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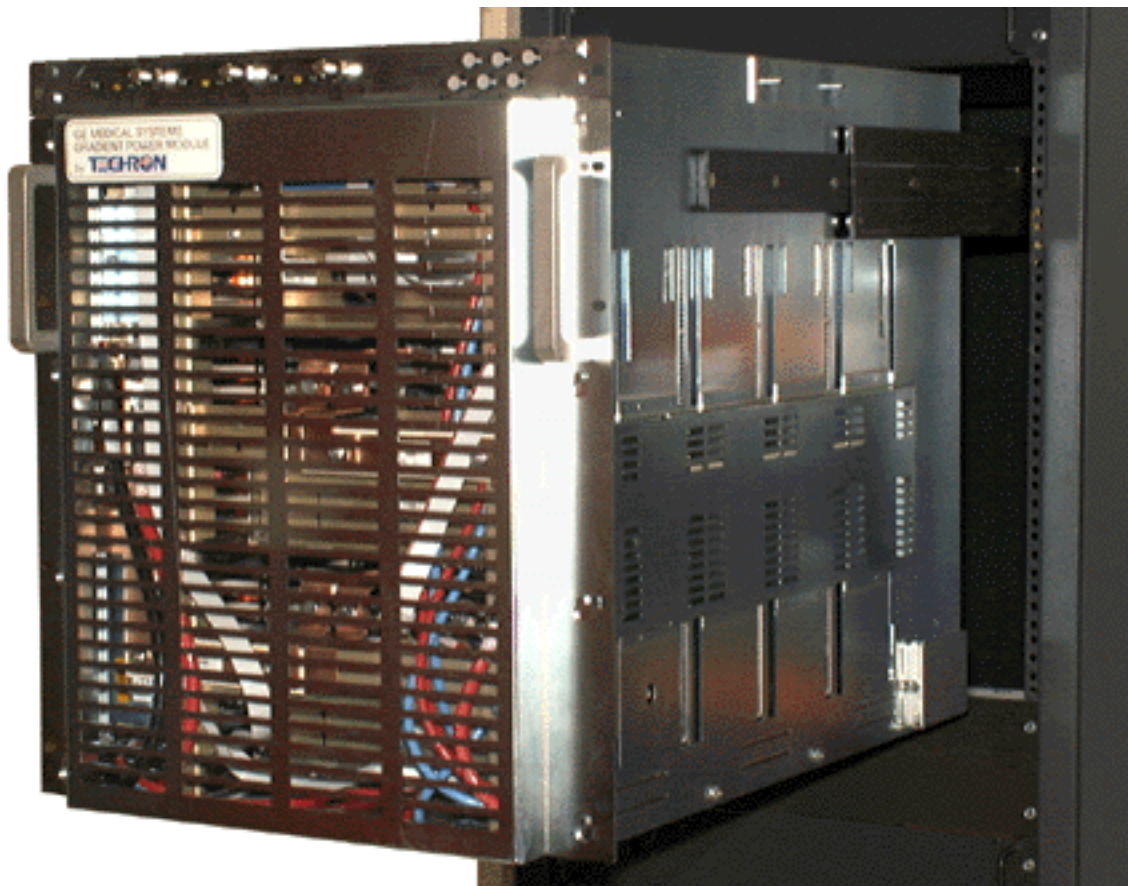
REVISION HISTORY..... 32

1- REPLACEMENT PROCEDURES

1-1 Introduction

This section consists of Gradient Power Module (GPM) disassembly and Level 1 FRU replacement procedures. Level 1 FRU components are interchangeable between axes and have standard replacement instructions. The only two exceptions are the Z-axis PPBM (Polyphase Buck Module) and the Z-axis output shelf which have unique configurations and, therefore, unique instructions.

See below for Illustration L6021 -- a view of the Gradient Power Module.



GRADIENT POWER MODULE (GPM)
ILLUSTRATION L6021

To install the GPM and its components, follow the disassembly instructions in reverse order.

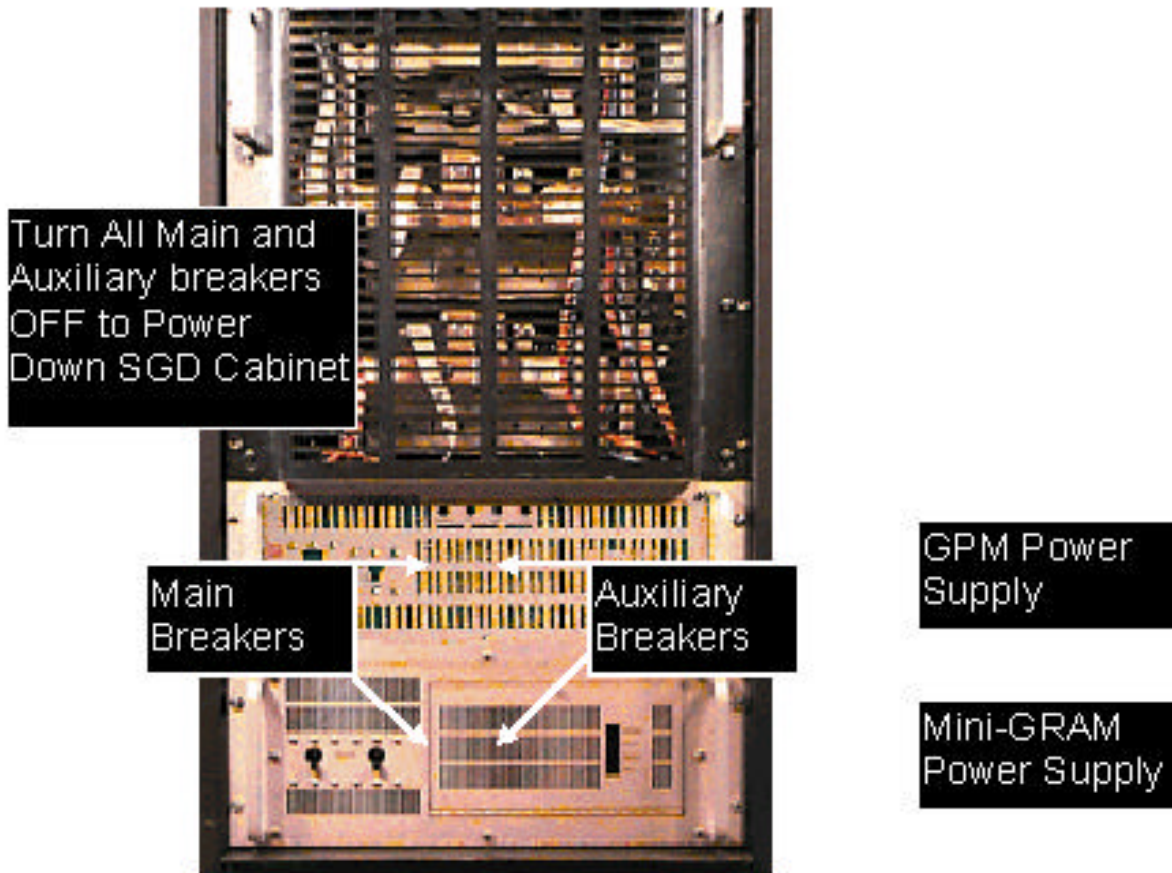
Note - Very Helpful Information - The GPM's top cover maps the location of the X-, Y-, and Z-axes' components. It may be helpful to reference these illustrations when servicing the GPM.

1-2 Hazard Alerts



FATAL ELECTRIC SHOCK HAZARD!! TO PREVENT FATAL ELECTRIC SHOCK, DISCONNECT POWER FROM THE PDU BEFORE YOU PERFORM THE FOLLOWING PROCEDURES. PERFORM LOCKOUT / TAGOUT PROCEDURE PER GE OSHA LOCKOUT / TAGOUT REQUIREMENTS 29 CFR 1910.147. DO THIS BY SECURING THE PDU CIRCUIT BREAKER FOR THE SCALEABLE GRADIENT CABINET.

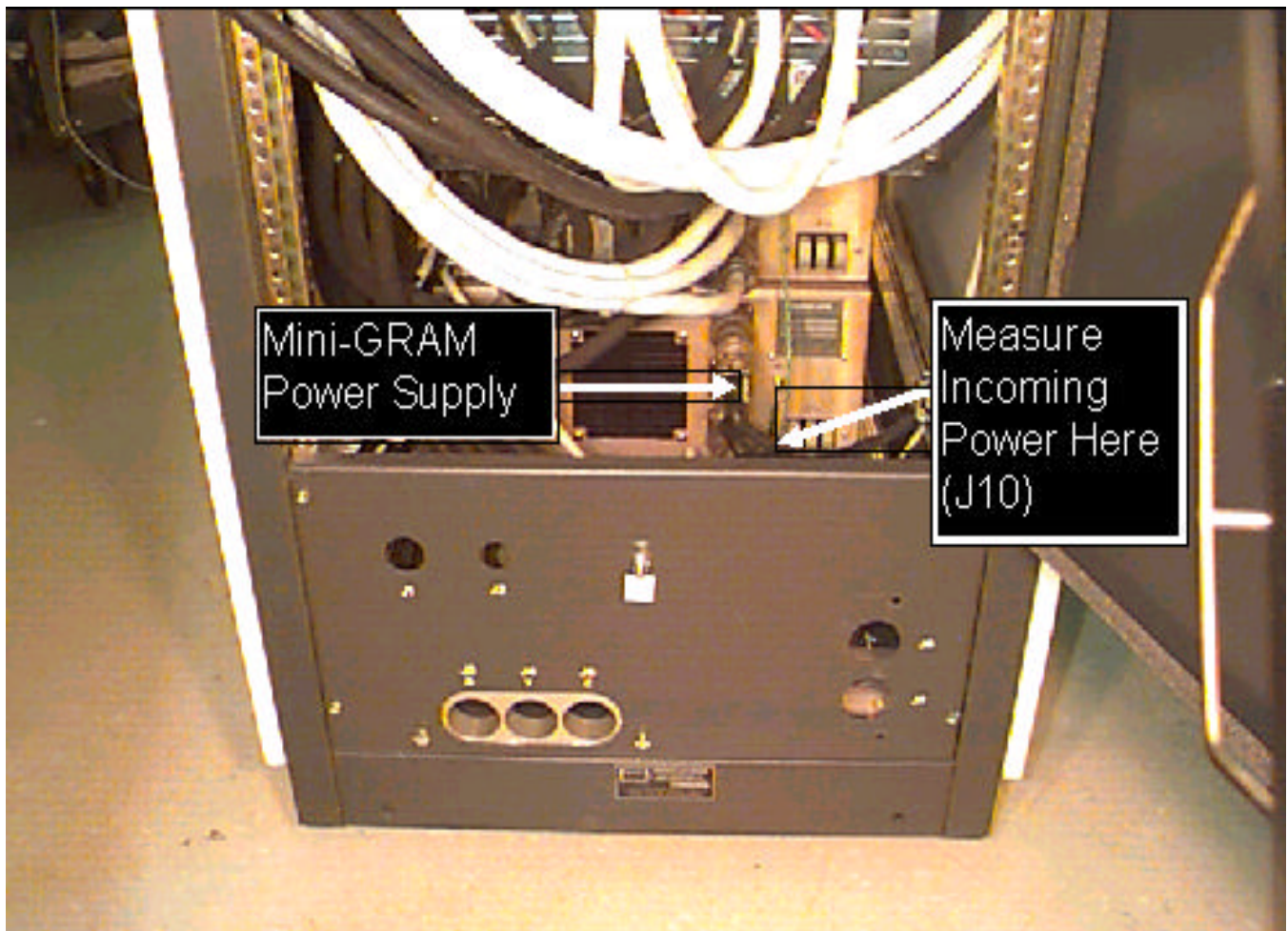
1. Power down the SGD Cabinet by turning off the Main Breakers and Auxiliary Breakers on the Front Panel of **both** the Mini-GRAM Power Supply and the Gradient Power Module Power Supply. See Illustration 1-1.



GPM AND MINI-GRAM POWER SUPPLIES
ILLUSTRATION 1-1

2. Turn off the SGD Cabinet Breaker at the Power Distribution Unit. Lock out the Breaker and tag it.

3. After power to the SGD Cabinet has had sufficient time to dissipate, take a Digital Multimeter and set it to its highest AC voltage range.
4. Verify that all energy has been dissipated by measuring incoming power to all components of the Scaleable Gradient Cabinet by following steps 5 and 6.
5. Measure incoming power to the Mini-GRAM Power Supply as follows:
 - Place the reference probe (black) on the SGD Cabinet Ground.
 - Locate J10. This is the 208V, 3 Phase input to the Mini-GRAM Power Supply.
 - Measure voltage at each of three 208 Volt input terminals. The meter should read 0 Volts AC at each of the three measuring points. See Illustration 1-2.



