use OutBack recommended wire type and gauge adjusted for temperature ratings and length?		
▶ All AC wiring rated for 75° C or higher?		
▶ Battery cables rated 75° C or higher?		
▶ 6.0 mm ² (10 AWG) wire used for AC Input Hot?		
▶ 6.0 mm ² (10 AWG) or larger wire used for AC HOT OUT?		
FX connected to AC circuit with 30 amp maximum branch-circuit over-current protection?		
▶ All cables torqued to OutBack specifications?		
▶ AC and PV breakers to 22 inch-lbs/2.48 Nm?		
▶ All DC connections to 10 foot-lbs/13.6 Nm?		
▶ FX AC terminals to 30 inch-lbs/3.38 Nm?		
▶ FX battery breaker to 45 inch-lbs/5.07 Nm?		
All terminal block screws torqued to 2.5 foot-lbs/3.4 Nm?		

APPENDIX RATINGS

FX2012ET

Nominal DC Input Voltage Range	12VDC
Nominal AC Voltage / Frequency	230VAC / 50 HZ
Continuous Power Rating at 25C Ambient	2000VA
Continuous AC RMS Output at 25°C	8.7 Amps AC
Idle Power - Full AC Output	≈ 20 Watts DC
Idle Power - Search Mode	6 Watts DC
Typical Efficiency	90%
Total Harmonic Distortion - Typical	2%
Output Voltage Regulation	± 2%
Maximum Output Current – Peak (1 mSec)	28 amps AC
Maximum Output Current - RMS (100 mSec)	20 amps AC
AC Overload Capability - Surge	4600VA
AC Overload Capability - 5 Second	4000VA
AC Overload Capability - 30 Minutes	2500VA
AC Input Current Maximum	30 Amps AC
AC Input Voltage Range	160 to 300VAC
AC Input Frequency Range	44.0 to 56.0 Hz
DC Input Range	21.0 to 34.0 VDC
DC Input Current – Rated Power	200 Amps DC
Continuous Battery Charger Output	100 Amps DC

FX2024ET

Nominal DC Input Voltage Range	24VDC
Nominal AC Voltage / Frequency	230VAC / 50 HZ
Continuous Power Rating at 25C Ambient	2000VA
Continuous AC RMS Output at 25°C	8.7 Amps AC
Idle Power - Full AC Output	≈ 20 Watts DC
Idle Power - Search Mode	6 Watts DC
Typical Efficiency	90%
Total Harmonic Distortion - Typical	2%
Output Voltage Regulation	± 2%
Maximum Output Current – Peak (1 mSec)	35 amps AC
Maximum Output Current - RMS (100 mSec)	25 amps AC
AC Overload Capability - Surge	5750VA
AC Overload Capability - 5 Second	4000VA
AC Overload Capability - 30 Minutes	3200VA
AC Input Current Maximum	30 Amps AC
AC Input Voltage Range	160 to 300VAC
AC Input Frequency Range	44.0 to 56.0 Hz
DC Input Range	21.0 to 34.0 VDC
DC Input Current – Rated Power	100 Amps DC
Continuous Battery Charger Output	55 Amps DC

FX2348ET

Nominal DC Input Voltage Range	48VDC
Nominal AC Voltage / Frequency	230VAC / 50 HZ
Continuous Power Rating at 25C Ambient	2300VA
Continuous AC RMS Output at 25°C	10.0 Amps AC
Idle Power - Full AC Output	≈ 23 Watts DC
Idle Power - Search Mode	6 Watts DC
Typical Efficiency	93.4%
Total Harmonic Distortion - Typical	2%
Output Voltage Regulation	± 2%
Maximum Output Current – Peak (1 mSec)	35 amps AC
Maximum Output Current - RMS (100 mSec)	25 amps AC
AC Overload Capability - Surge	5750VA
AC Overload Capability - 5 Second	4800VA
AC Overload Capability - 30 Minutes	3100VA
AC Input Current Maximum	30 Amps AC
AC Input Voltage Range	160 to 300VAC
AC Input Frequency Range	44.0 to 56.0 Hz
DC Input Range	42.0-68.0 VDC
DC Input Current – Rated Power	57.5 Amps DC
Continuous Battery Charger Output	30 Amps DC

