

Dear Customer:

Thank you for hiring Miller Solar to install your Outback Power System. This manual describes the operation of the Mate 3, the device that controls the equipment and provides you with essential readings.

The equipment comes with manuals that contain way more information than the user needs. The document you are reading is abbreviated from 190 pages down to about 11. The most important points are highlighted. Please familiarize yourself with this abbreviated manual and keep it handy



In case of problems, we can talk you through most problems over the telephone.

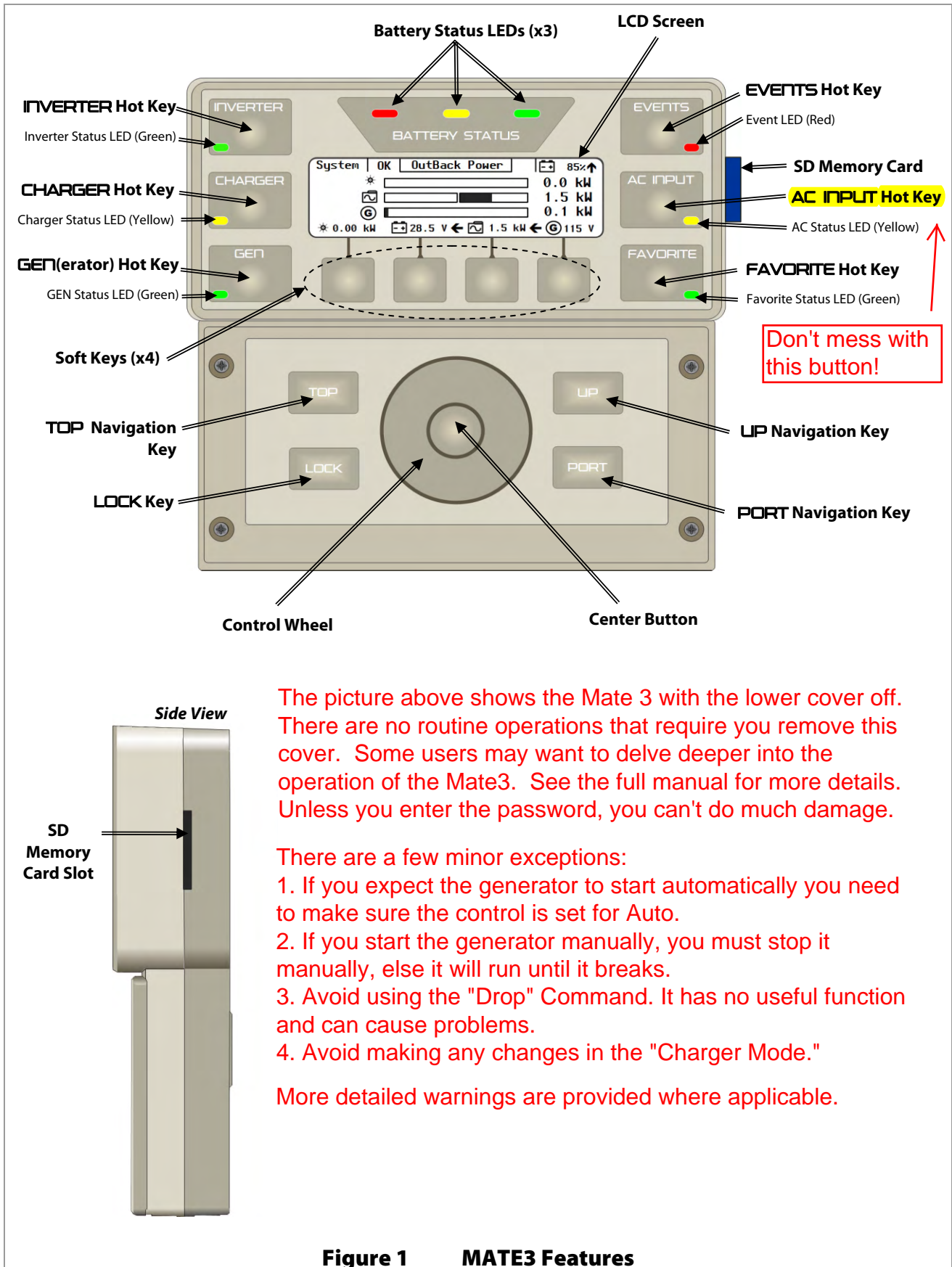
The most important thing is to take care of your batteries. We will provide information and training on the proper care and feeding of your battery bank.

