PAT-4 PHONO UPGRADE ASSEMBLY MANUAL

Revision 2p14 February 3, 2018

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Section 1: About This Manual

This manual gives the information you need to install the phono upgrade to the Dynaco PAT-4 Preamp. Manuals starting from Rev 2p13 cover the Rev B version of the kit, which substitutes a 1K resistor for the original 4K7 R1, instead of a jumper. As of this writing, the following other PAT-4 upgrades are available from Updatemydynaco, a division of Akitika LLC:

- Blue Light Kit (BLUE)
- Line Amp Distortion Reducer (DRD4)
- Tone Control Switch (TCS)
- Electronically Regulated Power Supply (PAT4PWR)

The blue light kit changes the light in the power switch from original orange to beautiful blue.

The Line Amp Distortion Reducer drops the distortion of the Line Amp by a factor of ten. The Line Amp is the stage that includes the volume and tone controls. All sound from the preamp passes through the Line Amp. This upgrade makes everything played through the PAT-4 sound better.

The Tone Control Switch replaces the existing Hi Filter switch with a two position rotary switch. In the OFF position, the tone controls are disabled. In the 15 position, tone controls maintain their normal function. After this modification, the other two positions of the HI FILTER switch (10 and 7) are not available. You can install optional resistors (not provided) that drop the Line Amp gain when the tone controls are off. This drops the gain of the Line Amp, increasing Signal to Noise Ratio.

The regulated power supply kit replaces the original diodes, 3-section cap, and resistors with an electronically regulated power supply. When you install the PAT4PWR supply, you dramatically reduce the hum in the PAT-4. It mounts conveniently in existing holes in the PAT-4.

These upgrades can be installed in any combination, but the phono upgrade kit requires the PAT4PWR supply to be installed.

Who Should Attempt these Projects?

You can build this kit if you can:

1. solder (using normal rosin core solder and a soldering iron),
2. use simple hand tools like screwdrivers, wire cutters, and pliers, and
3. Read and follow directions.

It helps if you:

1. know a bit about electronics, or
2. have a friend who knows a bit about electronics
3. can get to YouTube to watch a few helpful videos about the assembly process (not available as of this version of the manual)

Tools and Supplies You'll Need

You'll need the following tools:

1. flat blade screwdrivers for #4 and #6 screws, #2 Philips head screwdriver
2. needle nose pliers (helpful, but not strictly necessary)
3. pencil type soldering iron of 25 to 50 Watts (no huge honking soldering guns or blowtorches)
4. wire cutters and strippers
5. de-soldering tools (see the Appendix 1 and Appendix 2)
6. Magnifying glass, if you're over 42!
7. A multi-meter for measuring Ohms and DC volts is handy, but not strictly necessary

Recommended Solder

The kit must be assembled with 60/40 Rosin Core solder. The recommended diameter is 0.032 inches. Among many such sources of solder, I have used Radio Shack part number 64-009. It contains 8 oz. of solder, which is *much* more than you'll need to assemble this kit.

Project Overview

Broadly, the project consists of the following steps:

1. Labeling, then de-soldering all the wires from each circuit board.
2. Replacing a number of components from the phono section of the preamp with the supplied components.
3. Adding a few wires to the circuit boards.
4. Re-attaching the wires to the circuit boards (with a few modifications).
5. Reassembling the preamp.

Important Safety Notes

By purchasing, using, or assembling this kit, you have agreed to hold AkitikA, LLC harmless for any injuries you may receive in its assembly and/or use. To prevent injuries:

- Wear safety glasses when soldering to prevent eye injuries.
- Always unplug the power before working on the equipment.
- Large capacitors hold lots of energy for a long time. Before you put your hands into the equipment:
    - Pull the AC plug!
    - Wait 1 full minute for the capacitors to discharge!
- Remove jewelry and rings from your hands and wrists, or anything that might dangle into the amplifier.
- If working in the amplifier, keep one hand in your pocket, especially if you're near the power supply or power supply wires. This can prevent serious shocks.
- Build with a buddy nearby. If you've ignored all the previous advice, they can dial 911 or get you to the hospital.

Section 2: About the Phono Preamp Upgrade

Effects of the Modification

- The phono preamp will be 4 to 8 dB quieter than the stock preamp.
- Phono High and Phono Cer inputs will no longer be active.
- You'll have two more phono inputs because:
    - The special input will be equalized for phono.
    - The Tape Head input will be equalized for phono.
- Alternatively, you can change the wiring to provide 5 high level inputs and 1 phono input:
    - The phono input will be active
    - Tape Head and Special inputs will be converted to accept high level inputs
- The preamp won't clunk when you switch it in and out of phono positions.
- Your cartridge will actually see the correct loading impedance. The original PAT-4 design used a form of feedback biasing that made its input impedance look inductive, falling to 10K ohms or less at low frequencies. The upgrade modifies the topology such that the input impedance looks very close to 47K across the whole audio band.

Before you Begin

This modification gives you a wonderful opportunity to tweak the gain of your phono preamp. That lets you trade off sensitivity with phono preamp overload. *There is no one right answer. The best answer depends upon your equipment.* Here's the procedure:

Listen to a record with your preamp, cartridge, and turntable in its stock form. Note the "clock position" of the volume control when you're listening about as loud as you'd every reasonably expect to.

- Write down the clock position of the loudest sane setting here_____.
- If the volume "clock position" (for any input) is *never* above 12 O'clock, then you might want to drop the gain of the phono preamp by 6 dB. You'll do that by installing R2 equal to 243 Ohms. That makes the preamp more resistant to overload, and will make it cleaner on the most highly modulated records.
- If you often run your preamp with the volume clock position higher than 12 o'clock, then you should maintain the stock gain, and you'll install R2 equal to 121 Ohms (very near the original stock value of 120 Ohms).

Think about how you'd like to proceed, and circle your preference here:

- Drop gain by 6 dB to increase overload margin, R2=243 Ohms
- Keep gain at stock level. R2=121 Ohms.

Prerequisites

The PAT4PWR supply must be installed in order to install the phono preamp upgrade. The reason is that the PAT4PWR supply generates a -17.5 Volt supply that is used to bias the phono preamp in the upgraded design.

Preparing to Remove the Circuit Boards

1. Disconnect the PAT-4 from your music system.
2. Unplug the power cord and allow the preamp to sit for one minute before moving on.

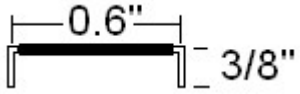
Caution: Be sure that the preamp power is unplugged! 120 VAC can be lethal! 240 VAC can be lethal!

