

# OutBack Power Systems

## *“Grid-Tie” FX and VFX Inverter/Charger*

### Installation and Programming Manual

Document Revision 7.1

**GTFX 2524** - 2.5 kW / 24 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Grid-Tie*)

**GTFX 3048** - 3.0 kW / 48 VDC / 120 VAC / 60 Hz (*Sealed + Turbo / Grid-Tie*)

**GVFX 3524** - 3.5 kW / 24 VDC / 120 VAC / 60 Hz (*Ventilated / Grid-Tie*)

**GVFX 3648** - 3.6 kW / 48 VDC / 120 VAC / 60 Hz (*Ventilated / Grid-Tie*)



*The “Sealed” version of the GFX*



*The “Vented” version of the GFX*

*The “Turbo Kit” that comes with the GTFX series is shown on page 17*

*Please check our website at [www.outbackpower.com](http://www.outbackpower.com) for the latest product information*



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## **OutBack GTFX and GVFX certificate of compliance to UL1741 utility-interactive inverters**

OutBack GTFX and GVFX inverters comply with UL1741 for utility-interactive inverters. The following are specifications of popular interest and refer to exporting power to a simulated utility source of less than 1% voltage THD.

The output of an OutBack GTFX or GVFX inverter exceeds the minimum power factor of 0.85 specified in UL1741 section 45.2.2. Typical power factor is 0.96 or better.

The total harmonic distortion (THD) of the rms current is less than 5 percent of the fundamental under the conditions of UL1741 section 45.4.2. Individual odd harmonics do not exceed the limits specified in Table 45.1 of UL1741. Individual even harmonics do not exceed the limits specified in Table 45.2 of UL1741.

The GTFX and GVFX inverters cease to export power to the simulated utility source under islanding conditions specified in section 46.3 of UL1741.

The GTFX and GVFX inverters cease to export power to the simulated utility source after the output voltage and frequency of the simulated utility source are adjusted to each of the conditions specified in Table 46.1 of UL1741 within the time specified in that table. All production GTFX and GVFX inverters are tested to comply with the table below as specified in section 46.2 of UL1741.

Condition	Voltage Range (VAC)	Frequency (Hz)	Seconds Allowed	Cycles Allowed
A	<60	60	0.1	6
B	<=60 to <105.6	60	2	120
C	>=105.6 to <=132	60	no cessation	no cessation
D	>132 to <164.4	60	2	120
E	>=164.4	60	0.033	2
F	120	<59.3	0.1	6
G	120	>60.5	0.1	6

## Installation Guidelines

This manual contains important instructions for the OutBack **GFX** (Grid-tie **FX**) series inverter/charger system with the software which allows classic series stacking of two units for higher power and/or higher voltage systems. The GFX comes in two different versions: the **GTFX** (Grid-tie Turbo **FX**) has a sealed chassis and includes a Turbo Kit to help with cooling and the **GVFX** (Grid-tie Vented **FX**) has a vented chassis and uses air from outside the GFX to cool down.

- 1 **All of the AC wiring to the AC terminals is to be torqued to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).** Wiring to these terminals must meet requirements of the National Electric Code (NEC). The terminals will accept up to 6AWG. Use copper conductors only with insulation rated for 75° C. See the AC WIRING CONNECTIONS section of this manual for more information.
- 2 **Torque the DC connections to 60 inch-pounds (equivalent to 5 foot-pounds or 6.8 Nm).** Cables to these terminals must use a crimp on type ring terminal or compression type lug. Cable must meet the requirements of the National Electrical Code. Use of large gauge cables (2/0 or 4/0 AWG) or larger is advisable to reduce losses and ensure high performance of the GFX. Cables of too small a gauge can result in poor performance and even damage the GFX. Keep the cables together as much as possible and ensure that both cables pass through the same knockout and conduit fittings and to allow the inductive currents to cancel.
- 3 For equipment grounding hook up, see the system configuration sections in this manual. This product is intended to be installed as part of a permanently grounded electrical system per the NEC.
- 4 AC overcurrent protection for all connections must be provided by others as part of the installation.
- 5 DC battery circuit overcurrent protection must be provided by others as part of the installation. OutBack offers 100, 175 and 250 amp DC breakers (part number OBDC-XXX) which can be used with the GFX. For non-NEC installations, OutBack also offers a stud mounted fuse which can be connected directly to the DC terminal of the GFX – it is available in 100, 175 and 250 amp sizes (part number SMF-XXX) The Stud mounted fuses require a 10mm hole in the battery terminal lug. US lugs are typically 3/8" diameter. Light filing may be required to insure proper fit of the nut shoulder into the lug hole.

- 6 The equipment ground on the inverter is marked with this symbol:



- 7 This inverter has a single phase output. It is marked with this symbol:



- 8 This inverter puts out a sine wave waveform. It is marked with this symbol:



- 9 **CAUTION:** To reduce the risk of fire, connect only to a circuit provided with 60 amp maximum branch-circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.
- 10 **WARNING:** To reduce the risk of fire, do not connect a single GFX to both hot legs of a 120/240 VAC AC load center having multi wire (common neutral) branch circuits connected. Use two GFX's wired in a series configuration and programmed for classic stacking for use with 120/240 VAC multi wire systems.
- 11 **IMPORTANT:** Always install the battery terminal covers, even in systems that include the DCC (DC Compartment Cover).

## General Precautions

1. Before using the GFX, read all instructions and cautionary markings on (1) the GFX, (2) the batteries and (3) all appropriate sections of this installation and operation manual.
2. **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.
3. The GFX is approved for indoor mounting only in any position.
4. Do not disassemble the GFX. Refer servicing to a qualified service center when service or repair is required. Incorrect re-assembly may result in a risk of electric shock or fire.
5. To reduce risk of electric shock, disconnect all wiring before attempting any maintenance or cleaning. Turning off the GFX may not reduce this risk. Solar modules may produce hazardous voltages when exposed to light - cover them with opaque material before servicing any connected equipment.
6. **WARNING - WORKING IN THE VICINITY OF A LEAD ACID BATTERY IS DANGEROUS. BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL OPERATION.** Provide ventilation to outdoors from the battery compartment. The battery enclosure should be designed to prevent accumulation and concentration of hydrogen gas in "pockets" at the top of the enclosure. Vent the battery compartment from the highest point. A sloped lid can also be used to direct the flow of hydrogen to the vent opening at the highest possible location.
7. NEVER charge a frozen battery.
8. No terminals or lugs are required for hook-up of the AC wiring. AC wiring must be copper wire and rated for 75°C or higher. Battery cables must be rated for 75°C or higher. Crimped and sealed copper ring terminal lugs with a 5/16" hole should be used to connect the battery cables to the DC terminals of this GFX. Soldered cable lugs are also acceptable.
9. **Torque all AC wiring connections to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).**
10. **Torque the DC connections to 60 inch-pounds (equivalent to 5 foot-pounds or 6.8 Nm).**
11. Be careful with tools to reduce the risk of dropping metal objects onto batteries. It may short-circuit the batteries or other electrical parts resulting in fire or explosion.

## Additional Notices

1. For instructions on mounting, see the MOUNTING section of this manual.
2. For battery installation and maintenance: read the battery manufacturer's instructions prior to installation and operation.
3. All installations must comply with local and national electrical codes and standards.
4. **GROUNDING INSTRUCTIONS** – The GFX should be connected to a grounded, permanent wiring system. For all installations, the negative battery conductor should be bonded to the grounding system at one (and only one) point in the system. All installations should comply with national and local codes and ordinances. Do not positive ground the FX.

## Personal Precautions While Working with Batteries

1. Someone should be within range of your voice to come to your aid.
2. Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing, or eyes.
3. Wear complete eye protection. Avoid touching eyes while working near batteries. Wash your hands with soap and warm water when done.
4. If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters eye, immediately flood eye with running cool water for at least 15 minutes and get medical attention immediately.
5. Baking soda neutralizes lead acid battery electrolyte. Keep a supply on hand in the area of the batteries.
6. **NEVER** smoke or allow a spark or flame in vicinity of a battery or generator.
7. Be extra cautious to reduce the risk of dropping a metal tool onto batteries. It could short-circuit the batteries or other electrical parts that may result in fire or explosion.
8. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a battery. A battery can produce a short circuit current high enough to weld a ring or the like to metal, causing severe burns.
9. 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 it to prevent starting while servicing. **NOTE:** GFX's do not work with generators at this time.

# RATINGS

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## NOMINAL SYSTEM AC VOLTAGE:

Single phase	120VAC at 60Hz
Series stacked	120VAC at 60Hz per AC output leg (limit two) / 240VAC at 60Hz across the AC output legs

## RECOMMENDED DC VOLTAGE RANGE:

24V Systems	22 – 32 VDC
48V Systems	44 – 64 VDC

## MAXIMUM DC INPUT CURRENT: 24 V units = 300 amps / 48V units = 150 amps

This is the most current the GFX will draw 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.

## RATED DC INPUT CURRENT: This is the highest continuous current that the FX will draw from the batteries when inverting.

<b>GTFX2524</b>	120 amps DC
<b>GTFX3048</b>	70 amps DC
<b>GVFX3524</b>	170 amps DC
<b>GVFX3648</b>	85 amps DC

## AC INPUT OPERATING VOLTAGE RANGE: 90 – 150 VAC

Voltages outside of this range may damage AC loads connected to the GFX's AC output.

**IMPORTANT:** The GFX is designed to accept a utility grid quality AC input. Using a GFX with a generator as the AC input is not recommended. Most generators, even high-power stable generators have been shown not to connect or charge through the GFX. OutBack is working on this problem, but for the time being, do not expect your generator to work with the GFX.

## MAXIMUM AC INPUT CURRENT: 60 amps at 120 VAC 60 Hz

The AC input on the GFX supplies power for two separate internal AC circuits – the AC transfer switch and the battery charging system. The battery charger will “back off” when the combined total of the AC load and the battery charger exceed the programmed AC input current limit.

## RECOMMENDED MAXIMUM AC PASS THROUGH CURRENT:

60 amps at 120 VAC 60 Hz for each GFX.

## MAXIMUM AC CURRENT FOR AC BATTERY CHARGER:

GTFX series: 16 amps AC at 120 VAC maximum – default setting is 12 amps AC

GVFX series: 20 amps AC at 120 VAC maximum – default setting is 18 amps AC

**Note:** Factory settings are 8 amps AC.

## OPERATING FREQUENCY RANGE:

The GFX will accept an AC source within the frequency range of 58 to 62 Hz. Once the GFX connects to the AC source, if the frequency goes outside of the range 58-62 Hz, the GFX will record an error and disconnect from the AC source. The GFX will stop selling back to the utility grid when the grid is outside of the frequency range of 59.3-60.5 Hz.

## MAXIMUM AC OUTPUT CURRENT:

70 amps (for 160 milliseconds) current limit

Inverter will shut down after 5 seconds of operation in current limit

**MAXIMUM CONTINUOUS OUTPUT POWER:** Varies with model number of the inverter:

**GRID-TIE VERSIONS**

<b>GTFX2524</b>	2500 VA
<b>GTFX3048</b>	3000 VA
<b>GVFX3524</b>	3500 VA
<b>GVFX3648</b>	3600 VA

**MAXIMUM AC OUTPUT FAULT CURRENT:**

The FX will go into fault if a sustained current draw of 50 amps RMS occurs when operating as an inverter. When passing an AC source through the FX via the AC transfer switch, the maximum AC output fault current will be determined by the AC source.

**NOMINAL DC OUTPUT VOLTAGE:**

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

Example: GTFX25**24** – 24V DC Voltage.

**MAXIMUM OVERCURRENT PROTECTION AMPACITY:**

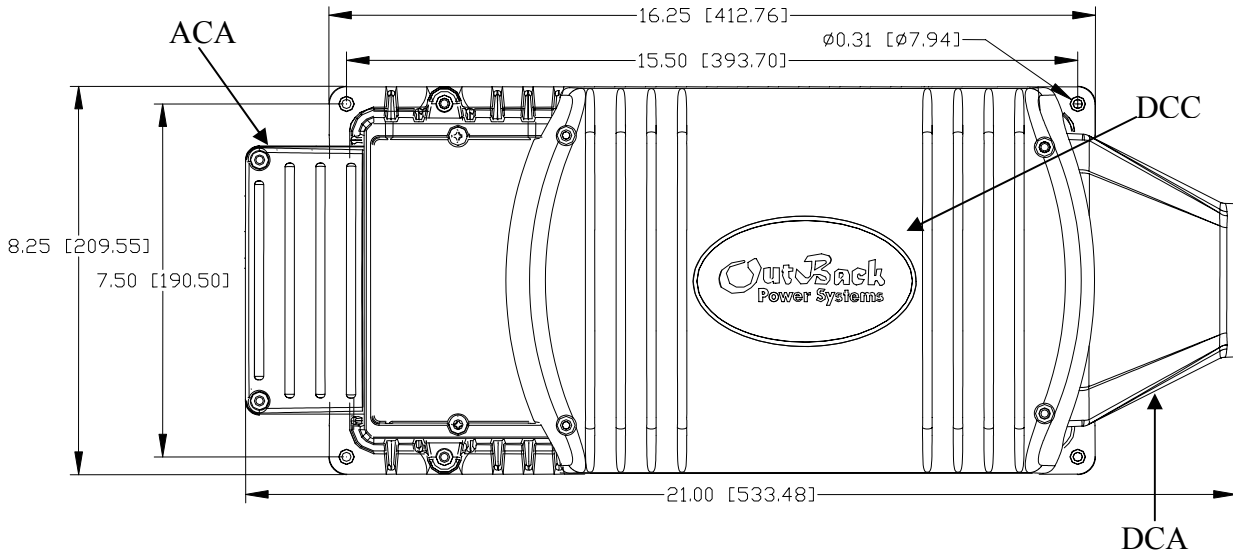
<u>GRID-TIE</u>	<u>AMPACITY</u>	<u>DC BREAKER</u>	<u>DC FUSE</u>
<b>GTFX2524</b>	175 amps	OBDC-175	SMF-175
<b>GTFX3048</b>	100 amps	OBDC-100	SMF-175
<b>GVFX3524</b>	250 amps	OBDC-250	SMF-250
<b>GVFX3648</b>	175 amps	OBDC-175	SMF-175

OBDC are panel mount circuit breakers. SMF are DC terminal mounted fuses and **are not** NEC compliant unless they are used in conjuncture with a UL listed disconnect. GFX's used in home installations should use properly sized DC breakers. A DC breaker includes both overcurrent protection and disconnect capability. SMF fuses are used primarily for marine installations where a DC disconnect is not required.

# MOUNTING

All OutBack GFX's can be mounted in any position. Better performance will be achieved if it is mounted in a location which allows for air to circulate around the exterior of the casing. Locating the GFX in a cool location will improve the operation and ensure the highest efficiency and power capacity.

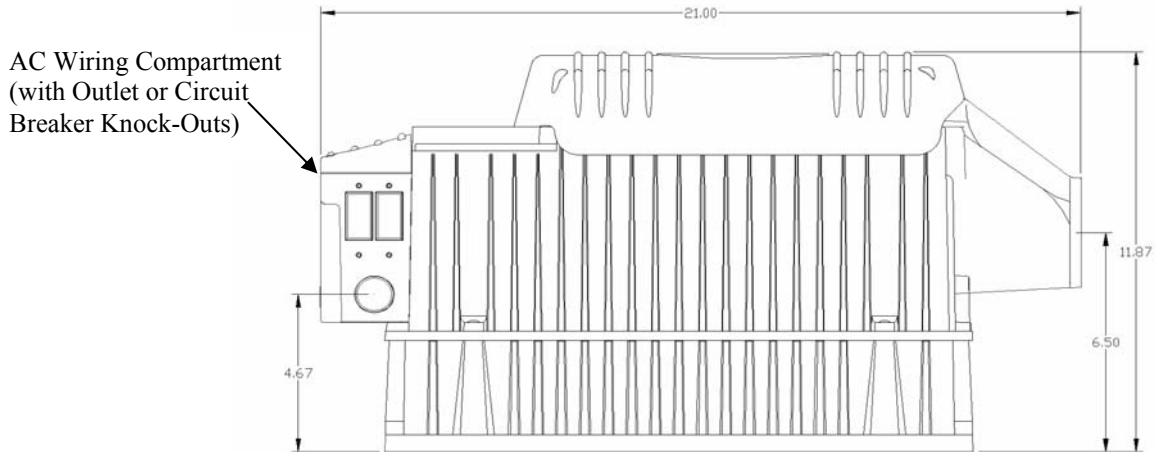
The following drawings provide the mounting and overall dimensions of the GFX with the FXA kit (DCC + ACA + DCA) attached. The first dimension is inches and the second value in parenthesis is the metric value in millimeters.



Depth out from Wall / Height up from Shelf: 11.87 inches (301 mm) / 12.87 INCHES (327mm) with Turbo installed

For installations where the GFX may be exposed to water spray, either mount the GFX with the base down (shelf mounting) or with the AC wiring compartment at the bottom (wall mounting). This will minimize the entry of water into the AC wiring compartment.

The FX-ACA can be used to add an AC outlet and one or two of OutBack's AC rated circuit breakers (up to 70 amps max). When these items are added to the GFX, it should only be used in an area that is protected from rain.



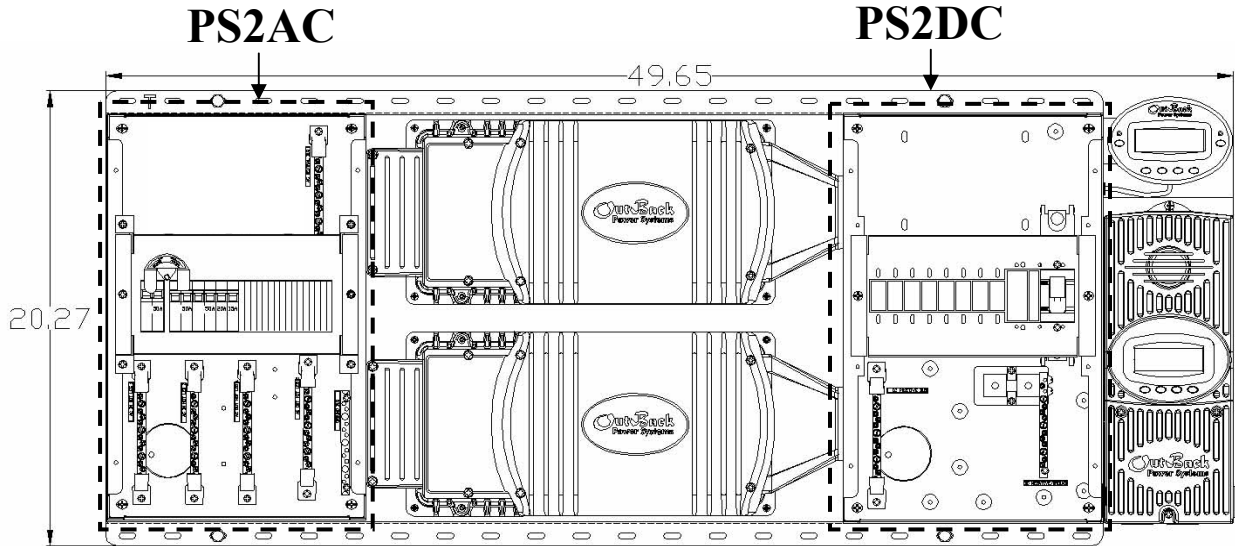
Side view of the GFX with an FXA attached. The Turbo Kit adds an additional 1" (25mm) to achieve a total height of 12.87" (327mm).

# COMPLETE OUTBACK INTEGRATED SYSTEMS

Shown below is a complete system of OutBack GFX's for indoor installations. The system is shown mounted to the OutBack **PS2MP** (Power System - 2 FX - Mounting Plate). The **PS2MP** comes with four 1x20mm thread forming screws for attaching inverters and breaker boxes. The use of an external toothed star washer (provided) is required on one screw on each piece of equipment in order to bite through the powder coating and ensure grounding of all metal components.

The mounting plate will typically need to be bolted to the studs in a wall using at least four 1/4" or 5/16" lag bolts 2" long. In addition to the **PS2MP** (the "2" in **PS2MP** refers to the maximum number of FX's that will fit), these installations are also shown with an OutBack **PS2DC** (DC breaker box), **PS2AC** (AC breaker box), **FX-DCA** (DC Conduit Adapter), **FX-DCC** (DC Compartment Cover), and the **FX-ACA** (AC Compartment Adapter). When two or more GFX's are installed in close proximity such as in this installation, it may be useful to install one or more 12VDC fans inside the PSDC that will pressurize the PSDC enclosure – forcing air up through the DC Manifold and down over the external fins. This will improve the battery charging performance by reducing the possibility of the GFX's limiting the output due to reaching their maximum allowed temperatures. The AUX outputs of the GFX's can be used to control and power the cooling fans.

These additional components are designed to complete the installation to NEC code while offering flexibility for future expansion.