VFX2612E

Nominal DC Input Voltage Range	12VDC
Nominal AC Voltage / Frequency	230VAC / 50 HZ
Continuous Power Rating at 25C Ambient	2600VA
Continuous AC RMS Output at 25°C	11.3 Amps AC
Idle Power - Full AC Output	≈ 20 Watts DC
Idle Power - Search Mode	6 Watts DC
Typical Efficiency	90%
Total Harmonic Distortion - Typical	2%
Output Voltage Regulation	± 2%
Maximum Output Current – Peak (1 mSec)	28 amps AC
Maximum Output Current - RMS (100 mSec)	20 amps AC
AC Overload Capability - Surge	4600VA
AC Overload Capability - 5 Second	4000VA
AC Overload Capability - 30 Minutes	3100VA
AC Input Current Maximum	30 Amps AC
AC Input Voltage Range	160 to 300VAC
AC Input Frequency Range	44.0 to 56.0 Hz
DC Input Range	10.5-17.0 VDC
DC Input Current – Rated Power	260 Amps DC
Continuous Battery Charger Output	120 Amps DC

VFX3024E

Nominal DC Input Voltage Range	24VDC
Nominal AC Voltage / Frequency	230VAC / 50 HZ
Continuous Power Rating at 25C Ambient	3000VA
Continuous AC RMS Output at 25°C	20 Amps AC
Idle Power - Full AC Output	≈ 20 Watts DC
Idle Power - Search Mode	6 Watts DC
Typical Efficiency	90%
Total Harmonic Distortion - Typical	2%
Output Voltage Regulation	± 2%
Maximum Output Current – Peak (1 mSec)	35 amps AC
Maximum Output Current - RMS (100 mSec)	25 amps AC
AC Overload Capability - Surge	5750VA
AC Overload Capability - 5 Second	4800VA
AC Overload Capability - 30 Minutes	3300VA
AC Input Current Maximum	30 Amps AC
AC Input Voltage Range	160 to 300VAC
AC Input Frequency Range	44.0 to 56.0 Hz
DC Input Range	21.0-34.0 VDC
DC Input Current – Rated Power	150 Amps DC
Continuous Battery Charger Output	85 Amps DC

VFX3048E

Nominal DC Input Voltage Range	48VDC
Nominal AC Voltage / Frequency	230VAC / 50 HZ
Continuous Power Rating at 25C Ambient	3000VA
Continuous AC RMS Output at 25°C	13 Amps AC
Idle Power - Full AC Output	≈ 23 Watts DC
Idle Power - Search Mode	6 Watts DC
Typical Efficiency	93%
Total Harmonic Distortion - Typical	2%
Output Voltage Regulation	± 2%
Maximum Output Current – Peak (1 mSec)	35 amps AC
Maximum Output Current - RMS (100 mSec)	25 amps AC
AC Overload Capability - Surge	5750VA
AC Overload Capability - 5 Second	4800VA
AC Overload Capability - 30 Minutes	3300VA
AC Input Current Maximum	30 Amps AC
AC Input Voltage Range	160 to 300VAC
AC Input Frequency Range	44-56 Hz
DC Input Range	42.0 to 68.0 VDC
DC Input Current – Rated Power	75Amps DC
Continuous Battery Charger Output	45 Amps DC

RATINGS DETAILED

NOMINAL AC OUTPUT VOLTAGE OF AN FX SYSTEM

Single Phase	230VAC at 50 Hz
Parallel Stacked	230VAC at 50 Hz on one AC output leg
Three Phase Stacked	230VAC at 50 Hz per AC output leg (limit three) / 400VAC at 50 Hz between AC output legs

RECOMMENDED FX DC VOLTAGE RANGE

NOTE: The last two digits in the model number designate the nominal DC voltage.