3. Remove the 4 screws that hold the cover in place, 2 on the left side and 2 on the right side.
4. Lift the cover straight up and set it aside in a safe place.
5. The kit is supplied with two sets of number labels, one for the right channel, and one for the left channel.
6. Mark all the wires that connect to the left channel (it's the one closer to the back of the chassis) PCB using the supplied labels. These labels have an eyelet number, and the letter B, for back. Make sure that the label numbers match the eyelet numbers etched in the copper traces on the solder side of the PCB. This will help you get the preamp back together after the modifications.
7. Desolder all the wires from the left channel PCB after they are labeled. Be careful not to put too much stress on the selector switch.
8. Mark all the wires that connect to the right channel (it's the one closer to the front of the chassis) PCB using the supplied labels. These labels have an eyelet number, and the letter F, for Front. Make sure that the label numbers match the eyelet numbers etched in the copper traces on the solder side of the PCB. This will help you get the preamp back together after the modifications.
9. De-solder all the wires from the right channel PCB after they are labeled. Don't put too much stress on the selector switch as you remove these wires.
10. The wires that used to go to eyelets 6, 7, and 8 will not be reconnected to the PCB. Carefully identify just these three wires, clip them near where they meet the selector switch, and discard these three wires. In subsequent assembly, eyelets 6 and 7 will remain open, and eyelet 8 will get a wire from the -17.5 Volt power supply.
11. Repeat the process for wires 6, 7, and 8 of the right channel PC board, the one closer to the front of the preamp.
12. Prepare to remove the two PCB's and the bracket that holds them in place by carefully dressing the wires out of the way,
13. Remove the two 6-32 nuts, lock washers, and screws that hold the U-shaped brackets that retain the circuit boards to the bottom of the chassis.
14. Remove the assembly of the brackets and the two PCB's from the chassis.
15. Remove the 4-40 hardware that holds the PCB's to the U-shaped bracket. Keep track of the lock washers, and remove them so they don't float around inside the preamp or on the PC board.
16. Once both boards are removed, clear the solder from the numbered eyelet holes. If you have official de-soldering equipment, use it. If you don't, you may want to use the Toothpick Trick (see Appendix 1 and 2) to clear the solder from these eyelets. Doing so will make reassembly much easier. Check for daylight visible through all the holes, and/or that they will pass a piece of bare hook-up wire.

PC Board Modifications

The listed procedure will be repeated for both left and right channel PC boards. In general, you will:

- Remove the indicated component
- Clear the solder from the associated PCB mounting holes
- Install the new component, carefully following the directions, as you'll mount some of the new components in unconventional ways to generate the upgraded topology of the phono preamp.
- Make a check-mark the left or the right channel board as you complete the step.

Remove this	**Install this**	Done ✓	Done ✓
Remove R1	Replace R1 by a 1K resistor (brown, black, black, brown, brown)[1]	☐	☐
Remove R3	Replace with 33K2 resistor (orange, orange, red, red, brown)	☐	☐
Remove R4	Replace R4 by a jumper made from the supplied 22 AWG black solid wire 	☐	☐
Remove R5	Replace R5 with a 48K7 Ohm resistor (yellow, gray, violet, red, brown).	☐	☐
Remove R6	• Replace with 3K32 resistor (orange, orange, red, brown, brown) supplied, or • Alternatively, you can replace R6 with the supplied 1650 Ohm resistor (brown, blue, green, brown, brown), but that requires you to modify your Update-mydynaco PAT4PWR.	☐	☐
Remove R7	Replace with 56K2 resistor (green, blue, red, red, brown)	☐	☐
Remove R8	Replace with 4k75 resistor (yellow, violet, green, brown, brown)	☐	☐
Remove R9	Replace R9 with a 25K5 Ohm resistor (red, green, green, red, brown).	☐	☐
Remove R30, if your board has it. If it's present, it will be parallel to C4, between C4 and the eyelet edge of the board.	If your board has a place for R30 then replace R30 with the enclosed 48K7 resistor (yellow, gray, violet, red, brown). If your board doesn't have a place for R30 then you'll wait to the end of this section to add R30 to the board.	☐	☐

[1] In Rev A of the kit, R1 was replaced by a jumper. Using a 1K resistor provides slightly higher white noise levels but typically less hum.

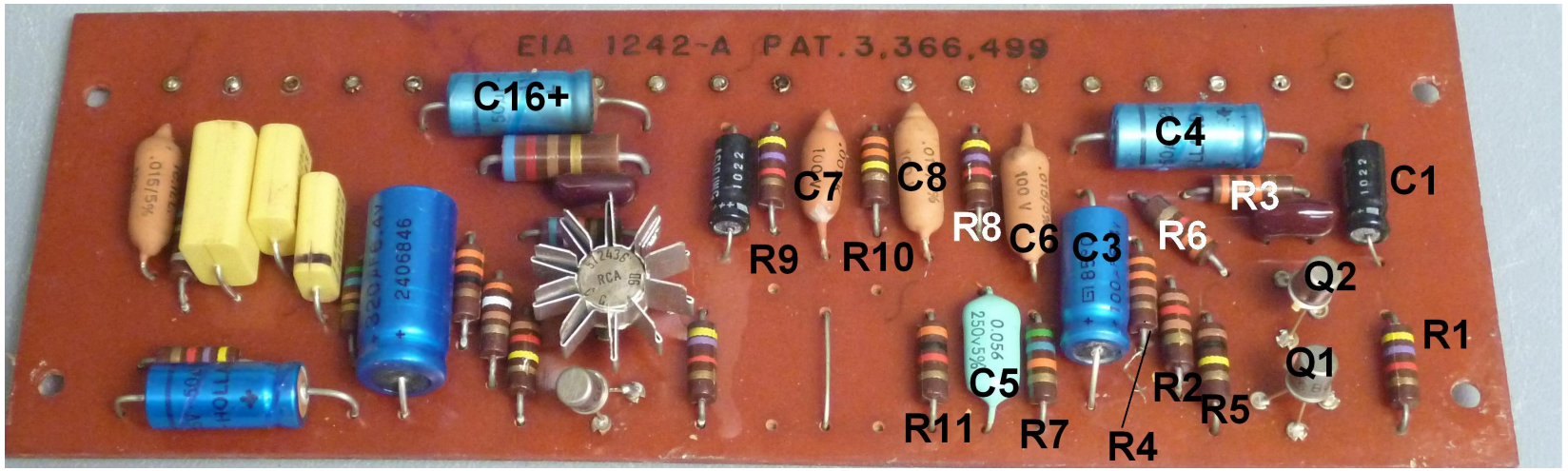


Figure 1-Stock PCB (before upgrade)