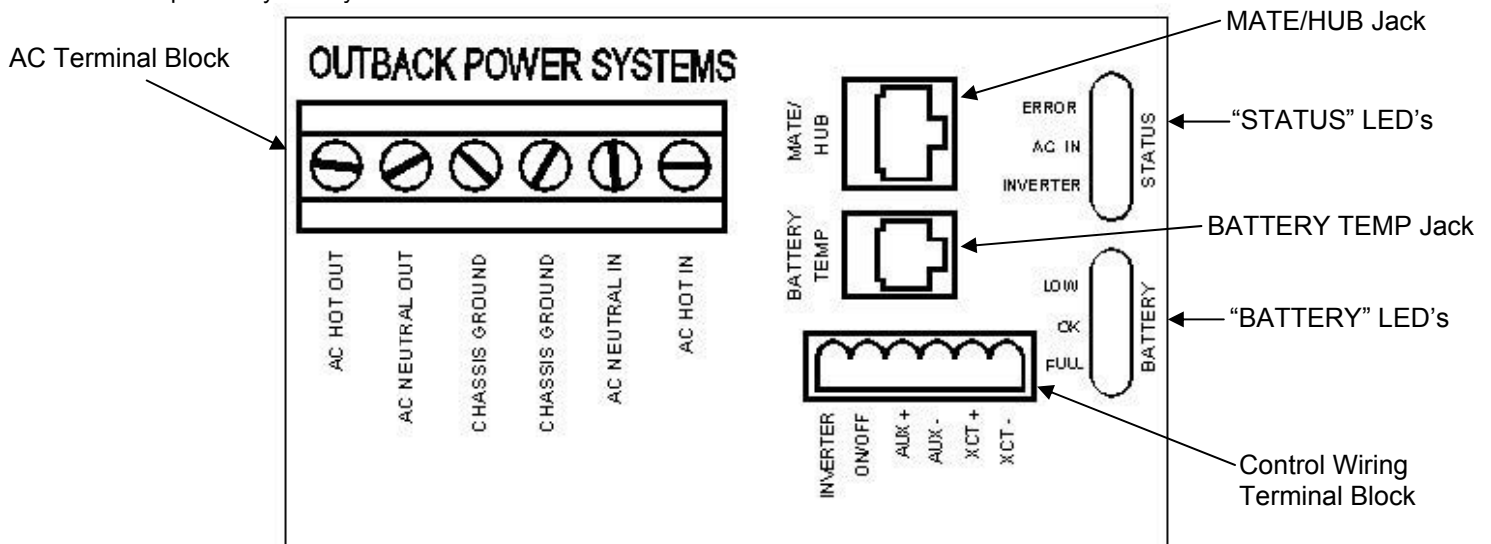
# AC WIRING CONNECTIONS

The GFX system and the other OutBack balance of system components are designed to make it easy to meet both local and National Electrical Codes (NEC) installation requirements.

If you are not familiar with the NEC, you should have the equipment installed by a qualified renewable energy equipment dealer or electrician. All wiring methods are to be made in accordance with the National Electrical Code, ANSI/NFPA 70.



The GFX includes an AC wiring compartment with both a removable cover and AC conduit plate. Depending on the type of installation, the AC conduit plate may or may not be used.



The AC terminal block in the AC wiring compartment is designed to accept up to 6 AWG (13.3mm<sup>2</sup>) wires. A typical installation will use 6 AWG (13.3mm<sup>2</sup>) THHN type wire. 6 AWG (13.3mm<sup>2</sup>) is required in order to handle the 60 amp capacity of the inverter's AC transfer switch. All AC wiring connected to the AC terminal block must be rated for at least 75° C. Torque all of the set screws on the AC terminal block to 30 inch-pounds (equivalent to 2.5 foot-pounds or 3.4 Nm).

The GFX is designed to accept a utility grid quality AC input. Using a GFX with a generator as the AC input is not recommended. Most generators, even high-power stable generators have been shown not to connect or charge through the GFX. OutBack is working on this problem, but for the time being, do not expect your generator to work with the GFX. The AC input should be supplied to the GFX through a 60 amp maximum AC branch rated circuit breaker. The AC hot input conductor (black) should be connected to the **AC HOT IN** terminal. The AC neutral input conductor (white) may be connected to the **AC NEUTRAL IN** terminal or a common Neutral bus. The **AC NEUTRAL OUT** terminal is common with the **AC NEUTRAL IN** terminal within the GFX and only one AC neutral connection is required to be connected to the GFX if a separate AC neutral bus is installed. The other three terminals of the AC terminal block are for AC output wiring. The **AC HOT OUT** terminal is to be connected to the AC loads through 50A to 60A branch rated AC circuit breakers.

Many installations will use the OutBack **AC-IOB-60** input/output bypass breaker assembly mounted in the OutBack PS2AC. This bypass assembly allows the user to completely bypass the GFX. While in the bypass mode, AC current flows directly from the AC source (generator or grid) through the bypass breaker and out to the loads. In addition to the AC bypass switch, OutBack has separate AC input breakers. These also need to be turned off. After the GFX has been powered down through the DC breaker, it can then be removed for servicing or replacement without loss of AC power to the AC loads of the system.

The AC terminal block includes two terminals labeled **CHASSIS GROUND** (older FX's have one of these terminals labeled "Filter Ground" even though it was never actually filtered). These terminals are connected to each other within the FX. Therefore, it is necessary to connect only one of these terminals to ground. It should be noted that the grounding lug near the battery terminals may also be connected to ground.

The AC wiring compartment also encloses the green terminal block used for the low voltage control wiring. This six position terminal block can be unplugged to make wiring easier and to simplify the removal and reinstallation of an inverter. Two sets of multi-colored LED indicators are provided to display the operation of the system. A set of three LEDs is provided to indicate the voltage level of the battery connected to the DC terminals of the GFX. This can be useful in troubleshooting the GFX. These battery status LEDs operate at the following voltage levels:

<u>LED Color</u>	<u>Nominal Battery Voltage</u>	
	<u>24 VDC</u>	<u>48 VDC</u>
Green	25.0 or higher	50.0 or higher
Yellow	23.0 to 25.0	46.0 to 50.0
Red	23.0 or lower	46.0 or lower

There is another set of three LED's which indicates the operation of the GFX. These LED's are active as follows:

<u>LED Color</u>	<u>LED Action</u>	<u>LED Indicates</u>
Green	Solid GREEN	Inverter ON
	Flashing GREEN	Search Mode or Slave Power Save
	Off	Inverter OFF
Yellow	Solid YELLOW	AC Source is Connected
	Flashing YELLOW	AC Input Live – Waiting to Connect to the GFX
	Off	No AC Input Present
Red	Solid RED	Error – An Error Message will be automatically displayed on the MATE
	Flashing RED	Warning – A non-critical fault happened to the GFX. The MATE can access this info.

## INVERTER ON/OFF

The left two terminals of the green terminal block marked **INVERTER** and **ON/OFF** can be used to control the inverter. Connecting the two terminals together through a switch will allow control of the inverter output if a MATE is not available. A small jumper wire is pre-installed into these two positions of the terminal block and needs to be removed in order to add the external switch. If the GFX's AC output is off, check that the jumper wire is present and well connected. An installed switch overrides the control provided by the OutBack MATE – if the switch is set to OFF, the MATE will not be able to turn ON the inverter. Cycling this switch quickly from ON to OFF and then to ON again puts the inverter into **Search** mode. Cycling the switch in this fashion again returns the inverter to the ON mode.

## AUXILIARY OUTPUT (AUX + / AUX -)

The Auxiliary output system uses the **AUX +** and **AUX -** terminals and is able to be programmed through the MATE to do a variety of tasks. The default use for these terminals is to drive one 12-volt fan for external cooling. The power available at these terminals is 12 VDC at 0.7 amps (8.4 watts) maximum. These terminals should not be connected to any type of DC load which has a high inrush current requirement. The GFX includes internal electronic overcurrent protection for this 12 VDC output circuit which auto resets if it is short circuited. No additional fuses are required. Use the OutBack FX Turbo Kit or DC12-FAN for cooling.

## XCT + / XCT -

These terminals are not operational at this time.

## BATTERY TEMP {REMOTE TEMPERATURE SENSOR (RTS)}

The OutBack GFX has a 4 position "phone" RJ-11 modular jack located in the AC compartment for the connection of an optional external battery temperature sensor, the **RTS** (sold separately), that allows for automatic adjustment of the battery charging process based on the temperature of the battery. Battery manufacturers provide recommended charge voltages based on temperatures of 25°C / 77°F. With the RTS attached, the GFX adjusts the battery voltage 0.06 volts per degree Celsius for a 24-volt battery bank or 0.12 volts per degree Celsius for a 48-volt battery bank. When a **HUB** is used, the RTS must be plugged into the Master GFX which must be plugged into port 1 of the HUB. If this is the case, only one RTS is required for all devices plugged into the HUB. The RTS should be stuck to the side of a battery below the electrolyte level so it can measure the temperature of the batteries. The wire from the RTS can be folded and routed underneath the transparent gray plastic lexan cover of the AC wiring compartment to allow connection to the battery. There is a small indentation in the aluminum casting between the battery terminals to allow for the wire to pass without affecting the sealing of the covers. When running additional wires under the smoked lexan cover, it may be required to snip some lexan away to allow for wire routing. The lexan will not crack when cutting or filing.

## MATE / HUB

The 8 conductor "Ethernet" RJ-45 modular jack allows direct connection of a **MATE** system controller and display to the GFX using standard CAT5 type cabling. If multiple GFX's or a GFX and a MX charge controller are both in the system, an OutBack **HUB** communication manager is required for stacking of the GFX's and for efficient system performance. The **HUB** acts similarly to a computer hub to combine the communication signals of the devices together into a networked system. OutBack offers two different **HUB** products at this time. The **HUB-4** accepts up to four OutBack products and one **MATE**. The **HUB-10** connects up to ten OutBack products and one **MATE**. **NOTE:** Although the **HUB** has 2 ports for **MATE's** only the 1<sup>st</sup> port is operational.

# BATTERY - GFX CABLING

## DC BATTERY TERMINALS

The DC terminals are made from solid brass with a stainless steel threaded stud. The threads are M8 x 1.25". The black terminal is negative and red terminal is positive. **DO NOT PUT ANY WASHERS BETWEEN THE TERMINAL MOUNTING SURFACE AND THE ACTUAL BATTERY CABLE LUG.** Place the flat washer, lock washer and nut on top of the battery terminal lug. **TORQUE TO 60 INCH-POUNDS (5 FOOT-POUNDS OR 6.8 NM) MAXIMUM.**

UL listed DC rated circuit breakers are available from OutBack Power Systems with amperages of 100, 175 and 250 amps DC. All of the OutBack DC breakers come with threaded studs out the back for connection to ring type terminal lugs. **ALWAYS INSTALL BREAKERS OR FUSES WITHIN THE POSITIVE BATTERY CABLE.**

OutBack also offers stud mounted fuses (SMF) for non-NEC code installations in 100, 175, and 250 amp sizes.

The minimum recommended cable size varies with the DC voltage. GVFX3524 installations must use 4/0 AWG (107mm<sup>2</sup>) cable minimum. GVFX3648, GTFX2524 and GTFX3048 installations can use 2/0 AWG (68mm<sup>2</sup>) cable as long as the distances are short (less than 10 feet / 3 meters per cable). If longer distances are required, increase the cable size to the next size as a minimum. It is advisable to keep the cables as short as possible. Keep the cables together as much as possible for their entire length. Tying or taping the cables together is advisable.

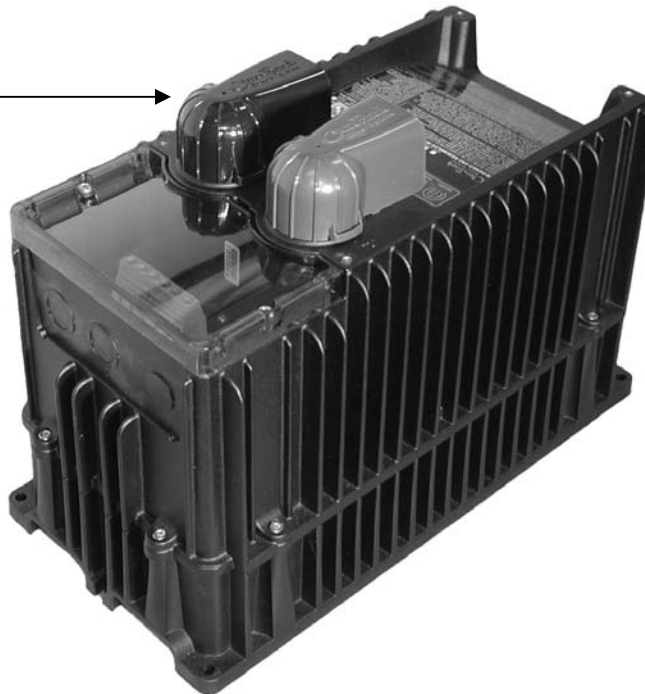
## EQUIPMENT GROUND TERMINALS

A set-screw type box lug is provided near the DC terminals to allow the connection of an equipment grounding conductor for the metal chassis of the GFX. It is located behind the battery negative terminal on the top of the GFX casting. A green ground symbol marks the location. When mounting a GFX to an OutBack mounting plate (PS2MP), use a star washer under a mounting screw to provide a good connection to the mounting plate. Connection to the ground terminal is not required if the star washer is used to connect the FX to the mounting plate and the mounting plate is grounded.

## BATTERY TERMINAL COVERS

The Battery Terminal Covers simply snap on. They are a little brittle, so use some care. Use a flat bladed screw driver blade in the slots provided on the sides of the battery terminal covers to pry the cap off. If the installation is exposed, DC conduit may be required. Connection of 2-inch conduit is possible when the **FX-DCA** and **FX-DCC** options are added to the GFX. **ALWAYS** install the Battery Terminal Covers, even in systems that have an **FX-DCC** included.

Battery Terminal Covers →



**FX-ACA (AC CONDUIT ADAPTER)**

This plastic box slips into grooves on the AC end of the GFX. This adapter extends the AC wiring compartment to match the PS2AC. It also provides more room for wiring than is available when using the supplied flat knockout plate.

There is a 2 inch TSC cut-out on the plastic box to allow it to be used with the PS2AC disconnect enclosure.

May also be used for mounting breakers and/or AC outlets through the knockouts provided.



**FX-DCA (DC CONDUIT ADAPTER)**

The FX-DCA allows the connection of 2-inch TSC conduit to the GFX. It fits on the opposite end of the GFX from the AC wiring compartment. The location of the 2-inch conduit opening matches the 2-inch knockouts provided in the PS2DC enclosure.

When installing a GFX with a PS2DC disconnect enclosure, both the FX-DCA and FX-DCC are required.



**FX-DCC (DC COMPARTMENT COVER)**

The FX-DCC covers the DC terminal area and allows a space which can be used to mount other components such as a DC current shunt. The FX-DCC can be used with or without the FX-DCA.

When installing a GFX with a PS2DC disconnect enclosure, both the FX-DCA and FX-DCC are required.



**FXA ACCESSORY KIT**

The FXA includes all three of these FX accessories in one box.



## HUB COMMUNICATION MANAGER

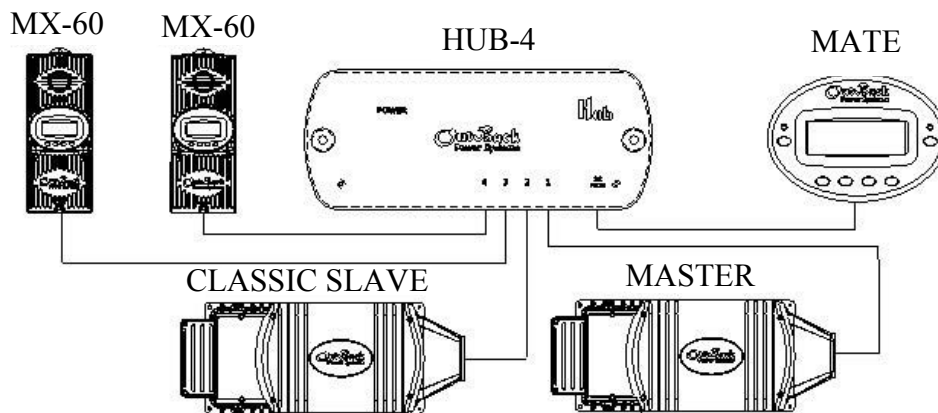
The HUB communication manager allows the MATE to control and monitor a maximum of ten OutBack products. Currently, the HUB comes in two types. The **HUB-4** can connect up to four Outback products (FX's and/or MX-60's). The **HUB-10** (shown below) can connect up to ten Outback products (FX's and/or MX-60's). The FX's can be operated in a stacked or independent configuration. If the FX's are to be stacked, the HUB must be part of the system. In a stacked configuration, the Master GFX must be plugged into port 1 of the HUB. The Slave GFX's must use the following ports (example: for 2 GFX's and 2 MX-60's, the Master GFX must be plugged into port 1, and the Slave GFX must be plugged into port 2. The MX-60's can use ports 3 & 4). Grid-Tie systems are limited to two GFX's and therefore these GFX's use only ports 1 and 2 of the HUB. Future OutBack products will also be compatible with the HUB. When using the HUB, the MATE must be plugged into the **1<sup>st</sup> MATE** port of the HUB. The MATE must be the last device plugged into the HUB for proper operation.

The HUB manages both the inter-GFX communications and the MATE-GFX communication.

When a HUB is used, the RTS (Remote Temperature Sensor) must be plugged into the Master GFX which must be plugged into port 1 of the HUB. If this is the case, only one RTS is required for all devices plugged into the HUB.

One MATE system controller and display can be connected to the HUB. Although there are two Mate ports on the HUB, only the **1<sup>st</sup> Mate** port is currently operational. The MATE can be located up to 1000 feet (305 meters) from the HUB / system location. Cabling from the HUB to the MATE is completed using standard CAT5 type ethernet communication cable with RJ45 modular 8-conductor jacks. This wiring is considered to be low voltage / limited energy circuitry.

All cabling from the GFX and MX-60 communication ports to the HUB is made with CAT5 type ethernet communication cabling. The maximum distance from the HUB-4 to the GFX or MX-60 should be less than 10 feet. OutBack includes two 3-foot (1 meter) and two 6-foot (2 meter) long CAT5 cables standard with the HUB-4. OutBack includes two 3-foot (1 meter) long and four 6-foot (2 meter) long CAT5 cables standard with the HUB-10. Check with your OutBack dealer for additional cables.



There is a limit of two GFX's when operated as a stacked system.  
A total of up to ten OutBack products plus one MATE displays can be used with a HUB-10.  
The HUB-4 (shown above) will only accept four OutBack products plus one MATE.

The Turbo Kit is included with all *sealed* GFX's. It is highly recommended in hot climates or for installations that can use a few hundred watts of extra power. Typically, the Turbo Kit adds 300-500 watts of power to the GFX (this power is included in the GFX ratings). In hot climates or when the GFX is the primary charging device the chances of the GFX overheating are heightened. When the GFX gets to its temperature limits, it will back off the charging process to avoid overheating (and a shutdown of the GFX). The Turbo Kit solves this problem by directing air over the casting and its fins, thus causing better convection for the GFX.

The signal powering the Turbo Kit fan comes from the auxiliary output of the GFX. The default setting on the auxiliary output is set to "CoolFan" which starts the Turbo Kit automatically when the GFX starts heating up.

The instructions for attaching a Turbo Kit are included with the Turbo Kit.

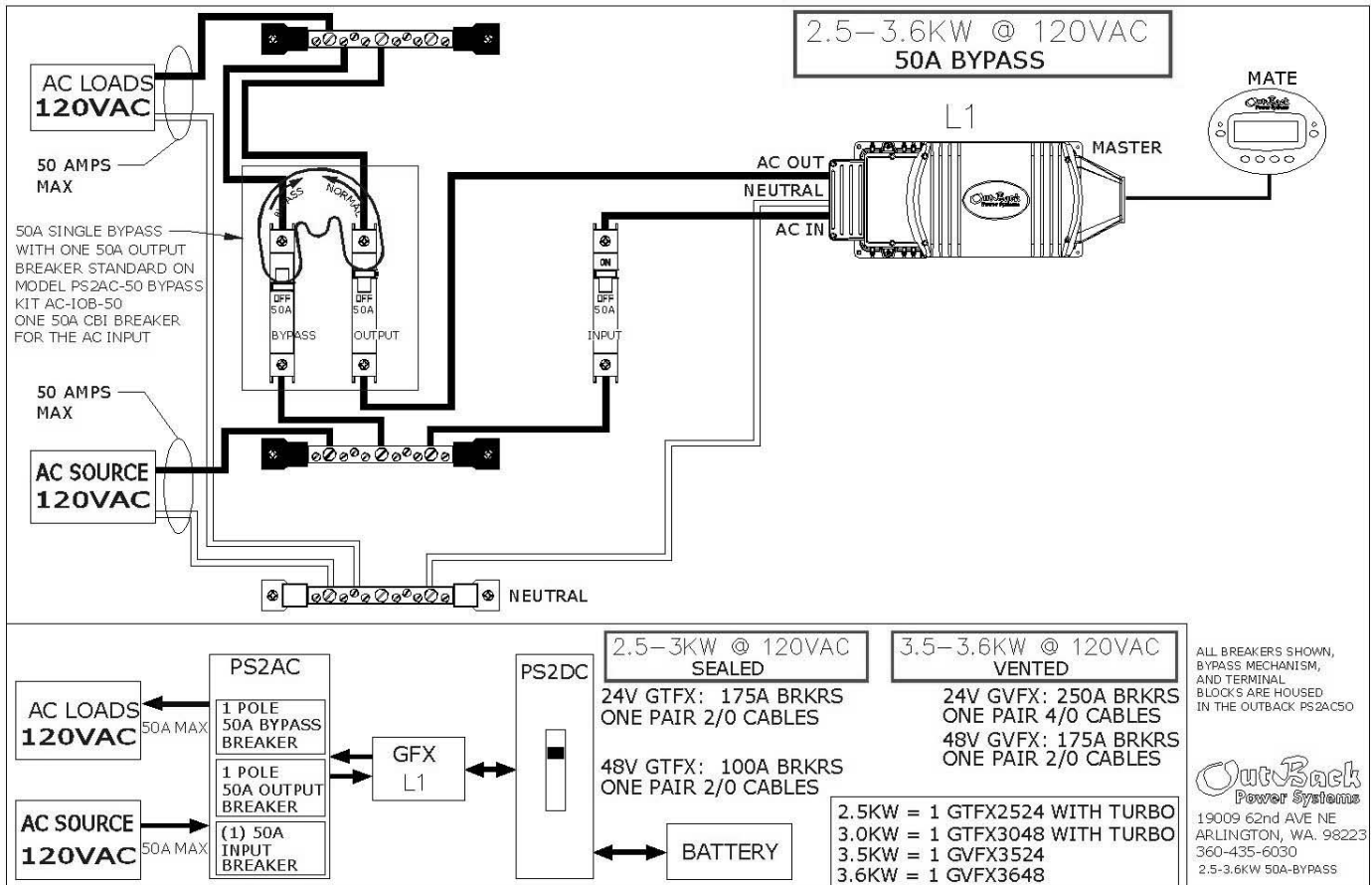


# GFX SYSTEM CONFIGURATION

The GFX System Configuration section shows diagrams of some typical system configurations using the GFX. There are diagrams for a single GFX and for two GFX's in series. The diagrams show the proper breakers and wiring for the AC side of the installations as well as connections to the HUB or MATE. Also included is information on the maximum continuous power of the systems and proper DC breaker sizes. This information is dependent on whether the GFX's are sealed or vented and on the system's battery voltage.

