Radian Series
Inverter/Charger Service Instructions

Purpose and Scope

These instructions detail how to replace the following parts of a Radian Series Inverter/Charger.

- **PCBA Module (SPARE-200, SPARE-202 and SPARE-204):** The PCBA Module is a set of circuit boards that allows connection of the AC wires, MATE3, Auxiliary, and Remote Temperature Sensor (RTS) cables as well as connection to the Power Module. They are pre-assembled for simple drop-in replacement. These circuit boards include the power supply, control, voltage/current sense, and AC boards along with a mounting plate.
- **Power Module (SPARE-201, SPARE-203 and SPARE-205):** The Power Module is a set of parts that allow connection to the battery and connection to the PCBA Module. It is pre-assembled for simple drop-in replacement. Either module consists of the power transformer, FET board, and related interconnect components within one chassis.

IMPORTANT: Back up (SAVE) the Configuration on the MATE3

Use the MATE3 to save the existing configuration file of the inverter that is to be repaired to an SD card. (If there are multiple inverters in the configuration, the configuration file will back up each inverter's settings.) Also record the firmware revision and Stack Phase settings of the inverter(s). If replacing the PCBA Module, performing these tasks will be helpful to return the inverter to its previous operational parameters. See the *MATE3 System Display and Controller Operator's Manual* for details.

IMPORTANT: MATE3 Upgrade

When replacing the PCBA Module, make certain to upgrade the MATE3 firmware to the latest revision. If it is not upgraded, the MATE3 may not recognize any new inverter functions. This will make them inaccessible to the user. See the OutBack website, www.outbackpower.com, for the latest firmware revisions.

Power Down

Power down and disconnect all power sources from the Radian inverter prior to replacement of internal parts. Use the inverter bypass if available and turn off all circuit breakers connected to the inverter.

- AC output circuit breaker
- Grid AC input circuit breaker
- Generator AC input circuit breaker
- DC circuit breakers
- Generator start circuit

Once these connections are turned off, verify with a voltmeter that NO voltage is present at the DC+ to DC– terminals (see Figure 1).

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. If the ribbon cables (see Figure 4) are removed prematurely, the Radian's capacitors will 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.

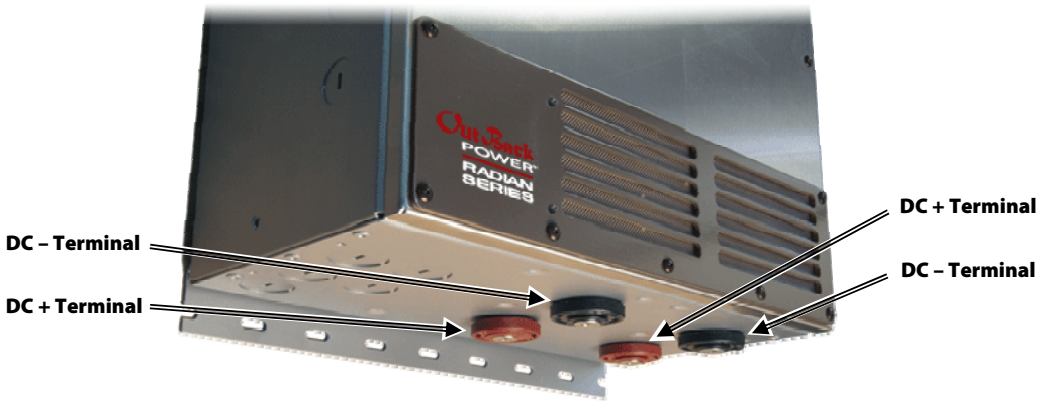

Figure 1 DC Terminals

- Verify no AC voltage is present between the following terminals and ground. These connections may be located in an electrical distribution box near the inverter. Some systems have no "L2" terminals.
  - ~ AC OUT HOT L1
  - ~ AC OUT HOT L2
  - ~ GRID IN HOT L1
  - ~ GRID IN HOT L2
  - ~ GEN IN HOT L1
  - ~ GEN IN HOT L2

Removal of Cover

Tools

- Phillips screwdriver

Procedure

To remove the front cover:

1. Use a Phillips screwdriver to remove the screws that attach the cover to the chassis.
2. Pull cover directly out from the chassis.
3. Set aside the cover and the cover screws.