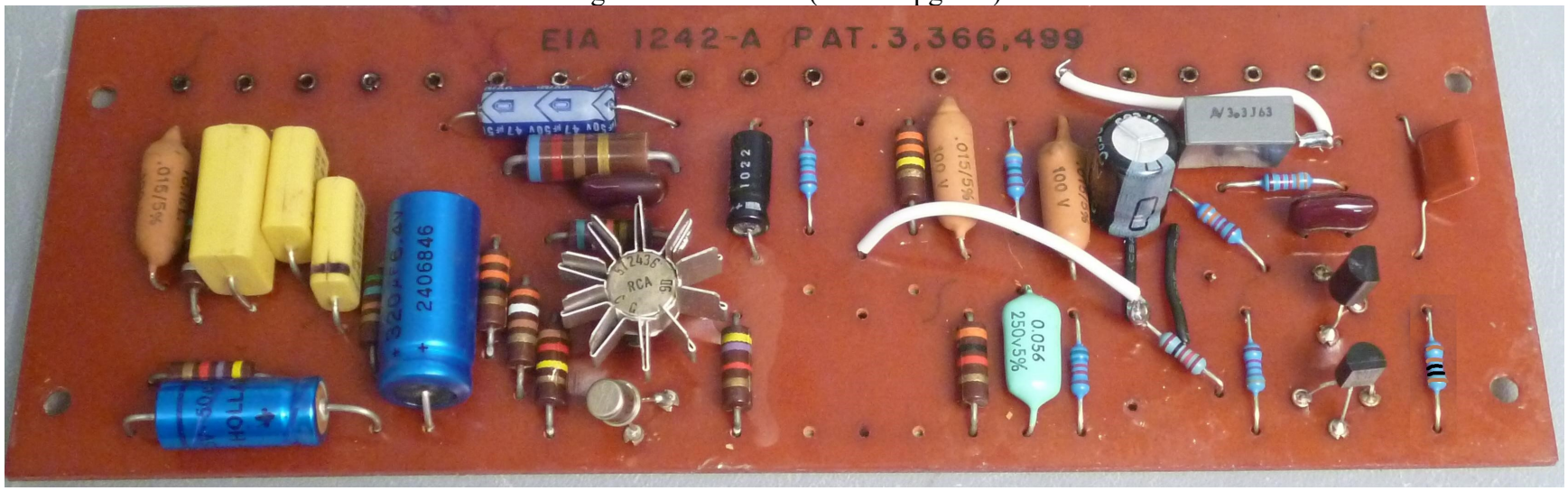


Figure 2-Stock PCB (after upgrade)

Remove C1	Replace C1 with a 0.33 µF film capacitor (carries the number 334 on the body).	☐	☐
Remove C3.	Replace C3 with a 1000 µF electrolytic capacitor. Slide a ½" piece of insulation stripped from the supplied black 22 AWG wire over the ***negative*** lead of C3. Stretch the negative lead out as shown in Figure 3, leaving it full length Install the positive lead of the new cap into the hole formerly occupied by the negative lead of the old C3.	☐	☐
Remove R2	Replace R2 by either a 1. 121 Ohm resistor, stock value, (brown, red, brown, black, brown), or a 2. 243 Ohm resistor, gain lowering value, (red, yellow, orange, black, brown), depending upon how you answered the volume control question at the beginning of the manual. Connect only the lead that goes to Q1's emitter, leaving the other lead unconnected for now. See Figure 3.	☐	☐
Remove C7	Note: The bottom C7 hole will be used shortly.	☐	☐
Remove the jumper directly below C7	Nothing goes in its place.	☐	☐
	Cut a 2" long piece of white stranded 22 AWG wire. Strip ¼" of insulation from each end.	☐	☐
	Twist together the free ends of C3 and R2 with one end of the white wire from the previous step. Solder the connection.	☐	☐
	Connect the free end of the white wire to the component hole on the PCB. See Figure 3. The bottom of C7 was previously connected there.	☐	☐

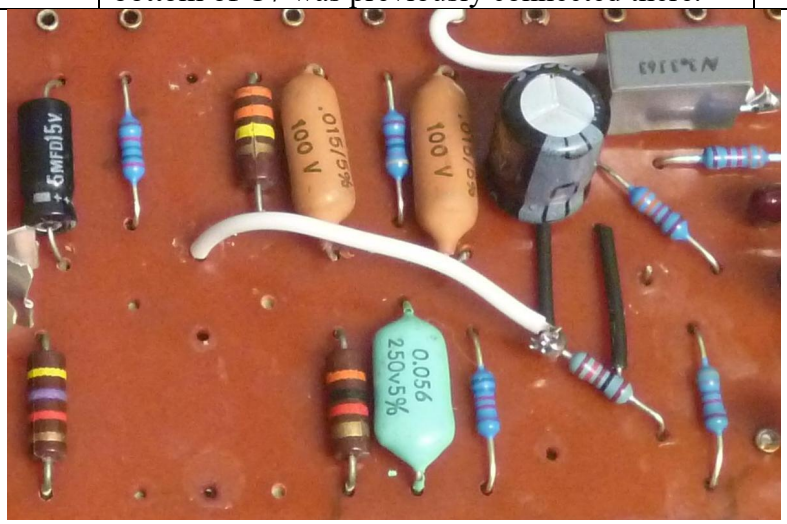


Figure 3-Detail of R2-C3-white-wire connection

Remove Q1	Replace Q1 by the MPSA18. Match the orientation of the flat to Figure 2.	☐	☐
Remove Q2	Replace Q2 with an MPSW45A. The flat side faces the near edge of the board, see Figure 2.	☐	☐
Remove C16[2]	Replace C16 with the supplied 47 µF 50 Volt capacitor. Make sure to get the polarity correct.	☐	☐

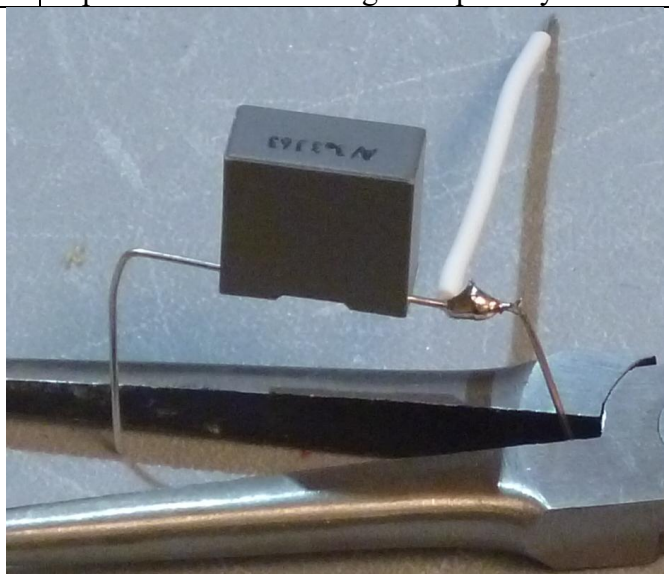


Figure 4-Preparing C4 for installation

	Cut a 2" white wire (22 AWG stranded) and strip ¼" of insulation from both ends. Twist the white wire around one lead of the new C4, a 3.3 µF 63 Volt film cap and solder it. See Figure 4.	☐	☐
Remove the old C4, a 50 µF 25 Volt capacitor.	Place the new C4 assembly into the board as shown in Figure 2 and Figure 7. For now, solder C4's right hand lead on the back of the board, but not the left-hand lead.	☐	☐
	Solder the free end of the white wire from C4 into eyelet 6.	☐	☐
	If your PCB has a location for R30, then solder the unsoldered (left-hand) wire of C4 on the back of the board, and you've completed the PCB Modifications.	☐	☐
	If your PCB doesn't have a location for R30, then see the next section for directions on installing R30 on the back of the board.	☐	☐

[2] C16 isn't part of the phono preamp. It's part of the high level stage. However, we'll replace it because it often goes bad due to its proximity to the heat generated by R20.