Example: FX2024ET = 24V DC Voltage.

12V Systems	11 – 16VDC (VDC = volts DC)
24V Systems	22 – 32VDC
32V Systems	29 – 43VDC
48V Systems	44 – 64VDC

MAXIMUM DC LOAD CURRENT

NOTE: This is the maximum DC current the FX will draw from the battery when starting very large AC loads. It is not used for sizing the DC disconnect or selecting DC cable gauge. It is used to select the minimum reasonable battery capacity.

12V FXs	600ADC per FX (ADC = amps DC)
24V FXs	300ADC per FX
32V FXs	225ADC per FX
48V FXs	150ADC per FX

RATED DC CHARGING CURRENT

NOTE: This is the maximum continuous DC current that the FX can send to the batteries when charging.

FX2012ET	100ADC (ADC = Amps DC)
FX2024ET	55ADC
FX2348ET	35ADC
VFX2612E	120ADC
VFX3024E	85ADC
VFX3048E	42ADC

AC INPUT OPERATING VOLTAGE RANGE

NOTE: This is the recommended AC input voltage range to be supplied to the FX. Voltages outside of this range may damage AC loads connected to the FXs AC output terminals.

All E Series FX Series Inverter/Chargers	160-300VAC (VAC = volts AC)
--	-----------------------------

MAXIMUM AC INPUT CURRENT

An AC input source connected to the FX supplies power for two separate internal AC circuits – the AC transfer relay and the battery charging system. The AC transfer relay transfers the AC input power to the AC loads. The FX's battery charger will "back off" if the total AC loads—including the charger—exceed the AC input current limit (default setting is 28 AAC). This "Input Limit" can be adjusted using the MATE to avoid overloading a generator or trip a circuit breaker. If your generator cannot produce 28 AAC or you are connecting to an AC input source that has a breaker that is rated for less than 30 AAC, please refer to the FX and VFX Series Inverter/Charger Programming Manual to change this setting.

All E Series 230 VAC FXs	30AAC per FX (AAC = Amps AC)
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MAXIMUM CURRENT FOR BATTERY CHARGER

Due to heat restraints, the FX limits incoming AC current to recharge the battery. Please refer to the FX and VFX Series Inverter/Charger Programming Manual to adjust this setting. The battery charger has an efficiency of 90%. Other factors, such as cable losses, might reduce this efficiency.

MAXIMUM AND DEFAULT AC INPUT AND DC CHARGER (bulk stage) OUTPUT VALUES

FX2012ET	AC Max = 6AAC (Default = 5 AAC)	DC Max = 100ADC
FX2024ET	AC Max = 7AAC (Default = 5 AAC)	DC Max = 55ADC
FX2348ET	AC Max = 7AAC (Default = 5 AAC)	DC Max = 35ADC
VFX2612E	AC Max = 7AAC (Default = 6 AAC)	DC Max = 120ADC
VFX3024E	AC Max = 10AAC (Default = 9 AAC)	DC Max = 85ADC
VFX3048E	AC Max = 10AAC (Default = 9 AAC)	DC Max = 45ADC

AC INPUT FREQUENCY RANGE

NOTE: If the AC input source is out of the range noted below, the FX will not connect or stay connected.

All E Series FX Models	44-56 Hz
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MAXIMUM AC OUTPUT CURRENT

This is the amount of surge current that the FX will quickly supply for a split second. Depending on the size of the surge, the FX can be overloaded for a minimum time of 5 seconds to a maximum time of 30 minutes.

All 12 VDC FXs	28AAC per FX for 1 millisecond
All Other FXs	35AAC per FX for 1 millisecond/25AAC per FX for 100 milliseconds

MAXIMUM CONTINUOUS OUTPUT POWER

An FX Series Inverter/Charger's model number indicates its maximum continuous output power by changing the last two digits to zeros. For instance, an FX2012ET has a maximum continuous output power of 2000VA (volt-amps).

