OutBack POWER™

an EnerSys® company

Mojave™ Grid-Hybrid Energy Storage System

Operator's Manual

GRIDHybrid™

OPTICS RE Compatible

About OutBack Power

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

Applicability

These instructions apply to the OutBack Power Mojave Energy Storage System only.

Contact Information

Address:	3767 Alpha Way Bellingham, WA 98226 USA
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Warranty

The warranty for this product can be downloaded from www.outbackpower.com/downloads/warranty_and_safety/warranty_mojave. A printed copy is available by sending a self-addressed envelope to the above address.

Notice of Copyright

Trademarks

Date and Revision

February 2022, Revision B

Part Number

900-00277-01-001 Rev B

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General Safety

Audience

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

Symbols Used

WARNING: Hazard to Human Life

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

CAUTION: Hazard to Equipment

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

IMPORTANT:

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

NOTE:

This type of notation indicates useful information. This symbol is not always used.

MORE INFORMATION

This symbol means that more information is available in other literature. If a number is present, it refers to the corresponding QR code near the beginning of the section. A numbered symbol is also a clickable hyperlink.

Symbols Used on the Mojave Inverter

The symbols shown below mean the following:

	**WARNING: To reduce risk of injury, read all instructions** The instructions indicated here include this manual, as well as the *Mojave Inverter/Charger Overview Guide*, the *Mojave Inverter/Charger Quick Start Guide*, and any other pertinent literature.

Symbols Used on the Mojave Battery

The symbols shown below mean the following:

	**WARNING: To reduce risk of injury, read all instructions** The instructions indicated here include this manual, as well as the *Mojave BatteryQuick Start Guide*, and any other pertinent literature. **AVERTISSEMENT : Pour prévenir les blessures, lire toutes les instructions**
	**WARNING: Hazardous voltage circuits** **AVERTISSEMENT : Circuits à tension élevée**

General Safety

	**WARNING: Limitations on Use** This equipment is NOT intended for use with life support equipment or other medical equipment or devices.
	**WARNING: Reduced Protection** If this product is used in a manner not specified by Mojave product literature, the product's internal safety protection may be impaired.
	**CAUTION: Equipment Damage** Only use components or accessories recommended or sold by OutBack Power or its authorized agents.

Introduction

Welcome to OutBack Power

Thank you for purchasing the Mojave™ OGHESS8015A Energy Storage System, or Mojave ESS. The ESS consists of the Mojave OGHI8048A inverter and the Mojave ESS lithium-ion battery.

This system can be used to add energy storage and backup capability to a grid-direct (GD) inverter and PV system. It is designed to be “AC Coupled”; that is, the ESS is meant to be installed in existing grid-direct systems to add energy storage and backup capability without interfering with grid interaction.

The system has an integrated wireless (wi-fi) hotspot and can also be connected to other local networks, wirelessly or by using a physical Ethernet connection.

CAUTION: Hazard to Equipment

The Mojave ESS battery may only be used with the Mojave OGHI8048A inverter. The Mojave ESS battery is not designed for use with any other products.

Figure 1 Mojave Inverter/Charger and Battery

Inverter Functions

- Battery-to-AC inverting which delivers power to run backup loads and other functions
  - Split-phase output
  - Model OGHI8048A can continuously produce up to 8 kVA (33 Aac)
- AC-coupled interaction
  - Mojave inverter accepts power on **GRID** connection and transfers it to protected **LOAD** connection
  - GD inverter is present on **LOAD** and maintains **GRID** connection through the Mojave inverter
  - **LOAD** connection accepts exported power from GD inverter and exports it back to **GRID**
    - ✓ Any loads on the Mojave inverter output will also be supported by the GD inverter production.
    - ✓ During grid loss, the Mojave inverter's protected load output will keep the GD inverter energized; exported power from the GD inverter will be used to run loads
- AC-to-battery charging
  - Requires split-phase input and a neutral conductor
  - During AC coupling, surplus GD inverter power can be used to charge the Mojave battery
- Dual AC inputs allow direct wiring to multiple sources
  - Utility grid
  - AC generator
- Rapid transfer between AC source and inverter output with minimal delay time
- Automatic generator start (AGS) function in the event of low batteries or other conditions
- Listed by UL to UL 1741 (2nd Edition with supplements SA and SB) and CSA 22.2 #107.1-16
- Meets SunSpec IEEE 2030.5-2018 CSIP
  - Provides secure communications protocols with utility companies
  - Certified for California Rule 21 Phase 2 and Phase 3, Functions 1 and 8

CAUTION: Equipment Damage

- ❖ This product is for use in backup power and AC-coupled applications. Use with independent solar charge controllers is not supported at this time.
- ❖ This product is designed and tested for stationary applications only. It is not listed or warranted for mobile use.
- ❖ This product is designed for use with the external current transducers included in the box. Other current transducer products must not be used.

Accessories

IMPORTANT:

The Mojave OGHI8048A inverter includes integrated communications and does not require accessories such as a system display. It is not compatible with previous system display products, including MATE-class or MATE3-class system displays. It is not compatible with HUB products or FM-class charge controllers.

Table 1 Accessories Included

Included in Inverter Packaging	Included in ESS Packaging	
Mojave Literature	ESS Literature	Wiring Gutter/Cover
Inverter Hardware	Battery Hardware	Ground-Bonding Conductor
Mounting Bracket	External Covers (2)	Battery Cables
Wi-Fi Antenna	Labels	CAT5E Cable
Current Transducers (2)		

User Interface

Accessing the User Interface (UI)

The Mojave inverter's web-based user interface allows monitoring and programming of all items. It can be accessed using a web browser once a local area network connection is established. The following information assumes local access. For remote access using the OPTICS RE site, see page 25.

Check the tablet, smartphone, or other device that will be used for access. A new wi-fi connection will appear after power-up. It appears as "Mojave-xxxx" and incorporates part of the inverter's serial number. Connect to the device. When prompted for a wi-fi password, the password consists of the last eight digits of the inverter's serial number. (See page 30 for serial number location.) In a new browser window, enter the inverter's IP address, which is 192.168.2.2. This will open the UI.

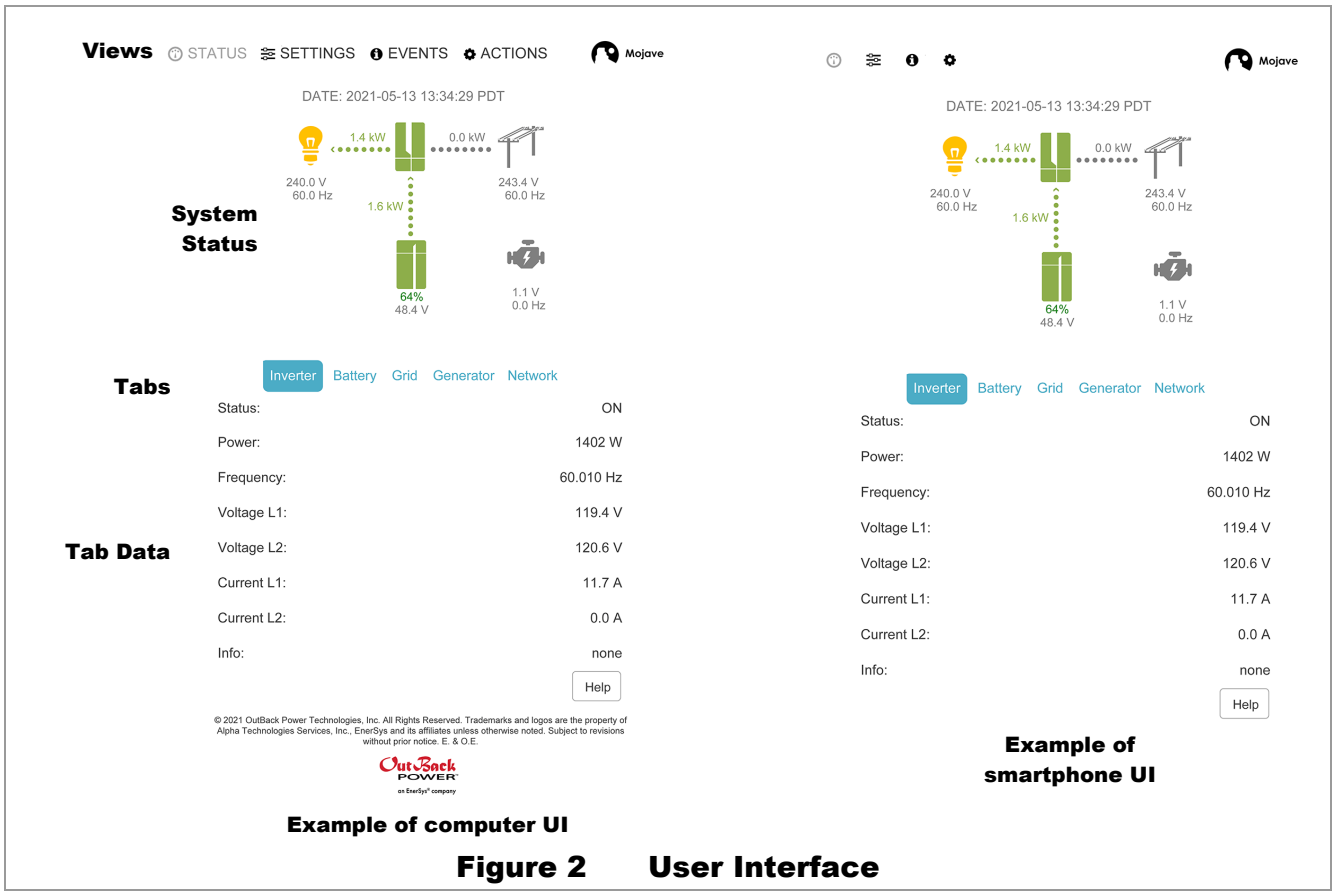


Figure 2 User Interface

NOTE:

Upon initial UI access, an overlay will appear. The viewer can use it to "walk" through available screens and options. Buttons will appear for the **Previous** or **Next** screen.

Tabs and Views

The interface features five tabs showing inverter functions. The tabs are **Inverter**, **Battery**, **Grid**, **Generator**, and **Network**. When a tab is selected, a solid box will appear around it.

The tabs are accessed with either of two views: **STATUS** and **SETTINGS**. Two additional views, **EVENTS**, and **ACTIONS**, allow access to more details not accessed by the tabs. When a view is selected, the title will turn gray.

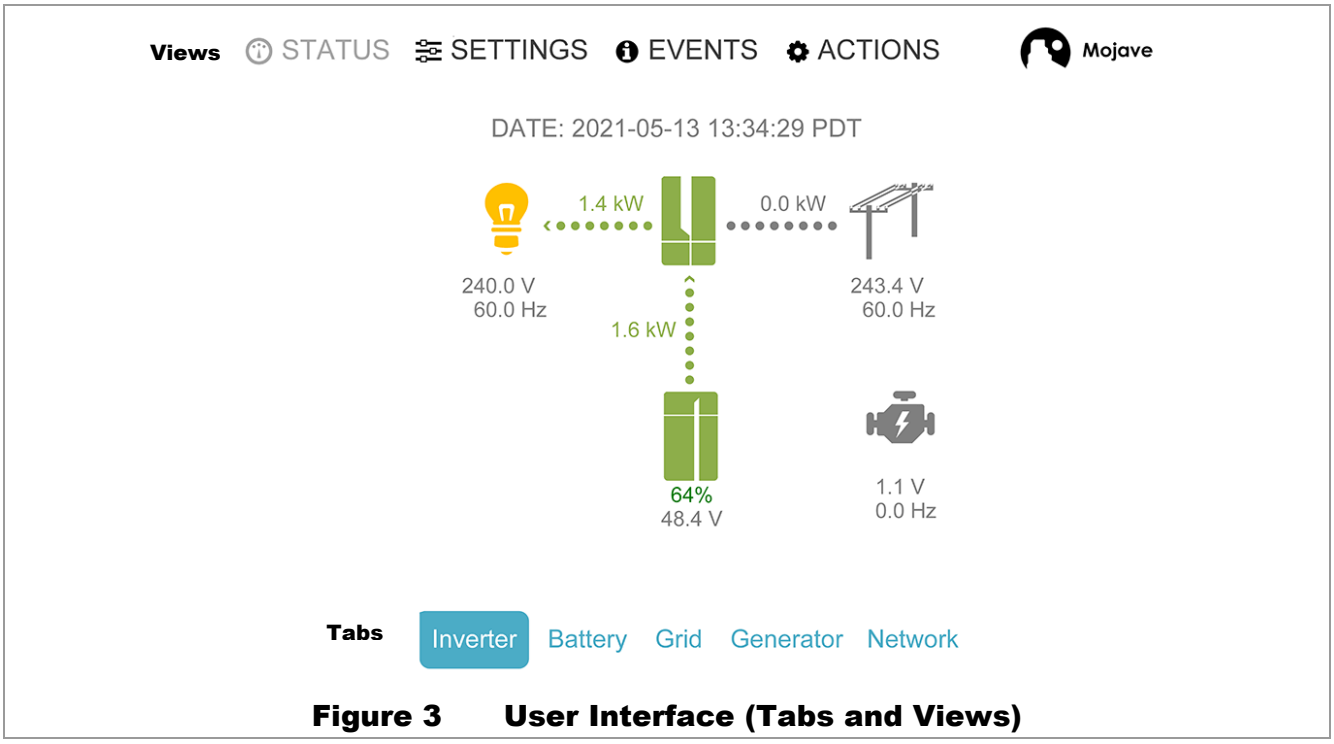


Figure 3 User Interface (Tabs and Views)

The **STATUS** view allows system monitoring. This is the default view; it will appear initially after connection. Selecting an individual tab brings up a table with data. See page 13 for more information on this view and each tab.

The **SETTINGS** view allows functions to be changed. Selecting an individual tab brings up a table with set points. This view also depicts a sixth tab, **Admin**, which permits login for higher-level access. See page 23 for a brief description of **SETTINGS**. See page 28 in the **Operations** chapter, for a full description of inverter functions as related to these settings.

The **ACTIONS** view features basic controls such as turning the inverter and some of its functions on and off. See page 22.

The **EVENTS** view features a history of significant inverter events. See page 24.

Most views feature a **Help** button which re-opens the UI overlay from page 11. This provides a walk-through of the screen as a reminder.

STATUS View

The **STATUS** view provides a simplified graphic of the supported elements in this system, the power flow to each, and other data.

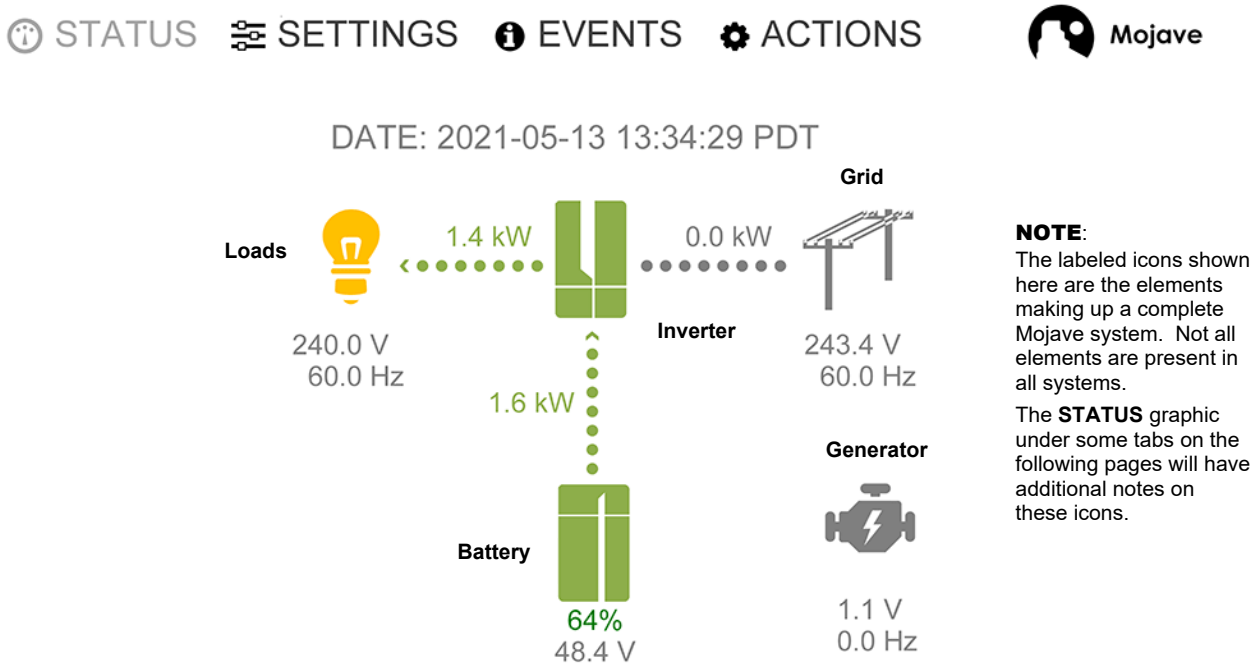


Figure 4 User Interface (Status Graphics)

- **SYSTEM TIME**: This displays the time of day (24-hour format), date, and time zone. It is normally synchronized automatically (to connected device or internet).
  - This item can be reset by entering any login under the **Admin** tab (see page 30). A small SET icon will appear to the right of this item. When pressed, a pop-up will appear, confirming update to the local time and date. Press the **OK** button to proceed. A complete reset of all power sources may be needed if the time zone has changed.
- Dotted lines: The flow of power between devices is shown by dotted lines between icons. Each line will "ripple" in the direction of power flow. This is also shown by a chevron-style arrow at the destination icon.
  - A green dotted line indicates power not purchased from grid or generator.
  - During AC-coupled operation (see page 35), the line to the load icon will be green and point to the right. If power is being exported to the grid, the grid icon line will also be green and point to the right.
  - A red dotted line indicates power purchased from grid or generator.
  - A red-green dotted line (leading to the loads) indicates a combination of power taken from both battery and utility grid.
  - A dotted line pointing away from the battery icon indicates that the battery is discharging. A dotted line pointing toward the battery indicates that it is charging. The color will depend on the source.

- **Icons:**
  - **Grid**: The utility grid source on the **GRID** terminals. This icon displays grid voltage and frequency. See page 18 for more information, including all ***Status*** items below.

    Icon colors:

    - ✓ Green = grid ***Status*** is ***Connected***. Inverter is using grid power. The grid relay is closed. (See page 42.)
    - ✓ Yellow = connection has been limited, by one of two means.

      When ***Inverter*** is set to ***Off*** in the ***Action Menu*** while **Grid Input** was set to ***Use***, ***Status*** is ***Connected***. The inverter will close the grid relay to transfer power to loads. However, it will not connect this power with the battery charger or any internal function.

      If **Grid Input** was set to ***Drop*** in the ***Action Menu***, ***Status*** is ***Dropped***. No power will be transferred. The inverter will run loads with battery power, if it is able.
    - ✓ Red = problem with grid source. See the ***Info*** item on page 18.
    - ✓ Gray = grid ***Status*** (and grid power) is ***Not Available***. The grid relay is open. The icon will be gray with a ***Status*** of ***Disconnected*** if the grid relay is automatically opened for another reason while grid power is still present.

  - **Inverter**: The Mojave inverter itself. See page 16 for more information, including all ***Status*** items.

    Icon colors:

    - ✓ Green = inverting, charging, or other normal operation. The inverter ***Status*** is simply ***ON***.
    - ✓ Yellow = inverter is operating, but is in a ***Warning*** state. See the **EVENTS** view on page 24.
    - ✓ Red = inverter has shut down with a status of ***Error***. This will usually be shown by the main LED indicator turning red. See the ***Info*** item on page 16, the **EVENTS** view on page 24, and **Troubleshooting** on page 63 for more information on symptoms and errors.

      See page 28 for more information on the main LED indicator.
    - ✓ Gray = inverter is inactive. It has been set to the status of ***OFF***.

  - **Loads**: The protected items on the **LOAD** terminals. This icon displays load voltage and frequency. See page 16.

    Icon colors:

    - ✓ Green = inverter is performing **AC Coupling**. See page 35.
    - ✓ Yellow = inverter is powering loads, either by battery, grid, or generator.
    - ✓ Red = inverter has shut down with a status of ***Off***. The inverter has detected an error at the **LOAD** terminals. See the ***Info*** item on page 16 and the **EVENTS** view on page 24.
    - ✓ Gray = no loads are being powered.

- **Battery**: The Mojave Lithium-Ion Battery. This icon displays state of charge (SoC)% and battery voltage. See page 16.

  Icon colors:

  - ✓ Green = any active battery condition (inverting, charging, etc.) during normal operation. It may not be green if any of the low-battery criteria have been met.
  - ✓ Yellow = low-battery (minimum SoC) criteria were met. A low-battery error may occur. See page 44.
  - ✓ Red = battery-related error. This is most likely a low-battery condition, a high battery temperature, or a BMS issue. See the ***Info*** item on page 16, the **EVENTS** view on page 24, and **Troubleshooting** on page 64 for more information on the problem.
  - ✓ Gray = no current flow in any direction.

- **Generator**: The AC source on the inverter's **GEN** terminals. This icon displays generator voltage and frequency. See page 19.

  Icon colors:

  - ✓ Green = generator ***Status*** is ***Connected***. Inverter is using generator power. The generator relay is closed. (See page 49.)
  - ✓ Yellow = generator is running, but inverter is not accepting power. The generator relay is open. Status may be ***Warming Up*** or ***Cooling Down***.

    If **Gen Input** was set to ***Drop*** in the ***Action Menu***, ***Status*** is ***Dropped***.
  - ✓ Red = problem with generator source. See the ***Info*** item on page 16, the **EVENTS** view on page 24, and **Troubleshooting** on page 63 for more information on the problem for more information on the problem.
  - ✓ Gray = generator ***Status*** (and generator power) is ***Not Available***. The generator relay is open. This should appear when the generator is not running. The icon will be gray with a ***Status*** of ***Disconnected*** if the generator relay is automatically opened for another reason while power is still present.

Inverter Tab

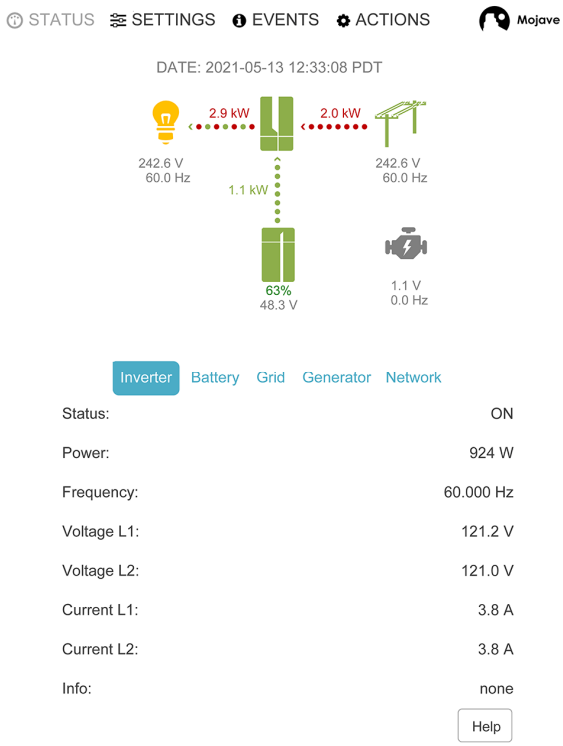


Figure 5 User Interface (Inverter tab, STATUS view)

This tab shows basic inverter output information. The first item is inverter ***Status***:

- ***ON***: Inverter set to ***On*** in **ACTIONS**. See page 22.
- ***OFF***: Inverter set to ***Off*** in **ACTIONS**.
- ***Error***: Shutdown due to a critical issue. See the **EVENTS** view on page 24 and **Troubleshooting** on page 63 for more information on symptoms and errors.

o ***Power*** — The power in watts (W) being exported using the inverting function.

o ***Frequency*** — The frequency in hertz (Hz) delivered by the internal frequency control.

o ***Voltage L1*** — The voltage in AC volts (Vac) measured at the inverter's L1 **LOAD** terminal.

o ***Voltage L2*** — The voltage in AC volts (Vac) measured at the inverter's L2 **LOAD** terminal.

o ***Current L1*** — The current in AC amperes (Aac) measured as imported or exported at the inverter's L1 **LOAD** terminal.

o ***Current L2*** — The current in AC amperes (Aac) measured as imported or exported at the inverter's L2 **LOAD** terminal.

Info — This item lists a series of messages providing additional information to what is shown in ***Status***. A common message is ***Performing Energy Management*** (when the **Time of Use** function is operating). It is equally common for this item to read ***None***. When ***Error*** is present as a ***Status***, the specific name of the error will appear here.

See the **EVENTS** view on page 24 and **Troubleshooting** on page 63 for more information on symptoms and errors.

Battery Tab

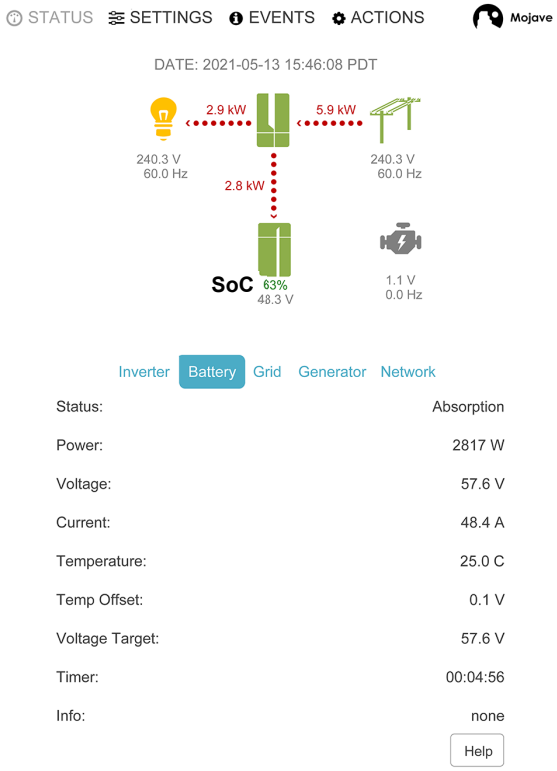


Figure 6 User Interface (Battery tab, STATUS view)

This tab shows battery information. Note that state of charge (SoC) is not included as one of these data items. It is shown in Figure 6 above.

The first item is battery charger ***Status***:

- ***Error***. Shutdown due to a battery-related error.
- ***BMS***: The charger is under the control of a battery management system (BMS). This is the usual status when using the Mojave Lithium-Ion Battery. See page 45.
- ***Off***: Unable to use the batteries due to an error elsewhere in the system. ***Error*** will be visible as a status under another tab. The appropriate icon will also be red. The battery icon will be gray.

o ***Power*** — The net power in watts (W) being imported from, or delivered to (in charging), the battery.

o ***Voltage*** — The voltage in DC volts (Vdc) measured at the inverter's internal battery terminals.

o ***Current*** — The net current in DC amperes (Adc) measured as imported or exported from the batteries.

o ***Temperature*** — The battery temperature in degrees Celsius as measured by the BMS.

o ***Temp Offset*** — This field is not used. It will read zero as long as the BMS is in use.

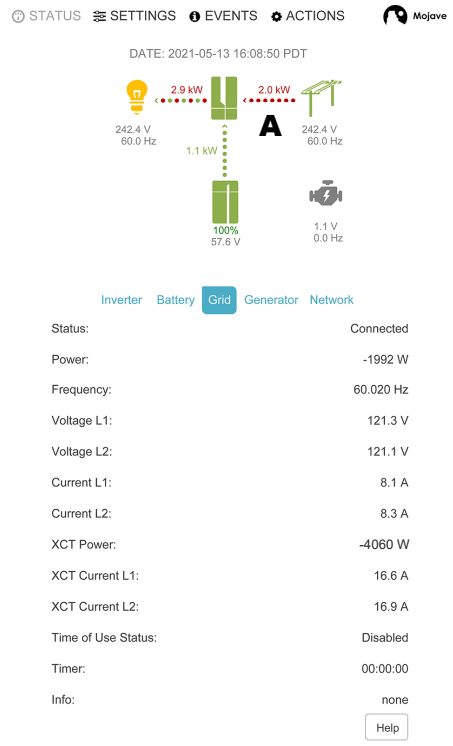
o ***Voltage Target*** — The target voltage requested by the BMS. See page 45.

o ***Timer*** — This field is not used. It will read zero as long as the BMS is in use.

Info — This item lists a series of messages providing additional information to what is shown in ***Status***. A common message is ***Discharging to support TOU schedule*** (when the **Time of Use** function is operating). It is equally common for this item to read ***None***. When ***Error*** is present as a ***Status***, the specific name of the error will appear here.

See the **EVENTS** view on page 24 and **Troubleshooting** on page 63 for more information on symptoms and errors. See page 69 to troubleshoot problems with the Mojave ESS battery.

Grid Tab



NOTE: The external current transducer (XCT) fields described in the bullets below will only appear if the XCT is enabled. (See page 39.)

The current transducers are placed at the main electrical panel. (See Figure 15 on page 27.) This point is represented by **A** in this image.

- When power flows through **A** from left to right (to the grid), the XCT readings noted below will be positive values.
- When power at A flows from right to left (from the grid), the XCT readings will be negative, as shown in the examples on this page.

Figure 7 User Interface (Grid tab, STATUS view)

This tab shows information on the inverter's connection to the utility grid. The first item is grid ***Status***:

- ***Connected*** — grid power is accepted for use. The grid relay is closed. (See page 42.)
- ***Disconnected*** — voltage is present at the **GRID** terminals, but the power is unacceptable or was manually disconnected. The grid relay is open.
- ***Dropped*** — grid power was manually disconnected in the ***Actions Menu***. The grid relay is open.
- ***Error*** — the inverter has detected a critical problem at the **GRID** terminals. The grid relay is open.
- ***Not Available*** — no voltage (or minimal voltage) is detected at the **GRID** terminals.

o ***Power*** — The net power in watts (W) being imported from, or exported to, the L1 and L2 **GRID** terminals.

o ***Frequency*** — The frequency in hertz (Hz) measured at the inverter's L1 and L2 **GRID** terminals.

o ***Voltage L1*** and ***Voltage L2*** — The voltage in AC volts (Vac) measured at the L1 and L2 **GRID** terminals.

o ***Current L1*** and ***Current L2*** — The current in AC amperes (Aac) measured at the **GRID** terminals.

o ***XCT Power*** — The net exported power in watts (W) measured at the external current transducers. This will read zero if the transducers are disabled. See pages 27 and 39.

o ***XCT Current L1*** and ***XCT Current L2*** — The current in AC amperes (Aac) measured at the L1 and L2 current transducers. This will read zero if the transducers are disabled. See pages 27 and 39.