## Single GFX System

The following diagram illustrates a typical single GFX installation. All AC wiring must handle a capacity of 50 amps AC or more. A single GFX system can continuously power 2.5-3.6KW of loads depending on which model is used. Connecting more power than the continuous rating of the GFX may cause breakers to trip or the GFX to shut off its AC output. A MATE must be connected to adjust any parameters or to display any meters. Once the GFX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



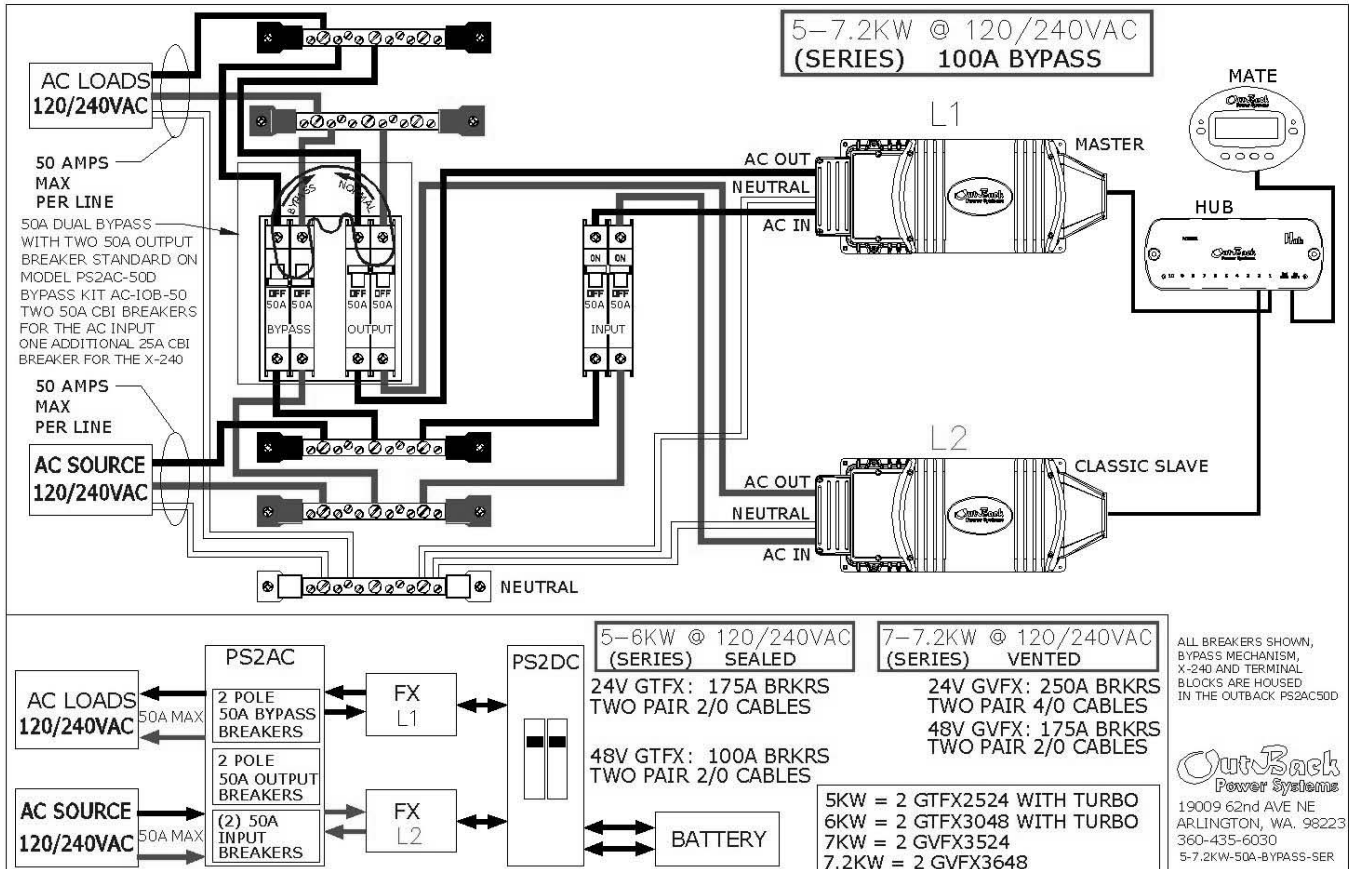
### NOTES:

The AC NEUTRAL OUTPUT IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the GFX. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system.

The AC input, AC output and DC terminals are isolated from the metal chassis of the inverter. Proper grounding of these circuits and the chassis of the GFX is the responsibility of the installer.

## Series Dual GFX System

The following diagram illustrates a typical series GFX installation using two GFX's. The AC wiring from the AC source and to the AC loads must handle 100 amps AC or more. All other AC wiring must handle a capacity of 50 amps AC or more. This type of GFX system can continuously power 5-7.2KW of loads depending on which model is used. Connecting more power than the continuous rating of the GFX may cause breakers to trip or the GFX to shut off its AC output. A HUB and a MATE must be connected to stack these FX's in series. A MATE (through the HUB if one is needed) must be connected to adjust any parameters or to display any meters. The slave GFX must be programmed through the MATE as a 'Classic Slave'. Once the FX has been programmed using the MATE, the MATE can be disconnected. The programming will be saved within the FX's non-volatile memory even if the FX is completely shut down.



**NOTES:** Program the top GFX as Master (1-2PH MASTER) and the lower GFX as a Classic Slave (CLASSIC SLAVE).

The AC NEUTRAL OUTPUT IS NOT BONDED TO THE CHASSIS OR THE GROUND TERMINAL of the GFX. This connection is to be made by the installer either in the AC service entrance or within the AC load distribution panel of the electrical system.

The AC input, AC output and DC terminals are isolated from the metal chassis of the inverter. Proper grounding of these circuits and the chassis of the GFX is the responsibility of the installer.

## ***START-UP & OPERATION***

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Once the GFX system installation is completed, it is time to power the system. Leave the breakers on the AC side in the OFF position until the GFX's are powered and programmed. Power the GFX's by switching the DC disconnect breakers to the ON position. The LED's (Light Emitting Diodes) in the AC compartment of each GFX will begin to light. For each GFX, one "BATTERY" LED will be lit. This "BATTERY" LED should be either the green "FULL" LED or yellow "OK" LED. If the red "LOW" LED is lit, check the battery voltage and the battery-to-GFX cabling for reasons why the GFX thinks the batteries are low. The other set of "STATUS" LED's will begin to light. The red "ERROR" LED may blink a few times, but this is just a symptom of powering the GFX. About 5 seconds to 10 seconds after battery power is applied, the green "INVERTER" LED will be lit with the "AC IN" and "ERROR" LED's not lit.

At this point, the GFX is producing an AC output voltage. If the user were to connect AC loads to the GFX, the GFX would use battery power to power the loads. Before doing this, the programming of the GFX should be performed using the MATE. If applicable, this programming should include stacking (see pages 23, 24 & 50 for more info), adjusting the charging set points using the battery manufacturers specification (see pages 21 & 45 for more info), programming any MX-60 charge controllers to work with the GFX's (described in the "Setup" section on the "Grid-Tie Instructions" page of this manual), setting the time and the date on the MATE (see MATE manual), and programming of the Auxiliary output for the function you wish it to perform (see pages 48 & 49 for more info).

The GFX system is now ready to perform per your specification. Switch the AC breakers ON with the bypass mechanism switched to "Normal". Provided that the AC source is active, the yellow "AC IN" LED in the AC compartment will begin to blink. If the voltage of the utility grid is within 108 vac to 140 vac and the frequency is within 58 Hz to 62 Hz, the GFX will connect to the utility grid. This process takes about 30 seconds and the "AC IN" LED will stop blinking and stay lit.

When the "AC IN" LED is lit, the AC transfer switch within the GFX is activated and the AC source power is applied to the loads. There is a 5 minute time delay (due to UL regulations) before the GFX is allowed to sell power back to the utility grid. This time delay also applies to the GFX's battery charger. After this 5 minute time period, the GFX will perform a complete charge on the batteries. This charging process will "Bulk" (raise) the battery voltage until they reach the "Absorb" voltage. The GFX will maintain this "Absorb" voltage for the "Absorb Time Period" (default of 1 hour). Once the hour is up, the GFX will go into "Silent" mode, essentially not charging or selling. If the battery voltage is above the "Sell RE Volts" described in the "Performance" section on the "Grid-Tie Instructions" page of this manual, the GFX will sell the excess power.

The GFX will sell power back to the utility grid as long as it sees that the utility grid is stable, within certain voltage and frequency ranges, and the battery voltage is above the "Sell RE Volts" value. The GFX will quit selling power (but stay connected) to the utility grid if the grid voltage is below 105.3 vac or above 132.0 vac. It will also quit selling back to the utility grid if the grid frequency is below 59.3 Hz or above 60.5 Hz. The GFX will completely disconnect from the utility grid if the frequency is below 58 Hz or above 62 Hz.

Keeping your battery bank healthy is very important. Although a battery bank may last for over 10 years if properly cared for, it can also be ruined in less than a month if neglected. Since the batteries are the lifeblood of the system and represent a large percentage of the cost to the consumer, keeping them healthy is necessary.

## Battery Charging Set Points

In order to make sure the batteries stay healthy, they must never be discharged too much and should be regularly charged back to near-full capacity. (Full capacity is only achieved by equalizing the batteries. Check with the battery manufacturer to see how often your batteries should be equalized.) It is necessary for the system operator to gather some information from the battery manufacturer. This information should include the following...

- The 'Absorb' Voltage
- The 'Float' Voltage
- The 'Equalize' Voltage
- The Recommended Depth of Discharge (DOD) of the batteries

These 'Absorb', 'Float', and 'Equalize' voltage set points should be programmed into the FX through the MATE (see page 45).

Programming the 'Absorb Time Limit' is tougher and requires some experimenting and calculations. We will be assuming that the utility grid will be the only device charging the batteries. A general rule for knowing when the batteries are fully charged and the absorption cycle can be stopped is the formula  $C/40$ . C is your battery bank capacity which you divide by 40. So, take the total amp-hour capacity of the batteries and divide it by 40. The resulting number is the 'DC current' at which the batteries are fully charged. Write this number down. Next, divide the 'DC Current' by the number of FX's that will be charging the batteries. This is your new 'DC Current'. Next, do a calculation to find the 'AC Current' needed to produce this 'DC Current' by following this formula...

$$\text{AC Current} = \frac{(\text{DC Current}) \times (\text{Absorb Voltage})}{(\text{AC Input Voltage})} \quad (\text{Round this number down to the nearest integer})$$

Next, through the MATE, follow the path MAIN / ADV / (any button) / PASSWORD (141) / FX / CHGR / DOWN / DOWN. The screen should show "Absorb Time Limit". Set this value arbitrarily high, like 4 hours.

To set the correct time in the 'Absorb Time Limit' the user must perform the following experiment on the system. First, the user should discharge the batteries to the recommended depth of discharge and then connect the AC input to all FX's charging the batteries and let the FX's charge the batteries. The user must carefully watch for when the FX's reaches the 'Absorb Setpoint' voltage and record the current time. Next, the user should watch the 'Charger Current' screen found by following the path MAIN / STATUS / FX / METER and pressing DOWN four times. When the value on the screen matches the 'AC Current' value that was calculated, then again record the current time. The appropriate 'Absorb Time Limit' for the system is the difference between these two times (round this value up if necessary). Follow the path MAIN / ADV / (any button) / PASSWORD (141) / FX / CHGR / DOWN / DOWN to get to the 'Absorb Time Limit' screen and use the INC or DEC buttons to adjust the value. If there is another source (solar, wind, hydro, etc.) charging the batteries, then the 'Absorb Time Limit' can be reduced. It is up to the user to decide or the System Design Specialist to set the 'Absorb Time Limit' if this is the case.

## Battery Charging Operation

The FX's battery charger includes five stages. The first stage, BULK, raises the battery voltage to the 'Absorb Setpoint'. The second stage, ABSORB, sustains the battery voltage at the 'Absorb Setpoint' for the 'Absorb Time Limit'. The charger then goes into the third stage, SILENT mode (no charging), until the battery voltage drops to the 'Float Setpoint'. This fourth stage, FLOAT, sustains this battery voltage for the 'Float Time Period'. The charger then goes into 'Silent' mode again until the battery voltage drops to the 'Refloat Setpoint'. This fifth stage, REFLOAT, will start another FLOAT charge. There are additional screens for "Equalize Setpoint" and 'Equalize Time Period'. An equalize charge must be manually started and should be performed once every three months. The time limits that it spends in the various stages are adjustable to provide control and maximize the performance of the battery charger and battery system.

## System Overview

The GFX comes in two styles. The GTFX (**Grid-tie Turbo FX**) is a sealed GFX with an external fan to provide cooling and an extra power boost. The GVFX (**Grid-tie Vented FX**) is a vented GFX that intakes air and directs it over the transformer. These GFX's are capable of selling power back to your local utility while giving you the piece of mind of a back-up power system in case the utility fails.

The components necessary to a system involving a GFX are (in order of power flow) the sun, solar panels (or other renewable energy sources), solar charge controller(s) (OutBack's MX-60 is highly recommended and works in conjuncture with the GFX to optimize performance), a battery bank of the proper voltage and capacity (minimum of 100 amp-hours recommended), the GFX(s), and the utility grid. The utility grid attaches to the GFX at its AC Input terminals.

The GFX comes pre-programmed to operate, even without the MATE. The MATE is necessary to program the GFX (to stack 2 GFX's, for instance) and must be connected for functions that involved the clock or to view voltage and current meters and "Error" messages. The MATE is highly recommended for Grid-Tie systems. **NOTE: The MATE must have a Code revision of 3.30 or greater (this is shown on the third start-up screen of the MATE).**

## SETUP

The GFX has a set of defaults pertaining to its Grid-Tie capabilities. The default setting for selling power back to the utility grid is called "Sell RE Volts" and is set at 25.6 volts (for a 24 volt battery bank) or 51.2 volts (for a 48 volt battery bank). When the GFX is working with an MX-60 charge controller (serial numbers 2000 and above) through the HUB there is some programming necessary for proper operation. Go to the MX-60's "Optimization" menu, then to the "MPPT" mode. Change the parameter from "nonGT" to "FX-GT". This will enable correct communications between the MX-60 and the GFX. Specifically, this will tell the MX-60 to raise its Float voltage to its Absorb voltage, effectively allowing it to sell more power back by trying to keep the battery voltage higher. If there isn't a HUB in the system then raise the MX-60's "Float" voltage to the same value as its "Absorb" voltage. Additionally, the "Absorb" voltage of the GFX must be below the "Absorb" voltage of the MX-60. It is a good idea to lower the "Absorb" voltage of the GFX down to 28.2 volts (for a 24 volt battery bank) or 56.4 (for a 48 volt battery bank) unless the "Absorb" voltage is already set to this value (check this using a MATE by following the path **MAIN / ADV / (any button) / Password (141) / FX / CHGR / DOWN**). If there is another Renewable Energy source (wind, hydro, etc.) in the system, this source must not restrict the battery voltage from reaching the GFX's "Absorb" voltage and sustaining it for the "Absorb Time" (1 hour default).

## CAPABILITIES

Currently, the Grid-tie inverters can only be classically stacked. This limits a stacked system to two GFX's, one per AC load leg. This means that GFX's cannot be parallel stacked. In reality, the number of GFX's is limited to the number of hot load legs in the power system. Future GFX systems will be capable of stacking up to 10 GFX's. **NOTE: The GFX CANNOT do time-of-day selling!**

If the utility grid fails, the GFX seamlessly transfers your loads to the battery bank. When the utility grid reappears, the GFX automatically recharges your battery bank in case of future power outages.

**WARNING: The X-240 transformer cannot be used for stacking with a GFX system at this time.  
The X-240 can be used to step-up the AC output of a single-GFX system, however.**

## PERFORMANCE

Once the complete system has been configured, the GFX can be powered through the DC disconnect breaker. The LED's on the GFX will light, showing the state of the batteries and the status of the GFX. The GFX will automatically sense if the utility grid is present and connect to it after a 30 second time delay. After sensing the utility grid, there is a five minute time delay before the GFX is able to start selling power or charging the batteries. (This five minute period of time is due to UL regulations.) After the 5 minute time delay, the GFX automatically charges the batteries. It performs this charge to ensure the batteries are full if the grid fails. The GFX will not sell back to the grid until it performs this charge. After this charge is performed, the GFX will operate under the following constraints. If the batteries are above the "Sell" voltage, 25.6 volts (for a 24 volt battery bank) or 51.2 volts (for a 48 volt battery bank), then the GFX will go into "Sell" mode. As long as the batteries are above the "Sell" voltage the GFX will sell power back to the utility grid. If the batteries fall to or below the "Sell" voltage then the GFX will go into "Silent" mode. NOTE: The battery voltage should only fall below the "Sell" voltage if DC loads are present, if the GFX's charger is turned off, if the batteries self-discharge over a long period of time or if the utility grid is disconnected. If the battery voltage falls to the re-float setpoint, 24.4 volts (for a 24 volt battery bank) or 48.8 volts (for a 48 volt battery bank), the GFX performs a "Float" charge. This "Float" charge charges the batteries to the "Float" voltage of 27.2 volts (for a 24 volt battery bank) or 54.4 volts (for a 48 volt battery bank). Once it reaches this "Float" voltage, it sustains it for the "Float Time Period" of one hour. After this hour of time the GFX will go into "Silent" mode. If the battery voltage stays above the "Sell" voltage then the GFX will begin to sell again. If the battery voltage falls to the re-float voltage then the GFX will perform another Float charge, and so on. If the utility grid is disconnected from the GFX then this process will start all over again. With the Mate, the above parameters can be adjusted to your specifications. If there are two stacked GFX's in the system, the Master GFX will control the Slave GFX's selling. Once the Master is selling 800 Watts, it calls on the Slave GFX to start selling. When the power that the two GFX's are selling drops below 200 Watts, the Slave GFX stops selling. When both GFX's are selling there might be a discrepancy in the power they are selling. This can attributed to either the utility grid voltages that each GFX sees being slightly different, the utility grid voltage or frequency on one leg has reached a limit, or one of the GFX's sees that the battery voltage is at the "Sell" voltage and the other GFX doesn't. As long as the GFX's are selling above 800 Watts and the discrepancy between their selling power is not great, this is not a problem.

## CERTIFICATIONS

All OutBack Power Systems GFX's are listed under ETL following UL 1741 which also encompasses IEEE 929. The GFX's are listed on the CEC as 91% efficient for the 24V models and 92% efficient for the 48V models.

## Grid-Tie Stacking

OutBack Power Systems allows you to stack two GFX's in series for higher voltage and more power. Series stacking of two GFX's creates two AC Output Legs producing 120VAC on each Leg and 240VAC between the two Legs. A HUB-4 or HUB-10 must be included to stack GFX's. Below is an explanation of each type of system.

**SERIES (CLASSIC) STACKING:** This stacking method pertains to a system that has only two GFX's and two 120VAC Output Legs that will produce 240VAC between them. In this system the Master GFX and the Slave GFX operate independently from each other. In other words, each GFX will power its own 120VAC Output Leg but if any 240VAC loads need to be powered both GFX's will be used. The AC Input source must be 240VAC for both Legs to be powered.

## Stacking Procedure

This section will help inform you on how to set up stacking correctly and what the screens in the stacking menu mean. Make sure that the GFX's connect to ports 1 & 2 of the HUB. First, turn off all AC breakers (the Bypass breaker can be left on). Next, turn on all GFX's using their DC breakers and verify that the MATE recognizes all GFX's. You can verify this by watching the MATE go through its boot-up sequence. The MATE's boot-up sequence will show the following screens: (1) "G'day Mate!" (2) "OutBack Power Systems" (3) Version (4) "HUB Found" (5) Hub ports and the OutBack devices connected to them. Screen (5) will allow you to verify that the MATE sees all of the GFX's. If it doesn't see all of the GFX's or if you aren't sure, you can do one of two things. Either disconnect and reconnect the MATE to the HUB or do a re-poll with the MATE. A re-poll on the MATE can be done by following the path **MAIN / SETUP / MATE / PG2 / COMM / REPOLL** (see the MATE manual for proper operation of the MATE). Once you are sure that the MATE recognizes all the GFX's connected to the HUB, you must access the "STACK" menu. This can be found on the MATE by following the path **MAIN / ADV / any button (this screen serves as a warning only) / PASSWORD (press the INC and DEC buttons until the number is 141 and then press ENTER) / FX / PG2 / PG3 / STACK**. You are now in the menu used for stacking GFX's. Before continuing we will inform you on what each screen pertains to, the possible selections of that screen and how to choose the next GFX for proper programming.