# **MATE3**

## **System Display and Controller**

### **Owner's Manual**

# Introduction



The picture above shows the Mate 3 with the lower cover off. There are no routine operations that require you remove this cover. Some users may want to delve deeper into the operation of the Mate3. See the full manual for more details. Unless you enter the password, you can't do much damage.

There are a few minor exceptions:

1. If you expect the generator to start automatically you need to make sure the control is set for Auto.
2. If you start the generator manually, you must stop it manually, else it will run until it breaks.
3. Avoid using the "Drop" Command. It has no useful function and can cause problems.
4. Avoid making any changes in the "Charger Mode."

More detailed warnings are provided where applicable.

**Figure 1 MATE3 Features**



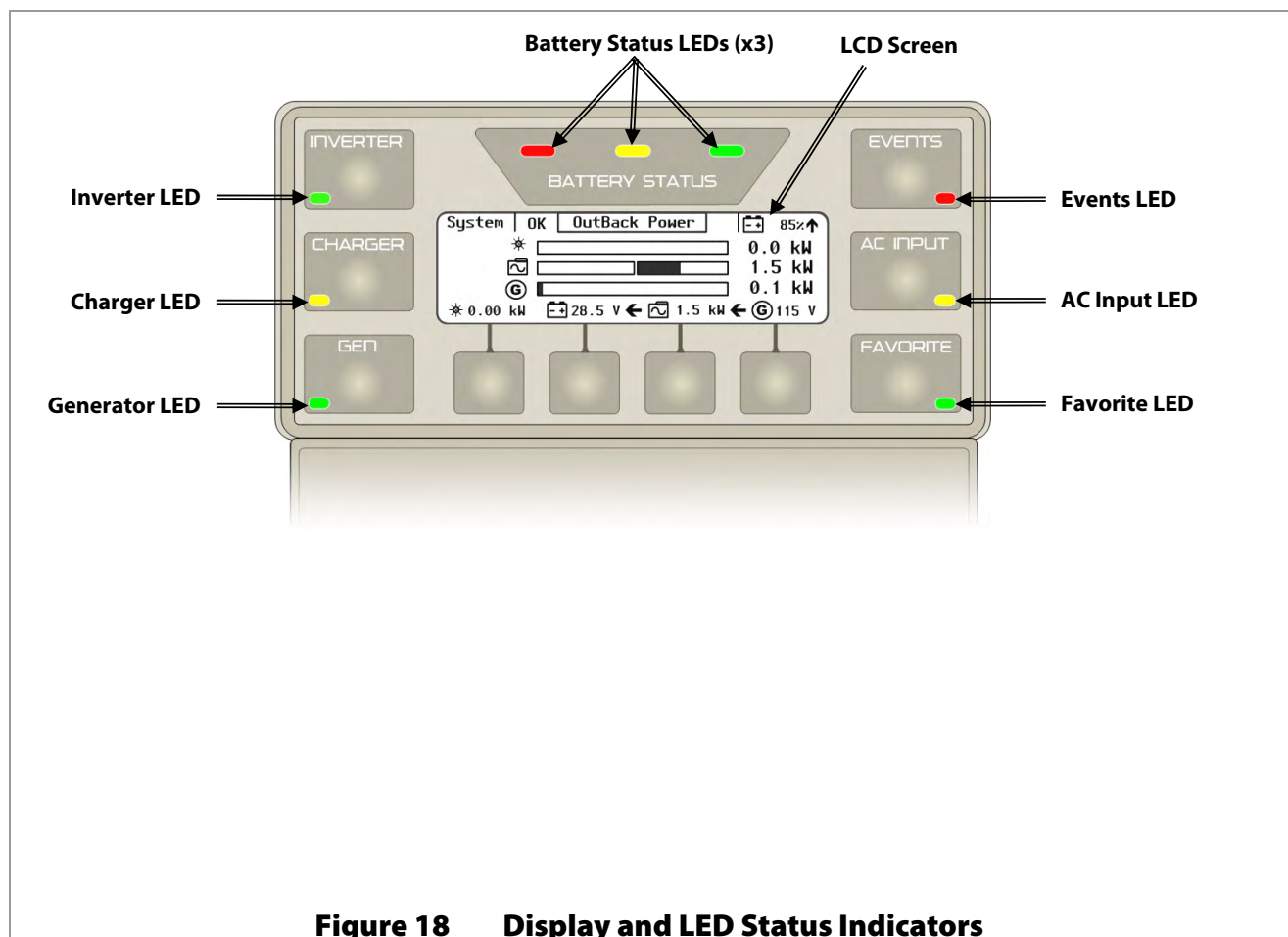
# Operation

Below is an overview of the Mate 3 controller. The unit will allow you to read critical values on your power system, make some adjustments and initiate important operations, such as starting the generator or starting an equalization charge (see attached battery instructions).

We have deleted unnecessary information so you do not need to read more than the minimum, enhancing your understanding of the really important points. We will provide training on the use and maintenance of your system.

if you wish to learn more about your Mate3 and associated equipment, please refer to the complete manual sets.

## Display and LED Status Indicators



**Figure 18** Display and LED Status Indicators

## LED Status Indicators

The actual battery voltages are a more reliable gauge on battery charge status.

### Battery LEDs

Three LEDs provide a visual reference to indicate the condition of the battery bank.

- A GREEN LED means the batteries have an adequate charge at that time. It does not always mean they are full. If an FNDC is installed, this means the batteries are  $\geq 80\%$  State of Charge (SOC).
- A YELLOW LED means the batteries are somewhat discharged. If an FNDC is installed, this means the batteries are  $\geq 60\%$  and  $\leq 70\%$ .
