

PM-HP24 POWER SUPPLY MODULE v3.1 ASSEMBLY & INSTALLATION INSTRUCTIONS

WARNING: This upgrade is not for the inexperienced in high voltage power supply theory and repair as the voltages inside the HP-24 power supply CAN and WILL KILL YOU! Be aware, different versions of the HP-24 power supply sometimes used different wiring colors. You MUST be able to read your schematic and understand the design, theory, wiring and construction of your particular HP-24 power supply to properly perform this upgrade.

Many thanks to John Wagner, W7JWW for the photos!

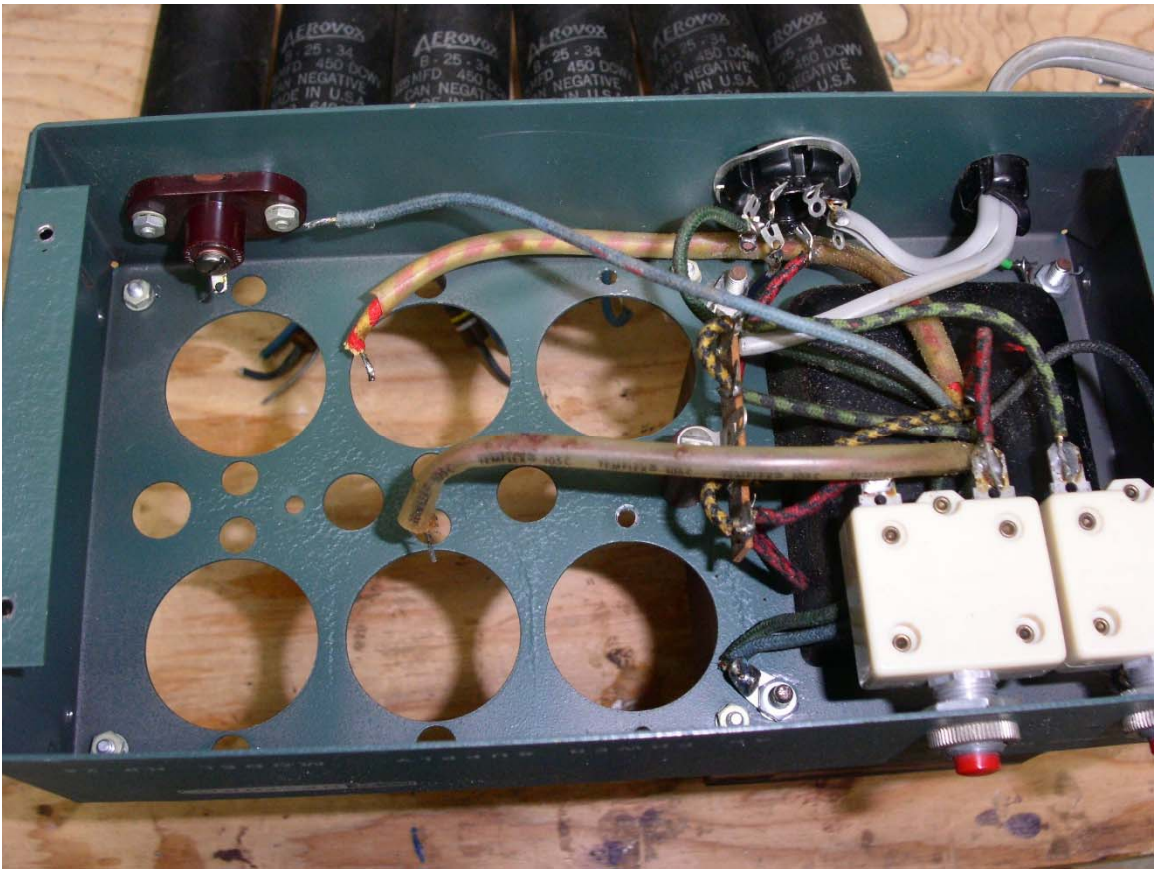
DISASSEMBLY OF THE HP-24 POWER SUPPLY

1. **Read, re-read and fully understand these instructions prior to beginning this upgrade.** Make sure to perform the steps in the order they are listed. Also, be sure to label wires as they are disconnected from various points inside the power supply. This will help when the time comes to re-attach the wires that will be disconnected during installation of the kit.
2. Go through the Bill of Materials (BOM) and compare that list with the parts in the kit to make sure all parts are present. If you are missing any parts, please contact Harbach Electronics, LLC.
3. Unplug the HP-24 power cord from the AC mains. Be sure to let any high voltage (HV) stored in the electrolytic capacitors bleed down. Verify the HV has bled down by measuring the voltage from the HV connector to chassis ground using a DVM capable of safely measuring up to 3000 VDC. **Once you are sure there is no HV left in the electrolytic capacitors**, then unscrew the HV cable from the HV connector on the HP-24
4. Remove the top and bottom covers. Be sure to use a shorting bar to short the HV to chassis ground to make sure the HV is bled completely off.
5. Turn the power supply over so it is resting on the top of the transformer and electrolytic capacitors and the underside of the chassis is facing up. Orient the supply so that transformer is on your right and the circuit breakers are facing you.
6. Unsolder or clip the following wires from the PC board:
 - DARK BLUE** wire at location "C" from pin #8 of the 8-pin socket
 - LIGHT BLUE** cloth wire at location "BLUE" from the transformer
 - RED** cloth wire in a plastic sheath at location "RED" from the transformer
 - YELLOW/BLACK** cloth wire at location "B" from electrolytic capacitor C2
 - BLACK** cloth wire at location "A" from chassis ground lug
7. Unscrew the two (2) screws securing the PC board to its mounting posts and remove the PC board. Re-attach the 5-position terminal strip to the right post using one (1) screw and one (1) lock washer.
8. Clip or unsolder the **BLUE** cloth wire from the lug on the HV connector. Be sure to clean out any solder or wire left in the hole. This connector is often broken. Inspect the connector and replace if necessary. The shell on the cable is a Millen P/N 37001C and the chassis-mounted flange is Millen P/N 37001D.
9. Unsolder or clip the **RED/YELLOW** cloth wire in a plastic sheath from electrolytic capacitor C5. Capacitor C5 is located in the middle of the three capacitors in a row below the HV connector.

10. Clip or unsolder all wire connections and 100K Ω resistors between all six (6) electrolytic capacitors. This includes the 100K Ω resistor and small **BLACK** wire from capacitor C7 connected to a 2-lug terminal strip mounted to one of the transformer mounting bolts.