### STACK PHASE

The "Stack Phase" screen establishes which GFX is the master and which GFX's follows the master's commands. Each GFX has a default of "1-2ph Master" (one or two phase Master). The GFX on port 1 of the HUB is always a Master (and usually the only Master), otherwise the MATE will give a communication error. For a single phase or split (two) phase system, the GFX in port 1 of the HUB should remain a "1-2ph Master". To select the next GFX connected to the HUB, press the PORT button on the MATE. In the upper right-hand corner of the MATE's screen is the "port" indicator. It will display a "P" followed by a number indicating the port it is controlling (for example "P01" indicates port 1, the Master FX's port). Repeatedly pressing PORT on the MATE will cycle through the ports on the HUB that have GFX's connected to them. Stop when you have reached a port that has an GFX on it that needs to be a Slave. By pressing the INC (increase) and DEC (decrease) buttons on the MATE, you can select the proper type of Slave that is appropriate for your system. Below are the different selections in the STACK PHASE menu with a description of what they do.

**1-2 PH MASTER:** 1-2 PH MASTER is used for stand-alone (one) GFX systems OR as the MASTER of a single phase or split phase system. Set the stack phase of the GFX you want as the master to '1-2 PH Master' (if it isn't already) and make sure it is in port 1 of the HUB. It is acceptable to have every GFX connected to the HUB be a "1-2ph Master". If this is the case, each GFX must be connected to a separate AC Output Leg (both Hot and Neutral). The master GFX is always considered to be the L1 phase.

**CLASSIC SLAVE:** If you have a system with two GFX's that you wish to produce 240VAC with but without an X-240 autotransformer, set the stack phase of the GFX you want as the slave to "Classic Slave" and make sure it is in port 2 of the hub. "Classic" stacking is meant for 120/240 vac systems where each FX handles their own 120 volt phase. The combination of the two GFX's creates 240 volts to run 240 loads. If this GFX is set to 'Classic Slave' then its output is 180 degrees out of phase from the master and is considered to be the L2 phase. Classic stacking can only stack two GFX's and there is no load sharing which is possible with 'OutBack' stacking.

**OB SLAVE L1 (DO NOT USE FOR GRID-TIE SYSTEMS): Single Phase:** If you have a system with two to ten FX's and you wish to produce 120VAC on the same AC Output Leg, set the stack phase of the FX's you want as the slaves to "OB Slave L1" and make sure that they are in the lowest numbered ports of the HUB. "OB Slave L1" is used for FX's that run in parallel with the master. These FX's are considered the L1 phase. **Split Phase:** Alternately, if you have a system with two to ten FX's and an X-240 autotransformer and you wish to produce 120VAC on both AC Output Legs and also 240VAC between the two AC Output Legs then set the stack phase of the FX's you want as **parallel** slaves (Leg 1) to "OB Slave L1". Make sure the slave FX's are in the lowest numbered ports of the HUB. "OB Slave L1" is used for FX's that run in parallel with the master. OutBack's X-240 autotransformer must be included in the system to use this stacking option. This FX is considered the L1 phase.

**OB SLAVE L2 (DO NOT USE FOR GRID-TIE SYSTEMS):** If you have a system with two to ten FX's and an X-240 autotransformer and you wish to produce 120VAC on both AC Output Legs and also 240VAC between the two AC Output Legs then set the stack phase of the FX's you want as **series** slaves (Leg 2) to "OB Slave L2". Make sure the slave FX's are in the lowest numbered ports of the HUB. "OB Slave L2" is used for FX's that run in series with the master. OutBack's X-240 autotransformer must be included in the system to use this stacking option. This FX is considered L2 phase.

## Stacking Procedure (Continued)

**3PH MASTER (DO NOT USE FOR GRID-TIE SYSTEMS):** If you have a system with three (and only three) FX's and you wish to produce 120VAC on three AC Output Legs as well as 208VAC between each AC Output Leg, set the stack phase of the FX you want as the master to "3PH Master" and make sure it is in port 1 of the HUB. The 3-phase stacking is similar to "Classic" stacking in the sense that each FX acts independently and cannot help out other phases. The HUB also has a jumper on it that needs to be changed for 3-phase stacking (refer to the HUB manual). This FX is considered phase A.

**3PH SLAVE (DO NOT USE FOR GRID-TIE SYSTEMS):** If you have a system with three (and only three) FX's and you wish to produce 120VAC on three AC Output Legs as well as 208VAC between each AC Output Leg, set the stack phase of the 2 FX's you want as the slaves to "3PH Slave" and make sure they are in ports 2 and 3 of the HUB. There are no selections to differentiate between phases B and C. When you set the jumper in the HUB for 3-phase, the HUB tells each slave which phase they are. "3PH slave" on HUB port 2 is considered phase B. "3PH slave" on HUB port 3 is considered phase C.

The next two screens in the "Stack" menu on the MATE are the "POWER SAVE LEVEL **MASTER** ADJUST ONLY" and "POWER SAVE LEVEL **SLAVE** ADJUST ONLY" screen. Since you have a Grid-Tied system and must use "Classic" stacking, these two screens do not pertain to your system. As an addition to the explanations above, we have offered an example procedure for stacking your system outlined below.

## System Example

### DUAL-STACKED SYSTEM USING "CLASSIC" STACKING

This type of system will include only two GFX's and must be set up as described here. Turn off all AC Output and AC Input breakers before powering up GFX's. In a dual stack, I am assuming that the top GFX is plugged into port 1 of the HUB and the 2<sup>nd</sup> GFX down is plugged into port 2 (This is not a rule, just for simplicity). Using the MATE, go to the stacking menu (explained earlier in the "Stacking Instructions" section). You are now at the 1<sup>st</sup> stacking menu called "Stack Phase". In the upper right hand corner of the mate screen will always be the HUB port number of the GFX you're working with at the time. Let's start out with the GFX that's on port 1. If something other than P01 appears in the upper right hand corner then press the PORT button until P01 appears. Set the "Stack Phase" of the port 1 GFX to "1-2 PH Master". Press the PORT button and verify that the label in the upper right hand corner displays P02. We are still in the "Stack Phase" menu but we are now talking to the GFX on port 2. Push the INC button once to set the "Stack Phase" to "Classic Slave". Now you've set 1 GFX (P02) to be in series with the master GFX (P01). The next two screens in the STACK menu do not apply to a Classically stacked system, so you need not worry about them. Have fun with your system!

## MATE - SYSTEM CONTROLLER AND DISPLAY

The OutBack MATE system controller and display allows you to program, control, and monitor the operation of one or more GFX's as well as any other OutBack products (such as the MX60 MPPT charge controller).

**In order to access the Grid-Tie settings in the MATE, a MATE with a Code Revision of 3.30 or higher must be used.** The Code Revision can be found on the MATE's third start-up screen. To view the 'Code' just unplug the MATE and plug it back in.

When connecting a MATE to more than one product is required, a HUB-4 or HUB-10 communication manager must be included in the system. The MATE can be located up to 1000 feet (300 meters) from the GFX system using standard 8 conductor CAT5 type communication cabling. This wiring is considered to be a low voltage / limited energy circuit.

The MATE can be used to program the GFX and then removed. All of the settings in the inverter are stored in non-volatile memory inside of the inverter itself - the battery can be removed from the GFX and the settings will not be lost.

The MATE also allows for monitoring and control of the GFX system's operation. Some of the more advanced system operating modes (such as the *HIGH BATTERY TRANSFER (HBX)* function or the *ADVANCED GENERATOR START (AGS)* function) requires that a MATE be connected to the GFX system all of the time.

The operating software used in the MATE is upgradeable to allow for the addition of new features to existing systems. It can be easily removed and exchanged by the system user – there is a single CAT5 RJ45 modular connection.

The MATE also includes an RS-232 PC serial communication port to allow monitoring and remote modem access of the system via phone or internet. This PC software is currently being developed by third party companies and will soon be offered as an option through your OutBack Power Systems dealer. Tracking software is available at [www.RightHandEng.com/OutBack](http://www.RightHandEng.com/OutBack).

Outback Power Systems currently offers five different versions of the MATE. In Grid-Tie systems, the "MATE" or the "MATE 2" is necessary to program Grid-Tie settings and view Grid-Tie meters. MATEs with the suffix 'M' should not be used with the GFX.

"MATE": Basic MATE with an oval encasing shown below. The casing is white in color. This option includes an RS-232 port.

"MATE B": Basic MATE with an oval encasing. The casing is black in color. This option includes an RS-232 port.

"MATE 2": Black flush mount version of the MATE shown below. This option includes an RS-232 port.

"MATE 2M": Black flush mount version with a simplified menu structure designed specifically for the Mobile market. No RS-232 access.

"MATE 2M-232": Same as MATE2M but with the RS-232 port accessible.

### OutBack MATE System Controllers



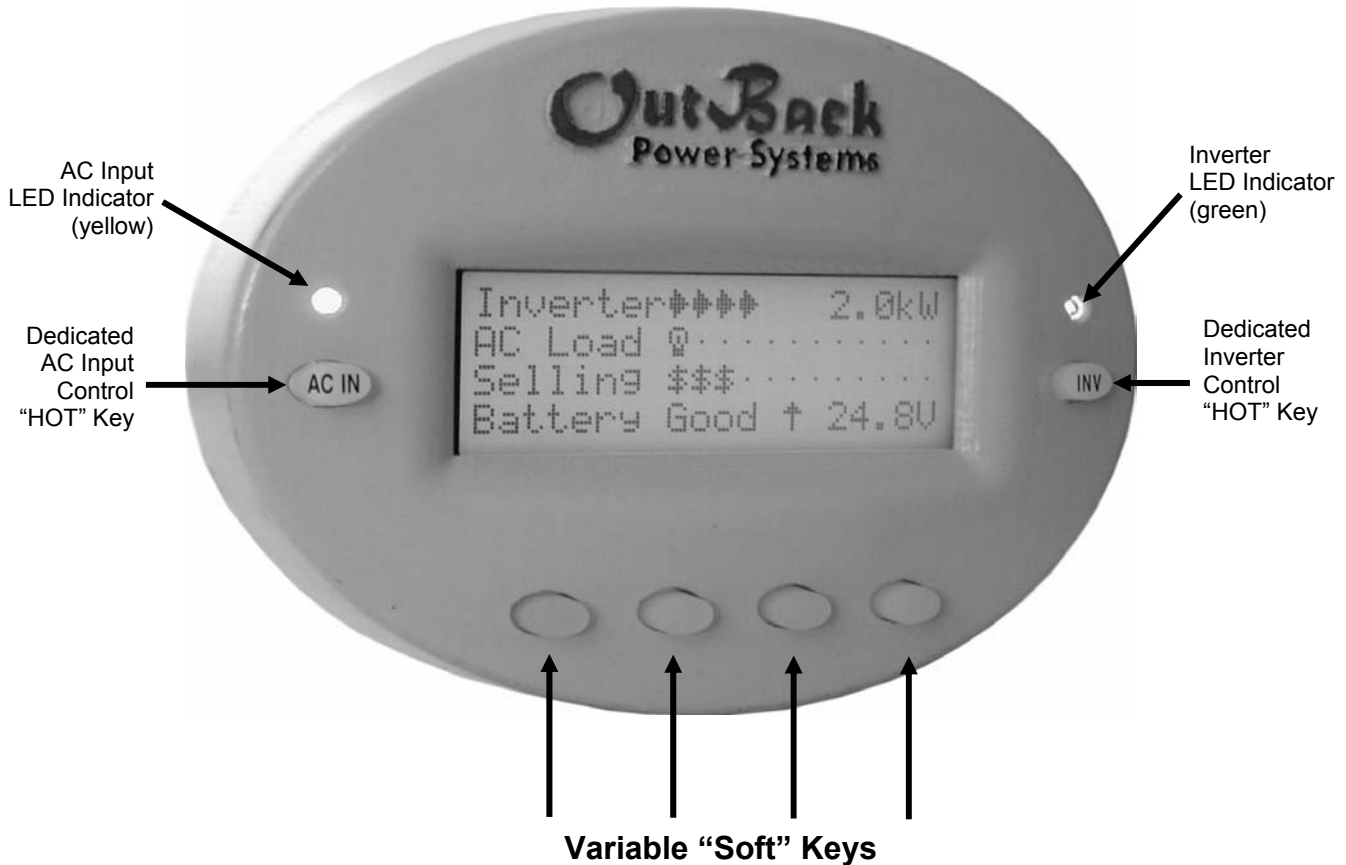
"MATE" "MATE B"



"MATE 2" "MATE 2M" "MATE 2M-232"

# OutBack MATE

## System Controller and Display



*Each one of the soft keys corresponds to a word on the bottom line of the LCD display*

The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade. For your particular menu system, consult your MATE manual.

The following pages show the portion of the menu structure that relates to the GFX. Most of the menu will be consistent no matter what type of GFX you have purchased. The MATE displays that follow are from the most current MATE being sold by OutBack Power Systems.

The *DC voltage* values (the letters "vdc" usually follow these values) shown in the following MATE displays will be the default values for a 24V version of the GFX. For the 48V version, multiply these values by 2. This multiplication process includes the incremental values (when changing a voltage setting you will use the 'increment' (INC) or decrement (DEC) buttons). For example, for a 24V GFX the increment value is 0.2V. A 48V GFX has an incremental value of 0.4V.

All values displayed in the "Setup" and "Advanced" menus are the default values unless otherwise stated.

For "M" versions of the MATE (example: MATE 2"M"), only the "Status" and "Advanced" menus are the same as non-"M" versions of the MATE. If you are using an "M" version of the MATE, please consult the MATE manual for proper navigation and screen information.

This section of the manual will cover how to use the buttons on the MATE to navigate the menus.

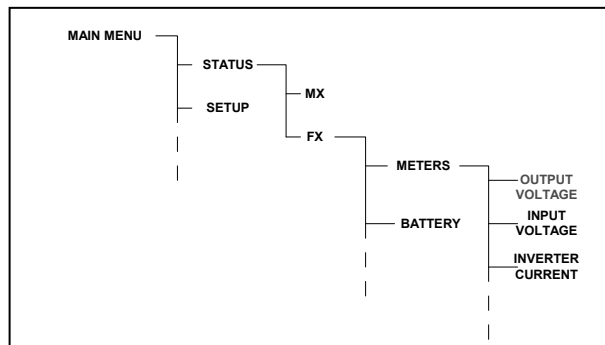
**NOTE:** The menu system displayed on the MATE will vary depending on the software version that the MATE was programmed with at the time of manufacturing or during its last software upgrade.

## MENU STRUCTURE

The OutBack MATE uses a branching menu structure to display various OutBack products operation modes and status. The menus are divided by product type and are categorized by type of setting or by information being displayed.

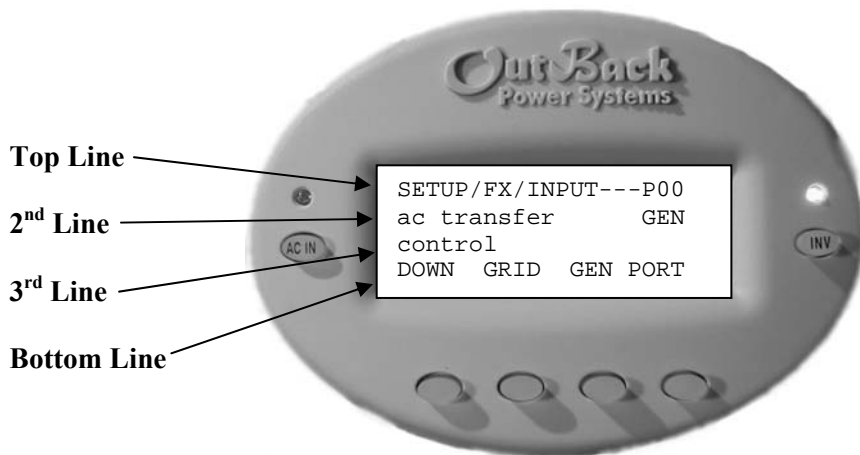
An example of the menu structure is shown to the right. All the screens that show AC meters are grouped together in one menu tree allowing the user to find the required meter with a minimum of button presses.

The top line of the MATE display will show the 'path' to the current menu; in this example it is STATUS/FX/METERS.



STATUS/FX/METERS-----  
 output 120 vac  
 voltage  
 DOWN UP TOP PORT

## MATE BUTTONS



The MATE uses a six button user interface to navigate the menus and to change set points of various OutBack products.

Two buttons are dedicated to the FX and are labeled **AC IN** and **INV**. These buttons are special in that they can be pressed at any time anywhere in the MATE menu structure, and they take you to the same screens. For this reason they are referred to as 'hot' keys. Many common functions that need to be accessed often are found under the **AC IN** and **INV** button.

The four lower buttons under the LCD are called 'soft' keys and are used for navigating around the menus and changing values. Each 'soft' key has various functions dependent on the label directly above it on the lower line of the LCD.

The top line on the MATE usually displays the path or location of where you are in the menu system. The 2<sup>nd</sup> and 3<sup>rd</sup> lines of the MATE usually give you a description of what meter is being displayed or what parameter is currently set in the MATE. The bottom line on the MATE is almost exclusively used for labels to the four soft keys below. Each button below the bottom line of the MATE's display corresponds to the word directly above it.

This manual will denote soft key button presses as **<BUTTON>**, where **BUTTON** corresponds with the label displayed on the screen directly above the soft key.

**NOTE: Pressing the left two buttons simultaneously from anywhere in the menu will return you to the MAIN menu screen.**

# MATE – SYSTEM CONTROLLER AND DISPLAY

---

## ‘SOFT’ KEYS

The four buttons under the LCD are referred to as the ‘soft’ keys. Their operation is dependent on what their label says. The label is the word on the bottom line of the LCD directly above the button.

Soft keys used to navigate the menus are commonly labeled <UP>, <DOWN>, <NEXT>, <BACK>, or <TOP>.

Soft keys that change settings are labeled either with the change they will make, such as : <OFF>, <AUTO>, and <ON>, or if there are more than a couple values that the setting can be changed to, <INC> and <DEC> are used to mean *increase* and *decrease*, respectively.

```
SETUP/FX/INPUT---P00
ac transfer      GRID
control
DOWN  GRID GEN  PORT
```

In this example, pressing <DOWN> will take you to the next set point screen in the SETUP/FX/INPUT menu.

---

```
SETUP/FX/INPUT---P00
Input setup
completed
TOP  SETUP  MAIN
```

In this example, pressing <TOP> will take you to the first screen in the SETUP/FX/INPUT menu. <SETUP> will return you to the SETUP/FX screen, and <MAIN> will take you back to the Main screen.

---

```
SETUP/FX/INPUT---P00
ac transfer      GRID
control
DOWN  GRID GEN  PORT
```

In this example, pressing <GRID> will change the FX AC transfer control to **GRID** mode. Conversely, pressing <GEN> will change the FX AC transfer control to **GEN** mode.

---

```
SETUP/FX/INPUT---P00
ac1/grid      60.0 aac
limit
DOWN  INC  DEC  PORT
```

In this example, pressing <INC> or <DEC> will change the numerical value of the **ac1/grid limit** setting.

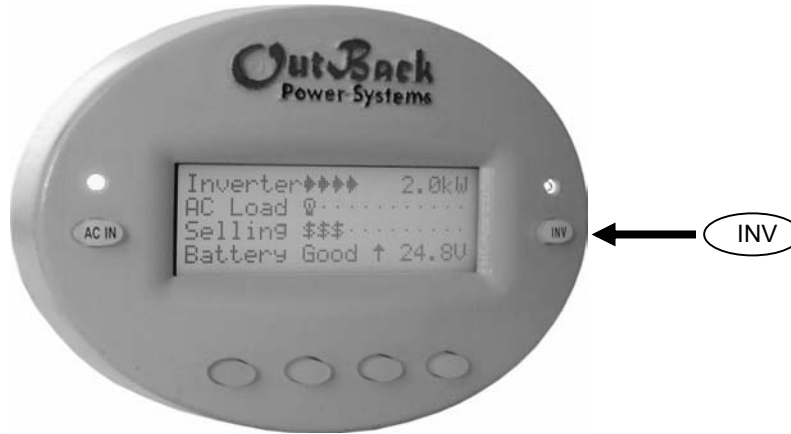
---

```
ADV/FX/AUX-----P00
aux output     CoolFan
function
DOWN  INC  DEC  PORT
```

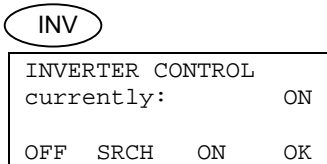
In this example, there are multiple operating modes for the aux output function. Pressing <INC> or <DEC> will cycle through the available modes.

---

## Inverter Control



The OutBack MATE includes an **INV** “hot” key to allow direct control of the inverter from anywhere in the menu system. The INV key is located on the right side of the MATE LCD display. Pressing the INV key takes you to the INVERTER CONTROL menu shown below. A green LED indicator is located above the INV key which flashes when the inverter is either in the search or power save modes and is on continuously when full AC output voltage is available from the inverter. When the inverter is turned off the green LED will not be illuminated.



Pressing the **INV** key once brings up the INVERTER CONTROL screen. To turn the inverter ON, press the key located below the word ON. Selecting SRCH will cause the inverter to begin operating in the search mode as long as the AC load connected is smaller than allowed by the programming of the search function. Selecting OFF turns off the inverters AC output signal.

Select OK to return to the point in the menu system from where you entered the INVERTER CONTROL screen.

## AC Input Control



The OutBack MATE includes a **AC IN** “hot” key to allow direct control of the AC input from anywhere in the menu system. The AC IN key is located on the left side of the MATE’s LCD display. Above the AC IN key is a yellow LED indicator which flashes when an AC source is available but not connected, and is on continuously when the AC source is connected. If no AC source is available the yellow LED indicator will remain off. The screens shown on this page apply to the “MATE”, the “MATE B” and the “MATE 2” only.