FX2012ET	2000VA (VA = volt-Amps)
FX2024ET	2000VA
FX2348ET	2300VA
FX2612E	2600VA
VFX3024E	3000 VA
VFX3048E	3000VA

MAXIMUM OVERCURRENT PROTECTION AMPACITY

This rating specifies the proper overcurrent protection ampacity.

- OBDC breakers are panel-mount circuit breakers.
- Class T DC fuses are terminal-mounted and should always be used in conjuncture with a disconnect mechanism.
- FXs used in home installations should use properly sized DC circuit breakers.
- A DC breaker includes both overcurrent protection and disconnect capability.
- OutBack Power Systems recommends Class T fuses for marine installations where a DC disconnect is not required.

MODEL	AMPACITY	DC BREAKER	DC FUSE
FX2012ET	200 amps	OBB-250-125VDC-PNL	400
FX2024ET	125 amps	OBB-175-125VDC-PNL	200
FX2348ET	57.5 amps	OBB-125-125VDC-PNL	200
VFX2612E	260 amps	OBB-250-125VDC-PNL	400
VFX3024E	150 amps	OBB-250-125VDC-PNL	200
VFX3048E	75 amps	OBB-125-125VDC-PNL	200

WIRE SIZES

The following chart contains information on wire sizes, the DC resistance of the wires and the corresponding diameters and areas of these wires. This information can be used to calculate the voltage drop of the wires or to find an equivalent wire size.

SIZE	DC (AWG) Resistance in Ohms (1000 feet)	CROSS-SECTIONAL AREA		APPROXIMATE DIAMETER	
		INCHES	MILLIMETERS	INCHES	MILLIMETERS
14	3.14	.0032	2.08	.0641	1.63
12	1.98	.0051	3.31	.0808	2.05
10	1.24	.0082	5.26	.1019	2.59
8	0.78	.0130	8.37	.1285	3.26
6	0.50	.0206	13.30	.162	4.11
4	0.31	.0328	21.15	.2043	5.19
2	0.19	.0521	33.62	.2576	6.54
1	0.15	.0657	42.41	.2893	7.35
1/0	0.12	.0829	53.50	.325	8.25
2/0	0.10	.1045	67.43	.365	9.27
3/0	0.08	.1318	85.01	.410	10.4
4/0	0.06	.1662	107.20	.460	11.7

Recommended Wire Sizes

FX Model	Max DC Amps	NEC Max Amps x 1.25*	2% Voltage Drop	Ohms Allowed	OutBack Suggested Cables	Max Battery Cable Length** (Positive + Negative)
FX2012ET	200	250	0.24	0.001200	4/0 250	20'
FX2024ET	125	156.25	0.48	0.003840	2/0 175	30'
VFX3024E	150	187.5	0.48	0.003200	4/0	30'
FX2348ET	57.5	71.875	0.96	0.016696	1/0	30'
VFX2612E	260	325	0.24	0.000923	4/0	15'
VFX3048E	75	93.75	0.96	0.012800	1/0	30'

* This is an example of ampacity derating; follow derating requirements for your local and national electrical codes.

** Divide lengths in half for one-way runs.

MAINTENANCE

If damaged or malfunctioning, the FX should be repaired by a qualified user, installer, or service center following OutBack Power Systems' instructions and guidelines. Please contact your energy dealer for assistance. Incorrect repairs and/or reassembly risks malfunction, electric shock or fire.

For routine, user-approved maintenance:

- Disconnect all circuit breakers and related electrical connections before doing any cleaning or adjustments.
- Solar modules may produce hazardous voltages when exposed to light; cover them with opaque material before servicing any connected equipment or service at night.
- If a remote or automatic generator start system is used, disable the automatic starting circuit and/or disconnect the generator from its starting battery while servicing. This will prevent accidental it to starting or operation.