11. Clip or unsolder the **GREEN** cloth wire connected to the insulated terminal of the 2-lug terminal strip that is attached to one of the transformer mounting bolts. This wire connects to pin #6 of the 8-pin socket.
12. Clip or unsolder the other end of the **GREEN** cloth wire from pin #6 of the 8-pin socket. Be sure to clean out any solder or wire left in the hole.
13. Clip or unsolder the other end of the **DARK BLUE** cloth wire from pin #8 of the 8-pin socket. Be sure to clean out any solder or wire left in the hole.
14. Clip or unsolder the **BLUE** and **GREEN** cloth wires connected to the ground lug of the 2-lug terminal strip. These wires are the ground sides of the bias and filament windings from the transformer.
15. Remove the 2-lug terminal strip and replace it with a supplied #8-32 2-hole solder lug. The resistor R7 (1.5K Ω) that is attached between the lug of the 2-lug terminal strip will be replaced and is now located on the new PC board. **DO NOT re-attach the GREEN cloth wire from pin #6 of the 8-pin socket to the new 2-hole solder lug. It will be connected to the new PC board later.**
16. Clean and tin the ends of the **BLUE** and **GREEN** cloth wires that were removed from the ground lug of the 2-lug terminal strip. Solder the **BLUE** and **GREEN** cloth wires to the #8-32 solder lug that was just installed.
17. Unsolder or clip the short **BLUE** or **BLACK** cloth wire from pin #5 of the 8-pin socket that is connected to a ground lug on the opposite transformer mounting bolt. Be sure to clean out any solder or wire left in the hole.
18. Remove the ground lug from the transformer mounting bolt. This lug will also have a **BLACK** cloth wire that you removed from location "A" on the PC board in Step 6.
19. Replace the old solder lug with a supplied #8-32 2-hole solder lug. Install a small (1.5" – 2") #20 black wire between pin #5 on the 8-pin socket and one of the holes in the newly installed #8-32 2-hole solder lug. **Solder the end of the wire to Pin #5 on the 8-pin socket but DO NOT solder the other end to the ground lug. Another ground wire will be soldered here in a later step.**
20. Turn the HP-24 supply back over and remove the six (6) electrolytic capacitors. Four (4) of the electrolytic capacitors are removed by unscrewing them from plastic bushings in the chassis. The remaining two (2) electrolytic capacitors are removed by unscrewing them from the chassis. **Be sure to save the four (4) #6-32 nuts and four (4) #6 lock washers as they will be used later.**
21. Lay the HP-24 supply on its side and remove the eight (8) plastic push-in bushings from the chassis by squeezing the tabs on the underside of the chassis and pushing them out.
22. Now is a good time to thoroughly clean the power supply as it is surely full of dust and debris. Just use a damp cloth and a mild cleaner to wipe down and clean the top and underside of the chassis to remove dirt, grime and dust. Compressed air cans also work well to remove dust and debris.
23. Place the power supply on the bench with the transformer on top and to your right. The HV connector and the 8-pin socket connector should be facing you.