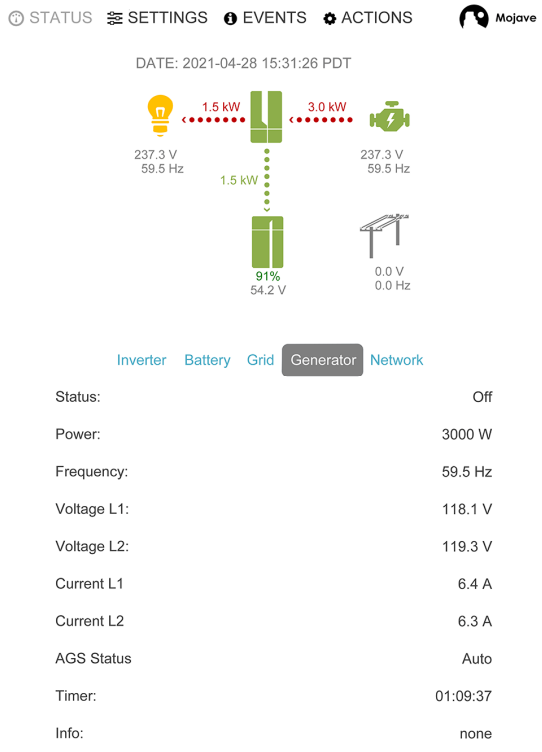
o ***Time of Use Status*** — ***Disabled***, ***Off-Peak (Grid)***, ***On-Peak (Battery)***. See page 36.

o ***Timer*** — The timer that runs when the ***Status*** is ***Connecting***.

o ***Info*** — This item lists a series of messages providing additional information to what is shown in ***Status***. A common message is ***Grid dropped***. It is equally common for this item to read ***None***. When ***Error*** is present as a ***Status***, the specific name of the error will appear here.

See the **EVENTS** view on page 24 and **Troubleshooting** on page 63 for more information on symptoms and errors.

Generator Tab



NOTE: When a generator is installed, the generator and grid icons will switch places.

Figure 8 User Interface (Generator tab, STATUS view)

This tab shows information on the inverter's connection to an AC generator. This includes the status of automatic generator starting (AGS), if used. The first item is generator ***Status***:

- ***Warming Up*** — generator is running without connecting to the inverter. The generator relay is open. The ***Timer*** is counting down the warmup time before connection.
- ***Connected*** — generator power is accepted for use. The generator relay is closed. The ***Timer*** is counting the generator's running time.
- ***Disconnected*** — voltage is present at the **GEN** terminals, but the power is unacceptable or was manually disconnected. The generator relay is open.
- ***Cooling Down*** — generator is running without connecting to the inverter. The generator relay is open. The ***Timer*** is counting down the cooldown time before stopping the generator.
- ***Dropped*** — generator power was manually disconnected in the ***Actions Menu***. The generator relay is open.
- ***Error*** — the inverter has detected a critical problem at the **GEN** terminals. The generator relay is open.
- ***Not Available*** — no voltage (or minimal voltage) is detected at the **GEN** terminals. The generator relay is open.

Additional items under the **Generator** tab:

- ***Power*** — The power in watts (W) being imported from the generator.
- ***Frequency*** — The frequency in hertz (Hz) measured at the inverter's L1 and L2 **GEN** terminals.
- ***Voltage L1*** and ***Voltage L2*** — The voltage in AC volts (Vac) measured at the inverter's L1 and L2 **GEN** terminals.
- ***Current L1*** and ***Current L2*** — The current in AC amperes (Aac) measured at the inverter's L1 and L2 **GEN** terminals.
- ***AGS Status***
  - ***Enabled*** — The AGS function has been activated in the ***Actions Menu*** and also in ***AGS*** under the **Generator** tab. (See pages 22 and 46.) It is waiting for proper conditions to start the generator.
  - ***Disabled*** — The AGS function has been been deactivated in the ***Actions Menu,*** in the **Generator** tab, or both. The generator may be started manually, but it will not start automatically.
- ***Timer*** — The timer that runs when the ***Status*** is ***Warming Up***, ***Connected***, or ***Cooling Down***.
- ***Info*** — This item lists a series of messages providing additional information to system operation. AGS conditions will appear here. A common message is ***Gen going through warmup period***. If the generator is not in use, this item will read ***None***. When ***Error*** is present as a ***Status***, the specific name of the error (such as ***At Minimum SOC setting***) will appear here.

See the **EVENTS** view on page 24 and **Troubleshooting** on page 63 for more information on symptoms and errors.

Network Tab

This tab shows the information for connection to a personal computer or network. As these settings can be customized (see page 32), not all items may match what is shown here.

- ***Wireless*** — The connection state when using a wireless ("wi-fi") network connection.
  - ***Disabled*** — The configuration has manually disabled the connection.
  - ***Disconnected*** — The wireless interface is enabled but is not able to connect.
  - ***Connected*** — The interface is enabled and connected.
  - ***Limited*** — The interface has a connection to the local network, but cannot reach external resources, such as internet.
- ***SSID*** — Service Set IDentifier; the designated name of the user's wireless network.
- ***IP Address*** — Internet Protocol address; the unique identifier assigned to the Mojave inverter.
- ***Netmask*** — The subnet "mask" assigned to the Mojave inverter.
- ***Gateway*** — The IP address of the device used to transfer requests between internet and local network. This often refers to the system's router.
- ***Wired*** — The connection state when using a wired (cable) network connection.
  - ***Disabled*** — The configuration has manually disabled the connection.
  - ***Disconnected*** — The wireless interface is enabled but is not able to connect.
  - ***Connected*** — The interface is enabled and connected.
  - ***Limited*** — The interface has a connection to the local network, but cannot reach external resources, such as internet.
- ***IP Address*** — Internet Protocol address; the unique identifier assigned to the Mojave inverter.
- ***Netmask*** — The subnet "mask" assigned to the Mojave inverter.
- ***Gateway*** — The IP address of the device used to transfer requests between internet and local network. This often refers to the system's router.
- ***DNS1*** and ***DNS2*** — Domain Name Server; the IP addresses for the first and second servers used to resolve domain names into IP addresses.
- ***MAC Address*** — the unique address of the Mojave inverter hardware; used to register with OPTICS RE. See page 25.
- ***OpticsRE*** — The status of connection to the OPTICS RE website. See page 25.
  - ***Disconnected*** — The inverter is not communicating with the OPTICS RE website
  - ***Connected*** — The inverter is communicating with the OPTICS RE website.

ACTIONS View

This view displays the ***Action Menu***, with various off/on and other commands for basic functions. It does not replace the **STATUS**, **SETTINGS**, or **EVENTS** views, but appears alongside them.

NOTE:

Clicking on this item a second time, or on the ***Action Menu*** heading, does not remove it from the screen. To remove it, press the ✖ symbol (see **A** in Figure 9).

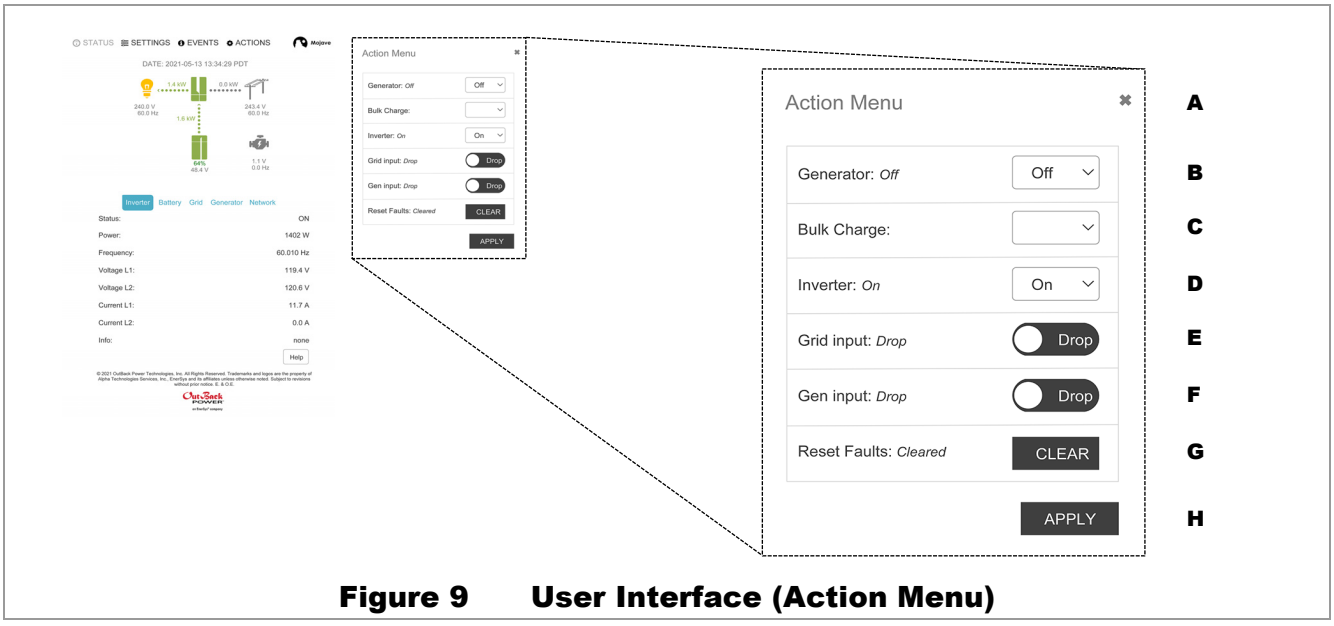


Figure 9 User Interface (Action Menu)

B. ***Generator*** — This drop-down menu has the options ***On***, ***Off*** (start or stop the generator immediately), and ***Auto*** (enable AGS for automatic generator control; see page 51).

C. ***Bulk Charge*** — This drop-down menu has the options ***Bulk Start*** (begin charging) or ***Stop***. See page 45 for information on charging.

D. ***Inverter*** — This drop-down menu has the options ***On*** (begin inverting; see page 34) or ***Off***.

NOTES:

- If **Grid** or **Gen Input** are set to ***Use*** with ***Inverter Off***, the unit will transfer power to loads (see pages 42 and 49). It **will not charge batteries** or otherwise interact with the power.
- The inverter cannot accept generator power if grid power is already being accepted. (See page 43.) It can accept the generator if the grid is present but ***Grid Input*** is set to ***Drop***.

E. **Grid Input** — This onscreen toggle has the options ***Use*** (connect) or ***Drop*** (disconnect). This is a manual command to connect or disconnect from the utility grid. ***Use*** connects to the grid if all other conditions are met. (See page 41.)

F. **Gen Input** — This onscreen toggle has the options ***Use*** (connect) or ***Drop*** (disconnect). This is a manual command to connect or disconnect from the generator. ***Use*** connects to the generator if all other conditions are met. (See page 48.) It does not influence AGS or any other generator interaction.

G. ***Reset Faults*** — The **CLEAR** button resets any active errors. When errors appear, they are displayed in the ***Status*** field under each of the **STATUS** tabs. See pages 16 through 19.

H. **Apply** — This button finalizes changes to the ***Action Menu***. Changes will not take effect otherwise.

SETTINGS View

This view allows functions to be changed. Selecting any of the tabs that were already discussed (**Inverter**, **Battery**, **Grid**, **Generator**, **Network**) brings up a table with set points related to that topic. This view also depicts a sixth tab, **Admin**, which permits login for higher-level access.

Selecting any tab in this view causes a gray box to appear around it.

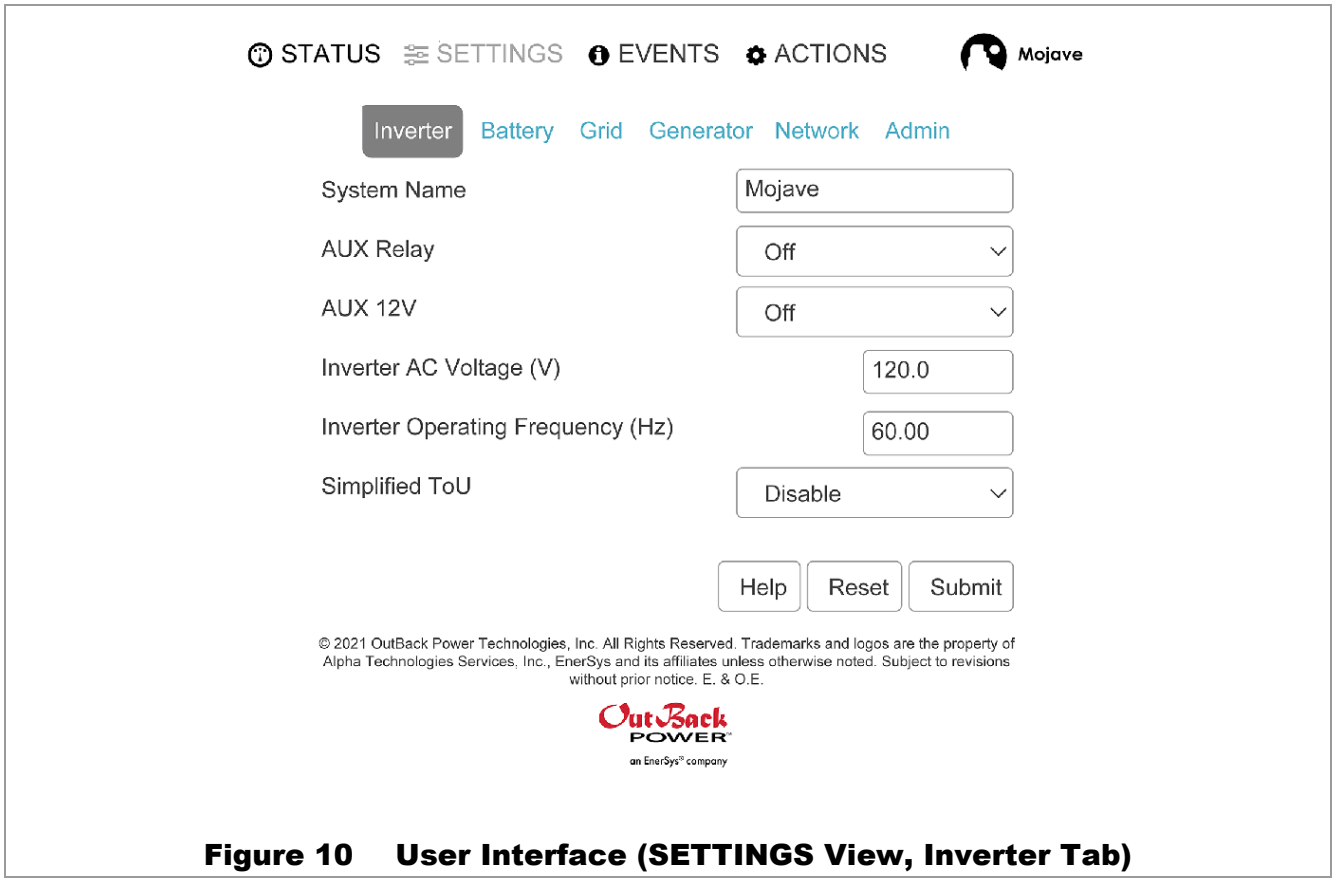


Figure 10 User Interface (SETTINGS View, Inverter Tab)

Each tab is addressed in the **Operation** chapter. This section of the book describes all inverter functions and explains the use of each setting. (The tabs may appear in a different order in **Operation** than they do here.)

- **Inverter** — Allows settings for all inverter functions, including Time of Use (ToU). See page 33.
- **Grid** — Allows settings for grid-related functions while connected. See page 39. Most items can only be adjusted by users with ***Installer*** access, after entering a password under the **Admin** tab. See page 30.
- **Generator** — Allows settings for all generator functions, including automatic generator start (AGS). See page 46.
- **Battery** — Allows settings for all battery functions, including various charging profiles for differing battery chemistries. See page 44.
- **Network** — Allows settings for connection to a personal computer or network. See page 32.
- **Admin** — Allows the selection of three access levels for the **Grid** tab. See page 30.

EVENTS View

This screen shows a history of all notable changes in Mojave inverter state or status. Event messages are dynamically generated and depend on the particulars of the occurrence. Types of events include the following.

- Fault history
- Changes in operating state
- Input source availability changes
- Charge state changes

Events are arranged under several categories. The user can select the number of items displayed.

- Type of event
  - Info — information on a status change or other event.
  - Warning — a non-critical issue that does not require the unit to shut down.
  - Fault – a critical wiring-related issue that requires the unit to shut down.
  - Error – a critical issue that requires the unit to shut down.

  See **Troubleshooting** on page 63 to investigate problems.
- Description of event
- Date and time of occurrence

The ***Show ___ entries*** item **A** can be set to display 10, 25, 50, or 100 items. These items can be sorted by **Type**, **Description**, or **Time** using the small arrow icons **B** to the right of each column. They can be organized in either ascending or descending order.

Clicking on a Description message will bring up additional details on the event.

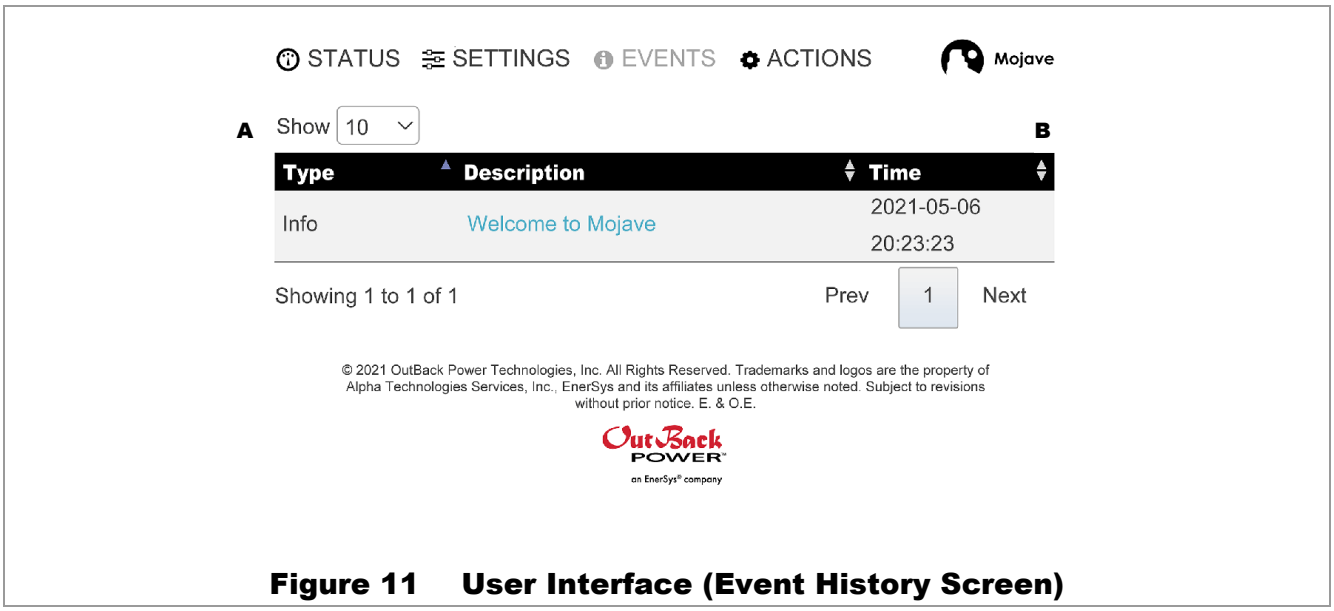


Figure 11 User Interface (Event History Screen)

OPTICS RE

OPTICS RE is the web-based remote monitoring and control application for OutBack Power devices, including the Mojave inverter.

OPTICS RE displays data in three tier levels. The levels are as follows.

- **Profile**: The entity or person that is the owner of the system.
  - **Site**: A physical location in which the Mojave inverters are installed. Since **Site** information is shared within a **Profile**, most **Profiles** only have one **Site**.
    - ✓ **System**: The installed OutBack Power equipment. Each inverter is treated as a different **System**.

A video tutorial for aggregating multiple **Systems** with OPTICS RE is part of the WattSchool 2 series of tutorials. OPTICS RE allows **Systems** to be entered as part of the same **Site**, or different **Sites** with other **Profiles**. Note that this product does not support stacking of multiple inverters on the same **System** at this time.

To set up OPTICS RE:

1. Connect a CAT5 cable to the **NETWORK** port in the Mojave inverter. (See Figure 12 and the *Mojave Inverter/Charger Quick Start Guide* for more information.) 1
2. Plug the cable into a router to put the inverter online.

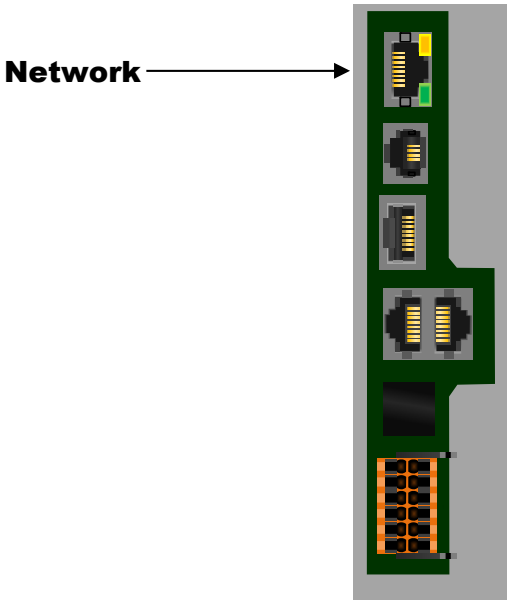


Figure 12 Network Port

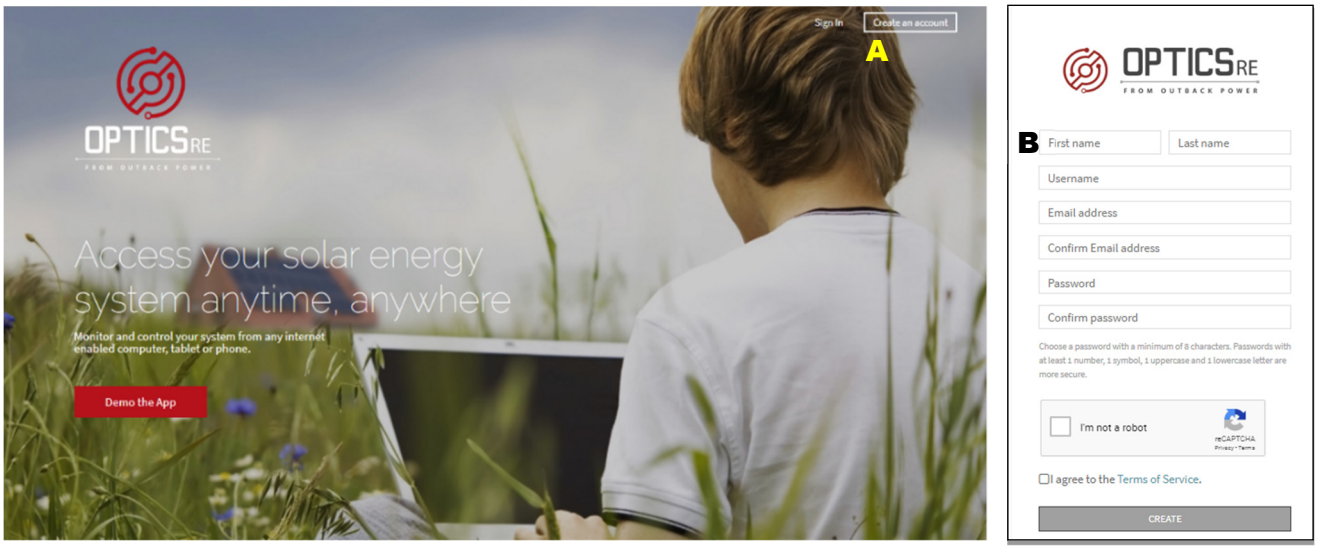


Figure 13 OPTICS RE Account

3. Create an account to be able to log in. From www.opticsre.com, click **Create an Account**. See **A** in Figure 13.

4. Fill in the appropriate account information fields. (See **B** in Figure 13.)
   - **a.** Check the ***I'm not a robot*** box.
   - **b.** After reading the terms of service, check the ***I agree to the terms of service*** box.
   - **c.** Click the **Create** button at the bottom of the screen.

5. OPTICS RE will send an email to the listed address for verification. Click on the confirmation within the email. Once confirmed, the account will be set up and ready for login.

To add a Mojave inverter to a Site:

1. Sign in to OPTICS RE. Note that the following steps require a valid MAC address from page 32.
2. Click on **Add a Profile**.
3. Set the **System Type** as **Mojave**.
4. Enter the MAC address for a Mojave inverter to be added to the **Site**. This unit must be online so that OPTICS RE can recognize it.
5. Select the existing **Profile** to add the selected inverter.
6. Select the existing **Site** to add the selected inverter.
7. Enter a unique **System** name to designate the inverter.
8. Verify device registration.

Once these steps are implemented, OPTICS RE can monitor each **System** on a **Site**. It can deliver aggregated **Site** data (by clicking on a **Profile**) or communicate with individual **System** units for settings, warnings, and errors.

IMPORTANT:

- Ensure that the ***OpticsRE*** status of each inverter shows as ***Connected***. See the **Network** tab on page 19.
- Make certain to record the MAC address for each inverter.

Operation

Connections

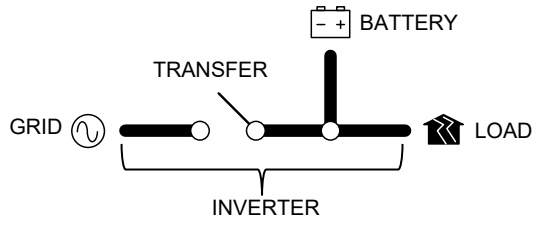
The Mojave inverter has two sets of AC source connections, which are labeled **GRID** and **GEN**. Two different AC sources can be connected during inverter installation. 1

In addition, it has connections for batteries, which are used both to supply power for operation, and to receive charging. Finally, it has AC **LOAD** terminals. These are used to operate the critical protected loads. They are also used for AC coupling operation. See page 35.

NOTES:

- The battery charger uses the same programming and settable limits regardless of which source is used. It does not have independent charger settings on each input.
- For wiring instructions and more information on terminal hardware, see the *Mojave Inverter/Charger Quick Start Guide*.
- For more information on inverting, charging, and other functions, see the descriptions of the **Inverter** tab on page 33, the **Grid** tab on page 39, the **Battery** tab on page 44, and the **Generator** tab on page 46.

Each distinct function or operation is accompanied by a symbol representing the inverter and that operation, as shown in Figure 14.

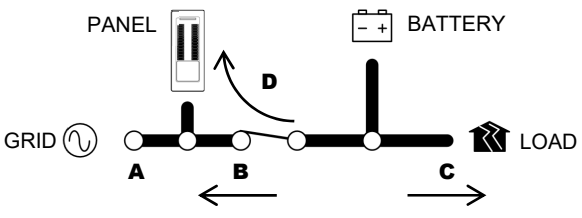


These items represent the power present at the AC source, the output to the AC loads, any DC functions (inverting, charging, etc.), and the grid (or generator) relay. Arrows on each symbol represent power flow. The symbols may have other features depending on the operation.

Figure 14 Icon Images

CT

Normally the Mojave inverter senses AC power at the **GRID** terminals. This point is shown as **B** in Figure 15. Once installed, the current transducers (CTs) will move this sensing point to another location, usually the main grid input **A**. See page 39 to enable the CT.



With no CT, power sent to the grid is measured at **B**. If no grid export is permitted, no power may be sent beyond **B**. The only supported loads are the protected loads at **C**.

With CT use, any restriction on export is controlled at **A**. This permits power to flow as far as the main panel, shown by arrow **D**. It allows the inverter to support more loads on the main panel while grid-connected.

Figure 15 Current Transducers

LED Indicator (Inverter)

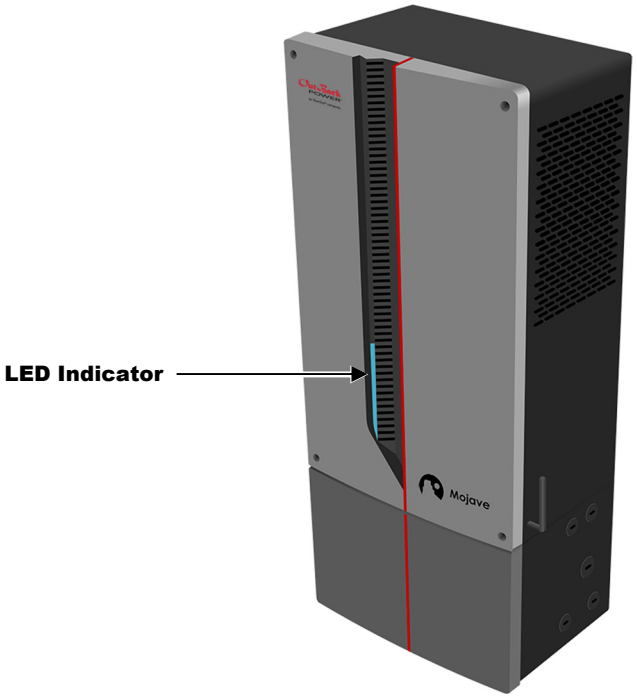


Figure 16 LED Indicator

The Mojave inverter has a single LED indicator to show states of operation. Additional states may be added in the future, using firmware updates, to reflect new features.

If the inverter indicates a state not shown here, please refer to the firmware release notes. 4
Alternately, consult an updated revision of this manual from www.outbackpower.com. 5

- **Blue**
  - Flashing — Powering up. The indicator will also flash blue during a firmware update.
  - Solid — Ready for operation. The Mojave inverter is off.
- **Green**
  - Solid — The Mojave inverter is operating. Any number of functions may be active. See page 13.
- **Yellow**
  - Flashing — An error threshold was exceeded. An error shutdown may be about to happen.
  - Solid — Inverter has been turned off, but is transferring power from grid to loads.
- **Red**
  - Solid — Error shutdown. See the **EVENTS** view on page 24 for error messages. See **Troubleshooting** on page 63 to investigate.
- **Alternating Red and Green**
  - Flashing — AC source problem (grid or generator). The inverter has disconnected from the source. See **Troubleshooting** on page 63 to investigate problems.

See page 61 for the Mojave ESS battery LED indicator.

Description of Inverter Operations

Most of the operations and functions can be programmed from the user interface **SETTINGS** view. This allows customization or fine tuning of inverter performance. Some of the inverter's operations occur automatically. Others are conditional or must be enabled manually before they will operate.

This section is organized using the six tabs available under the **SETTINGS** view: **Inverter**, **Grid**, **Generator**, **Battery**, **Network**, and **Admin**. These may not be in the same order as shown here.

Each section shows the settable items available under each tab. Following the list of items is a description of the related inverter functions.

Some of the items in this section are functions which can be manually selected, enabled, or customized. Other items are general topics or applications for the inverter. Any of these items may need to be adjusted so that the inverter is best matched to a particular application. The operator should review these items to see which are applicable.

SETTINGS View

The six selections under the **SETTINGS** view (tabs) are described beginning below. Each tab has different options. This view does not include the inverter's operating graphics. Instead, each of the following **Tab** topics shows the settable items available under each tab. Following the list of items is a description of the related inverter functions.

- After making any changes under a tab, press **Submit** to send the changes to the system.
- Select **Reset** to return that tab's values to factory default settings. Press **Submit** to finalize the **Reset**.
- Press **Help** to restart the "walk-through" overlay for that tab. (See page 11).

