

OutBack Power Systems

MATE

System Controller and Display

NOTE! This manual does not cover all functions of the MATE Controller. Rather, it is intended as a training aid for new customers. It does cover all necessary functions for normal operation of this unit. The most important information is highlighted in yellow. For complete function set, see the original manual.

Installation and User Manual for the OutBack MATE and MATE2



Please check our website at www.outbackpower.com for the latest product information

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1.0 Introduction

The OutBack MATE is a complete system controller and display for both the OutBack FX inverter/charger and the MX60 PV MPPT charge controller. It provides a display of the operation as well as allows for control and adjustment of the product setpoints. The OutBack MATE also coordinates the operation of the entire system to maximize the performance and to prevent multiple products from conflicting.

Through the use of an OutBack HUB communication manager a single OutBack MATE is able to connect to multiple FX inverter/chargers, MX60 PV MPPT charge controllers and any other OutBack products offered in the future. A maximum of ten OutBack products will be able to be connected to a single MATE via a HUB using CAT 5 type Ethernet cabling with 8 wire RJ45 modular connectors.

1.1 Features



LCD Display

Four line, 80 character backlit LCD display with alphanumeric and graphic displays

Control Keypad

Six backlit silicone membrane keys – dedicated Inverter and AC input “hot” keys for control & 4 soft keys

Status Indicators

Two LED indicators: *Green = Inverter status* *Yellow = AC Input status*

Communication Protocol

Proprietary OutBack Multi-drop network using the OutBack HUB.

Interconnecting Cable

Standard CAT 5 PC network cable with RJ45 modular connectors / wired as non-crossover

Maximum Cable Length

The maximum distance that has been tested is 1000 feet of cable in an office / commercial building with success.

PC computer interface

RS232 Opto-Isolated DB9 serial communication port

1.2 Installation

The OutBack MATE is designed for surface mounting in an Indoor location. Keep the MATE out of direct sunlight to make the display easier to view.

The cabling from the MATE to the FX inverter/charger, MX60 PV MPPT charge controller or HUB is standard CAT5 type computer cable. Standard Ethernet CAT5 cable, can be found at any home improvement or computer store. Consult your local inspector for specific installation requirements. The current and voltage in the communication cable is limited to less than 30 volts DC and is considered to be a "limited energy circuit". No conduit should be required. Either CAT5 or CAT5e cable can be used. The MATE is shipped with 50' of cable with the correct RJ45 connectors already installed. Longer or shorter cables can be purchased pre-made or custom length cable can be made on site. Follow the cable manufactures' instructions when choosing connectors and crimping tools.



NOTE: The maximum tested cable length from the MATE to an OutBack product is 1000 feet (300 meters). This distance can vary depending on cable routing and location. MATE cable that is run in a 'noisy' environment (ex. MATE cable run in conduit with AC wiring) will suffer from signal degradation, impacting the maximum length the cable can be run without incurring transmission errors.

The MATE should be wall mounted at just below the eye level of the typical user. No wiring box is required, although a standard 2 gang wiring box mounted in the horizontal position (as opposed to the typical vertical position of a light switch) can be used for the cable entry. By bending the wiring at a 90 degree angle just after the connector, no wiring will be visible. The RS-232 port for the PC computer is accessible from the bottom of the MATE when it is wall mounted. It also can be removed from the wall for connection of the serial cable.

To install the MATE, unsnap the cover from the back of the MATE. There are four holes in this plate for mounting screws. After installing the mounting plate on the wall, connect the cable to the jack on the back of the circuit board. Snap the MATE onto the mounting plate and push any excess cable back into the wall.

2.0 Basic Operation

2.1 Power Up

As soon as the MATE cable is plugged into a powered OutBack product, the MATE will power-up and display several information screens. After a greeting and copyright screen appears, the next screen displayed has the MATE Code and Screen Revisions (see below).

Version Code <i>a.aa</i> Serial #xxxxxxxx Screen EE <i>b.bb</i>
--

The MATE's operation and features are dictated by the code version. The serial number displayed matches the bar coded sticker on the MATE's main PCB. This can be viewed by removing the MATE's back cover. The Screen EE version refers to the menu system currently loaded in the MATE. All of the version and serial numbers should be referred to when contacting OutBack with MATE questions.

For an explanation of the differing code versions, see the **MATE firmware revisions** topic under **MATE Release Notes** on the **OutBack Power Systems User Forum** found at: <http://www.outbackpower.com/cgi-bin/Forum/ultimatebb.cgi>.

After the Version screen the MATE will display a connected devices screen (see below). If the MATE does not find the connected device, refer to the section [7.0 Troubleshooting](#).