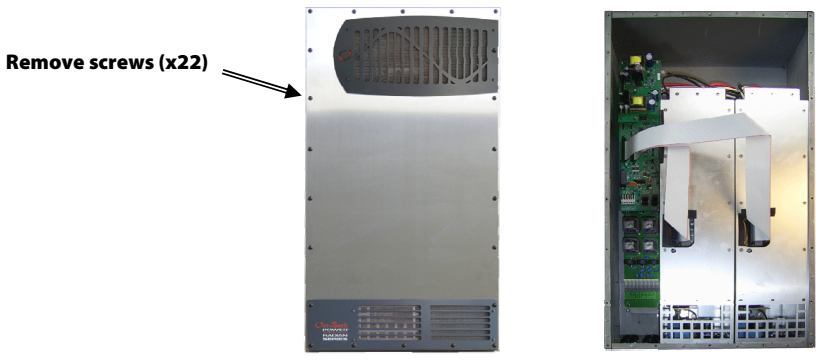

Figure 2 Radian Inverter With Cover and Without Cover

Replacement of the PCBA Module

IMPORTANT: MATE3 Upgrade

When replacing the PCBA Module, make certain to upgrade the MATE3 firmware to the latest revision. If it is not upgraded, the MATE3 may not recognize any new inverter functions. This will make them inaccessible to the user. See the OutBack website, www.outbackpower.com, for the latest firmware revisions.

Tools

- Flat screwdriver with small head (4 mm wide or less)
- Socket wrench with 8-inch extension and 10 mm socket

Procedure

To replace the PCBA Module:

1. Disconnect all connections to the Auxiliary terminals, MATE3, and RTS connectors. The connection to the MATE3 is labeled "Remote" on the control board. The connection to the RTS is labeled "Battery Temp" on the control board.
2. Disconnect the external AC input and output wiring by unlocking the tabs on the terminal block (pulling them to a perpendicular position so that they stand out from the board). Unlocking each tab releases the tension on the wire. Pull the wires free from the terminals.
3. The Power Module may have either four or six transformer wires connected to the PCBA Module, depending on Radian model (see image A in Figure 3). Additionally, the Radian models use different types of terminal blocks to secure the transformer wires.

   Note the locations of the wires for later reference. If possible, take a photograph of the wire placement prior to disconnection. For some Radian models the type of terminal block shows markings on the terminal blocks (L1=Black, L2=Red, N=Neutral) and below them on the circuit board (RIGHT XFMR, LEFT XFMR and NEUTRALS) that identify the correct connections. For other Radian models there are only markings on the circuit board (L2-L, NEU-L, L1-L, L2-R, NEU-R, L1-R) that identify the correct connections. Refer to Table 1 for model-specific locations of the transformer wires, fan wires and ribbon cables.

   NOTE: Models with only four wires do not have L2 connections or any NEUTRALS circuit board marking.
4. Disconnect these wires by one of two methods, depending on the type of terminal strip. If the terminal strip has locking tabs, unlock them just as in Step 2. (See image B in Figure 3.) Pull the wires free from the terminals.

   If the terminal block does not have locking tabs, insert the screwdriver horizontally into the terminal block slot for each wire. Lever the screwdriver outward (from the back of the housing to the front). This releases the tension on the wires. Pull the wires free from the terminals. (See image C in Figure 3.)

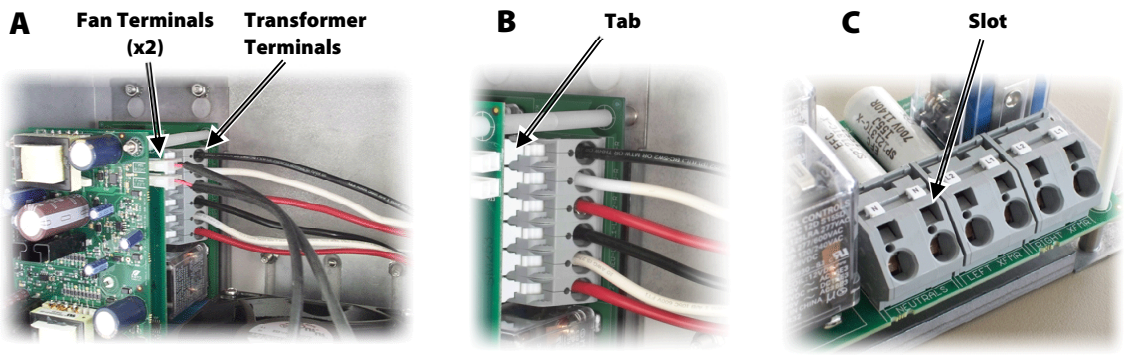

Figure 3 Transformer and Fan Terminals

5. Disconnect the fan wires by pinching their connectors and pulling to the right. Note the text on the circuit board that shows the correct connections (FAN RIGHT and FAN LEFT).