**AC IN**

```

AC INPUT CONTROL
currently:      USE
DROP  USE      OK
    
```

Pressing the **AC IN** key once brings up the AC INPUT CONTROL screen. USE enables the inverter to connect to the AC source when it is available. DROP disconnects the AC source but will allow it to be reconnected if the battery gets too low or the inverter is overloaded.

**AC IN** **AC IN**

```

GEN START CONTROL
currently:      MAN-OFF
OFF  AUTO  ON  OK
    
```

Pressing the **AC IN** key a second time brings up the GEN START CONTROL screen. Due to the fact that the GFX does not perform well with generators, this screen will be of no use to the user.

**AC IN** **AC IN** **AC IN**

```

CHARGER CONTROL
currently:      AUTO
OFF  AUTO      OK
    
```

Pressing the **AC IN** key a third time brings up the CHARGER CONTROL screen. This allows operation of the battery charger to be preset for when an AC source is available. In AUTO mode the charger will start charging when an AC source connects to the GFX or when the GFX decides the batteries need charging. In OFF mode the charger stays off but the AC source is still passed through to the loads.

**AC IN** **AC IN** **AC IN** **AC IN**

```

CHARGER MODE CONTROL
global charger mode
BULK  EQ      OK
    
```

Pressing the **AC IN** key a fourth time brings up the **CHARGER MODE CONTROL** screen. This screen allows the MATE to issue system wide (global) charger commands. Both OutBack MX and FX products will respond to global charger commands if they are connected through the HUB.

```

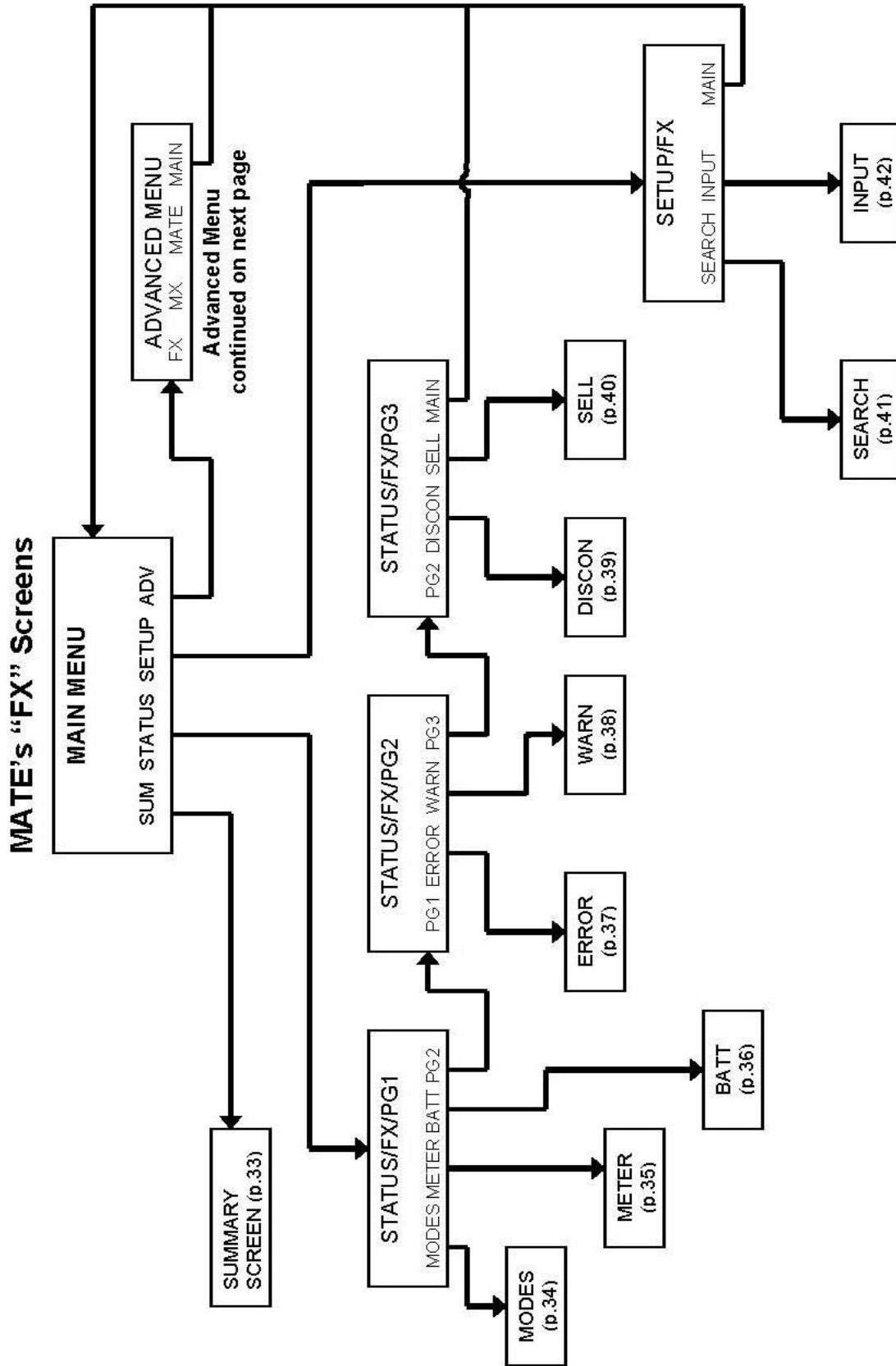
BULK CONTROL
START  STOP      OK
    
```

Pressing **<BULK>** brings up the **BULK CONTROL** screen, it will allow the user to start and/or stop a bulk charge cycle manually by pressing **<START>** or **<STOP>** respectively.

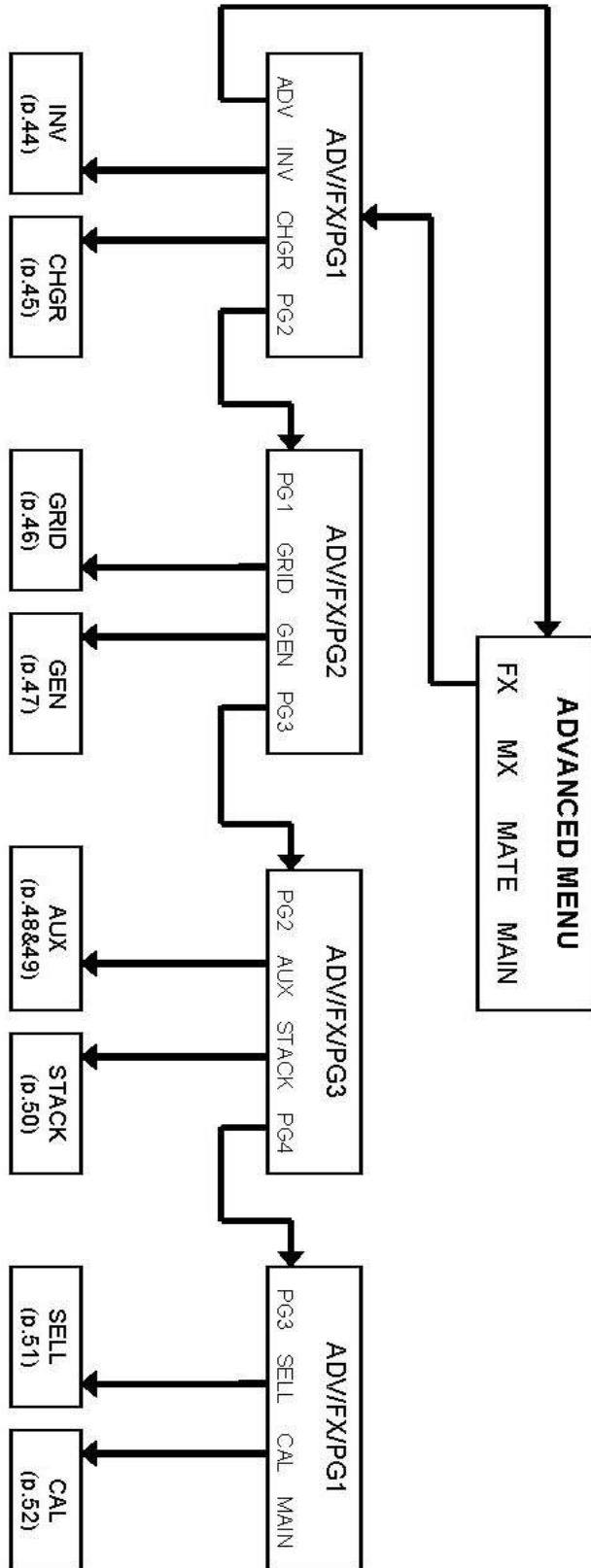
Pressing **<EQ>** brings up the **EQUALIZE CONTROL** screen.

When **<START>** has been selected, two informational screens are displayed. The user then must answer **<YES>** before an equalize charging cycle is allowed to begin.

Once the equalizing process has started, you can stop it at anytime by selecting **<STOP>** from this same control screen.



MATE's "FX Advanced Menu" Screens



# Summary Screen

The OutBack MATE includes a **SUMMARY** screen to allow easy understanding of the GFX operation. The display uses both words and symbols to show what currently is happening in the system, along with a limited amount of numbers. This makes it easier for the system user to understand where the power is flowing within the system. The first line of the summary screen displays "DC←→AC" and is measured in kilowatts (kW). This is to indicate the approximate AC power that is being both produced and consumed by all the GFX's connected to the MATE (multiple GFX's can be connected to one MATE through the HUB). Basically, it shows how much work the GFX's are doing and relates to energy being transferred between the GFX's and the batteries. The second line of the summary screen displays "AC Load" and has a light bulb symbol that appears for every 500 watts of power per GFX that is being delivered to the AC loads (so 1 one light bulb equals 1kW when two inverters are used with a single MATE). The third line displays four different things depending of the status of the AC input. It displays "No ACIN" when the GFX doesn't sense an AC source present. It displays "AC Drop" when an AC source is present but not connected. It displays "Buying" when an AC source is connected and the GFX is using the source to charge or pass-through to the loads. Finally, it displays "Selling" when the GFX is pushing power back into the AC source (Grid-Tie FX's only). In the third line, the symbol used to denote 500 watts or power per inverter is a dollar sign. The fourth line of the summary screen provides information about the battery (limited to battery voltage at this time).

To access the summary screen, press the button under the label SUM from the MAIN screen. Included below are some examples of different summary screens with an explanation of the information represented.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
↓
DC←→AC . . . . . 0.0kW
AC Load . . . . .
No ACIN . . . . .
Battery          25.6V
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

To access the summary screen, select SUM from the MAIN screen. A typical summary screen is shown here for a GFX when the inverter is off and no AC source is connected. The battery voltage is provided in the lower right corner of the display.

## EXAMPLES

```

DC←→AC >>> . 1.4kW
AC Load *** . . . .
No ACIN . . . . .
Battery          24.2V
    
```

**INVERTING:** The GFX is inverting and producing AC output voltage which is powering 1.4kW of AC loads. No AC source is connected to the inverter.

```

DC←→AC . . . . . 0.0kW
AC Load ** . . . . .
Buying $$ . . . . .
Battery          25.2V
    
```

**PASS-THROUGH:** An AC source has been connected and the AC loads are drawing power from the AC source that is passing through the GFX. The top line shows 0.0 kW indicating that the charger is in SILENT mode and is not charging the batteries. Approximately 1.0 kW loads are being powered from the AC source (assuming the system consists of one FX).

```

DC←→AC >>> . 1.7kW
AC Load * . . . . .
Buying $$$$ . . . .
Battery          26.8V
    
```

**BUYING (CHARGING & PASS-THROUGH):** The GFX is buying (four \$ ≈ 2.0kW) more power than it is delivering to the loads (one \* ≈ 0.5kW). This is an indication that the GFX is using the excess power to charge the batteries. The charger is charging at a rate of 1.7 kW of AC power going into the battery. The AC loads are low and are being powered from the AC source.

```

DC←→AC >>>> 2.5kW
AC Load ***** . .
AC Drop . . . . .
Battery          24.6V
    
```

**AC DROP:** The inverter is on and powering 2.5 kW of AC load from the batteries. The AC source is available but DROP was selected in the AC INPUT CONTROL. This will also be displayed when an AC source is available but not in use, such as during the initial time delay period once an AC source has been connected.

```

DC←→AC >>>> 2.2kW
AC Load * . . . . .
Selling $$$$ . . . .
Battery          26.8V
    
```

**SELLING:** The GFX is selling power back to the utility grid at about 1.5kW. It is also supplying about 0.5kW of AC loads. The GFX is taking about 2.2kW of power from the batteries. This excess battery power is coming from a different source (solar, wind, hydro, etc). This screen will only appear on "Grid-Tie" FX's.

# Status Screens

The **STATUS** screens allow the system user to check the operation of the GFX system. Both AC voltage and AC current meters are provided to enable monitoring, adjustment and troubleshooting of the system operation.

## MODES MENU

The **MODES** section lets the user view and change the various modes for a specific FX by pressing the PORT to access a specific FX. The modes include inverter, ac in, charger, auxiliary, and equalize. The operation of these modes can be changed by selecting the **CHANGE MODE** option on the screen. This is helpful if the user wishes to quickly enable or disable a particular function of a specific FX if necessary.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

STATUS-----
choose product:
FX  MX
    
```

Selecting **<STATUS>** allows selection of the product type:

```

<FX>      FX inverter/charger system
MX        MX60 PV MPPT charge controller
    
```

```

STATUS/FX/PAGE1----
choose category:
MODES METER BATT PG2
    
```

**<MODES>** Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the FX  
**BATT** Provides the battery voltage and charger set points and timers  
**PG2** Displays additional sections – ERRORS, WARNINGS and PG3

```

STATUS/FX/MODE--P00
inv control:      ON
                CHANGE
DOWN STAT  MODE  PORT
    
```

The **INV CONTROL** screen lets you see the status of the inverter function of the GFX. Pressing the STAT button returns you to the first page of the status menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the inverter OFF, turning the inverter ON, or putting the inverter into SEARCH. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
ac in control:   USE
                CHANGE
DOWN UP  MODE  PORT
    
```

The **AC IN CONTROL** screen lets you see if the GFX will accept an AC source at its input terminals. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of rejecting an AC source by pressing DROP or accepting an AC source by pressing USE. Pressing PORT will access the next GFX if a HUB is present.

```

STATUS/FX/MODE--P00
chr control:     AUTO
                CHANGE
DOWN UP  MODE  PORT
    
```

The **CHR CONTROL** screen lets you see what mode the charger is in. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the charger OFF or putting the charger into AUTO where it will follow the 5-stage charging algorithm. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
aux control:    AUTO
                CHANGE
DOWN UP  MODE  PORT
    
```

The **AUX CONTROL** screen lets you see the status of the auxiliary output. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of turning the Aux OFF, turning the Aux ON, or putting the Aux into AUTO mode. In AUTO mode it will follow the "Aux Output Function" and its parameters that can be set in the Advanced (ADV) menu. Pressing PORT will access the next FX if a HUB is present.

```

STATUS/FX/MODE--P00
eq enabled:     No
                CHANGE
                UP  MODE  PORT
    
```

The **EQ ENABLED** screen lets you see if the FX is in an equalize charging cycle and can also start or stop a cycle. Pressing the UP button returns you to the previous page of the MODES menu. Pressing the CHANGE MODE button opens a screen that gives the options of START or STOP to initiate or cancel an equalize charge. Pressing PORT will access the next FX if a HUB is present.

METER MENU

The **METER** section lets the user view the AC voltage and AC current meters as well as the software revision of the GFX's microprocessor. The user can view the input and output AC voltages, as well as the input, inverter, charger and sell currents. This can be used to verify that the GFX is sensing voltages and currents and also helps discern what the GFX is doing (like charging or inverting). The software revision is helpful when troubleshooting. Some functions of certain software revisions are incompatible with older MATEs.

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

MODES Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**<METER>** Provides the AC voltages and currents of the GFX  
 BATT Provides the battery voltage and charger set points and timers  
 PG2 Displays additional sections – ERRORS, WARNINGS and PG3

```
Invert P00
inv 0.0kw zer 0.0kw
chg 0.0kw buy 0.0kw
DOWN STATUS PORT
```

This screen shows the mode and where power is flowing within the GFX. The modes include **Invert**, **Charge**, **Pass Through**, **Support**, and **Sell**. When the GFX is in the Invert, Support, or Sell mode, the **inv 0.0kw** meter will change. When the GFX is in the Charge mode, the **chg 0.0kw** meter will change. The **zer 0.0kw** will change to **sel 0.0kw** and show a change when the GFX is in the Sell mode. The **buy 0.0kw** meter will change when the GFX is either in Pass Through or Charge mode.

```
STATUS/FX/METER--P00
output 120 vac
voltage
DOWN UP TOP PORT
```

The **OUTPUT VOLTAGE** meter indicates the AC voltage on the AC output of the GFX which is available to power the AC loads. When the inverter is in the SEARCH mode, the AC output voltage may not be the nominal output of 120 VAC. This is a normal condition – Increasing the AC load or selecting ON from the INVERTER CONTROL menu screen will return the AC output voltage to normal.

```
STATUS/FX/METER--P00
input 120 vac
voltage
DOWN UP TOP PORT
```

The **INPUT VOLTAGE** meter indicates the AC voltage on the AC input of the GFX system from an AC source, such as the utility grid. When the GFX is connected to an AC source, the input AC voltage will equal the output AC voltage. If the GFX is not connected to the AC source the two voltages can differ significantly.

```
STATUS/FX/METER--P00
inverter 0.0 aac
current
DOWN UP TOP PORT
```

The **INVERTER CURRENT** meter indicates the amount of current being supplied to the AC loads connected to the GFX's AC output terminals when the inverter is ON and no AC source is connected. Each "aac" (amp AC) equals approximately 120 watts of load. When the GFX system is connected to an AC source, this meter will read 0.

```
STATUS/FX/METER--P00
charger 0.0 aac
current
DOWN UP TOP PORT
```

The **CHARGER CURRENT** meter indicates the amount of AC current being used by the battery charger of the GFX. Each "aac" (amp AC) equals approximately 120 watts of charge. This meter will read zero when the GFX is not connected to an AC source.

```
STATUS/FX/METER--P00
input 0.0 aac
current
DOWN UP TOP PORT
```

The **INPUT CURRENT** meter indicates the total amount of current flowing into the AC input of the GFX. Some of this power may be used by the battery charger with the remainder flowing through the AC transfer switch to the AC loads (Passing Thru). To estimate the amount of current being used by the AC loads subtract the CHARGER INPUT current value from the INPUT CURRENT value.

```
STATUS/FX/METER--P00
sell 0.0 aac
current
DOWN UP TOP PORT
```

The **SELL CURRENT** meter indicates the amount of AC current that the GFX is pushing back into the utility grid. This screen is only operational on "Grid-Tie" FX models. Multiply this number by the INPUT VOLTAGE to get the power being sold back to the utility grid.

```
STATUS/FX/METER--P00
FX firmware 75
revision
DOWN UP TOP PORT
```

This menu displays the **FX FIRMWARE REVISION** number for the software loaded into the GFX's microcomputer. This may be required when troubleshooting or expanding your system. This is not the same as the software version in the MATE.

```
STATUS/FX/METER-----
end of meter menu

UP TOP STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/METER menu section. Selecting STATUS returns to the STATUS screen.

