Based on the BA183 amplifier circuit used in the 1066, 1073, 1272, and other Neve console modules, the N72 microphone preamp will deliver the same immediately recognizable transformer-colored character to your recordings.

Who Should Build This Kit?
The N72 is not difficult to build, but it is not intended for beginners. If you've never built an electronic project before, this is definitely **not** the one to start with. To guarantee success, make sure you have:

- The ability to make basic voltage and resistance measurements using a digital multi-meter (DMM).
- At least a rudimentary understanding of voltage, current, and resistance.
- Some experience soldering on printed circuit boards.
- The patience to follow instructions precisely and work carefully.

Essential Tools
Fine tipped 20-30 watt soldering iron w/ cleaning sponge (Hakko 936 or similar)
Eutectic (63/37) rosin core or "no clean" solder (.025" diameter is usually best)
Good-quality DMM
Small needle nose pliers
Small diagonal cutters
Wire stripper
Phillips screwdriver (#1)
Precision straight blade screwdriver (for adjusting potentiometers)

Highly Recommended Tools
Lead bender (Mouser 5166-801)
T-Handle wrench and 4-40 tap (Hanson 12001 and 8012)
MOLEX crimp tool (Waldom W-HT1919 or equivalent)
Magnifying glass

Optional Tools
Panavise w/ circuit board head
1/4" nut driver
5/16" nut driver
Oscilloscope
Signal generator

Work Area
Find a clean, flat, stable, well-lit surface on which to work. An anti-static mat is recommended for this project. If you're in a dry, static-prone environment, it's highly recommended. The importance of good lighting can't be overstated. Component markings are tiny, and you'll be deciphering a lot of them.

Soldering Technique

Make sure your iron's tip is tinned properly, and keep it clean! The trick to making perfect solder joints is to heat the joint quickly and thoroughly before applying the solder, and a properly tinned and clean tip is essential for this. Apply enough solder to form a "fillet" between the lead and the pad, a little mound of solder that smoothly transitions from the plane of the board up to the lead, **but don't use too much**. The finished joint should be smooth and shiny, not rough or gritty looking.

If you've never soldered a board with plated-through holes, you might be surprised to discover how difficult it can be to remove a component once you've soldered it in place. If you're using solder wick to correct a mistake, be very careful not to overheat the pads, since they will eventually delaminate and "lift". It's often better to sacrifice the component and remove its leads individually, and start over with a new part. If for some reason you need to unsolder a multipin component (like a rotary switch or integrated circuit), remove as much solder as you can with solder wick or a solder sucker, and then use a small heat gun to heat all the leads simultaneously. With care, you can remove the component without damaging the board.

Instruction Conventions

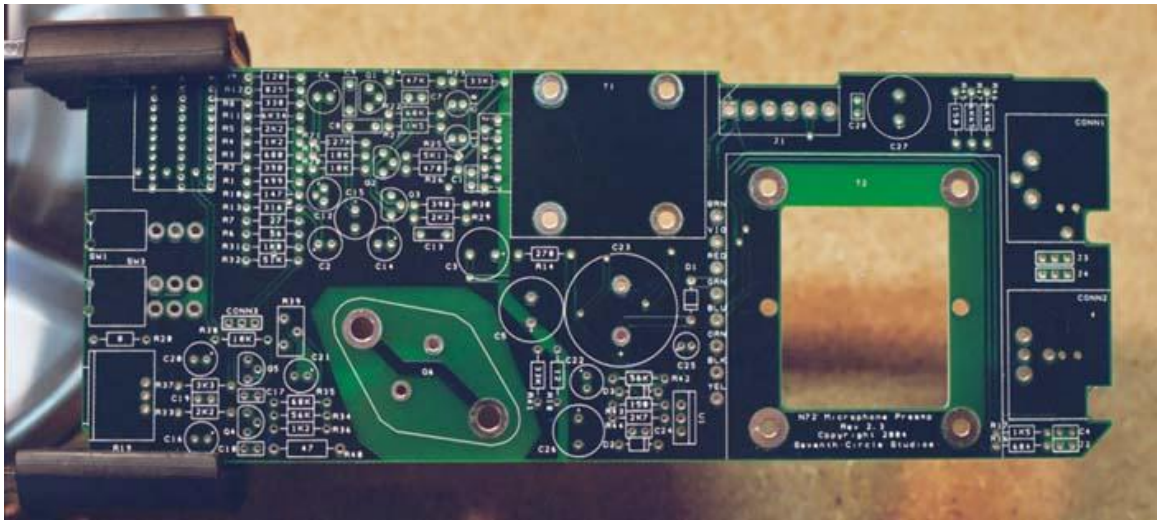
Text in **orange** indicates a step where extra care needs to be taken. Doing it wrong isn't a disaster, but it'll need to be corrected.

