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Description - This material describes the replacement of a Gradient Ramp Accelerator Module (GRAM) in Signa Horizon systems.

1- INTRODUCTION

The GRAM is a field-replaceable unit (FRU), so if it fails, the entire unit is replaced (except for the GASM Board, the GRAM Tuning Board, and the Fan Module; these are removed from the failed module, and are then attached to the replacement unit).

2- TOOLS REQUIRED

- A 100-mHz scope and a DVM with alligator clips is required for this procedure.
- The Magnetic Shield (46-317725G10), used with the RF Measurements Kit, is required if the scope display is affected by the magnetic field.
- The Universal Amplifier Hoist kit permits replacement of a GRAM by one person. This is the required method of replacement to avoid personal injury.

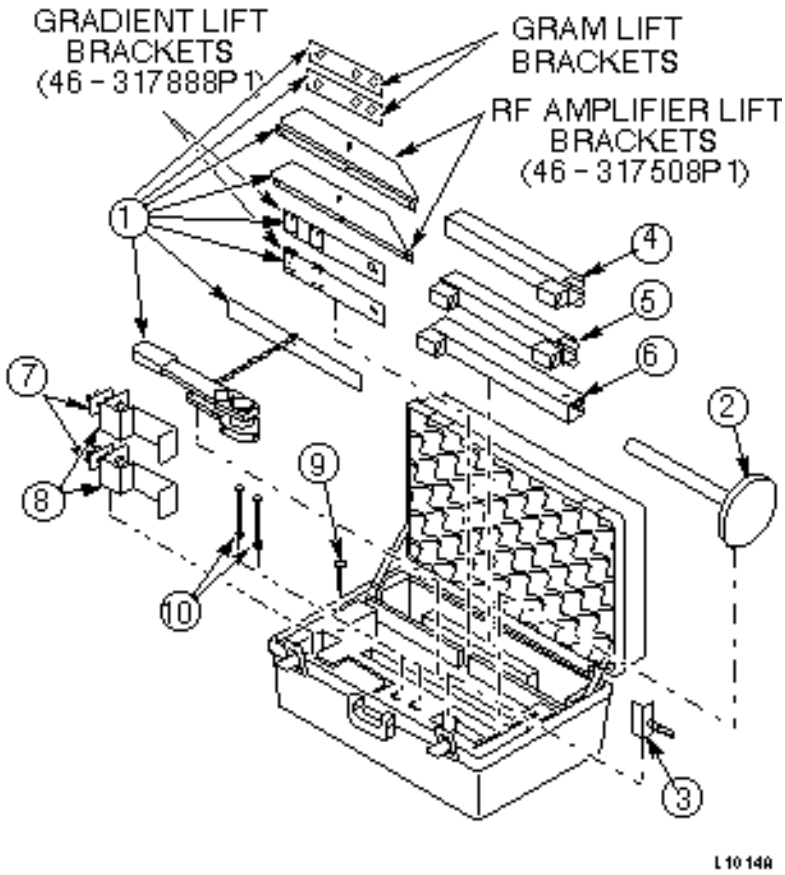
The hoist kit now applies to both fixed sites and mobiles, the latter being provided by the van manufacturer. Instructions for its use are in Section 4 - Universal Amplifier Hoist Kit Assembly and Installation.

Table 1 lists the components of the Universal Amplifier Hoist kit, 46-317266G3. The table has an accompanying illustration of the kit components.

TABLE 1
UNIVERSAL AMPLIFIER HOIST KIT – 46-317266G3

Item	Part Number	Description	Quantity
1	46-195700G4	Hoist Assembly	1
2	46-317263P1	Support Jack	1
3	46-317289G1	Jack Head for Support Jack	2
4	46-317258P1	Rail, Front Section	1
5	46-317259P1	Rail, Center Section	1
6	46-317451P1	Rail, Rear Section	1
7	46-317262P1	Plate (for Bracket)	2
8	46-317280G1	Bracket	2
9	46-221889P8	Lock Pin	1
10	46-208561P13	Cap Screw, ½"-13x4.75	2
11	46-208932P2	Cap Screw, ¼"-20x1.00"	4
12	46-208948P3	Hex Nut, ½"	2

Note
Current dwgs show items numbered, not lettered



UNIVERSAL AMPLIFIER HOIST KIT – 46-317266G3
ILLUSTRATION L4583C

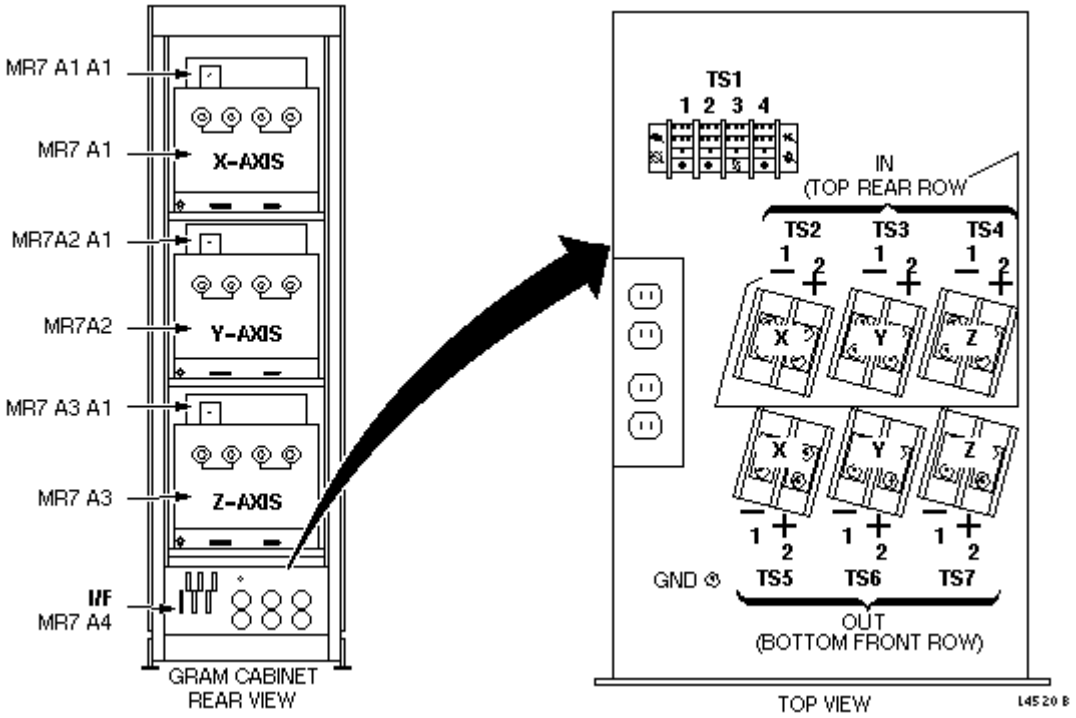
3- PRELIMINARY SET-UP

DANGER!!

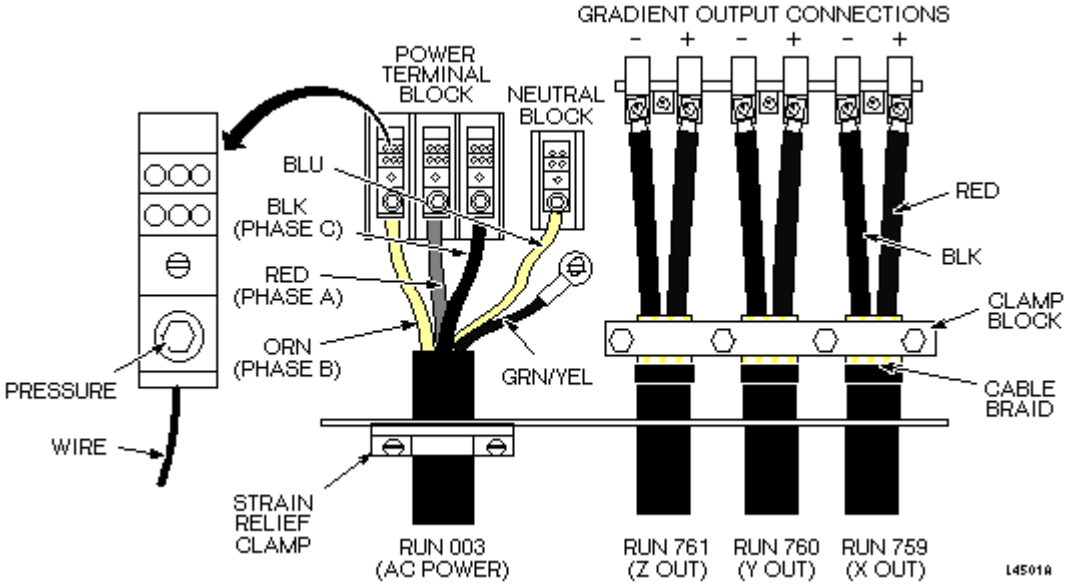
FATAL ELECTRIC SHOCK HAZARD!! THE GRAM <u>AND</u> GRADIENT AMPLIFIERS ACT AS CONSTANT LOAD SOURCES, AND WILL SEND MAXIMUM CURRENT TO ANY LOAD (INCLUDING YOU!). TO PREVENT FATAL ELECTRIC SHOCK, ENSURE THAT POWER IS OFF TO <u>BOTH</u> CABINETS BEFORE CONTINUING WITH THIS PROCEDURE.