LOCATION OF J10 ON MINI-GRAM POWER SUPPLY
ILLUSTRATION 1-2

WARNING!

FATAL ELECTRICAL SHOCK HAZARD. SHUT OFF THE GPM AND GRAM POWER SUPPLIES BEFORE REPLACING FRUS.

WARNING!

LETHAL VOLTAGES MAY BE PRESENT ON PPBM CAPACITORS EVEN AFTER POWER HAS BEEN SHUT OFF. AFTER SHUTTING OFF THE GPM POWER, WAIT AT LEAST TWO MINUTES UNTIL CAPACITORS HAVE DISCHARGED BEFORE TOUCHING ANY CONDUCTOR.

1-3 ESD Procedures

Tools required:

- Grounding wrist strap

Static electricity can damage the circuit boards in the GPM. Properly ground yourself with a wrist strap before servicing the GPM.

1-4 GPM Disassembly Procedures

Tool(s) required:

- 7mm nut driver

1. Remove the eight screws (7mm) that secure the GPM to the cabinet. See Illustration L6024.



GRADIENT POWER MODULE (GPM)
ILLUSTRATION L6024

2. Grasp the two front cover handles.
3. Pull the GPM out of the cabinet until the slide brackets lock into place. See Illustration L6026.



GPM SLIDES
ILLUSTRATION L6026

1-4-1 Front Cover Removal

Tool(s) required:

- 7mm nut driver

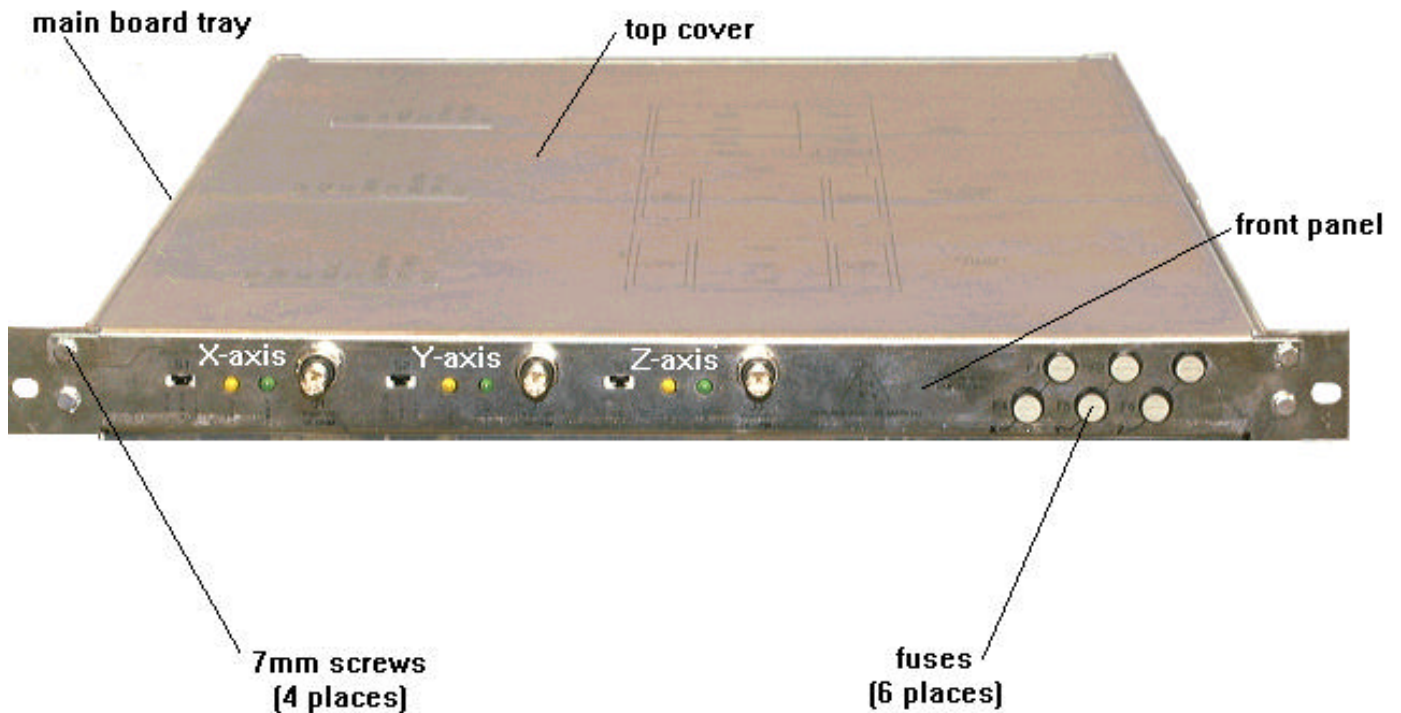
1. Loosen the eight 7mm hex screws that fasten the front cover to the chassis. See Illustration L6024 in Section 1-4.
2. Grasp two handles on the front cover. See Illustration L6024 in Section 1-4.
3. Lift the cover slightly to free it from the keyhole slots.
4. Remove the front cover.
5. Reverse the preceding steps to install the front cover.

1-4-2 Top Cover Removal

Tool(s) required:

- 7mm nut driver

1. Remove the top two 7mm hex screws that fasten the top cover to the main board tray and chassis. See Illustration L6020.



MAIN BOARD TRAY/FRONT PANEL CONTROLS
ILLUSTRATION L6020

2. Lift and slide the top cover toward you to disengage the rear flanges.
3. Remove the top cover.
4. Reverse the preceding steps to install the top cover.

1-4-3 Main Board Tray Removal

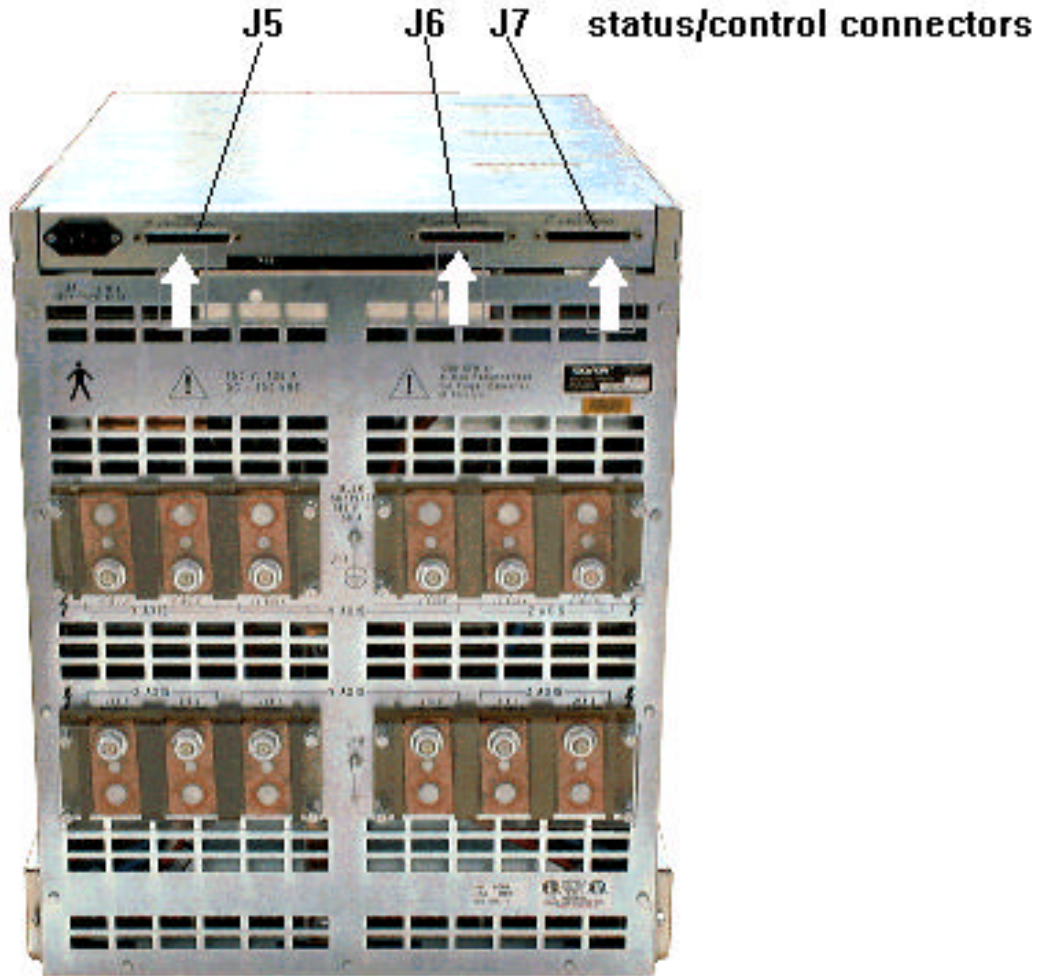
Tool(s) required:

- 7mm nut driver
- 8mm nut driver



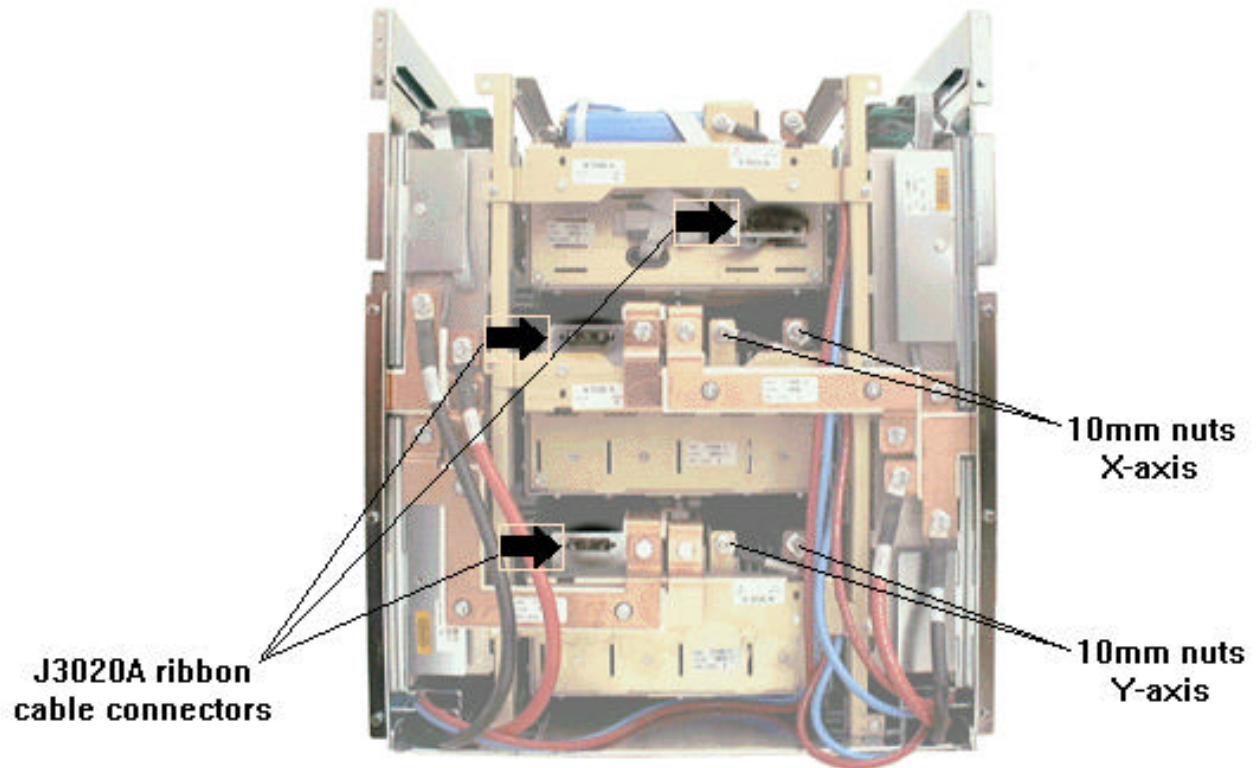
Avoid catching ribbon cables on the GPM's chassis or components during removal.

1. Remove status/control cables from the J5, J6, and J7 connectors located on the back of the main board tray. See Illustration L6023. Disconnect the AC Power cord from its socket near J-5.



