Board Replacement Instructions for FLEXmax Charge Controllers

Including Control Board, Button Board, Power Board, and FLEXmax 60 Fan

About OutBack Power Systems

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

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Important Safety Instructions

READ AND SAVE THESE INSTRUCTIONS!

This manual contains important safety instructions for replacing parts on the FLEXmax Series Charge Controllers. Read all instructions and cautionary markings on the FLEXmax Series Charge Controllers and on any accessories or additional equipment included in the installation. Failure to adhere to these instructions could result in severe shock or possible electrocution. Exercise extreme caution at all times to prevent accidents.

Symbols Used

Symbol	Description
	Ground
	AC Current
	DC Current
	Single-Phase
	Sine Wave

	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.

Audience

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.

Definitions

Table 1 Terms and Acronyms

Acronym	Definition
Button Board	Flat board containing the push-buttons and LCD.
Control Board	Narrow circuit board containing the unit's programming.
FET	Field Effect Transistor. The FETs used for power switching in the FLEXmax are classified as MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors).
LCD	Liquid-Crystal Display; refers to the FLEXmax data readout.
Power Board	Large circuit board containing the unit's power-switching circuitry.
PV	Photovoltaic; refers to the photovoltaic panels or modules used with the FLEXmax.

Personal Safety

WARNING: Personal Injury

- Use standard safety equipment such as safety glasses, ear protection, steel-toed safety boots, safety hard hats, etc. as prescribed by the Occupational Safety and Health Association (or other local codes) when working on this equipment.
- Use standard safety practices when working with electrical equipment (e.g., remove all jewelry, use insulated tools, wear cotton clothing, etc.)
- Never work alone when installing or servicing this equipment. Have someone nearby that can come to your aid if necessary.

PV Safety

WARNING: Shock Hazard

Photovoltaic (PV) arrays can be energized with minimal ambient light available. Therefore to ensure a safe disconnect from the system, be sure to install a PV disconnect, breaker, or accessible fuse box (depending on local code requirements).

CAUTION: Equipment Damage

PV Arrays must be wired with correct polarity (positive-to-positive, negative-to-negative). Connecting the cables incorrectly can damage or destroy the equipment.

Equipment Safety

CAUTION: Equipment Damage from Static Discharge

A static-safeguarded workspace should be used to preserve the FLEXmax controller's static-sensitive components during the removal and installation procedure. This includes grounding yourself and your workspace to remove any possible static charge. Practices that will help avoid static include standing on a concrete floor, preferably on a rubber floor mat, doing the repairs on a metal workbench, and avoiding static-causing synthetic clothing.

WARNING: Lethal Voltage

Review the system configuration to identify all sources of energy. (PV arrays can be energized with minimal ambient light available.) Ensure ALL sources of power are disconnected before performing any installation or maintenance on this equipment. Confirm that the terminals are de-energized using a validated voltmeter (rated for a minimum 1000 Vac and 1000 Vdc) to verify the de-energized condition.

WARNING: Burn Hazard

Internal parts can become hot during operation. Do not remove the cover during operation or touch any internal parts. Be sure to allow them sufficient time to cool down before attempting to performance any maintenance.

WARNING: Fire Hazard

- Do not place combustible or flammable materials within 12 feet (3.7 m) of the equipment.
- Use only the recommended cable sizes (or greater) for AC and DC conductors in compliance with local codes. Ensure all conductors are in good condition. Do not operate the unit with damaged or substandard cabling.

CAUTION: Equipment Damage

- Do not perform any servicing other than that specified in these instructions unless qualified to do so and have been instructed to do so by OutBack Power Systems Technical Support personnel.
- Only use components or accessories recommended or sold by OutBack Power Systems or its authorized agents.
- Thoroughly inspect the equipment prior to energizing. Verify that no tools or equipment have been inadvertently left behind.
- Ensure clearance requirements are strictly enforced and that all vents are clear of obstructions that can prevent proper airflow around or through the unit.

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Table of Contents

List of Figures

Introduction

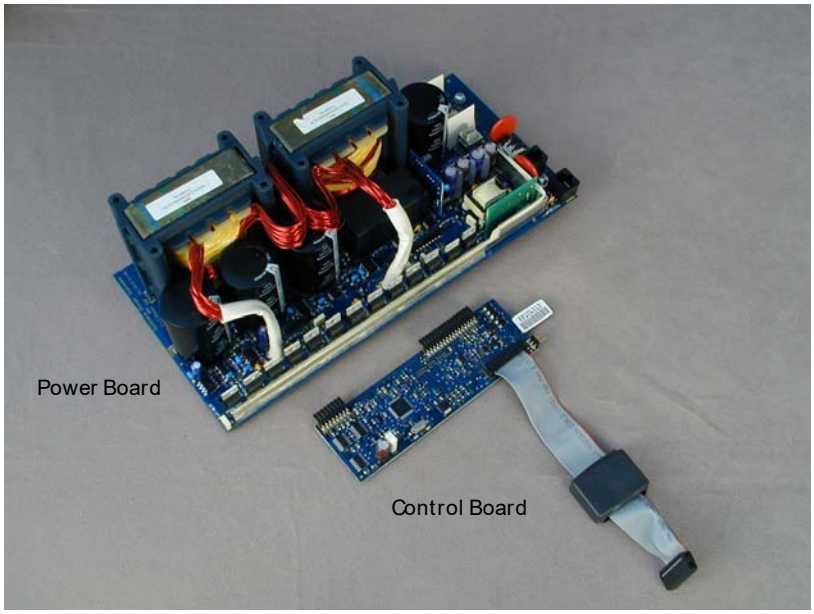
Overview

This step-by-step guide illustrates the replacement of the Control Board, Power Board and Button Board for all FLEXmax Series Charge Controllers. It also illustrates the replacement of the Fan for FLEXmax 60 charge controllers only. It does not cover replacing the fan in a FLEXmax 80 charge controller.

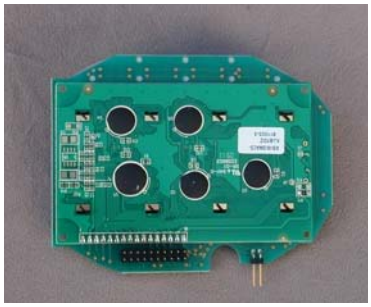
A static-safeguarded workspace should be used to preserve the FLEXmax controller's static-sensitive components during the removal and installation procedure. See the section titled Equipment Safety on page 3 for more specific instructions.

Please review this guide and familiarize yourself with the complete repair procedure. OutBack technical support is also available at (360) 618-4363 or support@outbackpower.com.

⚠	**CAUTION: Equipment Damage** This procedure involves sensitive electronics which must be handled gently and carefully during removal and installation. Applying excess force can damage the components and cause the FLEXmax controller to malfunction.



Button Board
(front)



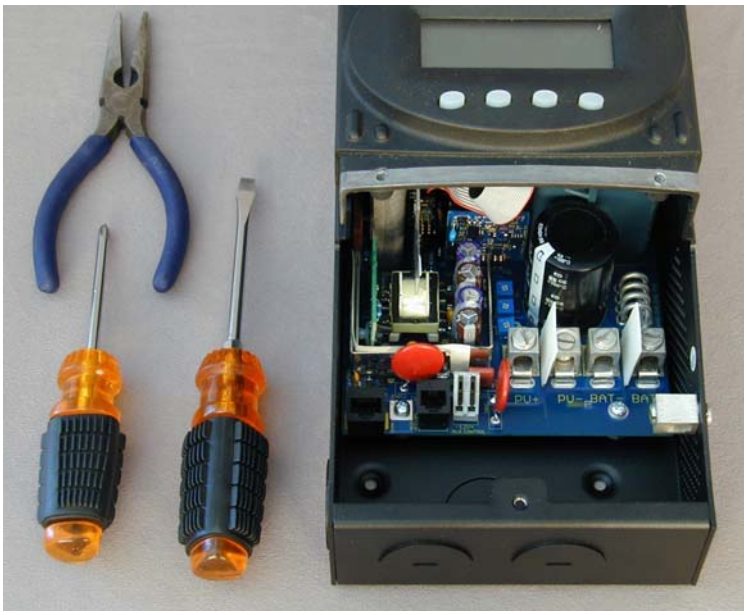
Power Board
(back)

Figure 1 Components

Tools Required

- Phillips Screwdriver
- Flat Screwdriver
- Long-Nose Pliers
- Diagonal Wire Cutters (not shown)

Preliminary



WARNING: Shock Hazard

If the unit has been in use, power can still be present even after the unit has been disconnected.

- Remove all electrical connections from the FLEXmax controller.
- Allow the controller to "rest" for approximately ten minutes to fully discharge the PV input capacitors.

Figure 2 Charge Controller "At Rest"

NOTE: As many as 33 screws may be removed during this procedure. Be sure to put them aside in the order they are removed.

Summary List of Instructions

The following is a list of the instructions that are included in this document.

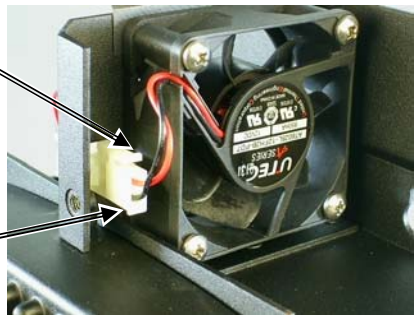
- For instructions for Removing the FLEXmax 80 Fan Cable, see page 9.
- For instructions for Disassembling the Chassis, start on page 10.
- For instructions for Removing the Heat Sink, see page 11.
- For instructions for Removing the FET Bar, see page 12
- For instructions for Separating the Heat Sink from the Power Board, see page 14.
- For instructions for Replacing the Fan and Button Board, see page 17.
- For instructions for Replacing the Control Board and Power Board, see page 23.
- For instructions for Reassembling the Charge Controller, see page 27.