1. Lock out and tag out the PDU Circuit Breaker for the GRAM Cabinet and the 8645 Gradient Amplifier Cabinet using appropriate OSHA procedure. (Refer to CD-ROM *Dir. 2187583-3 [or -2], MR Release Signa 5x/8x Service Methods, Renewal Parts and Service Tools,* Safety, Section 6, OSHA LOCKOUT/TAGOUT REQUIREMENTS.)

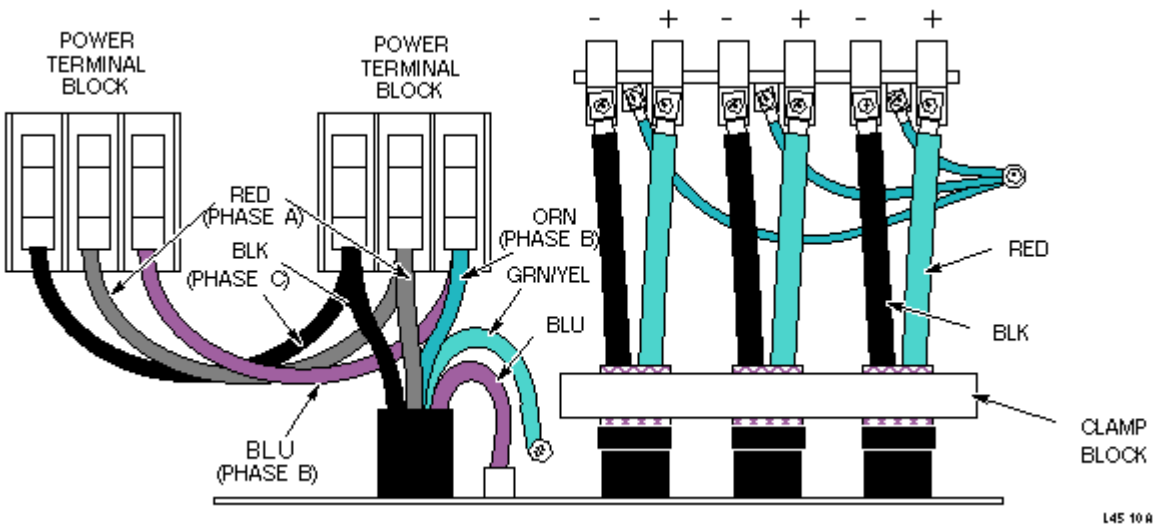
2. Verify that all energy has been disabled by measuring incoming power to the GRAM Cabinet at TS1 (see Illustration L4520B). Verify that all of the energy has been disabled for the 8645 Gradient Amplifier Cabinet by measuring power at TS1. Also see Illustration L4501A for the Signa Horizon HiSpeed system, or Illustration L4510A for Signa Horizon or Horizon EchoSpeed systems.



GRAM CABINET, REAR VIEW – BOTTOM PANEL AND TS1
ILLUSTRATION L4520B

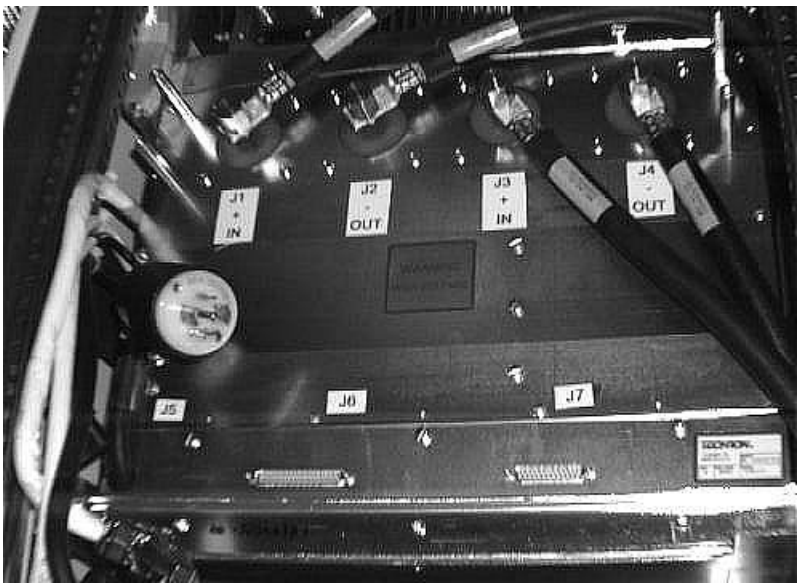


8645 CABINET POWER AND OUTPUT CABLE CONNECTIONS
ILLUSTRATION L4501A



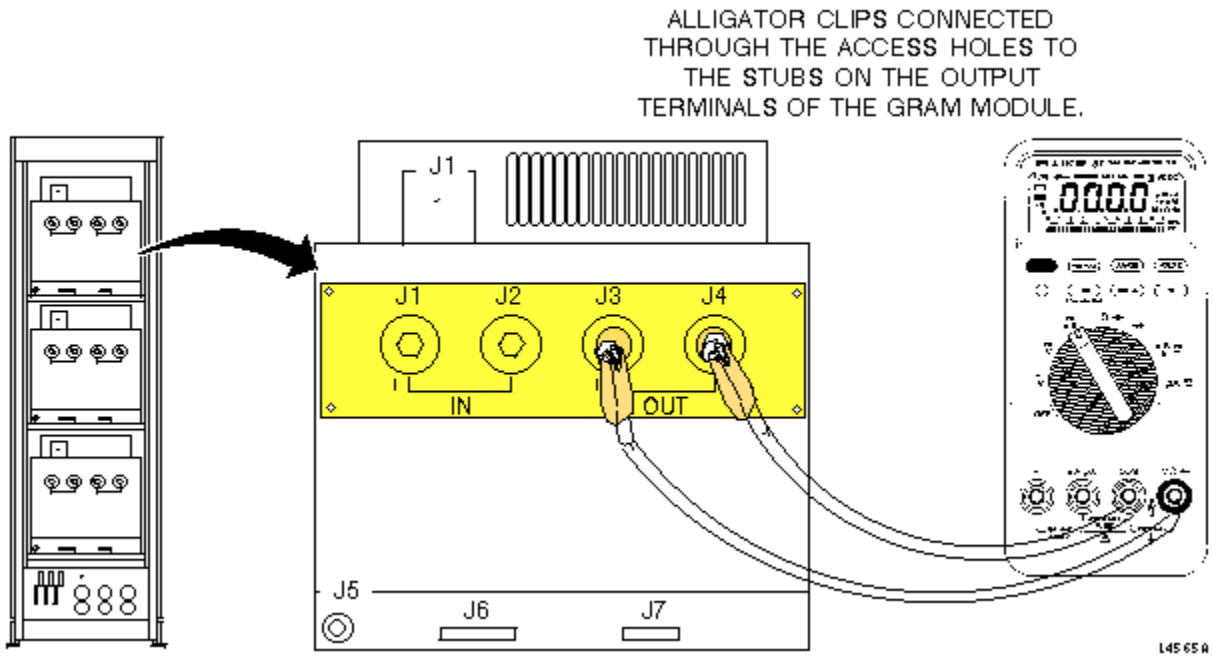
INCOMING POWER TO A DOUBLE-BAY 8645 GRADIENT CABINET
ILLUSTRATION L4510A

3. At rear of GRAM Cabinet, disconnect 220Vac 3-phase power cable from failed GRAM at J5. Illustration L4591A shows various cable connections.



GRAM: REAR VIEW SHOWING CABLE CONNECTIONS
ILLUSTRATION L4591A

4. Verify that power is off by connecting a DVM across the input leads (J1, J2) and output leads (J3, J4) at rear of GRAM, as shown in Illustration L4565A.