FX DEFAULT VALUES (SUBJECT TO CHANGE WITH FX UPGRADES)

12 VDC System	DEFAULT	MINIMUM	MAXIMUM
Float Voltage	13.6V	12V	15V
Absorb Voltage	14.4V	13V	16V
EQ Voltage	14.4V	14V	17V
ReFloat	12.5V	11V	13V
LBCO	10.5V	9V	12V
LBCI	12.5V	10V	14V
Sell RE	13V	10V	15V
Gen Alert			
Off Set Point	14V	12V	18V
On Set Point	11V	10V	14V
Load Shed Off Set Point	11V	10V	14V
Vent Fan ON Set Point	13V	10V	16V
Diversion ON Set Point	14.6V	12V	16V
Absorb Time	1.0 hours	0.0 hours	24.0 hours
EQ Time	1.0 hours	0.0 hours	24.0 hours
Float Time	1.0 hours	0.0 hours	24.0 hours
AC2/Gen Transfer Delay (Cycles for AC)	60 cycles* (*20 for Grid-Tie)	0 cycles	240 cycles
Search	6	0	50
Grid Lower Limit	207V	80V	220V
Grid Upper Limit	270V	250V	300V
Grid Connect Delay	.5 min	.2 min	15.0 min
DROP or USE	USE	N/A	N/A
Charger OFF/AUTO/ON	AUTO		
AUX Output Option	COOL FAN		
Gen Alert ON Delay	4 min	0 min	240 min
Gen Alert OFF Delay	9 min	0 min	240 min
Vent Fan OFF Delay	5 min	0 min	30 min
Gen Window Lower Limit	208V	80V	220V
Gen Upper Window Limit	270V	250V	300V
AC1/Grid Transfer Delay (Cycles of AC)	6	0	240
Set AUX Control	AUTO		
Search Pulses	8	2	20
Search Pulse Spacing (Cycles AC)	60	4	120
Stacking Phase	1 or 2 phase		
InPut Select	Master Gen		
Charge Rates			
Vented 24 & 48 VDC	9 AAC	0 AAC	10 AAC
Vented 12 VDC	6 AAC	0 AAC	7 AAC
Sealed 24 & 48 VDC	5 AAC	0 AAC	7 AAC
Sealed 12 VDC	5 AAC	0 AAC	6 AAC
Grid Input Settings			
Set AC Input Size	28 Amp	5 Amp	30 Amp
Gen Input Settings	28	2	30
Set VAC	230V	210V	240V

Correction Factor •24VDC: Multiply 12VDC values by 2 •32VDC: Multiply 12VDC values by 2.64 •48VDC: Multiply 12VDC values by 4



TWO YEAR LIMITED WARRANTY INFORMATION

FX Series Inverter/Charger Products

OutBack Power Systems, Inc. ("OutBack") provides a two year (2) limited warranty ("Warranty") against defects in materials and workmanship for its FX/VFX Series Inverter/Charger products ("Product(s)") if installed in fixed location applications.

The term of this Warranty begins on the Product(s) date of manufacture or the initial purchase date as indicated on the warranty registration card submitted to OutBack, whichever is greater. This Warranty applies to the original OutBack Product(s) purchaser, and is transferable only if the Product(s) remains installed in the original use location. The warranty does not apply to any Product(s) or Product(s) part that has been modified or damaged by the following:

- Installation or Removal;
- Alteration or Disassembly;
- Normal Wear and Tear;
- Accident or Abuse;
- Corrosion;
- Lightning;
- Repair or service provided by an unauthorized repair facility;
- Operation contrary to manufacturer product instructions;
- Fire, Floods or Acts of God;
- Shipping or Transportation;
- Incidental or consequential damage caused by other components of the power system;
- Any product whose serial number has been altered, defaced or removed; or
- Any other event not foreseeable by OutBack.

OutBack's liability for any defective Product(s), or any Product(s) part, shall be limited to the repair or replacement of the Product(s), at OutBack's discretion. OutBack does not warrant or guarantee workmanship performed by any person or firm installing its Product(s). This Warranty does not cover the costs of installation, removal, shipping (except as described below), or reinstallation of Product(s).