24. Temporarily remove the two (2) screws that attach the old PC board mounting posts to the chassis so that the PC board will lay flat on the chassis for the next step. **Be sure to save the screws and lock washers!**
25. Use the new PC board as a template to mark and center punch the mounting holes for the new PC board. Center the PC board in the area to the left of the transformer where the electrolytic capacitors were previously mounted. **Be sure the hole marked "ALIGNMENT" on the PC board is nearest the 8-pin socket connector and the transformer before marking and center-punching the mounting holes.**
26. Drill the four (4) new mounting holes using a 9/64" drill bit. Be sure to clean any metal shavings from inside the power supply after drilling the mounting holes.
27. Loosely mount the four (4) 5/8" male/female aluminum hex standoffs to the top of the chassis by pushing the male threaded end of each standoff through one of the four (4) holes that were just drilled and secure each standoff using a #6-32 nut and lock washer that were saved in Step 20.
28. Re-attach the old PC board mounting post that has the 5-position terminal strip on the other end to the chassis using the original screw and lock washer. You may install the other mounting post if you wish but it is no longer used or needed.
28. The top and bottom of the chassis should now look like the photos below.





ASSEMBLY OF THE PM-HP24 POWER SUPPLY MODULE

29. Assemble the PM-HP24 according to the parts layout diagram and silkscreen on the PC board. All parts mount on the top (silk screened) side of the new PC board. **Resistors R1-R6 MUST be spaced approximately 1/8" – 1/4" above the PC board for proper heat dissipation. Use any kind of spacer you have to help secure the resistor while soldering it, but make sure the resistors are properly spaced above the PC board! Diodes D1-D5 and D8-D12 are mounted in the vertical orientation.** All other components mount flat to the top (silk screened) side of the PC board and are soldered to the bottom (unscreened) side of the PC board.
30. The assembled PM-HP24 PC board should look like the photo below.