FLEXmax Charge Controller Disassembly

If you have a FLEXmax 60, proceed with removing the chassis screws as described on page 10.

Removing the FLEXmax 80 Fan Cable

1. Remove the machine screw that secures the fan cover.
2. Press both sides of the fan cover to release the tabs. Pull up on the cover.
3. Remove the fan cover once the tabs have cleared their slots. Keep the fan cover and machine screw in a safe place.
4. Note the fan cable plugged into the jack.
5. Remove the fan cable by squeezing the tabs on either side of the plug. You can do this with your fingers, or with a pair of long-nose pliers.



6. Note the jack for the fan cable, which is snapped into the fan bracket.

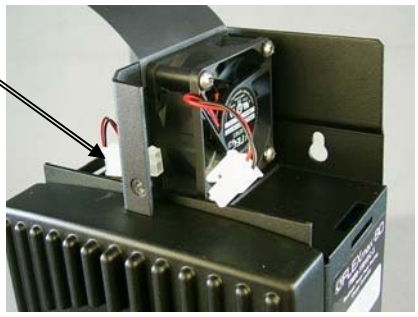
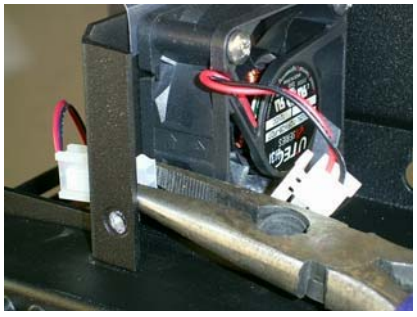


Figure 3 Removing Fan Cover



7. Remove the cable jack by pinching the retaining tabs on either side of the jack, using long-nose pliers. The jack can be taken out through the rear of the bracket.

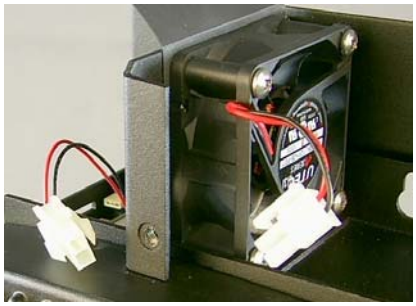


Figure 4 Removing Cable Jack

Removing Chassis Screws

1. Set the unit on its side to remove the two back screws. Keep the screws and star washers together.

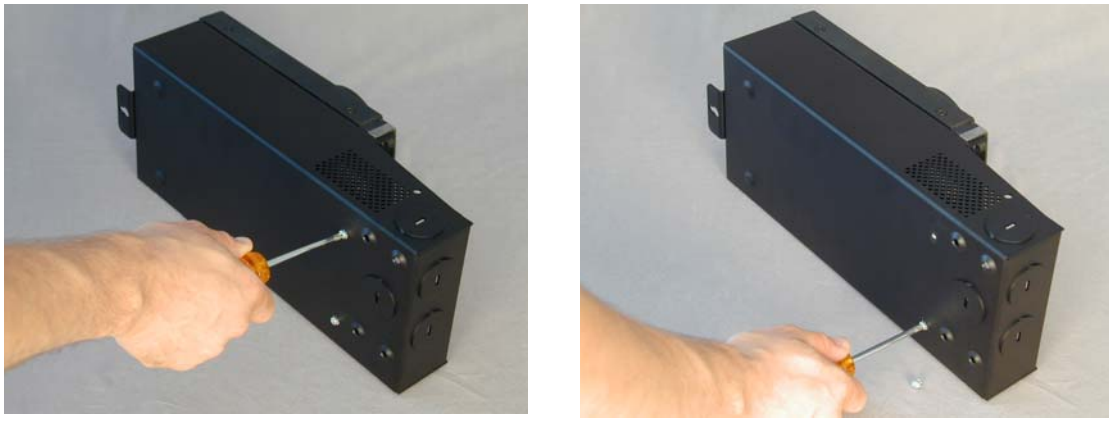


Figure 5 Back Screw Removal

2. With the unit still on its side, remove two side screws.

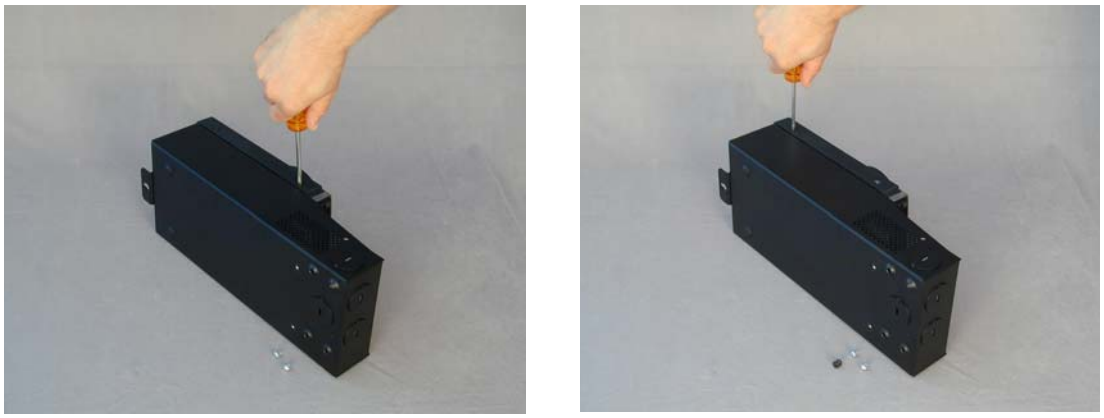


Figure 6 Side Screw Removal (part 1)

3. Set the unit on its other side and remove the two remaining screws.

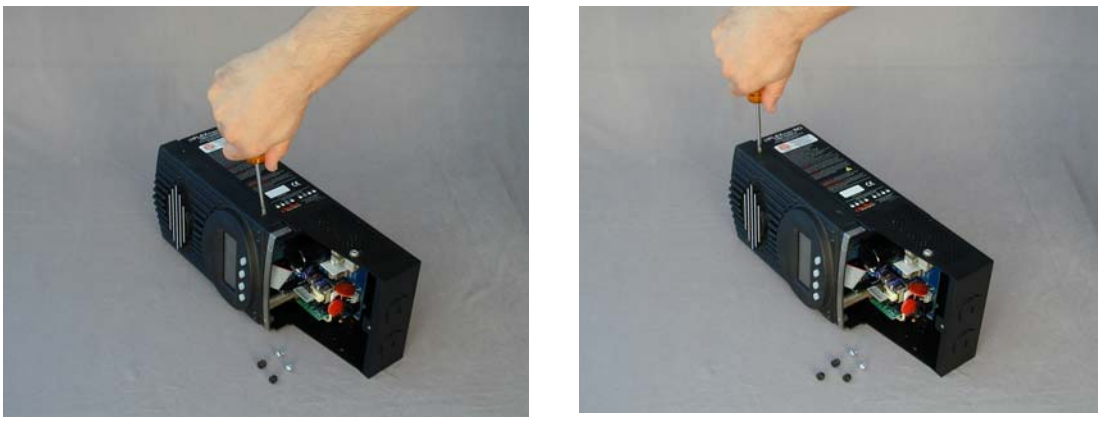


Figure 7 Side Screw Removal (part 2)

The heat sink can now be removed from the chassis.

Removing the Heat Sink

1. To remove the heat sink, grip it along each flank and raise its lower end.

2. Slide the control board past the grounding lug. Make certain the power board is raised high enough to avoid the grounding lug

3. Slide the heat sink away from the chassis.

Figure 8 Heat Sink Removal

Removing the FET Bar

1. Set the unit on its side as shown in Figure 9 and remove the 12 screws securing the FET mounting bar to the heat sink.

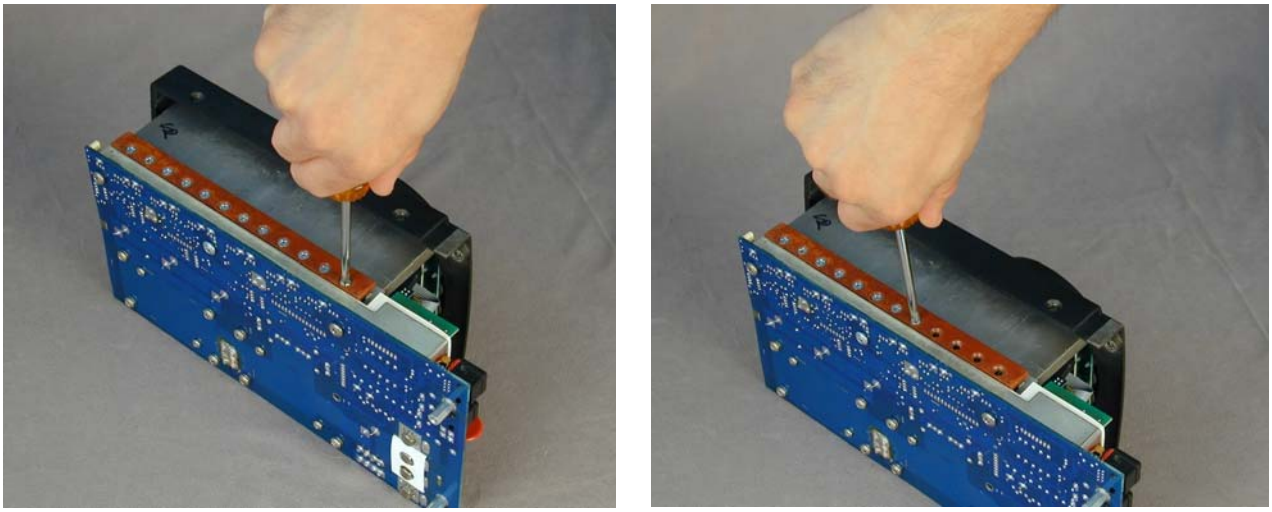
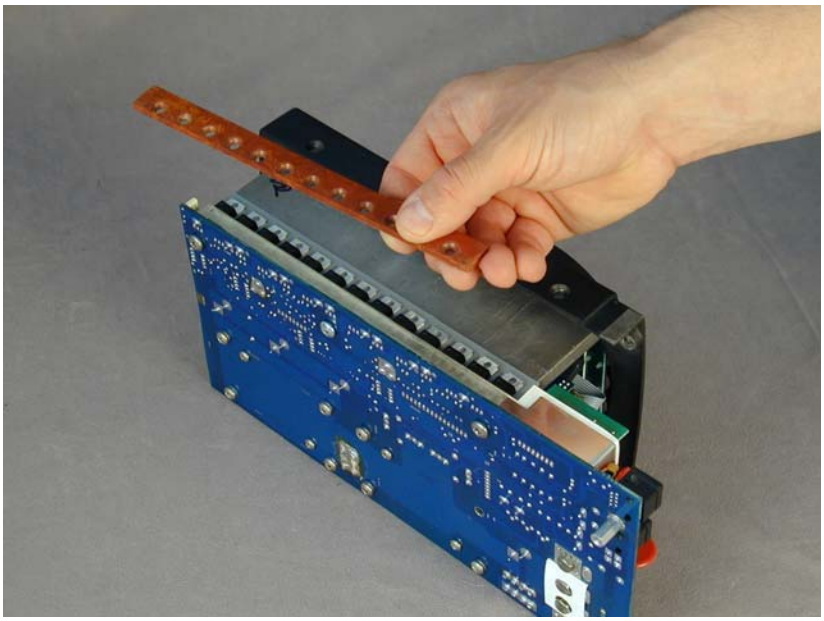