MATE found an FX

Searching for Devices FX Found

MATE found a MX

Searching for Devices MX Found

MATE found no OutBack Product

Searching for Devices No Devices Found
--

2.2.3 '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 setpoint 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 setpoint 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 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      Remote
function
DOWN  INC  DEC  PORT
```

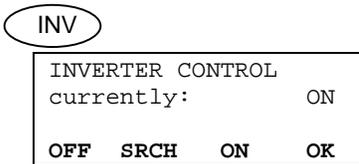
In this example, there are multiple operating modes for the aux output function. Pressing <INC> or <DEC> will cycle through the available modes.

2.2.4 The 'INV' Hot Key

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 will take you to the **INVERTER CONTROL** menu section as 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 or when the AC input source is being used, the green LED will not be illuminated.

When an OutBack HUB is employed, the **INVERTER CONTROL** options effect all FX inverters on the HUB.

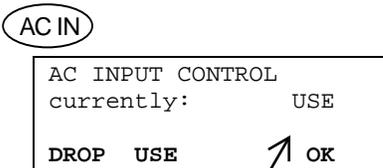


- <OFF>** Turns all the inverters connected to the MATE off
- <SRCH>** Causes the inverter to begin operating in the search mode if the AC load connected is smaller than allowed by the programming of the search function.
- <ON>** Turns all the inverters connected to the MATE on
- <OK>** Returns to the point in the menu system where you entered the **INVERTER CONTROL** screen

2.2.5 The 'AC IN' Hot Key

The OutBack MATE includes an **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 LCD display.

Above the **AC IN** key is a yellow LED indicator which flashes when an AC source is available but not connected and which is on continuously when the AC source is connected and in use. If no AC source is connected the yellow LED indicator will remain off.



DANGER: You must see "USE" in this window or problems will occur

Pressing the **AC IN** key once brings up the **AC INPUT CONTROL** screen. This screen allows the user to select whether the FX inverters connect to the AC input source. When an OutBack HUB is employed, the **AC INPUT CONTROL** only effects the Master FX connected to PORT 1. The Master then echoes the command to all of its slaves.

- <USE>** Enables the inverter to connect to the AC source when it is available
- <DROP>** Disconnects the AC input source but will allow it to be reconnected if the battery gets low or the inverter is overloaded
- <OK>** Returns to the point in the menu system from you entered the **AC INPUT CONTROL** screen

Continued on next page

AC IN AC IN

GEN START CONTROL
Currently: Auto
OFF AUTO ON OK

Pressing the **AC IN** key a second time brings up the **GEN START CONTROL** screen. This screen allows the user to change the Advanced Generator Start (AGS) mode. Modes can only be changed when Advanced Generator Start is enabled (See section [4.3 Advanced Generator Start](#) for more information). When an OutBack HUB is employed, the **GEN START CONTROL** only effects the FX that has been programmed as the AGS PORT in the AGS menu.

- <OFF> Manually overrides AGS mode and shuts off the generator
- <AUTO> Allows the MATE to automatically start and stop the generator according to the settings programmed in the AGS menu
- <ON> Manually overrides AGS mode and starts the generator
- <OK> Returns to the point in the menu system where you entered the **GEN START CONTROL** screen

AC IN AC IN AC IN

CHARGER CONTROL
currently: OFF
OFF AUTO OK

DANGER: You must see "ON" in this window or problems will occur

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. The charger's operation is independent of the inverter: you can set the charger to come on when AC is available but have the inverter stay off when AC is disconnected. When an OutBack HUB is employed, the **CHARGER CONTROL** only effects the Master FX connected to PORT 1. The Master then echoes the command to all of its slaves.

- <OFF> Disables all charger functions in the FX
- <AUTO> Enables automatic battery charging when an AC input source is connected
- <OK> Returns to the point in the menu system where you entered the **CHARGER CONTROL** screen

AC IN AC IN AC IN AC IN

CHARGER MODE CONTROL
Global charger mode
BULK EQ OK

BULK CONTROL
START STOP OK

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.

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 the **<START>** has been selected, two informational screen 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.



NOTE: For a global charger command to work, all of the OutBack products must be connected to a HUB. The **CHARGER MODE CONTROL** effects both FX inverters **and** MX60 charge controllers. This requires that the FX and MX firmware versions support this feature (See section [7.0 Troubleshooting](#) if this command fails to function).

2.3 Common Screens

2.3.1 The Main Screen