To request warranty service, you must contact OutBack Technical Services at (360) 435-6030 or support@outbackpower.com within the effective warranty period. OutBack Technical Support will attempt to troubleshoot the product and validate that the failure is product related. If warranty service is required, OutBack will issue a Return Material Authorization (RMA) number. A request for an RMA number requires all of the following information:

1. Proof-of-purchase in the form of a copy of the original Product(s) purchase invoice or receipt confirming the Product(s) model number and serial number;
2. Description of the problem; and
3. Shipping address for the repaired or replacement equipment.

After receiving the RMA number, pack the Product(s) authorized for return, along with a copy of the original purchase invoice, in the original Product(s) shipping container(s) or packaging providing equivalent protection and mark the outside clearly with the RMA number. The sender must prepay all shipping charges to the agreed upon OutBack Power Systems location, and insure the shipment, or accept the risk of loss or damage during shipment. OutBack is not responsible for shipping damage caused by improperly packaged Products, the repairs this damage might require, or the costs of these repairs. If, upon receipt of the Product(s), OutBack determines the Product(s) is defective and that the defect is covered under the terms of this Warranty, OutBack will then and only then ship a repaired or replacement Product(s) to the purchaser freight prepaid, non-expedited, using a carrier of OutBack's choice, where applicable.

The warranty period of any repaired or replacement Product is twelve (12) months from the date of shipment from OutBack, or the remainder of the initial warranty term, which ever is greater.

THIS LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY APPLICABLE TO OUTBACK PRODUCTS. OUTBACK EXPRESSLY DISCLAIMS ANY OTHER EXPRESS OR IMPLIED WARRANTIES OF ITS PRODUCTS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. OUTBACK ALSO EXPRESSLY LIMITS ITS LIABILITY IN THE EVENT OF A PRODUCT DEFECT TO REPAIR OR REPLACEMENT IN ACCORDANCE WITH THE TERMS OF THIS LIMITED WARRANTY AND EXCLUDES ALL LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR PRODUCTS NOT BEING AVAILABLE FOR USE OR LOST REVENUES OR PROFITS, EVEN IF IT IS MADE AWARE OF SUCH POTENTIAL DAMAGES. SOME STATES (OR JURISDICTIONS) MAY NOT ALLOW THE EXCLUSION OR LIMITATION OF WARRANTIES OR DAMAGES, SO THE ABOVE EXCLUSIONS OR LIMITATIONS MAY NOT APPLY TO YOU.



Limited Warranty Registration

Complete this form to request a Limited Warranty, and return it to:

Outback Power Systems Inc.
19009 62nd Ave. NE
Arlington, WA 98223

NOTE: Please submit a copy (not the original) of the Product purchase invoice, which confirms the date and location of purchase, the price paid, and the Product Model and Serial Number.

Two Year Limited FX Inverter/Charger Warranty Registration

System Owner

Name: _____ Country: _____
Address: _____ Telephone Number: _____
City, State, Zip Code: _____ E-mail: _____

Product

Product(s) Model Number(s): _____ Sold by: _____
Product(s) Serial Number(s): _____ Purchase Date: _____

Please circle the three most important factors affecting your purchase decision:

- Price
- Product Reputation
- Product Features
- Reputation of OutBack Power Systems
- Value

System

System Install/Commission Date: _____ Total Nominal System AC Output in KW: _____
Nominal System AC Voltage: _____ System Battery Bank Size (Amp Hours): _____
Type of Batteries: _____

Are you using a generator with this system? (Circle One): Yes No

If yes, please list the make and model: _____

If yes, is the generator's output is (Circle One): AC DC

Installer

Name (If Applicable): _____ Address: _____
City, State, Zip: _____ E-mail: _____
Contractor Number: _____

*Extended Warranty

OutBack Power Systems offers an optional three (3) year extension to the standard two (2) year Limited Warranty for the FX/VFX Series Inverter/Charger product. To request a 3-year Limited Warranty extension for a total effective warranty coverage period of five (5) years; include a check or money order in the amount of \$300USD payable to OutBack Power Systems, Inc. along with your Warranty Registration.

Revision.2008-04-01

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