Figure 9 FET Bar Screw Removal



2. Remove the FET mounting bar.

Figure 10 FET Bar Removal

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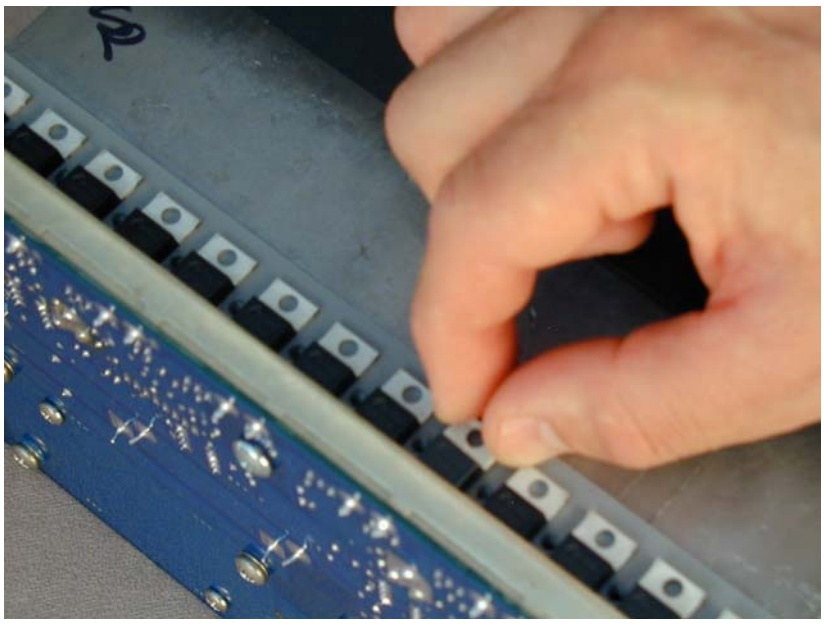


3. Lift the tab of the FETs off from the Sil-Pad (gray insulator pad) using your finger and thumb.

CAUTION! Do not attempt to remove the FETs from the power board. The FET pins are soldered to the board.

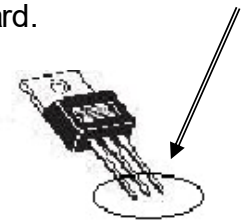


Figure 11 Freeing the FET from the Insulator

If the FETs are difficult to break free, rock the tabs gently with long-nose pliers until they lift off the Sil-Pad.

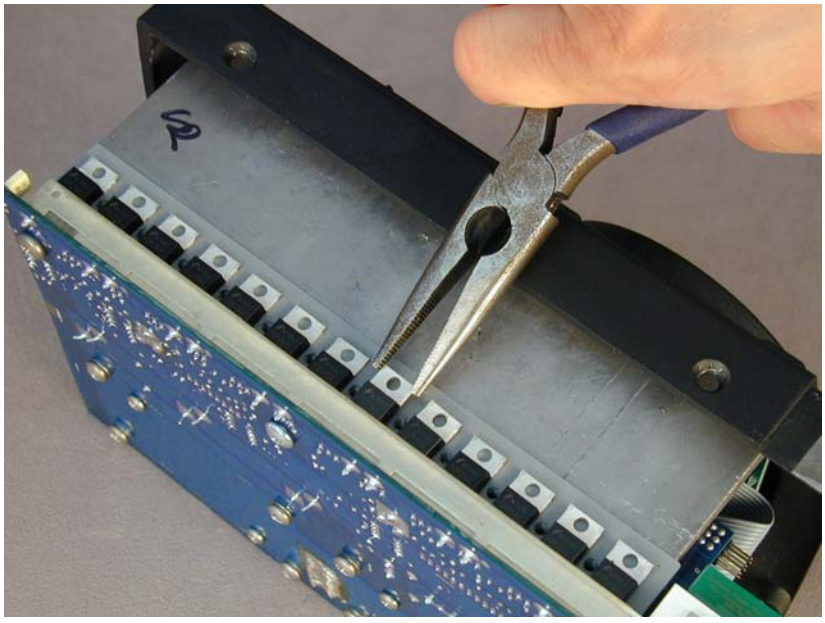
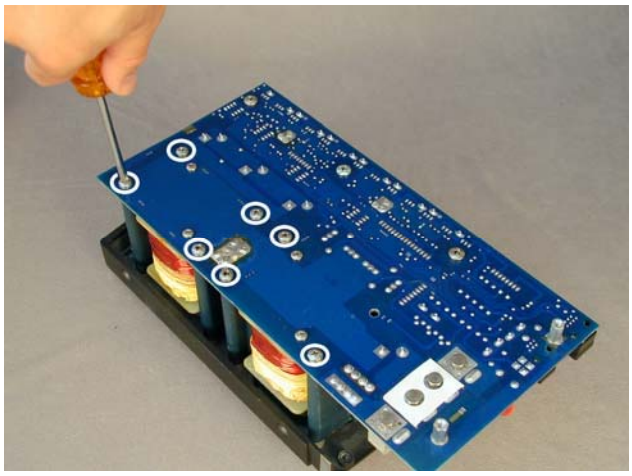


Figure 12 Freeing the FET with Pliers

Separating the Heat Sink from the Power Board

Place the charge controller upside down and remove the seven screws circled in white in Figure 13, on the left. Do not remove the four cradle screws and washers identified with the X symbol in Figure 13 on the right.



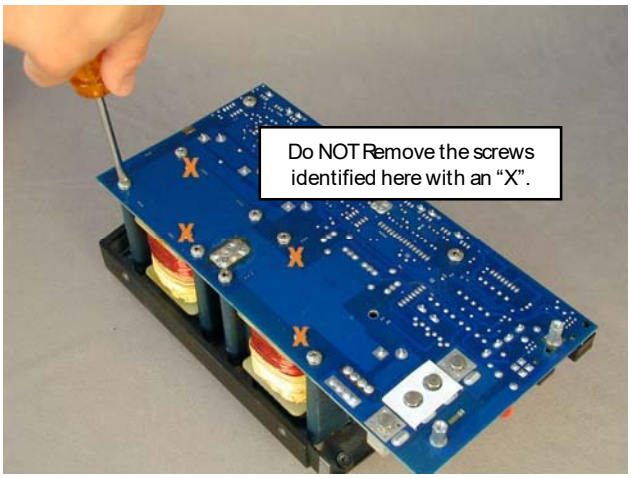
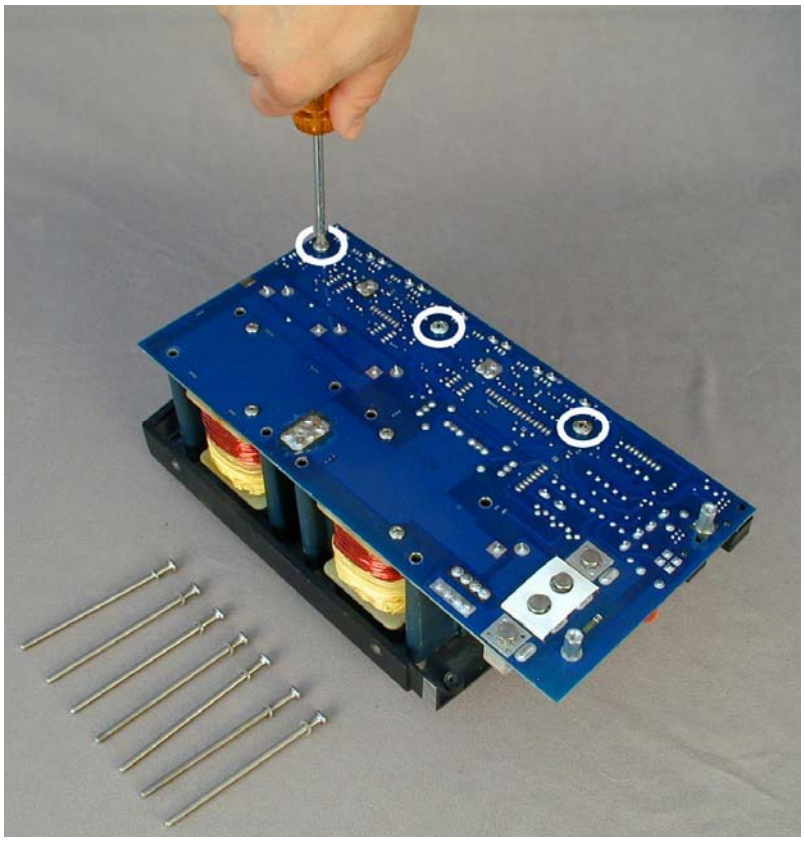