- A RED LED means the batteries are greatly discharged and may require attention. If an FNDC is installed, this means the batteries are  $< 60\%$ . May be accompanied by an event indicator and a **Low Battery V** error. (See pages 31 and 43.)

**Table 2 Battery Status LEDs**

Color	12 Vdc Unit	24 Vdc Unit, $\pm 0.2$ Vdc	36 Vdc Unit, $\pm 0.3$ Vdc	48 Vdc Unit, $\pm 0.4$ Vdc	Battery Status
GREEN	12.5 Vdc or higher	25.0 Vdc or higher	37.5 Vdc or higher	50.0 Vdc or higher	ACCEPTABLE
YELLOW	11.5 to 12.4 Vdc	23.0 to 24.8 Vdc	34.5 to 37.2 Vdc	46.0 to 49.6 Vdc	USABLE
RED	11.4 Vdc or lower	22.8 Vdc or lower	34.2 Vdc or lower	45.6 Vdc or lower	LOW

**NOTES:**

- Gaps in the table (higher-voltage units) are due to the resolution of the inverter's DC meter.
- These voltage settings are not the same as the inverter's Low Battery Cut-Out voltage. (See page 88.) The Battery LED settings cannot be changed.
- Voltages higher than shown in the GREEN row usually means that the batteries are charging.

### Inverter LED (green)

This LED is located on the **INVERTER** hot key. (See page 55.) It provides a visual reference for the status of the inverter operation.

- **ON** (solid) — inverter is converting DC to AC in order to power loads.
- **ON** (flashing) — the inverter is in Search mode. Not recommended.
- **OFF** (not illuminated)
  - ~ the inverter is not converting DC power to AC power, or
  - ~ the AC input source is powering the loads.

In stacked configurations, the master inverter controls this LED status. If any inverters in a stacked system have a different inverting status from the master, this LED will not display their status.

### Charger LED (yellow)

This LED is located on the **CHARGER** hot key. (See page 56.) It provides a visual reference for the status of the battery charger.

- **ON** (illuminated) — a device on the HUB is delivering more than a minimal amount of charging power. The device may be an inverter or a charge controller.
- **ON** (flashing) — the batteries are being equalized.
- **OFF** (not illuminated) — no device is actively charging the batteries, for several reasons.
  - ~ the charger(s) may be functional, but in a quiescent state such as Silent.
  - ~ the charger(s) may be functional, but the charging sources may be disconnected or unavailable.
  - ~ the charger(s) may be turned off.