Adding R30 if your PCB doesn't have a place for it

Only perform the operations in this section if your PAT-4 is one of the early production models that did not have a place on the PCB for R30.

Insert a 48K7 Ohm resistor into the back of the board as shown in Figure 5. Note that two leads fit in the one hole that connects to eyelet 5: C4's still unsoldered lead, and R30.

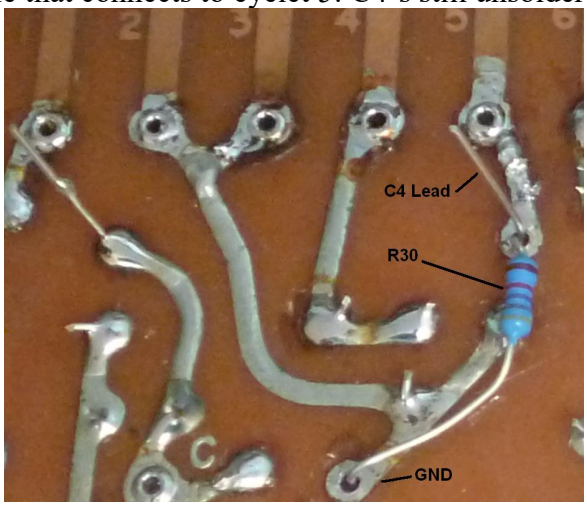


Figure 5-Insert R30 in from the back of the board

Solder both sides of R30. On the Eyelet 5 side, you'll solder C4 and R30 leads simultaneously. Clip the extra lead length on both sides of the board.

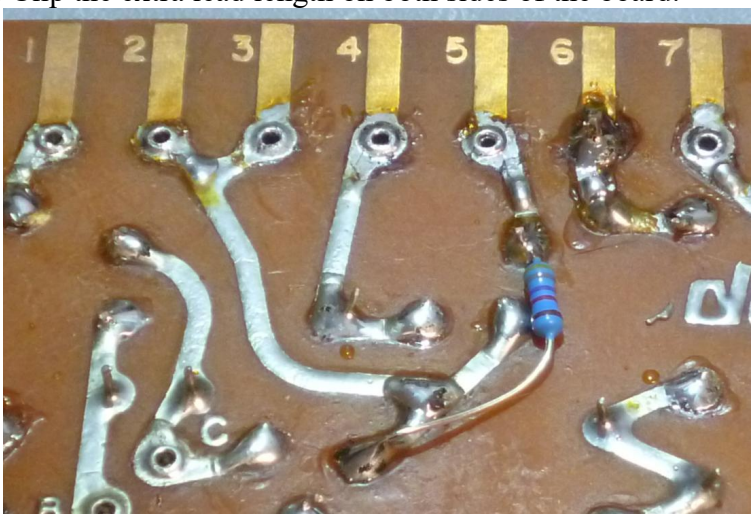


Figure 6-Final step of R30 installation in those cases where holes don't already exist on the PCB

Installing the DRD4 Kit

If you purchased a DRD4 Kit, this is the perfect time to install it. See the DRD4 manual for details. The special DRD4 transistor and heat sink replaces the stock transistor Q4 and its star-shaped heat sink.

PAT-4 PWR Modifications (Optional)

*The modification in this section must be performed **only** if you chose to install the 1650 Ohm resistor for R6.* That change doubles the output current available from the phono

preamp. Using R6=1650 Ohms can be beneficial in some cases, but is not necessary. It's most likely to matter if you have a high output cartridge playing highly modulated records with lots of high frequency content.

Making this modification nearly doubles the current drawn by the phono preamp, so you'll also need to make a modification to the PAT4PWR power supply.

PAT4PWR Power Supply Modification	
Remove R15	Replace with 2K resistor (red, black, black, brown, brown)
Remove R19	Replace with 2K resistor (red, black, black, brown, brown)

Inspection and Preliminary Reassembly

Inspect your work for good solder joints and freedom from solder bridges. Touch up any questionable connections now. It will be painful to have to disassemble things to repair something later. Verify that the eyelets along the tops of the boards are free of solder and are ready to accept the labeled wires.

Attach the PC boards to the U-shaped bracket. Use the original 4-40 screws and the new 4-40 keps nuts. They have captive lock washers that simplify reassembly. Screw the assembly of PC-boards and U-shaped bracket back into the PAT-4 chassis. Use the original 6-32 screws and the new 6-32 keps nuts (also with captive lock washers).

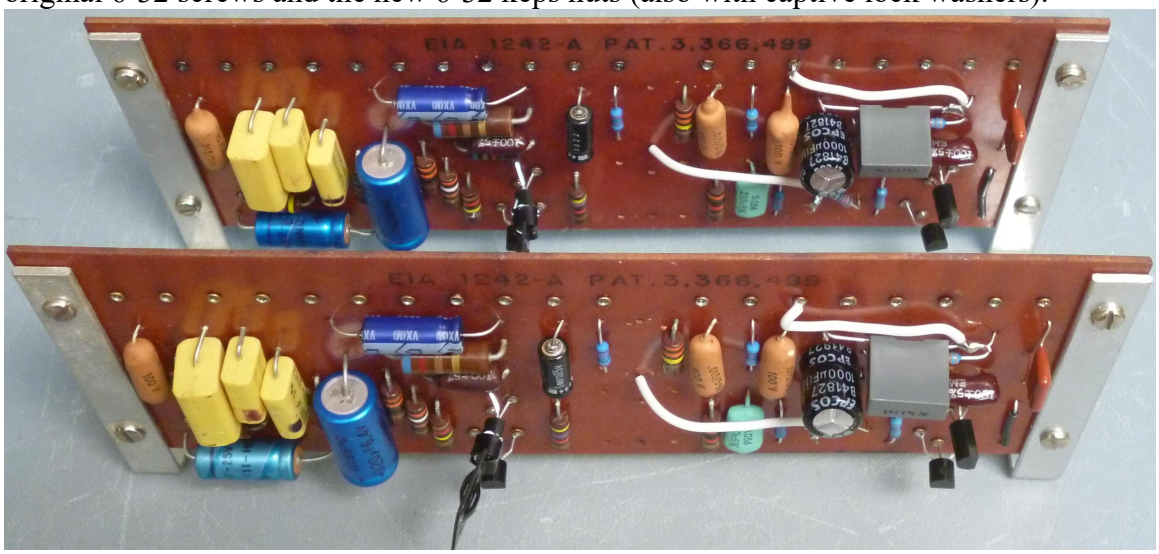


Figure 7-Both PCBs reassembled onto U brackets, ready for installation (DRD4 kit installed also)