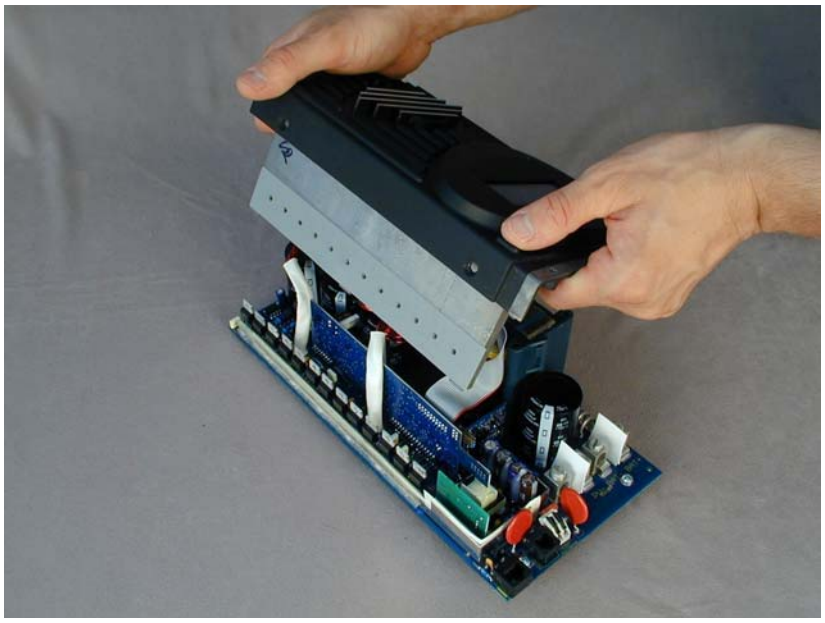
Figure 13 Bottom/Cradle Screw Removal



2. Remove the last three (3) remaining screws, circled in white in Figure 14.

Figure 14 Removing Remaining Screws

Continued on next page.



3. With all the screws removed, the heat sink can be separated from the power board. Set the unit upright and carefully pry and lift the heat sink off the power board.

Figure 15 Heat Sink Removal

CAUTION! Do not force the removal. The heat sink is connected to the power board by a ribbon cable from the control board.

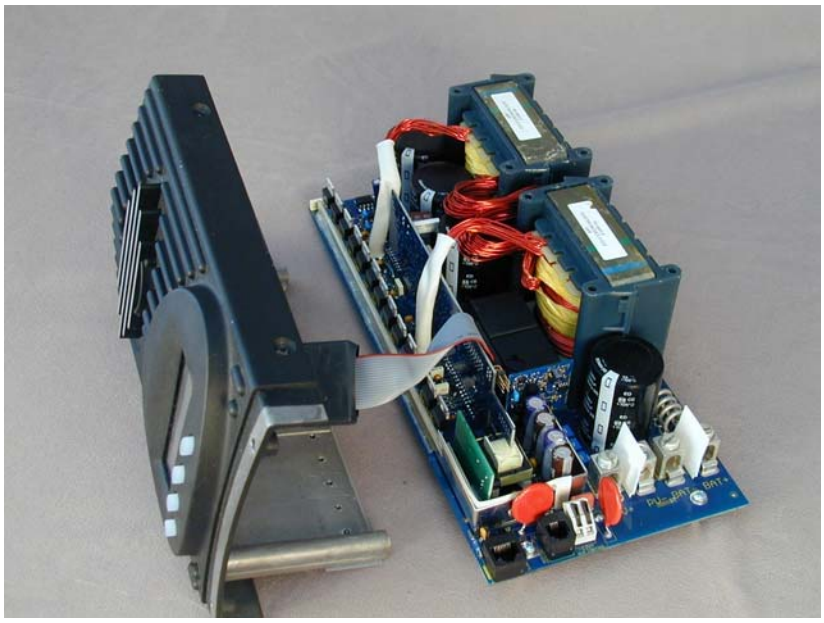


Figure 16 Heat Sink Connected to Power Board

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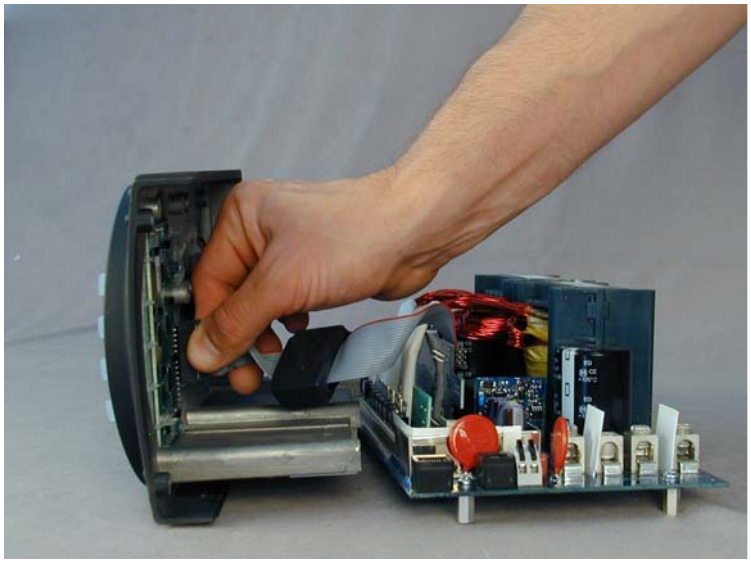


4. Set the heat sink on its side and the power board down flat.
5. Remove the ribbon cable connector from the LCD connector.

The connector may have a dollop of silicone sealant on it which must be peeled off. When reassembling the controller, it is recommended to apply more silicone sealant if available.)

If you have a FLEXmax 60 controller and are only replacing the fan, it is not necessary to remove the cable.

Figure 17 Cable Removal

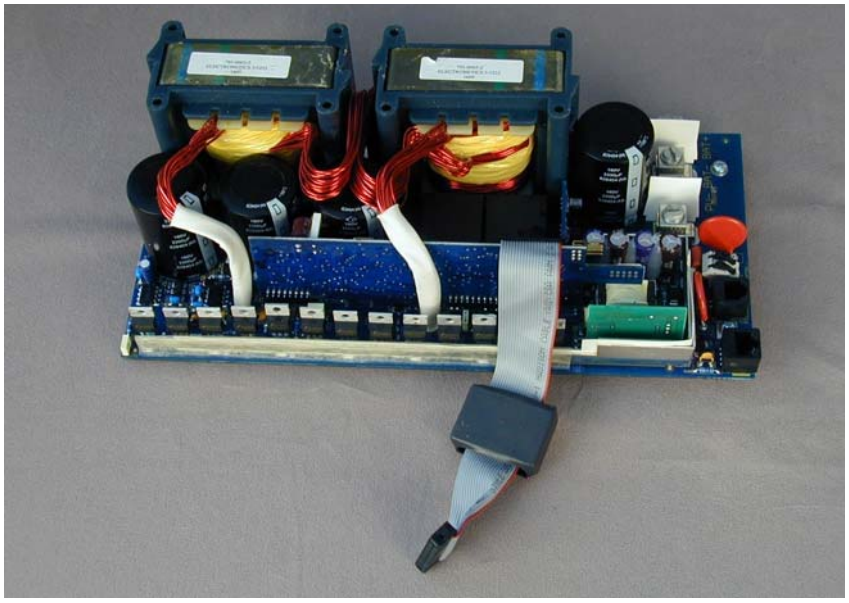


Figure 18 Power Board - Top View

For instructions on Replacing the Fan in a FLEXmax 60 Charge Controller, see page 17.

For instructions on Replacing the Button Board, see page 19

For instructions on Replacing the Control Board and Power Board, see page 24.

For instructions on Reassembling the Controller, see page 27.

Replacing the FLEXmax 60 Fan

Disassemble the controller as described on page 9 through page 16.

Removing the Fan

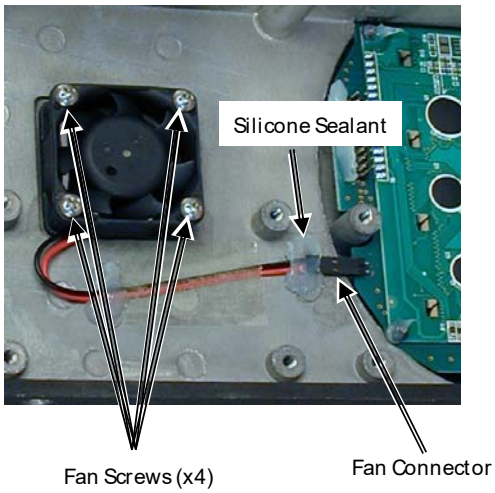


Figure 19 Fan Removal

To remove the fan:

1. Disconnect the connector from the LCD. The connector may have a dollop of silicone sealant to ensure a firm connection. This should be peeled or pulled off.
2. Remove the four screws holding the fan in place.

NOTE: The ribbon cable is shown disconnected in this illustration for convenience only.