## Generator LED (green)

This LED is located on the **GEN** hot key. (See page 59.) It provides a visual reference for the status of a generator that is controlled by the Advanced Generator Start (AGS) function. (See page 115.)

- **ON** (illuminated) — The generator is detected to be running after receiving an **ON** command in the **Generator Status** menu. The MATE3 determines the generator is running based on input AC voltage (if the generator type is AC). This LED will usually illuminate in conjunction with the **AC INPUT** LED. This LED will only illuminate when an AC generator is used.
- **OFF** (not illuminated) — The **Generator Status** menu has been set to **OFF**, or the AGS function has not been enabled. If the generator shuts down or stops delivering power, this LED will remain on until a generator fault is declared.

## Events LED (red)

This LED is located on the **EVENTS** hot key. (See page 61.) It indicates that an event requires acknowledgement. Generally, this LED only illuminates when a fault occurs.

- **ON** (solid) — An error has occurred. This is usually accompanied by inverter shutdown. This event can also indicate a generator fault if the voltage is lost from an automatic generator. (See page 59.)
- **ON** (flashing) — A warning has occurred.
- **OFF** (not illuminated) — No particular status. Events may be logged in Event History, but they do not require attention.

This LED will remain on until the event has been acknowledged in the **Event Status Detail** menu. (See page 61.) It may be necessary to troubleshoot and deal with the cause of the event. (See pages 42, 43, and 150.) Specific error or warning messages are defined in the inverter *Operator's Manual*.

## AC Input LED (yellow)

This LED is located on the **AC INPUT** hot key. (See page 62.) It provides a visual reference for the status of the AC input.

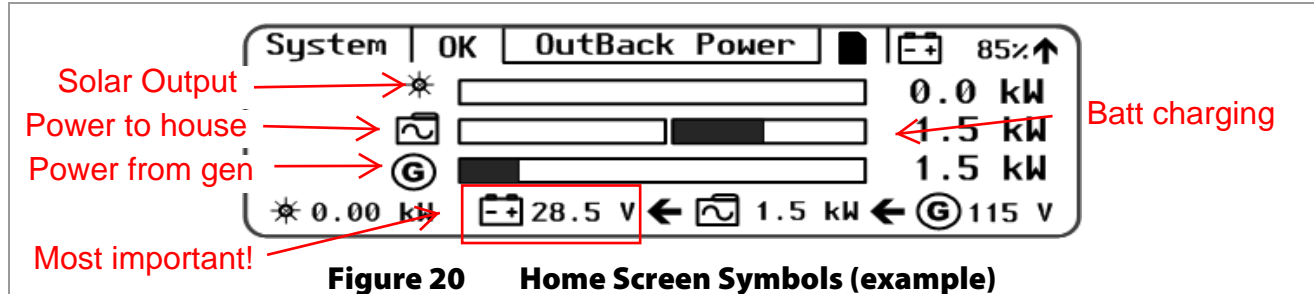
- **ON** (solid) — The AC source is connected and providing power. Unit may or may not be charging the batteries, depending on settings.
- **ON** (flashing) — The AC source is present but has not been accepted. If flashing continues, the unit is refusing the source. This can occur for the following reasons.
  - ~ The AC source may have quality issues. To determine system warnings for AC source problems see page 55 for the Warnings menu. To view AC source measurements see page 62.
  - ~ In the **AC INPUT** hot key menu, the **AC Input Status** is set to **Drop**. See page 62.
  - ~ The HBX function or the Grid Use Time function intentionally disconnected the inverter. (See page 124 and page 125 for descriptions of these functions.)
- **OFF** (not illuminated) — No AC source is detected.

In stacked configurations, the master inverter controls this LED status. If any inverters in a stacked system have a different AC input status from the master, this LED will not display their status.

There is no reason to press the AC Input button, and you can do some harm. Specifically, you don't want to use the "Drop Command".