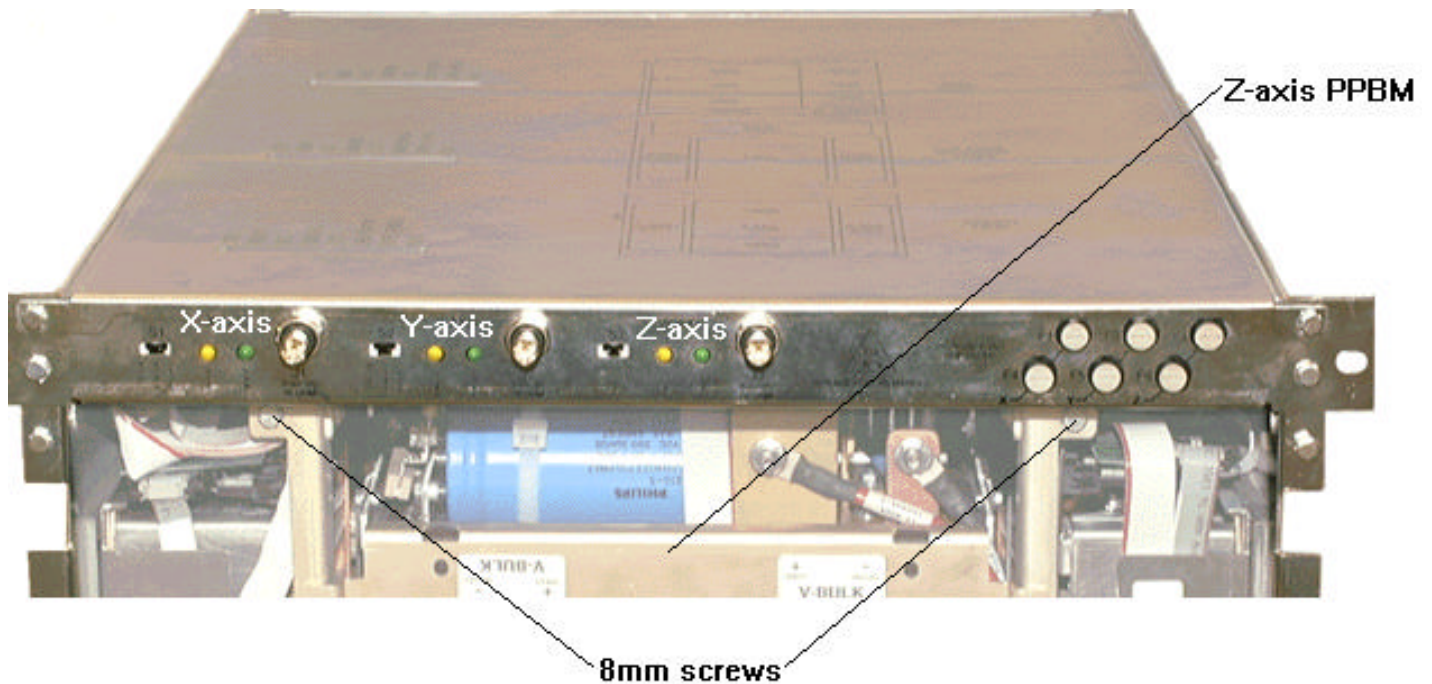
BACK PANEL/STATUS AND CONTROL CABLE CONNECTORS
ILLUSTRATION L6023

2. Remove the J3020A cables from each of the three connectors on the front of the PPBMs. See Illustration L6028.



FRONT VIEW/J3020A CONNECTORS
ILLUSTRATION L6028

3. Remove the four 7 mm hex screws that fasten the main board tray to the chassis. See Illustration L6020 in Section 1-4-2.
4. Remove the two 8 mm screws that fasten the main board tray to the PPBM tower. See Illustration L6034.

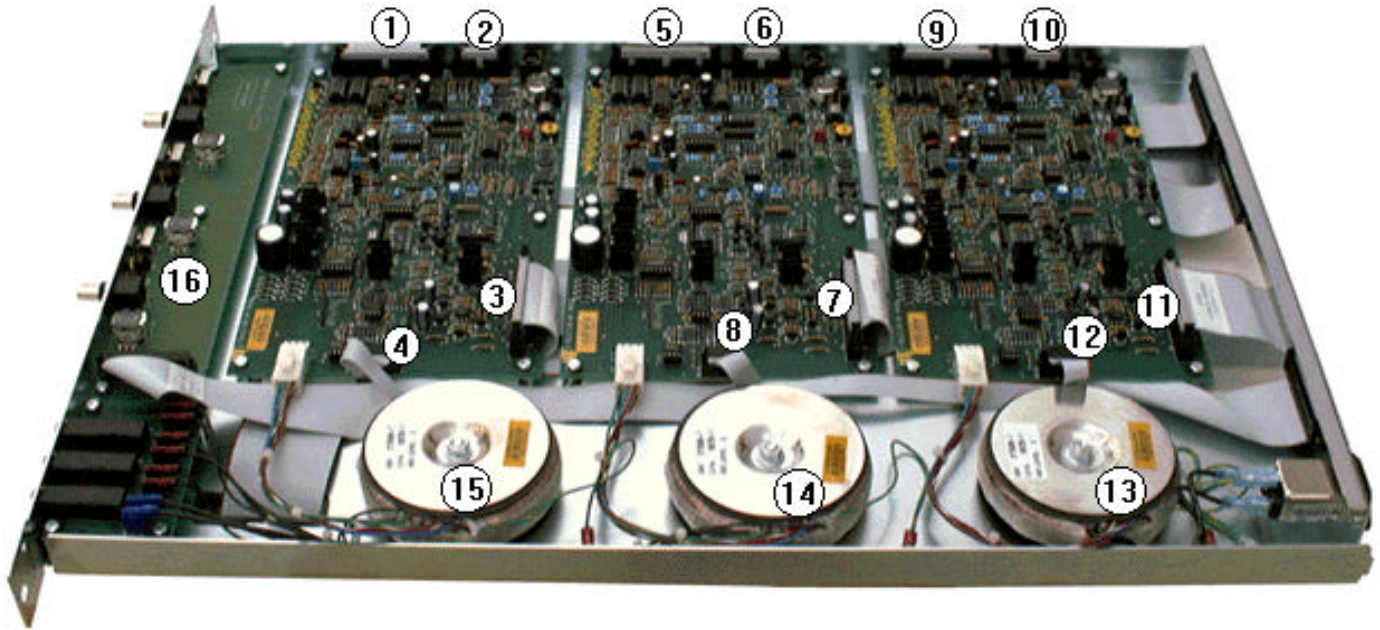


MAIN BOARD TRAY/FRONT PANEL CONTROLS
ILLUSTRATION L6034

Note

Remove J400 ribbon cables - it may be helpful to lift the front of the main board tray and wedge a screwdriver handle between the tray and the GPM chassis. This will provide additional clearance and allow use of both hands when removing the J400 cables. After removing the J400 cable from the Z-axis main board, push the cable down through the opening in the main board tray. This will ensure that the cable does not catch on any of the tray's components during removal.

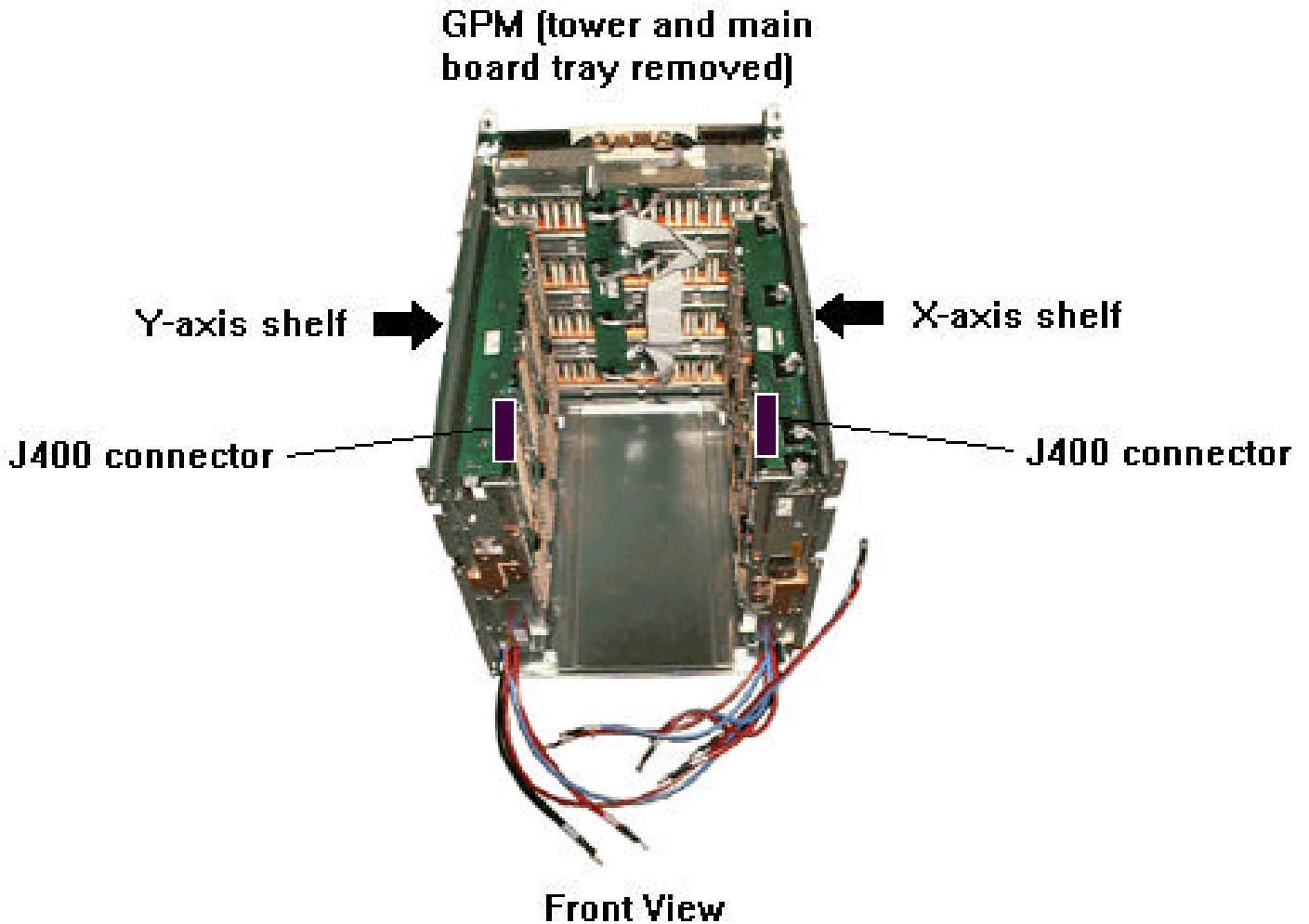
5. Remove the J400 ribbon cable from its connector on the Z-axis main board. See Illustration L6022.