6. Disconnect the ribbon cables from the PCBA Module by pressing outwards on their clips and then gently pull the connector away from the board. **Do NOT pull on the ribbon cable. Pull on the connector.** Pulling on the ribbon cable can damage the cable. Refer to Figure 4.

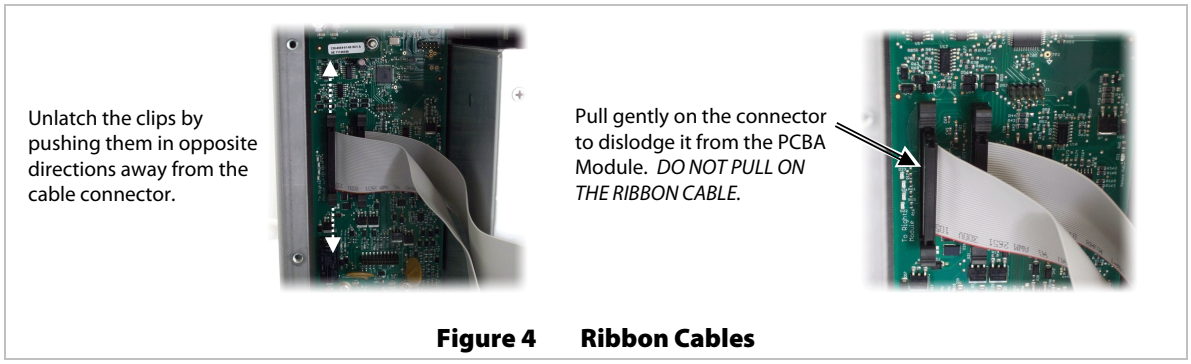

Figure 4 Ribbon Cables

7. Remove the two lower nuts using the socket wrench with a 10 mm socket.
8. Loosen (but do not remove entirely) the two upper nuts using the socket wrench with a 10 mm socket.