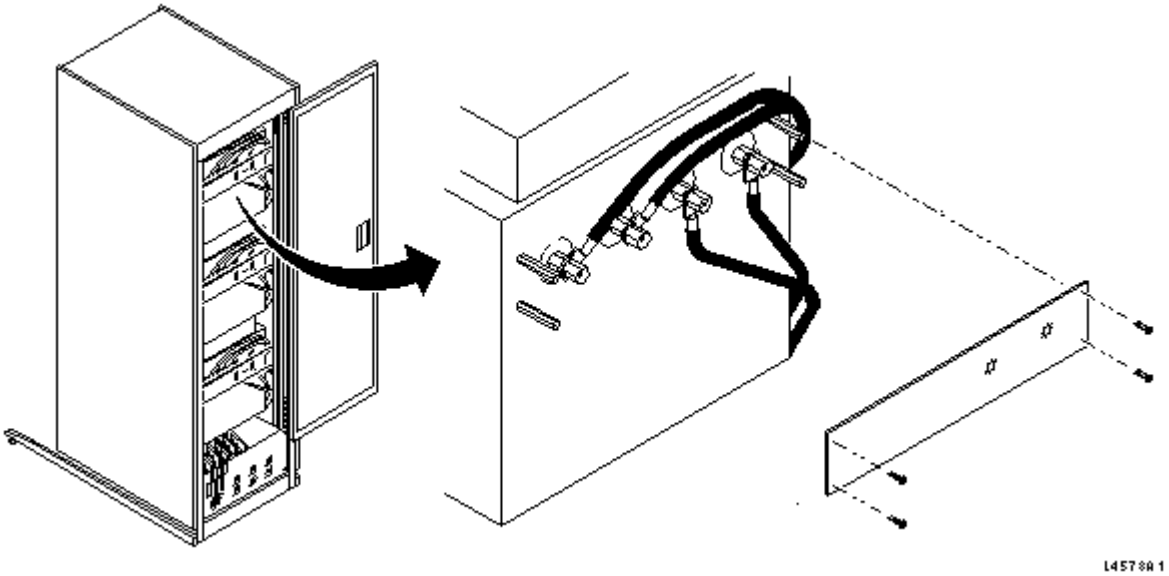


GRAM: REAR VIEW SHOWING VOLTMETER ACROSS THE OUTPUTS
ILLUSTRATION L4565A

Note - Checking input leads - When checking the input leads, you must hold the alligator clips against J1 and J2.

5. Disconnect data cables from rear of GRAM at J6 and J7. See Illustration L4591A in Section 3.

6. Remove the clear cover from in front of input/output connections J1–J4 (see Illustration L4578A1).

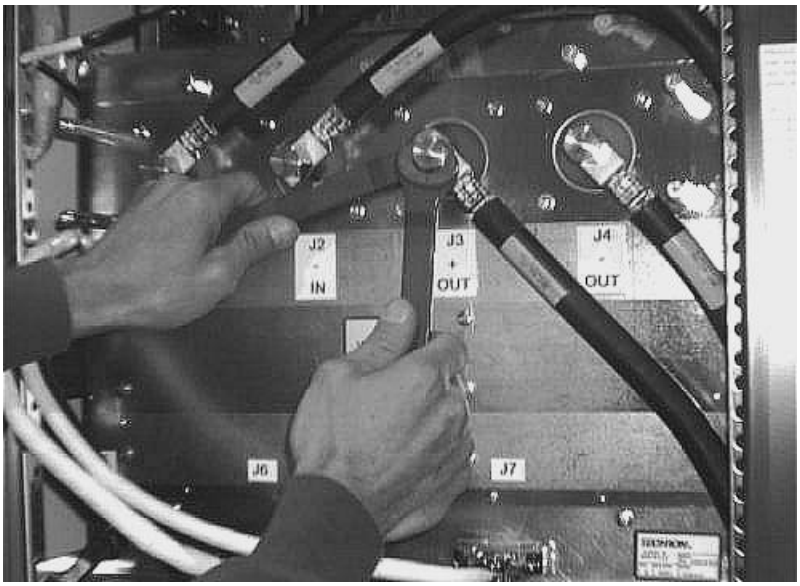


REMOVING CLEAR PROTECTIVE COVER
ILLUSTRATION L4578A

CAUTION

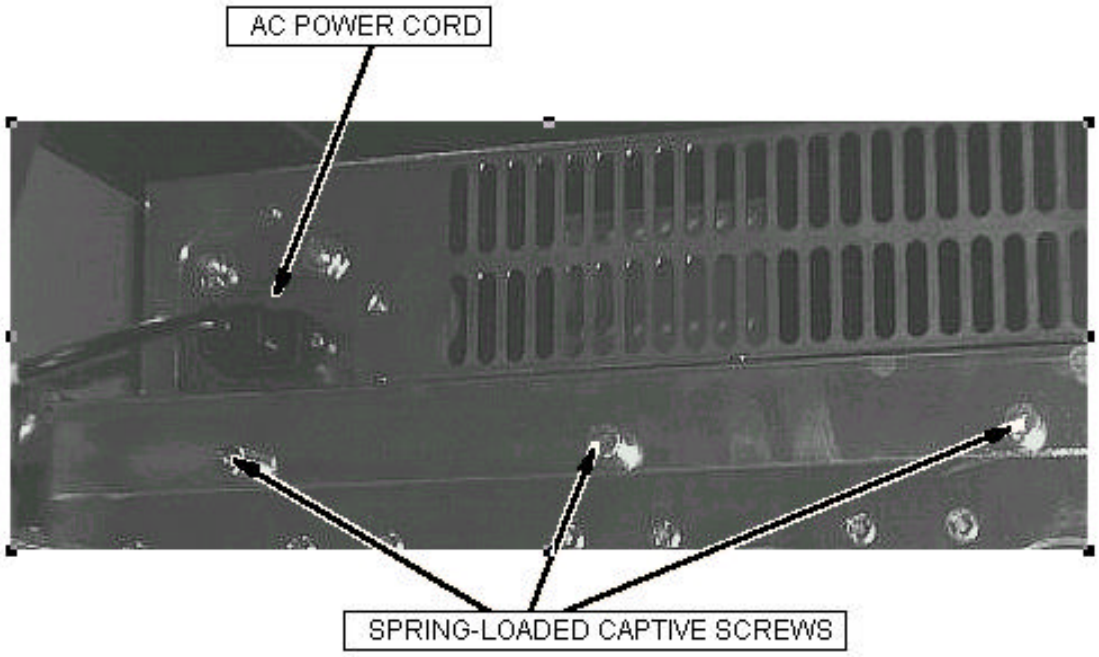
Possible equipment damage. Two wrenches are necessary when removing the cables from the four GRAM input/output connectors: one prevents the post from turning, while the other loosens the cap nut. If you try to loosen the cap nut with only one wrench, the post itself could turn, and damage to the circuit board inside the module could occur.

7. Each of the four GRAM input/output lead connectors consists of a 3/4-inch (19 mm) hex cap nut and a hex post. The cap nut holds the ring terminal to the post. Two wrenches are needed to remove the cable from the post, one to hold the post (behind the ring terminal) to prevent it from turning, and the other to loosen the cap nut so you can remove the cable. Refer to Illustration L4580A.



REMOVING LEAD CONNECTOR HEX CAP NUTS
ILLUSTRATION L4580A

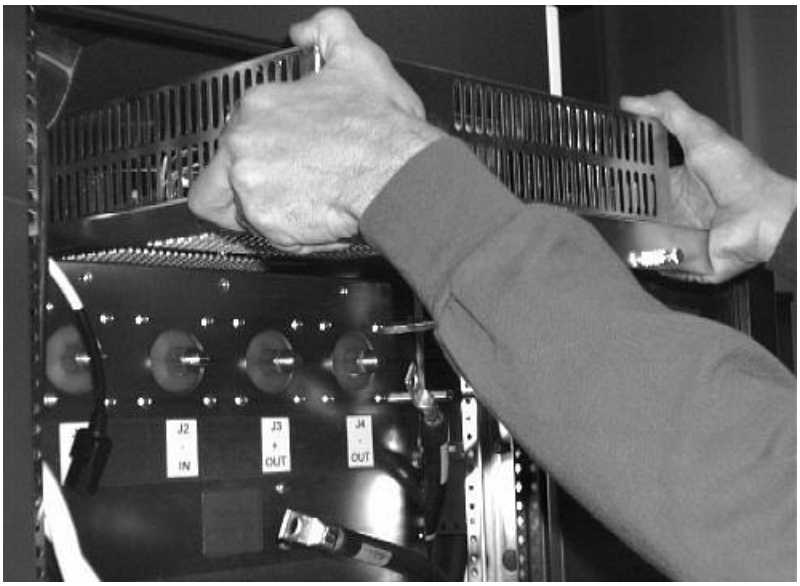
8. Disconnect the ac power cord from Fan Module. See Illustration L4581A.



GRAM: REAR OF FAN MODULE
ILLUSTRATION L4581A

9. Loosen the three spring-loaded captive screws that secure the Fan Module. They are at the upper-rear edge of the GRAM, and are shown in Illustration L4581A.

10. Remove the Fan Module by sliding it off of the top of the GRAM, and out the rear of the GRAM Cabinet, as Illustration L4581B shows.