Final Wiring and Reassembly

These Steps Are Important!	Done ✓	Done ✓
You'll see that the PEC 555005 attaches to a number of pins around the phono inputs. Cut lead 3 of PEC 555005 near where it attaches to the center conductor of the RCA jack labeled "Phono Low", leaving the lead as long as possible. Bend the lead out of the way, and tape it if necessary to keep it from shorting anything. Repeat this for both the left and right channel PEC's. *Don't cut the wire that goes to the selector switch! It must remain in place.*	☐	☐
Using the wire labels to guide you, reconnect the rest of the wires to the front preamp PCB, with the exception of eyelets 6, 7 and 8.	☐	☐
Run a wire from eyelet 8 of the left-channel board to one of the negative 17.5 volt outputs (N17P5) of the PAT4PWR board.	☐	
Using the wire labels to guide you, reconnect the rest of the wires to the back preamp PCB, with the exception of eyelets 6, 7 and 8.	☐	☐
Run a wire from eyelet 8 of the right-channel board to the other of the negative 17.5 volt outputs (N17P5) of the PAT4PWR board.	☐	

If you want 5 high level inputs and 1 phono input

Perform the modifications in this section ONLY if you want 5 high level inputs and 1 phono input. After performing these modifications, TAPE HEAD and SPECIAL will both accept normal high level inputs.

If you want to have the capability for three phono inputs (using the phono, tape head, and special inputs), then skip this section.

Ground Changes	Done ✓
Desolder the ground wire from FRONT PC-16, eyelet 2. Cover the bare portion with electrical tape, but leave it connected to the switch.	☐
Desolder the ground wire from REAR PC-16, eyelet 2. Cover the bare portion with electrical tape but leave it connected to the switch.	☐
Remove the following ground wires at the rear panel: a. Short Lug 2-3 to Short Lug 4-5 b. Short Lug 13-14 to Short Lug 15-16	
Add the following ground wires at the rear panel: a. Short Lug 4-5 to Short Lug 6-7 b. Short Lug 15-16 to Short Lug 17-18	

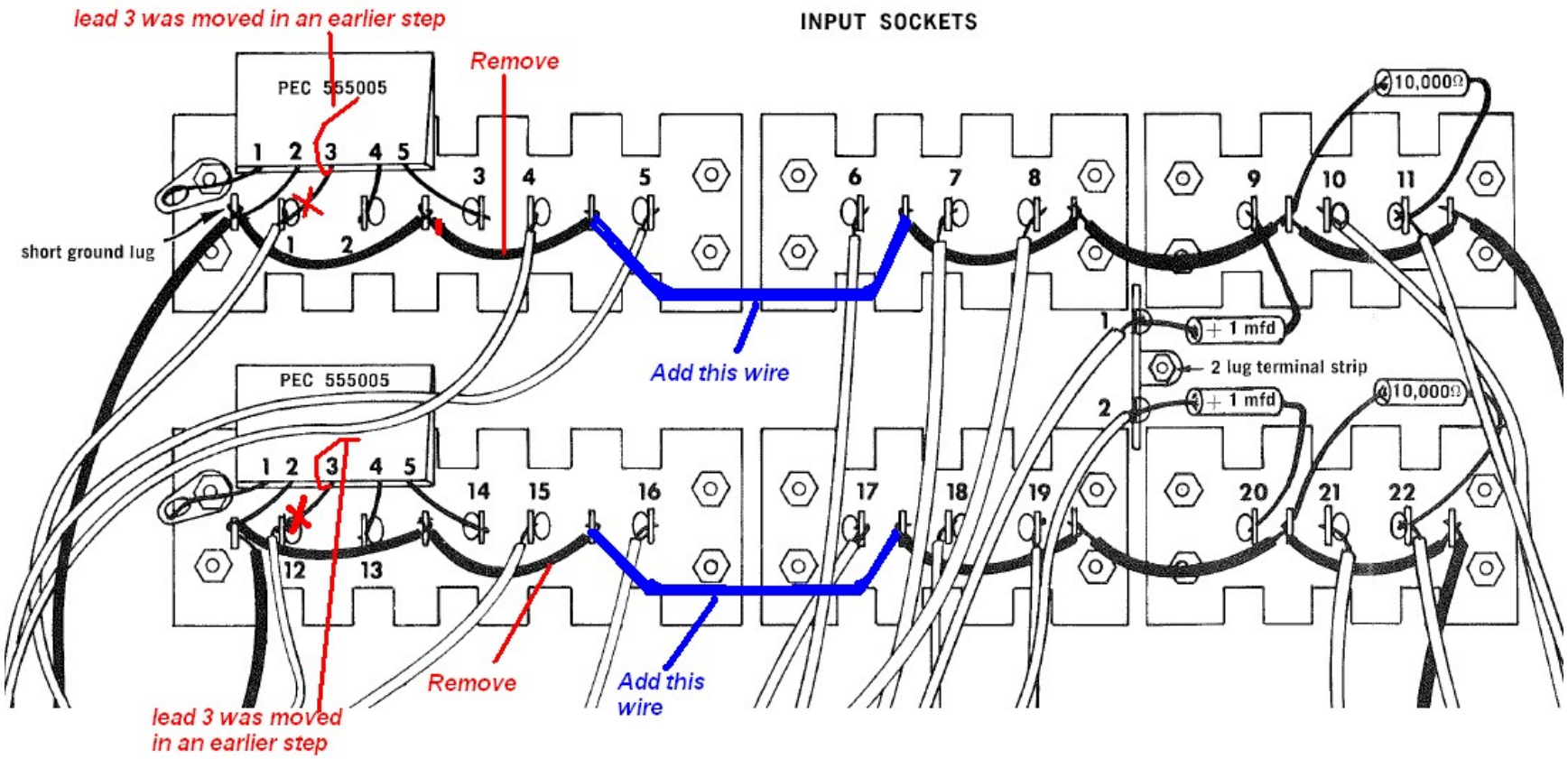


Figure 8-Changes to grounds for 5 high level input version of PAT-4

Disconnect the following wires from the PC-16's by de-soldering them.	Done ✓
Front PC-16, Eyelet 1	☐
Front PC-16, Eyelet 5	☐
Twist the above two wires together, solder, and tape the connection.	☐
Rear PC-16, Eyelet 1	☐
Rear PC-16, Eyelet 5	☐
Twist the above two wires together, solder, and tape the connection.	☐

Refer to Figure 8 as you perform these steps:	Done ✓
Desolder (or clip) the wire that connects to back-panel terminal 1 (this is the left channel phono input jack). Untwist this wire from the others, and route it and connect it to eyelet 5 of the REAR PC-16. (On some PAT-4's, it may be so short that you'll have to replace this wire with a longer wire.)	☐
Desolder (or clip) the wire that connects to back-panel terminal 12 (this is the right channel phono input jack). Untwist this wire from the others, and route it and connect it to eyelet 5 of the FRONT PC-16.	☐