## Home Screens

The Home screen appears after the MATE3 detects any devices that are connected to it. Home screens contain icons and meter bars that display various types of information depending on the system type selected. There are three different Home screens depending on the system type selected.



## Meter Bars

Much of the Home screen data is shown by kilowatt meters in the form of black bars. These meter bars expand to the right or to the left with an increase in wattage. The meter bars next to the various icons are based on **System Information** listed on page 74. The scale of a bar will vary with the size set for each element. (Not all data is present in all cases. See Home Screen Types below.)

- The ☀ meter bar represents the charge controller output and is scaled according to the **Array Wattage** setting.
- The left ⏏ meter bar represents inverter output and is scaled to the **Gen kW Rating** setting. If **Gen Type** is set to DC, this bar is scaled to the **Max Inverter kW** setting.
- The right ⏏ meter bar represents the inverter's charger output and is scaled to the **Max Charger kW** setting.
- The Ⓜ meter bar represents the generator output and is scaled to the **Gen kW Rating** setting.
- The left \$ meter bar represents the power bought from the grid and is scaled to the total of the **Max Inverter kW** and **Max Charger kW** settings.
- The right \$ meter bar represents the amount of power sold by the inverter and is scaled to the **Max Inverter kW** setting.
- In the Grid Tied Home screen, the ⏏ meter bar represents the amount of power being used by the loads and is scaled to the **Max Inverter kW** setting, if the inverter is not in PassThru mode. If the inverter is in PassThru, then it is equal to 7.2 kW multiplied by the number of inverters present on the HUB. For details on PassThru mode see the *Operator's Manual* for the inverter.
- In the Backup Home screen, the ⏏ meter bar is scaled differently. Please see page 36 for details.

See pages 34 through 36 for the icons and meter bars that are used with each Home screen.

The meter at the top of the page gives you an overview of power flow. It will show you:

- \* How much solar charge is coming in,
- \* How much power is going to your house
- \* How much power is coming from the generator
- \* how much power is going into the batteries for charging.

The most important value is the battery voltage. If your system is 48 volts, any voltage above 48 means the batteries are more than half charge. Less than 48 volts, less than half charged. The lowest you should see is 45, the highest is about 60. We will provide more details on these values during your training.

## Hot Keys

Six hot keys are available to navigate through the most commonly used operational screens. Some screens will have operational options, such as ON, OFF, or AUTO. Some will show current operational status for that function. Status, mode, and measurements are the collective status of the system, not of an individual inverter, unless specified otherwise.

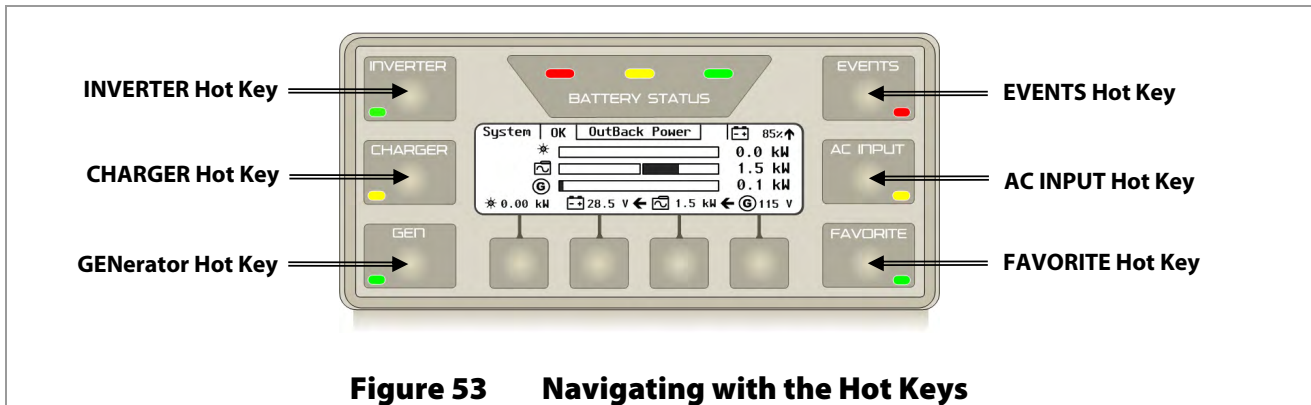


Figure 53 Navigating with the Hot Keys

## INVERTER Hot Key

The **INVERTER** hot key displays the *Inverter Status* screen. The *Inverter Status* screen displays the current inverter mode, input and output voltage and wattage, battery voltage, and load draw.