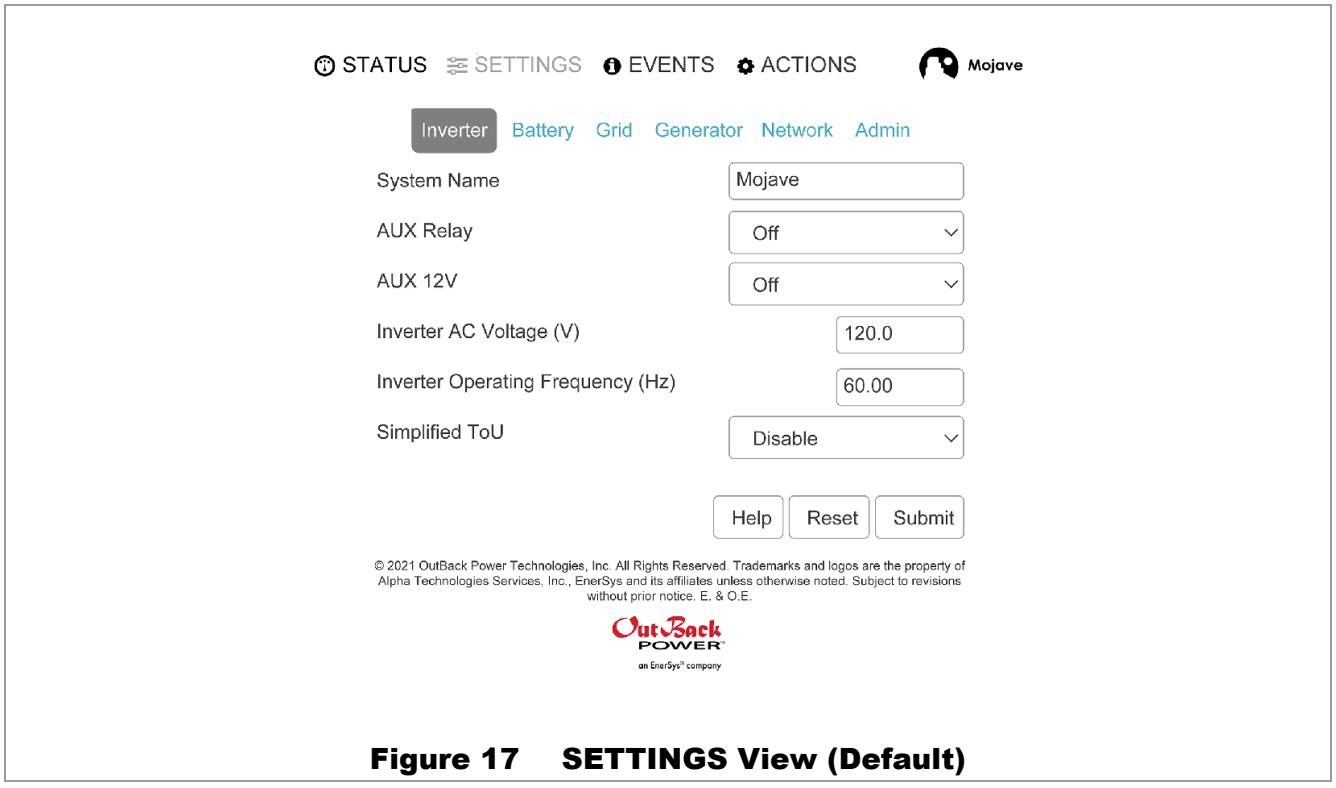


Figure 17 SETTINGS View (Default)

Admin Tab

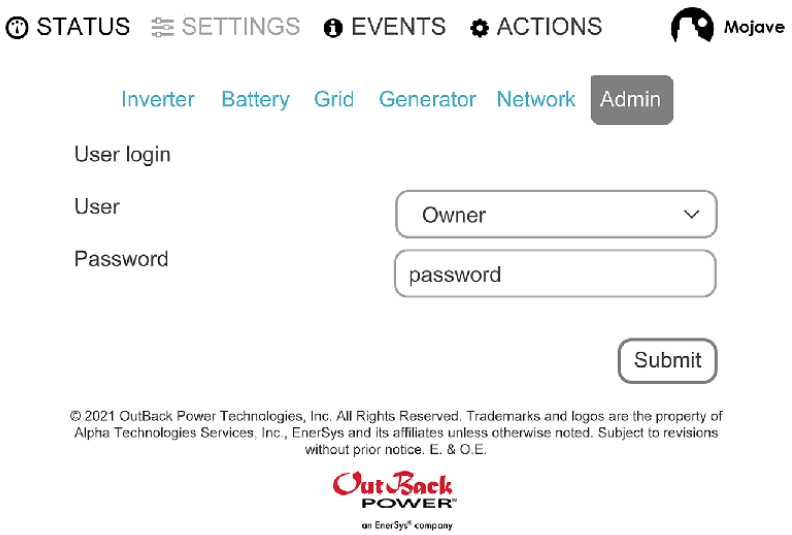


Figure 18 Admin Tab (SETTINGS View)

The page displayed by this tab allows login for greater access to settings. To log in, select the ***User*** level, enter the ***Password***, and press **Submit**. (See Figure 18.)

UserName — Range: ***Owner***, ***Installer***, ***Admin***. Default: ***Owner***.

This item selects the access level for settings. These passwords are also used for initial UI login as described on page 11.

- The ***Owner*** settings allow changes to items under the **Network**, **Inverter**, **Battery**, or **Generator** tabs.
- The ***Installer*** settings can change the grid-protection settings under the **Grid** tab.
- The ***Admin*** selection is reserved for future use.

Password — The default password is the same in all three cases. It consists of the last eight digits of the inverter's serial number. For example, in a unit with the serial number OGHI2107E0100236, the default password would be E0100236. The serial number can be found on a label directly beneath the wi-fi antenna as shown in Figure 19.

After installation, it is recommended that all passwords be changed for security.

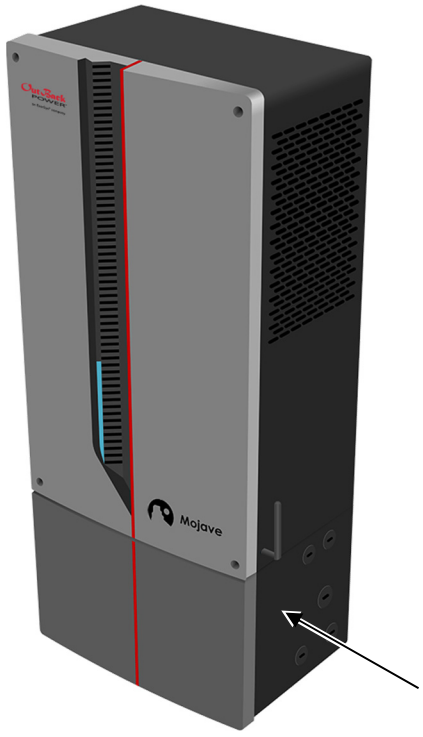


Figure 19 Serial Number

After the initial login, the screen will change as shown in Figure 20. Three new options are offered.

Change Password

This item will change the password for the current access level.

Enter the new password under ***New***, then re-enter the new password under ***Confirm***. Press **Submit**.

Reset

When an invalid password is entered, a **Reset** button is displayed. If the password is lost or forgotten, press the **Reset** button to reset the password. Additional instructions will appear.

Historical Data

This item allows download of a .csv file to review system data.

Enter the date range under ***From*** and ***To*** (two-digit month, two-digit day, four-digit year). Press **Download**.

Firmware Update

This item shows the last version of firmware to be installed. It also shows the newest downloaded version. To update to the newest version, press **Install**.

If an upgrade file is located elsewhere on the computer or device, press **Choose File** to locate and download it.

To log out, press **Logout**.

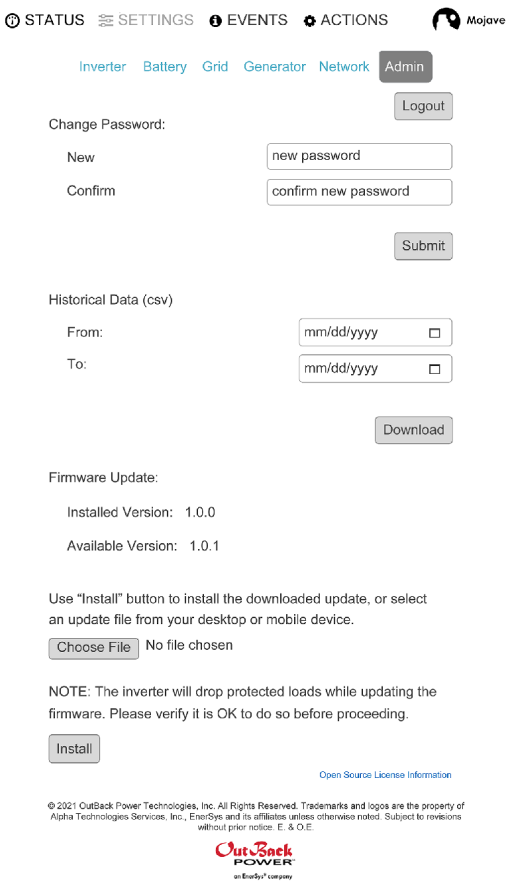


Figure 20 After Login

Network Tab

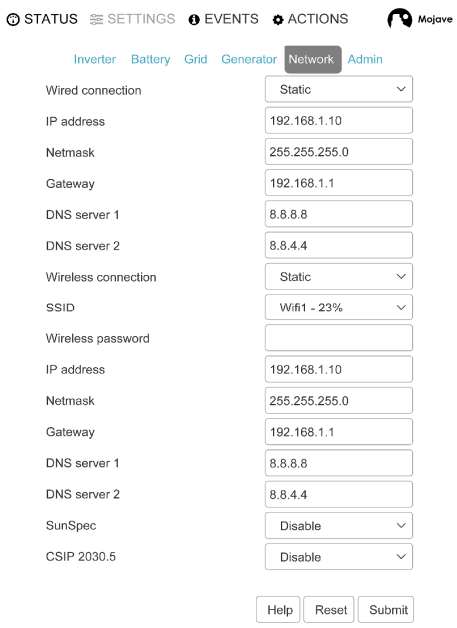


Figure 21 Network Tab (SETTINGS View)

The items under this tab allow connection to a personal computer or network (wired or wireless). If DHCP is used with a network device such as router, modem, or switch, then many of these values will be assigned from the network device. If the local area network does not use DHCP, ***Static*** should be selected. The values in each field must then be set manually.

When DHCP is selected, the configuration elements are provided by the router and cannot be configured here. These items will not appear onscreen. They can be viewed on page 19.

- ***Wired_Connection*** — Range: ***Disabled***, ***DHCP***, or ***Static***. Default: ***Static***
- ***IP address*** —Default: 192.168.1.10 (DHCP will auto-populate this item.)
- ***Netmask*** — Default: 255.255.255.0 (DHCP will auto-populate this item.)
- ***Gateway*** — Default: 192.168.1.1 (DHCP will auto-populate this item.)
- ***DNS server 1*** and ***2*** — The first and second domain name servers (DHCP will auto-populate these items.) If a static network is used, these items are available from the service provider.
- ***Wireless_Connection*** — Range: ***Disabled***, ***DHCP***, or ***Static***. Default: ***DHCP***
- ***SSID*** — The names and signal strength (in percentage) of any available wireless networks.
- ***Wireless_Password*** — The password for the selected wireless network.
- ***IP address*** — Default: 192.168.1.11 (DHCP will auto-populate this item.)
- ***Netmask*** — Default: 255.255.255.0 (DHCP will auto-populate this item.)
- ***Gateway*** — Default: 192.168.1.1 (DHCP will auto-populate this item.)
- ***DNS server 1*** and ***2*** — The first and second domain name servers (DHCP will auto-populate these items). If a static network is used, these items are available from the service provider.
- ***SunSpec*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***
- ***SunSpec port***

  These items activate a remote control interface that is accessed using third-party software. See www.sunspec.org for more information.
- ***CSIP 2030.5*** — Displays a series of elements to be configured by the utility company when required.

Inverter Tab

The items under this tab affect many of the Mojave inverter's basic functions. Interactions with utility grid, generator, and battery charging are set under other tabs.

The items presented here are described on the designated pages. They may not appear in the same order as shown below.

NOTE: Although **SYSTEM TIME** on page 13 uses a 24-hour clock format, settable times of day in this menu are formatted using a 12-hour clock.

- ***System Name*** — This item is user-settable and provides an easy identifier to the system. A unique name can be assigned with up to 60 characters.
- ***AUX Relay*** — Range: ***Off***, ***On***, ***AGS***, or ***Rapid Shutdown***. Default: ***Off***

  These are dry contacts that can serve as a switch for the AGS function. It can also serve to set off an indicator or alarm for the rapid shutdown function. See pages 38 and 50.
- ***AUX 12V*** — Range: ***Off***, ***On***, ***AGS***, or ***Rapid Shutdown***. Default: ***Off***

  This is a 12-volt output that can drive a relay to activate the AGS function. It can also serve to set off an indicator or alarm for the rapid shutdown function. See pages 38 and 50.
- ***Inverter AC Voltage (V)*** — Range: ***0*** to ***148***. Default: ***120***

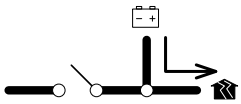
  In off-grid usage, the inverter's output voltage can be adjusted for unique applications or devices. This does not affect the voltage transferred from an AC source. See pages 34, 41, and 48.
- ***Inverter Operating Frequency (Hz)*** — Range: ***55*** to ***66***. Default: ***60***

  In off-grid usage, the inverter's operating frequency can be adjusted for unique applications or devices. This does not affect the frequency transferred from an AC source. See pages 34, 41, and 48.
- ***Simplified ToU*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***

  This enables Time of Use operation. When the cost of grid energy exceeds the cost of battery energy, the inverter displaces grid use with battery energy. See page 36.

  When ***Simplified ToU*** is set to ***Enabled***, the items below will appear. These items will not appear on the screen, nor will they function, if it is set to ***Disabled***.
- ***Peak rate period*** — Range: ***Disabled***, ***Weekdays***, ***Weekends***, or ***Daily***. Default: ***Weekdays***
- ***Start time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***04:00 PM***
- ***Stop time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***09:00 PM***
- ***Peak rate period*** — Range: ***Disabled***, ***Weekdays***, ***Weekends***, or ***Daily***. Default: ***Disabled***
- ***Start time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***12:00 AM***
- ***Stop time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***12:00 AM***
- ***Peak rate period*** — Range: ***Disabled***, ***Weekdays***, ***Weekends***, or ***Daily***. Default: ***Disabled***
- ***Start time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***12:00 AM***
- ***Stop time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***12:00 AM***
- ***Peak rate period*** — Range: ***Disabled***, ***Weekdays***, ***Weekends***, or ***Daily***. Default: ***Disabled***
- ***Start time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***12:00 AM***
- ***Stop time*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***12:00 AM***

Inverting



This is the Mojave inverter's primary function. The inverter converts DC voltage from the Mojave battery into AC voltage that is usable by AC loads. It will continue to do this as long as the batteries have sufficient energy.

The inverter's design uses a transformer and high-frequency H-Bridge FET modules to achieve the required high-wattage output. It can deliver the rated wattage continuously at 25°C. The maximum output is derated at temperatures exceeding 40°C. See page 88 for worst-case derated output.

Calculate the total load wattage so that it does not exceed the inverter's capacity. When excessive load is applied, the inverter's output current will be limited and the voltage waveform may be distorted. If enough overload occurs, its output voltage will drop low enough that it will shut down with an undervoltage error (displayed under the **EVENTS** view and the **Inverter** tab under the **STATUS** view).

IMPORTANT:

- The Mojave inverter cannot support severe output load imbalance. It can maintain a load difference of no more than 4.2 kVA continuously between the L1 or L2 output (a neutral current exceeding 35 Aac). For example, it cannot maintain the inverter's full output of 8 kVA on L1, even if the load on L2 is 0.

  Neutral currents exceeding 35 Aac will be current-limited (similar to an excessive load) and may result in undervoltage.
- The Mojave ESS requires the Mojave Lithium-Ion Battery for normal operation. No other DC sources are supported for this product.

CAUTION: Equipment Damage

Do not substitute other DC sources in place of the Mojave Lithium-Ion Battery. High or irregular voltages may damage the inverter.

AC Voltage

The Mojave inverter's nominal voltage is 120/240 Vac (split-phase), consisting of 120 Vac on L1 and L2. The ***Inverter AC Voltage (V)*** set point can adjust the output voltage for off-grid operation in applications that require a more specific nominal voltage.

The ***Inverter AC Voltage (V)*** adjustment is applied to both single-phase output voltages on the **LOAD L1** and **L2** terminals (with respect to neutral). For example, if ***Inverter AC Voltage (V)*** is set to a value of ***125***, both the L1 and L2 outputs will read 125 Vac. The total output voltage will become 250 Vac.

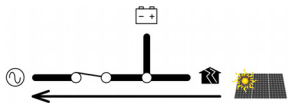
AC Frequency

The Mojave inverter's nominal frequency is 60 Hz. The ***Inverter Operating Frequency (Hz)*** set point can adjust the output frequency for off-grid operation in applications that require a more specific nominal frequency.

NOTES:

- The Mojave inverter only supports split-phase systems where the center-tap neutral is a grounded conductor. It cannot support 230 Vac (single-phase) loads or power systems. It cannot support three-phase loads or power systems, or any system where L1 and L2 are unbalanced by more than 5% in voltage.
- The Mojave inverter cannot support 50 Hz loads or power systems.

AC Coupling

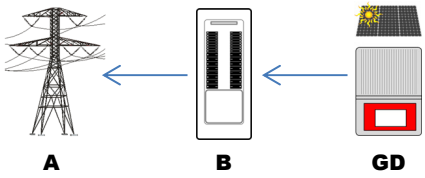


NOTE:

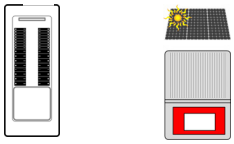
This function is performed automatically when the conditions are met as described below. It has no adjustable settings.

Many inverter products are “grid-direct” (GD), converting PV power to AC power and sending it directly to the utility grid without the use of batteries. These products have no backup capability.

In systems with an existing GD inverter, the Mojave inverter can be added to “couple” the battery backup ability to the grid-tied AC system.



A standard GD system sees the inverter send PV-based power to its main connection point, the main utility panel **B**. The power then travels back to the utility grid **A**.



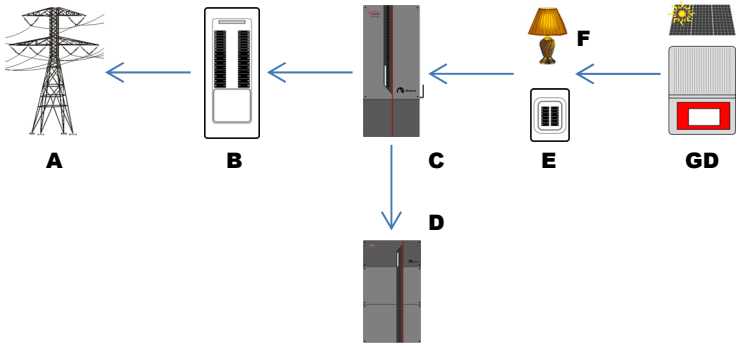
If the grid fails, the GD inverter shuts down and is unable to function. Although PV power may be available, it cannot be used.

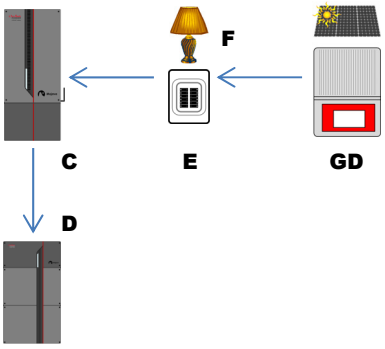
In an AC-coupled system, the GD inverter’s main connection point moves to the subpanel **E**. This is the location of the Mojave inverter’s protected loads **F** during backup activity. **E** connects to the inverter’s **LOAD** terminals at **C**. This means that the Mojave inverter serves as the GD inverter’s source.

During normal activity, the GD inverter sends power to **F** and **C**. The inverter’s first priority is to charge the batteries **D**. (The Mojave battery charger settings will still apply. See page 44.)

If additional GD power is available, the grid relay (see page 41) is still closed. Surplus power is sent to the main panel **B** and on to the grid **A**.

NOTE: AC coupling affects the inverter’s performance during **Time of Use**. See page 37.



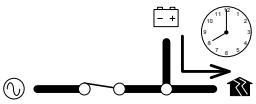


If the grid becomes unstable, fails, or is otherwise not present, the Mojave inverter’s grid-protective function (see page 39) will force it to open the grid relay and disconnect from the grid. With no grid power present:

- As long as the Mojave inverter is active and providing backup power, the GD inverter will receive that power and also remain active. It will **continue** producing PV-based power to run the subpanel **E** and any protected loads **F**.
  - If GD power is not sufficient to run the loads, the Mojave inverter will add battery power to the production.
  - If more GD power is available than needed for the loads, the Mojave inverter will route it to charge the batteries **D**.
  - If more GD power is available than is needed for either loads or charging, the Mojave inverter will adjust its output to make the GD inverter reduce its production. The GD inverter may be required to shut down temporarily.

Figure 22 AC Coupling

Time of Use (ToU)



The Mojave inverter can choose to run the protected loads using either grid or battery power based on day and time. This permits the system to take advantage of varying utility rates. ToU in this inverter is referred to as “simplified”. It is less complex than similar functions in other products, which may require the entry of specific utility rates and the like. It does, however, require the user to know when the most and least advantageous billing rates are in effect.

The settable time blocks are to designate periods when the inverter ceases importing grid power and switches to battery use. This is most effective if used when utility rates are highest. The term “time of use” refers to use of battery power, not grid power.

This function should be set to activate during the time(s) of day when peak utility rates are in effect.

The ToU function is activated by setting ***Simplified ToU*** to ***Enable***. Four ToU blocks are available. Each has the following settable items.

- ***Peak rate period***
- ***Start time***
- ***Stop time***

Peak rate period has four options.

- ***Disable*** prevents ToU from using this time block.
- ***Weekdays*** utilizes ToU during this time block, Monday through Friday only.
- The first ***Weekdays*** block is preset to operate between 4 PM and 9 PM, as this is the most common peak rate period.
- ***Weekends*** utilizes ToU during this time block, Saturday and Sunday only.
- ***Daily*** utilizes ToU during this time block every day.

Start time and ***Stop time*** begin and end the time period for use of battery power.

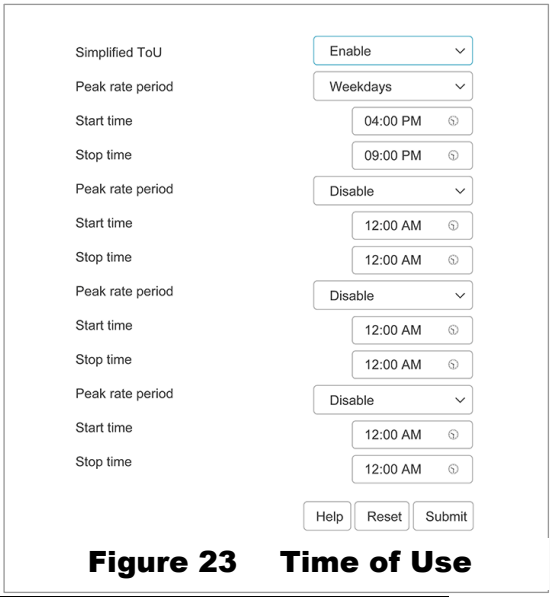


Figure 23 Time of Use

IMPORTANT:

- If the batteries reach either the ***Min SoC (%)*** set point or the ***LBCO*** set point before reaching ***Stop time***, the inverter will revert to using grid power. This avoids over-discharge of the batteries.
- The above items, as well as the size of the battery bank and the protected loads, should be arranged for the most effective operation of the system. Undersized batteries, oversized loads, or inappropriate settings could cause the system to revert to grid power long before expected.

NOTES:

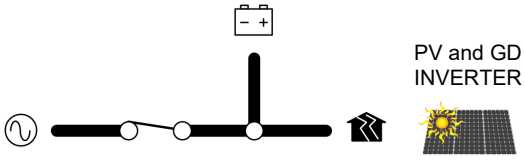
- This function is not a timed connection or disconnection from the grid. The grid relay does not open. See **Grid Relay** on page 41.
- This function may be used in conjunction with AC Coupling. See pages 35 and 37.

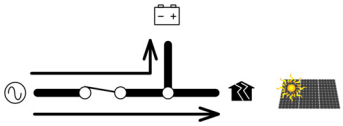
The choice to use the ToU function should depend on utility rates and individual factors, including the cost effectivity of recharging the battery during off-peak periods.

- It may only be feasible to use battery power at a fixed time every day (the ***DAILY*** option).
- For greater flexibility, separate times may be set up for ***WEEKDAY*** and ***WEEKEND*** use.
- Note that other settings such as ***Import limit*** will be in effect regardless of peak times. See page 39.

AC coupling (see page 35) may be used with ToU. In the example shown in Figure 24, the Mojave inverter is used in conjunction with a GD inverter (with a PV array) on the protected loads panel.

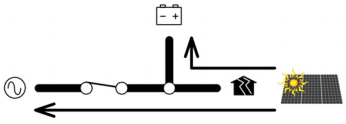
The utility company's peak rate occurs between 5 PM and 8 PM. The user sets ***Simplified ToU*** to ***Enable***. The first ***Peak rate period*** block remains on ***Weekdays***, but the ***Start time*** is changed to ***05:00 PM***. The ***Stop time*** is changed to ***08:00 PM***. The system proceeds to operate.



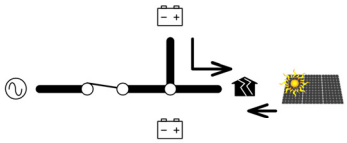


On the first morning, which is cloudy, the PV array and the GD inverter have little production. The Mojave inverter imports grid power normally. This power is transferred to run the household loads. Some power is used to maintain the batteries, which are kept in a fully-charged state.

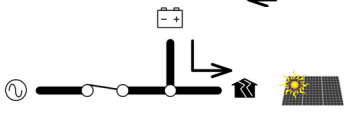
At 12 PM, the sky clears. The PV array and the GD inverter begin producing power. This power is used to support the loads. Excess power is available, which is sent to the Mojave inverter. Some power is used to maintain the batteries. The rest continues to the grid and is sold normally.



NOTE: The Mojave inverter is not exporting this power; it is simply acting as a conduit for the GD inverter to export power.

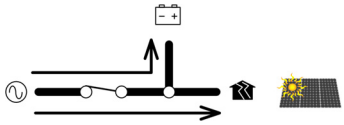


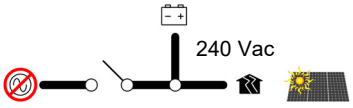
At 5 PM, the inverter enters the peak rate period. The Mojave inverter ceases importing any grid power. By this time, the GD inverter is producing much less power. It is no longer exporting to the grid and is only producing part of the power for the household loads. The Mojave inverter supplies the rest of the needed power from the batteries.



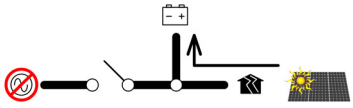
During the peak rate period, after sundown, the GD inverter has stopped producing power. The Mojave inverter supplies all needed power from the batteries.

At 8 PM, the peak rate period ends, and utility rates drop again. The inverter begins importing grid power to run the loads. It also recharges the batteries to 100%. This continues into the next morning.



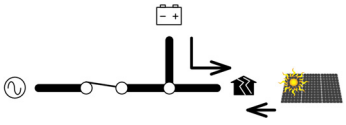


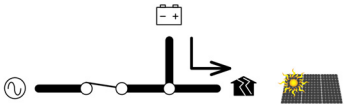
During the second morning, a utility outage occurs. The Mojave inverter loses grid power and begins producing power from the batteries instead. The output from the Mojave inverter acts as the "grid" to the GD inverter so that it can remain active.



During this period, the PV array and GD inverter continue producing power, which is used to support the protected loads. Excess power is available, which is sent to the Mojave inverter to maintain the batteries.

Grid power is restored at 4:30 PM. The GD inverter and Mojave inverter have supplied enough power to support the loads during the blackout. The batteries remain fully charged.





At 5 PM, the inverter enters the peak rate period and ceases importing grid power. The Mojave inverter and GD inverter support the loads. After sundown, the Mojave inverter uses battery power to support the loads by itself. The cycle proceeds normally from there.

Figure 24 ToU with AC Coupling

For illustrations of the respective flow of power between grid, each inverter, and batteries, see the explanation of AC coupling on page 35. For more detailed descriptions of these functions, see the applications note *AC Coupling with Time of Use (ToU) using the Mojave Inverter*. 6

Rapid Shutdown (RSD)

In an emergency, a responder may need to quickly place the system in a de-energized state. The auxiliary (**AUX**) terminal block has terminals designed to receive signals from OutBack Power's RSI (Rapid Shutdown Initiator) or a similar rapid shutdown device.

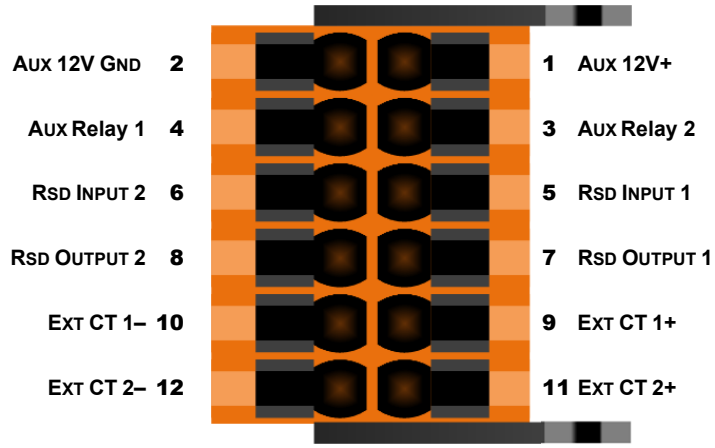


Figure 25 AUX terminals

Terminals **5** and **6** are used for the rapid shutdown function. These terminals can receive rapid shutdown (RSD) commands to quickly shut down the Mojave inverter. The terminals detect electrical continuity, which is present while the RSD contacts remain closed. If a rapid shutdown event occurs (an RSD switch is opened), these contacts will open. The circuit will detect the loss of continuity and the inverter will shut down. The inverting function will not operate. The inverter will not accept power from AC sources, and consequently cannot transfer power or charge batteries.

Any initiator device with normally-closed contacts can work with this function. If more than one device is used, all contacts must be wired in series so that any device will shut down the inverter.

If a rapid-shutdown device is not installed, this function should be disabled. This is performed by directly shorting terminals **5** and **6** with a small wire. A jumper is installed at the factory for this purpose.

IMPORTANT:

- A jumper is factory-installed on terminals **5** and **6**. It may need to be removed if another device is installed.
- The inverter will not function unless the jumper, the RSI, or a similar normally-closed device is installed. Initial power-up will result in a Rapid Shutdown signal.

The ***AUX 12V*** connections (terminals **1** and **2**) or ***AUX Relay*** connections (terminals **3** and **4**) can activate an alarm in response to a rapid shutdown. The ***AUX 12V*** or ***AUX Relay*** menu item should be set to ***Rapid Shutdown***.

It is most common for the rapid shutdown function to be implemented separately in the GD inverter. If the GD inverter has terminals for an external connection ("daisy-chaining"), they can be connected to terminals **5** and **6** to cause rapid shutdown in the Mojave inverter. If another external device requires rapid shutdown, the RSD output on terminals **7** and **8** can be used.

Note that in AC coupling applications (see page 35), a GD inverter may require the RSD function.

Grid Tab

The items under this tab affect the Mojave inverter's interactions with the utility grid.

The items presented here are described on the designated pages. They may not appear in the same order as shown below.

- ***Grid Profile*** — Range: ***IEEE 1547-2003***, ***IEEE 1547-2018***, ***CA Rule 21***, ***CA Rule 21 2022***, ***HECO 14H***, ***ISO NE***, ***PREPA***. Default: ***IEEE 1547-2003***

  Also known as a grid interconnection profile, this is the code or utility company regulation which specifies a series of preloaded settings.

- ***External CT*** — Range: ***Disabled*** or ***Enabled***. Default: ***Enabled***

  The default reading of utility grid current would take place at the **GRID** terminals. Once installed, the current transducer (CT) adds an external location for current sensing. See page 27 (earlier) for a simplified description of placement and operation. See the *Quick Start Guide* for wiring instructions.