Reconnect the phono jacks with Shielded Cable Directly to the PC-16's	Done ✓
Prepare an 11" long piece of shielded cable. See Appendix 3. Connect one end to the RIGHT channel PHONO LO input jack as follows: a. Ground wire to ground terminal of phono low connector b. Center conductor to signal terminal of phono low connector	☐
Connect the other end of that piece of shielded cable: c. Ground wire to eyelet 2 of the FRONT PC-16 d. Center conductor to eyelet 1 of the FRONT PC-16	☐
Prepare a 5" long piece of shielded cable. Connect one end to the LEFT channel PHONO LO input jack as follows: e. Ground wire to ground terminal of phono low connector f. Center conductor to signal terminal of phono low connector	☐
Connect the other end of that piece of shielded cable: g. Ground wire to eyelet 2 of the REAR PC-16 h. Center conductor to eyelet 1 of the REAR PC-16	☐

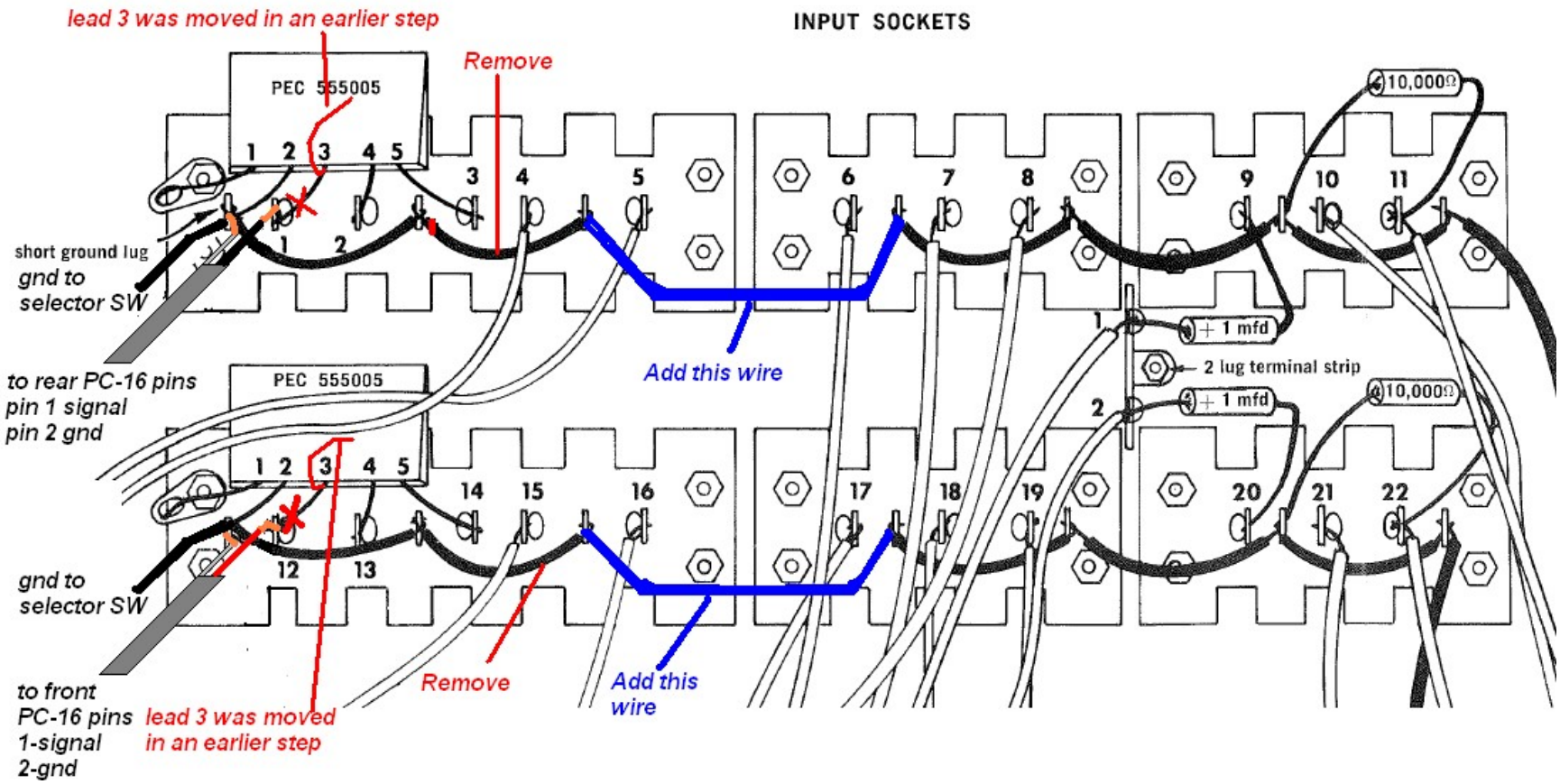


Figure 9-Adding shielded cable as part of the 5 high level input modification

Final Sanity Checks

Here are a few last tests before you reconnect your PAT-4 to your music system. With the top still off, plug in the AC mains. Turn on the power switch. Set your meter to DC volts. Connect one lead of the meter to ground.

Be careful! These steps are performed with the power connected and turned on!	Done ✓	Done ✓
The voltage on eyelet 8 of both preamp PCB's should measure between -17 and -18 Volts DC (with respect to ground).	☐	☐
The voltage on eyelet 4 of both preamp PCB's should measure between 17 and 18 volts DC (with respect to ground).	☐	☐
The voltage on eyelet 12 of both preamp PCB's should measure between 36 and 40 volts DC (with respect to ground).	☐	☐

Prepare to Reconnect your PAT-4 to your Music System

- Turn off the power.
- Remove the AC plug from the wall socket.
- Replace the cover.
- Reinstall the four screws that hold the cover in place.
- Reinstall the PAT-4 to your music system.
- Notes:
    - Use the PHONO LOW input for your turntable. The other two PHONO inputs, PHONO HIGH and PHONO CER are disconnected.
    - If you chose the three phono wiring, then:
        - The TAPE HEAD input will also be equalized for a turntable, so it could be used as an input for a second turntable
        - The SPECIAL input will also be equalized for a turntable, so it could be used as an input for a third turntable
    - If you chose the 5 high level and one phono wiring, then:
        - The TAPE HEAD input is a high level input
        - The SPECIAL input is a high level input

Appendix 1: The Toothpick Trick

This appendix describes an easy way to clear the solder from a hole in the PCB. It can also be used to clear the solder from terminals on pots or jacks. Doing so makes it easier to install a new component, or reinstall wires that were temporarily removed to allow access to some other component.

All you'll need is a soldering iron and some toothpicks with sharp points. The diameter of the pointed part of the toothpick must be smaller than the diameter of the hole that you're trying to clear.