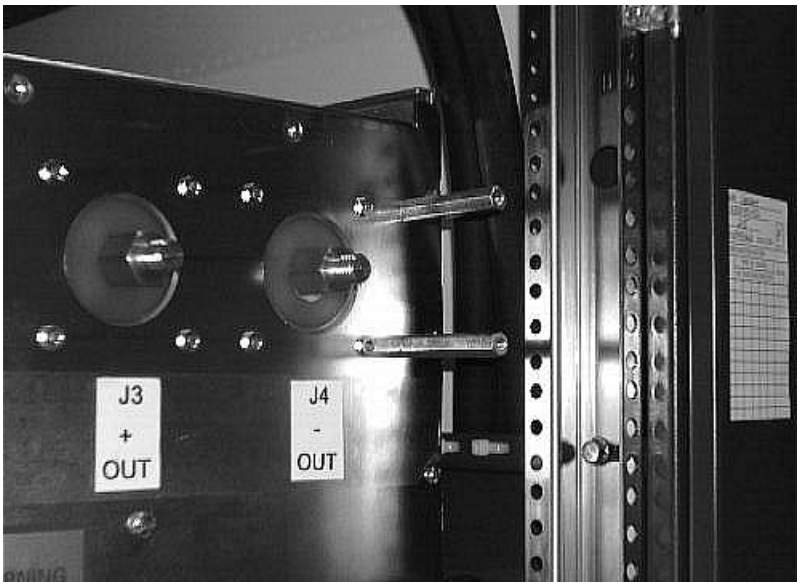


REMOVING THE FAN MODULE
ILLUSTRATION L4581B

CAUTION

Possible equipment loss. In mobiles, the four hex stand-offs that hold the clear cover in front of the input/output leads must be removed. In some vans, the stand-offs are secured with Pem nuts; in others, screws are used. In the latter case, be sure to not drop these screws; they will fall down inside the GRAM.

For mobile sites only:
Remove the four hex Clear Cover Standoffs by turning them counterclockwise. See Illustration L4582A.



REMOVING FOUR CLEAR COVER STAND-OFFS
ILLUSTRATION L4582A

Note

Remove stand-offs in mobiles - The four hex stand-offs that hold the clear cover in front of the input/output leads are removed because the small space in a mobile van may not allow you to turn the GRAM once you get it outside of this cabinet. (The GRAM must be turned 90 degrees to allow the hoist room to lower it.)

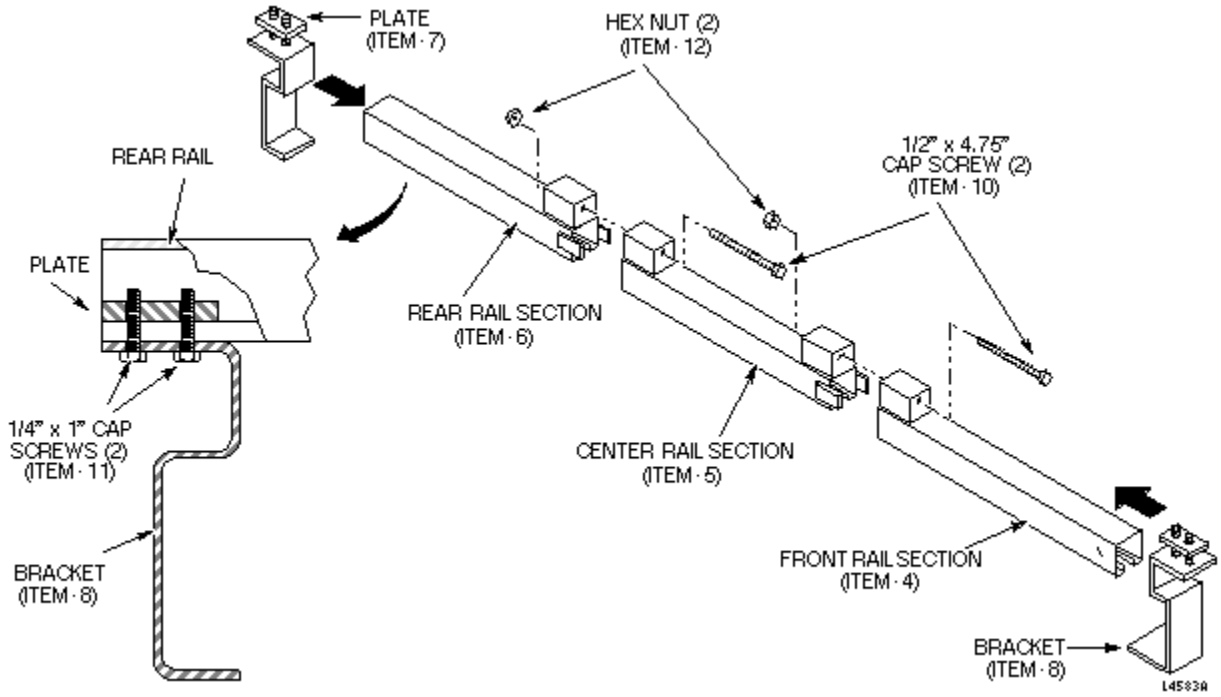
4- UNIVERSAL AMPLIFIER HOIST KIT ASSEMBLY AND INSTALLATION

CAUTION

Possible personal injury and/or equipment damage. Use the Amplifier Hoist kit to remove and replace the GRAM. The module weighs more than 69 kg (152 pounds). Two people are needed to remove the assembly from the cabinet if the hoist kit is not used. This procedure assumes the use of the hoist.

1. Assemble three-piece Rail (items 4, 5, and 6) with Cap Screws (item 10) and nuts (item 12). See Illustration L4583A.

2. Assemble Bracket (item 8) to Plate (item 7) with two Cap Screws (item 11). See Illustration L4583A.



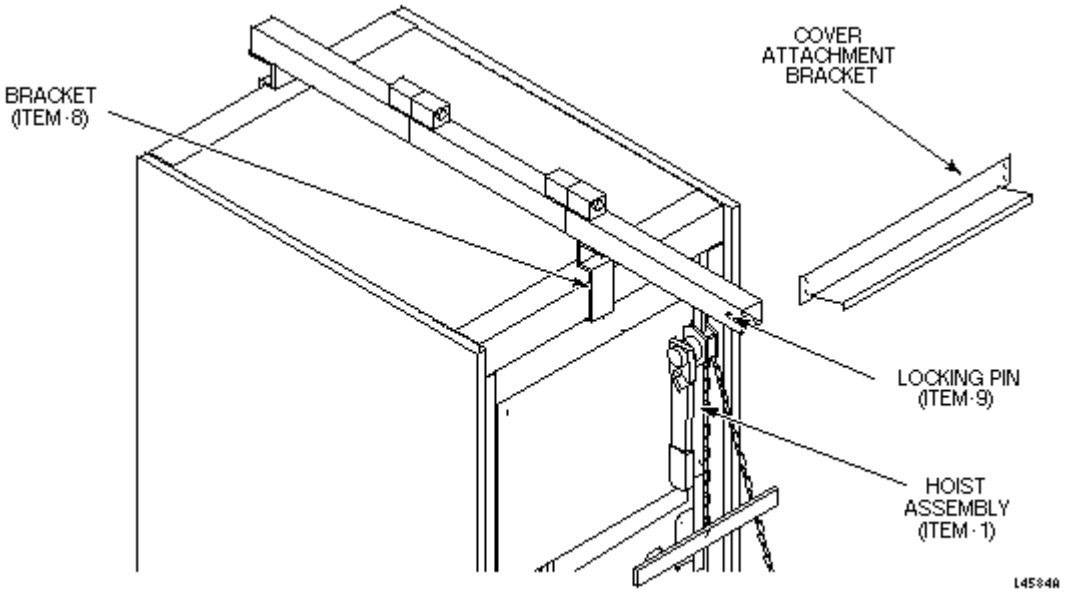
UNIVERSAL AMPLIFIER HOIST ASSEMBLY
ILLUSTRATION L4583A

3. Insert Plate into slot in rear Rail Section until flush; tighten Cap Screws.

4. Remove front cover from cabinet.

5. Remove front cover attachment bracket. See Illustration L4584A.

6. Place rail assembly on top of cabinet with attached bracket to rear of cabinet. See Illustration L4584A.



ATTACHING HOIST TO GRAM CABINET
ILLUSTRATION L4584A

7. Assemble Bracket to Plate with two Cap Screws.

8. Insert Plate into front Rail Section, push bracket against cabinet front, and tighten Cap Screws. See Illustration L4584A.

9. Insert Hoist Assembly pivot bearings, with handle at left, into front Rail Section. See Illustration L4584A.

CAUTION

Possible personal injury and/or equipment damage. Throughout this entire procedure, keep an eye on the Lock Pin once it is inserted in the front Rail Section. The motion of the chain may cause the pin to slightly shift position.