  When this is set to ***Enabled***, the items below will change to ***Export limit at external CT*** and ***Import limit at external CT*** to reflect the new monitoring locations.

- ***Export limit (W)*** — Reserved for future use.
- ***Import limit (W)*** — Range: ***48000*** to ***0***. Default: ***48000***
- ***Charge from grid limit (W)*** — Range: ***13200*** to ***0***. Default: ***7860***

Grid Protection Settings

The items below this point are a series of protective settings required by various regulations or utility companies for interconnection.

Not all items are available with all ***Grid Profile***s. The settings shown are for the ***IEEE 1547-2003*** profile. Certified ranges are only shown when they differ from the maximum range.

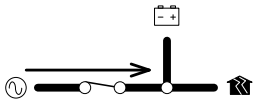
IMPORTANT:

- For the configurations of other If the preconfigured ***Grid Profile*** items do not apply, each setting can be customized.
- Changing these settings requires ***Installer*** login as shown under the Admin tab on page 30. These settings should not be changed unless explicitly instructed by the utility company or the appropriate authorities.
- For the configuration of ***Grid Profile*** items other than the settings of IEEE 1547-2003, see Table 15 and Table 16 beginning on page 91.

o ***LV1 voltage (pu)*** — Range: ***0*** to ***0.98***	Certified Range: ***0.5*** to ***0.95***	Default: ***0.880***
o ***LV1 time (s)*** — Range: ***0.08*** to ***50***	Certified Range: ***0.1*** to ***50***	Default: ***2.00***
o ***LV2 voltage (pu)*** — Range: ***0*** to ***0.98***	Certified Range: ***0.25*** to ***0.70***	Default: ***0.500***
o ***LV2 time (s)*** — Range: ***0.08*** to ***50***	Certified Range: ***0.1*** to ***50***	Default: ***0.16***
o ***HV1 voltage (pu)*** — Range: ***1.02*** to ***1.2***	Certified Range: ***1.05*** to ***1.2***	Default: ***1.100***
o ***HV1 time (s)*** — Range: ***0.08*** to ***13***	Certified Range: ***0.1*** to ***13***	Default: ***1.00***
o ***HV2 voltage (pu)*** — Range: ***1.02*** to ***1.2***	Certified Range: ***1.05*** to ***1.2***	Default: ***1.200***
o ***HV2 time (s)*** — Range: ***0.08*** to ***13***	Certified Range: ***0.1*** to ***13***	Default: ***0.16***
o ***LF1 Hz (Hz)*** — Range: ***50*** to ***59.98***	Certified Range: ***50*** to ***59.9***	Default: ***59.3***
o ***LF1 time (s)*** — Range: ***0.16*** to ***1000***	Certified Range: ***0.16*** to ***1000***	Default: ***0.16***
o ***LF2 Hz (Hz)*** — Range: ***50*** to ***59.98***	Certified Range: ***50*** to ***59.9***	Default: ***57.00***
o ***LF2 time (s)*** — Range: ***0.16*** to ***1000***	Certified Range: ***0.16*** to ***1000***	Default: ***0.16***

o ***HF1 Hz (Hz)*** — Range: ***60.02*** to ***66***	Certified Range: ***60.1*** to ***66***	Default: ***60.50***
o ***HF1 time (s)*** — Range: ***0.16*** to ***1000***	Certified Range: ***0.16*** to ***1000***	Default: ***0.16***
o ***Enter service*** — Range: ***Disabled*** or ***Enabled***		Default: ***Enabled***
o ***Enter service HV (pu)*** — Range: ***0.88*** to ***1.1***		Default: ***1.050***
o ***Enter service LV (pu)*** — Range: ***0.88*** to ***1.1***		Default: ***0.917***
o ***Enter service HF (Hz)*** — Range: ***55*** to ***66***		Default: ***60.10***
o ***Enter service LF (Hz)*** — Range: ***55*** to ***66***		Default: ***59.50***
o ***Enter service delay (s)*** — Range: ***0*** to ***1600***		Default: ***300***
o ***Random delay (s)*** — Range: ***0*** to ***1000***		Default: ***0***
o ***Enter service ramp time (s)*** — Range: ***0*** to ***1000***		Default: ***300***
o ***PF export*** — Range: ***Disabled*** or ***Enabled***		Default: ***Disabled***
o ***PF import*** — Range: ***Disabled*** or ***Enabled***		Default: ***Disabled***
o ***Export limit*** — Range: ***Disabled*** or ***Enabled***		Default: ***Disabled***
o ***Export limit (pu)*** — Range: ***0*** to ***1***		Default: ***1.000***
o ***Constant Vars*** — Range: ***Disabled*** or ***Enabled***		Default: ***Disabled***
o ***Constant Vars setpoint (pu)*** — Range: ***–1*** to ***1***		Default: ***0.000***
o ***Export ramp (pu/s)*** — Range: ***0.01*** to ***1***		Default: ***1.000***
o ***PF export setpoint (pu)*** — Range: ***0.4*** to ***1***		Default: ***1.000***
o ***PF import setpoint (pu)*** — Range: ***0.4*** to ***1***		Default: ***1.000***

Grid Input



When the Mojave inverter's **GRID** terminals are connected to a grid-quality AC source and the ***Grid Input*** command is set to ***Use***, the inverter will synchronize itself with the grid source and connect to it. Its grid relay will engage, linking the **GRID** terminals directly with the **LOAD**. (See page 42.) It can also use the grid to charge batteries. (See below; also, see page 44.)

Charging from the Grid

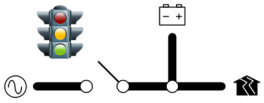
This product will not import grid power to charge batteries under all conditions. It will not charge from the grid if any of the following conditions are true:

- **Grid Input** is set to ***Drop*** in the **ACTIONS** view
- ***Inverter*** is set to ***Off*** in the **ACTIONS** view. If **Grid Input** is set to ***Use***, the inverter will transfer power to loads, but it will not charge batteries while the inverting function is off.
- ***Charge from grid limit (W)*** is set to ***0*** under the **Grid** tab (**SETTINGS** view)
- ***Max Charge Current (A)*** is set to ***0*** under the **Battery** tab (**SETTINGS** view)
- ***Simplified ToU*** is enabled and the inverter enters any of the ***Peak Rate Period*** time settings under the **Inverter** tab (**SETTINGS** view)

The inverter will restrict charging from the grid if any of the following conditions are true:

- ***Charge from grid limit (W)*** is set to a low number
- ***Max charge current (A)*** is set to a low number
- AC-coupled power, supplied by a GD inverter, is supplying most or all of the charging needs

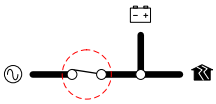
Grid Protection Parameters



- The inverter must wait for the configured grid-interactive delay period (usually 5 minutes) before it can connect to grid power.
- To be accepted, the utility grid must meet certain parameters, notably voltage and frequency. Agreements for utility interconnection may require other specified settings. See below.
  - When these conditions are met, the inverter will close its grid relay and accept the grid.
  - If the conditions are not met, the inverter will not accept the grid.
  - When a grid instability, outage, or shutoff occurs during normal operation, the inverter will open the grid relay. This isolates itself and the protected loads from the grid so that it may serve the loads from the battery.
- The loads powered by the inverter must not exceed the size of the inverter's grid relay.

Grid Profile and Protection Settings

When a ***Grid Profile*** is selected, it preloads a series of grid protection settings that have been designated according to each regulation or company. See page 39.

Grid Relay 

The Mojave inverter uses mechanical relays to connect the inverter, AC sources, and loads. The **GRID** and **GEN** terminals have separate, independent relays. These are not interchangeable. Each input has a separate set of acceptance criteria (also known as "enter service" criteria). (See the **Generator** tab on page 46.)

Until the grid relay energizes, the **GRID** terminals are electrically isolated from **LOAD**. When the relay closes, the **GRID** and **LOAD** terminals are electrically common. (The **GEN** terminals remain isolated.) When the relay changes states, the physical transfer delay is as fast as 20 milliseconds.

The inverter's input is limited to 55 Aac per phase or line. The continuous loads should never exceed this amount. When connected to an AC source, the inverter cannot limit the load current. The **GRID** or **LOAD** circuit breakers may trip.

CAUTION: Equipment Damage

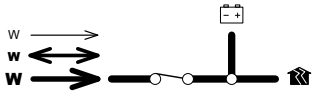
Current draw in excess of the recommended amount can damage the inverter's components. This damage is not covered by warranty. Use protective devices of appropriate size.

IMPORTANT:

- Do not apply generator power to the **GRID** terminals.
- Do not apply grid power to the **GEN** terminals.

NOTES:

- The relay does not open during any stage of **Time of Use**. (See page 36.)
- The neutral connections are not switched. Neutral conductors use a common bus bar.
- The independent inputs are intended to simplify the connection to multiple AC sources; however, the inverter can only use one input at a time. If both inputs are powered, the default setting is for the inverter to accept the **GRID** input.
- If the grid voltage or frequency vary too widely, the inverter will disconnect itself. However, any variations within the inverter's acceptance range will be transferred to the loads. The inverter does not "clean up" or condition the power from the source.

Power Limits 

The inverter's settings control the amount of power (kilowatts) that the inverter uses from the grid. These settings are meant to protect an AC source of limited size, as well as other possible limits to the system. If necessary, adjust these settings to match the input size.

- ***Import limit (W)*** attempts to restrict the total amount of power used from the grid. This setting affects ***Charge from grid limit (W)***. It does not affect ***Export limit (W)***.
- ***Export limit (W)*** is reserved for future use.
- ***Charge from grid limit (W)***, as indicated by its name, restricts the amount of power used to charge batteries from the grid. This number is limited by the ***Import limit (W)*** setting.

See the next page for more information.

NOTES:

- The charger cannot exceed the ***Import limit (W)*** setting, even if ***Charge from grid limit*** is set higher than ***Import limit (W)***.
  - ✓ The inverter gives priority to any loads. The inverter cannot restrict the amount of power sent to the loads.
  - ✓ If the combination of loads and charging exceeds ***Import limit (W)***, the inverter will reduce the charge rate to avoid overloading the source. .
  - ✓ If the loads **equal** ***Import limit (W)***, the charge rate will be reduced to zero.
  - ✓ If the loads **exceed** ***Import limit (W)***, see below.
- The ***Charge from grid limit (W)*** setting does not restrict charging performed while AC coupling. See page 35.

Demand Mitigation (Peak Reduction)

If the loads exceed ***Import limit (W)***, the inverter will support the loads by adding battery power to the power used from the grid.

This function will discharge the batteries at a current level controlled by the BMS. The level may vary with operating conditions such as temperature and the present state of the battery. This operation continues until reaching lower target setting of ***Minimum SoC***.

Battery Tab

The items under this tab affect the Mojave inverter's interactions with the Mojave ESS lithium-ion battery (see page 55), particularly battery charging. Under ***Battery Model***, this battery is represented by ***Mojave BMS***, which is pre-selected in the inverter.

The selection of ***Mojave BMS*** will automatically load all Mojave battery and charging parameters into the inverter. It will enable operation of the Battery Management System or BMS (see page 45). Only a few selectable options will be featured onscreen, as shown below.

IMPORTANT:

Follow all steps for Mojave battery installation on page 56. Make certain the BMS cable is connected.

The following items will appear.

- ***Battery Model*** — Once BMS communications are detected, the model selection is automatically set to ***Mojave BMS***. No other battery models are supported for the Mojave ESS.
- ***Max SOC (%)*** — Range: ***60*** to ***100***. Default: ***100***.

  The uppermost SOC for the charger to work. See page 44.
- ***Min SOC (%)*** — Range: ***10*** to ***60***. Default: ***50***.

  The lowest operating point for the inverter. See page 44.

Battery Parameters

Low and High Battery Limits

- ***Max SoC (%)***: After reaching maximum SoC (state of charge), the charger turns off. Setting this item to less than 100% could result in the battery becoming undercharged.
- ***Min SoC (%)***: This selection is the lowest operating point for all functions that discharge the batteries. When the batteries reach ***Min SoC (%)***, the inverter will begin a new charge cycle.
  - The system graphic under the **STATUS** view will show the system's measured SoC. (See page 17.)
  - If no charging source is available, the inverter will remain inactive until a source becomes available.
  - Below this point is the reserve battery supply for inverter basic functionality when no AC source is present. This battery reserve is required to boot the inverter's internal functions.

All other battery functionality is controlled and set by the BMS. See page 45.

Battery Management System (BMS)

The Mojave BMS will typically manage its own charging dynamically, rather than relying on the staged charging that is common in other inverter/chargers. The BMS tracks the battery's condition and automatically assesses the best charging parameters based on current conditions. These parameters are communicated to the Mojave inverter/charger using a CANBUS connection. The inverter/charger can adjust the charging voltage and current to maintain the best performance of the battery, while still respecting any user-set limits. There is no "typical" BMS charging cycle due to the adaptive nature for each unique situation.

The BMS plays a critical role in the safe operation of the Mojave battery. While monitoring the battery's condition, the BMS can communicate alerts or faults to the inverter/charger. In some cases, the BMS may disconnect the battery pack entirely if a potentially unsafe situation is detected, or if communication is lost.

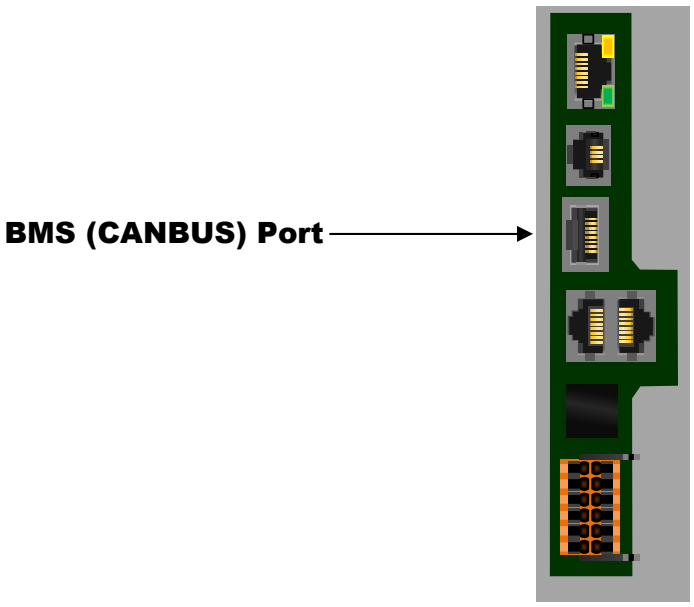


Figure 26 BMS Port (on Inverter)

See page 60 for more information on the cable connections.

Generator Tab

The items under this tab affect the Mojave inverter's interactions with an AC generator, particularly automatic starting.

The items presented here are described on the designated pages. They may not appear in the same order as shown below.

NOTE: Although **SYSTEM TIME** on page 13 uses a 24-hour clock format, settable times of day in this menu are formatted using a 12-hour clock.

- ***Generator output rating (kVA)*** — Range: ***0*** to ***100***. Default: ***5.0***.

  The generator's size in kilovolt-amps (kVA), usually treated the same as kilowatts (kW). See page 48.
- ***High voltage limit (V)*** — Range: ***84*** to ***140***. Default: ***130***.

  The highest AC voltage the inverter can accept from a generator before disconnection. See page 48.
- ***Low voltage limit (V)*** — Range: ***85*** to ***140***. Default: ***105***.

  The lowest AC voltage the inverter can accept from a generator before disconnection. See page 48.
- ***High frequency limit (Hz)*** — Range: ***55*** to ***65***. Default: ***63***.

  The highest frequency the inverter can accept from a generator before disconnection. See page 48.
- ***Low frequency limit (Hz)*** — Range: ***55*** to ***65***. Default: ***57***.

  The lowest frequency the inverter can accept from a generator before disconnection. See page 48.
- ***Warmup time (s)*** — Range: ***0*** to ***1800***. Default: ***60***.

  The time in seconds the generator is allowed to run with no load (before charging begins). This time should follow the generator manufacturer's recommendations This setting applies only when using AGS. See pages 48 and 50.
- ***Cooldown time (s)*** — Range: ***0*** to ***1800***. Default: ***300***.

  The time in seconds the generator is allowed to run with no load (after charging has finished). This time should follow the generator manufacturer's recommendations. This setting applies only when using AGS. See pages 48 and 50.
- ***AGS*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***.

  This item controls the Automatic Generator Start (AGS) function. See page 50.
- ***Start on low battery*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***.

  This item allows AGS to start the generator upon reaching a either a low state of battery charge, or progressively lower battery voltages. See page 52.
  - ***Start SoC (%)*** — Range: ***0*** to ***80***. Default: ***50***.

    The low state of charge that causes AGS to start the generator. See page 52.
  - ***Stop SoC (%)*** — Range: ***0*** to ***100***. Default: ***80***.

    The high state of charge that causes AGS to stop the generator. See page 52.
  - ***24 hour start voltage (V)*** — Range: ***40*** to ***64***. Default: ***48.8***.

    The low battery (DC) voltage that will cause AGS to start the generator after 24 hours. See page 52.
  - ***2 hour start voltage (V)*** — Range: ***40*** to ***64***. Default: ***47.2***.

    The low battery (DC) voltage that will cause AGS to start the generator after 2 hours. See page 52.
  - ***2 minute start voltage (V)*** — Range: ***40*** to ***64***. Default: ***44.0***.

    The low battery (DC) voltage that will cause AGS to start the generator after 2 minutes. See page 52.

- ***Start on high load (V)*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***.

  This item allows AGS to start the generator due to a high inverter load. See page 53.

  - ***Start kW (kW)*** — Range: ***0*** to ***8***. Default: ***5.0***.

    The load size above which AGS will start the generator. See page 53.
  - ***Stop kW (kW)*** — Range: ***0*** to ***8***. Default: ***2.0***.

    The load size below which AGS will stop the generator. See page 53.
  - ***High load start delay (m)*** — Range: ***0*** to ***90***. Default: ***1***.

    The delay in minutes before AGS starts the generator due to high load. See page 53.
- ***Quiet time*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***.

  This item restricts AGS from starting the generator automatically during certain hours. See page 53.

  - ***Quiet time start*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***10:00 PM***.

    The beginning of the scheduled period that restricts automatic start. See page 53.
  - ***Quiet time stop*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***05:00 AM***.

    The end of the scheduled period that restricts automatic start. See page 53.
- ***Exercise*** — Range: ***Disabled*** or ***Enabled***. Default: ***Disabled***.

  This item starts the generator periodically regardless of other conditions. See page 53.

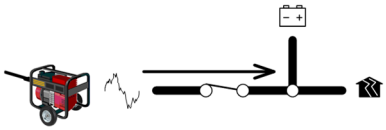
  - ***Exercise day*** — Range: ***Sunday*** to ***Saturday***. Default: ***Sunday***.

    The scheduled day for automatic generator exercise. See page 53.
  - ***Exercise start*** — Range: ***12:00 AM*** to ***11:59 PM***. Default: ***04:00 PM***.

    The scheduled time for automatic generator exercise. See page 53.
  - ***Exercise duration*** — Range: ***5 minutes***, ***15 minutes***, or ***30 minutes***. Default: ***15 minutes***.

    The scheduled length of the exercise period. See page 53.

Generator Usage



The Mojave inverter can connect to a generator to charge batteries and run loads when the utility grid is not available. The generator must be 120/240 Vac (three-wire or "split-phase") and 60 Hz. It cannot accept single-phase (two wire 120 Vac, 230 Vac, or 240 Vac) or three-phase input.

The generator can be started with a manual command or programmed to run automatically with the automatic generator start (AGS) function. The generator can start or stop according to battery state, load size, or several other external conditions.

Generator Limits

The generator's size should be specified with the setting ***Generator output rating***. This will help prevent the inverter from overloading the generator.

The generator must be stable within certain voltage and frequency limits. These limits are adjustable with the following settings:

- ***High voltage limit***
- ***Low voltage limit***
- ***High frequency limit***
- ***Low frequency limit***

CAUTION: Equipment Damage

Use of a three-phase generator with this equipment may damage either the inverter or the generator. This damage to the inverter is not covered by the product warranty.

NOTES:

- The Mojave inverter will not work with a DC generator. The input from an AC generator must be connected to the **GEN** terminals and must not be connected to other locations.
- The inverter has a separate **GRID** connection (see page 42). These independent connections are used for wiring to multiple AC sources. However, the inverter can only use one AC source at a time. If both connections are powered, the inverter automatically accepts **GRID**. It cannot accept **GEN** as long as **GRID** is active.
- If inverter programming has forced a disconnection from the grid (even if grid power is still present), the inverter can accept generator power instead.

Generator Input

When the inverter **GEN** terminals are connected to a stable AC generator, the **GRID** terminals are not in use, and ***Generator*** in the **ACTIONS** view is set to ***Use***, the inverter will synchronize itself with the generator and connect to it. When automatically started, the ***Warmup time (s)*** setting allows the generator to temporarily run unloaded while its output stabilizes. Once this time expires, the inverter's transfer relay will engage, linking the **GEN** terminals directly with the **LOAD**.

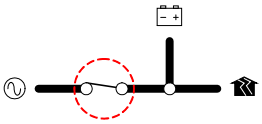
See page 49 for more information on the function of the transfer relay.

- When these conditions are met, the inverter will close its transfer relay and accept the generator. If the conditions are not met, the inverter will not close the relay or accept the generator.
- If the generator is shut down (or if the parameters are no longer met), the inverter will open the relay. This isolates the protected loads from the generator and allows the inverter to serve the loads instead.

- Upon connection, the generator power will be used to run any loads and charge batteries.
- During automatic shutdown, the inverter will open its transfer relay for the ***Cool down time***, then turns off the generator. This avoids the condition of shutting off the generator while loaded.
- If the loads exceed ***Generator output rating (kVA)***, the inverter will support the loads by adding battery power to the power used from the generator.

  This function will discharge the batteries at a current level controlled by the BMS. The level may vary with operating conditions such as temperature and the present state of the battery. This operation continues until reaching lower target setting of ***Minimum SoC***.

Generator Relay



The Mojave inverter uses mechanical relays to alternate between the states of inverting and of accepting an AC source. The **GRID** and **GEN** terminals have separate, independent relays. These terminals are not interchangeable. Each input has a separate set of acceptance criteria.

Until the generator relay energizes, the **GEN** terminals are electrically isolated from **LOAD**. When the relay closes, the **GEN** and **LOAD** terminals are electrically common. (The **GRID** terminals remain isolated.) When the relay changes states, the physical transfer delay is as fast as 20 milliseconds.

The inverter's input is limited to 55 Aac per phase or line. The continuous loads should never exceed this. When connected to an AC source, the inverter cannot limit the load current. The **GEN** or **LOAD** circuit breakers may trip.

	**CAUTION: Equipment Damage** Current draw in excess of the recommended amount can damage the inverter's components. This damage is not covered by warranty. Use protective devices of appropriate size.
	**IMPORTANT:** ❖ Do **not apply generator** power to the **GRID** terminals. ❖ Do not apply grid power to the **GEN** terminals.
	**NOTES:** ❖ The neutral connections are not switched. Neutral conductors use a common bus bar. ❖ The independent inputs are intended to simplify the connection to multiple AC sources; however, the inverter can only use one input at a time. If both inputs are powered, the default setting is for the inverter to accept the **GRID** input. ❖ If the generator's voltage or frequency vary too widely, the inverter will disconnect itself. However, any variations within the inverter's acceptance range will be transferred to the loads. The inverter does not "clean up" or condition the power from the source.

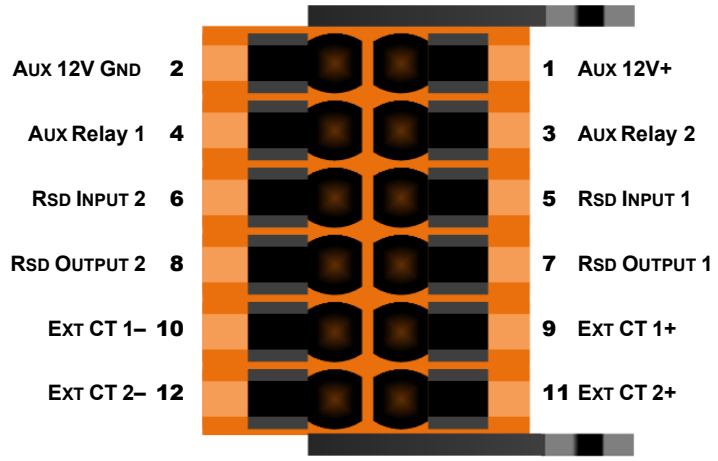


Figure 27 AUX terminals

Generator Control

The ***Generator*** item in the ***Action Menu*** (see page 22) will manually start or stop a generator when set to ***On*** or ***Off***. When set to ***Auto***, it will start and stop the generator automatically once the requirements for ***AGS*** are met (under the **Generator** tab). A "start command" in the Mojave inverter refers to either situation. (See the next page for more explanation of automatic control.)

The **AUX** connections send generator commands. It is more common for the start circuit on a two-wire-start generator to use dry contacts. However, either a 12-volt output or “dry” relay contacts can be used, as shown in the *Quick Start Guide*. 1

If using a generator with a three-wire-start circuit, a three-wire to two-wire conversion kit may be needed in conjunction with the **AUX**. Atkinson Electronics (www:atkinsonelectronics.com) is one company that makes these kits. The Atkinson GSM-Mini is intended to work with OutBack Power products.

CAUTION: Equipment Damage

These functions, particularly AGS, can damage the generator or the batteries if either are not properly maintained. Be sure to follow all maintenance requirements for all the components in the system to prevent unnecessary and expensive damage.

NOTES:

- When ***Start*** is pressed, the generator will continue to run until commanded to ***Stop***. It will not stop automatically unless AGS is in use.
- The ***Cool down time*** setting only applies when AGS is in use. It is not used during a manual stop.

To Enable the Generator for Operation:

1. Connect the generator's AC wiring to the inverter's **GEN L1** and **L2** input terminals.
2. Connect the generator's control wiring to either the **AUX RELAY** or the **AUX 12V** terminals.
    - Connect any additional hardware needed for starting the generator.
    - Consult the generator literature or manufacturer as needed to determine the generator's starting requirements.
    - See the *Quick Start Guide* for more information on any of these wiring connections.
3. Using the UI:
    - Under the Generator Tab, set AGS to Enabled.
    - In the Action Menu, set Generator to Auto.
    - Enter any generator settings, such as power or voltage limits.
    - Enable either the **RELAY AUX** or the **12V AUX** terminals, depending on the wiring.
    - Test-start the generator.

Manual Generator Start

The generator may be manually started using the ***Generator*** item in the ***Action Menu***, or from the generator's own controls. AGS does not need to be enabled for a manual start. The **Quiet Time**, **Exercise**, warm-up, and cool-down functions will not operate when the generator has been manually started. The generator will continue to run until it is manually stopped.

Automatic Generator Start

AGS allows the inverter to start and stop the generator automatically. The advanced functions allow generator control based on battery state or load size. It can be exercised during inactive periods, or prevented from starting late at night or during other "quiet times."

AGS starts the generator when any of its Start conditions are met and stops the generator when any of its Stop conditions are met. A **Quiet Time** schedule overrides most Start conditions to keep the generator from running at inappropriate hours.

AGS requires two functions to be enabled before it can operate.

- The ***Generator*** item in the ***Action Menu*** is set to ***Auto***. (See page 22.)
- ***AGS*** is set to ***Enabled*** under the **Generator** tab. (See page 46.)

If both of these items are not set correctly, none of the functions below will start the generator. However, it can still be manually started as described below.

When the **AUX** connection sends a start command and the **GEN** terminals receive voltage from the running generator, the ***Status*** (under the **Generator** tab) changes to ***Warming Up***. During this countdown, the generator is allowed to run with no load. When the ***Warm up time*** setting expires, the inverter will close its generator relay and display ***Connected***.

- If the start command was due to an exercise period, it will not close the relay. ***Info*** will display ***Gen start triggered due to exercise schedule*** instead. The ***Status*** will display ***Disconnected.***
- If the **GRID** terminals are in use, it will not close the relay and will display ***Disconnected***.

- If the power becomes unacceptable at any point (including while warming up), the inverter will open the generator relay and display a status of ***Error***. (***Info*** will indicate the specific problem.) It will not shut off the generator in the expectation that the power will return to normal.
- If no power is received after three minutes of attempting the start sequence, the inverter will cease any starting attempts. ***Status*** will display ***Error***. (***Info*** will indicate ***Generator failed to start***.) This error must be cleared before the inverter can attempt to start the generator again (see page 22). The **EVENTS** view will also display details. (See page 24.)

When the run period is over (whether due to automatic criteria or a manual command), the inverter opens its relay and displays ***COOLING DOWN***. During this countdown, the generator is allowed to run with no load.

When the ***Cool down time*** setting expires, the **AUX** connection sends a stop command.

SOC Start

When the battery discharges to the ***Start SoC (%)*** set point, the generator will start and the inverter will use generator power to charge the batteries. When the battery is charged to the ***Stop SoC (%)*** set point, the generator will stop. These settings will only operate when the ***Start on low battery*** item is enabled.

- The system graphic under the **STATUS** view will show the system's measured SoC. (See page 16.)

NOTE:

When using the Mojave Lithium-Ion Battery (which uses BMS to determine SoC), this is the most advisable mode to use

Voltage Start

When the batteries discharge to any of several selected low-voltage points for a designated period of time, the generator will start and the batteries will be charged. The designated time periods are 24 hours, 2 hours, and 2 minutes. When the inverter completes a battery charge (see page 44), the generator will stop. The generator will also stop if it reaches the ***Max SOC (%)*** set point (see page 17) before reaching the end of the cycle.

- If the battery voltage decreases below any of these set points, the designated timer starts counting down.
- If the voltage increases above the set point, the timer resets to maximum.
- The timers also reset to maximum when AGS stops the generator or upon an AGS fault.
- When any timer reaches zero (0), a start command is sent to the generator.
- These timers cannot be viewed.

The three time designations are meant to show increasing levels of urgency (due to increased battery discharge). The voltages should be set accordingly.

- ***24 hour start voltage*** is intended to start the generator after a mild battery discharge.
- ***2 hour start voltage*** is intended to start the generator after a major battery discharge.
- ***2 minute start voltage*** is intended to start the generator after a critical battery discharge.
    - This is considered an emergency start and should be set accordingly. It is the only AGS setting that will override **Quiet Time**.

These settings will only operate when the ***Start on low battery*** item is enabled.

Load Start

The inverter will start the generator when running a high load. It will stop the generator when the load decreases.

- When the **LOAD** terminals register an amount greater than ***Start kW*** for the ***High load start delay*** time, the generator will start.

  Following this operation:

- When the **LOAD** terminals register an amount less than ***Stop kW*** for the ***High load start delay*** time, the generator will stop.

NOTES:

- This function is meant to protect against rapid and unnecessary battery discharge. It does not protect against overload if the load is simply too large. Large, instantaneous loads can still overload the Mojave inverter if the generator does not start in time. The loads should be sized appropriately.
- When this function runs the generator, the inverter will charge the batteries. However, it is not programmed to perform a complete charge cycle. The charge might not be complete if the inverter reaches the ***Stop kW*** point and shuts down.

These settings will only operate when the ***Start on high load*** item is enabled.

Quiet Time

During evening hours or other times when generator noise is not desired, the generator can be prevented from starting automatically.