Replacing the Fan

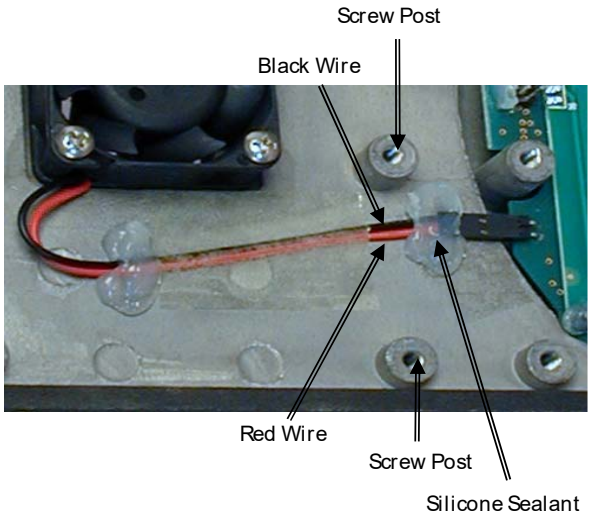


Figure 20 Fan Replacement

To replace the fan:

1. Insert the new fan aligning the mounting holes to the heat sink.
2. Align the connector so that the red wire of the connector lines up with the positive (+) pin and the black wire with the negative (-) pin as shown in Figure 20. Position the wires between the screw posts.
3. Plug in the connector.
4. Tighten the screws so the fan is snug against the heat sink.
5. Reapply silicone sealant to secure the connector (if possible).

If no other repairs are necessary, see the reassembly instructions on page 27. After reassembly, return to page 18 for testing procedures.

Fan Test Procedures

Test the fan using the following procedures:.

1. Remove the Remote Temperature Sensor (RTS) jack from the port, if present.

2. Insert a flat screwdriver inside the RTS port. Gently press the screwdriver tip against all the pins at once. This will create a false signal that will turn the fan on.

3. Check the LCD. The operational mode on the FLEXmax screen should change from "Sleeping" to "BatTmpErr". The fan will begin running.

4. Once the fan operation has been verified, remove the screwdriver from the RTS port and reconnect the RTS, if available.

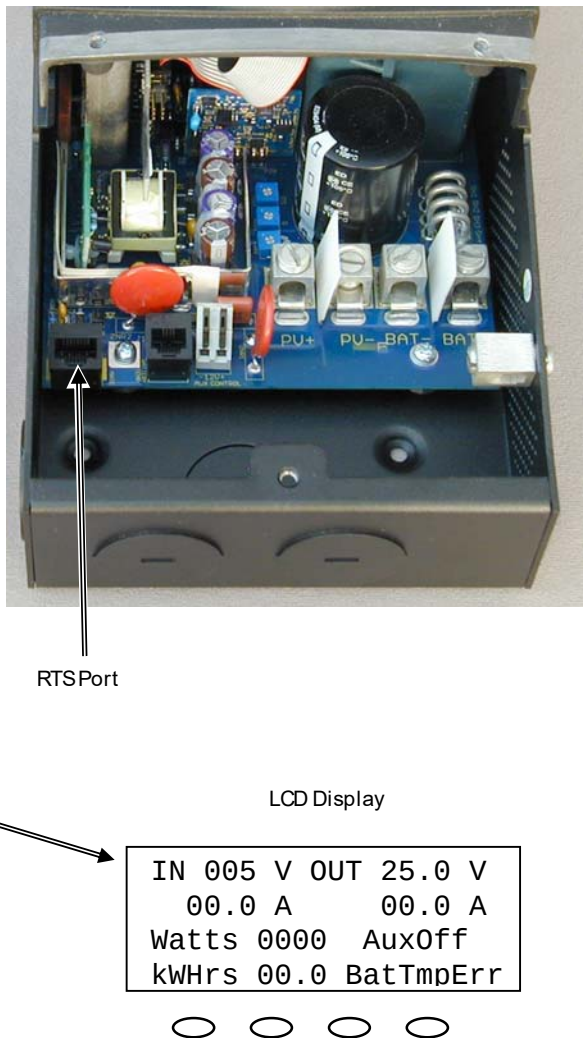


Figure 21 Fan Test Procedure

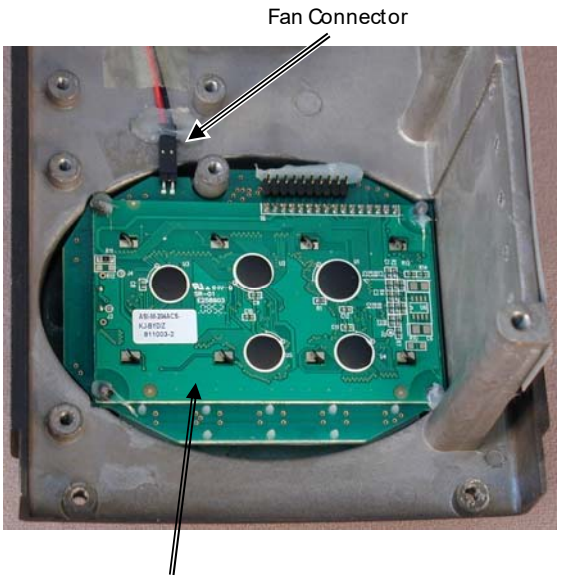
You may now apply PV input to the FLEXmax Charge Controller to resume charging.

Replacing the Button Board

To locate the button board:

1. Disassemble the controller as described on page 11 through page 18.
2. Remove the Remote Temperature Sensor (RTS) from the port, if present.
3. The Button Board is located on the inside of the heat sink.

Figure 22 Locating the Button Board



To disconnect the fan:

1. Disconnect the fan by gently pulling the connector away from the button board..
2. Remove the Silicone Sealant if present.

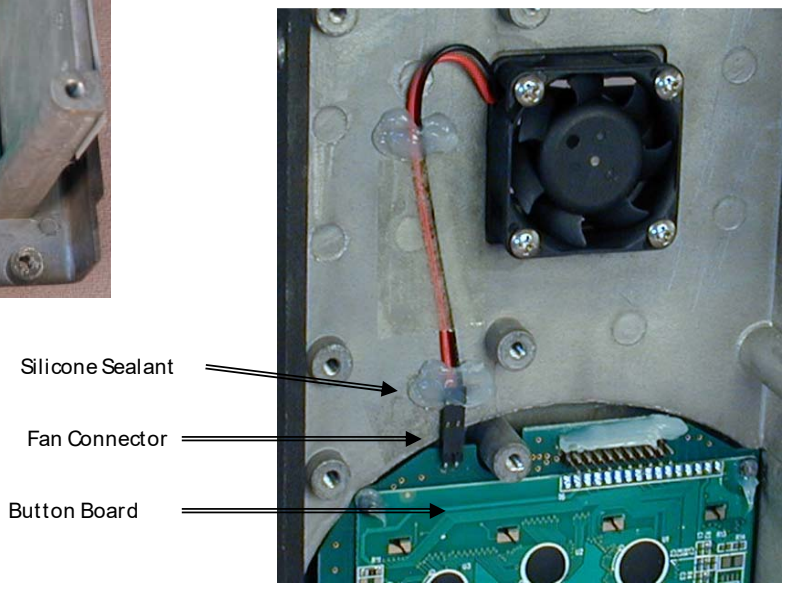


Figure 23 Disconnecting the Fan

The button board is mounted to the heat sink on four metal pegs at the corners of the board. It is retained in place by push-nuts which slide over each peg, and which are covered in turn by silicone sealant.

To expose the pegs:

1. Remove the silicone sealant from all four pegs.

Figure 24 Exposing the Button Board Mounting Peg

Once the push-nuts are exposed, they will need to be removed without damaging the metal pegs. The push-nut is very thin and does not have much of an edge. Using a sharp set of wire cutters, remove the push-nuts by squeezing them on either side so that they deform.

To remove the push-nut:

1. Carefully grip the push-nut on either side with the wire cutters. Be sure not to damage the peg or the circuit board.

Figure 25 Gripping the Push-nut

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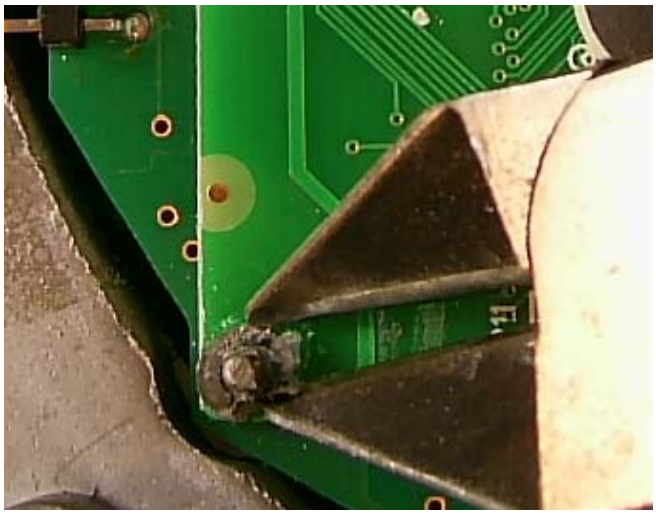


Figure 26 Deforming the Push-nut

2. Slowly close the wire cutters, exerting enough pressure to crush or deform the push-nut. The push-nut cannot be reused after doing this.