1. J200 cable, X-axis	5. J200 cable, Y-axis	9. J200 cable, Z-axis	13. Xfmr., Z-axis
2. J301 cable, X-axis	6. J301 cable, Y-axis	10. J301 cable, Z-axis	14. Xfmr., Y-axis
3. J400 cable, X-axis	7. J400 cable, Y-axis	11. J400 cable, Z-axis	15. Xfmr., X-axis
4. J300 cable, X-axis	8. J300 cable, Y-axis	12. J300 cable, Z-axis	16. Display Board

MAIN BOARD TRAY
ILLUSTRATION L6022

6. Remove the J400 ribbon cables from the interconnects of X and Y output shelves. See Illustration L6032.



X- AND Y-AXES OUTPUT SHELF/J400 LOCATION
ILLUSTRATION L6032

7. Lift the main board tray off of the GPM.
8. Reverse the preceding steps to install the main board tray.

1-4-4 PPBM Tower Removal

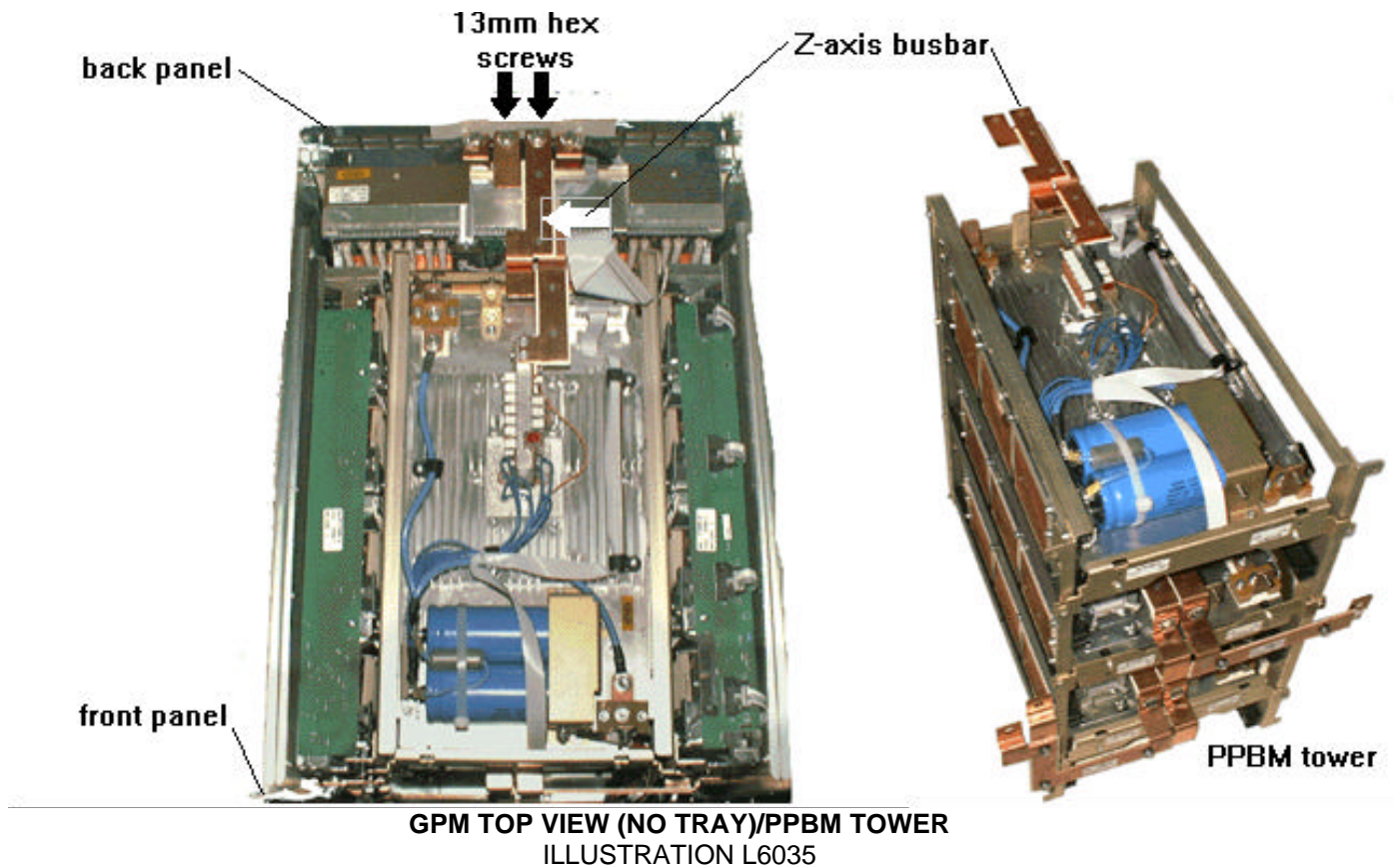
Tool(s) required:

- 8mm nut driver
- 10mm nut driver
- 13mm nut driver

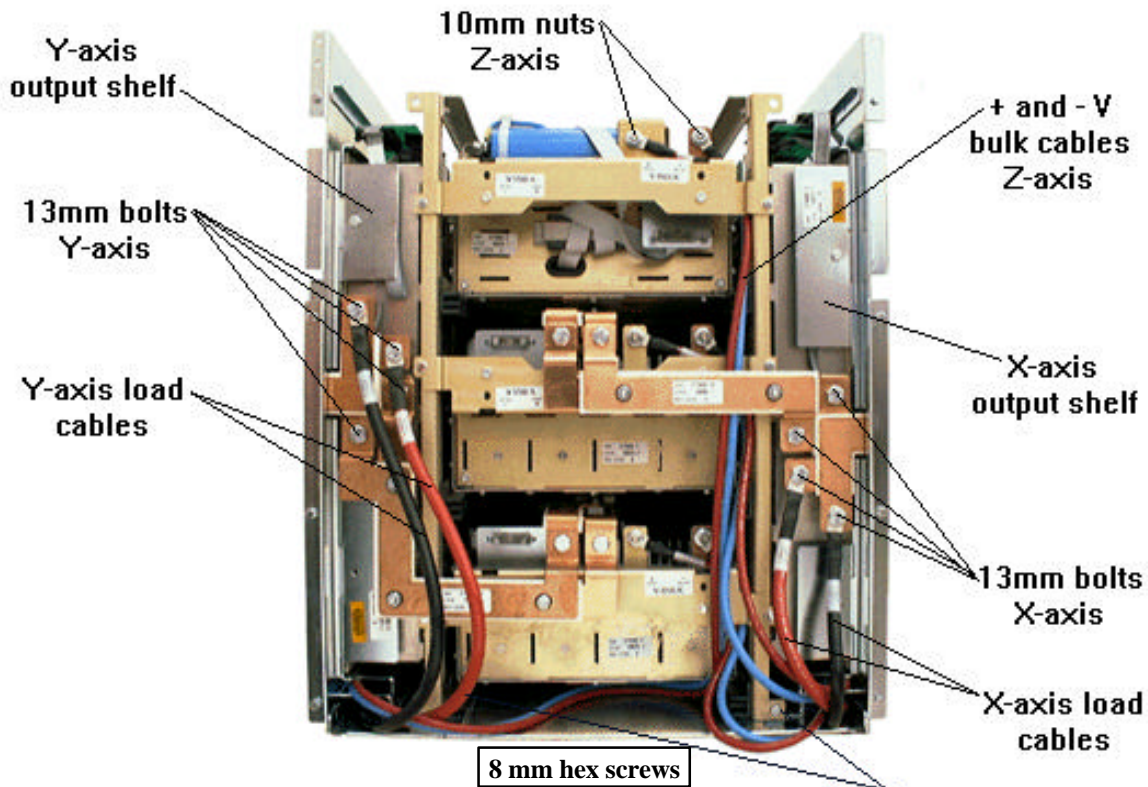


The PPBM tower weighs approximately 70 pounds. Make sure you have a clear path to your destination before removing the tower from the GPM. Avoid catching the tower on any GPM hardware.

1. Remove front cover. See section 1-4-1 Front Cover Removal.
2. Remove the two 13 mm hex screws that fasten the Z-axis bus assembly to the Z- axis shelf. See Illustration L6035.



3. Remove the two 13 mm hex screws that fasten the X- and Y-axes load cables to the X- and Y- axes shelves. See Illustration L6033.



FRONT VIEW/X- AND Y-AXES SHELVES/PPBM TOWER
ILLUSTRATION L6033

4. Remove the two 13 mm hex screws that fasten the X- and Y- axes bus assemblies to the X- and Y- axes shelves. See Illustration L6033 above.
5. Remove the 10 mm hex nuts that fasten the +V and - V bulk cables (red and blue) to all three tower shelves of the PPBM. See Illustration L6033 above.
6. Remove the cables making sure they are free and clear of the PPBM tower and GPM hardware.
7. Remove the 8 mm hex screws that fasten the tower to the chassis. See Illustration L6033 above.
8. Grasp the tower frame.
9. Slowly pull the PPBM tower toward you and out from the GPM.
10. Reverse the preceding steps to install the PPBM tower.

1-5 Level 1 FRU Replacement Procedures

1-5-1 GPM Replacement

GEMS part number 2175599-1

Techron part number 100976-1

Tool(s) required:

- 8mm nut driver
- 17mm nut driver

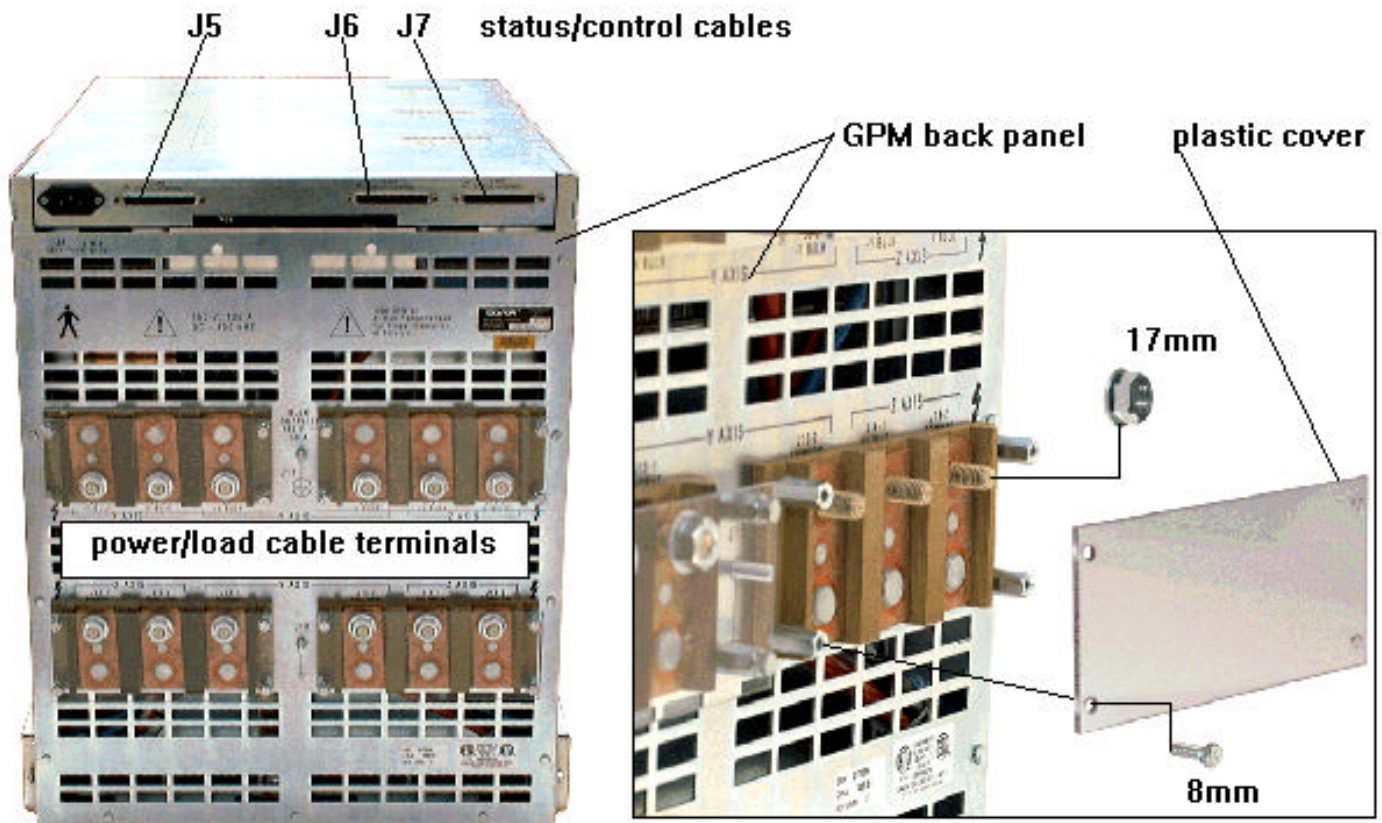
WARNING!

THE GPM WEIGHS APPROXIMATELY 280 POUNDS. USE THE GEMS UNIVERSAL LIFT TO SUPPORT THE GPM WHEN REMOVING IT FROM THE CABINET. FAILURE TO DO SO CAN CAUSE PERSONAL INJURY.

WARNING!

BEFORE UNLOCKING THE SLIDES, MAKE SURE THAT ALL OF THE GPM'S WEIGHT IS SUPPORTED BY THE LIFT, INDEPENDENT OF THE SLIDES. FAILURE TO DO SO MAY CAUSE PERSONAL INJURY.

1. Remove the 8mm screws and the plastic terminal covers from the back panel. See Illustration L6036.



BACK PANEL CABLE TERMINALS AND HARDWARE
ILLUSTRATION L6036

2. Remove the 17mm hex nuts and power supply cables from the back panel. See Illustration L6036 above.
3. Remove the 17mm hex nuts and load cables from the back panel. See Illustration L6036 above.
4. Remove the eight screws (7mm) that secure the GPM to the cabinet. See Illustration L6024 in Section 1-4.
5. Grasp the two front cover handles and pull the GPM out of the cabinet until the slides lock into place. See Illustration L6026 in Section 1-4.