- The 24-hour and 2-hour start settings will not start the generator during these times.
  - Similarly, the ***Start SoC***, ***Start on high load***, and ***Exercise*** functions will not start the generator.
- The generator can be started normally with the ***Generator*** item under the **ACTIONS** view.
- The generator can be started normally using its own controls
- ***Quiet time start*** will begin a single, daily quiet time. This period will end upon reaching ***Quiet time stop***.
  - Alternate quiet times for weekends or other occasions are not available.

NOTE:

The 2-minute start setting will start the generator regardless of quiet time. This is considered an emergency start due to low battery voltage. It overrides quiet time to perform required battery charging.

These settings will only operate when the ***Quiet time*** item is enabled.

Exercise Start

The generator can be started on a regular basis to ensure that it does not sit unmaintained too long.

- When the inverter reaches the ***Exercise start time*** on the designated ***Exercise day***, the generator will start. It will continue running for the ***Exercise duration***.
- The generator will not close the relay during an exercise period. It will not charge batteries or deliver generator power to the loads.

Start/Stop Table

This table summarizes the various start and stop conditions that apply to both AGS and manual control.

Table 2 Start and Stop Reasons

START REASONS	Full Charge Cycle	Stop Reasons						
		Stop SOC%	Below ***Stop kW***	Quiet Time	Exercise Time Expires	***Generator*** set to ***Off***	Generator Controls	Run During Quiet Time?
2 minute start voltage	Yes	Stop				Stop	Stop	Yes
2 hour start voltage	Yes	Stop		Stop		Stop	Stop	No
24 hour start voltage	Yes	Stop		Stop		Stop	Stop	No
Start SoC (%)		Stop		Stop		Stop	Stop	No
Start kW			Stop	Stop		Stop	Stop	No
Exercise				Stop	Stop	Stop	Stop	No
Generator set to ***On***	Yes					Stop	Stop	Yes
Generator controls	Yes					Stop	Stop	Yes

Mojave ESS Battery

The Mojave ESS battery is sold for use with the Mojave inverter. It is a nominal 48-volt lithium-ion system intended for use in non-dwelling spaces. The battery can be charged and discharged at up to 200 Adc continuously.

This battery incorporates passive overcurrent protection in the form of circuit breakers and fuses. The battery incorporates active BMS protection for overcurrent, overvoltage, undervoltage, over-discharge, and low and high temperature conditions. The battery communicates operating limits to the connected inverter via CAN communications. It self-protects in case these limits are violated.

WARNING: Explosion, Electrocution, or Fire Hazard

- A battery can present a risk of electric shock, burns from high short-circuit current, fire, or explosion. Observe proper precautions.
- Ensure the cables are properly sized.
- Ensure clearance requirements are strictly enforced around the batteries.
- Ensure the area around the batteries is well ventilated and clean of debris.
- Never smoke near the batteries. Never allow a spark or flame near the batteries.
- Always use insulated tools. Avoid dropping tools onto batteries or other electrical parts.
- Never charge a frozen battery.
- If the battery must be removed, always remove the grounded terminal from the battery first. Make sure all devices are de-energized or disconnected to avoid causing a spark.

CAUTION: Equipment Damage

- Failure to install or use this product as instructed can result in damage to the product that may not be covered under the limited warranty.
- This product has no user-replaceable parts. It is only serviceable by qualified personnel.
- Do not connect multiple Mojave ESS batteries in series or in parallel. Do not connect them to other batteries.

IMPORTANT:

- See page 8 for labels displayed on the battery.
- Install this product in accordance with local electrical, building, fire, and other codes or utility requirements.
- Use with copper conductors rated 75°C minimum.
- When installing batteries, leave adequate clearance between batteries.
- If installed in the United States, all wiring methods shall be in accordance with the National Electrical Code® (NFPA 70), Current Edition.
- If installed in Canada, all wiring methods shall be in accordance with the Canadian Electrical Code®, C22.1, Current Edition.
- Wear complete eye and clothing protection when working with batteries.
- Do not expose to rain or spray.
- Fire suppression equipment must be available in case of fire. The minimum required equipment for this installation is a type ABC fire extinguisher.

NOTE:

- The exterior covers have been removed from the battery due to the risk of damage in transport. These covers should not be attached until the rest of the installation process is complete.
- The battery housing is still protected by a set of inner covers. One of these covers must be removed for wiring purposes. See page 59.

Installation

Requirements

Make certain to observe all environmental and placement requirements for this product.

- Indoor installation only, with an operating temperature range of 0 to 45°C. Installers should check with local authorities to confirm maximum permitted installation size or any other requirements.
- This product is to be installed on the floor. The battery must be anchored against a wall or similar surface. The back of the product will not be accessible after installation.
- Install this product in accordance with NEMA-1 or IP2X requirements. Do not install in an area where flooding may occur. If the water level rises above ¼" or water is sprayed on the product, stop using the product immediately.
- This product must be used in a negative-ground system, with the negative conductor mechanically bonded to the system ground.
- TL 797 or UL 797A conduit of 1½" size must be installed between inverter and battery bank.
- This product is not meant for installation in hazardous locations where concentrations of gas may accumulate and ignite.
- Alarms for smoke, heat, and/or flammable gas must be installed on the site, in accordance with building, fire, and installation codes.
- Ventilation:
  - Room must not be sealed; airflow to the outside is required
  - Use of an exhaust fan is recommended
- Keep the following away from this product:
  - Water
  - Moisture
  - Dust, particularly conductive material

NOTE: To meet UL 9540 in certain jurisdictions:

- A Mojave ESS battery should not be installed within 3' (1 m) of a doorway, window, or another battery.
- A maximum of 2 units may be installed in an attached non-living space (a garage or similar structure). Living spaces include bathrooms, toilet rooms, closets, halls, and storage spaces.
- A maximum of 5 units may be installed in a location detached from a living space (a shed, or similar structure more than 5' or 1.52 m from a house or dwelling)

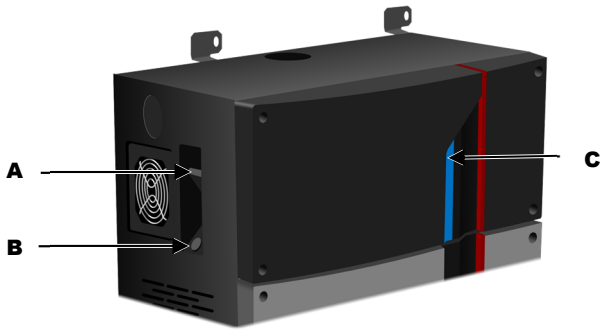
Emergency Protection

- Alarms for smoke, heat, and/or flammable gas must be installed on the site.
- In case of emergency or uncontrolled operation, the battery is equipped with a 250 A circuit breaker. When these conditions occur, open this breaker immediately.
- In case of fire:
  - Small fire — A type ABC extinguisher is the minimum required safety equipment.
  - Large fire — Vacate the area and contact emergency services.
- In case of gas leak, take the following steps to prevent gas accumulation:
  - Turn on ventilation fans
  - Open external windows
  - Close internal doors

Tools Required

- ✓ Socket wrench
- ✓ $^{7}/_{16}$" socket
- ✓ 5 mm hex (Allen) driver
- ✓ Socket wrench, torque
- ✓ 13 mm socket
- ✓ Screwdriver, torque, flat

Battery Features



- **Circuit Breaker (A)**. This item completely removes the battery from the circuit.
- **On/Off Button (B)**. This item turns battery functionality on or off. When off, the battery is unable to supply power or receive a charge.
  - Press and release this button to turn the battery on. Press and hold for 5 seconds to turn it off. There will be a 10-second delay after pressing before the battery turns off.
- **LED Indicator (C)**. This item depicts battery operating status. See page 61.

Figure 28 Features

Mounting

The Mojave ESS battery must be installed on a level surface. To protect against accidental tipping, the battery must be anchored against a wall or similar surface.

To mount the battery:

1. Four rubber bumpers are provided in the hardware kit. Install these bumpers into the rear of the battery by pushing them into the holes designated by **D** in Figure 29.

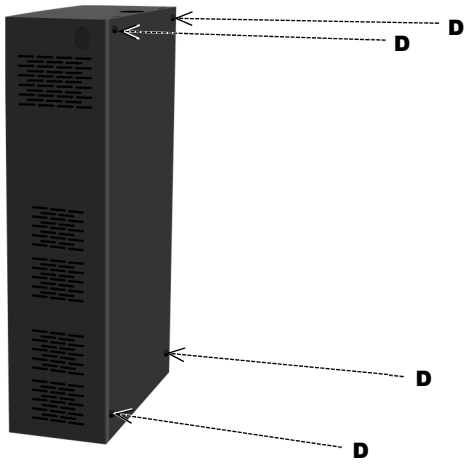


Figure 29 Rubber Bumpers

2. Place the battery on a level section of floor against the wall. The rubber bumpers will offset the battery from the wall surface by ⅜” (9.5 mm).

   NOTE: If the wall structure does not have studs with 16” spacing, the mounting surface should be reinforced with attached plywood or similar material as shown in Figure 30.

3. Insert the brackets **E** into the top slots on the battery as shown in the Figure 30 inset. These brackets will sit loosely until secured in the next step.

4. Two lag screws of $^{1}/_{4}$" thickness (**F**) are provided in the hardware kit. Using a $^{7}/_{16}$" socket, install the brackets in place on the wall. Mount the brackets into 16” wall studs if available; otherwise, seat them in the plywood. Once tightened, the brackets will hold the battery securely against the mounting surface.

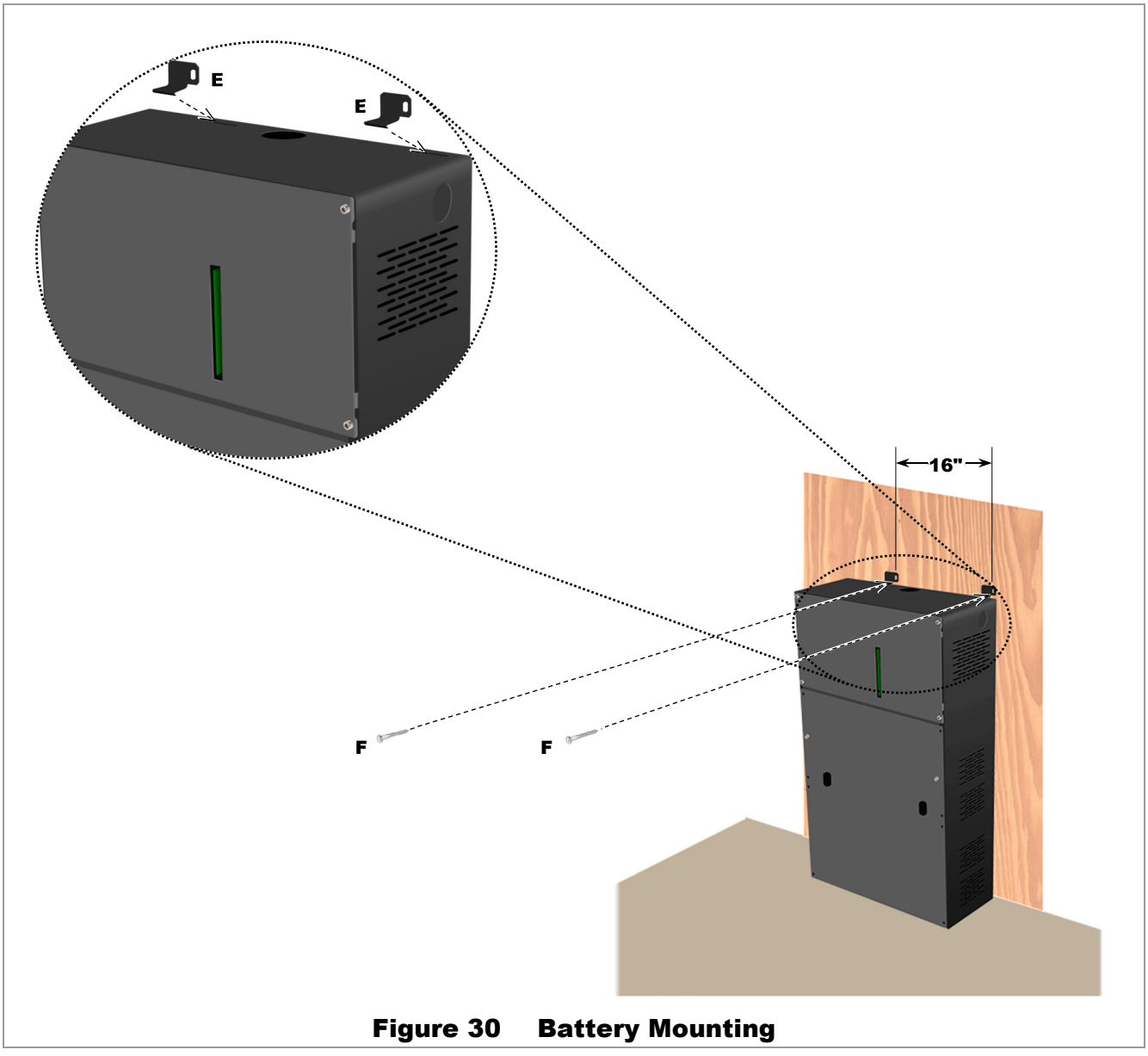


Figure 30 Battery Mounting

Mounting is complete.

See the *Mojave ESS Planning Guide* for information on mounting the battery with the inverter. 10

Wiring

WARNING: Shock Hazard

This battery must be turned off (using the circuit breaker) for at least 30 seconds before opening the wiring compartment.

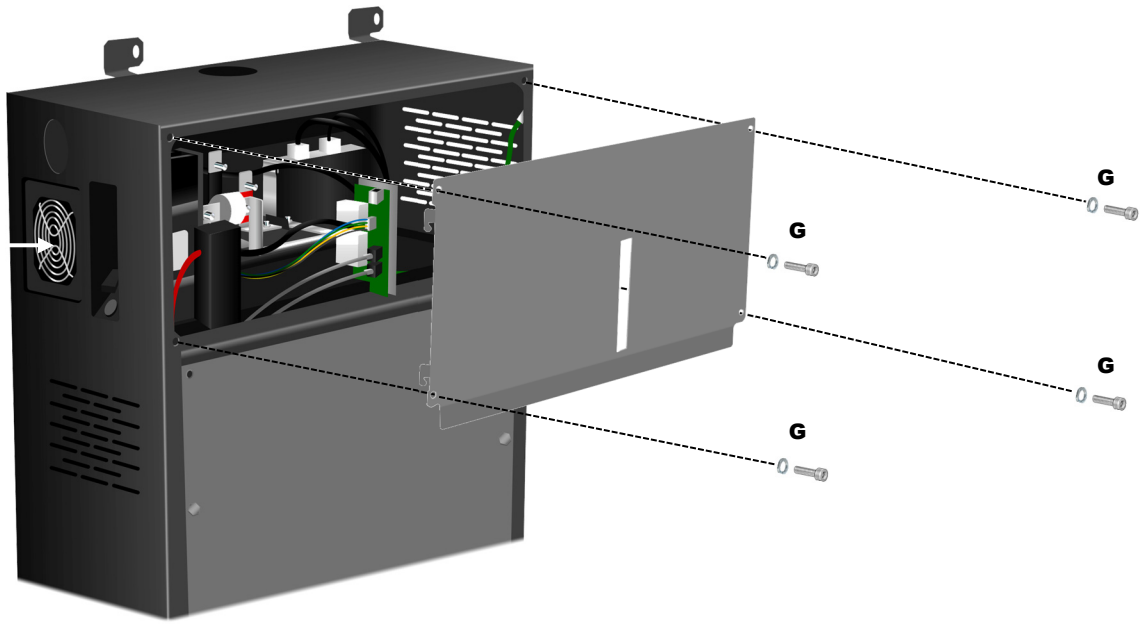


Figure 31 Removing Wiring Cover

Wiring Connections

The battery's exterior covers are not installed before shipping. The interior covers are present. The topmost of these must be removed for wiring access.

To open the wiring compartment, use a 5 mm hex (Allen) driver to remove the four M6 screws holding the cover in place (**G** in Figure 31).

The following items are included in the hardware kit:

- ✓ Exterior covers
- ✓ Communication cable, CAT5E, length/max length
- ✓ 2 primary conductors, 4/0 AWG, red and black
- ✓ Grounding conductor, #4 AWG

Wiring to Inverter

Although battery conductors are provided: If it is necessary to substitute longer cables, they must meet the following requirements:

- ✓ Size: 4/0 AWG
- ✓ Maximum length: 10' (3 m)
- ✓ Temperature rating: 75°C
- ✓ Termination: 8 mm ring lug

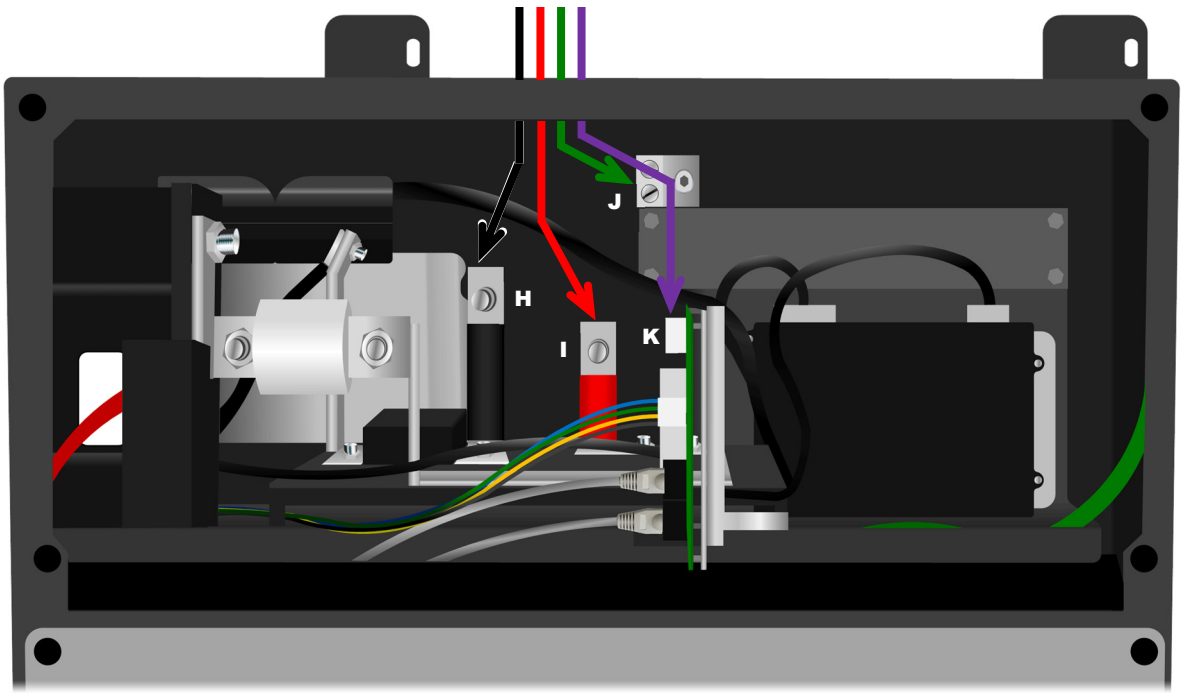
To make connections to the battery (see Figure 32 for all items):

1. Make all connections to the inverter, main disconnect, and external overcurrent protection (if present).
2. Using a 13 mm socket, attach the negative conductor to the negative bus bar **H** with a ring lug.
3. Using a 13 mm socket, attach the positive conductor to the positive bus bar **I** with a ring lug.
4. Insert the bare ground conductor into one of the open box terminals **J**. Tighten with a flat screwdriver.
5. Tighten all conductors according to Table 3.

Table 3 Battery Torque Values

Cable	In-lb	Nm
Positive (**I**)	65 to 75	7.3 to 8.5
Negative (**H**)	65 to 75	7.3 to 8.5
Ground (**J**)	35	4.0

6. The BMS port is located at **K**. Insert the CANBUS (RJ45) cable for BMS communications.



NOTE: It is required to make one, and only one, mechanical bond between the negative and ground conductors. This bonding is generally done in the Mojave battery between points **H** and **J**. A conductor is provided with the battery for that purpose.

Figure 32 Battery Wiring and BMS Cable

Wiring is complete.

See the *Mojave ESS Planning Guide* for information on connecting the battery to the inverter.

LED Indicator (Battery)

The Mojave ESS battery has a single LED indicator to show states of operation. Additional states may be added in the future, using firmware updates, to reflect new features.

If the inverter indicates a state not shown here, please refer to the firmware release notes. 4 Alternately, consult an updated revision of this manual from www.outbackpower.com. 5

- **Blue** — Battery is discharging or in a resting state. The Mojave inverter LED indicator (see page 28) will also be blue if the system is not operating.
- **Green** — Battery is charging.
- **Red** — Error shutdown. See page 64 for troubleshooting. The battery icon in the **STATUS** view will turn red at the same time. See page 17.

See **EVENT** view on page 24 for further descriptions of any status.

Battery Use

Commissioning

To commission the battery for ESS operation:

1. Confirm a valid bond between negative and ground. Check for voltage between points **H** and **J** in Figure 32 on page 60. The voltage reading should be zero.
2. Replace all covers. This step includes the exterior covers **L**, **M**, and **O** shipped with the unit, as well as the interior cover **N** for the wiring compartment. Do not remove any other interior covers. Do not remove the hex screws **P**. Install the covers **L**, **M**, **N**,and **O** as shown in Figure 33. Use a 5 mm hex (Allen) driver to install the M6 screws and washers at locations **L**, **M**, and **N**.

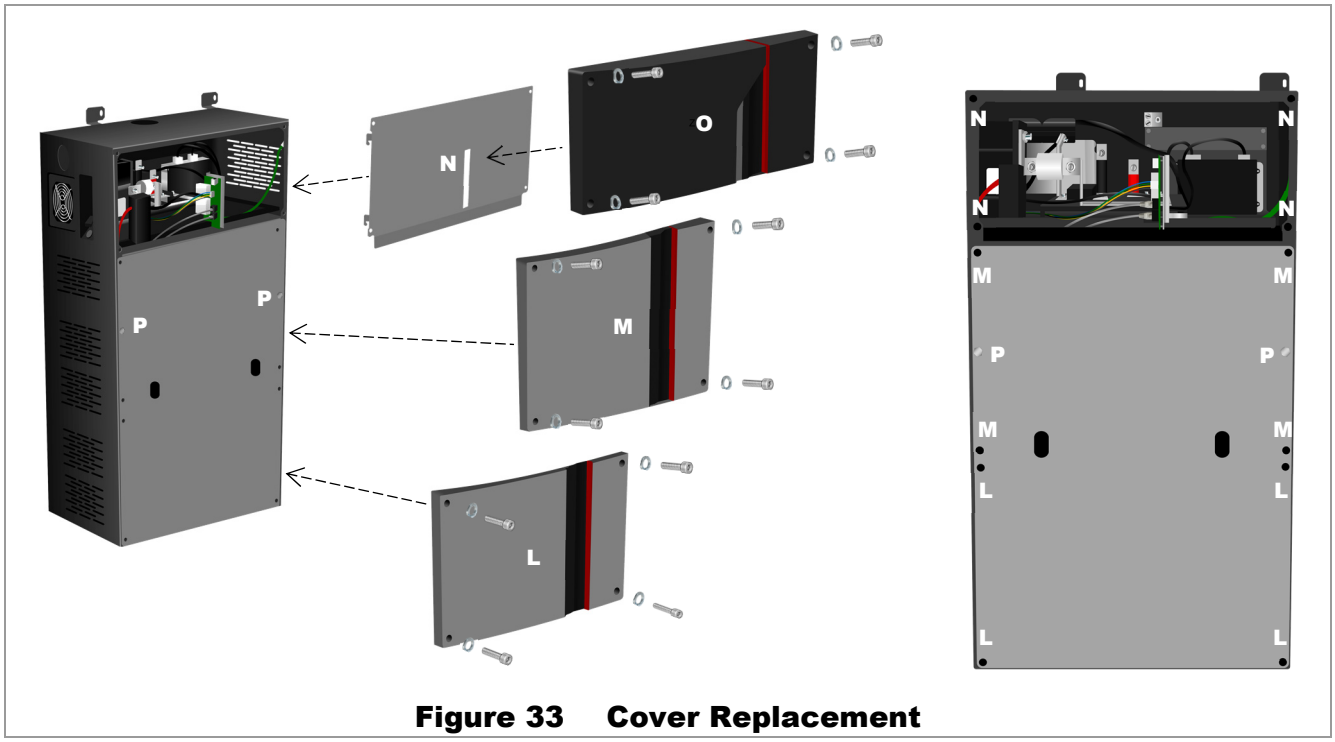


Figure 33 Cover Replacement

3. Turn on the circuit breaker. See page 57.
4. Press and release the **On/Off** button. See page 57.
5. Check the battery LED indicator to ensure that it illuminates (blue). See page 61.
6. Refer to the *Mojave Inverter/Charger Quick Start Guide* for inverter commissioning. 1
7. Check the inverter LED indicator to ensure that it illuminates (blue). See page 28.
8. Check the user interface to confirm communications. The battery **STATUS** screen will switch from a generic battery icon to a Mojave battery icon. See page 16.
9. Begin using the system normally. The battery can now supply power to a nominal 48 Vdc device.

Commissioning is complete.

If any steps do not proceed as expected, see page 64 for troubleshooting

Charging

CAUTION: Equipment Damage

This battery is equipped with a BMS. Do not disable it or circumvent its use.
Do not use other means of charging, such as two-stage charging, with this battery.

The BMS tracks the battery's condition and automatically assesses the best charging parameters based on current conditions. These parameters can be communicated to the inverter/charger using the CANBUS connection. There is no "typical" BMS charging cycle due to the adaptive nature for each unique situation.

Powering Up and Down

Following commissioning, the normal powering up of the battery should follow these steps:

1. Turn on the circuit breaker. See page 57.
2. Press and release the **On/Off** button. See page 57.
3. Check the battery LED indicator to ensure that it illuminates (blue). See page 61.

Power the battery down with these steps:

1. Press and hold the **On/Off** button for 5 seconds. See page 63. Wait 10 seconds for a response.
2. Turn off the circuit breaker. See page 63.

Additional Information

NOTES:

- See **Preventative Maintenance** on page 86.
- See **Specifications** on page 87.
- The Mojave battery ships from the factory with an initial state of charge of 30%.

Disposal

WARNING: Explosion Hazard

Do not dispose of this battery by fire.

Disposal or recycling of this battery should be managed in accordance with approved local, state and federal requirements. Consult state environmental agencies and/or the federal EPA.

Troubleshooting

FAQ

Table 4 Frequently Asked Questions

Question	Answer
What is the default password?	The default password for all access levels (***Owner***, ***Installer***, ***Admin***) consists of the last eight digits of the unit's serial number. See page 30.
What is the inverter's IP address?	The IP address is 192.168.2.2.
I forgot my password. How do I reset it?	***Owner***: enter the incorrect password and use the **Reset** button. See page 31. ***Installer***: Consult OutBack Power. ***Admin***: Consult OutBack Power.
Why is there a difference between my own handheld meter readings and the readings on the UI?	Differences in both reading tolerances and calibration may result in different figures. In addition, efficiency losses are not always taken into account.
Can I turn off AC coupling?	No. See page 35.
Does this inverter have a mode for exporting power from other DC sources (”DC coupling”)?	No. See page 10.
Can I use lithium-ion battery models other than those discussed in this book?	No. See page 44.
Can I use current transducer products other than those discussed in this book?	No. See page 10.
Can I interface the Mojave inverter with previous products by OutBack Power?	No. See page 10.
Can I use ACC power during ToU to charge the battery?	Yes. See page 37.

Inverter Troubleshooting

If the main LED indicator turns red or an error is shown by another means, check the ***Status*** view. If any errors are present, one icon will turn red to indicate the general location of the error. Only one icon can be red at a time.

To continue troubleshooting:

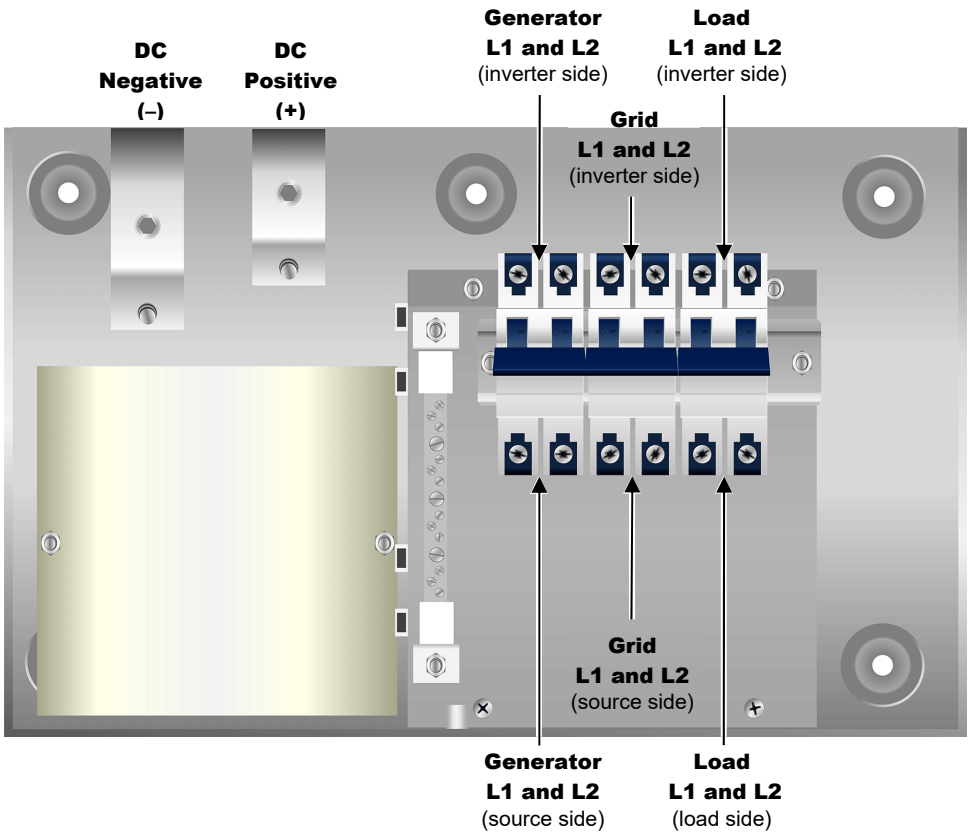


Figure 34 Measurement Points

On the following pages, Table 5 is organized in order of common symptoms, with a series of possible causes. It shows which LED indicator or icon colors should accompany a known problem. Each shows possible troubleshooting remedies, including checks with a handheld meter at the points shown in Figure 34. 1

For troubleshooting of the Mojave ESS battery, see page 69.