Heat the solder land on the component side of the board until the solder flows. Insert the toothpick from the component side of the board while pushing and twisting the toothpick. If the solder has melted, the toothpick should push through the board, displacing the

solder. Remove the soldering iron, but let the toothpick remain in the hole until the solder has solidified. Now remove the toothpick. There should be a hole through the solder sufficiently large to allow you to insert the component lead or wire.

Sometimes, a bit of the toothpick will break off in the hole. If this happens, use a stiff piece of wire to push the toothpick fragment out of the hole.

Appendix 2: First Class De-soldering

De-soldering can be easy if you have the right tools. Through the years, I've used a number of "make-do" methods:

- The toothpick trick – not bad for clearing a hole if the diameter is big enough.
- Sold-a-pult- these spring loaded, one shot solder vacuums are a step in the right direction, but can't supply both heat and vacuum action simultaneously. Some people cut a v-shaped hole in the tip to poke the soldering iron through, but it's still a bit hit or miss, and frustrating.
- Solder wick- this is copper braid that you heat up in connection with the joint. The idea is that the solder wicks into the copper braid, away from the joint. It's still slow and frustrating, and takes so much heat that you worry about the board.

At some point, you'll decide that you deserve a better way to desolder, and you'll buy a heat source with a built in continuous vacuum pump. Big industrial units can cost many hundreds of dollars. Here's the best value I've found so far, the Hakko 808. I bought mine for about $180, and it's worth every penny. Often when I de-solder components, the action is so clean that they just fall out of the board.

Once you've treated yourself to a real de-soldering tool like the Hakko 808, you'll wonder why you waited so long.

Schematics

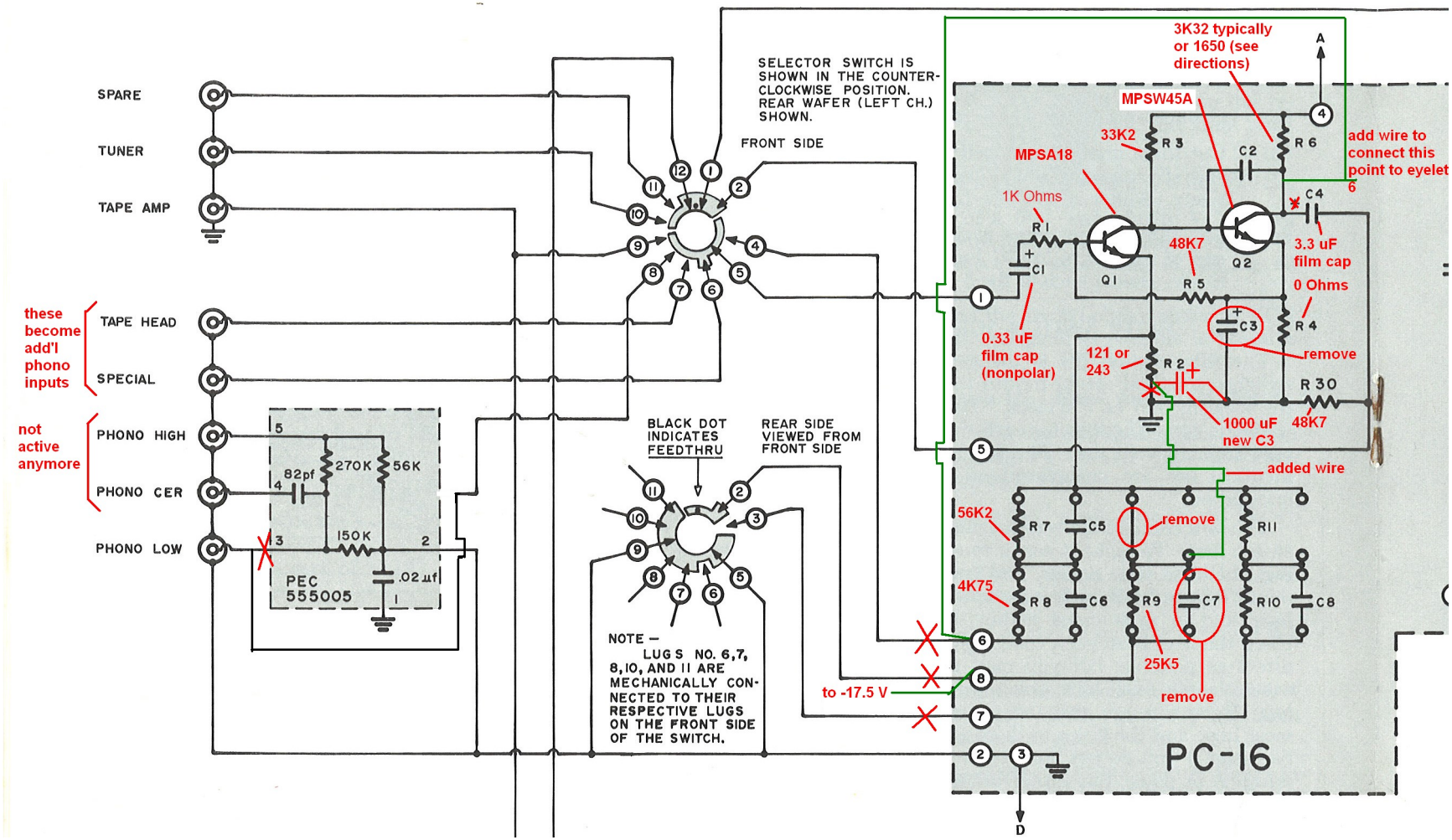


Figure 10-Schematic shows phono preamp with modifications (3 High level and 3 phono level inputs)