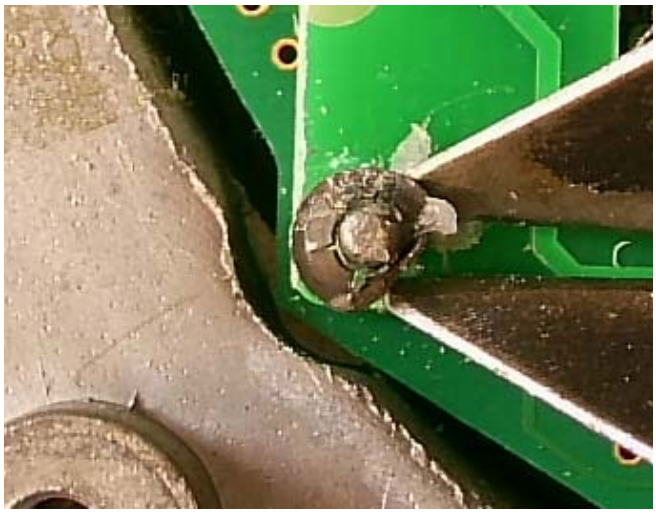


Figure 27 Removing Push-nut

3. Once the push-nut is deformed, push the wire cutters beneath it and pry it off the peg.

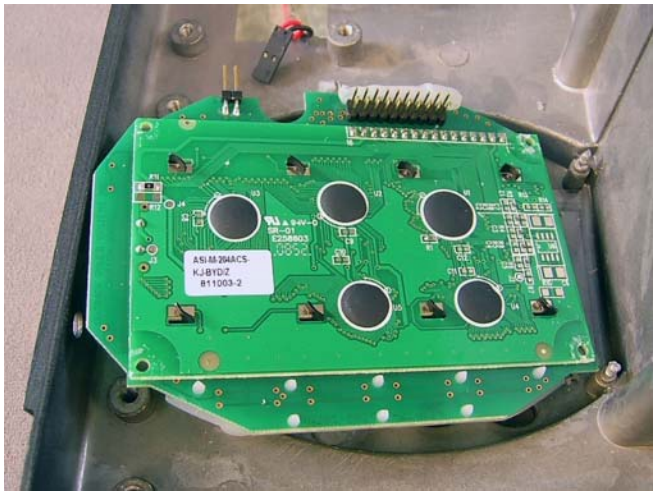


Figure 28 Removing the Button Board

4. Finally, work the button board free of the four pegs and remove it from the housing.

Continued on next page.

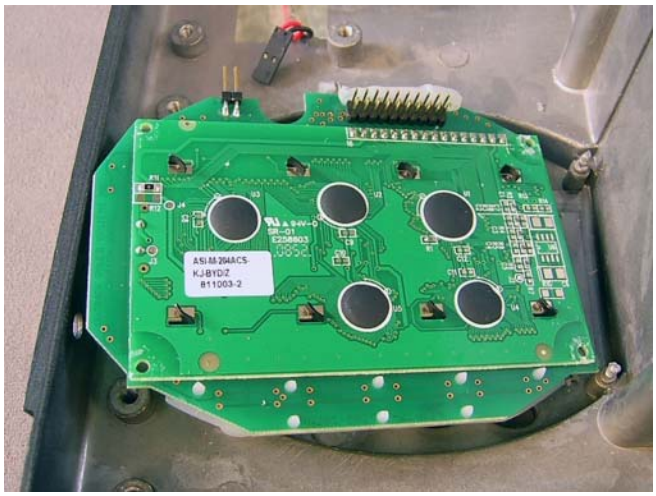


Figure 29 Inserting the New Button Board

5. Insert the replacement board and align it with the four pegs.

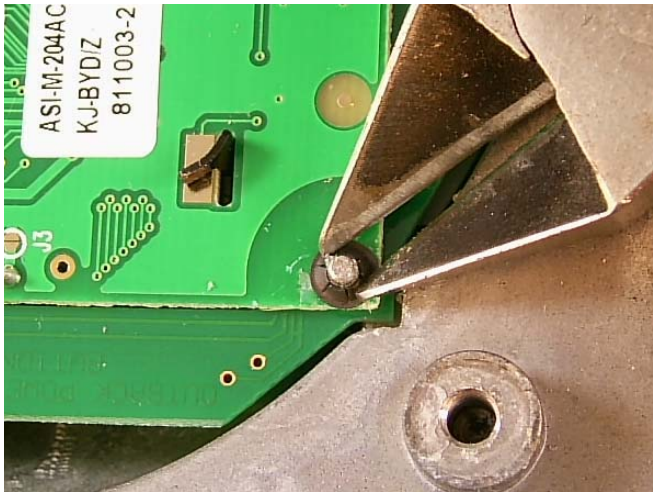


Figure 30 Inserting New Push-nut

6. Lay a replacement push-nut over each peg. The push-nuts are not flat. Make certain to place them so that the edges are lower and the convex center is higher.
7. Using the wire cutters or long-nose pliers, press along both sides of the push-nut so that it is driven onto the peg. Continue pressing until the push-nut is firmly against the button board.
8. Repeat with the other three push-nuts and pegs.

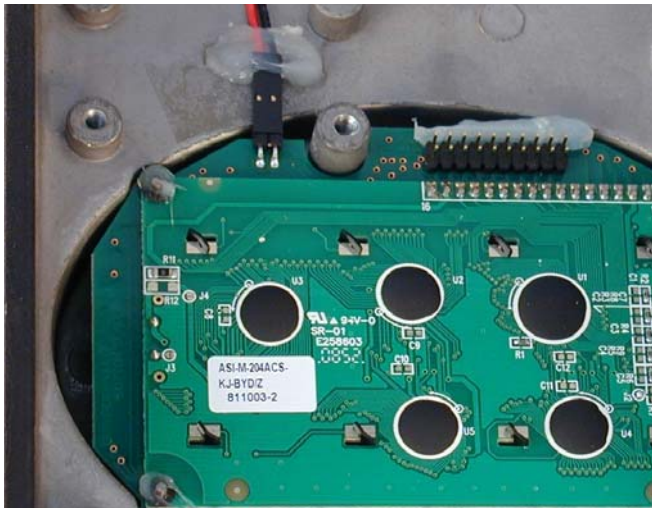


Figure 31 Reconnecting the Fan

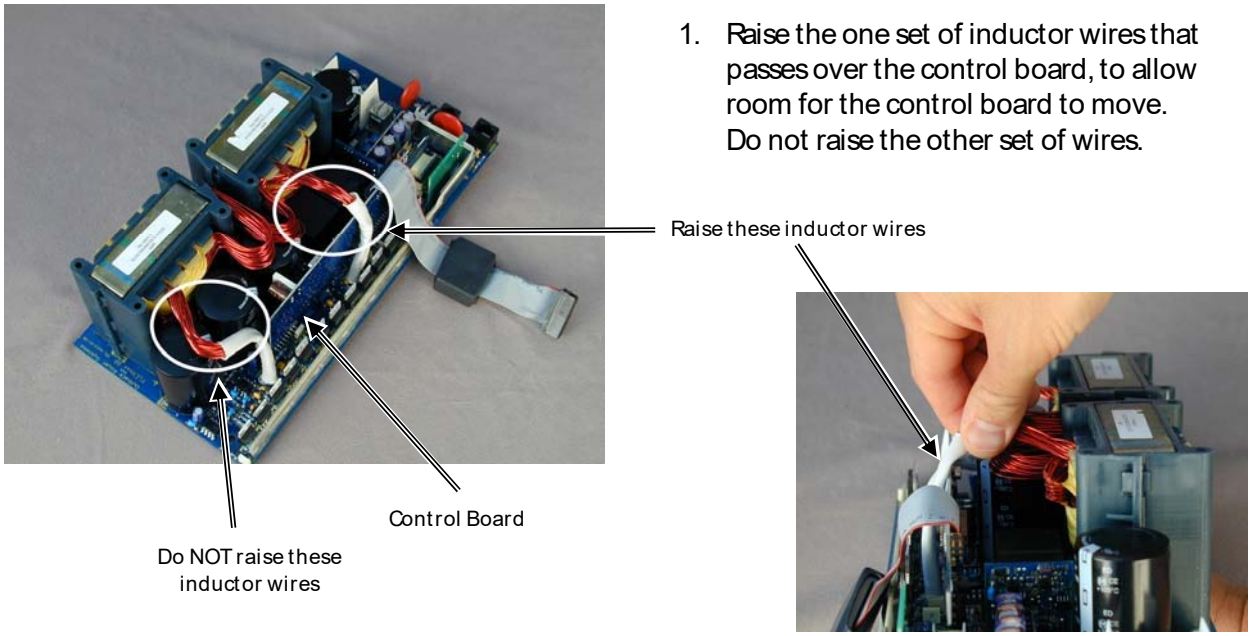
9. Reattach the connector for the fan.
10. If possible, reapply silicone sealant to secure the fan connector and the four push-nuts.

Proceed to the next section if you need to replace the control board or power board.

If not, proceed to page 27 to begin reassembling the charge controller.

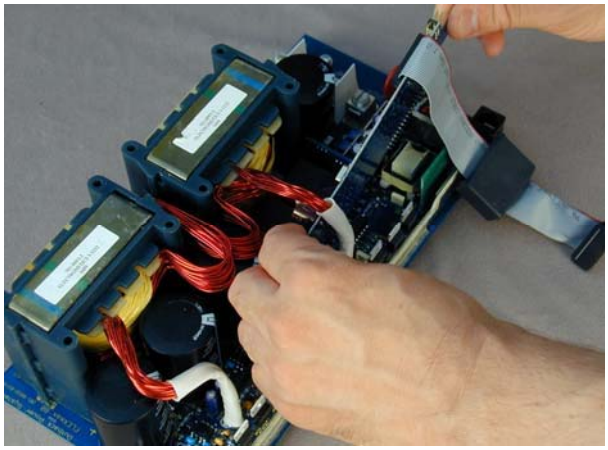
Control Board and Power Board

Removing the Control Board



1. Raise the one set of inductor wires that passes over the control board, to allow room for the control board to move. Do not raise the other set of wires.

Figure 32 Lifting the Inductor Wires



2. Pinch the ends of the control board and pull upward.
3. If the board resists, gradually pull up one end at a time, alternating between the two ends.
4. Remove the control board by sliding it out of the power board, avoiding any components on the board.

CAUTION! The pins of the control board should not be obstructed by the components on the power board.