Table 5 Inverter Troubleshooting

Symptom	Possible Cause	LED Indicator or Icon	Possible Remedy
No AC output (will not invert)	No DC voltage	N/A	Use a DC voltmeter to check the voltage directly on the DC terminals. If not present, the problem is external. If present, the inverter could be damaged.
	Battery voltage <40 Vdc	• Red LED • Red battery icon	Use a DC voltmeter to check the voltage directly on the DC terminals. Check the voltage at the batteries. Charge the batteries if necessary.
	Circuit breaker open (in wiring compartment)	• Green inverter icon	Check position of load circuit breaker. (See Figure 34.) Use an AC voltmeter to check the voltage on both sides of the circuit breaker.
	Inverter set to ***Off***	• Gray inverter icon	In the **ACTIONS** view, set the ***Inverter*** item to ***On***.
Inverter set to ***On*** and will not go to the "ON" state	Rapid shutdown connection not installed	• Red LED • Red inverter icon	Ensure that a jumper or rapid shutdown device is installed across pins **5** and **6** of the **AUX** terminal block.
	Error condition	• Red LED • Various icons red	Check the **EVENTS** view for any errors.
Will not connect to the AC source	Circuit breaker open (in wiring compartment)	• Gray source icon (grid or generator)	Check position of circuit breaker. (See Figure 34.)
	No AC input	• Gray source icon (grid or generator)	Using a handheld meter, check the AC voltage at the inverter's grid or generator terminals. (See Figure 34.) If not present, the problem is external. If present, the inverter could be damaged.
	AC source does not meet requirements	• Red/green LED • Red source icon (grid or generator)	Check the **EVENTS** view for the reason for disconnection. Check the source voltage and frequency using the **Grid** or **Generator** tabs under the **STATUS** view. Confirm these readings with a handheld meter if necessary.
	Inverter is connected to two lines of three-phase source	• Red/green LED • Red source icon (grid or generator) • Red inverter icon	Inverter cannot connect to three-phase power. Make certain that 120/240 Vac power is available.
	Inverter was manually set to disconnect from AC	• Gray source icon (grid or generator)	In the **ACTIONS** view, set the appropriate toggle (***Grid*** or ***Gen***) to ***Use***. (If this setting was intentional, then no action is required.)

Table 5 Inverter Troubleshooting

Symptom	Possible Cause	LED Indicator or Icon	Possible Remedy
Will not charge	No AC input	• Gray source icon (grid or generator)	See "Will not connect to the AC source" listings.
	Inverter set to ***Off***	• Gray inverter icon	In the **ACTIONS** view, if ***Grid*** or ***Gen*** is set to ***Use*** but ***Inverter*** is set to ***Off***, inverter will not charge.
	Charger set to zero	• Green battery icon	In the **SETTINGS** view, check ***Max charge current (A)*** under the **Battery** tab. (If this setting was intentional, then no action is required.) **NOTE**: The ability to charge from the utility grid may have been restricted due to utility requirements.
	Grid input set to zero	• Green grid icon	In the **SETTINGS** view, check the following under the **Grid** tab: ❖ ***Import limit (W)***. ❖ ***Charge from grid limit (W)*** (If either setting was intentional, then no action is required.) **NOTE**: The ability to import from the utility grid may have been restricted due to utility requirements.
Low charge rate	Charge complete or nearly complete	• Green battery icon	Check the DC voltage and charging stage using the UI. Confirm with a handheld DC voltmeter.
	System display DC meter reads significantly higher than actual battery voltage	• N/A	Using a handheld DC voltmeter, check the voltage on the inverter's DC terminals. If different from the UI reading, the inverter could be damaged. Otherwise, check the DC voltage on the batteries. If different from the reading on the inverter, this could be a DC connection problem.
	High output loads	• N/A	If total loads and charge exceed the AC input setting, charge rate decreases to give priority to the loads. Turn off some of the output loads and test the charge rate again.
	High inverter temperature	• N/A	The inverter will reduce the current rate for charging and other activities if the internal temperature exceeds a certain level. Check temperature and allow the inverter to cool if necessary. External cooling may also be applied.
Multiple HBCI events	Battery bank too small in AC coupling application	• N/A	The inverter will charge the batteries with excess AC-coupled power. The batteries must be sized accordingly. Increase the bank size if necessary.

Table 5 Inverter Troubleshooting

Symptom	Possible Cause	LED Indicator or Icon	Possible Remedy
Will not export AC- coupled power to the utility grid (See page 35)	Grid power does not meet requirements; inverter will usually disconnect	• Red/green LED • Red grid icon	Verify grid voltage and frequency. Determine if they are within the inverter's approved limits. If not, the inverter is operating correctly. Contact the utility company if necessary.
	The inverter has other criteria which must be met, such as the qualifying time	• Gray grid icon	Wait until qualifying timer expires.
	All available AC-coupled power is used by batteries	• N/A	If the batteries need a full charge, this may consume all power. Wait until charge is complete.
	All available AC-coupled power is used by loads	• N/A	Reduce loads. (If loads are desired size, no action is required.)
	GD inverter problem	• N/A	Confirm that the grid-direct inverter is operating correctly.
Unusual voltage on hot or neutral output line	System neutral and ground may not be bonded	• N/A	Using a handheld AC voltmeter, test the **N**, **L1** and **L2 LOAD** terminals. (See page 64.) These measurements should give full voltage. Test neutral and ground connections. This measurement should read zero volts. Any other result means neutral and ground are not bonded correctly. If this is the case, the hot line often reads 60 to 75 Vdc and the neutral reads 45 to 60 Vdc with respect to ground. (If bonding is not required or is prohibited by national or local codes, then no action may be required.)
Unusual and different voltages on AC hot input lines	Input neutral is not connected correctly ❖ Inverter may also not connect to AC source ❖ Loads may behave unusually	• N/A	Test **L1** input and neutral connections with AC voltmeter. Test **L2** input and neutral connections with AC voltmeter. (This can be on **GRID** or **GEN** input, depending on where the symptoms appear.) Test **L1** to **L2** input. From hot to neutral should be approximately 120 Vac unless the output has been adjusted. **L1** to **L2** should be approximately 240 Vac. If the two outputs are different voltages but still add up to 240 Vac, the neutral is not connected to the inverter.

Table 5 Inverter Troubleshooting

Symptom	Possible Cause	LED Indicator or Icon	Possible Remedy
Loads drop out or crash during transfer	Loads sensitive to inverter's transfer time	• N/A	The inverter features a small but noticeable response time during transfer. Certain loads (such as highly sensitive computers) may not respond well. An uninterruptible power supply may be needed.
	Loads too large	• Red LED • Red inverter icon	The unit can transfer more power than it can invert. If loads are oversized, the unit will falter or crash when switching to batteries. Reduce the size of the loads.
	Undersized battery cables	• Red LED	Battery cables smaller than recommended will cause a significant voltage drop when switching to batteries, acting like either an overload or a low-battery condition. Size all cables correctly.
Generator fails to start; AGS conditions were met	***Generator*** not set to ***Auto*** in ***Action Menu***	• N/A	Both items must be set before AGS can function. In the **STATUS** view, ***AGS Status*** will not read ***Enabled*** if both items are not set.
	AGS not set to ***Enable*** under **Generator** tab		
Generator, external fan, etc. fails to start when signal is provided by **AUX** output	**AUX** output is not connected	• Yellow LED • Yellow generator icon	Test the generator or device to confirm functionality. Test the appropriate **AUX** terminals with a DVM. (If the **RELAY AUX** terminals are in use, test for continuity. If the **12V AUX** terminals are in use, test for 12 Vdc.) ❖ If the proper results are present when the ***Action Menu*** indicates the function is ***On*** (and the device still does not work), then there is an external connection problem. ❖ If the proper results are not present with the function ***On***, the **AUX** circuit may be damaged.
	Wrong **AUX** terminals were programmed	• Yellow LED • Yellow generator icon	Confirm that the **AUX** item that was programmed matches the terminals that are in use.
	Wrong **AUX** terminals are in use	• Yellow LED • Yellow generator icon	If generator or external device requires 12 Vdc, confirm the **12V AUX** terminals have been connected. The **RELAY AUX** terminals do not provide voltage.

Battery Troubleshooting

WARNING: Hazard to Human Life

In the event of an electrolyte leak, do not come in contact with the electrolyte. Immediately disconnect the battery and properly dispose of it.

CAUTION: Hazard to Equipment

Do not connect multiple Mojave batteries in series or in parallel. Do not connect them to other batteries.

Low SOC Recovery

CAUTION: Hazard to Equipment

Failure to follow these instructions can cause permanent battery damage.

The Mojave ESS battery will protect itself from a damaging overdischarge by ceasing to power the inverter. This occurs in the case of extended operation without a charging source. It is indicated by a red battery LED indicator. When this occurs, check OPTICS RE for more information.

To recover the system from this state, perform the following steps.

1. Verify a charging source (AC grid, generator, etc.) is available to immediately begin charging the battery upon connection to the inverter. Failure to immediately charge the battery after resumption of operation in this state can cause permanent damage to the battery.
2. Press and hold the **On/Off** button to override the protection mechanism and allow the inverter to power up.
3. Inverter should energize and charging should begin upon qualification of the source. This charge may be at a lower power level than usual until the battery returns to the normal operating range. If the inverter is unable to qualify the AC source and begin charging the battery, then the battery should be turned off. This will preserve capacity for further troubleshooting. A connected inverter will continue to drain the battery in this state.

General Troubleshooting

For possible solutions to other problems, consult Table 6.

Table 6 Battery Troubleshooting

Symptom	Possible Cause	Possible Remedy
On/Off button will not turn battery off	Delays are not being observed	Press and hold the **On/Off** button for 5 seconds. Wait at least 10 seconds for battery to respond. Do not push the button again in that time. If the button fails to respond, turn off the circuit breaker.
Inverter does not recognize Mojave battery; inverter does not update UI with appropriate information	Connection issue	○ Confirm that the BMS cable is securely connected to the proper port on the inverter. See page 45. ○ Confirm that the BMS cable is securely connected to the proper port on the battery. See page 60.
	Inverter may not be approved for use	Check that the inverter is approved to support the use of the Mojave battery.
Battery goes into a fault state (red LED) and stops providing power after 2 hours of idle operation	Connection issue	○ Confirm that the BMS cable is securely connected to the proper port on the inverter. See page 45. ○ Confirm that the BMS cable is securely connected to the proper port on the battery. See page 60.
	Inverter may not be approved for use	Check that the inverter is approved to support the use of the Mojave battery.
Battery goes into a fault state (red LED) and stops providing power during operation	Various error states; if inverter is powered down, UI will not respond	Check OPTICS RE for an error log and associated troubleshooting steps.
		Cycle the power. Press and hold the **On/Off** button for 5 seconds. Wait at least 10 seconds for battery to respond. Do not push the button again in that time. If the button fails to respond, turn off the circuit breaker, wait a short time, and turn it back on.
Battery goes into a fault state (red LED) and stops providing power during commissioning	Pre-charge test failure	Check the polarity of the DC connection. Confirm that a short is not present on the battery cables.
Charging/discharging is at a lower power than expected	Configuration	Input and output power limits can be set in the inverter. Check that these values are set appropriately under the **Grid** tab (page 39) or the **Generator** tab (page 46).
	Operating conditions	Charging and discharging power can be limited by thermal conditions.
		Charging and discharging power may be limited near the very high and low ends of the SoC range.
The inverter does not stop charging or discharging at the desired battery SoC	Configuration	SoC charging and discharging limits can be set in the inverter. Verify appropriate values are set.
The system does not correctly calculate the SoC of Mojave battery used in series or parallel with another battery	This is not a supported use; it poses a significant risk of equipment damage	Immediately disconnect the battery from this system.

Service Instructions

CAUTION: Equipment Damage

- These instructions are for use by qualified personnel who meet all local and governmental code requirements for licensing and training for the installation of electrical power systems with AC and DC voltage up to 600 volts.
- This product is only serviceable by qualified personnel. Performing these operations without first consulting OutBack Power may void the product's warranty.
- These instructions pertain to the Mojave inverter only. The Mojave battery has no user-replaceable parts. It is only serviceable by qualified personnel.

Replacement Kits

This chapter details how to perform service on the Mojave Series Inverter/Charger. The following instructions will cover the following replacement kits:

- **SPARE-501** (Mojave Control Board)
- **SPARE-502** (Mojave 60 Hz AC Board)
- **SPARE-504** (Mojave Carrier Board)
- **SPARE-506** (Mojave Power Module)
- **SPARE-508** (Mojave Fan Module)

The instructions for the following kits are not included as separate procedures. The instructions for these kits are either part of existing procedures (as noted on the following pages),or are part of the standard installation instructions as detailed in the *Mojave Inverter/Charger Quick Start Guide*.

- **SPARE-509** (Mojave CANBUS Terminator and Auxiliary Terminal)
- **SPARE-510** (Mojave Antenna Kit)
- **SPARE-511** (Mojave Mounting Bracket)
- **SPARE-512** (Mojave Cover)
- **SPARE-514** (Mojave BOS [Wiring Compartment] Door)
- **SPARE-515** (Mojave BOS [Wiring Compartment] Door Hardware Kit)

The following parts are also available.

- OBR-16-DIN (Relay)
- RTS (Remote Temperature Sensor)
- OBCT-200 (Current Transducer)
- DIN-60D-AC (AC Circuit Breaker)
  - This item is usable when adding a **GEN** input, as well as a replacement for the **GRID** or **LOAD** circuit breakers.

Preparatory Steps

Follow the procedures which are applicable to the system. If any elements are not present, ignore those procedures.

Tools Needed

- Digital multimeter (DMM)
- 5 mm hex (Allen) wrench
- #1 Phillips screwdriver
- #2 Phillips screwdriver
- Torque driver

Disconnection

Power down and disconnect all power sources from the inverter prior to performing any service. Turn off all circuit breakers connected to the inverter.

- **LOAD** circuit breaker
- **GRID** circuit breaker
- **GEN** circuit breaker
- DC circuit breakers
- Generator start circuit

Voltage Check

Once these connections are turned off, verify with a voltmeter that NO voltage is present at the DC+ to DC– terminals. Refer to Figure 34 on page 64.

WARNING: Shock Hazard and Equipment Damage

It may take time for internal capacitance to fully discharge. Ensure full discharge for at least one minute (less than 1 Vdc) prior to continuing. The inverter's capacitors may retain a sizable charge, which can cause electrical shock or severe equipment damage during normal handling. This damage is not covered under the unit's warranty.

Removal of Covers

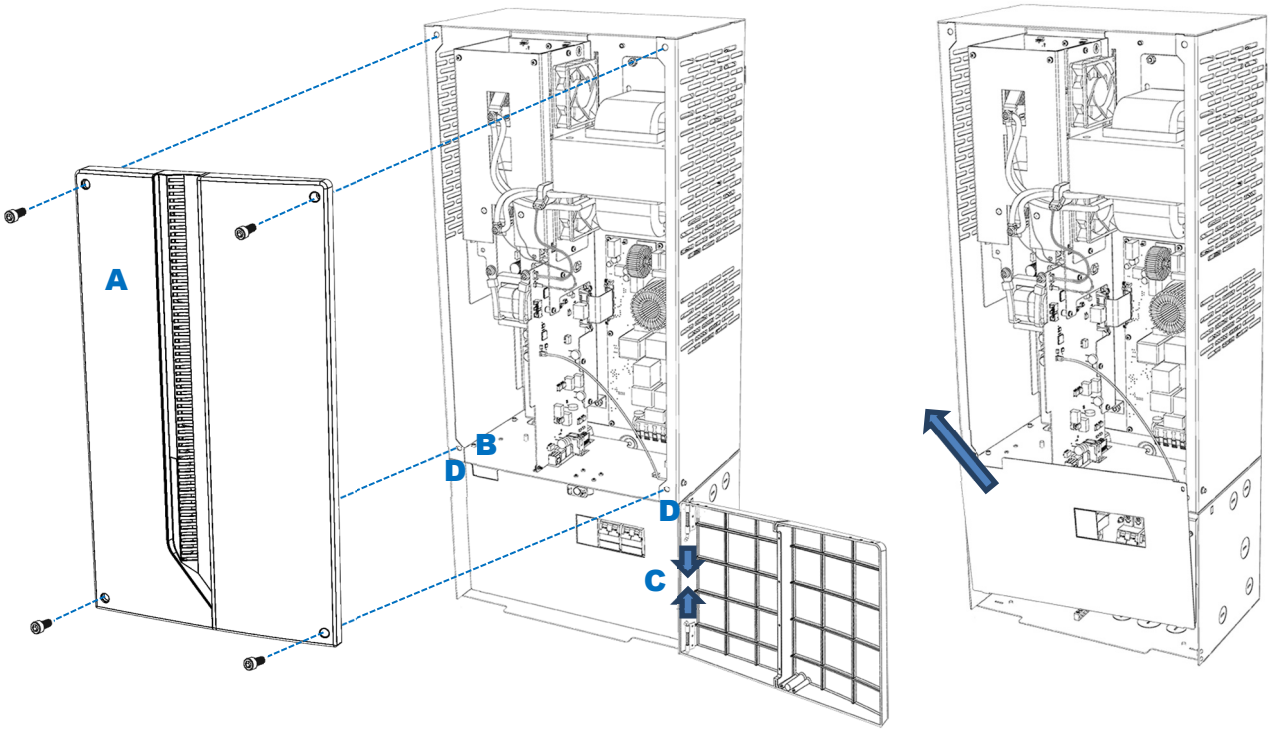


Figure 35 Removal of Covers

To remove the covers:

4. Using a 5 mm hex (Allen) wrench, remove 4 screws from the cover. Remove the cover. See **A** in Figure 35.
5. Open the wiring compartment door by pressing the latch at **B**. The door swings to the right. Remove the door by pulling inward on the pins **C** at the corners of the door.
6. Inside is a “dead front” which prevents accidental contact with anything other than the circuit breakers. To remove the dead front, remove the two screws **D** from the corners of the dead front. The dead front will rotate forward from the top, but is slotted in place at the bottom. Remove the dead front by pulling upward and out. See **E**.

Removal is complete. Proceed to the replacement instructions.

Replacement of Control Board

To replace the control board (SPARE-501):

1. Remove the **AUX** terminal block from its socket. See **A** in Figure 36. Use the black levers **B** on the sides of the block to help remove it.
2. Using a #1 Phillips screwdriver, remove the securing screw for the control board. See **C** in Figure 36.

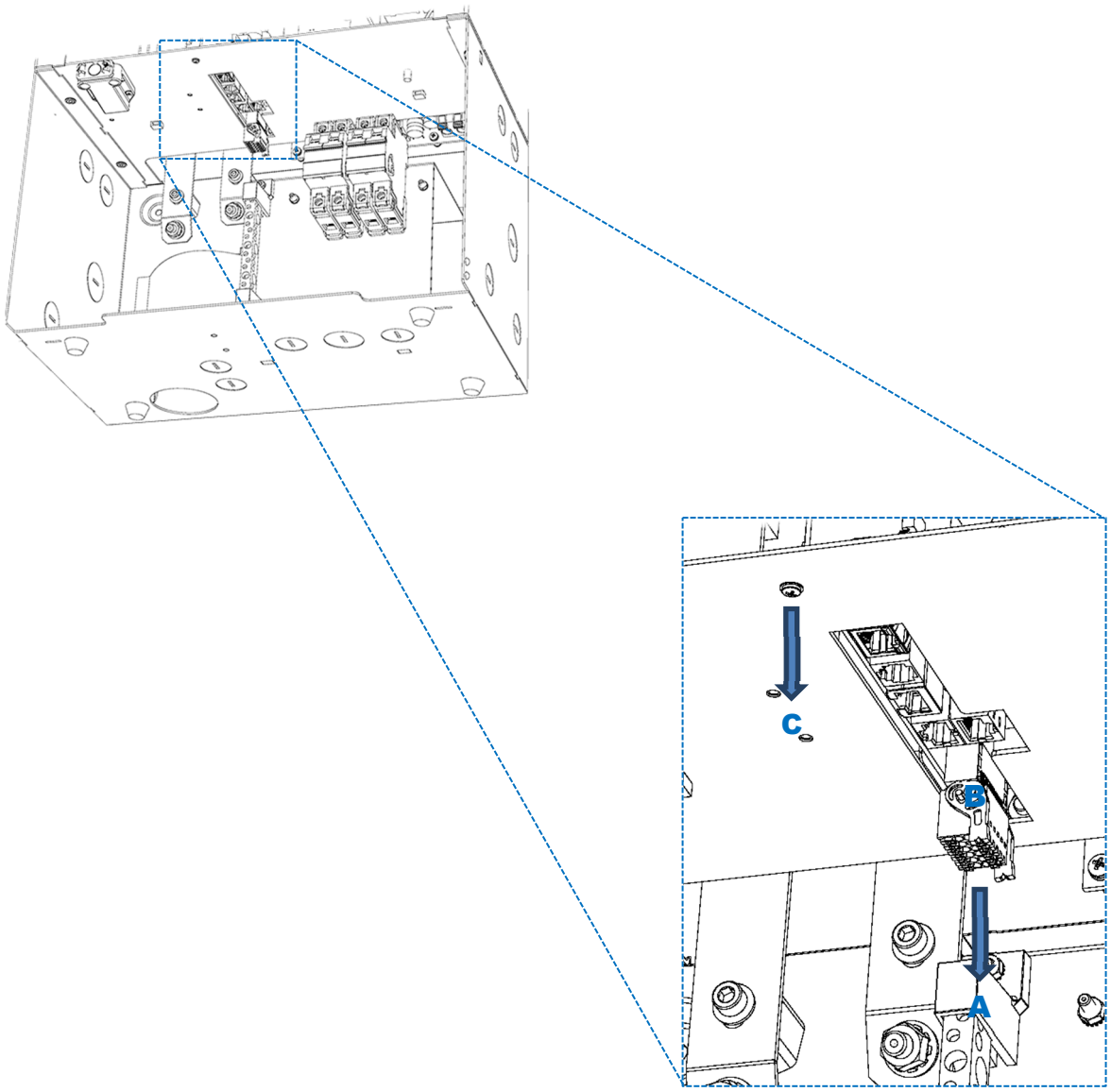


Figure 36 Control Board External Attachments

3. On the control board, remove the following connectors (see Figure 37):
   - SMA connector (**D**) for the antenna wire.
   - Ribbon cable (**E**) for the AC board.
   - 5-pin connector (**F**) for the current transducer.
   - 2-pin connector (**G**) for the power modules.

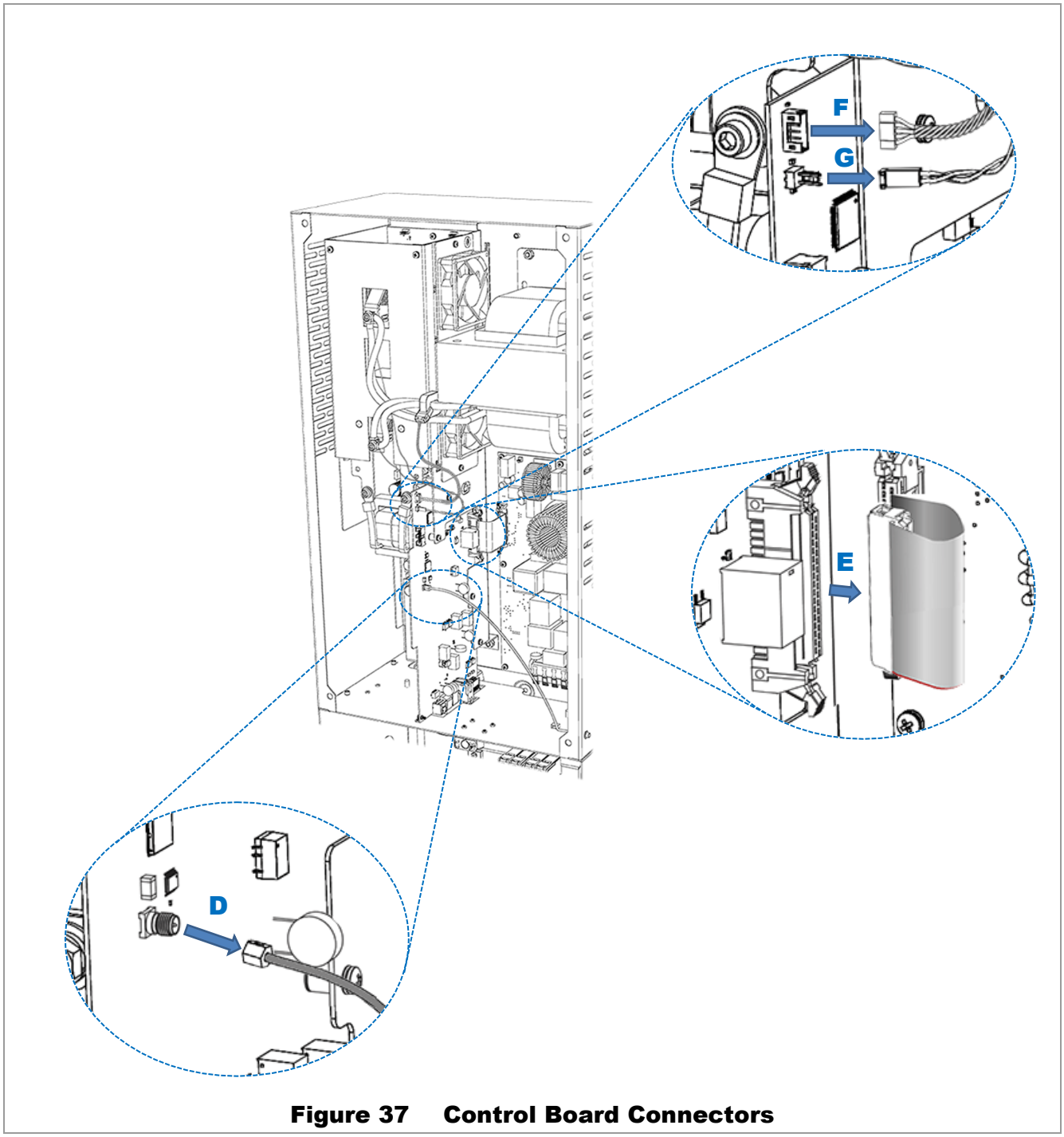


Figure 37 Control Board Connectors

4. Using a #2 Phillips screwdriver, remove 4 screws **H** from the control board. See Figure 38.

5. Carefully remove the control board, pulling toward the front of the inverter, as shown in Figure 38.

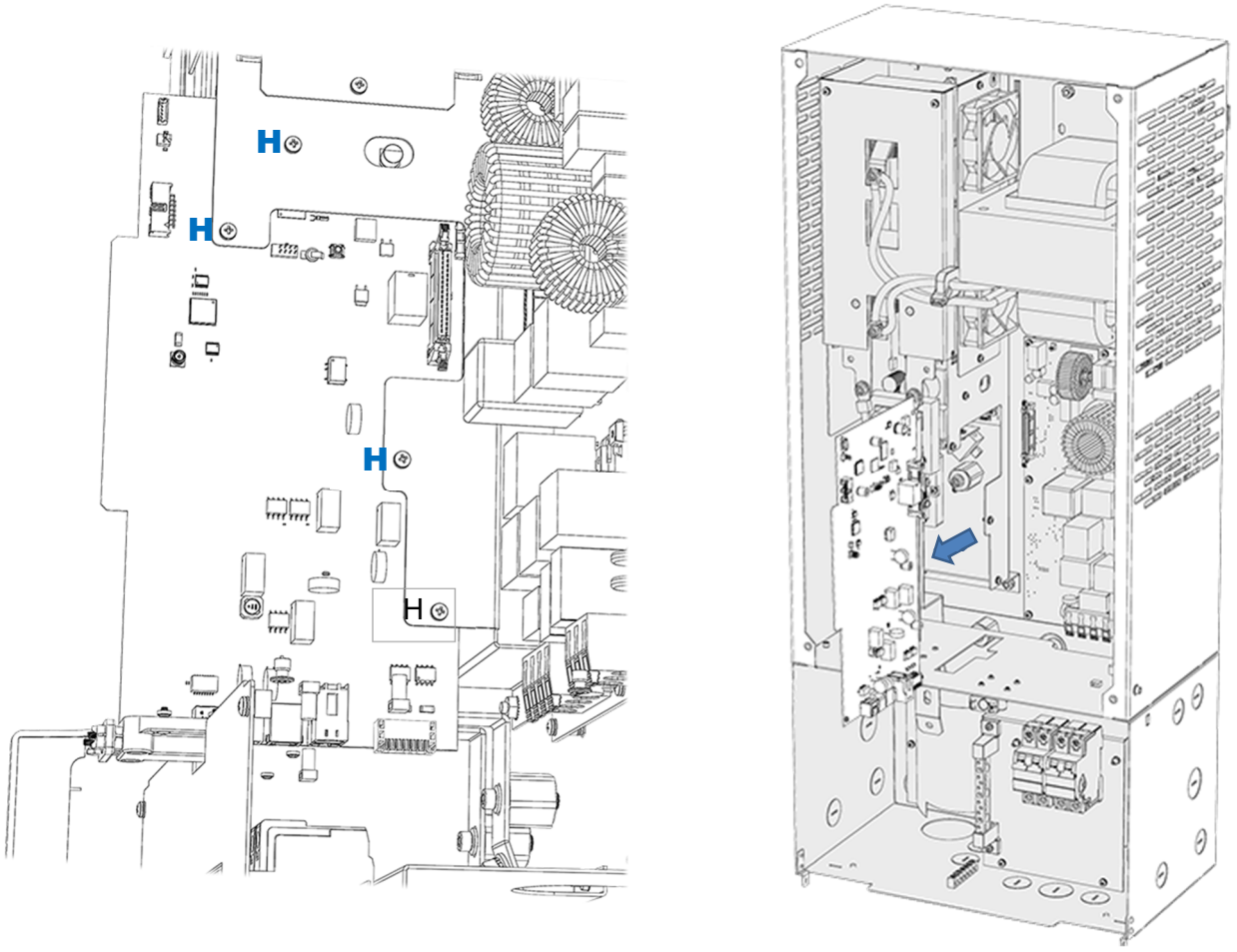


Figure 38 Dismounting Control Board

6. Replace the control board. Perform all previous steps in reverse order.
   - Insert the control board.
   - Replace the screws **H**. Do not tighten.
   - Replace the connectors **G** and **F**. See Figure 37 if necessary.
   - Replace the ribbon cable **E** and the SMA cable **D**. See Figure 37 if necessary.
   - Replace the securing screw **C**. See Figure 36 if necessary.
   - Tighten all screws **H**.
   - Replace the **AUX** terminal block **A**. See Figure 36 if necessary.

Replacement is complete.

Replacement of AC Board

To replace the AC board (SPARE-502):

1. Before beginning, remove the SMA cable for the antenna wire. See **A** in Figure 39. Note that this is not a required step for board replacement, but will make access to the board easier.
2. Unclip all wires from AC terminals at the bottom of the board, including the neutral wire. See **B**.

IMPORTANT:

- Mark or note the wire positions so that they can be reinstalled correctly. The wire positions on the terminals do not correspond to their positions on the circuit breakers.
- This example does not depict generator wiring. If a generator is connected (**B1** and **B2**), these wires must be disconnected as well.