WARNING!

THE GPM WEIGHS APPROXIMATELY 280 POUNDS. USE THE GEMS UNIVERSAL LIFT TO SUPPORT THE GPM WHEN REMOVING IT FROM THE CABINET. FAILURE TO DO SO CAN CAUSE PERSONAL INJURY.

6. Attach the Universal Lift Hoist to the GPM. Refer to the procedure for Universal Lift Kit Assembly & Operation.
7. Raise the lift until all of the GPMs weight is supported by the lift.

8. Unlock the slides by depressing the catch on each slide. See Illustration L6026 in Section 1-4. Push the slides into the cabinet.
9. Remove the GPM from the cabinet while supporting it with the lift.
10. Reverse the preceding steps to install the GPM.

1-5-2 Main Board Replacement

GEMS part number 2175599-5

Techron part number 101276-1

Tool(s) required:

- 7mm nut driver

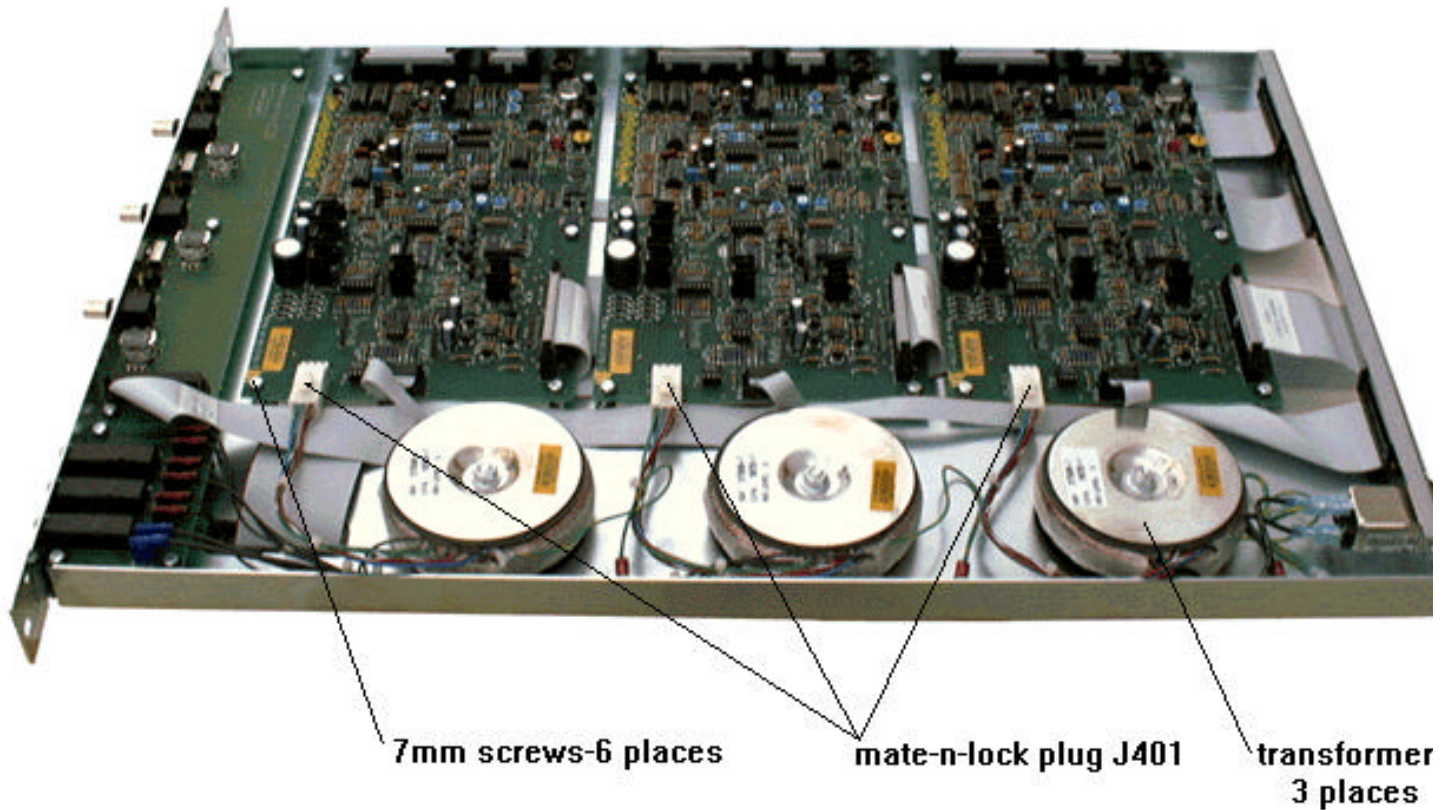
1. Remove front cover. Section 1-4-1 Front Cover Removal.
2. Remove top cover. Section 1-4-2



Static electricity can damage the circuit boards in the GPM. Properly ground yourself with a wrist strap before servicing the GPM.

3. Remove the four ribbon cables from their connectors (J200, J300, J400, and J301) on the main board. See Illustration L6022 in Section 1-4-3.

Remove the mate-n-lock plug from its socket (J401). See Illustration L6030 .



MAIN BOARD TRAY/TRANSFORMERS/MAIN BOARDS
ILLUSTRATION L6030

5. Remove the six 7mm hex screws that fasten the main board to the main board tray. See Illustration L6030 above.
6. Remove the main board.
7. Verify that the main board insulator is centered between the four pem studs.
8. Reverse the preceding steps to install the main board.

1-5-3 Transformer Replacement

GEMS part number 2175599-7
Techron part number 100735-1

Tool(s) required:

- 7mm nut driver
- 10mm nut driver

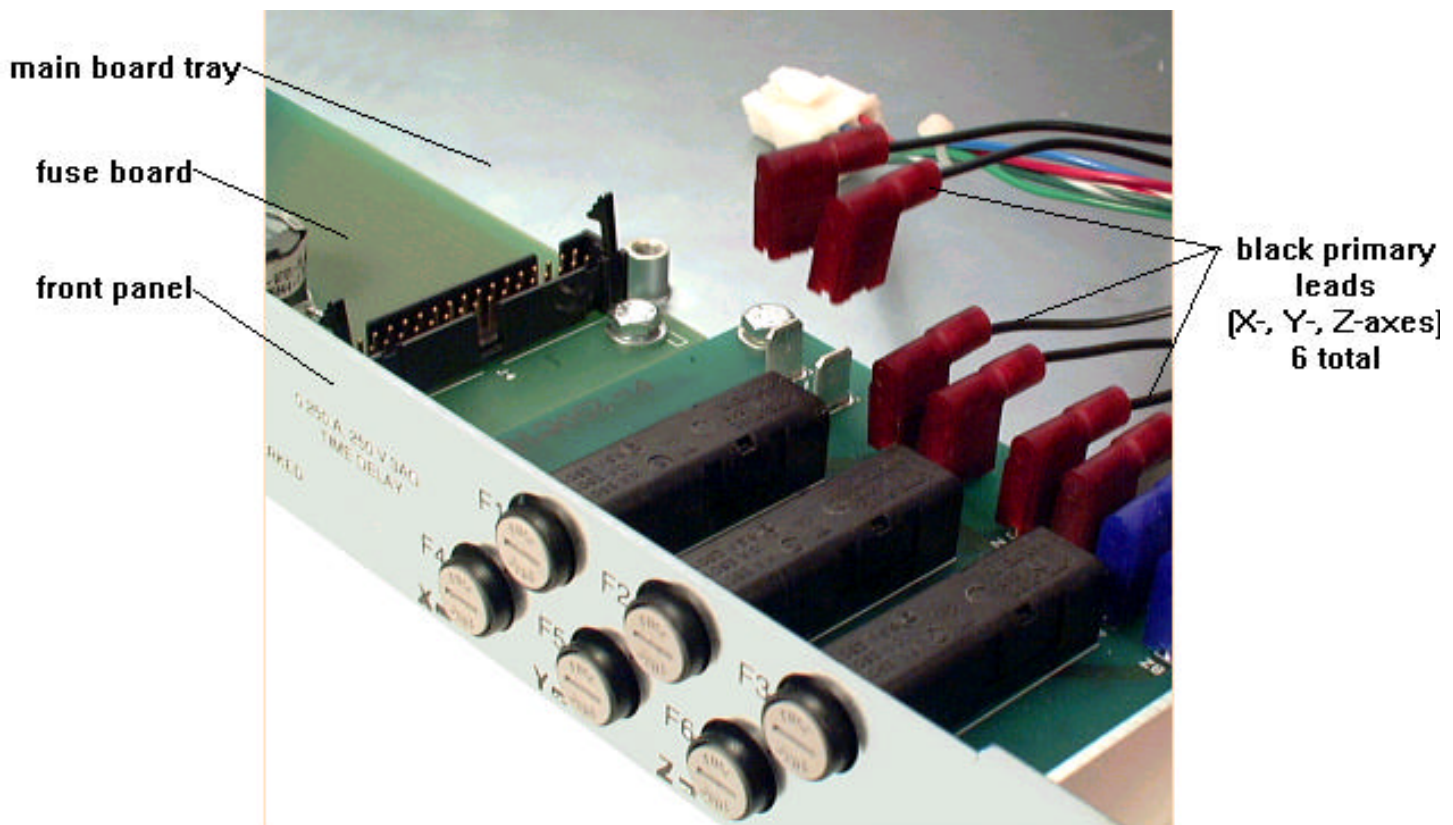
CAUTION

It is necessary to cut the tie wraps that secure the transformers input lines when removing the transformer. Avoid cutting the wires or insulation when removing the tie wraps.

CAUTION

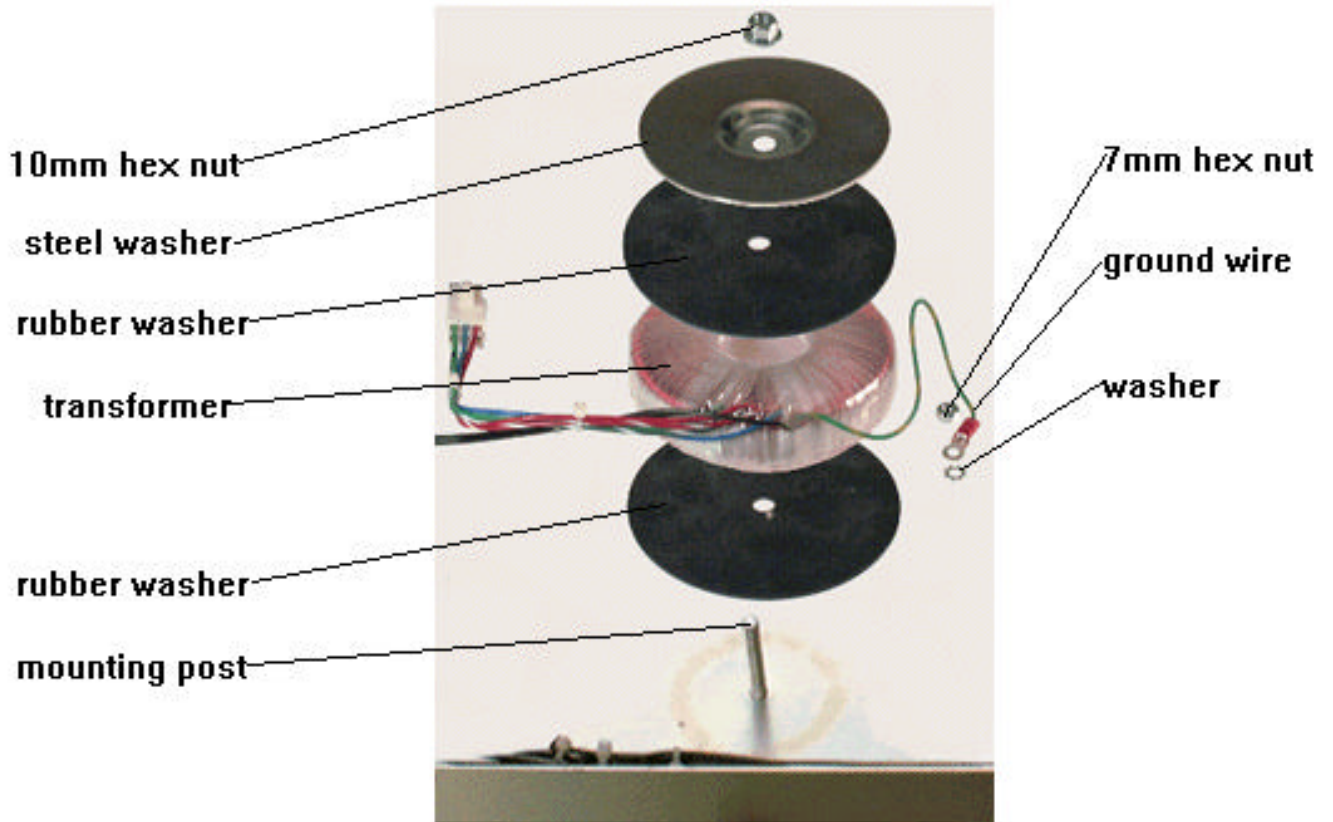
Static electricity can damage the circuit boards in the GPM. Properly ground yourself with a wrist strap before servicing the GPM.