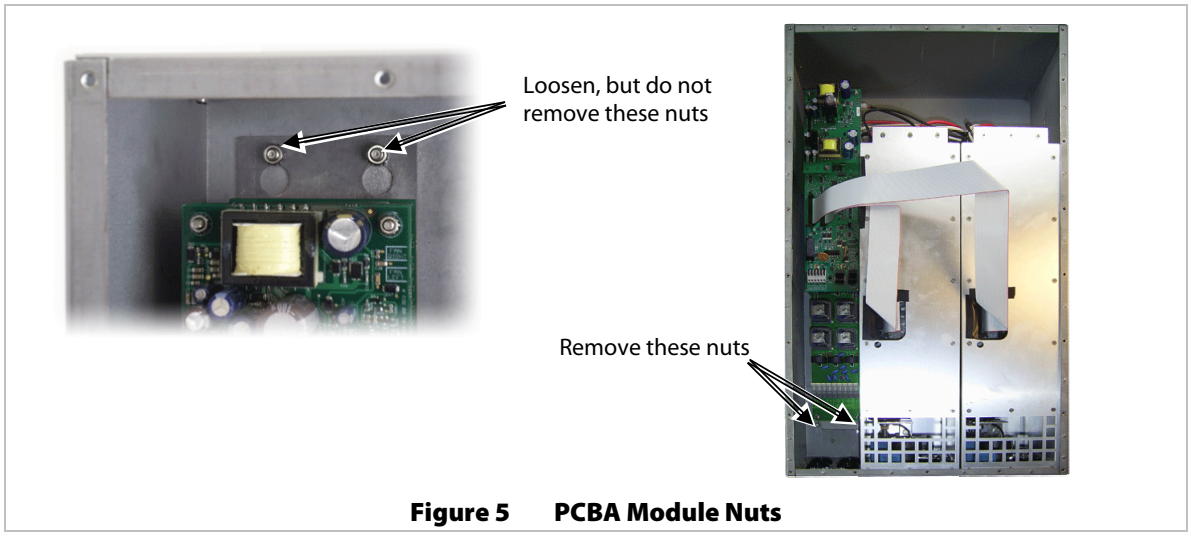

Figure 5 PCBA Module Nuts

9. Push the PCBA Module up about 1/2 inch (13 mm). This allows the keyhole slots in the back plate of the module to clear the two upper nuts. Pull the PCBA Module outwards to remove.
10. Install the replacement PCBA Module by reversing steps 1 through 9. Tighten the nuts in steps 7 and 8 to a torque value of 60 to 68 in-lb. Refer to Tabke 1 for model-specific locations of transformer wires, fan wires and ribbon cables.
11. Proceed to the **Replacement of the Front Cover** section on page 6.

Table 1 Radian Model Connection Locations

Model	Power Module Position	Black Wire Terminal	White Wire Terminal	Red Wire Terminal	Fan Cable Terminal	Ribbon Cable
GS8048	Left	L1 (LEFT XFMR)	N (NEUTRALS)	L2 (LEFT XFMR)	FAN LEFT	J8
	Right	L1 (RIGHT XFMR)	N (NEUTRALS)	L2 (RIGHT XFMR)	FAN RIGHT	J4
GS7048E	Left	L1 (LEFT XFMR)	N (LEFT XFMR)	N/A	FAN LEFT	J8
	Right	L1 (RIGHT XFMR)	N (RIGHT XFMR)	N/A	FAN RIGHT	J4
GS8048A	Left	L1-L	NEU-L	L2-L	FAN LEFT	J8
	Right	L1-R	NEU-R	L2-R	FAN RIGHT	J4
GS3548E	Left	L1 (LEFT XFMR)	N (LEFT XFMR)	N/A	FAN LEFT	J8
GS4048A	Left	L1-L	NEU-L	L2-L	FAN LEFT	J8

Replacement of the Power Module

There are either one or two Power Modules per Radian inverter depending upon the Radian model. Only one replacement is provided. Please identify the Power Module that needs replacement prior to continuing. Contact OutBack Technical Support for assistance.

Tools

- Flat screwdriver with small head (4 mm wide or less)
- Socket wrench with 8-inch extension and 10 mm socket
- 1/2" (13 mm) wrench

Procedure

To replace the power module:

1. The Power Module may have either two or three transformer wires connected to the PCBA Module, depending on Radian model (see image A in Figure 3). Additionally, the Radian models use different types of terminal blocks to secure the transformer wires.
2. Note the locations of the wires for later reference. If possible, take a photograph of the wire placement prior to disconnection. For some Radian models the type of terminal block shows markings on the terminal blocks (L1=Black, L2=Red, N=Neutral) and below them on the circuit board (RIGHT XFMR, LEFT XFMR and NEUTRALS) that identify the correct connections. For other Radian models there are only markings on the circuit board (L2-L, NEU-L, L1-L, L2-R, NEU-R, L1-R) that identify the correct connections. Refer to Table 1 for model-specific locations of the transformer wires, fan wires and ribbon cables.
3. Disconnect these wires by one of two methods, depending on the type of terminal strip. If the terminal strip has locking tabs, unlock them (pulling them to a perpendicular position so that they stand out from the board). Unlocking each tab releases the tension on the wire. Repeat for the remaining wire(s) connected to the module that is to be replaced. Pull the wires free from the terminals. (See image A in Figure 3.)

   If the terminal block does not have locking tabs, insert the screwdriver horizontally into the terminal block slot for each wire. Lever the screwdriver outward (from the back of the housing to the front). This releases the tension on the wire. Repeat for the remaining wire(s) connected to the module that is to be replaced. Pull the wires free from the terminals. (See image C in Figure 3.)
4. Disconnect the fan wire from the PCBA Module for the Power Module that is to be replaced by pinching its connector and pulling to the right. Refer to Figure 3.
5. Disconnect the Power Module's DC+ and DC– connections at the Radian inverter's terminals by using a 1/2" (13mm) wrench. These are present on the outside of the chassis on the bottom of the inverter. Remove the bolts and washers and set aside.
6. Disconnect the ribbon cable from the Power Module by pressing outwards on the clips and then pulling to the right. This connection is within the Power Module. A rectangular gap is present for access to this connection. Refer to Figure 4.
7. Remove the battery terminal nuts which secure the Power Module to the chassis. These are present around the DC+ and DC– terminals. Rotate them counterclockwise for removal. This may be done with a strap wrench if room is available; otherwise, it may be necessary to pry them with a screwdriver. Refer to Figure 1.