10. Insert Lock Pin (item 9) through holes in front Rail Section. See Illustration L4584A.

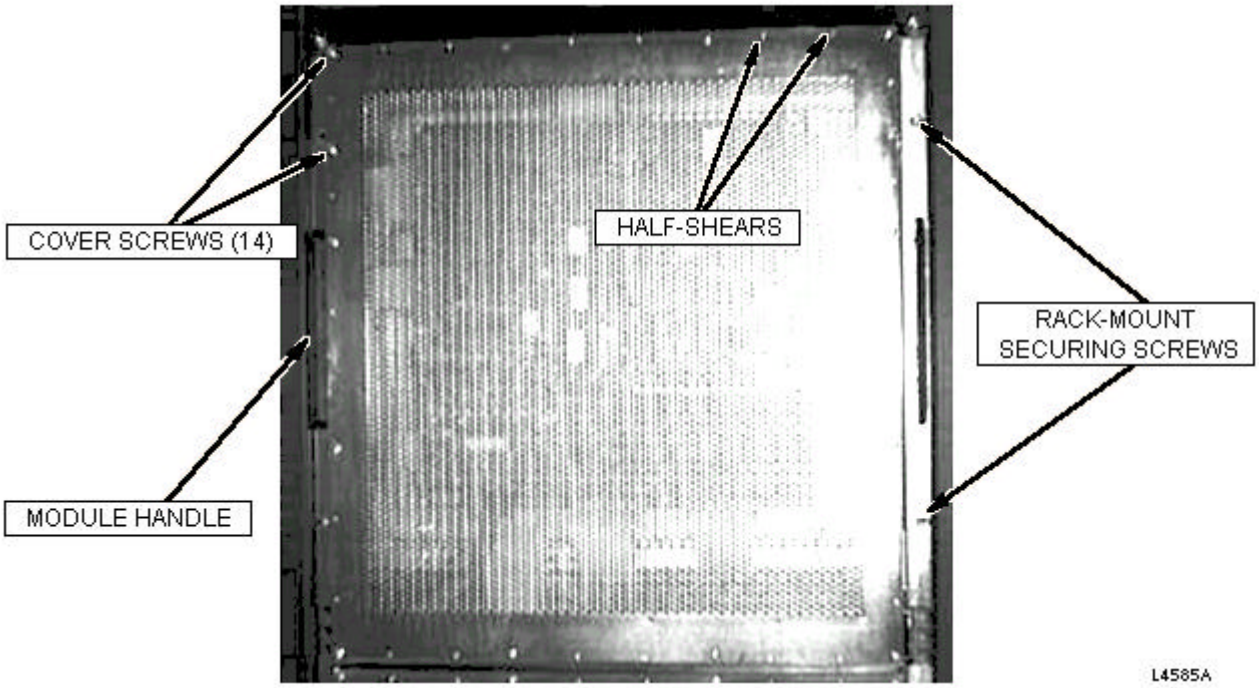
5- REPLACING THE GRAM

CAUTION

Possible equipment damage. The GRAM has static-sensitive components that may be damaged if not handled in a static-free environment. Take appropriate care (e.g., wear wrist grounding strap) when handling this module.

5-1 Preparing to Remove Failed GRAM

1. Use proper ESD precautions, and, at the front of the GRAM Cabinet, remove and set aside the fourteen screws that hold the electromagnetic compatibility (EMC) cover on the GRAM (see Illustration L4585A).



EMC COVER, SCREWS, AND MODULE HANDLES
ILLUSTRATION L4585A

Note - Importance of EMC cover screws - These fourteen screws help the EMC cover prevent RF leakage; do not misplace any of them.

2. The existing GASM Board and GRAM Tuning Board must be transferred to the replacement GRAM. Start by disconnecting the two ribbon cables on the GASM Board (see Illustration L4562A). Also disconnect the ribbon cable(s) from the Tuning Board.

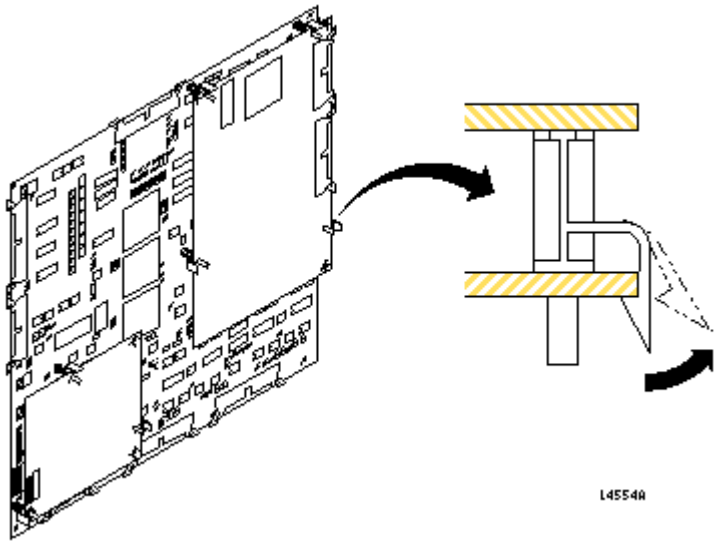
GASM BOARD
ILLUSTRATION L4562A

Note - Analog Tuning Board, and Digital Tuning Board cable differences - The Analog Tuning Board has only one ribbon cable to disconnect; however, the Digital Tuning Board has two ribbon cables to disconnect for this step.

CAUTION

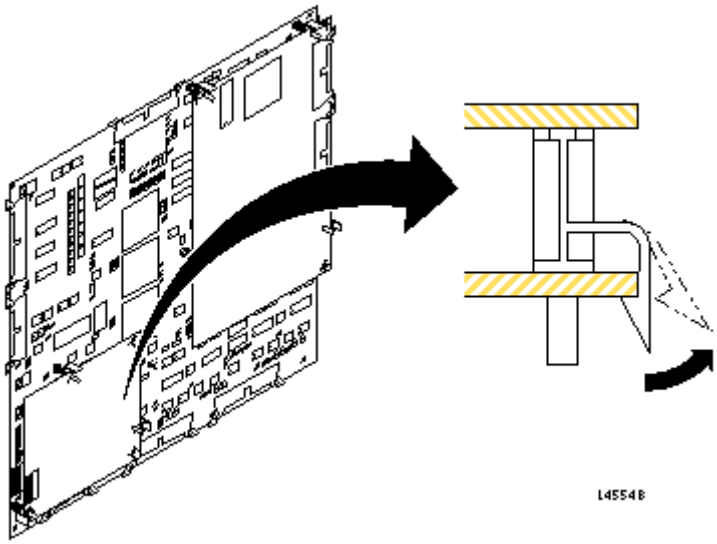
Equipment damage possibility. Do not pull the circuit board off. The nylon standoffs are quite brittle and will break. Push the top of the standoff away from the circuit board one by one. If they do not push off of the circuit board at first, work on the other standoffs iteratively.

3. Carefully push back the four white nylon stand-offs on the GASM Board (see Illustration L4554A), one at a time, until all are released. Remove the board, and place it in a static bag.



NYLON STAND-OFFS ON GASM BOARD
ILLUSTRATION L4554A

4. Do the same with the three stand-offs on the GRAM Tuning Board (see Illustration L4554B). Place this board in a static bag.



GRAM ANALOG TUNING BOARD STAND-OFFS
ILLUSTRATION L4554B

5. Reattach the EMC cover. Be sure that the half-shears (small bumps) between the screw holes face in, toward the cabinet, not out. It is important to the electromagnetic integrity of the cover that you account for all fourteen screws. Tighten them just to snug. See Illustration L4585A.

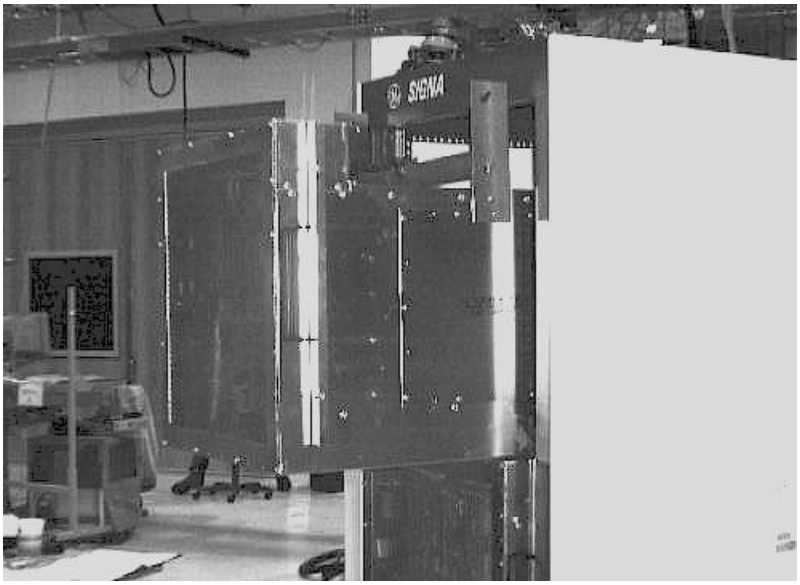
6. At the front of the GRAM are four Rackmount Securing Screws, two on each side, next to the module handles (see Illustration L4585A). Remove these, and set aside.