The **INVERTER** hot key can also be used to turn the inverter on or off. This is a global command issued to all inverters.

If you ever get a system overload, correct the problem then turn the inverter off and then back on. This resets the inverter.

Inverter Status			
Mode	ON	Battery	28.5 V
Input	115 VAC 1.5 kW		
Output	115 VAC 0.0 kW	Load	0.0 kW
Back	On	Off	Search

**Soft Key Options:**

- <Back> returns to the Home screen.
- <ON> turns the inverter ON.
- <OFF> turns the inverter OFF.
- <Search> toggles the Search mode **ON** or **OFF**.

Avoid the search mode. It does not help in 99% of systems.

**Screen Items:**

- Mode** displays the setting selected by the soft keys (<ON>, <OFF>, or <Search>).
- Battery** displays the battery voltage, not compensated for temperature. (See page 41 for the compensated value.)
- Input** displays the AC input source voltage and the power in kilowatts drawn from the AC source.
- Output** displays the voltage measured at the inverter's output and the power in kilowatts produced by the inverter. The inverter's produced power may equal the load wattage, but it may also include power sold to the grid (in grid-interactive inverters).
- Load** displays the power in kilowatts delivered to the inverter's output.

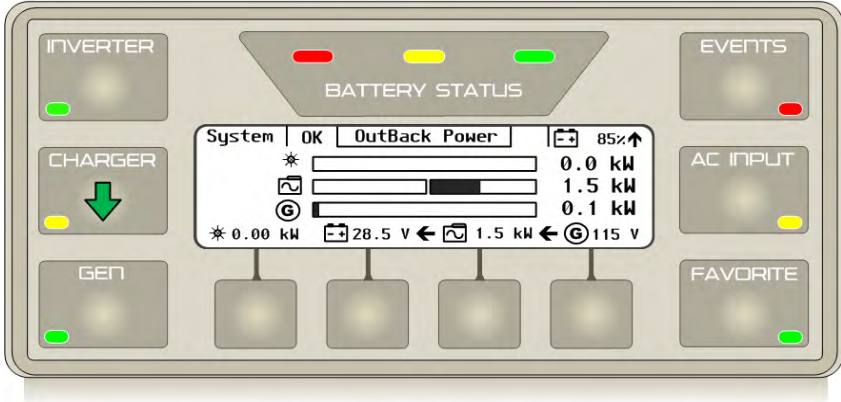
Figure 54 Using the INVERTER Hot Key

## CHARGER Hot Key


The **CHARGER** hot key displays the **Charger Status** screen. The **Charger Status** screen displays the current charger mode, battery voltage, absorb and float voltage settings and timers. Soft key options include starting or stopping the charger, which is a global command issued to all inverters in the system. Other options include starting or the bulk or equalization charge functions, which are global commands issued to all inverters and charge controllers in the system.


**NOTE:** The charging information displayed on this screen is for inverters only. In a multiple inverter system, the master inverter controls this status. If an inverter or charge controller has a different charging status from the master inverter, this screen will not display its status.


**CHARGER Hot Key**




Charger Status	
Battery	28.5 V
Absorb	29.2 V
Float	26.8 V
Charger Control	ON
	00:00 remaining
	00:00 remaining
Back	Bulk Charge
	EQ Charge
	Charger Mode









**Soft Key Options:**

- <Back> returns to the Home screen.
- <Bulk Charge> advances to the **Bulk Charge** screen to start a new charging cycle.
- <EQ Charge> advances to the **Equalize Charge** screen.
- <Charger Mode> advances to the **Charger Mode** screen to enable or disable the charger.

**Screen Items:**

- Battery** displays the uncompensated battery voltage.
- Charger Control** displays the mode of the charger.
- Absorb** displays the target voltage for the Bulk and Absorption stages.
- Float** displays the target voltage for the Float stage.