   It may be necessary to remove bus bars to facilitate the removal of these nuts. (If the GSLC is present, see the *GS Load Center Installation Manual* for assembly and disassembly of these bus bars.) Set aside.
8. Remove the two upper nuts located above the fan using the socket wrench with 10 mm socket. Refer to Figure 6 on the next page.

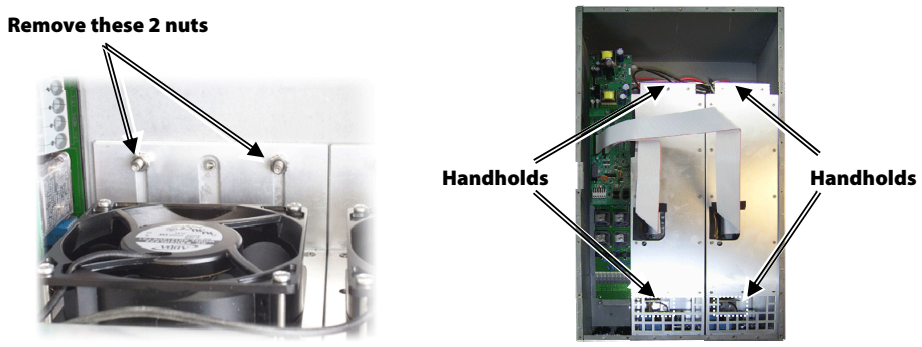

Figure 6 Power Module Nuts and Handholds

9. Using the two handholds provided on the Power Module, lift up at least 1 inch and then outwards to remove the Power Module.
10. Insert the replacement Power Module by reversing steps 1 through 9. Tighten the nuts in step 8 to a torque value of 60 to 68 in-lbs. Refer to Table 1 for model specific locations of the transformer wires, fan wires and ribbon cables.
11. Proceed to the **Replacement of the Front Cover** section.

Replacement of the Front Cover

Tools

- Phillips screwdriver

Procedure

To replace the front cover:

1. Prior to replacement of the cover ensure no tools or loose hardware has been left inside the chassis. Also ensure that all electrical connections have been made. These include the AC input and output terminations, ground termination, Remote cable, Auxiliary wires, Battery Temp cable, two ribbon cables (both ends), two fan cables, and the four or six connections from the Power Module to the PCBA Module.

   NOTE: For Radian models that have only one Power Module there is only one ribbon cable, one fan, and either two or three connections from the Power Module to the PCBA Module. In this case it is necessary to use the "Left" connections
2. Use a Phillips screwdriver to insert the 22 screws that attach the cover to the chassis. Tighten screws to "finger tight," as excessive torque may warp the cover. Refer to Figure 2.

Power Up

After replacement of internal items it is necessary to power up the Radian inverter and other related electronics to check that the repair has been successful. If only a Power Module has been replaced, please proceed through the steps below, ignoring those pertaining to firmware updates and configuration files. If the PCBA Module was replaced, it may need to be programmed in order for proper system operation. Additionally, the firmware revision number will need to be the same as the firmware of other Radian inverters in the system if they are present.

IMPORTANT: MATE3 Upgrade

When replacing the PCBA Module, make certain to upgrade the MATE3 firmware to the latest revision. If it is not upgraded, the MATE3 may not recognize any new inverter functions. This will make them inaccessible to the user. See the OutBack website, www.outbackpower.com, for the latest firmware revisions.

Single Inverter

If there is only one Radian inverter, then the replacement should contain the latest firmware available. This may not match the existing revision that was in the replaced module but contains equivalent or improved functionality and features. Make certain the latest revision is installed. It can be found on the OutBack website, www.outbackpower.com.