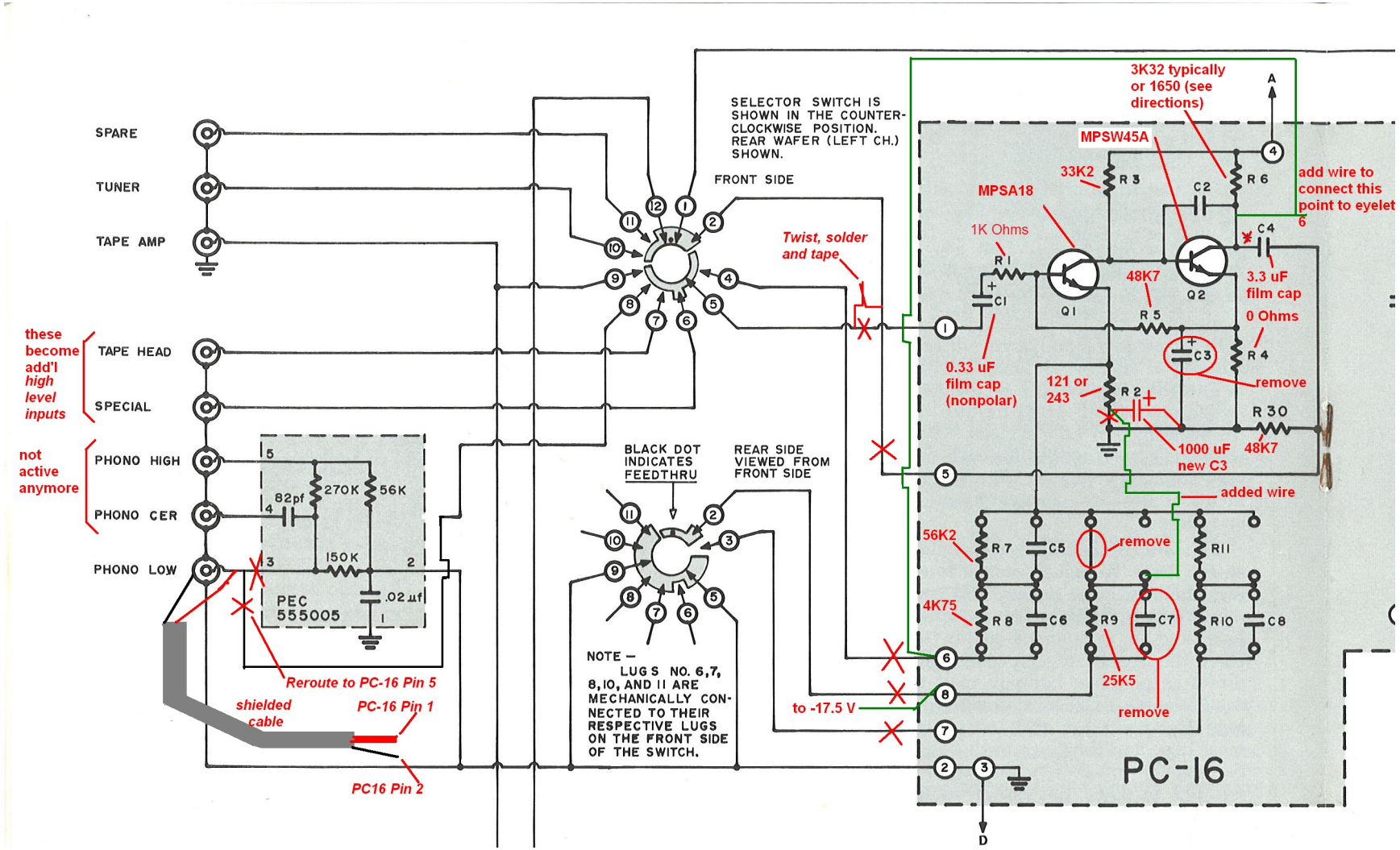


Figure 11-Schematic when modified for 1 phono and 5 high level inputs

Record Playing Reminders

If it has been a while since you've played records here are a few hints that you may find useful.

- The ground wire between the turntable and the ground screw on the back-panel of the PAT-4 preamp must be connected to minimize the hum. Usually, that wire runs loosely along with the RCA cords.
- Check your tracking force and anti-skating force. Re-balance your tone arm if it has been a while.
- Make sure that the grounding crown of the RCA plugs fit snugly around the grounds of on the preamp inputs. A good connection is important for low noise performance.
- Remember that PHONO LOW, TAPE HEAD, and SPECIAL inputs are all available for playing records now. You might find an advantage to using TAPE HEAD or SPECIAL, just because the jacks are likely to be less worn.
- Watch for acoustic feedback that can arise if the speakers are too close to the turntable. Increasing the space between the speakers and the turntable will help.
- The signal to noise ratio (SNR) of a record isn't what you're used to with digital, it's less. Still, the music on the records mostly masks the noise, except in soft portions, or if the record is worn or dirty.
- Is one channel out? Swap phono outputs and preamp inputs to get to the bottom of the problem. This will let you figure out if it's a turntable/cartridge problem or a preamp problem.
- A frequent source of "one channel out" problems in the turntable/cartridge system comes from bad connections between the wires in the head-shell and the phono cartridge. The push-on connectors become flakey. If this is the issue, you can often renew the connection by carefully rotating the push-on connector on the cartridge's input pin:
    - Be careful not to bump the stylus or catilever.
    - Hold the cartridge body in one hand.
    - Rotate the push-on connectors around the input pin using needle nose pliers. This will clean the crud, and also let you tell if the connections are so loose as to also cause a problem.
- Need more information on your old turntable? Visit www.vinylengine.com . They have an extensive collection of turntable service manuals.
- Why Vinyl? Because it seems to have a higher SAR (Soul to Annoying Artifacts Ratio) than most digital.

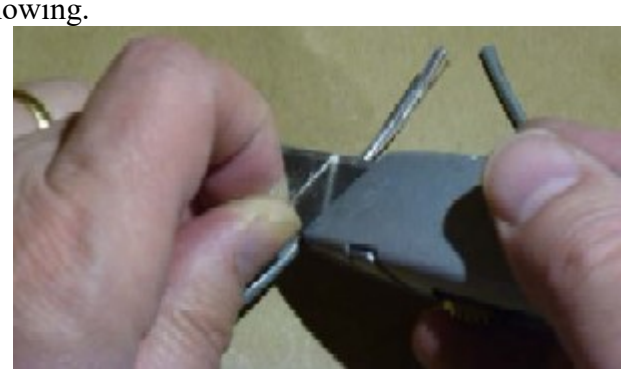
Appendix 3 - Preparing a Shielded Cable End

This section tells how to prepare the ends of the shielded cable. This process will be repeated four times, at both ends of both input cables (although the cables will have different overall lengths).

1. Cut the shielded cable to the overall required length.

2. Use a utility knife with a new, sharp blade to cut the plastic jacket of the shielded cable 1” back from the end. Hold the blade perpendicular to the cable, and draw it across the cable lightly as you rotate the cable along its long dimension. This creates a scored line through the plastic jacket. With a sharp blade, not much pressure is needed. You may need a bit of practice to get the feel.

3. If you’ve scored the jacket carefully, you can separate the jacket at the score line without using tools. Pull the insulating jacket off, exposing the cable, showing the foil shield, the drain wire, and the fuzzy string. The result is shown here, with the foil shield showing.



4. Cut off the fuzzy string.

5. Separate and twist the drain wire.

6. Peel back and remove the foil. Remove the plastic wrap from the red and black wires. The drain (bare wire), red, and black wires are exposed now that gray insulating jacket, foil shield, and plastic over-wrap have been removed.
7. To make a shielded cable for a right channel application, pull the black wire out of the shielded cable and leave the red wire for RIGHT channel signals.
8. To make a shielded cable for a LEFT channel application, pull the red wire out of the shielded cable and leave the black wire for LEFT channel signals.
9. Slip about half of the gray outer jacket you removed in the first step over the drain wire. This will keep the bare drain wire from contact something by accident.
10. Remove 3/8” of insulation from the red wire. Twist its strands tightly. Twist and tin the ends of the red wire and the drain wire.