7. Pull firmly on the two handles, sliding the GRAM out the front of the cabinet until the Slide Lock Bracket causes it to stop. It will come out only about half way, but this exposes the shoulder screw on each side of the GRAM; these are where you will connect the hoist (see Illustration L4586A).

SHOULDER SCREW FOR ATTACHING HOIST LIFT PLATE
ILLUSTRATION L4586A

5-2 Connecting Hoist to Failed GRAM

1.Attach the right and left Lift Plates to the GRAM via the shoulder screws; tighten same. See Illustration L4587A.



RAM WITH LIFT PLATES AND CENTER BAR ATTACHED
ILLUSTRATION L4587A

2. Install the Center Bar between the Lift Plates, as shown in Illustration L4587A.

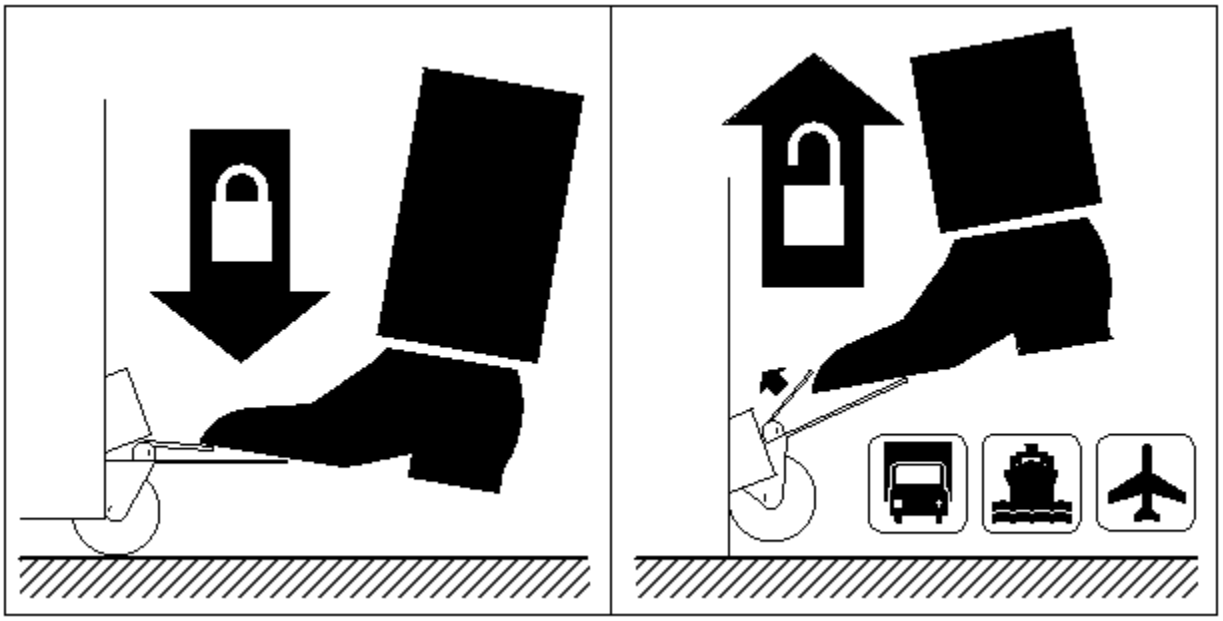
3. Connect hoist to Center Bar, making sure that the handle of the Hoist Assembly is to your left as you face the cabinet. This puts the take-up end of the chain between you and the GRAM case, where you can control it. See Illustration L4584A in Section 4.

5-3 Special Shipping Case

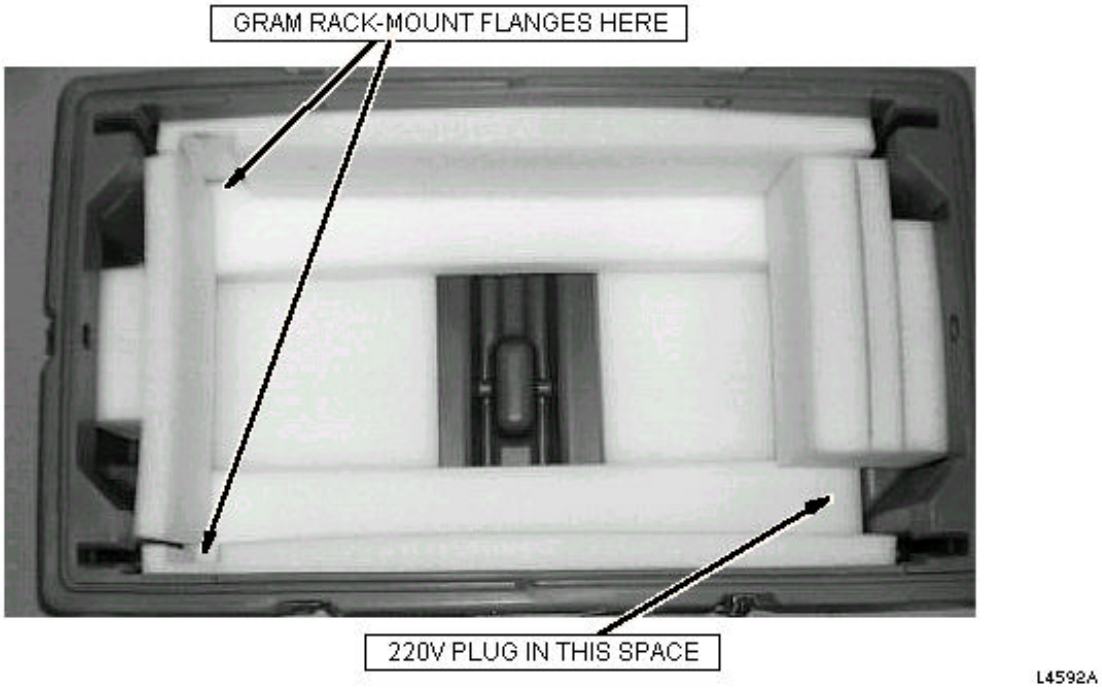
The replacement GRAM comes in a special case that consists of two identical halves, each with its own set of wheels; there is no “top” or “bottom.” The case will hold the failed unit for shipment back to the manufacturer.

1. Wheel the case with the replacement GRAM to a convenient spot nearby.

2. Remove the cover, lower and lock the four wheels (see Illustration L4588A), and place the cover, on its wheels, in front of the GRAM Cabinet. Illustration L4592A shows proper placement of case to receive failed GRAM from Cabinet.



GRAM CASE WHEELS – LOCKED AND UNLOCKED
ILLUSTRATION L4588A



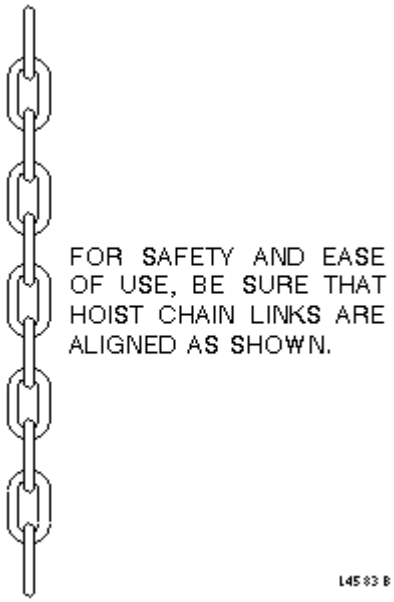
SPECIAL GRAM SHIPPING CASE
ILLUSTRATION L4592A

CAUTION

Possible personal injury and/or equipment damage. Before putting the weight of the GRAM on the hoist, be sure that the shoulder screws are correctly located in the small end of the keyholes in the Lift Plates.

CAUTION

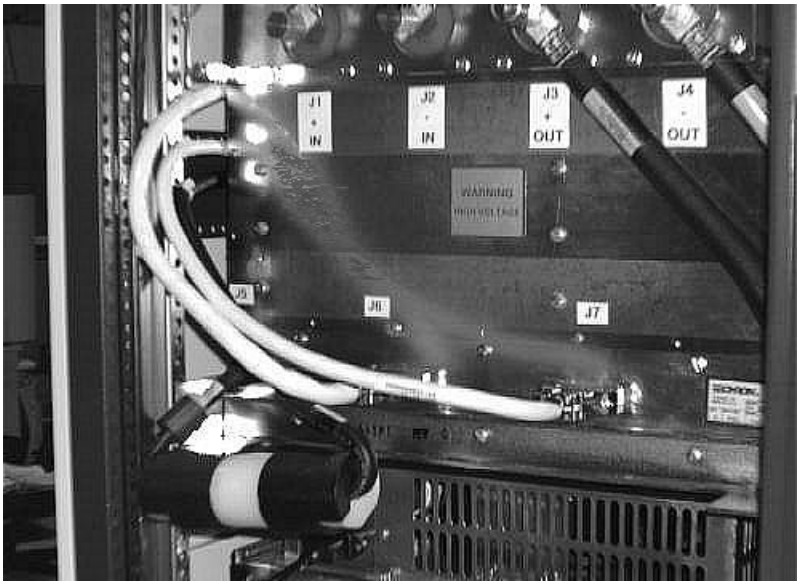
Possible personal injury and/or equipment damage. Before putting weight on the hoist chain, be sure that the links are aligned as Illustration L4583B shows. This will help avoid the chain binding up, or becoming kinked, which is nearly impossible to correct when chain is under tension. This is especially important during replacement of the top module, where space and chain length are minimal.