1. Apply power to the inverter by turning on the DC circuit breakers. Keep the AC circuit breakers in the OFF position.
2. Use the MATE3 to verify the firmware within the inverter. Upgrade the firmware if necessary. Instructions for this are located in the *Radian Series Inverter/Charger Operator's Manual* and the *MATE3 System Display and Controller Owner's Manual*.
3. Program the inverter by re-installing the configuration file, running the configuration wizard, or manually accessing the inverter's settings and making the appropriate changes.

   NOTE: Radian models GS3548E and GS4048A must be re-programmed for their specific model. Using the MATE3, press the "LOCK" button, press the "UP" button, and insert the "Installer" password. The default password is [1][7][3][2] but may have been changed. If necessary, contact the installer or OutBack Power Technical Support.

   Press the center button, scroll down to "Model Select", press the center button and then change the model to the correct version (labeled on the left side of the Radian chassis as well is within the chassis in the upper right-hand corner). The results of this model change will take effect within 1 minute of making this change. Please allow this amount of time to pass without making any further changes to settings.
4. Turn on the AC input circuit breakers and an AC input source to verify that the correct voltage is present at the inverter. Verification can be through a voltmeter or the MATE3.
5. If the system is in bypass mode, return it to normal mode, connecting the AC output of the inverter system to the loads. Verify that the voltage is correct through a voltmeter or the MATE3.
6. Re-apply power to any other items that were powered down during the repair of the inverter. This may include reactivating the automatic generator start feature, if present.

Multiple Stacked Inverters

All inverters in a system must have the same firmware revision number. After replacing a PCBA module in a system with multiple Radian inverters, the replacement should contain the latest firmware available. This revision may not match other inverters in the system but contains equivalent or improved functionality and features. Make certain the latest revision is installed. It can be found on the OutBack website, www.outbackpower.com. All inverters should have the latest revision. If the firmware revisions within a multiple stacked inverter system do not match, all inverters whose firmware does not match the Master inverter's firmware will not operate. The revision of each inverter can be viewed through the MATE3, however, and can be updated at any time.

1. Turn on all DC circuit breakers for inverters in the system. Ensure the AC circuit breakers remain OFF.
2. Verify through the MATE3 that the firmware of all of inverters is the same. If they *are* the same, skip the next step.
3. If there is a conflict in the firmware then it must be upgraded to the latest firmware. Access the latest revision and use the MATE3 to update the system to this firmware. The process to perform this task can be found in the Radian and MATE3 manuals.
4. If the configuration file was saved, re-install it in the system. The process to perform this task can be found in the Radian and MATE3 manuals. If the configuration file is not available, it is recommended to run the configuration wizard to set up the system again, ***especially if the repaired inverter is the MASTER or is a SUB-PHASE MASTER in a 3-phase system***. If the repaired inverter is not the MASTER or a SUB-PHASE MASTER and there is no configuration file , then access the programming of the repaired inverter (noting the port of the HUB on which it is installed), set the "Stack Mode" to the appropriate setting and reprogram the Auxiliary port to the desired functionality if necessary.

   NOTE: Radian models GS3548E and GS4048A must be re-programmed for their specific model. Using the MATE3, press the "LOCK" button, press the "UP" button, and insert the "Installer" password. The default password is [1][7][3][2] but may have been changed. If necessary, contact the installer or OutBack Power Technical Support.

   Press the center button, scroll down to "Model Select", press the center button and then change the model to the correct version (labeled on the left side of the Radian chassis as well is within the chassis in the upper right-hand

corner). The results of this model change will take effect within 1 minute of making this change. Please allow this amount of time to pass without making any further changes to settings.

5. Using the MATE3, confirm that the firmware revisions of the Radian inverters on the system are all identical. Also ensure, in the Stack Mode section, that there is only one MASTER inverter (and it is connected to Port 1 of the HUB) and the remaining inverters are set to their appropriate settings.
6. Turn on the AC input circuit breakers and an AC input source to verify that the correct voltage is present at the inverter. Verification can be through a voltmeter or the MATE3.
7. If the system is in bypass mode, return it to normal mode, connecting the AC output of the inverter system to the loads. Verify that the voltage is correct through a voltmeter or the MATE3.
8. Re-apply power to any other items that were powered down during the repair of the inverter. This may include reactivating the remote generator start function, if present.

Part replacement is complete.

Contact Information

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Date and Revision

March 2014, Revision C

Part Number

900-0128-01-00 Rev C