1. Remove top cover.
2. Remove the mate-n-lock plug (transformer secondary wires) from the main board. See Illustration L6030 in Section 1-5-2.
3. Remove the transformers primary leads from the fuse board. See Illustration L6019.



FUSE BOARD/TRANSFORMER LEADS
ILLUSTRATION L6019

4. Remove the 10mm hex nut. See Illustration L6027.



TRANSFORMER (LOCATED IN MAIN BOARD TRAY)
ILLUSTRATION L6027

5. Remove the steel washer. See Illustration L6027 above.
6. Remove the rubber washer. See Illustration L6027 above.
7. Remove the 7mm hex nut and washer that secure the green and yellow ground wire. See Illustration L6027 above.
8. Remove the ground wire. See Illustration L6027 above.
9. Remove the transformer leaving the bottom rubber washer in place. See Illustration L6027 above.
10. Reverse the preceding steps to install the secondary power transformer.
11. Tie wrap the transformers black input lines together.

1-5-4 Fuse Replacement

GEMS part number 2175599-6

Techron part number A10285-1

Tool(s) required:

- Medium flat blade screwdriver.

1. Insert screwdriver blade into fuse holder slot. See Illustration L6020 in Section 1-4-3.
2. Turn counterclockwise 1/8 turn.
3. Remove fuse holder.
4. Replace fuse
5. Reverse the preceding steps to install fuse(s).

1-5-5 Z-axis PPBM Replacement

GEMS part number 2175599-2

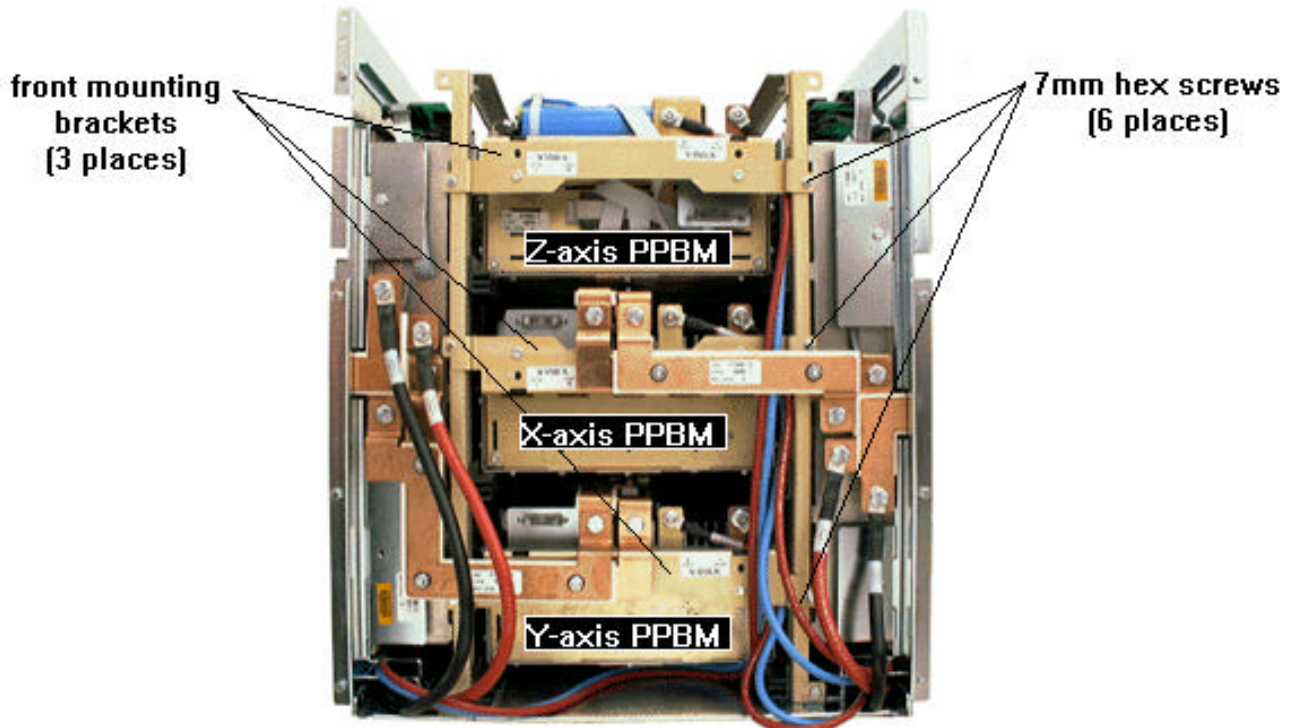
Techron part number 100978-1

Tools required:

- 7mm nut driver
- 10mm nut driver
- 13mm nut driver

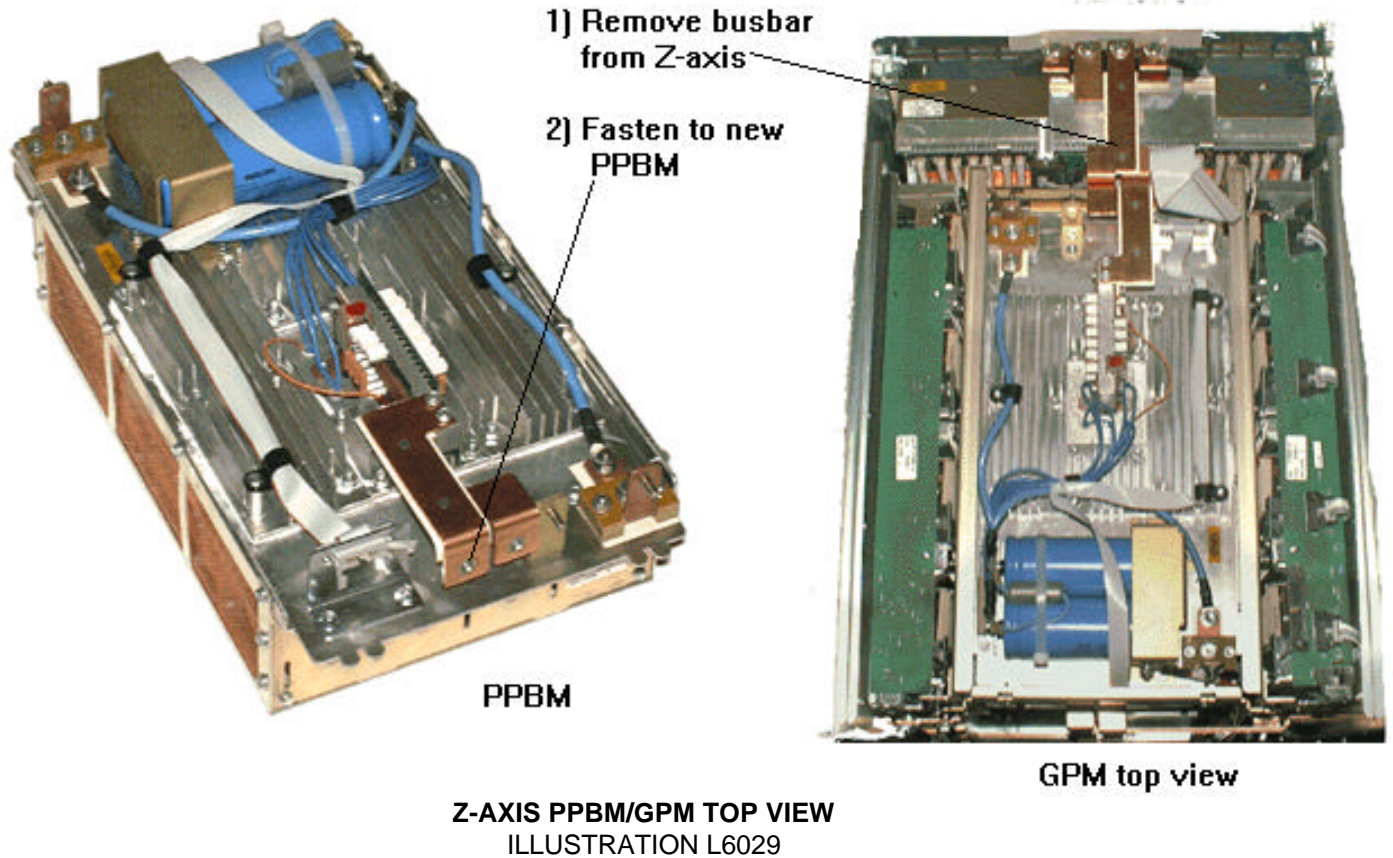
Remove the front cover from GPM. Refer to section 1-4-1 Front Cover Removal.

1. Remove the two 13 mm hex screws and washers that fasten the Z-axis bus bar to the Z-axis shelf. See Illustration L6035 in Section 1-4-4.
2. Remove the two 7 mm hex screws along with the front mounting bracket from the PPBM tower. See Illustration L6037.



FRONT VIEW/PPBM TOWER
ILLUSTRATION L6037

3. Remove the two 10 mm hex nuts that fasten the +V and - V bulk cables (red and blue) to the PPBM. See Illustration L6033 in Section 1-4-4.
4. Remove the cables making sure they are free and clear of the PPBM tower and GPM hardware.
5. Make sure that the PPBM hardware is free and clear of GPM hardware.
6. Slowly slide the Z-axis PPBM out of the tower.
7. Remove the Z-axis PPBM bus bar and install on the replacement PPBM. See Illustration L6029.



8. Reverse the preceding steps to install the Z-axis PPBM.

1-5-6 X- or Y- Axis PPBM Replacement

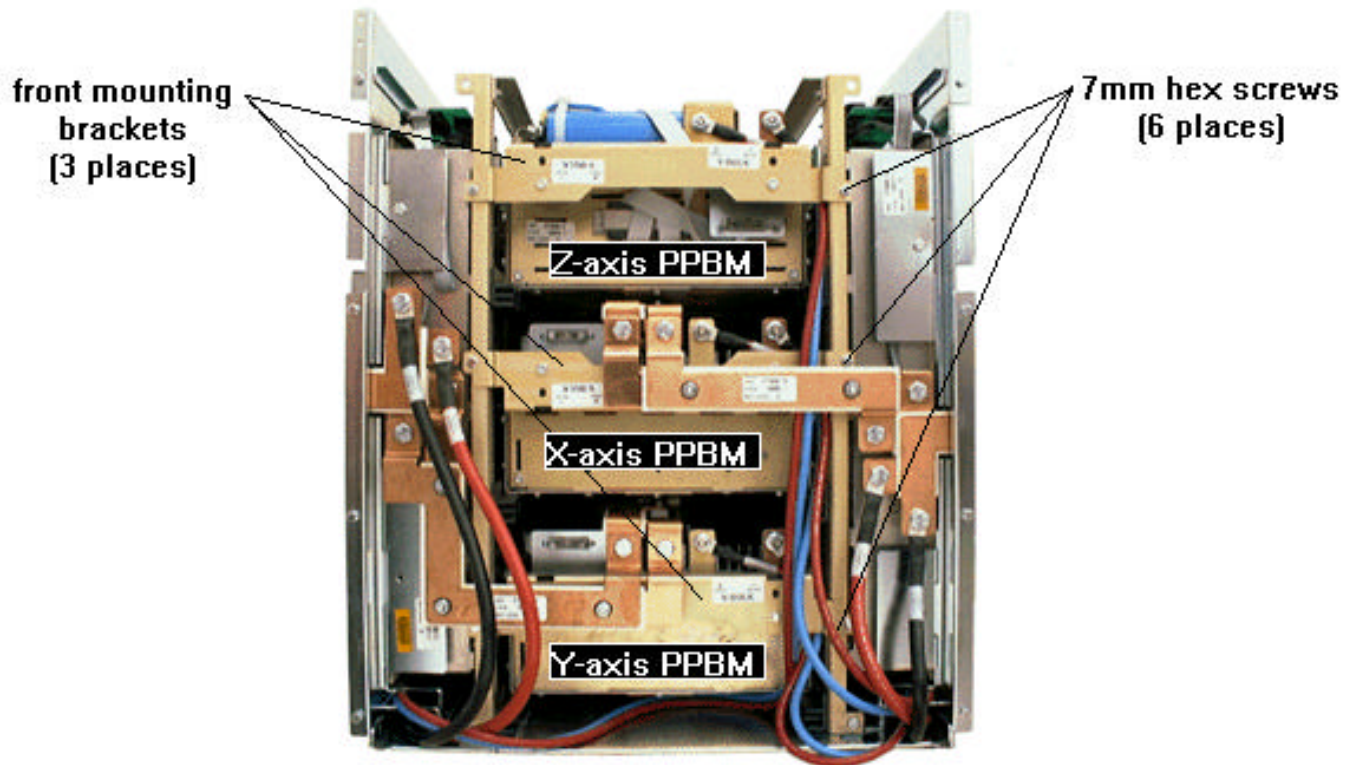
GEMS part number 2175599-2

Techron part number 100978-1

Tools required:

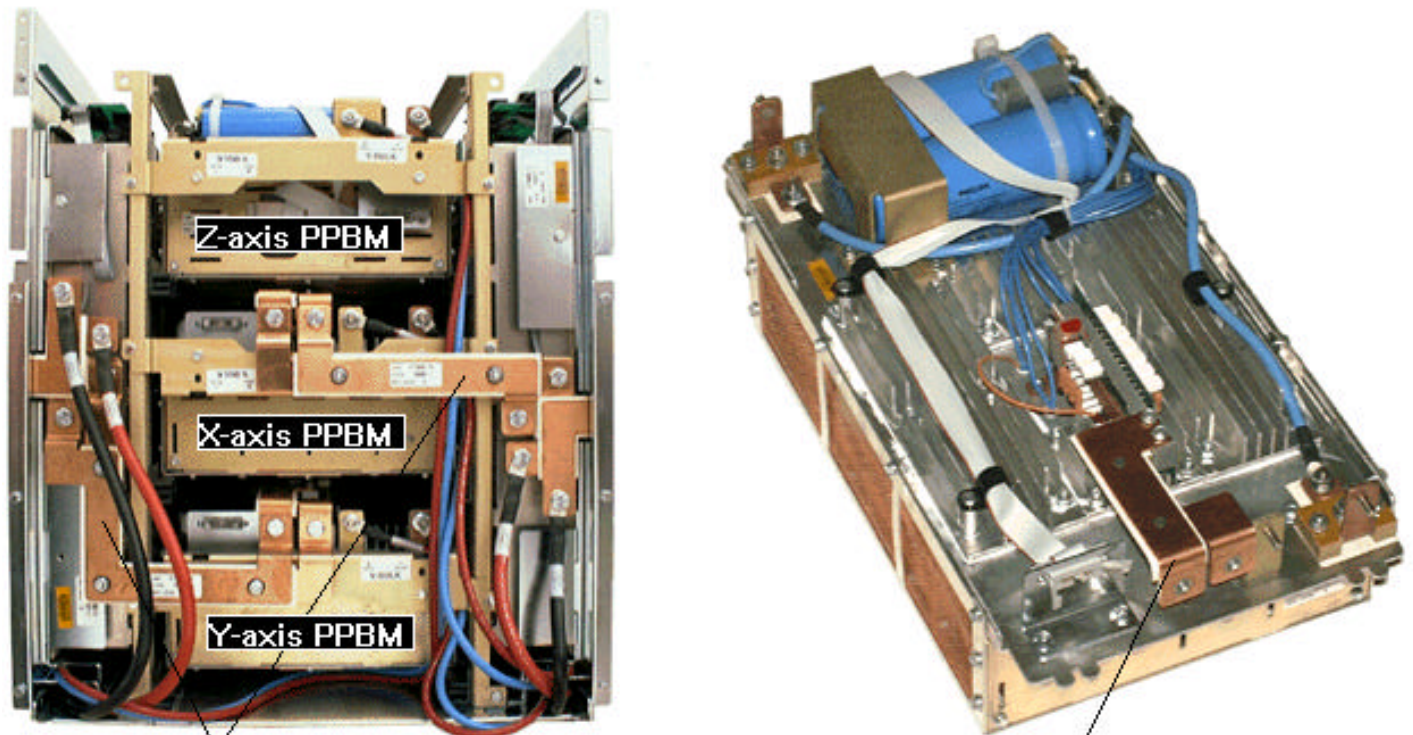
- 7mm nut driver
- 13mm nut driver

1. Remove front cover from GPM. Refer to section 1-4-1 Front Cover Removal.
2. Remove the four 13 mm hex screws that fasten the PPBM bus bar to the output shelf bus bars. See Illustration L6033 in Section 1-4-4.
3. Remove the two 7 mm hex screws along with the front mounting bracket from the PPBM tower. See Illustration L6037.



FRONT VIEW/PPBM TOWER
ILLUSTRATION L6037

4. Remove the two 10 mm hex nuts that fasten the +V and - V bulk cables (red and blue) to the PPBM. See Illustration L6028 in Section 1-4-3.
5. Remove the cables making sure they are free and clear of the PPBM tower and GPM hardware.
6. Slowly slide the PPBM out of the tower.
7. Remove the X- or Y-axis PPBM bus bar and install on the replacement PPBM. See Illustration L6038.



1) Remove busbar
from X- or Y-axis PPBM

2) Fasten to new
PPBM

X- AND Y-AXES PPBM AND BUS BAR LOCATIONS
ILLUSTRATION L6038

8. Reverse the preceding steps to install the X- or Y-axis PPBM.

1-5-7 Z-axis Output Shelf Replacement

GEMS part number 2175599-4
Techron part number 101577-2

Tool(s) required:

- 8mm nut driver
- 13mm nut driver



Each output shelf weighs approximately 45 lb. Make sure you have a clear path to your destination before removing the shelf. Set the shelf down with the component side facing up and the bus bar assembly down.

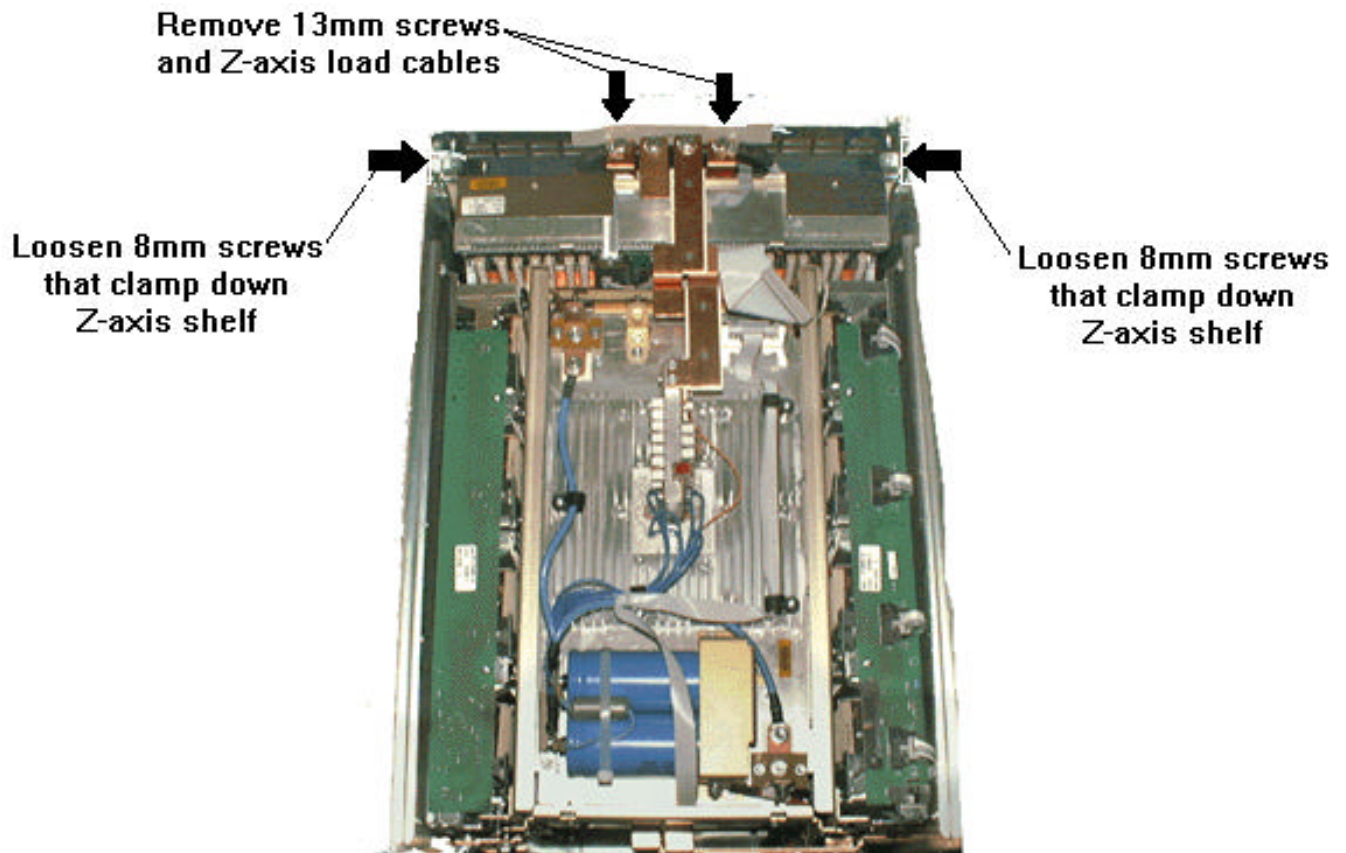
1. In order to safely remove the Z-axis output shelf, the GPM must be near ground level.

2. Follow the procedure for removing the GPM listed in section 1-5-1 GPM Replacement.
3. Using the universal lift, lower the GPM near ground level. (This will allow better leverage and safe removal of the shelf.)
4. Remove front cover. Refer to section 1-4-1 Front Cover Removal.
5. Remove top cover. Refer to section 1-4-2 Top Cover Removal.
6. Remove main board tray. Refer to section 1-4-3 Main Board Tray Removal.
7. Remove the Z-axis PPBM. Refer to section 1-5-5 Z-axis PPBM Replacement.

Note

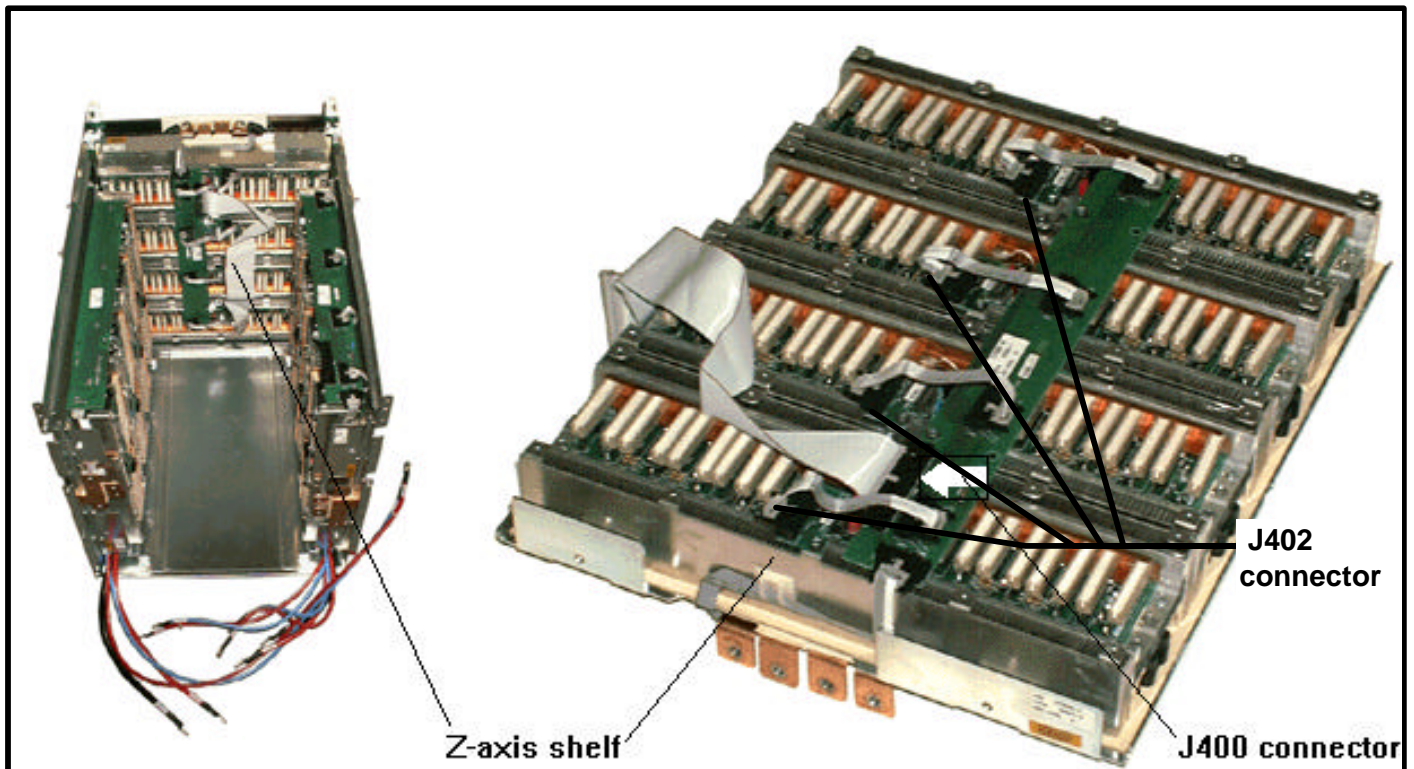
PPBM does not have to be completely removed. Slide the PPBM out of its tower far enough to clear the Z-axis output shelf and to reach the ribbon cable going to the interconnect board.