## BATTERY MENU

The **BATTERY** menu section allows the user to check the status of the battery voltage and the battery charging process. Both the actual battery voltage and the temperature compensated battery voltage are provided. The battery charging process set points are displayed along with the associated timer for the charging process. No adjustments are allowed from this section. To change the battery charger's operation, go the **ADVANCED** programming section. The values displayed are not defaults.

```
STATUS/FX/PAGE1-----
choose category:

MODES METER BATT PG2
```

**MODES** Shows status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the FX  
**<BATT>** Provides the battery voltage and charger set points and timers  
**PG2** Displays additional sections – ERRORS, WARNINGS and PG3

```
STATUS/FX/BATT---P00
battery 24.4 vdc
actual
DOWN STATUS PORT
```

Selecting **BATT** displays the **ACTUAL BATTERY** voltage measured by the GFX. If the RTS battery temperature sensor is not connected, then the actual battery voltage will equal the temperature compensated battery voltage. Selecting **<DOWN>** advances the display to the next item in the battery menu. Selecting **STATUS** returns you to the Status screen. Selecting **PORT** allows viewing of the next FX connected to the MATE.

```
STATUS/FX/BATT---P00
battery 24.4 vdc
temp compensated
DOWN UP TOP PORT
```

This menu displays the **TEMPERATURE COMPENSATED BATTERY VOLTAGE** which is used by the battery charger for regulation. The Remote Temperature Sensor (RTS) must be connected to the Master FX for temperature compensation. If the RTS is connected then this value will be higher than the **ACTUAL BATTERY VOLTAGE** when the battery is hot and will be lower than the actual battery voltage when the battery is cold.

```
STATUS/FX/BATT---P00
absorb 28.8 vdc
set point
DOWN UP TOP PORT
```

This is the battery charger set point for the absorb stage of the battery charging process. The voltage will be held at the **ABSORB VOLTAGE SET POINT** level for the **ABSORB TIME LIMIT** period that is set in the **ADVANCED** menu section. This value can only be changed in the **ADVANCED** menu.

```
STATUS/FX/BATT---P00
absorb 01.0 hrs
time remaining
DOWN UP TOP PORT
```

The **ABSORB TIME REMAINING** is the period of time remaining for the absorb cycle. When the GFX is performing an absorb charge this time value will start counting down once the absorb voltage has been reached. When this value reaches 0.0 hrs, the GFX will go into **SILENT** (charger turns off) mode until the battery voltage drops to the **FLOAT** voltage.

```
STATUS/FX/BATT---P00
float 27.2 vdc
set point
DOWN UP TOP PORT
```

This is the battery charger set point for the float stage of the battery charging process. The voltage will be held at the **FLOAT VOLTAGE SET POINT** level for the float time period that is programmed in the **ADVANCED** menu section. After leaving the absorb charging stage the charger first turns off and waits for the battery voltage to drop to the refloat voltage set point before the charger begins to float the battery.

```
STATUS/FX/BATT---P00
float 00.0 hrs
time remaining
DOWN UP TOP PORT
```

The **FLOAT TIME REMAINING** is the amount of time remaining for the float stage of the battery charging process. The battery charger does not continuously float the batteries. It instead only floats for the **FLOAT TIME LIMIT** period set in the **ADVANCED** menu section. Once the time period has been met, the charger turns off (called **SILENT** on the **SUMMARY** screen). When the GFX is in the "Float" charging stage, the "float time remaining" value appears and starts to count down.

```
STATUS/FX/BATT---P00
refloat 24.4 vdc
set point
DOWN UP TOP PORT
```

The **REFLOAT SET POINT** is the battery voltage at which the battery charger will restart the float charging process and hold it there for the **FLOAT TIME PERIOD**. This setting is compared with the **BATTERY ACTUAL** voltage.

```
STATUS/FX/BATT---P00
equalize 29.2 vdc
set point
DOWN UP TOP PORT
```

This is the battery charger set point for the equalize stage of the battery charging process. The voltage will be held at the **EQUALIZE VOLTAGE SET POINT** level for the equalize time period that is programmed in the **ADVANCED** menu section. The equalization process must be manually triggered while an AC source is connected to the GFX's AC input. Equalize can be triggered by pressing the **AC IN** button four times, pressing the **EQ** button then selecting **START**.

```
STATUS/FX/BATT---P00
equalize 00.0 hrs
time remaining
DOWN UP TOP PORT
```

The **EQUALIZE TIME REMAINING** is the amount of time remaining for the equalize stage of the battery charging process. Once the **EQUALIZE TIME** period has been met, the charger turns off. When the FX is in the "Equalize" charging stage, the "equalize time remaining" value appears and starts to count down.

```
STATUS/FX/BATT---P00
battery temp 255
(not in degrees C/F)
DOWN UP TOP PORT
```

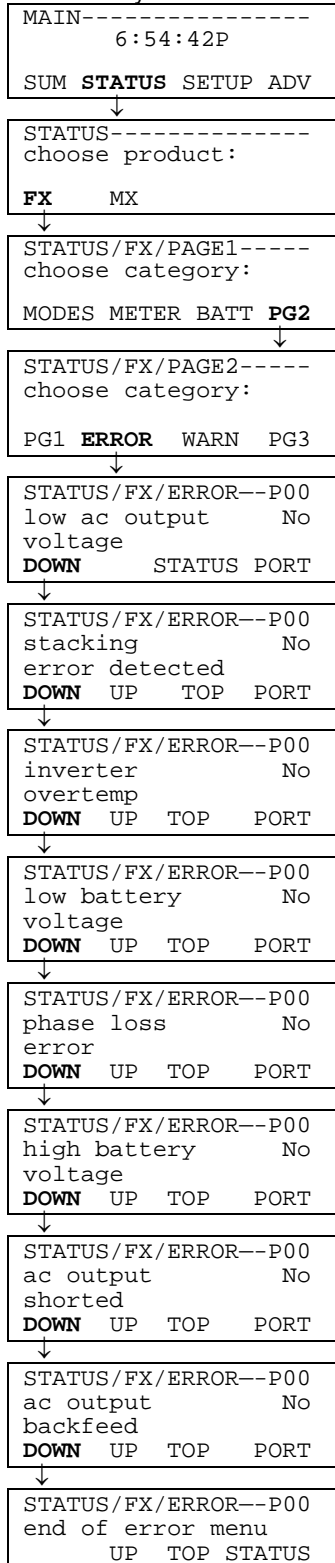
The **BATTERY TEMP** is a reference value used by the battery charger when an RTS is connected to the GFX. A displayed value of 255 means the sensor is not connected or has been damaged. At normal room temperatures a value around 130 ± 15 will be shown. As the battery temperature increases, the value displayed will get lower and vice versa.

```
STATUS/FX/BATT-----
end of battery menu
UP TOP STATUS
```

Selecting **TOP** returns the user to the top of the **STATUS/FX/BATT** menu section. Selecting **STATUS** returns to the **STATUS** screen.

**ERROR MENU**

The **ERROR** section allows the user to check the cause of an error condition when the GFX shuts down. When an error has occurred, the red error LED indicator in the GFX's wiring compartment will be illuminated (not to be confused with a blinking LED that indicates a WARNING). If an error occurs, the GFX will cease operation and the MATE will display an error screen. Pressing **<VIEW ERROR>** from this screen brings the user to a list of error causes that will be available by pressing the **DOWN** button. The particular error that the GFX is experiencing will be displayed on the MATE by the presence of the word "YES" next to the appropriate cause. An error can be cleared by pressing the **<INV>** button on the MATE and then turning the FX **<OFF>** and then [back again to] **<ON>**. Once the error has been cleared and the inverter reset, the display will change back to "NO" as shown on the screens below. The inverter automatically resets from an over-temperature and low battery conditions.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

- <FX>** FX inverter/charger system
- MX MX60 PV MPPT charge controller

- MODES Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ
- METER Provides the AC voltages and currents of the GFX
- BATT Provides the battery voltage and charger set points and timers
- <PG2>** Displays additional sections – ERRORS, WARNINGS and PG3

- PG1 Returns to page 1 of the STATUS section
- <ERROR>** Displays the different causes for errors and qualifies each cause with a Yes or No
- WARN Displays the different causes for warnings and qualifies each with a Yes or No
- PG3 Displays additional sections – reason for last DISCONNECT and SELL

**LOW OUTPUT AC VOLTAGE** indicates that the inverter was not able to maintain adequate AC output voltage (105 VAC or above) to power the loads connected. This typically is caused by the load demanding more power than the inverter is able to deliver.

**STACKING ERROR DETECTED** indicates that a problem has occurred with the communication cabling between stacked GFX's, or if the GFX's are stacked incorrectly. Check the stacking programming. If this condition persists contact your dealer for servicing instructions.

**INVERTER OVERTEMP** indicates that the GFX reached its maximum allowed operating temperature. This can be caused by powering large AC loads or charging for too long. It can also be caused by restricting the amount of air which is able to flow around the casting or operation in high temperature environments. The inverter will automatically reset and resume operation once it cools down.

**LOW BATTERY VOLTAGE** indicates that the battery voltage dropped below the LOW BATTERY CUT-OUT VOLTAGE set point (21.0 volts for a 24 volt FX) for 5 minutes. The inverter will restart once the battery voltage exceeds the LOW BATTERY CUT-IN VOLTAGE set point (25.0 volts for a 24 volt FX) for 10 minutes.

**PHASE LOSS ERROR** is not operational at this time. If a 'Yes' accompanies this Error, please disregard.

**HIGH BATTERY VOLTAGE** indicates that the battery voltage rose above the high battery voltage level (40.0 volts for a 24 volt GFX) for 10 seconds. The inverter will restart once the battery voltage drops below the high battery voltage level (40.0 volts for a 24 volt GFX) for 1 second.

**AC OUTPUT SHORTED** indicates that the inverter immediately reached its maximum current and shut down. This is usually caused by a short circuit condition (hence the AC OUTPUT SHORTED label) but can also be caused by attempting to operate a load which far exceeded the inverter output capability.

**AC OUTPUT BACKFEED** indicates that another AC source of power was connected to the AC output of the GFX. Usually this is an installation issue. It often occurs when there is an X-240 transformer in the system that hasn't been installed properly. Also, check that there are no connections between the AC input and AC output circuitry.

Selecting TOP returns the user to the top of the STATUS/FX/ERROR menu section. Selecting STATUS returns to the first page of the STATUS screen.

## WARNING MENU

The **WARNINGS** section of the STATUS menu allows the user to check the cause of a warning condition for the GFX. When a warning condition has occurred, the red "ERROR" LED indicator in the GFX's wiring compartment will flash. The cause of the warning will not be immediately displayed on the MATE like an ERROR will. Instead, you must access this WARNINGS menu and scroll down the list to find out which warning is present. This is indicated by the presence of a "YES" next to the appropriate cause listed. Once the warning has been cleared, the display will change back to "NO" as shown below and the red LED will stop flashing. A warning will not shut the GFX down like an error will.

```
STATUS/FX/PAGE2-----
choose category:
PG1 ERROR  WARN  PG3
```

PG1 Returns to page 1 of the STATUS section  
 ERROR Displays the different causes for errors and qualifies each cause with a Yes or No  
**<WARN>** Displays the different causes for warnings and qualifies each with a Yes or No  
 PG3 Displays additional sections – reason for last DISCONNECT and SELL

```
STATUS/FX/WARN---P00
acin freq          No
too high
DOWN              STATUS PORT
```

**AC IN FREQUENCY TOO HIGH** indicates that the GFX is approaching the upper limit of its frequency window and will drop the AC source if the frequency gets much higher. If the frequency of the AC source is above 66 Hz, the GFX will display this warning.

```
STATUS/FX/WARN---P00
acin freq          No
too low
DOWN              UP    TOP  PORT
```

**AC IN FREQUENCY TOO LOW** indicates that the GFX is approaching the lower limit of its frequency window and will drop the AC source if the frequency gets much lower. If the frequency of the AC source is below 54 Hz, the GFX will display this warning.

```
STATUS/FX/WARN---P00
acin voltage       No
too high
DOWN              UP    TOP  PORT
```

**AC IN VOLTAGE TOO HIGH** indicates that the AC source's voltage is over the upper limit (default is 140 VAC) of its voltage window. If an AC source was just applied to the GFX, the GFX will not connect to the AC source until the voltage drops below the upper limit.

```
STATUS/FX/WARN---P00
acin voltage       No
too low
DOWN              UP    TOP  PORT
```

**AC IN VOLTAGE TOO LOW** indicates that the AC source's voltage is below the lower limit (default is 108 VAC) of its voltage window. If an AC source was just applied to the GFX, the GFX will not connect to the AC source until the voltage rises above the lower limit.

```
STATUS/FX/WARN---P00
ac input           No
current exceeds max
DOWN              UP    TOP  PORT
```

**AC INPUT CURRENT EXCEEDS MAX** indicates that the AC loads are drawing more current than the rating of the GFX allows. Exceeding this current limit for an extended period of time could cause the GFX to fail. Reduce the loads on the GFX's AC output to prevent damage.

```
STATUS/FX/WARN---P00
temperature        No
sensor fault
DOWN              UP    TOP  PORT
```

**TEMPERATURE SENSOR FAULT** indicates that one of the temperature sensors internally located in the GFX is not working correctly. The GFX needs to be checked by a qualified repair technician. The AIRTEMP, FETTEMP and CAPTEMP warnings listed below can help with troubleshooting.

```
STATUS/FX/WARN---P00
internal comm      No
error detected
DOWN              UP    TOP  PORT
```

**INTERNAL COMMUNICATION ERROR DETECTED** indicates that a communication problem has occurred between the MATE and the GFX. This warning may occur if the communication lines between the GFX and the MATE have been severed. If this is the case, turn the GFX "off" and then "on" through the DC disconnect. If this does not solve the problem, call OutBack for assistance.

```
STATUS/FX/WARN---P00
internal fan       No
failure detected
DOWN              UP    TOP  PORT
```

**INTERNAL FAN FAILURE DETECTED** warns that the fan mounted above the transformer inside the GFX has stopped working or is not functioning properly. This will eventually cause an INVERTER OVERTEMP error if the cause of the fan failure is not fixed. Restart the GFX and listen for the fan to verify a fan failure. The fan should run for about 15 seconds on start-up.

```
STATUS/FX/WARN---P00
airtemp           206
DOWN              UP    PORT
```

**AIRTEMP** shows a numerical value that the GFX understands as a temperature. The value comes from a sensor inside the GFX that measures the temperature of the air. This warning is given for troubleshooting purposes.

```
STATUS/FX/WARN---P00
fettemp           200
DOWN              UP    PORT
```

**FETTEMP** shows a numerical value that the GFX understands as a temperature. The value comes from a sensor inside the GFX that measures the temperature of the FET's (Field Effect Transistors). This warning is given for troubleshooting purposes.

```
STATUS/FX/WARN---P00
captemp           203
DOWN              UP    PORT
```

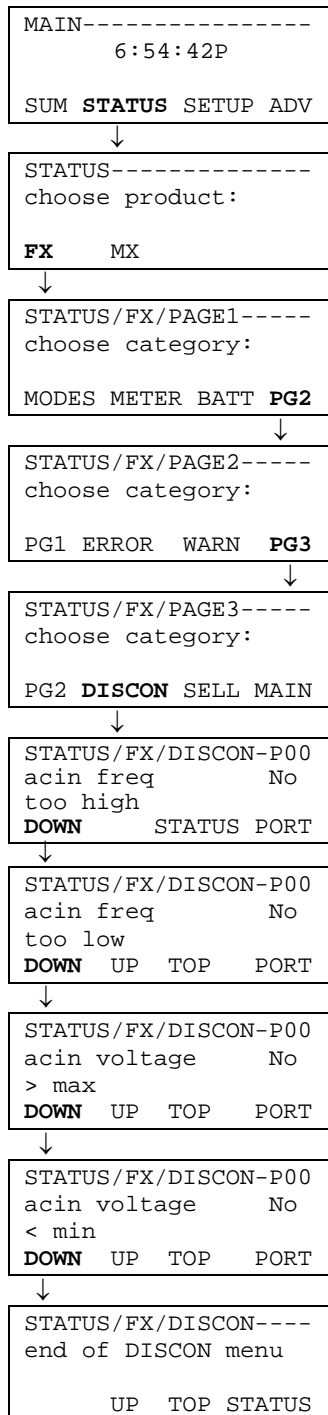
**CAPTEMP** shows a numerical value that the GFX understands as a temperature. The value comes from a sensor inside the GFX that measures the temperature of the ripple capacitors. This warning is given for troubleshooting purposes.

```
STATUS/FX/WARN-----
end of warnings
menu
UP    TOP  STATUS
```

Selecting TOP returns the user to the top of the STATUS/FX/WARN menu section. Selecting STATUS returns to the STATUS screen to allow selection of another product.

DISCONNECT MENU

The GFX includes a section that displays the reason for last **DISCONNECT** from the AC source. This is helpful if the GFX rejects the AC source and the user wants an explanation and help on rectifying the problem. The GFX will disconnect from an AC source if the AC source falls out of the GFX's frequency or voltage ranges. If the AC source disconnects from the GFX and none of the reasons for disconnect are followed by a "Yes" it is possible that the AC source shut itself down.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

**<FX>** FX inverter/charger system  
 MX MX60 PV MPPT charge controller

**MODES** Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the GFX  
**BATT** Provides the battery voltage and charger set points and timers  
**<PG2>** Displays additional sections – ERRORS, WARNINGS and PG3

**PG1** Returns to page 1 of the STATUS section  
**ERROR** Displays the different causes for errors and qualifies each cause with a Yes or No  
**WARN** Displays the different causes for warnings and qualifies each with a Yes or No  
**<PG3>** Displays additional sections – reason for last DISCONNECT and SELL

**PG2** Displays additional sections – ERRORS, WARNINGS and PG3  
**<DISCON>** Displays the reason that the GFX last disconnected from the AC source  
**SELL** Displays the code related to the reason for the last disconnection while selling  
**MAIN** Returns the user to the MAIN menu

The **ACIN FREQ TOO HIGH** screen displays a "Yes" if the GFX disconnected from the AC source due to the frequency of the AC source exceeding 69 Hz. The MATE does not display the frequency of the AC source, but this can be verified using an oscilloscope.

The **ACIN FREQ TOO LOW** screen displays a "Yes" if the GFX disconnected from the AC source due to the frequency of the AC source being below 51 Hz. The MATE does not display the frequency of the AC source, but this can be verified using an oscilloscope.

The **ACIN VOLTAGE > MAX** screen indicates that the AC source's voltage exceeded the maximum AC voltage the GFX allows (140 vac default). This value can be adjusted in the ADVANCED menu, in the GRID or GEN sections (depending on your input type). The GFX disconnects to protect the loads from high voltage. If you expect significant voltage drop due to long cable runs, it may be safe to raise the limit. This screen is not operational at this time.

The **ACIN VOLTAGE < MIN** screen indicates that the AC source's voltage is below the minimum AC voltage the GFX allows (108 vac default). This value can be adjusted in the ADVANCED menu, in the GRID or GEN sections (depending on your input type). The GFX disconnects to protect the loads from low voltage. If your AC source operates near this voltage limit, it could affect the charging function (the GFX backs off the charger if the AC voltage reaches the lower limit) and adjusting the limit lower may be in order. This screen is not operational at this time.

Selecting TOP returns the user to the top of the STATUS/FX/DISCON menu section. Selecting STATUS returns to the STATUS screen to allow selection of another product.

## SELL MENU

The **SELL** section of the STATUS menu has only one screen. This screen gives a number that refers to a reason the GFX would stop selling. OutBack Power Systems technicians use this number to quickly understand what the GFX thinks is happening. The system user should not be concerned about this number unless they are experiencing many unknown grid disconnects and they need troubleshooting help. This screen is only operational with "Grid-Tie" FX's.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

STATUS-----
choose product:
FX  MX
    
```

Allows selection of the product type:

**<FX>** FX inverter/charger system  
 MX MX60 PV MPPT charge controller

```

STATUS/FX/PAGE1-----
choose category:
MODES METER BATT PG2
    
```

**MODES** Status and allows adjustment of Inverter, AC input, Charger, Aux, and EQ  
**METER** Provides the AC voltages and currents of the GFX  
**BATT** Provides the battery voltage and charger set points and timers  
**<PG2>** Displays additional sections – ERRORS, WARNINGS and PG3

```

STATUS/FX/PAGE2-----
choose category:
PG1 ERROR WARN PG3
    
```

**PG1** Returns to page 1 of the STATUS section  
**ERROR** Displays the different causes for errors and qualifies each cause with a Yes or No  
**WARN** Displays the different causes for warnings and qualifies each with a Yes or No  
**<PG3>** Displays additional sections – reason for last DISCONNECT and SELL

```

STATUS/FX/PAGE3-----
choose category:
PG2 DISCON SELL MAIN
    
```

**PG2** Displays additional sections – ERRORS, WARNINGS and PG3  
**DISCON** Displays the reason that the GFX last disconnected from the AC source  
**<SELL>** Displays the code related to the reason for the last disconnection while selling  
**MAIN** Returns the user to the MAIN menu

```

STATUS/FX/SELL---P00
stop sell      14
reason
STATUS        PORT
    
```

The **STOP SELL REASON** displays a numerical value that indicates a reason that the GFX stopped selling to the utility grid. It could indicate that the utility grid's voltage or frequency is out of the acceptable ranges or that the utility grid failed altogether. This screen is used for troubleshooting by OutBack Power Systems technicians. Selecting STATUS returns the user to the beginning of the STATUS menu. Selecting PORT selects the next GFX on the HUB.

# Setup Screens

The OutBack GFX includes a **SETUP** menu to allow limited adjustment of some of the settings which may need to be accessed by the system user.

## SEARCH MENU

The **SEARCH** mode is an automatic system which reduces the power consumption of the GFX during periods of no power demand. It is primarily used for off-grid applications where the power is being generated by solar panels or other renewable energy sources and the system user is concerned about conserving every possible watt of power. Properly setup and operated, SEARCH mode can save considerable amounts of power compared to keeping an inverter in the ON mode 24 hours a day.

The GFX includes a load detection method that is called "search mode" in which the inverter produces a pulsed AC output to detect the magnitude of the AC load which is connected to the inverter AC output. Once a large enough load has been turned on, the inverter resumes normal operation providing continuous AC power. If the AC load is reduced to a level below the SEARCH SENSITIVITY setting, then the inverter turns off and the pulsed AC output (search mode) is resumed. The power saved by using the SEARCH pulsing method comes both from the reduced consumption of the inverter itself and from the elimination of the power consumed by "phantom" AC loads – appliances which consume power even though they are not operating. The SEARCH SENSITIVITY setting can be adjusted to ignore small AC loads such as a VCR display, etc. Use of the search mode requires some tuning of the settings for the particular loads connected and may not work well with some loads such as fluorescent lights with magnetic ballasts.

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

SETUP-----
choose product:
FX                MATE
    
```

Allows selection of the product type:  
**<FX>** GFX inverter/charger system  
MATE MATE system display and user interface

```

SETUP/FX-----
choose category:
SRCH INPUT      MAIN
    
```

The categories are then displayed for the settings which can be adjusted in the setup menu.  
**<SRCH>** Allows adjustment of the settings for the Search mode.  
INPUT Allows selection of the AC INPUT and current limit adjustment.  
MAIN Returns the display to the MAIN screen.

```

SETUP/FX/SEARCH--P00
search          6
sensitivity
DOWN INC DEC PORT
    
```

The **SEARCH SENSITIVITY** setting determines how much AC load (watts) is required to make the GFX switch from the 'search' mode to the normal inverter 'on' mode. Increasing the number (INC) decreases the sensitivity (more watts must be turned 'on' to bring the GFX out of 'search') while decreasing the number (DEC) increases the sensitivity (less watts must be turned 'on' to bring the GFX out of 'search'). Adjusting this setting to zero will effectively disable the search mode operation.

```

SETUP/FX/SEARCH--P00
search          8 cycles
pulse length
DOWN INC DEC PORT
    
```

The **SEARCH PULSE LENGTH** setting determines the number of pulses produced by the inverter in quick succession (actually AC cycles) which are used to detect level of the AC load connected. Some AC loads do not draw much power from a single AC pulse – setting this value to 8 or more pulses may allow the AC load to be detected more reliably. This setting has a range between 4 cycles and 20 cycles in 1 cycle increments.

```

SETUP/FX/SEARCH--P00
search          60 cycles
pulse spacing
DOWN INC DEC PORT
    
```

The **SEARCH PULSE SPACING** is the amount of time (in number of AC cycles) that the inverter waits before producing additional AC pulses to sense a load. The larger this 'search pulse spacing' number is, the lower the power consumption of the FX, but the more noticeable the delay between when the AC load is turned 'on' and when it actually comes 'on'. This setting has a range between 4 cycles and 120 cycles (2 seconds) in 1 cycle increments.