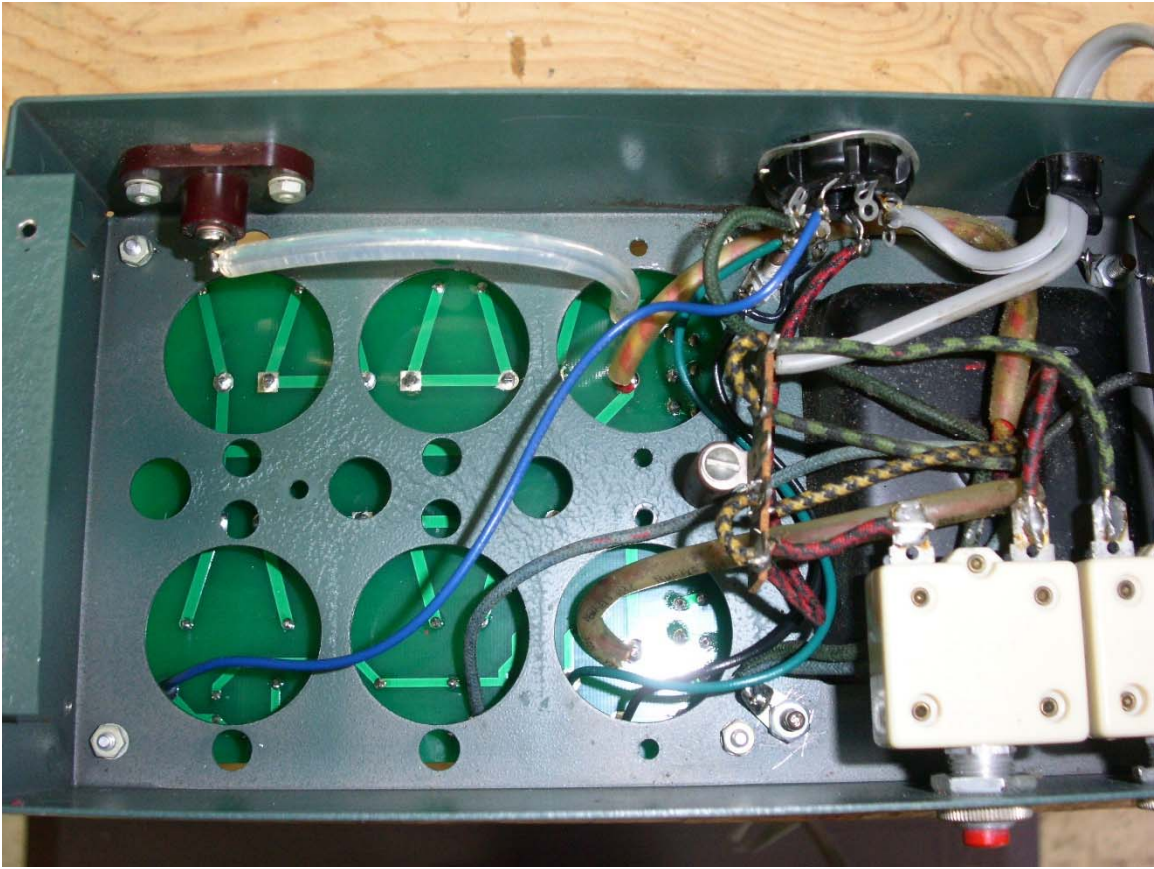
31. Remove approximately $\frac{1}{4}$ " of insulation from and tin each end of the 6" **WHITE** high voltage wire, the 7" #18 **BLACK** wire, the 7" #18 **GREEN** wire and the 12" #18 **DARK BLUE** wire supplied with the kit.
32. Insert one end of each wire into the location noted below on the new PC board. Insert the wire from the bottom (unscreened) side of the PC board and solder each wire on the top (silk screened) side of the PC board:
 - WHITE HV** high voltage wire to solder pad "**B+**"
 - BLACK** #18 wire to solder pad "**BLK**"
 - GREEN** #18 wire to solder pad "**ALC**"
 - DARK BLUE** #18 wire to solder pad "**BIAS**"

INSTALLATION OF THE PM-HP24 POWER SUPPLY MODULE

33. Loosely attached the new PC board to the $\frac{5}{8}$ " hex standoffs using four (4) #6-21 x $\frac{1}{4}$ " screws supplied with the kit. **DO NOT** tighten the PC board to the standoffs or tighten the standoffs to the chassis.
34. Route the **WHITE HV**, **BLACK**, **GREEN** and **DARK BLUE** wires through the holes in the chassis where the old electrolytic capacitors were mounted. Route and solder the wires to the following locations:
 - WHITE HV** to the lug on the HV connector
 - BLACK** to the ground lug where the **BLACK** wire from pin #5 of the 8-pin socket is attached (solder **BOTH BLACK** wires on the ground lug)
 - GREEN** to pin #6 of the 8-pin socket
 - DARK BLUE** to pin #8 of the 8-pin socket