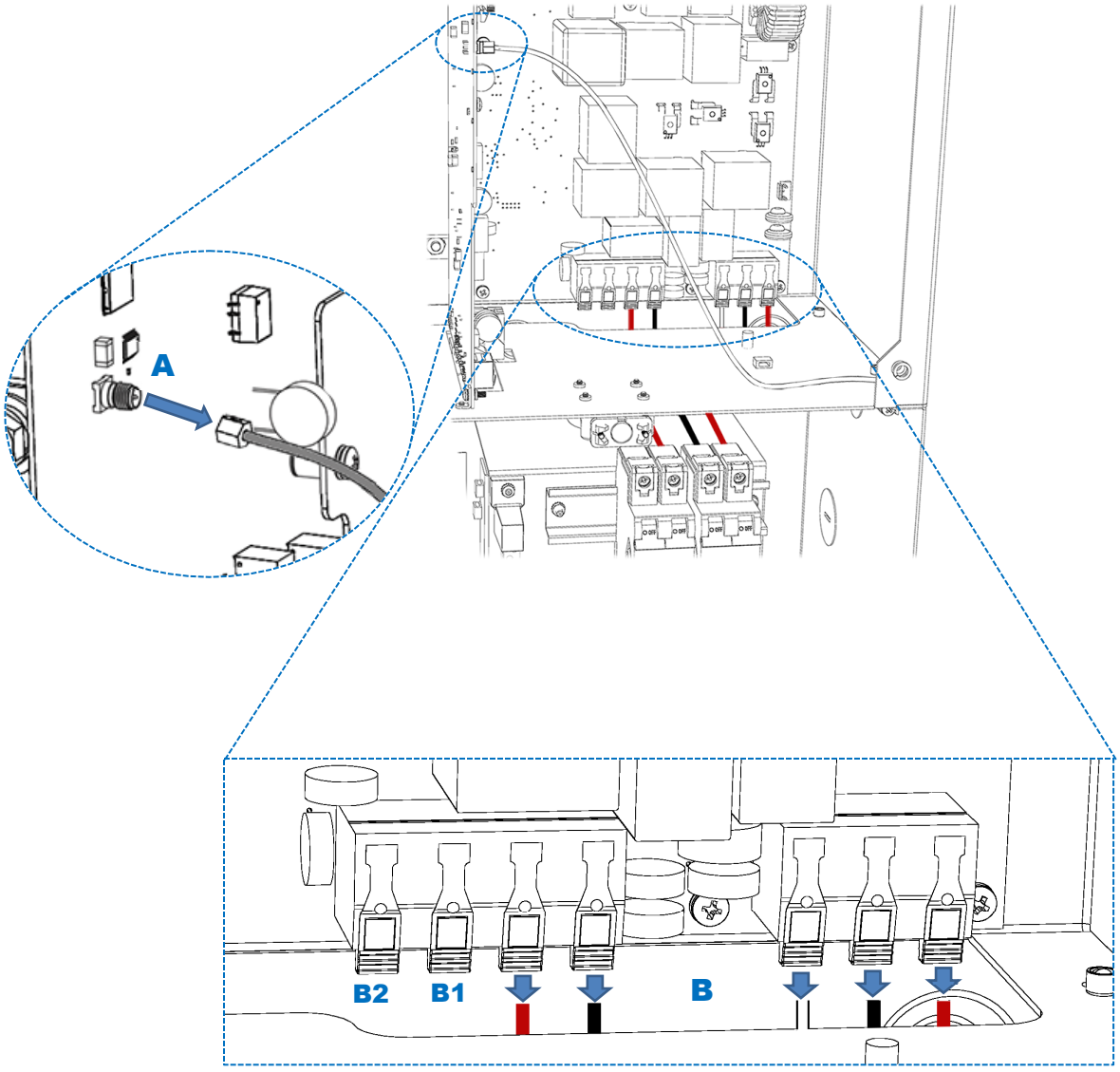


Figure 39 AC Terminals

Unclip all wires from the transformer terminals. See **C** in Figure 40. .

IMPORTANT:

- Mark or note the wire positions so that they can be reinstalled correctly. The four wires are marked with numbers 5 through 8. They are installed in the positions shown in Figure 40. The terminals, however, are not marked.

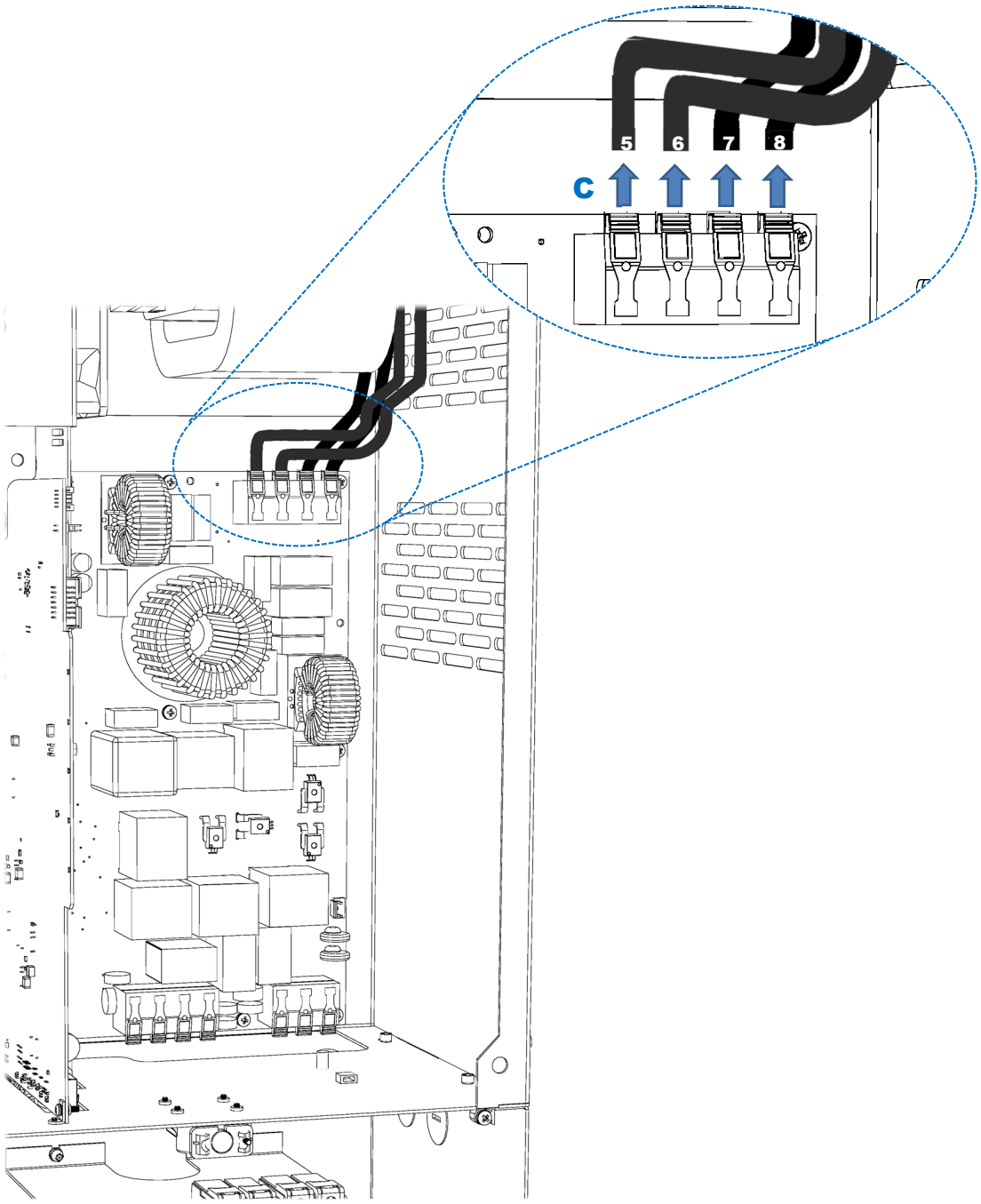


Figure 40 Transformer Terminals

3. On the AC board, remove the following connectors (see Figure 41):
   - Ribbon cable (**D**) for the control board.
   - 2-pin connector (**E**) for the transformer.

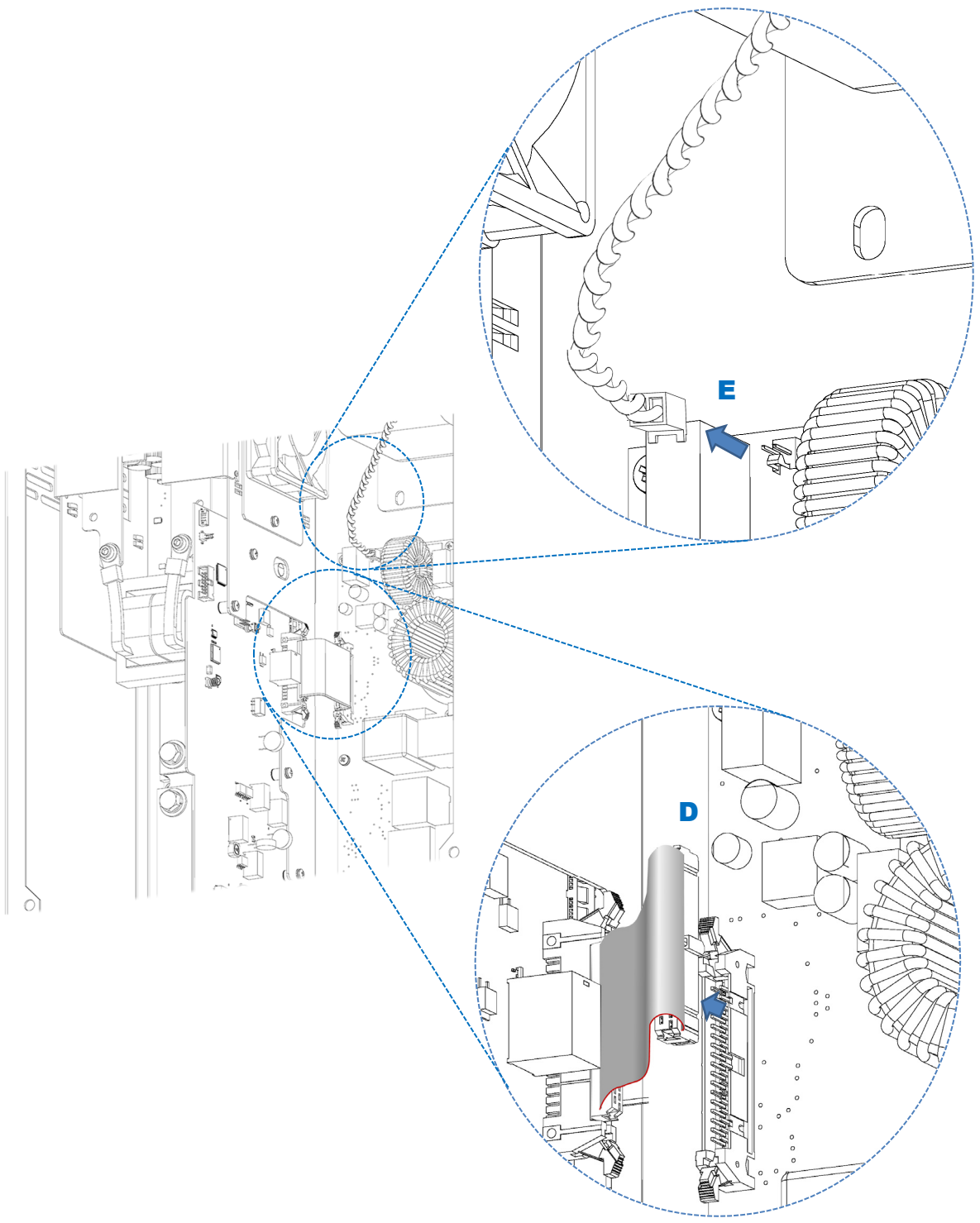


Figure 41 AC Board Connectors

4. Using a #2 Phillips screwdriver, remove 9 machine screws **F** that secure the AC board in place. See Figure 42.
5. Carefully remove the AC board. Avoid gripping the board by the large chokes (coils). If necessary, the plastic relay housings such as **G** can be used to hold the board.

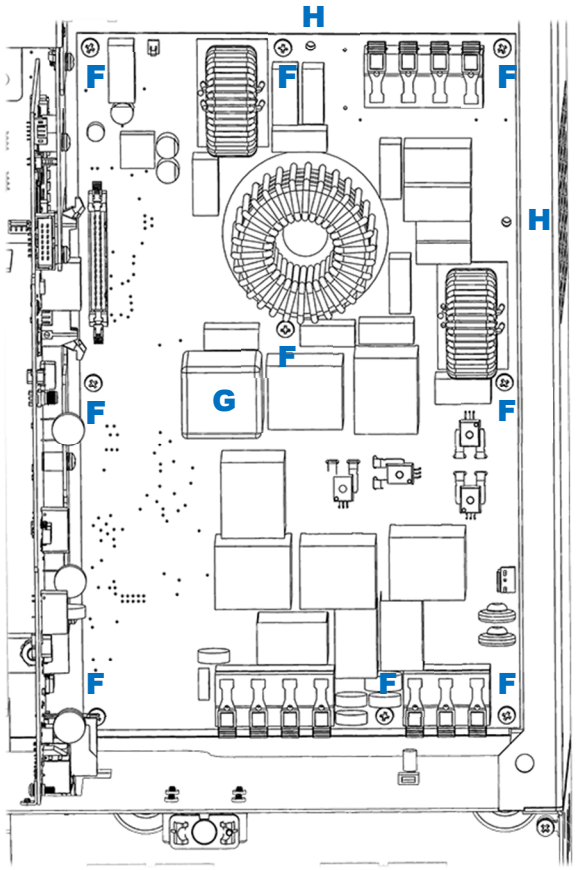


Figure 42 Dismounting AC Board

6. Replace the AC board. Perform all previous steps in reverse order.
   - Carefully insert the AC board. Ensure that the board fits over the two alignment pins **H**. Components on the board can be damaged through mishandling at this stage.
   - Replace the screws **F**.
   - Replace the connectors **E** and **D**. See Figure 41 if necessary.
   - Replace the transformer wires **C**. Make certain to observe the correct wire positions. See Figure 40 if necessary. Make certain that the wires are fully inserted and that no stray strands are exposed. After latching, tug on the wires to ensure that they are secure.
   - Replace the AC wires **B** and the SMA cable **A**. See Figure 39 if necessary. After latching, tug on the wires to ensure that they are secure.

Replacement is complete.

Replacement of Fan Module

To replace the fan module (SPARE-508):

1. Remove the two fan plugs at the top of the carrier board. See **A** in the Figure 43 inset. If necessary, loosen the power module cage cover at **B** to allow access to the plugs.
2. Using a #2 Phillips screwdriver, remove the two screws securing the fan module. See **C** in Figure 43.
3. Slide the fan module out of its slot in the direction indicated by **D** in Figure 43. Note that the module will have to slide under the transformer cables **E**, which have not been removed.

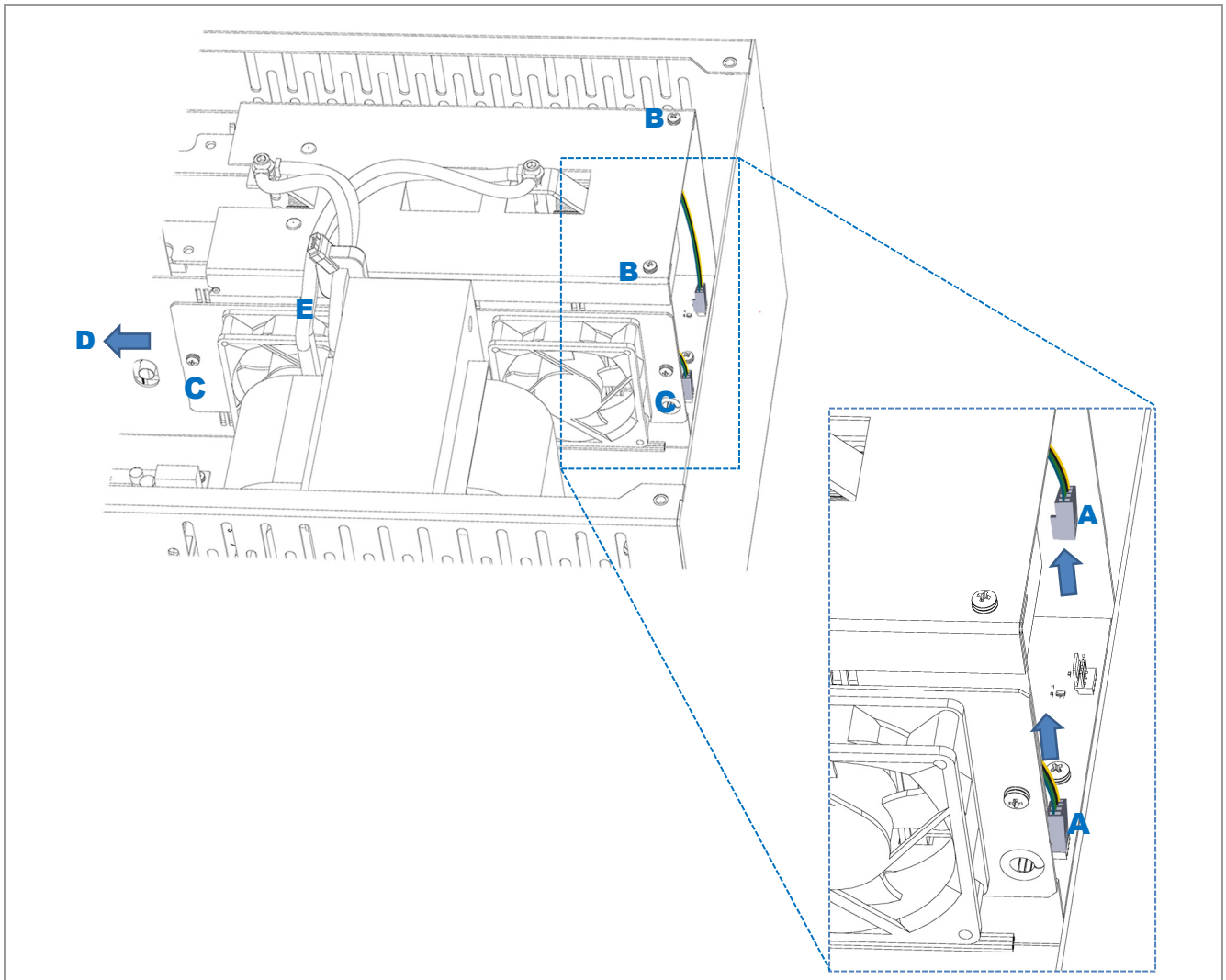


Figure 43 Fan Module

4. Replace the fan module. Perform all previous steps in reverse order. See Figure 43.
   - Insert the fan module by passing it under the transformer cables **E**.
   - Replace the screws **C**.
   - Replace the connectors **A**. (Replace the screws **B** if loosened.)

Replacement is complete.

Replacement of Power Module

To replace either of the two power modules (SPARE-506):

1. Remove the 5-conductor current transducer plug from the control board. See **A** in Figure 44.
2. Remove the 2-pin voltage sense connector. See **B** in Figure 44.

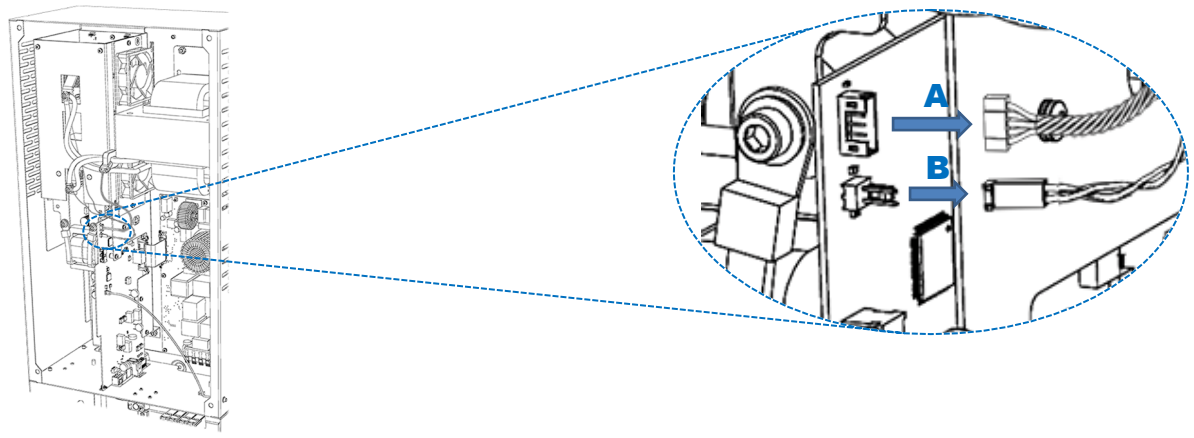


Figure 44 Control Board Connectors

3. Using a 5 mm hex (Allen) wrench, remove bolts and washers for transformer cables. See **C** in Figure 45.
4. Remove transformer wires by bending them away from work area. See **D** in Figure 45. The voltage sense wires will be completely disconnected at this stage; set them aside.
5. Remove the cover for the power module cage. See Figure 45 for all items.
   - Using a #2 Phillips screwdriver, remove the two screws **E** securing the cover at the top.
   - Tilt the cover up from the top as in **F**. Disengage the keyhole fasteners from the bottom of the cover as in **G**. Once disengaged, remove the cover.

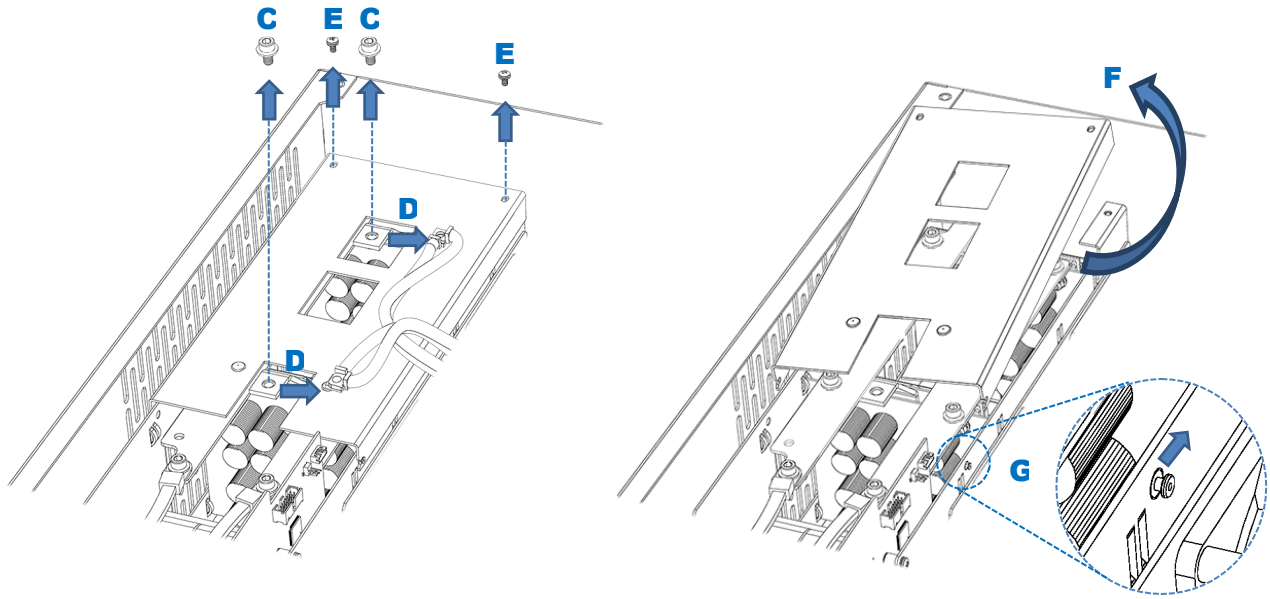


Figure 45 Power Module Cover

6. Using a 5 mm hex (Allen) wrench, remove bolts for bus bars. See all items **H** in Figure 46. Remove the two bus bars **I**.
7. Remove the power module to be replaced. Pull upward to unsocket the module. See **J** in Figure 46.

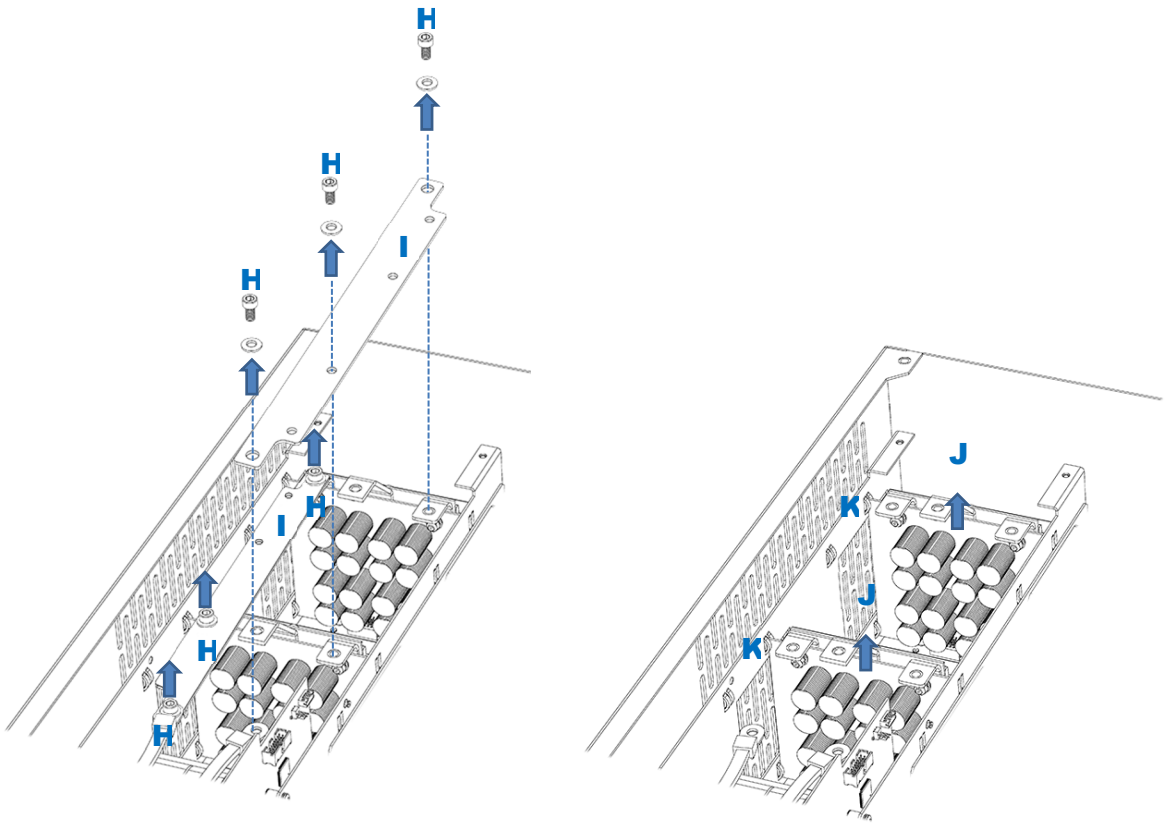


Figure 46 Bus Bars and Power Modules

8. Replace the power module or modules. Perform all previous steps in reverse order.
   - Insert the power module into its slot. Ensure that the new board is slotted into the card guides **K**. (See Figure 46.) Ensure it is seated firmly.
   - Replace bus bars **I**. Replace bolts **H**. Tighten to a torque value of 60 in-lb (6.8 Nm). See Figure 46.
   - Replace the cage cover by attaching the keyhole fastener **G** and lowering the cover into place **F**. Replace the cover screws **E**. See Figure 45 if necessary.
   - Replace the transformer cables and hardware **C**. See Figure 45 if necessary. Ensure that the hardware is stacked in the following order.
     - ✓ Voltage sense wire (top)
     - ✓ Washer
     - ✓ Transformer cable
     - ✓ Transformer cable (bottom)
   - Replace voltage sense connector **B** and current transducer connector **A**. See Figure 44 if necessary.

Replacement is complete.

Replacement of Carrier Board

To replace the carrier board (SPARE-504):

1. Follow all steps to remove the control board. See the procedure **Replacement of Control Board** on page 74.
2. Remove the common-mode choke **A**. See Figure 47 for all items.
   - Using a 5 mm hex (Allen) wrench, remove the bolts **B** on the bus bars.
   - Using a 5 mm hex (Allen) wrench, remove the bolts **C** on the bottom of the choke. Support the choke while the bolts are being removed, then remove the choke.
3. Remove the 4-pin connector (not depicted in Figure 47) that plugs into the carrier board at **D**.

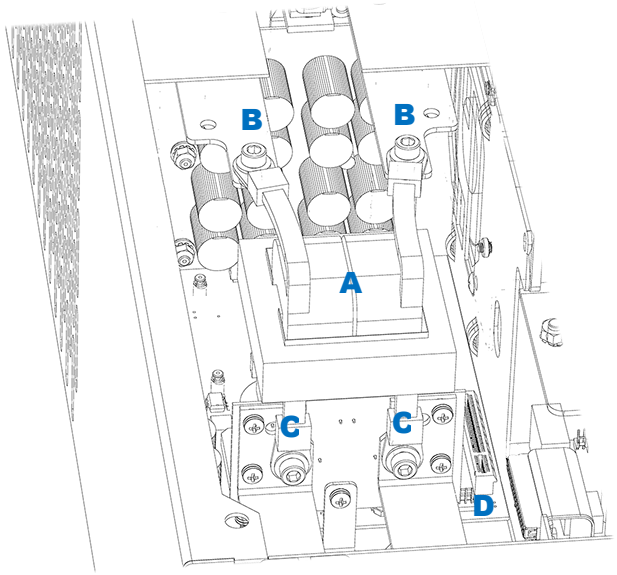


Figure 47 Common-Mode Choke

4. Follow all steps to remove the power modules. See the procedure **Replacement of Power Module** on page 82. Both modules must be removed.

5. Remove the two fan plugs at the top of the carrier board **F**. See **E** in Figure 48. If necessary, see **A** in the Figure 43 inset.
6. Using a #2 Phillips screwdriver, remove the screws **G** at the top and bottom of the carrier board. See Figure 48.
7. Push the board upward slightly to disengage the keyhole fasteners. One of these fasteners is indicated at **H**. All fasteners must be disengaged.
8. Remove the carrier board **F**. It may be necessary to tilt the board to avoid obstacles.

9. Replace the carrier board. Perform all previous steps in reverse order. When reinstalling washers, bolts, and similar hardware, use the replacement hardware included in the kit.
   - Replace the carrier board **I**. See Figure 48 for all items.
     - ✓ Pull downward to engage the keyhole fasteners **H**.
     - ✓ Replace the screws **G**.
   - Replace the fan plugs **E**.
   - Replace the common-mode choke **A**. See Figure 47 for all items.
     - ✓ Replace the lower bolts **C** while supporting the choke by hand.
     - ✓ Do not replace the bus bar bolts **B** yet.
   - Replace the power modules. See page 82 if necessary.
     - ✓ Replace the bus bars and all bolts.
   - Replace the connector at **D**.
   - Replace the control board. See page 74 if necessary.

Replacement is complete.

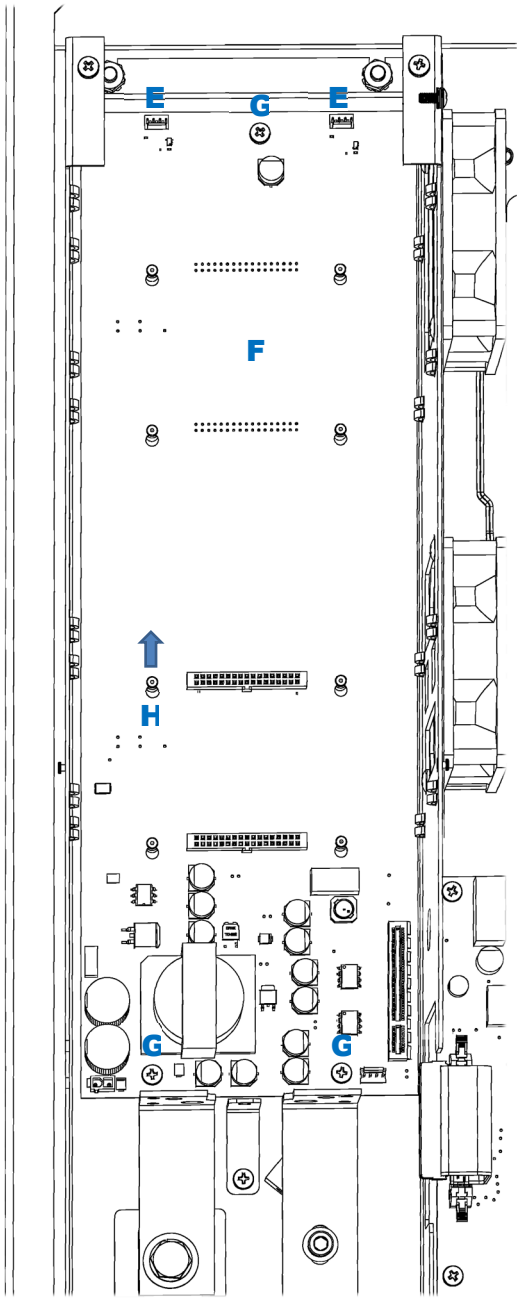


Figure 48 Carrier Board

Preventative Maintenance

Inverter Maintenance

The Mojave inverter requires almost no regular maintenance. However, OutBack Power recommends the following items:

- Vacuum or otherwise clean all vents on a regular basis.
- Check all electrical connections periodically for tightness using the torque values listed in the *Mojave Inverter/Charger Quick Start Guide*. [1] Turn off all circuit breakers before making these checks.