```

MAIN-----
                12:00:30P
SUM STATUS SETUP ADV
    
```

After the power-up screens is the Main screen. It is the root, or home screen to the entire menu structure. If you get lost exploring the MATE's many screens, press the two left soft keys **simultaneously** to return to the Main Screen from anywhere in the menu system. Additionally, most menu branches end with a soft key labeled <MAIN>; pressing this button will return you to the Main screen.

2.3.2 Summary Screens

The Summary screens provided by the MATE summarize the current status of all the OutBack products connected to it. Summary screens can be accessed from the Main screen by pressing the <SUM> button or can be set to pop up like a screen saver after a delay (See section 3.3 Summary Screen Options for more setup information). Any MATE button pressed while the Summary screen is being displayed returns you to the screen that was active before the summary screen was displayed.

If the MATE has one or more FXs connected to it, an FX summary screen will be displayed. It shows three bar graphs that summarize power flow in an FX system. Each bar graph is made up of segments that roughly represent 500 watts of power per FX inverter connected (ex. With 2 FXs, each segment would represent 1000 Watts).

```

DC<>AC ..... 0.0kw
AC Load .....
Buying .....
Battery                25.6V
    
```

```

DC<>AC >>>... 1.5kw
    
```

The DC<>AC bar graph represents the amount of power conversion happening in the system. It could be either the FX's inverting and supplying AC power to the loads, or the FX's charging the batteries with an AC input source. There is also a numerical read-out (in kilowatts) in the upper right hand corner.

```

AC Load ☀☀☀☀.....
    
```

The AC LOAD bar graph shows the amount of power that the FX is sending out its AC OUTPUT to power loads. This bar graph should equal the DC<>AC bar graph when all the FXs in a system are inverting and will equal pass-thru loads when all the FXs are connected to an AC source.

```

Buying   $$$$$$.....
    
```

The next bar graph denotes the power coming in or going out of the AC input terminals of the FX. Its label can be Buying when the AC input source is providing power to the FX and loads or Selling when the FX is exporting excess battery capacity back to the Grid.

```

Battery                26.5V
    
```

The last line is for displaying battery voltage.

If the MATE has one or more MX60 MPPT charge controllers attached to it, an MX summary screen will be displayed. Each arrow displayed on the MX summary screen is equal to 500 watts per MX (ex. With 3 MXs, each arrow would represent 1500 watts).

```

-----
MX CHARGER  1.5kw
>>>.....
Battery                25.6V
    
```



NOTE: A MATE connected to a HUB with both FXs and MXs connected to it will switch between both types of summary screens every 20 seconds.

2.3.3 Status Screens

The Status menu that can be accessed by pressing **<STATUS>** on the Main screen contains all the meters and mode displays for OutBack products that are connected to the MATE.

```
MAIN-----
                12:00:30P
SUM STATUS SETUP ADV
```

The Status menu is divided first by product; then it is further divided into menu categories, such as meters, modes, and statuses.

```
STATUS-----
Choose product:

FX   MX
```

The Status screens available differ by product type and revision. (See section [5.0 Menu Map](#) for locations of all of the status screens available.) Consult your specific OutBack product owner manual for an explanation of all the operating modes and meters.

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

MODES METER BATT PG2
```



NOTE: Not all Status screens are applicable to all FX models. An example would be; none Grid-Tie FX may not display grid-tie parameters.

2.3.4 Setup Screens

The Setup screens allow the user to adjust basic setpoints for the MATE and FX inverters. Changing Setpoints in the MX60 is not supported via the MATE at this time. Pressing **<SETUP>** from the Main screen allows the user to choose the FX or the MATE setup menu.

```
MAIN-----
                12:00:30P
SUM STATUS SETUP ADV
```

MATE Setup will be covered in section [3.0 MATE Setup](#).

The FX Setup menu will allow the user to change Search and Input settings only. Refer to the FX user manuals for an explanation of these settings and their functions.

```
SETUP/FX-----
Choose category:

SRCH  INPUT      MAIN
```

2.3.5 Advanced Screens

The Advanced menu system is where most of the initial system settings are programmed. Because changing these settings could adversely effect how the system operates, the user must input a password to enter the advanced menus. The settings under the Advanced menu should only be changed by someone that has read and understands the specific products (FX or MX) users manual.

The Advanced menus can be accessed by pressing the **<ADV>** from the Main screen. Pressing **<ADV>** brings up a warning screen. Pressing any of the soft keys at the warning screen will bring the user to the password screen.

```
MAIN-----
                12:00:30P
SUM STATUS SETUP ADV
```

Using the **<INC>** or **<DEC>** buttons changes the number displayed to match the Advanced menu password. When the password is set, press **<ENTER>** to go into the Advanced menu. Pressing **<EXIT>** will return the user to the Main screen.

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

The Advanced Menu Password is 141

2.3.5 Advanced Screens cont.

The Advanced menus allow the user to set most of the initial system setpoints for the FX, MX, and MATE. After entering the password choose the product you would like to change the Advanced settings for.