UNIVERSAL AMPLIFIER HOIST CHAIN
ILLUSTRATION L4583B

3. Use hoist to lift GRAM slightly, to take weight off.

4. Remove the three screws from Slide Lock Bracket (see Illustration L4579A).



GRAM: SLIDE LOCK BRACKET SCREWS
ILLUSTRATION L4579A

5. Pull on the GRAM handles and slide the unit out, turning it ninety degrees. See Illustration L4593A, which shows the GRAM turned with its front to the left).

GRAM TURNED 90 DEGREES
ILLUSTRATION L4593A

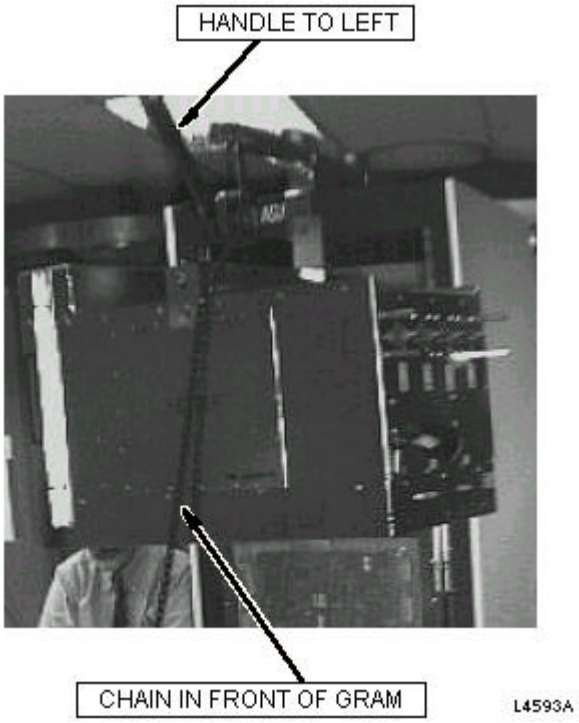
Note

GRAM must be turned - the GRAM is deeper, front to rear, than the reach of the hoist rail; therefore, the module must be turned 90 degrees to allow the hoist room to lower it.

CAUTION

Possible personal injury and/or equipment damage. When lowering the GRAM into the case, be sure that it does not catch on anything, such as cables, or any part of the cabinet.

6. Paying close attention to the take-up part of the chain, slowly and carefully lower the GRAM into the case (see Illustration L4594A).



FAILED GRAM IN SHIPPING CASE
ILLUSTRATION L4594A

7. Disconnect hoist from the Center Bar, and roll the failed module out of the way.

8. Remove Lift Plates and Center Bar from failed module, and attach to replacement module.

5-4 Installing the Replacement GRAM

1. Roll other case half, with replacement module, into place.

2. Connect hoist to Center Bar on replacement module.

CAUTION

Possible personal injury and/or equipment damage. Before putting weight on the hoist chain, be sure that the links are aligned as Illustration L4583B shows. This will help avoid the chain binding up, or becoming kinked, which is nearly impossible to correct when chain is under tension. This is especially important during replacement of the top module, where space and chain length are minimal.

3. Use hoist to lift replacement GRAM into position for sliding into cabinet.

4. Slide GRAM into position and, with the weight still off of the new module, replace the three screws in the Slide Lock Bracket at the rear of the cabinet.

5. Disconnect hoist from Center Bar, remove Center Bar from Lift Plates, and remove Rail from top of GRAM Cabinet.

6. Remove Lift Plates, and tighten shoulder screws in sides of replacement GRAM.

7. At the front of the cabinet, push the new GRAM into final position.

8. Replace the four Rack-mount Securing Screws that hold the module in place.

9. At the front of the GRAM Cabinet, remove and set aside the fourteen screws that hold the EMC cover on the GRAM.

10. Remove the GASM and GRAM Tuning boards from the static bags, and carefully attach them to the replacement GRAM. Attach the ribbon cables to each board.

11. Reattach the EMC cover with the fourteen screws. It is important to the electromagnetic integrity of the cover that you account for all of the screws. Be sure that the half-shears (small bumps) between the screw holes face in, toward the cabinet, not out.

12. Remove hoist from cabinet and set aside.

For mobiles only:
Replace the four posts that hold the clear cover in front of the input/output lead connectors.

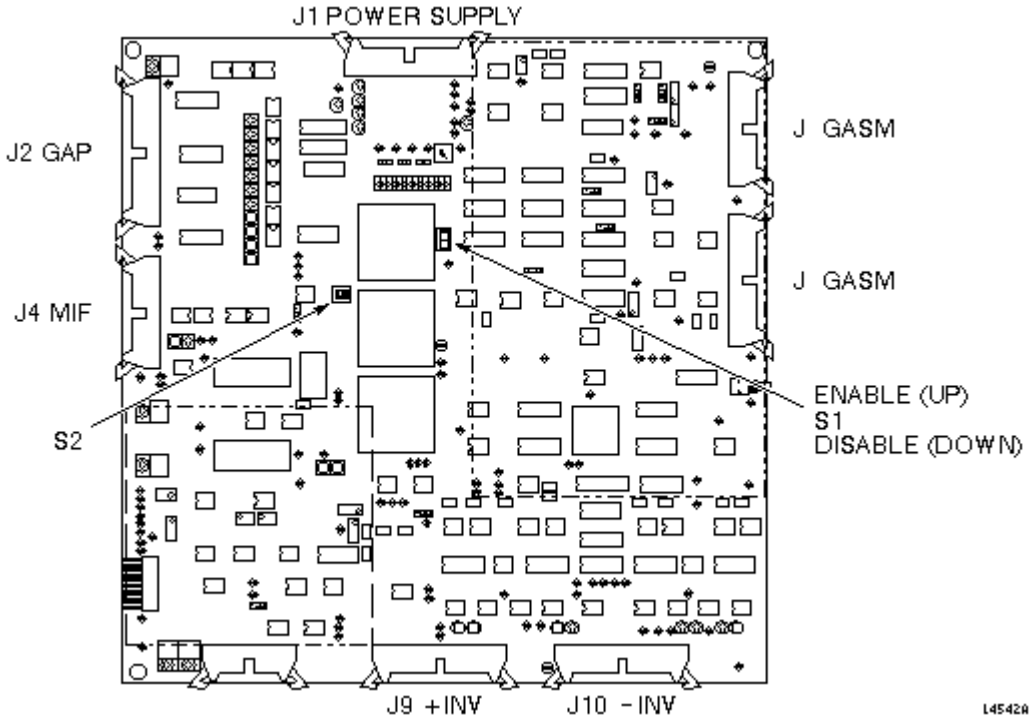
13. Slide Fan Module into place on the GRAM; secure with the three captive screws at upper-rear of module.

14. Verify the position of all jumpers and switches on the GRAM Control Board and the GRAM Power Supply Board for each axis being tuned.

    a. See Table 7 and Illustration L4542A for proper switch settings for the GRAM Control Board.

TABLE 7
GRAM CONTROL BOARD SWITCH SETTINGS

Number	Position	Setting	Switch Name and Position Definition
S1	N/A	up	GRAM Enabled - When S1 is Down, the GRAM is Disabled
S2	1	down	(RES) Reserved - Not Used
S2	2	down	(HV) High Voltage Enable - Under Software Control
S2	3	down	(FW) Free Wheel - Enables PWM mode under software control. Up is Freewheel mode, no PWM.
S2	4	down	(MAN) Manual Ready - Manual Ready is controlled by GAP. Up is Troubleshooting, it forces the GRAM to Manual Ready. (S1 must also be up or enabled. When MAN is Up.)