35. Prepare the end of the **RED/YELLOW** and **RED** wires for soldering to the new PC board. Slide the plastic sheath covering each wire over the free end and clip approximately $\frac{1}{2}$ " – $\frac{3}{4}$ " from the end of each plastic sheath. Slide each sheath back over the wire to expose the free end of wire. Clip off any old wire and solder from the end of each wire. Remove approximately $\frac{1}{8}$ " of old insulation from each wire and tin the end of each wire. **Make sure to get a good clean tinned end as this will help when soldering the wires to the new PC board.**
36. Route the **RED/YELLOW** wire in the plastic sheath to the hole below the solder pad labeled "R/Y" on the PC board. Push the tinned end of the **RED/YELLOW** wire up through the hole in the "R/Y" solder pad and **solder the wire to the pad on the TOP (SILK SCREENED) side of the PC board.** Once the wire is soldered, slide the plastic sheath down the wire until it touches the PC board.
37. Route the **RED** wire in the plastic sheath to the hole below the solder pad labeled "RED" on the PC board. Push the tinned end of the **RED** wire up through the hole in the "RED" solder pad and **solder the wire to the pad on the TOP (SILK SCREENED) side of the PC board.** Once the wire is soldered, slide the plastic sheath down the wire until it touches the PC board.
38. Prepare the end of the **BLUE** cloth wire from the transformer for soldering to the new PC board. Clip off any old wire and solder from the end of the wire. Remove approximately $\frac{1}{8}$ " of old insulation from the wire and tin the end of the wire. **Make sure to get a good clean tinned end as this will help when soldering the wire to the new PC board.**
39. Route the **BLUE** cloth wire through a hole in the chassis below the solder pad labeled "BLU" on the PC board. Push the tinned end of the **BLUE** cloth wire up through the hole in the "BLU" solder pad and **solder the wire to the pad on the TOP (SILK SCREENED) side of the PC board.**
40. The completed installation and wiring of the HP-24 kit should look similar to the photos below.





41. Once all wires have been attached to the new power supply PC board, finish tightening the four (4) hex standoffs to the chassis and tightening the four (4) #6-32 x 1/4" screws to the standoffs. Be sure to dress the wires away from sharp edges or high voltage areas.
42. **Review the installation and recheck your wiring and soldering at this point!**