The FX Advanced menus have categories like:

- INV – Inverter setup
- CHGR – Charger setpoints
- GRID – Grid input setpoints
- GEN – Generator input setpoints
- AUX – FX Aux output settings
- STACK – FX stacking setup
- SELL – Grid-Tie setup
- CAL – FX meter calibrations



NOTE: Not all Advanced menu screens are applicable to every model FX. An example would be a non Grid-Tie FX may not display grid-tie parameters, or allow their adjustment.

The MX Advanced menus only allow for the setup and control of the MX60s AUX output.

The Mate Advanced menus contain the settings for:

- HBX – High battery transfer
- GRIDUSE – Time of day grid usage
- AGS – Advanced generator starting

These advanced settings are covered in section [4.0 Mate Control Modes](#)

2.4 Using the MATE with a HUB

A HUB-4 or HUB-10 can be used to connect multiple OutBack products to the MATE. A HUB-10 communication manager allows a single MATE to control and monitor a maximum of ten OutBack products, while a HUB-4 is limited to four OutBack products.

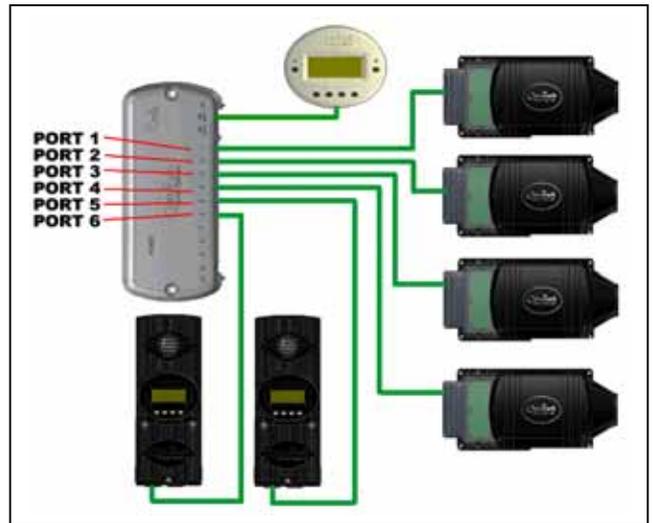
A HUB has 4 to 10 ports labeled 1-10 for various OutBack products to be plugged into.

When setting-up a HUB based system to work with the MATE, several guidelines must be followed:

A system comprised of all FX inverters must have the Master FX plugged into Port 1 of the HUB.

A system comprised of all MX charge controllers must have one of the MXs plugged into Port 1.

A system that has a mix of FXs and MXs must have the Master FX plugged into Port 1 and have the slave FXs plugged into the next lowest numbered Ports. For example, if a system comprised of 4 FX's and 2 MX's, the FXs must be plugged into Ports 1 – 4; the MXs can be plugged into any Port numbered greater than 4.



When first powering-up the system, make sure all of the OutBack products are plugged into the HUB and powered before plugging the MATE into the HUB.

When a MATE that is plugged into a HUB powers up, it will first display that it has found the HUB.

Searching
for Devices
HUB Found

Next it will display the Port Assignment screen. This screen shows all of the connected devices and what Port that they are found on. If a connected device is not shown on this screen, check that it is connected correctly and is powered up. Then either unplug and plug the MATE back into the HUB or use the RE POLL command described in the [MATE Setup](#) section to force the MATE to rediscover all devices.

Port Assignment			
1>FX	2>FX	3>FX	4>FX
5>MX	6>MX	7>--	8>--
9>--	10>--	2M>--	

Once powered up, the MATE operation with a HUB is basically the same as when the MATE is directly connected to an OutBack product.

STATUS/FX/METER-----	P01
Output	120vac
Voltage	
DOWN UP TOP	PORT

The most important difference is the Port Identifier in the upper right hand corner of most screens. The number after the **P** in **P01** tells you that the meter reading currently displayed on the screen is coming from the FX in Port 1. By pressing the **<PORT>** button, you can cycle through all of the devices on the system.



NOTE: When the user is in a menu that is dedicated to FXs, only FX Ports can be cycled through by pressing the **<PORT>** button. Using the above system as an example, only **P01**, **P02**, **P03**, and **P04** will be displayed when the **<PORT>** button is pushed while in a FX menu. Conversely, only **P05** and **P06** will be displayed when the **<PORT>** button is pressed in an MX menu.



NOTE: Any time a new device is plugged into a HUB or an existing device is moved to a different Port, the MATE must be either unplugged and plugged back into the HUB or the RE POLL command described in the [MATE Setup](#) section must be used to force the MATE to rediscover all devices.