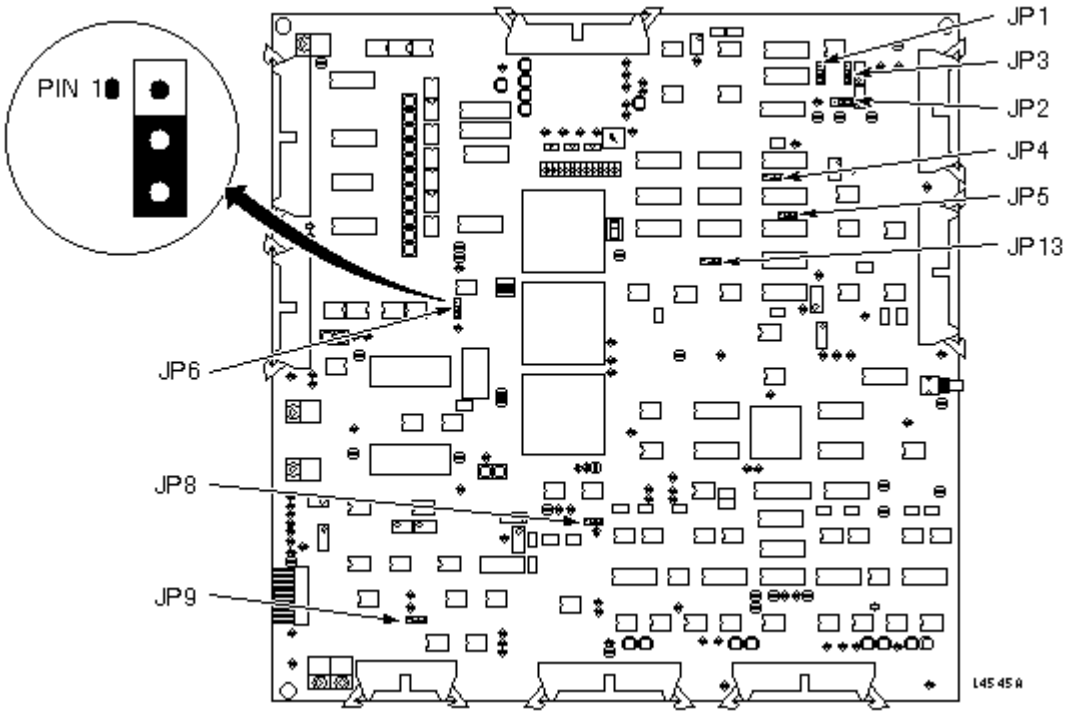


GRAM CONTROL BOARD SWITCH LOCATIONS
ILLUSTRATION L4542A

b. See Table 8 and Illustration L4545A for proper jumper settings for the GRAM Control Board.

TABLE 8
GRAM CONTROL BOARD JUMPER SETTINGS

Number	Position	Setting
JP1	2&3	
JP2	2&3	
JP3	2&3	
JP4	2&3	(V/**D**) Voltage or Digital to Analog Converter - DAC selected
JP5	2&3	(AN/**DIG**) Analog or Digital - Digital selected
JP6	2&3	(DIS/**EN**) Disable or Enable - Enable selected
JP8	2&3	(TST/**NRM**) Test or Normal - Normal selected
JP9	2&3	Sets up one current sensor. JP9 is located under the Tuning Board
JP13	2&3	(AN/**DIG**) Charge mode

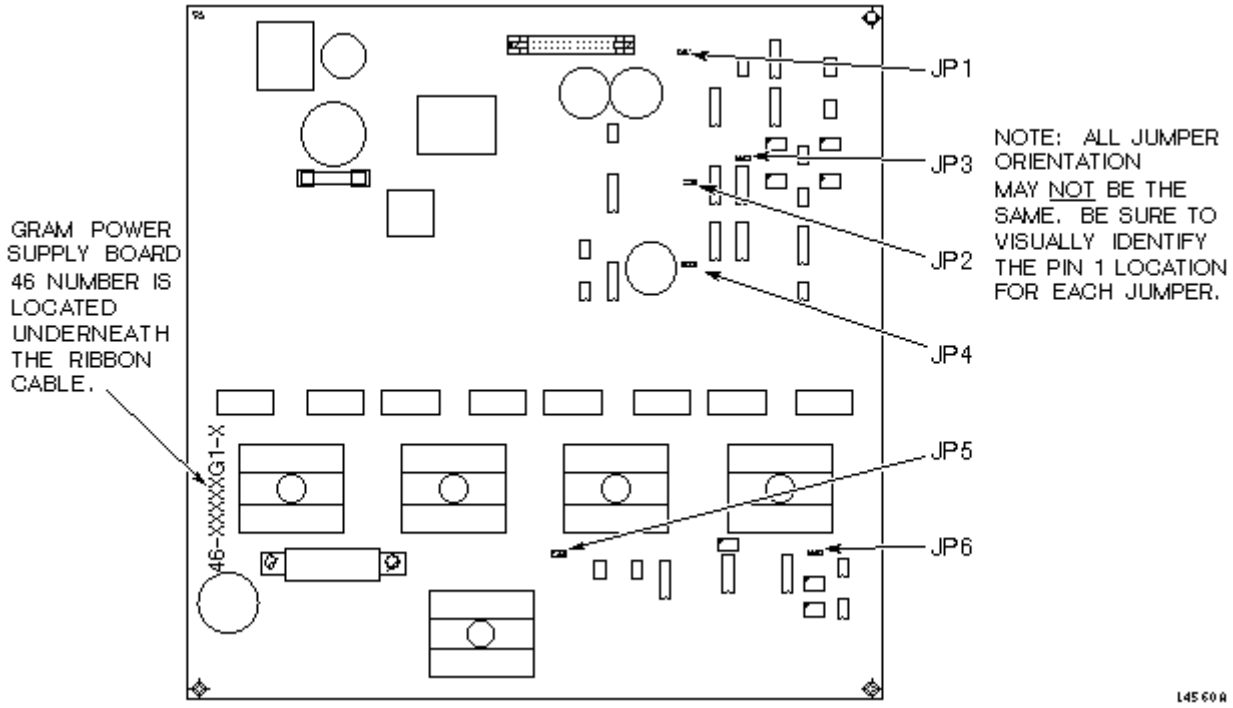


GRAM CONTROL BOARD JUMPER LOCATIONS
ILLUSTRATION L4545A

c. See Table 9 and Illustration L4560A for proper jumper settings for the GRAM Power Supply Board.

TABLE 9
GRAM POWER SUPPLY BOARD JUMPER SETTINGS

Name	Position (Rev B Board)	Position (Rev C Board)	Setting
JP1	2 & 3	2 & 3	Triangle Enable
JP2	1 & 2	2 & 3	Connects LGND to AGND
JP3	1 & 2	2 & 3	High Voltage Enable
JP4	2 & 3	2 & 3	Under Voltage Enable
JP5	1 & 2	2 & 3	High Voltage Enable
JP6	1 & 2	2 & 3	NORM - Normal Mode



GRAM POWER SUPPLY BOARD JUMPER LOCATIONS
ILLUSTRATION L4560A

15. Reconnect ac power cord to Fan Module.

16. Remove the clear protective cover from the back of the replacement GRAM to gain access to the four input/output lead posts.

17. Using two wrenches, connect the four input/output leads to the connector posts J1-J4. Tighten hex cap nuts to 35 ft lbs.

18. Replace the clear protective cover in front of J1-J4.

19. Connect data cables to rear of GRAM at J6 and J7.

20. Connect the 220Vac 3-phase power cable at J5.

21. Release the Lock Out Tag Out from the PDU for the GRAM Cabinet and the Gradient Cabinet.

6- FUNCTIONAL CHECKS REQUIRED

Refer to Table 2 for a quick reference of Functional Checks.

1. Perform GRAM Tuning using Procedure for GRAM Tuning (Digital Tuning Bd). You will only need to perform Auto Lcoil, DC offsets and Vbus Adjustment. Do not run Grafidy.

   Note - Alternate proprietary procedure is available for GE use, and to sites with a valid Advanced Service Package Limited License. See the procedure for GRAM Tuning - (Proprietary).

2. Check shim using procedure for LV Gradient shim Check; shim if necessary.

3. Check gradient calibration using procedure for Gradient Calibration (DQA Version) or alternate proprietary procedure for SPT Quick Head Check; calibrate if necessary.

For Systems With EPI Option:

4. Check shim using procedure for LV Gradient Shim check; shim if necessary.

5. B0 Image check

TABLE 2
FUNCTIONAL CHECKS REQUIRED

FRU	**8X Functional Checks Required**
GRAM and GRAM FRUs **T3503AS - Gram Assy.** **T3503CG - Gram PS** **T3503CH - Control Brd.**	- Auto Lcoil - DC Offset - Vbus Adjust - Check Gradcal (non-prop) or SPT Quickcheck (prop) - LV Gradient Shim Check
GRAM and GRAM FRUs (w/EPI option) **T3503AS - Gram Assy.** **T3503CG - Gram PS** **T3503CH - Control Brd.**	- Auto Lcoil - DC Offset - Vbus Adjust - Check Gradcal (non-prop) or SPT Quickcheck (prop) - LV Gradient Shim Check - B0 Image Check

REVISION HISTORY

REV	DATE	AUTHOR	PRIMARY REASONS FOR CHANGE
0	May 22, 1998	J. Saperstein	Initial conversion from Toolbook to Word.