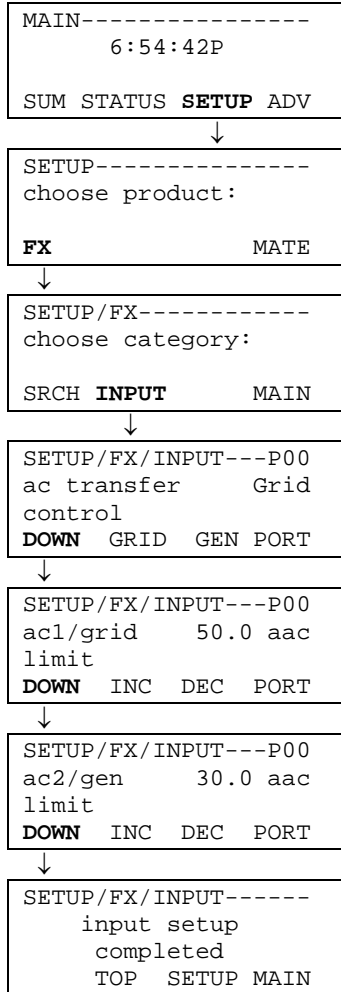
```

SETUP/FX/SEARCH-----
search setup
completed
TOP SETUP MAIN
    
```

Selecting TOP returns the user to the top of the SETUP/FX/SEARCH menu section. Selecting SETUP returns you to the setup screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## INPUT MENU

The other settings currently accessible to the system user in the SETUP menu involve the AC **INPUT**. The system user can specify what type of AC INPUT is being used, whether it is a generator (GEN, will not work with a GFX) or the utility grid (GRID). Following this are two screens, one for GEN and one for GRID, that allow the user to adjust the maximum AC current that the GFX will allow to enter before the GFX gives a warning.



The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

Allows selection of the product type:

**<FX>**           FX inverter/charger system  
MATE            MATE system display and user interface

The categories are then displayed for the settings which can be adjusted in the setup menu.

SRCH            Allows adjustment of the settings for the Search mode.  
**<INPUT>**       Allows selection of the AC INPUT and current limit adjustment.  
MAIN            Returns the display to the MAIN screen.

The **AC TRANSFER CONTROL** screen lets the user select the type of AC input which is connected to the GFX. This is used to choose the source of the AC input entering the GFX. The two choices are GRID for the utility grid or GEN for a generator. The settings for the AC source are found in the advanced menu under the headings GRID and GEN (see next page).

The **AC1/GRID LIMIT** is the maximum amount of current that the GFX will allow to be drawn by AC loads and battery charger together from the utility grid. When this limit is reached the charger will be “backed off” to keep from overloading the utility grid. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

The **AC2/GEN LIMIT** is the maximum amount of current that the GFX will allow to be drawn by AC loads and battery charger together from the generator. When this limit is reached the charger will be “backed off” to keep from overloading the generator. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

Selecting TOP returns the user to the top of the SETUP/FX/INPUT menu section. Selecting SETUP returns you to the setup screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## Advanced Screens

The **ADVANCED** menu section allows adjustment of all the settings involved with the operation of the GFX. Changes made to these settings are stored internally in non-volatile memory inside of the GFX – the settings are not lost when the MATE is removed or battery power is disconnect.

Some settings appear both in the SETUP and in the ADV menus. Changes made to these settings in one area will cause the same changes to occur in the other area. The settings are provided in both menus to make it more convenient for the GFX programmer by giving access to all of the settings in the advanced menu.

Access to the settings in the advanced menu is restricted through the use of a password. This password is required to view and adjust the settings. Once the password has been entered, all **ADVANCED** categories can be adjusted without having to re-enter the password. If the advanced menu is exited and re-entered, the password must be re-entered, however. Use of the “hot” keys AC IN and INV is allowed from the advanced menu and selecting OK from these screens will return you to the same point in the advanced menu.

The password for the GFX is currently fixed to the same value for all of the GFX's.

### PASSWORD CODE: 1 4 1

```

MAIN-----
      6:54:42P
SUM STATUS SETUP ADV
    
```

The **MAIN** screen is where the menu system starts. The four words in the bottom line of the display correspond to the four buttons located below the display. The word in **BOLD** on the bottom line indicates the selection used to advance the display to the next screen. Pressing the left two buttons simultaneously from anywhere in the menu will return you to this screen.

```

ADV/SETTINGS/WARNING
changes made could
adversely effect
system performance
    
```

Selecting **<ADV>** brings up a warning message. Please read the message. Pressing any of the four keys below the display advances the display to the password screen.

```

ADV/PASSWORD-----
enter the password:
      132
ENTER INC DEC EXIT
    
```

**Entering the correct password** number is done by pressing the **<INC>** key to increase the number or the **<DEC>** key to decrease the number. Once the number shown matches the password code, press the key below the word **<ENTER>**. To leave the advanced menu area without making any changes, press EXIT.

```

ADV-----
choose product:
FX  MX  MATE  MAIN
    
```

Following the password screen is a screen that allows selection of the OutBack product type. Selecting **<FX>** allows adjustment of the GFX's advanced programming. Selecting MX will allow access to the advanced sections of any MX-60's connected to the system (through a HUB). Selecting MATE will allow access to the MATE's advanced screens. Selecting MAIN returns the user to the MAIN menu.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

There are eight categories of settings in the GFX:

- INV**      Allows adjustment of the INVERTER settings and operation
- CHGR**    Allows adjustment of the CHARGER settings and operation
- GRID**    Allows adjustment of the AC input settings and operation if the GFX's input is set to GRID
- GEN**     Allows adjustment of the AC input settings and operation if the GFX's input is set to GEN
- AUX**     Allows adjustment of the AUX OUTPUT settings and operation
- STACK**   Allows adjustment of the master/slave settings for multi-GFX systems
- SELL**    Allows adjustment of the Grid-Tie settings and operation
- CAL**     Allows adjustment of the voltage calibration measurements to improve operation

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

```

ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
    
```

```

ADV/FX/PAGE3-----
choose category:
PG3  SELL  CAL  MAIN
    
```

Selecting ADV will send the user back one screen to the “choose product” screen in the advanced menu. PG2 will advance the user to page 2 of the advanced menu. PG3 will advance the user to page 3 of the advanced menu. PG4 will advance the user to page 4 of the advanced menu. Selecting MAIN will return the user to the MAIN screen.

## INVERTER MENU

The **INVERTER** category of the advanced menu section allows adjustment of the inverter's operation to match the AC load and battery requirements. Specifically, this section allows adjustment of the 'Search' function, the low battery cut-out function, the GFX's AC output voltage, and allows the user to reset the GFX to its factory defaults.

```

ADV-----
choose product :
FX   MX  MATE  MAIN
    
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT menu is displayed. Selecting **<FX>** allows adjustment of the GFX's advanced programming.

```

ADV/FX/PAGE1-----
choose category :
ADV  INV  CHGR  PG2
    
```

Selecting **<INV>** allows adjustment of the GFX's inverter set points and operation.

```

ADV/FX/INVERTER--P00
search          6
sensitivity
DOWN  INC  DEC
    
```

The **SEARCH SENSITIVITY** setting determines how much AC load is required to make the GFX switch from the 'search' mode to the normal inverter 'on' mode. Increasing the number (INC) decreases the sensitivity (more power must be turned 'on' to bring the GFX out of 'search') while decreasing the number (DEC) increases the sensitivity (less power must be turned 'on' to bring the GFX out of 'search'). Adjusting this setting to zero will effectively disable the search mode operation.

```

ADV/FX/INVERTER--P00
search          8 cycles
pulse length
DOWN  INC  DEC
    
```

The **SEARCH PULSE LENGTH** setting determines the number of pulses produced by the inverter in quick succession (actually AC cycles) which are used to detect level of AC load connected. Some AC loads do not draw much power from a single AC pulse – setting this value to 8 or more pulses may allow the AC load to be detected more reliably. This setting has a range between 4 cycles and 20 cycles in 1 cycle increments.

```

ADV/FX/INVERTER--P00
search          60 cycles
pulse spacing
DOWN  INC  DEC
    
```

The **SEARCH PULSE SPACING** is the number of AC cycles that the inverter waits before producing additional AC pulses. The larger this 'search pulse spacing' number is, the lower the power consumption, but the more noticeable the delay becomes when an AC load is first turned on. This setting has a range between 4 cycles and 120 cycles (2 seconds) in 1 cycle increments.

```

ADV/FX/INVERTER--P00
low battery 21.0 vdc
cut-out set point
DOWN  INC  DEC
    
```

The **LOW BATTERY CUT-OUT** setting determines when the inverter will turn off to prevent over discharge of the battery system. If an AC source is available and the AC INPUT was set to DROP, the GFX will transfer all of the AC loads on the inverter to the AC source. A fixed delay of 5 minutes is included to reduce nuisance inverter shutdowns. This setting has a range between 18.0 vdc and 24.0 vdc in 0.2 vdc increments.

```

ADV/FX/INVERTER--P00
low battery 25.0 vdc
cut-in set point
DOWN  INC  DEC
    
```

The **LOW BATTERY CUT-IN** setting determines when the inverter will turn back on after it had shut off due to a low battery situation. A fixed delay of 10 minutes is provided to reduce the possibility of the system cycling on and off. This setting has a range between 20.0 vdc and 28.0 vdc in 0.2 vdc increments.

```

ADV/FX/INVERTER--P00
adjust          120 vac
output voltage
DOWN  INC  DEC
    
```

The **ADJUST OUTPUT VOLTAGE** setting allows the user to change the output voltage to a lower or higher voltage. This may be necessary if some loads are far away from the GFX or if some loads are sensitive to higher voltages. This setting has a range between 110 vac and 125 vac in 1 vac increments.

```

ADV/FX/INVERTER-----
reset FX to factory
defaults
DOWN                               MORE
    
```

The **RESET FX TO FACTORY DEFAULTS** resets all of the settings in the GFX back to the factory default set points. **THIS WILL CAUSE ALL OF THE PREVIOUS PROGRAMMING TO BE LOST.** Selecting MORE displays a screen that allows the user to select which port on the HUB that the GFX to be reset is on. Once the user has chosen the PORT of if there is not a HUB the user should press NEXT to proceed. To complete the reset to factory defaults, the user must press 1 and then 2.

```

ADV/FX/INVERTER-----
inverter programming
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/INVERTER menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

**CHARGER MENU**

The **CHARGER** section allows for adjustment of the battery charger's operation to match the requirements of the batteries used. OutBack's default battery charging set points may not be correct for the type of batteries being used. Please contact the battery manufacturer for correct ABSORB, FLOAT and EQUALIZE voltages. See the BATTERY CHARGING INSTRUCTIONS on page 21 for guidelines on how to set some of these values.

The GFX's battery charger includes five stages. BULK raises the battery voltage to the 'Absorb Setpoint'. ABSORB sustains the battery voltage for the 'Absorb Time Limit'. The charger then goes into SILENT mode (no charging) until the battery voltage drops to the 'Float Setpoint'. FLOAT sustains this battery voltage for the 'Float Time Period'. The charger then goes into 'Silent' mode until the battery voltage drops to the 'Refloat Setpoint'. REFLOAT will start another FLOAT charge. There are additional screens for "Equalize Setpoint" and 'Equalize Time Period'. An equalize charge must be manually started. The time limits that it spends in the various stages are adjustable to provide control and maximize the performance of the battery charger and battery system.

```
ADV-----
choose product:
FX                MATE
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting <FX> allows adjustment of the GFX's advanced programming.

```
ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
```

Selecting <CHGR> allows adjustment of the battery charger set points and operation. The CHARGER LIMIT is the maximum amount of AC current that will be used by the GFX to power the battery charger. In most systems this setting will not need to be changed. This setting has a range as low as 0.0 aac and as high as 14.0 aac to 20.0 aac (depending on the model) in 1.0 aac increments.

```
ADV/FX/CHARGER---P00
charger          18.0 aac
limit
DOWN  INC  DEC  PORT
```

The **CHARGER LIMIT** is the maximum amount of AC current that will be used by the FX to power the battery charger. In most systems this setting will not need to be changed. This setting has a range as low as 0.0 aac and as high as 12.0 aac to 20.0 aac (depending on the model) in 0.5 aac increments.

```
ADV/FX/CHARGER---P00
absorb          28.8 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **ABSORB SET POINT** is the voltage that the batteries will be charged to during the first stage of the charging process. This stage of charging raises the battery voltage higher than the nominal battery voltage and allows the batteries to regain their charge. The 'Absorb Time Limit' must be long enough for the batteries to regain 100% of their charge. This setting has a range between 26.0 vdc and 32.0 vdc in 0.2 vdc increments.

```
ADV/FX/CHARGER---P00
absorb          01.0 hrs
time limit
DOWN  INC  DEC  PORT
```

The **ABSORB TIME LIMIT** can be adjusted to provide enough time at the 'Absorb Setpoint' to achieve a fully recharged battery. For large batteries a longer time may be required – small batteries may require a lower setting. The GFX automatically reduces the 'Absorb Time Limit' when the charger is connected to a partially charged battery. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

```
ADV/FX/CHARGER---P00
float           27.2 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **FLOAT SET POINT** is the voltage that the batteries will be 'trickle' charged to. This charge will finish the charging process by putting the last few percentage points of charge into the batteries. This set point can be adjusted to match the specific requirements of the batteries being charged. This setting has a range between 24.0 vdc and 30.0 vdc in 0.2 vdc increments.

```
ADV/FX/CHARGER---P00
float           01.0 hrs
time period
DOWN  INC  DEC  PORT
```

The **FLOAT TIME PERIOD** can be adjusted to set the amount of time that the battery is held at the 'Float Setpoint'. For large batteries a longer time may be required – smaller batteries may use a lower setting. Once the battery has been held at the 'Float Setpoint' for the 'Float Time Period', the battery charger goes silent and provides no charge to the battery. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

```
ADV/FX/CHARGER---P00
refloat        24.4 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **REFLOAT SET POINT** voltage is used to "trigger" the battery charger back into another FLOAT cycle when the battery voltage falls to this set point. This can provide maintenance charging of batteries and is also useful when intermittent DC loads are operated from a battery system and an AC source is available. This setting has a range between 24.0 vdc and 26.0 vdc in 0.2 vdc increments.

```
ADV/FX/CHARGER---P00
equalize        29.2 vdc
setpoint
DOWN  INC  DEC  PORT
```

The **EQUALIZE SET POINT** voltage can be set for a high voltage to de-stratify the batteries on occasion. The user can start an equalization charge through the AC IN "hot" key. The batteries must be supervised throughout the equalization process. Consult the battery supplier as to specific instruction on the battery equalizing process. This setting has a range between 28.0 vdc and 34.0 vdc in 0.2 vdc increments.

```
ADV/FX/CHARGER---P00
equalize        01.0 hrs
time period
DOWN  INC  DEC  PORT
```

The **EQUALIZE TIME PERIOD** can be adjusted to limit the amount of time that the battery is equalized. The timer starts to advance once the battery voltage exceeds the absorb voltage set point. Once the timer reaches the equalize time period, the charger goes into the silent stage of the charging process. This setting has a range between 0 hours and 24 hours in 0.1 hour increments.

```
ADV/FX/CHARGER-----
charger programming
completed
TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/CHARGER menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## GRID MENU

The **GRID** category of the advanced menu section allows for adjustment of the AC input voltage window and time delays to match the characteristics of the AC source if that AC source is the utility grid. This setting can be found in the SETUP/FX/INPUT menu. The "Grid-Tie" FX's have a default of GRID as the AC source.

```
ADV-----
choose product:
FX                MATE
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting **<FX>** allows adjustment of the GFX's advanced programming.

```
↓
ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
```

Selecting **<PG2>** advances the user to the second page of the advanced menu.

```
↓
ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
```

Selecting **<GRID>** allows adjustment of the AC input set points and operation.

```
↓
ADV/FX/GRID-----P00
ac input    00.5 min
connect delay
DOWN  INC  DEC  PORT
```

The **AC INPUT CONNECT DELAY** set point adjusts the time period of when the GFX sees an acceptable AC source to when it connects the AC loads to that source. This is useful to allow the utility grid to become stable after a utility power outage. This setting has a range between 0.2 minutes to 15 minutes in 0.1 minute increments.

```
↓
ADV/FX/GRID-----P00
ac1/grid    108 vac
lower limit
DOWN  INC  DEC  PORT
```

The **AC1/GRID LOWER LIMIT** set point allows adjustment of the minimum voltage that the AC source is allowed to be in order for the GFX to connect to that source. The GFX will back off the charger if the AC source is at this lower limit. If the AC source falls below this limit, the GFX will disconnect from the AC source until it is above this value. This setting has a range between 70 vac and 110 vac in 1 vac increments.

```
↓
ADV/FX/GRID-----P00
ac1/grid    140 vac
upper limit
DOWN  INC  DEC  PORT
```

The **AC1/GRID UPPER LIMIT** set point allows adjustment of the maximum voltage that the AC source is allowed to be in order for the GFX to connect to that source. If the AC source exceeds this value, the GFX will disconnect from the AC source until it is below this value. This setting has a range between 130 vac and 150 vac in 1 vac increments.

```
↓
ADV/FX/GRID-----P00
ac1/grid    50.0 aac
input limit
DOWN  INC  DEC  PORT
```

The **AC1/GRID INPUT LIMIT** sets the maximum amount of current the GFX allows to be drawn from the AC source. When the AC input current limit is reached, the power draw of the battery charger is backed off to prevent overloading the AC source. If the AC loads exceed this limit, the GFX will give a warning and start blinking the red "ERROR" LED. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

```
↓
ADV/FX/GRID-----P00
ac1/grid    6 cycles
transfer delay
DOWN  INC  DEC  PORT
```

The **AC1/GRID TRANSFER DELAY** is the amount of time that the AC input will remain connected to the AC source when the AC input voltage drops below the AC1/GRID lower limit setting. Once the AC voltage has risen above the AC1/GRID lower limit setting for the AC INPUT CONNECT DELAY time period, the AC source will be reconnected. This setting has a range between 0 cycles and 240 cycles in 1 cycle increments.

```
↓
ADV/FX/GRID-----
GRID programming
completed
TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/GRID menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

**GENERATOR MENU**

Normally, the **GEN** (generator) category of the advanced menu section allows for adjustment of the AC input voltage window and time delays to match the characteristics of the AC source if that AC source is a generator. At this time, the GFX 's follow the GRID voltage and frequency windows no matter if the AC input is set up for GRID or GEN. Therefore, changes made in this section will not take effect. All OutBack Power System FX's other than the "Grid-Tie" FX's have a default of GEN (generator) as the AC source.

```

ADV-----
choose product:
FX                MATE
    
```

Once the password has been correctly entered, the ADV - CHOOSE PRODUCT is displayed. Selecting <FX> allows adjustment of the GFX's advanced programming.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

Selecting <PG2> advances the user to the second page of the advanced menu.

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

Selecting <GEN> allows adjustment of the AC input set points and operation.

```

ADV/FX/GEN-----P00
ac input      00.5 min
connect delay
DOWN  INC  DEC  PORT
    
```

The **AC INPUT CONNECT DELAY** set point adjusts the time period of when the GFX sees an acceptable AC source to when it connects the AC loads to that source. This is useful to allow a generator to warm up. This setting has a range between 0.2 minutes to 15 minutes in 0.1 minute increments.

```

ADV/FX/GEN-----P00
ac2/gen       108 vac
lower limit
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN LOWER LIMIT** set point allows adjustment of the minimum voltage that the AC source is allowed to be in order for the GFX to connect to that source. The GFX will back off the charger if the AC source is at this lower limit. If the AC source falls below this limit, the GFX will disconnect from the AC source until it is above this value. This setting has a range between 70 vac and 110 vac in 1 vac increments.

```

ADV/FX/GEN-----P00
ac2/gen       140 vac
upper limit
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN UPPER LIMIT** set point allows adjustment of the maximum voltage that the AC source is allowed to be in order for the GFX to connect to that source. If the AC source exceeds this value, the GFX will disconnect from the AC source until it is below this value. This setting has a range between 130 vac and 150 vac in 1 vac increments.

```

ADV/FX/GEN-----P00
ac2/gen       30.0 aac
input limit
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN INPUT LIMIT** sets the maximum amount of current the GFX allows to be drawn from the AC source. When the AC input current limit is reached, the power draw of the battery charger is backed off to prevent overloading the AC source. If the AC loads exceed this limit, the GFX will give a warning and start blinking the red "ERROR" LED. This setting has a range between 5.0 aac and 60.0 aac in 1.0 aac increments.

```

ADV/FX/GEN-----P00
ac2/gen       20 cycles
transfer delay
DOWN  INC  DEC  PORT
    
```

The **AC2/GEN TRANSFER DELAY** is the amount of time that the AC input will remain connected to the AC source when the AC input voltage drops below the AC1/GRID lower limit setting. Once the AC voltage has risen above the AC1/GRID lower limit setting for the AC INPUT CONNECT DELAY time period, the AC source will be reconnected. This setting has a range between 0 cycles and 240cycles in 1 cycle increments.

```

ADV/FX/GEN-----P00
ac2/gen       OFF
support
DOWN  OFF  ON  PORT
    
```

The **AC2/GEN SUPPORT** setting allows the GFX to assist the generator for very large AC loads or if the generator's continuous power is less than the continuous power of the GFX and the loads are drawing more power than the generator can give. Currently the GFX cannot work with generators and, furthermore, OutBack's generator support is inoperable at this time.

```

ADV/FX/GEN-----
GEN programming
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/GEN menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## AUXILIARY MENU

The **AUX** (auxiliary) section can be used to control external AC or DC loads, signal a generator start system (Again, it is not recommended to use a generator as the AC input to a GFX. It may not connect or charge properly), send a fault alarm signal, or to run a fan. The AUX output provides a 12 vdc, 0.7 adc max output on the AUX terminals located in the wiring compartment.