Figure 33 Sliding the Control Board Out

Replacing the Control Board or Power Board

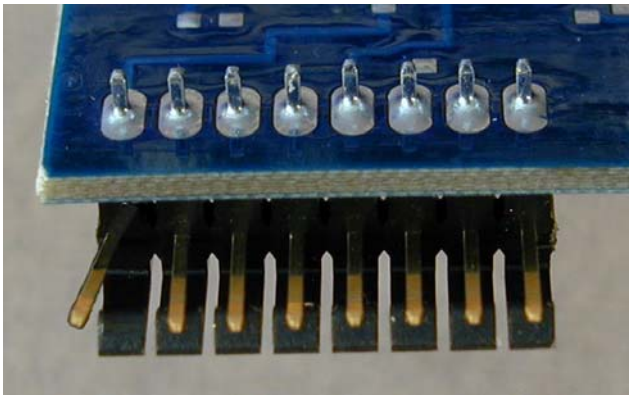


Figure 34 Bent Pin on Control Board

1. Inspect the connector pins on the control board for any bends. Straighten any bent pins with a flat screwdriver or your finger.

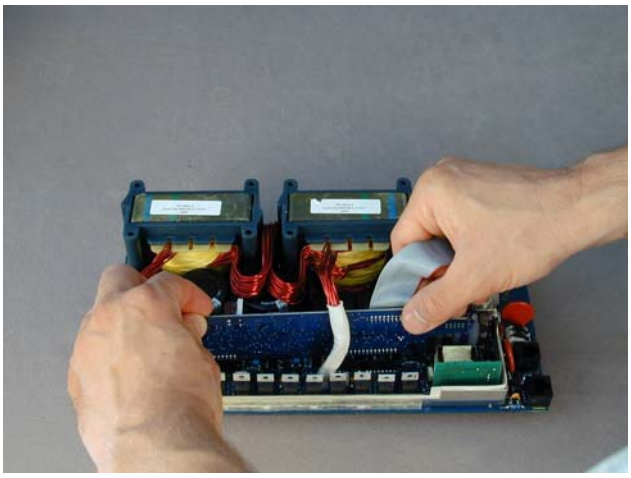


Figure 35 Inserting Control Board

2. Slide the control board into the power board. Do not hit any components on the power board.
3. Inspect the pins again before connecting the control board to the power board.
4. Carefully align the control board connector with the power board connector. Be sure the pins and holes are lined up with each other precisely.

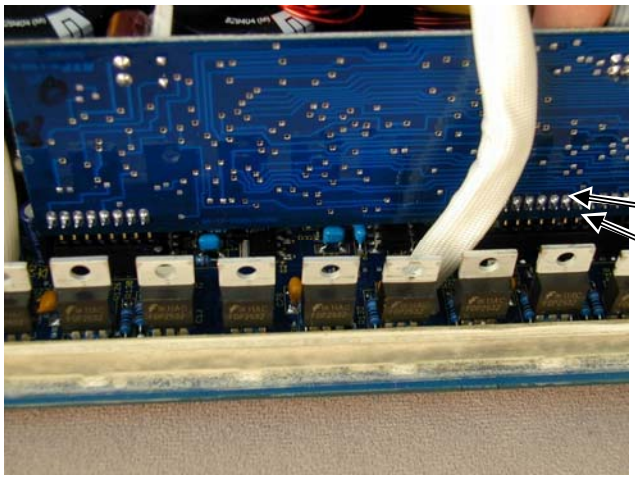
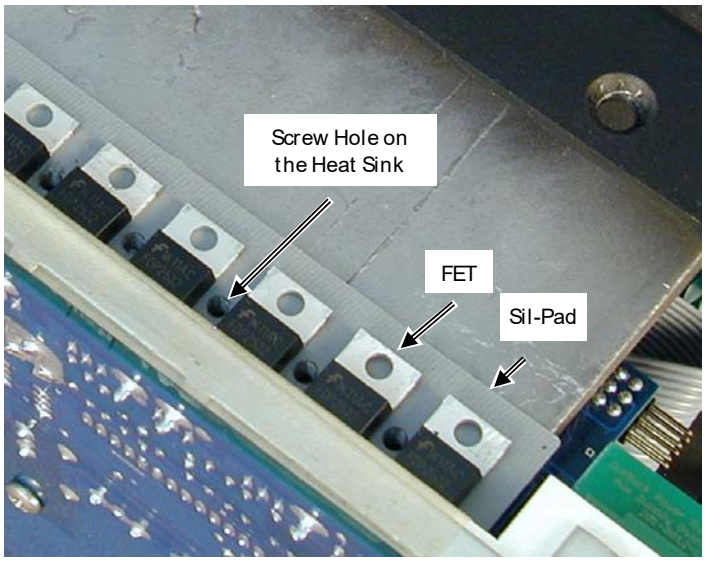


Figure 36 Pins and Connectors

5. When the pins and connectors line up, push the control board into the power board.

Continued on next page.



6. Using the replacement that came with the new board, replace the gray Sil-Pad insulator on the heat sink.

Figure 37 FETs and Sil-Pad Insulator on Heat Sink

	IMPORTANT: Make certain the new Sil-Pad is lined up with the screw holes on the heat sink.

	CAUTION: Equipment Failure Always replace the Sil-Pad even if the old Sil-Pad appears usable. It could easily have been damaged when removing the heat sink from the power board. Even a pin-sized hole can lead to catastrophic board failure.

Notes:

Reseating the Control or Power Board

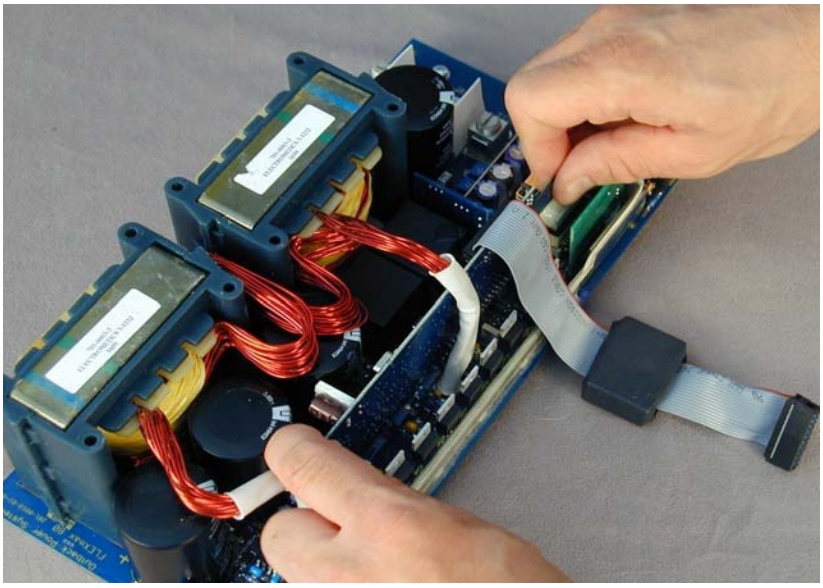


Figure 38 Reseating Control Board

1. Push on both ends of the control board to confirm it is still properly seated on the power board.

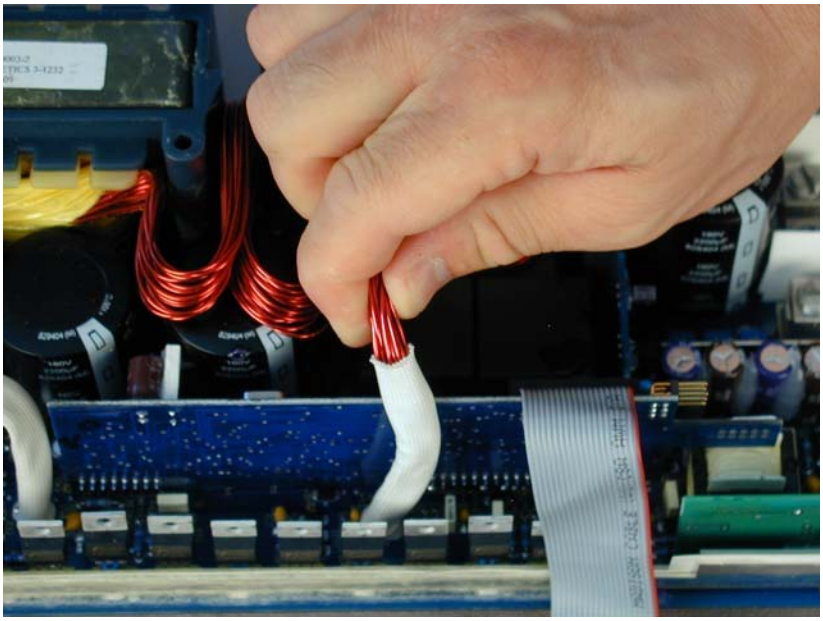


Figure 39 Placing Inductor Wires

2. Bend and move the inductor wires over the control board. These are the same inductor wires which were bent out of the way in Figure 32. Make sure the wires do not strike the fan or button board when the heat sink is reinstalled.

Reconnecting the Heat Sink to the Power Board

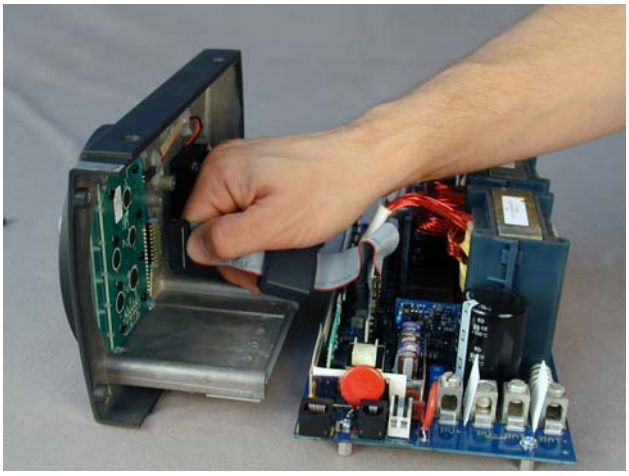


Figure 40 Reinstalling Ribbon Cable

1. With the control board secured to the power board, connect the ribbon cable.

CAUTION! The ribbon cable is not keyed. Do not install it backward. In the correct orientation, the red stripe must face the heat sink side wall.