If the timer is running to the right of either **Float** or **Absorb**, the system is in that charging stage.

If your batteries can be opened, they are called 'flooded' batteries. They need to have water checked and an equalization charge every 30 days. This button starts the process. See the Miller Solar battery white paper for details. This is very important!

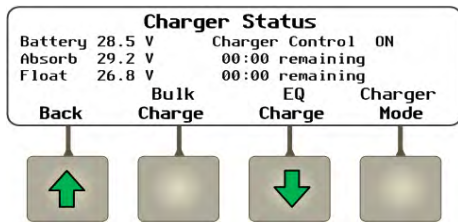
**Figure 55 CHARGER Hot Key**

This key allows you to make bad choices about battery charging operations. We suggest you stay away from this menu.



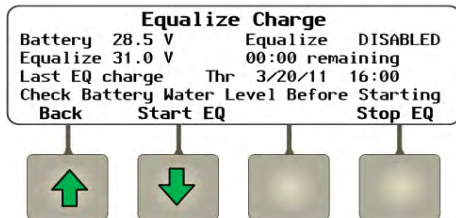
## Operation

From the **CHARGER** hot key's **Charger Status** screen, the **<EQ Charge>** soft key brings up a series of screens that can turn on the battery equalization process.



Screens below continue the process to equalize the batteries.

If your batteries cannot be opened or if you have a grid connection, you can ignore this step. See Miller Solar for details.



### Screen Items:

**Battery** displays the uncompensated battery voltage.

**Equalize** (below **Battery**) displays the target voltage for the Equalization stage. The timer to the right of this item begins running once this voltage is reached.

**Equalize** (right side of screen) displays whether this mode is enabled or disabled.

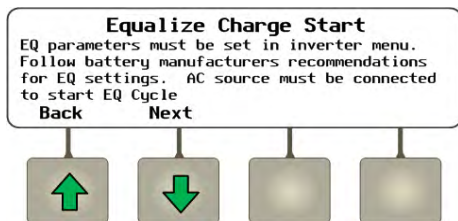
**Last EQ charge** displays the date and time for the most recent equalization cycle.

### Soft Key Options:

**<Back>** returns to the **Charger Status** screen.

**<Start EQ>** starts the equalize charging stage.

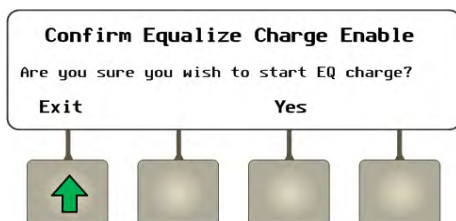
**<Stop EQ>** stops the equalize charging stage.