```
ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting <PG2> shows a second screen of categories.

```
ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
```

Selecting <PG3> shows a third screen of categories.

```
ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
```

Selecting <AUX> allows adjustment of the auxiliary output set points and operation. The **AUX OUTPUT CONTROL** screen allows selection of the mode of the AUX output. Selecting INC or DEC changes the mode between OFF, AUTO, and ON. Selecting OFF disables the AUX output from operating. Selecting AUTO allows the AUX output to automatically perform the function that is selected in the **AUX OUTPUT FUNCTION** screens below. Selecting ON forces the AUX output to be kept ON regardless of the function selected. Pressing <DOWN> allows the selection of the AUX OUTPUT FUNCTION. There are nine functions in this section. The default setting is "Cool Fan" which is set to run a Turbo Kit without any programming. The function at the top of the menu is "AC Drop". The user must press <INC> three times in order to get to the top of the list of functions.

```
ADV/FX/AUX-----P00
aux output      AUTO
control
DOWN  INC  DEC  PORT
```

Selecting **AC DROP** enables the AUX output when the AC source that is connected to the GFX ceases (due to a power outage). This allows the user to attach an indicator to the AUX output to warn the user that the GFX does not recognize that an AC source is available.

```
ADV/FX/AUX-----P00
aux output      AC Drop
function
DOWN  INC  DEC  PORT
```

Selecting **DIVERT** enables the AUX output to function as a diversion controller. This can be used to send excess power from a renewable energy source to a load. This can allow control of sources such as wind turbines or hydro-generators. Two choices of DIVERT are provided – 'DivertDC' and 'DivertAC'. 'DivertDC' is used to divert power to DC loads and 'DivertAC' is used to divert power to AC loads. The only difference is that the 'DivertAC' setting will turn off the AUX output if the inverter is overloaded. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-----P00
aux output      DivertAC
function
DOWN  INC  DEC  PORT
```

```
ADV/FX/AUX-----P00
aux output      DivertDC
function
DOWN  INC  DEC  PORT
```

Selecting **COOLFAN** (default) enables the AUX output to function as a thermostatically operated ventilation system controller. When the GFX approaches an over temperature condition, the AUX output will be energized. This can be used to power a small 12 vdc brushless "muffin" type fan, the Turbo Kit, or can be used to control a larger cooling fan via a 12 vdc coil relay.

```
ADV/FX/AUX-----P00
aux output      Cool Fan
function
DOWN  INC  DEC  PORT
```

Selecting **VENTFAN** enables the AUX output to function as an automatic battery ventilation system controller. The AUX output can provide 0.7 amps of power for connection to a 12 vdc brushless "muffin" type fan. The fan will be automatically turned on when the voltage exceeds the VENTFAN ON voltage set point. The fan can be set to operate intermittently by adjusting the VENTFAN OFF TIME PERIOD. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-----P00
aux output      Vent Fan
function
DOWN  INC  DEC  PORT
```

Selecting **FAULT** enables the AUX output to function as an alarm output. When the GFX enters any of the error conditions, the AUX output is energized. This can be used to send an alarm signal via radio, pager or telephone dialer. It also can be used to log error conditions by using it to trigger an event recording device.

```
ADV/FX/AUX-----P00
aux output      Fault
function
DOWN  INC  DEC  PORT
```

Selecting **GENALERT** enables the AUX output to function as a simple voltage controlled generator start signal. 'GenAlert' can be used to "alert" the system user to start the generator due to the battery voltage being low. Only connection to a 2-wire type generator is possible and must be done through a 12 volt DC relay. Time delays for ON and OFF are adjustable. Using 'Advanced Generator Start' (AGS) will override any AUX function that is programmed. See the next page to adjust the set points for this function. **GFX's do not work well with generators.**

```
ADV/FX/AUX-----P00
aux output      GenAlert
function
DOWN  INC  DEC  PORT
```

Selecting **LOADSHED** enables the AUX output to function as a load management system. When the battery voltage drops below the LOAD DISCONNECT set point for more than 3 seconds, the AUX output is energized. Connecting a normally closed (NC) relay to the circuitry of non-vital loads will disengage them with this function. LOADSHED will also occur when the GFX approaches an over-temperature condition or when the AC output voltage drops below 105 vac for more than 3 seconds. There is a 3-minute fixed delay before the AUX output is de-energized. See the next page to adjust the set points for this function.

```
ADV/FX/AUX-----P00
aux output      LoadShed
function
DOWN  INC  DEC  PORT
```

Selecting **REMOTE** enables the AUX output to be controlled by the MATE or a PC computer connected to the MATE PC communication port. This function is currently not operational. It will be operational in the future.

```
ADV/FX/AUX-----P00
aux output      Remote
function
DOWN  INC  DEC  PORT
```

Press <DOWN> after selecting the AUX OUTPUT FUNCTION of your choice. The AUX menu section is continued on the following page.

**AUXILIARY MENU (CONTINUED)**

This page contains to settings for the various functions that can be chosen in the AUX OUTPUT FUNCTION screen described on the previous page. There are voltage and time period settings for 'GenAlert', 'LoadShed', 'VentFan', and 'Diversion'.

The following displays allow the adjustment of the particular AUX OUTPUT FUNCTION that was selected on the previous screen in the AUX menu section.

```
ADV/FX/AUX-----P00
genalert    22.0 vdc
on setpoint
DOWN INC DEC PORT
```

The **GENALERT ON SET POINT** is the battery voltage at which the AUX output is energized when the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 20.0 vdc and 28.0 vdc in 0.2 vdc increments.

```
ADV/FX/AUX-----P00
genalert    4 min
on delay
DOWN INC DEC PORT
```

The **GENALERT ON DELAY** is the amount of time that the battery voltage must remain below the GENALERT ON SET POINT voltage for the AUX output to become energized. This setting is provided to allow for short periods of heavy load usage. This setting has a range between 0 minutes and 240 minutes in 1 minute increments.

```
ADV/FX/AUX-----P00
genalert    28.0 vdc
off setpoint
DOWN INC DEC PORT
```

The **GENALERT OFF SETPOINT** is the battery voltage at which the AUX output is de-energized when the AUX OUTPUT FUNCTION has been set to GENALERT. This setting has a range between 24.0 vdc and 36.0 vdc in 0.2 vdc increments.

```
ADV/FX/AUX-----P00
genalert    9 min
off delay
DOWN INC DEC PORT
```

The **GENALERT OFF DELAY** set point is the amount of time that the battery voltage must remain above the GENALERT OFF SETPOINT voltage for the AUX output to become de-energized. This setting is provided to allow the battery charger to more fully recharge the battery once it has been started. This setting has a range between 0 minutes and 240 minutes in 1 minute increments.

```
ADV/FX/AUX-----P00
loadshed    22.0 vdc
off setpoint
DOWN INC DEC PORT
```

The **LOADSHED OFF SETPOINT** is the battery voltage at which the AUX output is energized to reduce the load on the inverter and battery system. Once the battery voltage has dropped below this setting for 3 seconds the AUX output will have 12 vdc available to power a DC coil relay to disconnect an AC load. Once the LOADSHED function has been triggered it will remain on for a minimum of 3 minutes. This setting has a range between 20.0 vdc and 28.0 vdc in 0.2 vdc increments.

```
ADV/FX/AUX-----P00
ventfan     26.0 vdc
on setpoint
DOWN INC DEC PORT
```

The **VENTFAN ON SETPOINT** is the battery voltage at which the AUX output is energized when the AUX OUTPUT FUNCTION has been set to VENTFAN. The AUX output can be used to keep hydrogen from accumulating by exchanging the air in the battery enclosure. This setting has a range between 20.0 vdc and 32.0 vdc in 0.2 vdc increments.

```
ADV/FX/AUX-----P00
ventfan off  5 min
period
DOWN INC DEC PORT
```

The **VENTFAN OFF PERIOD** set point can be used to allow for intermittent operation of the battery enclosure ventilation system. Setting the time period to 5 minutes will operate the fan at a 50% duty cycle as the "on" time period is fixed at 5 minutes. Setting the VENTFAN OFF PERIOD to zero will keep the fan on continuously when the battery voltage exceeds the VENTFAN ON voltage set point. This setting has a range between 0 minutes and 30 minutes in 1 minute increments.

```
ADV/FX/AUX-----P00
diversion   29.2 vdc
on setpoint
DOWN INC DEC PORT
```

The **DIVERSION ON SETPOINT** enables the AUX output to function as a diversion controller. This can be used to send excess power from a renewable energy source to a load. This can allow control of sources such as wind turbines or hydro-generators. Two types of DIVERT are selectable – DIVERTDC and DIVERTAC. The only difference is that the AC diversion setting will quickly turn off the AUX output if the GFX is overloaded. This setting has a range between 24.0 vdc and 32.0 vdc in 0.2 vdc increments.

```
ADV/FX/AUX-----P00
diversion   30 sec
off delay
DOWN INC DEC PORT
```

The **DIVERSION OFF DELAY** is the amount of time that the AUX output will continue to be energized after the battery voltage falls below the DIVERSION ON SETPOINT voltage. In cases where the battery voltage is hovering around the DIVERSION ON SETPOINT voltage, the AUX output won't flicker. This setting has a range between 0 seconds and 240 seconds in 1 second increments.

```
ADV/FX/AUX-----
aux output
setup completed
TOP ADV MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/AUX menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## STACKING MENU

The **STACK** (stacking) section is used to program the stacking of the GFX's. An explanation of stacking can be found on pages 23 & 24 of this manual. The GFX can be connected in series for higher voltage. This type of stacking is called "Classic Stacking" by OutBack Power Systems. The programming of the "master" and "slave" units must be completed with the inverters OFF in order to prevent possible problems.

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting <PG2> shows a second screen of categories.

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

Selecting <PG3> shows a third screen of categories.

```

ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
    
```

Selecting <STACK> allows adjustment of the stacking set points and operation.

```

ADV/FX/STACK-----P00
Stack Master
phase
DOWN  INC  DEC  PORT
    
```

The **STACK PHASE** screen sets the hierarchy of the GFX's. If the system is to be stacked, a HUB must be included and the GFX that is to be the MASTER must be plugged into port 1 of the HUB. The default for every GFX is 'Master'. Pressing PORT will select the next port that a GFX is plugged into. When the port for the slave GFX has been chosen, press INC to make the GFX a CLASSIC SLAVE.

```

ADV/FX/STACK-----P00
power save level  0
master adjust only
DOWN  INC  DEC  PORT
    
```

The **POWER SAVE LEVEL MASTER ADJUST** is used to set the number of 'slaves' that will remain 'On' when the system is operating at light load levels. The value corresponds to the rank of the SLAVE. For example, setting this value to 2 allows all SLAVE's with POWER SAVE LEVEL SLAVE ADJUST ONLY values 2 or less to stay on at all times. This setting does not yet pertain to Grid-Tied systems. This setting is for "OutBack Stacking" methods which the GFX is not currently compatible

```

ADV/FX/STACK-----P00
power save level  1
slave adjust only
DOWN  INC  DEC  PORT
    
```

The **POWER SAVE LEVEL SLAVE ADJUST** is used to set a slave inverter's priority for operation when the total inverter system is operating at medium to heavy loads. By setting each of the slaves to a different number you can control the sequence that the slave inverters are turned on by the master inverter. This setting does not yet pertain to Grid-Tied systems. This setting is for "OutBack Stacking" methods which the GFX is not currently compatible.

```

ADV/FX/STACK-----
stacking setup
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/STACK menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

**SELL MENU**

The **SELL** menu is used to set the functions that control the process of selling power back to the utility grid. These functions include setting the voltage at which the GFX sells back to the utility grid, setting the window in which the Grid-Tie function operates, and to enable or disable the Grid-Tie function. The default values enable the GFX to sell back to the utility grid after the GFX has completed a charge cycle. To disable this charge cycle, press the **<AC IN>** "hot" button four times, press **<BULK>**, press **<STOP>** and then press **<OK>**. The GFX waits 5 minutes after it has accepted the utility grid as an AC source and must be above the "sell RE volts" (found in this menu) to start selling. **NOTE: The GFX CANNOT do time-of-day selling!**

```

ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
    
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

```

ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
    
```

Selecting **<PG3>** shows a third screen of categories.

```

ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
    
```

Selecting **<PG4>** shows a fourth screen of categories.

```

ADV/FX/PAGE4-----
choose category:
PG3  SELL  CAL  MAIN
    
```

Selecting **<SELL>** allows adjustment of the Grid-tie and selling set points and operation.

```

ADV/FX/SELL-----P00
sell re      25.6 vdc
volts
DOWN  INC  DEC  PORT
    
```

The **SELL RE VOLTS** (RE = Renewable Energy) screen allows the user to set the voltage at which they would like to sell battery power back to the utility grid. If the battery voltage is above the voltage shown on this screen and the GFX isn't charging then the GFX will sell power back to the utility grid. This setting has a range between 20.0 vdc and 30.0 vdc in 0.2 vdc increments.

```

ADV/FX/SELL-----P00
grid tie      IEEE
window
DOWN  IEEE  USER  PORT
    
```

The **GRID TIE WINDOW** screen controls the voltage and frequency windows that the grid-tie function operates in. If the GFX repeatedly disconnects from the utility grid this value may need to be changed. This function **should not**, I repeat, **should not** be changed without consulting OutBack Power Systems first.

```

ADV/FX/SELL-----P00
grid tie      GridTie
authority
DOWN  INC  DEC  PORT
    
```

The **GRID TIE AUTHORITY** screen allows the user to turn on or off the selling function of the GFX. When the screen displays "GridTie" (default), the GFX will sell power under the correct conditions. Pressing DEC will change "GridTie" to "No Sell" and the selling function will be disabled. Pressing INC will change the display back from "No Sell" to "GridTie".

```

ADV/FX/SELL-----
selling setup
completed
TOP  ADV  MAIN
    
```

Selecting TOP returns the user to the top of the ADV/FX/SELL menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## CALIBRATION MENU

The **CAL** (calibration) section is used in the factory or field to make fine adjustments in the operation of the FX. It is particularly useful when multiple FX's are connected together in the different stacking configurations to maximize the performance of the FX's.

In most cases, the user will not need to adjust these settings from the factory default values.

```
ADV/FX/PAGE1-----
choose category:
ADV  INV  CHGR  PG2
```

Once the password has been correctly entered, the ADV - CHOOSE CATEGORY: screen is displayed. Selecting **<PG2>** shows a second screen of categories.

```
ADV/FX/PAGE2-----
choose category:
PG1  GRID  GEN  PG3
```

Selecting **<PG3>** shows a third screen of categories.

```
ADV/FX/PAGE3-----
choose category:
PG2  AUX  STACK  PG4
```

Selecting **<PG4>** shows a fourth screen of categories.

```
ADV/FX/PAGE4-----
choose category:
PG3  SELL  CAL  MAIN
```

Selecting **<CAL>** allows calibration of the AC input, AC output, and battery voltage set points.

```
ADV/FX/CALIBRATE-P00
vac input    120 vac
adjustment
DOWN INC DEC PORT
```

The **VAC INPUT ADJUSTMENT** allows calibration of the AC input voltage. If the AC source is measured and is different than the value read from the MATE, the user can adjust it to match the measured value. This value can be raised by pressing the INC button. Conversely, this value can be lowered by pressing the DEC button. The value can be raised or lowered up to 2 vac.

```
ADV/FX/CALIBRATE-P00
vac output   120 vac
adjustment
DOWN INC DEC PORT
```

The **VAC OUTPUT ADJUSTMENT** allows calibration of the AC output voltage. If the AC output is measured and is different than the value read from the MATE, the user can adjust the reading to match the measured value. This value can be raised up to 2 vac by pressing the INC button and lowered up to 2 vac by pressing the DEC button. NOTE: Only affects MATE's voltage display - See page 44 [ADJ. OUTPUT VOLTAGE] for actual adjustment of inverter VAC output.

```
ADV/FX/CALIBRATE-P00
battery vdc  25.6 vdc
adjustment
DOWN INC DEC PORT
```

The **BATTERY VDC ADJUSTMENT** allows calibration of the battery voltage. If the battery voltage is measured and is different than the value read from the MATE, the user can adjust it to match the measured value. This value can be raised by pressing the INC button. Conversely, this value can be lowered by pressing the DEC button. The value can be raised or lowered up to 0.4 vdc.

```
ADV/FX/CALIBRATION--
calibration setup
completed
TOP  ADV  MAIN
```

Selecting TOP returns the user to the top of the ADV/FX/CALIBRATION menu section. Selecting ADV returns you to the advanced screen to allow selection of another product connected to the MATE. Selecting MAIN returns the display to the MAIN screen.

## END OF ADVANCED MENU SYSTEM

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 (AWG)	DC Resistance in Ohms (1000 feet)	CROSS-SECTIONAL AREA		APPROXIMATE DIAMETER	
		INCHES	MILLIMETERS	INCHES	MILLIMETERS
14	3.14	.0032	2.08	.078	1.98
12	1.98	.0051	3.31	.101	2.57
10	1.24	.0082	5.26	.126	3.20
8	0.78	.0130	8.37	.162	4.11
6	0.50	.0206	13.30	.215	5.46
4	0.31	.0328	21.15	.269	6.83
2	0.19	.0521	33.62	.337	8.56
1	0.15	.0657	42.41	.376	9.55
1/0	0.12	.0829	53.50	.423	10.74
2/0	0.10	.1045	67.43	.508	12.90
3/0	0.08	.1318	85.01	.576	14.63
4/0	0.06	.1662	107.20	.645	16.38

## OutBack Power Systems **Two Year Limited Warranty**

OutBack Power Systems Inc. warrants that the products it manufactures will be free from defects in materials and workmanship for a period of two (2) years subject to the conditions set forth below.

The limited warranty is extended to the original user and is transferable. The limited warranty term begins on the date of invoice to the original user of the product. The limited warranty does not apply to any product or part thereof damaged by a) alteration or disassembly, b) accident or abuse, c) corrosion, d) lightning, e) reverse polarity, f) repair or service provided by an unauthorized repair facility, g) operation or installation contrary to instructions pertaining to the product.

OutBack Power Systems' liability for any defective product or any part thereof shall be limited to the repair or replacement of the product, at OutBack Power Systems' discretion. OutBack Power Systems does not warrant or guarantee the workmanship performed by any person or firm installing its products.

THIS LIMITED WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS THAT VARY FROM STATE TO STATE (OR JURISDICTION TO JURISDICTION). OUTBACK POWER SYSTEMS' RESPONSIBILITY FOR MALFUNCTIONS AND DEFECTS IN HARDWARE IS LIMITED TO REPAIR AND REPLACEMENT AS SET FORTH IN THIS LIMITED WARRANTY STATEMENT. ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LIMITED WARRANTY PERIOD SET FORTH ABOVE AND NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER SUCH PERIOD. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

OUTBACK POWER SYSTEMS DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES SET FORTH IN THIS LIMITED WARRANTY STATEMENT OR LIABILITY FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION ANY LIABILITY FOR PRODUCTS NOT BEING AVAILABLE FOR USE. SOME STATES (OR JURISDICTIONS) DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE EXCLUSION OR LIMITATION MAY NOT APPLY TO YOU.

During the two year period beginning on the invoice date, OutBack Power Systems will repair or replace products covered under this limited warranty that are returned to OutBack Power Systems' facility or to an OutBack Power Systems authorized repair facility, or that are repaired on site by an OutBack Power Systems authorized repair technician. To request limited warranty service, you must contact OutBack Power Systems at 360-435-6030 within the limited warranty period. If limited warranty service is required, OutBack Power Systems will issue a Return Material Authorization (RMA) Number. Mark the outside of the package with the RMA number and include a copy of the purchase invoice in the package. You must ship the products back to OutBack Power Systems in their original or equivalent packaging, prepay shipping charges, and insure the shipment or accept the risk of loss or damage during shipment. OutBack Power Systems will ship the repaired or replacement products to you freight prepaid if you use an address in the continental United States, where applicable. Shipments to other locations will be made freight collect.

Your purchase of an OutBack Power Systems product is an important investment. Registering your products will help us maintain the standard of excellence you expect from us in terms of performance, quality and reliability.

Please take a moment to register and provide us with some important information.

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State, Zip Code: \_\_\_\_\_

Country: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

E-mail: \_\_\_\_\_

Sold by: \_\_\_\_\_

Installer: \_\_\_\_\_

Purchase Date: \_\_\_\_\_

Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Circle all that apply:

Off-Grid Installation

Residential Installation

North America Location

Utility Connected Installation

Commercial Installation

Other \_\_\_\_\_

## Extended Warranty Application

OutBack Power Systems offers an optional three year extension to the standard two year limited warranty. Purchase of extended warranty coverage is available on products listed below provided conditions shown are met. Extended warranty coverage must be purchased within 90 days of the original sale of the product covered.

PRODUCT	REQUIRED SURGE PROTECTION	EXTENDED WARRANTY COST
Any FX Series Inverter/Charger	AC Input; AC Output, DC Input	\$300.00
MX60	DC Input; DC Output	\$100.00
MATE	NA	\$50.00
HUB 4	NA	\$35.00
HUB 10	NA	\$50.00

<u>Product Covered</u>	<u>Serial Number</u>	<u>Quantity</u>	<u>Extended Warranty Cost</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
<b>Total</b>			_____

Send check or money order payable to OutBack Power Systems. Include a completed copy of this application and send to:

OutBack Power Systems  
Extended Warranty Program  
19009 62nd Ave NE  
Arlington, WA 98223 USA