8. Remove the two 13mm screws that fasten the J17 output cables (red and black) to the Z-axis bus bar. See Illustration L6039.



GPM TOP VIEW/Z-AXIS SHELF AND BUS BAR LOCATION
ILLUSTRATION L6039

9. Disconnect the J400 ribbon cable from its connector on the Z-axis interconnect board. See Illustration L6025.



Z-AXIS OUTPUT SHELF/J400 CONNECTOR LOCATION
ILLUSTRATION L6025

10. Feed the ribbon cable through the main board tray so the cable is not damaged during removal.
11. Loosen the two 8mm screws that clamp down the Z-axis shelf. See Illustration L6039 above.
12. Turn the clamps to allow the Z-axis shelf to be removed.
13. Carefully remove the Z-axis shelf making sure all output shelf hardware is free and clear of the GPM hardware.
14. Disconnect the four J402 connectors from the output shelf.
15. Remove screws that hold the interconnect board assembly in place.
16. Lift interconnect board assembly from Z-axis output shelf and install on new Z-axis output shelf.
17. connect the four J402 connectors to the Z-axis output shelf.
18. Plug in the J400 ribbon cable going to the Z-axis interconnect board before replacing Z-axis PPBM. See Illustration L6025 above.

19. Reverse the preceding steps to install the Z-axis output shelf.
1-5-8 X- or Y- Axis Output Shelf Replacement

GEMS part number 2175599-3

Techron part number 101577-1

Tool(s) required:

- 8mm nut driver
- 13mm nut driver

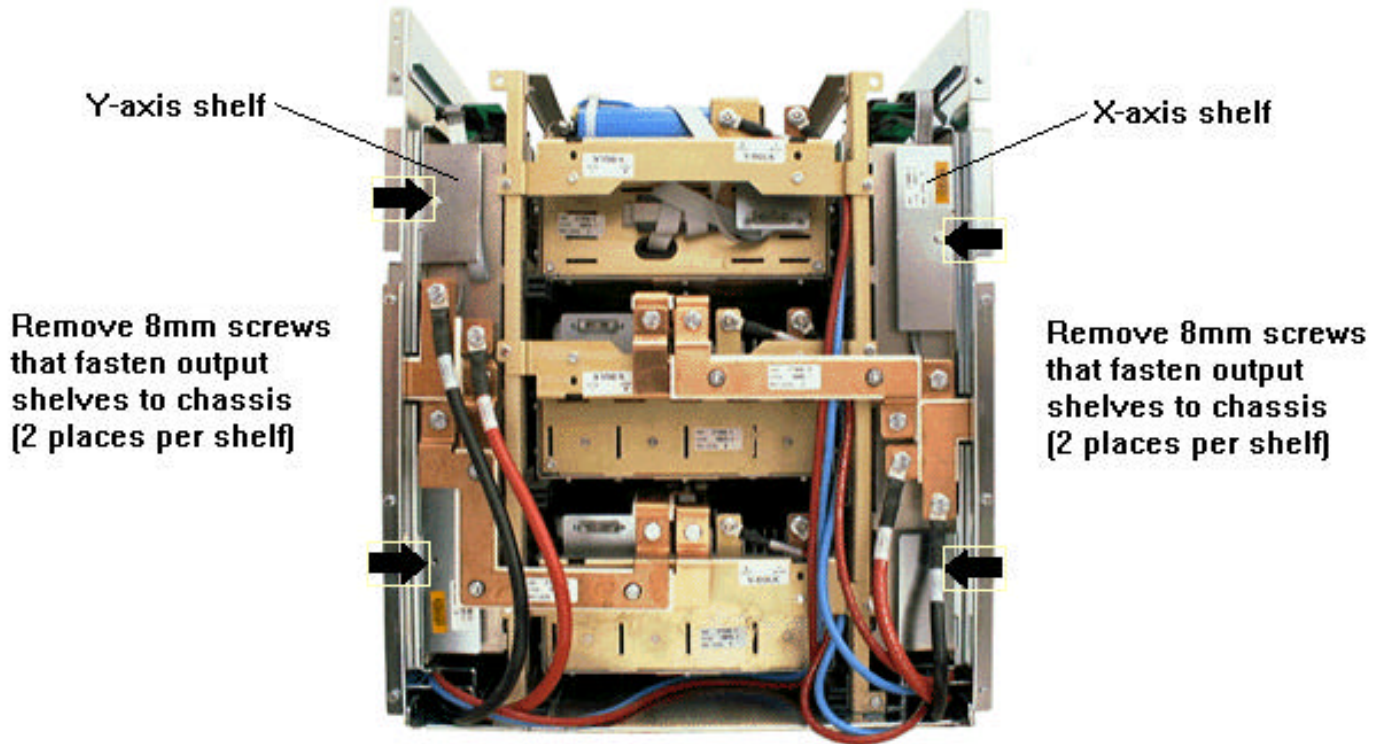


Each output shelf weighs approximately 45 lb. Make sure you have a clear path to your destination before removing the shelf. Set the shelf down with the component side facing up and the bus bar assembly facing down.



Avoid damaging the interconnect board or ribbon cables when removing an output shelf. It may be helpful to lift the front of the main board tray and wedge a screwdriver handle between the tray and the GPM chassis. This will provide additional clearance as an alternative to removing the entire main board tray. Refer to section 1-4-2 Top Cover Removal.

1. Remove front cover. Refer to section 1-4-1 Front Cover Removal. Remove the Main Board Tray.
2. Remove the PPBM tower. Refer to section 1-4-4 PPBM Tower Removal.
3. Remove the J400 ribbon cables from the connector on the output shelf's interconnect board. See Illustration L6032 in Section 1-4-3.
4. Remove the two 8mm screws that fasten the output shelf to the chassis. See Illustration L6031.



FRONT VIEW/X- AND Y-AXES SHELVES/PPBM TOWER
ILLUSTRATION L6031

5. Carefully remove the X- or Y-axis shelf making sure all output shelf hardware is free and clear of the GPM hardware.
6. Grasp the X or Y-axis shelf at the bottom of the shelf. Move it toward the center of the GPM. Be careful not to grasp the circuit board while removing the shelf.
7. Lay the X or Y-axis shelf on a flat surface..
8. Remove 3 screws on the four interconnect boards attached to output wells. See Illustration 1-1

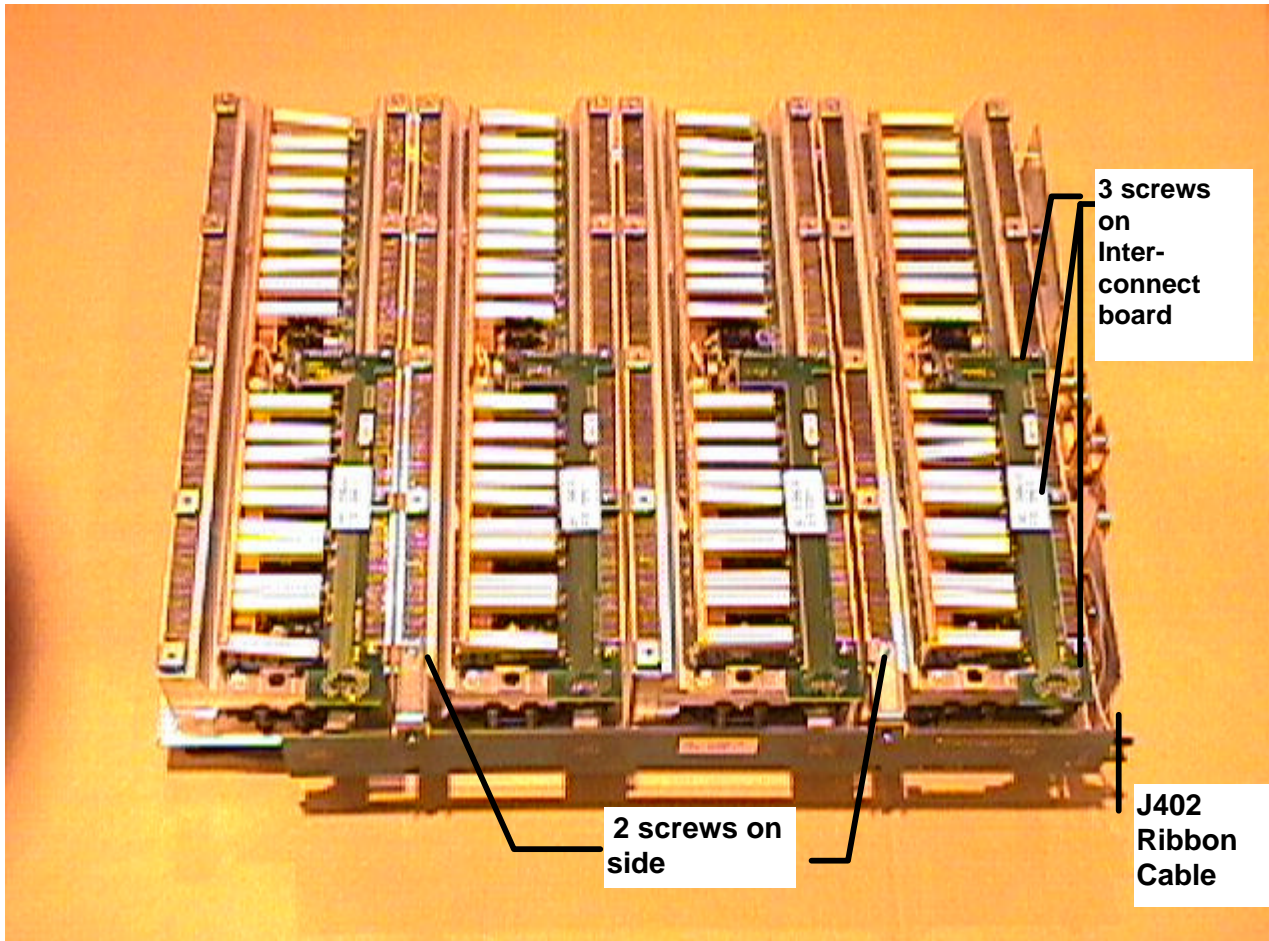


ILLUSTRATION 1-1
X- OR Y-AXIS OUTPUT SHELF

9. Remove 2 screws on the side interconnect board. See Illustration 1-1.
10. Remove the J402 ribbon cable from the interconnect board on the side of the output shelf. See Illustration 1-1.
11. Lift the interconnect board assembly by detaching from output shelf.
12. Reverse the preceding steps to install interconnect board assembly on new X- or Y-axis output shelf.
13. Reverse the preceding steps to install the X- or Y-axis output shelf.

1-6 Functional Checks Required

There are no calibrations required following replacement of the GPM or any of its parts. Power up the cabinet and prepare for a scan to verify operation.

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	May 28, 1998	J. Saperstein	Initial conversion from Toolbook to Word.
1	July 31, 1998	M. Whitlow	Retaining interconnect boards in output shelf replacement