### Soft Key Options:

**<Back>** returns to the **Equalize Charge** screen.

**<Next>** advances to the confirmation screen.



### Soft Key Options:

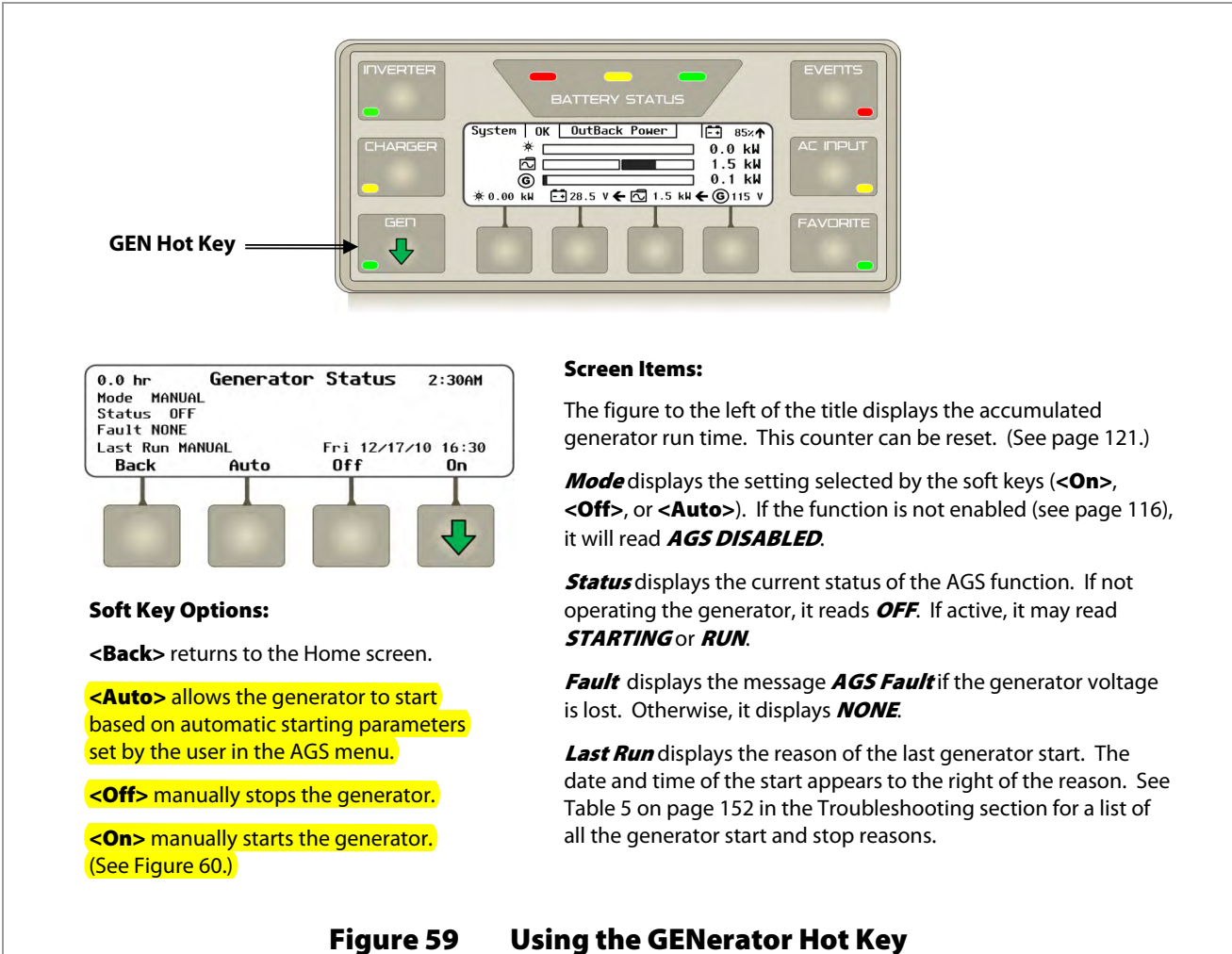
**<Exit>** returns to the **Charger Status** screen.

**<Yes>** begins the equalization process and simultaneously returns to the **Equalize Charge** screen. The process can be stopped by pressing the **<Stop EQ>** soft key on the **Equalize Charge** screen.

**Figure 57 Using the CHARGER Hot Key (EQ Charge)**

## GENERator Hot Key

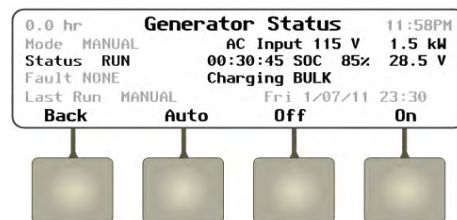
The **GEN** hot key displays the **Generator Status** screen. The **Generator Status** screen displays information on the Advanced Generator Start (AGS) mode. Soft key options include: **<Back>**, **<Auto>**, **<Off>**, and **<On>**.



**Figure 59 Using the GENERator Hot Key**

When **<On>** is pressed, generator data appears on the right side of the screen.

- The first line displays the generator's AC voltage and the number of kilowatts being used from the generator.
- The second line displays the updated status **RUN**, the length of time since the start command was sent, the battery state of charge (**SOC**), and the battery voltage. (If no battery monitor is present, the **SOC** field will be blank.)
- The third line displays the charging stage.



**NOTE:** The generator can only be started if the AGS mode is enabled in **AGS Setup** (see page 116). If it is not enabled, this information will not appear.

**Figure 60 Generator Status Screen**

END OF ABBREVIATED MANUAL