Battery Maintenance

CAUTION: Equipment Damage

Do not perform any form of equalization with this battery.

The Mojave ESS battery requires almost no regular maintenance. However, OutBack Power recommends the following items:

- Check the operation of the battery fan periodically. Observe the fan during hot (high-power) operation to ensure that it runs.
- Vacuum or otherwise clean all vents on a regular basis.
- Check all electrical connections periodically for tightness using the torque values listed in the *Mojave Inverter/Charger Quick Start Guide*. [1] Turn off all circuit breakers before making these checks.

Specifications

Electrical Specifications

Table 7 Electrical Specifications for Mojave Inverter

Specification		Value
Continuous output power at 40°C	Grid-tied	7680 VA
	Off-grid	8000 VA
Continuous AC output current	Grid-tied	32 Aac
	Off-grid	34 Aac
AC output voltage		120/240 Vac
AC output frequency		60 Hz
AC output type		Split-phase
AC waveform		True Sinewave
Typical efficiency		93.5%
CEC weighted efficiency		Pending
Total harmonic distortion (maximum)	Voltage	0.75%
	Current	1.5%
AC Overload Capability (100 ms surge)		10 kVA
AC Overload Capability (5 second)		10 kVA
AC Overload Capability (30 minute)		8 kVA
AC Maximum Output Fault Current and Duration		365 Aac for 75 uS
AC Maximum Backfeed Current and Duration	UL 1741	420 A_{peak} for 17.7 ms
	CSA	Zero
Power Consumption (idle) – Invert mode, no load		100 W
Power Consumption – Off		10 W
Grid Input Current (maximum continuous)		55 Aac
Grid-Interactive Voltage Range (continuous)		211.2 to 264 Vac
Grid-Interactive Frequency Range		50 to 66 Hz
Generator Input Current (maximum continuous)		55 Aac
DC Input Voltage (nominal)		48 Vdc
DC Input Voltage Range		42 to 60 Vdc
DC Maximum Input Voltage		68 Vdc
DC Input Max. Current (continuous full power)		200 Adc
DC Input Maximum Current (short-circuit)		352.5 Adc for 13.9 ms
Battery Charger Maximum AC Input		32 Aac at 240 Vac
Battery Charger Maximum DC Output		170 Adc
DC Output Voltage Range (charging)		40 to 64 Vdc

Specification		Value
Auxiliary Output		0.8 Adc at 12 Vdc
Auxiliary Relay		4 A at 250 Vac or 30 Vdc
CT wire length	Included with product	8’ (2.5 m)
	Maximum allowed length	32.8’ (10 m)

Table 8 Electrical Specifications for Mojave Battery

Specification		Value
Output and Input Current, Maximum		200 Adc
Output and Input Voltage	Maximum	55.9 Vdc
	Minimum	48.0 Vdc
Capacity: 296 Ah (14.8 KWh)	Nameplate	296 Ah (14.8 kWh)
	Usable	236 Ah (11.8 kWh)
Technology		Lithium NMC

Mechanical Specifications

Table 9 Mechanical Specifications for Mojave Inverter

Specification	Value
Dimensions (H × W × D)	37.75 × 15.87 × 11.22" (95.9 × 40.3 × 28.5 cm)
Packaged Dimensions (prone) (H × W × L)	16.0 × 21.25 × 44.5" (40.6 × 53.9 × 113.0 cm)
Inverter Weight	133.0 lb (60.3 kg)
Accessory Ports	RJ11 (batt temp) and CANBUS (BMS)
Non-volatile Memory	Yes
Neutral-Ground Bond Switching	No
Chassis Type	Vented

Table 10 Mechanical Specifications for Mojave ESS Battery

Specification	Value
Dimensions (H × W × D)	43.9 × 24.0 × 12.3” (111.7 × 61.0 × 31.2 cm)
Packaged Dimensions (H × W × D)	46.0 × 26.7 × 13.3” (116.8 × 67.7 × 33.7 cm)
Battery Weight, Maximum	455.0 lb (207 kg)

Table 11 Shipping Dimensions for Mojave ESS

Specification	Value
Pallet Size (H × W × D)	52.75 × 48.0 × 40.0” (133.9 × 121.9 × 101.6 cm)
Pallet Weight, Approximate	630 lb (286 kg)

Environmental Specifications

Table 12 Environmental Specifications for Mojave Inverter

Specification	Value
Rated Ambient Temperature Range (meets component specifications; however, please note that the inverter output is derated between 40° and 50°C) Derated Output (worst-case)	–4°F to 122°F (–20°C to 50°C) 6600 VA
Operational Temperature Range (functions, but not rated for operation; does not necessarily meet all specifications)	–40°F to 140°F (–40°C to 60°C)
Storage Temperature Range	–40°F to 140°F (–40°C to 60°C)
IP (Ingress Protection) Rating of Enclosure	IP2X
Environmental Category	Indoor unconditioned
Wet Locations Classification	Wet locations: No
Relative Humidity Rating	93%
Pollution Degree Classification	PD 2
Maximum Altitude Rating	6561’ (2000 m)
Overvoltage Category (AC Input)	3
Overvoltage Category (DC Input)	1

Table 13 Environmental Specifications for Mojave Battery

Specification	Value
Coolant Mechanism	Passive
Application	Non-living space residential, commercial
Thermal Protection	Battery Management System
Ambient Temperature Range	32°F to 113°F (0°C to 45°C)
Storage Temperature Range	14°F to 140°F (–10°C to 60°C)
Special Environmental Ratings and Limitations	Indoor only
Chassis Type	NEMA 1 or IP2X

Wireless Specifications

Table 14 Wireless Specifications for Mojave Inverter

Specification	Value
2.4 GHz	2.4 GHz
Wireless Standard	WiFi 4 (802.11n; also supports 802.11b/g)
Speed	Up to 150 Mbps

Regulatory Specifications: Inverter

Listings

This product carries a listing report by UL and is listed to the following standards:

- UL® 1741 2nd Edition with SA
- CSA C22.2, No. 107.1-16 Ed:4

Certifications

This product has been certified by UL to meet the following standards:

- IEEE 1547-2003 — Standard for Interconnecting Distributed Resources with Electric Power Systems
- IEEE 1547.1-2005 — Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems

Directives

This product meets the following directive:

- RoHS: Directive 2011/65/EU — “The restriction of the use of certain substances in electrical and electronic equipment”

Regulatory Specifications: Battery

Listings

This product carries a listing report for the following:

- ANSI/CAN/UL STD 1973 — Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications
- ANSI/CAN/UL STD 9540 — Energy Storage Systems and Equipment
  - ISO 13849-1:2015 — Safety-Related Parts of Control Systems

Directives

This product meets the following directive:

- RoHS: Directive 2011/65/EU — “The restriction of the use of certain substances in electrical and electronic equipment”

Grid Protection Settings (All Profiles)

Table 15 and Table 16 contain the default settings for all grid profiles (see page 39). The ranges of adjustment are also included for reference.

NOTE:

IEEE 1547-2018 default settings are used in grid profiles where the utility has set no requirement. In most cases this has no impact to the operating performance of the unit. However, some value must be loaded into the settings registers, so the IEEE default values are used. This will most commonly be seen for the ***Watt/VAr*** function. At present, no utilities are known to require this function and the utilities have no need to specify ***Watt/VAr*** settings.

Table 15 Grid Protection Settings (IEEE 1547 and CA Rule 21)

	Range of Adjustment		Certified Range		IEEE 1547-2003	IEEE 1547-2018 Cat III/B	CA Rule 21
Parameter	Min	Max	Min	Max			
Volt/VAr [1]	***Disabled***	***Enabled***	n/a	n/a	n/a	***Disabled***	***Enabled***
Volt/VAr Vref (pu)	***0.950***	***1.050***	n/a	n/a	n/a	***1***	***1***
Volt/Var Vref Auto	***Disabled***	***Enabled***	n/a	n/a	n/a	***Disabled***	***Disabled***
Volt/VAr auto vref response time (s)	***300***	***5000***	n/a	n/a	n/a	***300***	***300***
Volt/VAr response time (s)	***0.0***	***90.0***	n/a	n/a	n/a	***5.0***	***5.0***
Volt/VAr 1 voltage (pu)	***0.770***	***1.050***	***0.770***	***1.030***	n/a	***0.920***	***0.920***
Volt/VAr 1 reactive power (pu)	***0.000***	***0.700***	***0.000***	***0.530***	n/a	***0.440***	***0.300***
Volt/VAr 2 voltage (pu)	***0.920***	***1.050***	***0.920***	***1.050***	n/a	***0.980***	***0.967***
Volt/VAr 2 reactive power (pu)	***–0.700***	***0.700***	***–0.530***	***0.530***	n/a	***0.000***	***0.000***
Volt/VAr 3 voltage (pu)	***0.950***	***1.080***	***0.950***	***1.080***	n/a	***1.020***	***1.033***
Volt/VAr 3 reactive power (pu)	***–0.700***	***0.700***	***–0.530***	***0.530***	n/a	***0.000***	***0.000***
Volt/VAr 4 voltage (pu)	***0.950***	***1.230***	***0.970***	***1.180***	n/a	***1.080***	***1.070***
Volt/VAr 4 reactive power (pu)	***–0.700***	***0.000***	***–0.530***	***0.000***	n/a	***–0.440***	***–0.300***
Volt/Watt	***Disabled***	***Enabled***	n/a	n/a	n/a	***Disabled***	***Enabled***
Volt/Watt response time (s)	***0.0***	***90.0***	n/a	n/a	n/a	***10.0***	***10.0***
Volt/Watt 1 voltage (pu)	***1.000***	***1.090***	***1.000***	***1.090***	n/a	***1.060***	***1.060***
Volt/Watt 1 power (pu)	***1.000***	***1.000***	***1.000***	***1.000***	n/a	***1.000***	***1.000***
Volt/Watt 2 voltage (pu)	***1.010***	***1.100***	***1.010***	***1.100***	n/a	***1.100***	***1.100***
Volt/Watt 2 power (pu)	***–1.000***	***1.000***	***0.000***	***0.000***	n/a	***0.000***	***0.000***
LV1 voltage (pu)	***0.000***	***0.980***	***0.500***	***0.950***	***0.880***	***0.880***	***0.880***
LV1 time (s)	***0.08***	***50.00***	***0.100***	***50.00***	***2.00***	***21.00***	***21.00***
LV2 voltage (pu)	***0.000***	***0.980***	***0.250***	***0.700***	***0.500***	***0.500***	***0.700***
LV2 time (s)	***0.08***	***50.00***	***0.10***	***50.00***	***0.16***	***2.00***	***11.00***
LV3 voltage (pu)	***0.000***	***0.980***	***0.250***	***0.700***	n/a	n/a	***0.500***
LV3 time (s)	***0.08***	***50.00***	***0.10***	***50.00***	n/a	n/a	***1.50***

[1] Only one of the four VAr functions (***Volt/VAr***, ***Watt/VAr***, ***Constant PF***, ***Constant VAr***) can be enabled at one time.

Table 15 Grid Protection Settings (IEEE 1547 and CA Rule 21)

	Range of Adjustment		Certified Range		IEEE 1547-2003	IEEE 1547-2018 Cat III/B	CA Rule 21
Parameter	Min	Max	Min	Max			
LV momentary voltage (pu)	*0.000*	*5*	n/a	n/a	n/a	*0.500*	*0.500*
LV momentary time (s)	*0.08*	*50.00*	n/a	n/a	n/a	*0.08*	*0.16*
HV1 voltage (pu)	*1.020*	*1.200*	*1.050*	*1.200*	*1.100*	*1.100*	*1.100*
HV1 time (s)	*0.08*	*13.00*	*0.10*	*13.00*	*1.00*	*13.00*	*13.00*
HV2 voltage (pu)	*1.020*	*1.200*	*1.050*	*1.200*	*1.200*	*1.200*	*1.200*
HV2 time (s)	*0.08*	*13.00*	*0.10*	*13.00*	*0.16*	*0.16*	*0.16*
HV momentary voltage (pu)	*1.020*	*1.200*	n/a	n/a	n/a	*1.100*	*1.100*
HV momentary time (s)	*0.08*	*13.00*	n/a	n/a	n/a	*0.08*	*0.16*
LF1 Hz (Hz)	*50.00*	*59.98*	*50.00*	*59.9*	*59.30*	*58.50*	*58.50*
LF1 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*0.16*	*300.00*	*300.00*
LF2 Hz (Hz)	*50.00*	*59.98*	*50.00*	*59.9*	*57.00*	*56.50*	*57.00*
LF2 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*0.16*	*0.16*	*0.16*
HF1 Hz (Hz)	*60.02*	*66.00*	*60.1*	*66.00*	*60.50*	*61.20*	*60.50*
HF1 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*0.16*	*300*	*300.00*
HF2 Hz (Hz)	*60.02*	*66.00*	*60.1*	*66.00*	n/a	*62.00*	*62.00*
HF2 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	n/a	*0.16*	*0.16*
Freq Droop	*Disabled*	*Enabled*	n/a	n/a	n/a	*Enabled*	*Enabled*
Freq Droop OF deadband (Hz)	*0.000*	*1.000*	*0.000*	*1.000*	n/a	*0.036*	*0.036*
Freq Droop UF deadband (Hz)	*0.000*	*1.000*	*0.017*	*1*	n/a	*0.036*	*0.036*
Freq Droop OF ratio	*0.020*	*0.070*	*0.02*	*0.07*	n/a	*0.050*	*0.033*
Freq Droop UF ratio	*0.020*	*0.070*	*0.02*	*0.07*	n/a	*0.050*	*0.033*
Freq Droop response time (s)	*0.20*	*10.00*	*5*	*5*	n/a	*5.00*	*5.00*
Freq Droop PMin (%)	*–100.0*	*100.0*	n/a	n/a	n/a	*0.0*	*0.0*
Watt/VAr [2]	*Disabled*	*Enabled*	n/a	n/a	n/a	*Disabled*	*Disabled*
Watt/VAr 1 power (pu)	*–1.000*	*0.000*	n/a	n/a	n/a	*–1.000*	*–1.000*
Watt/VAr 1 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	n/a	*0.440*	*0.440*
Watt/VAr 2 power (pu)	*–1.000*	*0.000*	n/a	n/a	n/a	*–0.500*	*–0.500*
Watt/VAr 2 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	n/a	*0.000*	*0.000*
Watt/VAr 3 power (pu)	*–1.000*	*0.000*	n/a	n/a	n/a	*–0.200*	*–0.200*
Watt/VAr 3 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	n/a	*0.000*	*0.000*
Watt/VAr 4 power (pu)	*0.000*	*1.000*	n/a	n/a	n/a	*0.200*	*0.200*
Watt/VAr 4 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	n/a	*0.000*	*0.000*
Watt/VAr 5 power (pu)	*0.000*	*1.000*	n/a	n/a	n/a	*0.500*	*0.500*
Watt/VAr 5 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	n/a	*0.000*	*0.000*
Watt/VAr 6 power (pu)	*0.000*	*1.000*	n/a	n/a	n/a	*1.000*	*1.000*
Watt/VAr 6 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	n/a	*–0.440*	*–0.440*

[2] Only one of the four VAr functions (***Volt/VAr***, ***Watt/VAr***, ***Constant PF***, ***Constant VAr***) can be enabled at one time.

Table 15 Grid Protection Settings (IEEE 1547 and CA Rule 21)

	Range of Adjustment		Certified Range		IEEE 1547-2003	IEEE 1547-2018 Cat III/B	CA Rule 21
Parameter	Min	Max	Min	Max			
Enter service	*Disabled*	*Enabled*	n/a	n/a	*Enabled*	*Enabled*	*Enabled*
Enter service HV (pu)	*0.880*	*1.100*	n/a	n/a	*1.058*	*1.050*	*1.058*
Enter service LV (pu)	*0.880*	*1.100*	n/a	n/a	*0.917*	*0.917*	*0.883*
Enter service HF (Hz)	*55.00*	*66.00*	n/a	n/a	*60.50*	*60.10*	*60.50*
Enter service LF (Hz)	*55.00*	*66.00*	n/a	n/a	*59.30*	*59.50*	*58.50*
Enter service delay (s)	*0*	*1600*	n/a	n/a	*300*	*300*	*15*
Random delay (s)	*0*	*1000*	n/a	n/a	*0*	*0*	*0*
Enter service ramp time (s)	*1*	*1000*	*1*	*1000*	*1*	*300*	*50*
PF export [3]	*Disabled*	*Enabled* [4]	n/a	n/a	*Enabled*	*Enabled*	*Disabled*
PF import [3]	*Disabled*	*Enabled* [4]	n/a	n/a	*Enabled*	*Enabled*	*Disabled*
Export limit	*Disabled*	*Enabled*	n/a	n/a	*Disabled*	*Disabled*	*Disabled*
Export limit (pu)	*0.000*	*1.000*	n/a	n/a	*1.000*	*1.000*	*1.000*
Constant Vars [3]	*Disabled*	*Enabled*	n/a	n/a	*n/a*	*Disabled*	*Disabled*
Constant Vars setpoint (pu)	*–1.000*	*1.000*	n/a	n/a	*n/a*	*0*	*0.000*
Export ramp (pu/s)	*0.010*	*1.000*	*0.010*	*1.000*	*1.000*	*1.000*	*1.000*
PF export setpoint [5]	*0.400*	*1.000*	*0.400*	*1.000*	*0.949*	*1.000*	*0.950*
PF import setpoint [5]	*0.400*	*1.000*	*0.400*	*1.000*	*0.949*	*1.000*	*0.950*
PF export excitation [6]	*Absorbing*	*Injecting*	*Absorbing*	*Injecting*	*Absorbing*	*Absorbing*	*Absorbing*
PF import excitation [6]	*Absorbing*	*Injecting*	*Absorbing*	*Injecting*	*Injecting*	*Injecting*	*Injecting*

[3] Only one of the four VAr functions (***Volt/VAr***, ***Watt/VAr***, ***Constant PF***, ***Constant VAr***) can be enabled at one time.
[4] ***PF export*** and ***PF import*** must both be either enabled or disabled. It is not valid to have one enabled while the other is disabled. This is the ***Constant PF*** function from IEEE 1547-2018 and the previous notes.
[5] By default, ***PF export*** is set to under-excited while ***PF import*** is set to over-excited. Modification of those defaults is only possible through SunSpec or 2030.5 communications.
[6] Power Factor during export should always be absorbing, and during import it should be injecting. This will be made clear in a pending update to IEEE P1547.9. The simple reason is that during active power export voltage will tend to rise and absorbing VArs will help pull voltage back down. Conversely, during active power import, voltage will tend to drop and injecting VArs will help to pull voltage back up. This minimizes the impact on voltage from changes in active power import and export.

Table 16 Grid Protection Settings (HECO and ISO-NE)

	Range of Adjustment		Certified Range		HECO 14H-2018	ISO NE-2018	ISO NE-2021
Parameter	Min	Max	Min	Max			
Volt/VAr [7]	*Disabled*	*Enabled*	n/a	n/a	*Enabled*	*Disabled*	*Disabled*
Volt/VAr Vref (pu)	*0.950*	*1.050*	n/a	n/a	*1*	*1*	*1*
Volt/Var Vref Auto	*Disabled*	*Enabled*	n/a	n/a	*Disabled*	*Disabled*	*Disabled*
Volt/VAr auto vref response time (s)	*300*	*5000*	n/a	n/a	*300*	*300*	*300*
Volt/VAr response time (s)	*0.0*	*90.0*	n/a	n/a	*10.0*	*5.0*	*5.0*
Volt/VAr 1 voltage (pu)	*0.770*	*1.050*	*0.770*	*1.030*	*0.940*	*0.920*	*0.920*
Volt/VAr 1 reactive power (pu)	*0.000*	*0.700*	*0.000*	*0.530*	*0.440*	*0.440*	*0.440*
Volt/VAr 2 voltage (pu)	*0.920*	*1.050*	*0.920*	*1.050*	*0.970*	*0.980*	*0.980*
Volt/VAr 2 reactive power (pu)	*–0.700*	*0.700*	*–0.530*	*0.530*	*0.000*	*0.000*	*0.000*
Volt/VAr 3 voltage (pu)	*0.950*	*1.080*	*0.950*	*1.080*	*1.030*	*1.020*	*1.020*
Volt/VAr 3 reactive power (pu)	*–0.700*	*0.700*	*–0.530*	*0.530*	*0.000*	*0.000*	*0.000*
Volt/VAr 4 voltage (pu)	*0.950*	*1.230*	*0.970*	*1.180*	*1.060*	*1.080*	*1.080*
Volt/VAr 4 reactive power (pu)	*–0.700*	*0.000*	*–0.530*	*0.000*	*–0.440*	*–0.440*	*–0.440*
Volt/Watt	*Disabled*	*Enabled*	n/a	n/a	*Disabled*	*Disabled*	*Disabled*
Volt/Watt response time (s)	*0.0*	*90.0*	n/a	n/a	*10.0*	*10.0*	*10.0*
Volt/Watt 1 voltage (pu)	*1.000*	*1.090*	*1.000*	*1.090*	*1.060*	*1.060*	*1.060*
Volt/Watt 1 power (pu)	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*	*1.000*
Volt/Watt 2 voltage (pu)	*1.010*	*1.100*	*1.010*	*1.100*	*1.100*	*1.100*	*1.100*
Volt/Watt 2 power (pu)	*–1.000*	*1.000*	*0.000*	*0.000*	*–1.000*	*0.000*	*0.000*
LV1 voltage (pu)	*0.000*	*0.980*	*0.500*	*0.950*	*0.880*	*0.880*	*0.880*
LV1 time (s)	*0.08*	*50.00*	*0.100*	*50.00*	*21.00*	*2.00*	*3.00*
LV2 voltage (pu)	*0.000*	*0.980*	*0.250*	*0.700*	*0.700*	*0.500*	*0.500*
LV2 time (s)	*0.08*	*50.00*	*0.10*	*50.00*	*11.00*	*1.10*	*1.10*
LV3 voltage (pu)	*0.000*	*0.980*	*0.250*	*0.700*	*0.500*	*n/a*	*n/a*
LV3 time (s)	*0.08*	*50.00*	*0.10*	*50.00*	*2.00*	*n/a*	*n/a*
LV momentary voltage (pu)	*0.000*	*0.980*	n/a	n/a	*0.500*	*0.500*	*0.500*
LV momentary time (s)	*0.08*	*50.00*	n/a	n/a	*0.16*	*0.08*	*0.08*
HV1 voltage (pu)	*1.020*	*1.200*	*1.050*	*1.200*	*1.100*	*1.100*	*1.100*
HV1 time (s)	*0.08*	*13.00*	*0.10*	*13.00*	*1.00*	*2.00*	*2.00*
HV2 voltage (pu)	*1.020*	*1.200*	*1.050*	*1.200*	*1.200*	*1.200*	*1.200*
HV2 time (s)	*0.08*	*13.00*	*0.10*	*13.00*	*0.16*	*0.16*	*0.16*
HV momentary voltage (pu)	*1.020*	*1.200*	n/a	n/a	n/a	n/a	*1.100*
HV momentary time (s)	*0.08*	*13.00*	n/a	n/a	n/a	n/a	*0.08*
LF1 Hz (Hz)	*50.00*	*59.98*	*50.00*	*59.9*	*57.00*	*58.50*	*58.50*
LF1 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*21.00*	*300.00*	*300*
LF2 Hz (Hz)	*50.00*	*59.98*	*50.00*	*59.9*	*56.00*	*56.50*	*56.50*
LF2 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*0.16*	*0.16*	*0.16*

[7] Only one of the four VAr functions (***Volt/VAr***, ***Watt/VAr***, ***Constant PF***, ***Constant VAr***) can be enabled at one time.

Table 16 Grid Protection Settings (HECO and ISO-NE)

	Range of Adjustment		Certified Range		HECO 14H-2018	ISO NE-2018	ISO NE-2021
Parameter	Min	Max	Min	Max			
HF1 Hz (Hz)	*60.02*	*66.00*	*60.1*	*66.00*	*63.00*	*61.20*	*61.20*
HF1 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*21.00*	*300*	*300*
HF2 Hz (Hz)	*60.02*	*66.00*	*60.1*	*66.00*	*65*	*62*	*62*
HF2 time (s)	*0.16*	*1000.00*	*0.16*	*1000.00*	*0.16*	*0.16*	*0.16*
Freq Droop	*Disabled*	*Enabled*	n/a	n/a	*Enabled*	*Disabled*	*Enabled*
Freq Droop OF deadband (Hz)	*0.000*	*1.000*	*0.000*	*1.000*	*0.036*	*0.036*	*0.036*
Freq Droop UF deadband (Hz)	*0.000*	*1.000*	*0.017*	*1*	*1.000* [8]	*0.036*	*0.036*
Freq Droop OF ratio	*0.020*	*0.070*	*0.02*	*0.07*	*0.040*	*0.050*	*0.050*
Freq Droop UF ratio	*0.020*	*0.070*	*0.02*	*0.07*	*0.040*	*0.050*	*0.050*
Freq Droop response time (s)	*0.20*	*10.00*	*5*	*5*	*0.50*	*5.00*	*5.00*
Freq Droop PMin (%)	*–100.0*	*100.0*	n/a	n/a	*0.0*	*0.0*	*0.0*
Watt/VAr [9]	*Disabled*	*Enabled*	n/a	n/a	*Disabled*	*Disabled*	*Disabled*
Watt/VAr 1 power (pu)	*–1.000*	*0.000*	n/a	n/a	*–1.000*	*–1.000*	*–1.000*
Watt/VAr 1 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	*0.440*	*0.440*	*0.440*
Watt/VAr 2 power (pu)	*–1.000*	*0.000*	n/a	n/a	*–0.500*	*–0.500*	*–0.500*
Watt/VAr 2 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	*0.000*	*0.000*	*0.000*
Watt/VAr 3 power (pu)	*–1.000*	*0.000*	n/a	n/a	*–0.200*	*–0.200*	*–0.200*
Watt/VAr 3 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	*0.000*	*0.000*	*0.000*
Watt/VAr 4 power (pu)	*0.000*	*1.000*	n/a	n/a	*0.200*	*0.200*	*0.200*
Watt/VAr 4 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	*0.000*	*0.000*	*0.000*
Watt/VAr 5 power (pu)	*0.000*	*1.000*	n/a	n/a	*0.500*	*0.500*	*0.500*
Watt/VAr 5 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	*0.000*	*0.000*	*0.000*
Watt/VAr 6 power (pu)	*0.000*	*1.000*	n/a	n/a	*1.000*	*1.000*	*1.000*
Watt/VAr 6 reactive power (pu)	*–0.500*	*0.500*	n/a	n/a	*–0.440*	*–0.440*	*–0.440*
Enter service	*Disabled*	*Enabled*	n/a	n/a	Enabled	Enabled	Enabled
Enter service HV (pu)	*0.880*	*1.100*	n/a	n/a	*1.100*	*1.100*	*1.050*
Enter service LV (pu)	*0.880*	*1.100*	n/a	n/a	*0.880*	*0.880*	*0.917*
Enter service HF (Hz)	*55.00*	*66.00*	n/a	n/a	*60.10*	*61.20*	*60.10*
Enter service LF (Hz)	*55.00*	*66.00*	n/a	n/a	*59.90*	*58.50*	*59.50*
Enter service delay (s)	*0*	*1600*	n/a	n/a	*300*	*300*	*300*
Random delay (s)	*0*	*1000*	n/a	n/a	*0*	*0*	*0*
Enter service ramp time (s)	*1*	*1000*	*1*	*1000*	*303* [10]	*50*	*300*

[8] Setting dBuf to 1.000 Hz is the limit of the range of adjustment in this inverter model. Setting the value to this limit partially disables frequency-droop under-frequency response. HECO 14H does not require under frequency response, see Figure 4 of HECO 14H, where frequency response is flat below 60 Hz.

[9] Only one of the four VAr functions (***Volt/VAr***, ***Watt/VAr***, ***Constant PF***, ***Constant VAr***) can be enabled at one time.

[10] The published requirement in HECO 14H is 0.33 % / s. A value of 1/0.0033 = 303 seconds.

Table 16 Grid Protection Settings (HECO and ISO-NE)

	Range of Adjustment		Certified Range		HECO 14H-2018	ISO NE-2018	ISO NE-2021
Parameter	Min	Max	Min	Max			
PF export [11]	*Disabled*	*Enabled* [12]	n/a	n/a	*Disabled*	*Enabled*	*Enabled*
PF import [11]	*Disabled*	*Enabled* [12]	n/a	n/a	*Disabled*	*Enabled*	*Enabled*
Export limit	*Disabled*	*Enabled*	n/a	n/a	*Disabled*	*Disabled*	*Disabled*
Export limit (pu)	*0.000*	*1.000*	n/a	n/a	*1.000*	*1.000*	*1.000*
Constant Vars [11]	*Disabled*	*Enabled*	n/a	n/a	*Disabled*	*Disabled*	*Disabled*
Constant Vars setpoint (pu)	*–1.000*	*1.000*	n/a	n/a	*0.000*	*0.000*	*0.000*
Export ramp (pu/s)	*0.010*	*1.000*	*0.010*	*1.000*	*1.000*	*1.000*	*1.000*
PF export setpoint [13]	*0.400*	*1.000*	*0.400*	*1.000*	*0.950*	*0.950*	*1.000*
PF import setpoint [13]	*0.400*	*1.000*	*0.400*	*1.000*	*0.950*	*0.950*	*1.000*
PF export excitation [14]	*Absorbing*	*Injecting*	*Absorbing*	*Injecting*	*Absorbing*	*Absorbing*	*Absorbing*
PF import excitation [14]	*Absorbing*	*Injecting*	*Absorbing*	*Injecting*	*Injecting*	*Injecting*	*Injecting*

[11] Only one of the four VAr functions (***Volt/VAr***, ***Watt/VAr***, ***Constant PF***, ***Constant VAr***) can be enabled at one time.
[12] ***PF export*** and ***PF import*** must both be either enabled or disabled. It is not valid to have one enabled while the other is disabled. This is the ***Constant PF*** function from IEEE 1547-2018 and the previous notes.
[13] By default, ***PF export*** is set to under-excited while ***PF import*** is set to over-excited. Modification of those defaults is only possible through SunSpec or 2030.5 communications.
[14] Power Factor during export should always be absorbing, and during import it should be injecting. This will be made clear in a pending update to IEEE P1547.9. The simple reason is that during active power export voltage will tend to rise and absorbing VArs will help pull voltage back down. Conversely, during active power import, voltage will tend to drop and injecting VArs will help to pull voltage back up. This minimizes the impact on voltage from changes in active power import and export.

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