In Figure 40, the cable is oriented so that the red stripe is on the bottom.

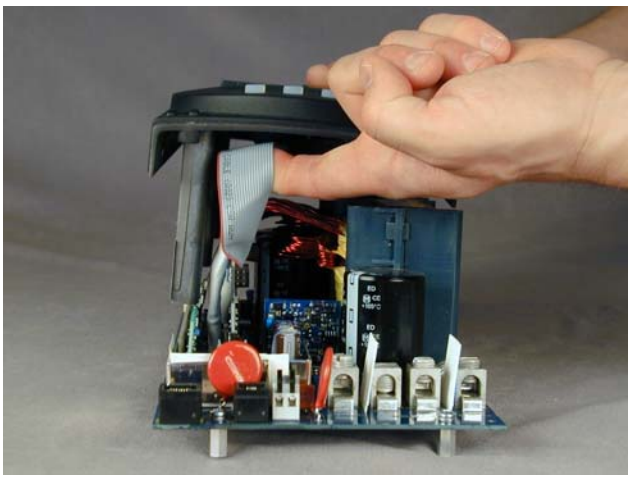


Figure 41 Gently Pulling On Ribbon Cable

2. Set and align the heat sink onto the power board.
3. While aligning the heat sink, tuck one finger under the ribbon cable and pull as indicated in Figure 41. This will take up the slack in the ribbon cable. It keeps the cable from interfering with the alignment of the heat sink and the power board.

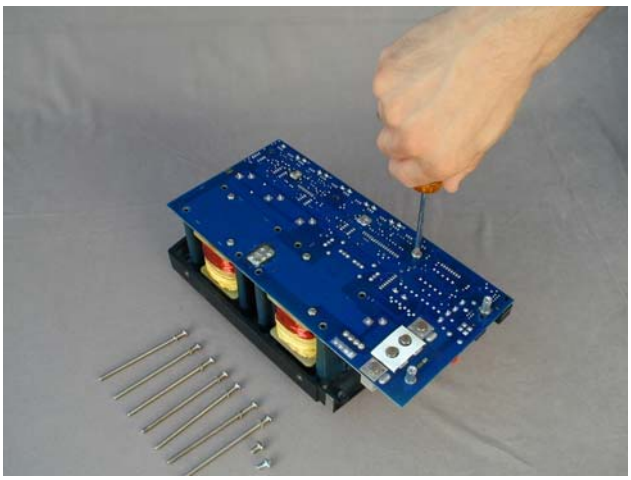
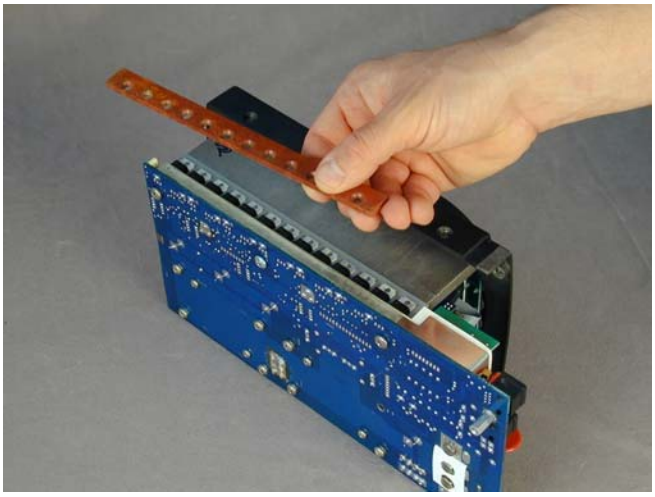


Figure 42 Installing and Tightening Screws

4. Set the unit upside down, and align the power board screw holes against the heat sink screw holes.
5. Reinstall all the screws that had been removed previously and hand-tighten them.

Continued on next page.



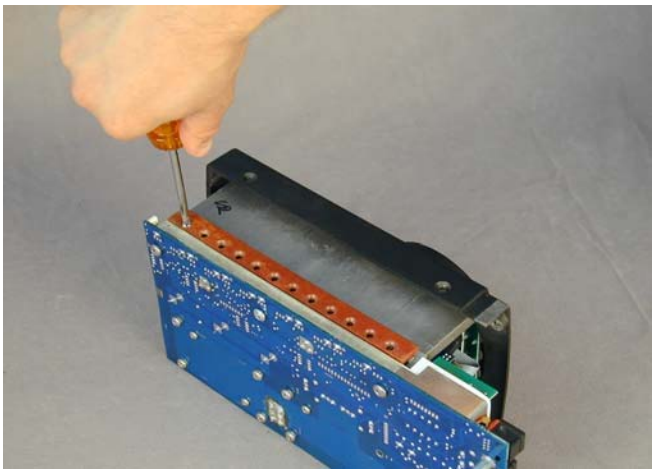
6. Set the unit on its side with the FETs in between the screw holes on the heat sink.

   If they do not line up, move the tabs on the FETs to align them between the screw holes. The alignment of the FETs between the screw holes protects them from damage when reinstalling the FET mounting bar and screws.

7. If you are reassembling the unit (following fan replacement) and have not already performed this step: using the replacement that came with the fan, replace the gray Sil-Pad insulator on the heat sink. Refer to the illustration on page 27 if necessary.

Figure 43 Aligning FETs and Installing the FET Bar

⚠	CAUTION: Equipment Damage Always replace the Sil-Pad even if the old Sil-Pad appears usable. It could easily have been damaged when removing the heat sink from the power board. Even a pin-sized hole can lead to catastrophic board failure. Make sure the new Sil-Pad is lined up with the screw holes on the heat sink.



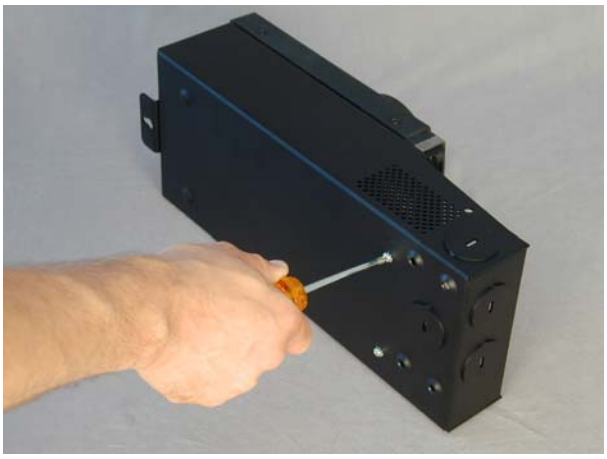
8. Place the FET mounting bar on the FETs.
9. Install the FET bar screws and tighten.

Figure 44 Installing FET Bar Screws

Reconnecting the Heat Sink to the Chassis

1. Slide the reassembled unit into the chassis working around the Grounding lug.

Figure 45 Reinstalling the Heat Sink onto the Chassis



2. Replace and tighten down all the screws on the back of the chassis.

3. Replace and tighten down all the screws on the sides of the chassis.

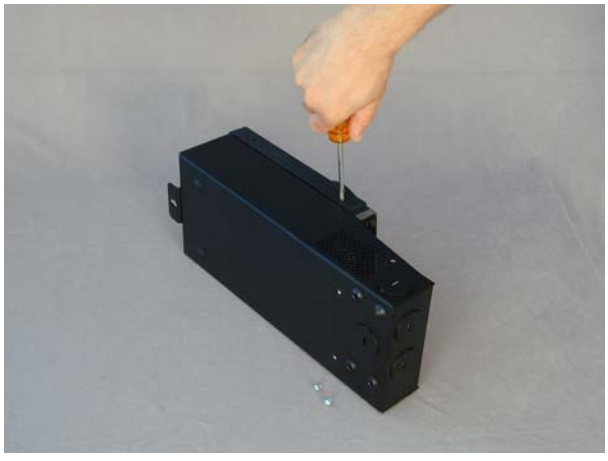
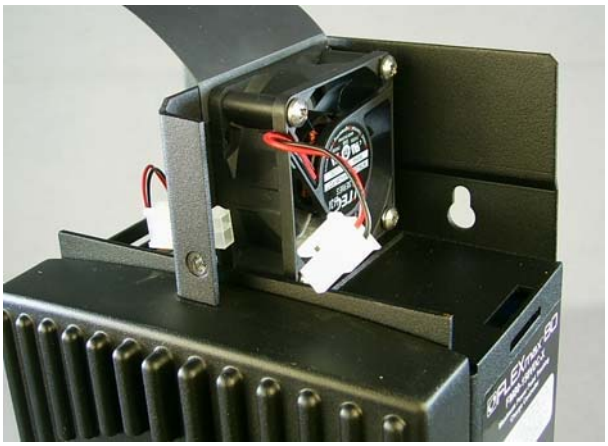


Figure 46 Replacing the Chassis Screws

For the FLEXmax 80 Controller, follow the steps on for reinstalling the fan plug before proceeding.

Reinstalling FLEXmax 80 Fan Plug



1. Snap the fan cable jack into the bracket.

Figure 47 Reinstalling Cable Jack

2. Snap the fan cable into the jack.

Figure 48 Reinstalling Cable Plug

3. Replace the FLEXmax 80 fan cover.

Figure 49 Fan Cover

System Functional Test

Perform a Functional Test as follows before putting the system back into full service.

1. Reinstall FLEXmax Charge Controller back into the system.
2. Initially apply only battery power to the FLEXmax controller.
3. The display should “boot up” and the soft keys should function properly. Test the soft keys by cycling through the menus.
4. Once proper operation is verified, apply PV input to the FLEXmax Charge Controller to resume charging.
5. Using a digital multimeter, test the applicable test points to confirm proper voltage levels as they are applied to the system.
6. Replace all the appropriate component covers and secure the system for official use by the customer.

If the unit does not perform as expected or fails the Functional Test, disconnect all power sources (i.e. open all breakers or disconnects) and contact OutBack Technical Support for additional assistance.

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