TESTING THE PM-HP24 POWER SUPPLY MODULE

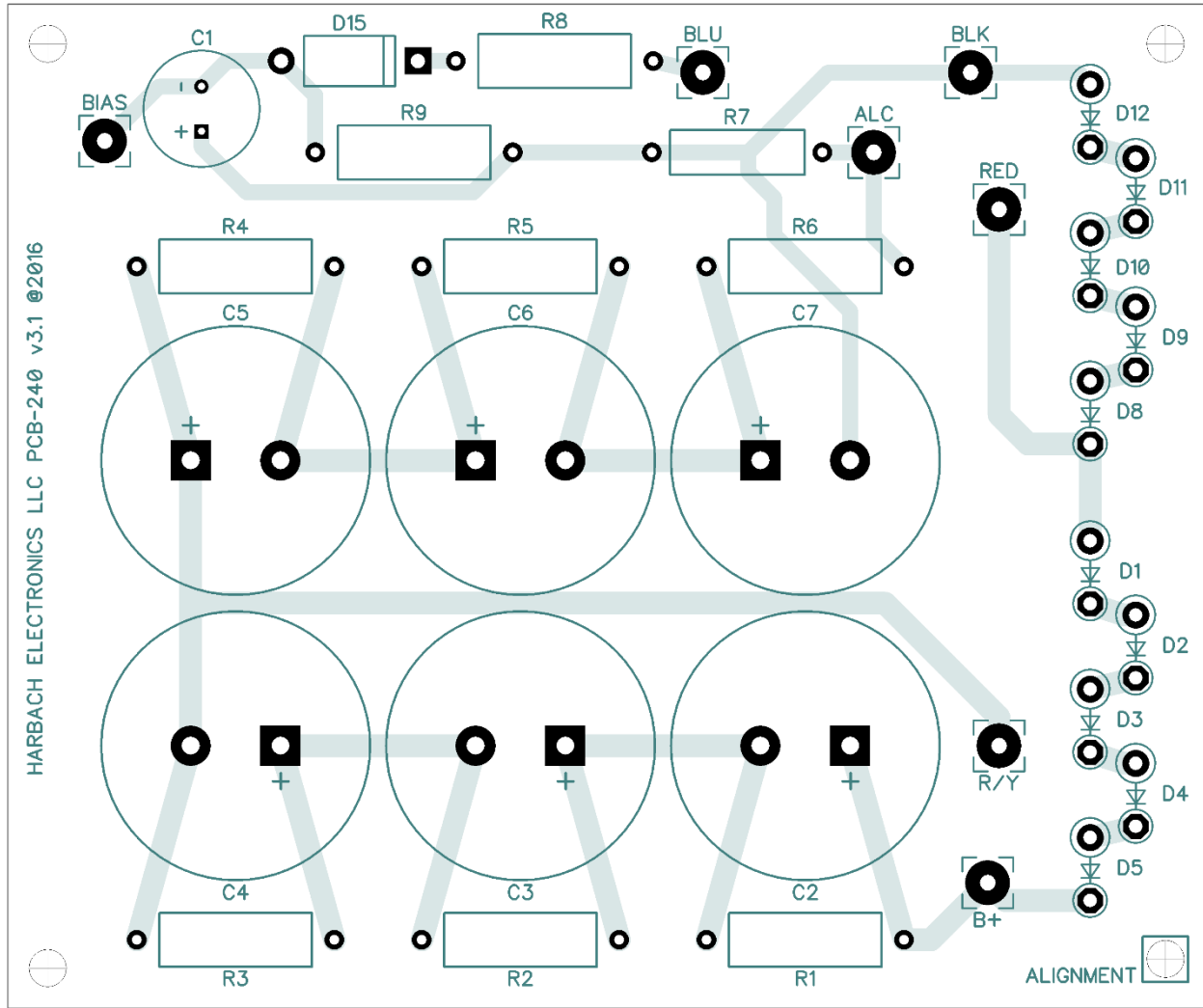
43. To test the various voltages of the HP-24, connect a voltmeter between the chassis ground (negative voltmeter lead) at the locations listed below (positive voltmeter lead). **If you test the B+ voltage, you must use a voltmeter capable of measuring 3000 VDC or use a high voltage probe. Note, these measurements are no-load voltages since the power supply is not connected to the amplifier. You must also jumper pins 2 and 4 on the 8-pin octal connector to make the supply turn on.**

<u>TEST POINT</u>	<u>LOCATION</u>	<u>VOLTAGE</u>
B+ HIGH VOLTAGE	HV terminal	2500 ± 200 VDC
BIAS VOLTAGE	PIN 8 of 8-pin connector	-180 ± 30 VDC
FILAMENT VOLTAGE	PIN 7 of 8-pin connector	13.5 ± 1.5 VAC

44. Once testing has been successfully completed, remove the test leads from the power supply and replace the top and bottom covers using the original screws.

This completes the installation of the PM-HP24 power supply module. It will provide you with additional years of reliable service from your Heathkit HP-24 power supply.

PM-HP24 POWER SUPPLY MODULE PCB PARTS LAYOUT (PCB-240)



PM-HP24 BILL OF MATERIALS (BOM)

Verification	Part Number	Quantity	Description	Designation
[]	PCB-240	1	PM-HP24 Power Supply Module PCB v3.1	N/A
[]	CAP-240	1	47 μ F 250VDC Electrolytic Capacitor	C1
[]	CAP-111	6	220 μ F 450VDC Electrolytic Capacitor	C2-C7
[]	DIO-102	11	3A 1000 PIV Diode (1N5408)	D1-D5, D8-D12, D15
[]	RES-101	7	100K Ω 3W Resistor	R1-R6, R9
[]	RES-303	1	1.5K Ω 3W Resistor	R7
[]	RES-104	1	100 Ω 3W Resistor	R8
[]	LUG-102	2	#8-32 2-Hole Solder Lug	N/A
[]	WIR-240	6"	#18 White High Voltage Wire	N/A
[]	WIR-241	10"	#18 Black Wire	N/A
[]	WIR-242	7"	#18 Green Wire	N/A
[]	WIR-243	12"	#18 Dark Blue Wire	N/A
[]	SPA-240	4	5/8" Male/Female Aluminum Hex Standoff	N/A
[]	SCR-105	4	#6-32 x 1/4" Pan Head Machine Screw	N/A

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