Text in **red** indicates a step that **must** be done correctly. Doing it wrong will guarantee improper operation, and probably damage components and/or the circuit board.

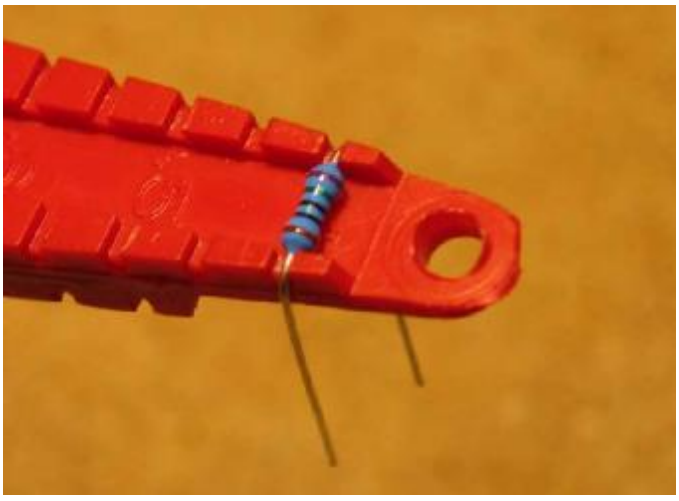
Assembly

1. Before you begin, carefully unpack the kit and examine the parts. Check the contents of each small bag against the BOM to make sure all the parts have been included. If you think something's missing, please e-mail the details to sales@seventhcircleaudio.com and we'll ship replacement parts ASAP.

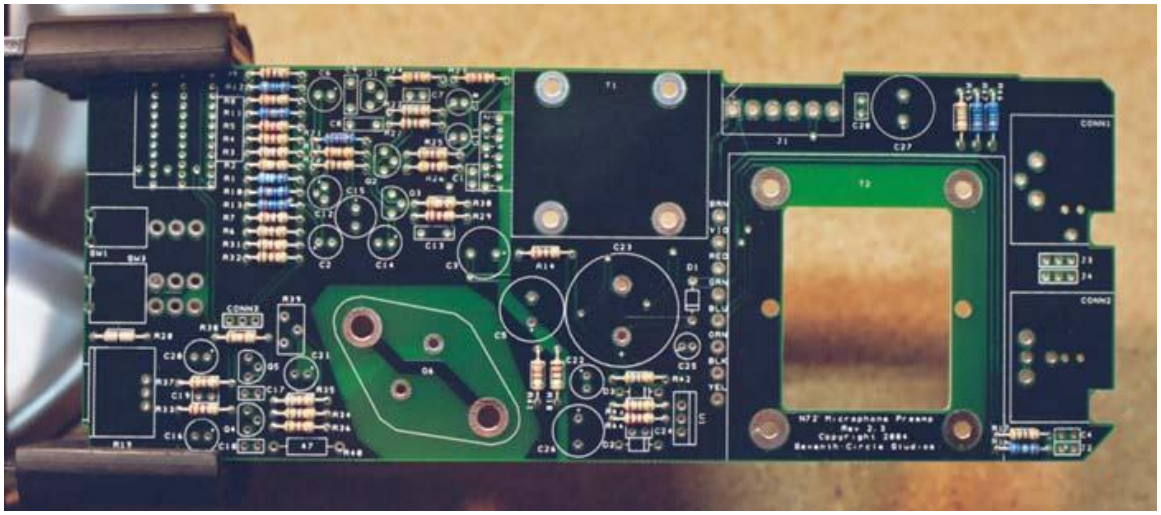
2. Generally, the idea when "stuffing" or "populating" a circuit board by hand is to start with the lowest profile parts, such as the resistors, and work your way up to the taller components. In each step below, insert the components, flip the board onto your work surface component-side down, and carefully solder and trim the leads. Use a piece of stiff cardboard to hold the parts in place while you flip the board. First, orient the board as shown.



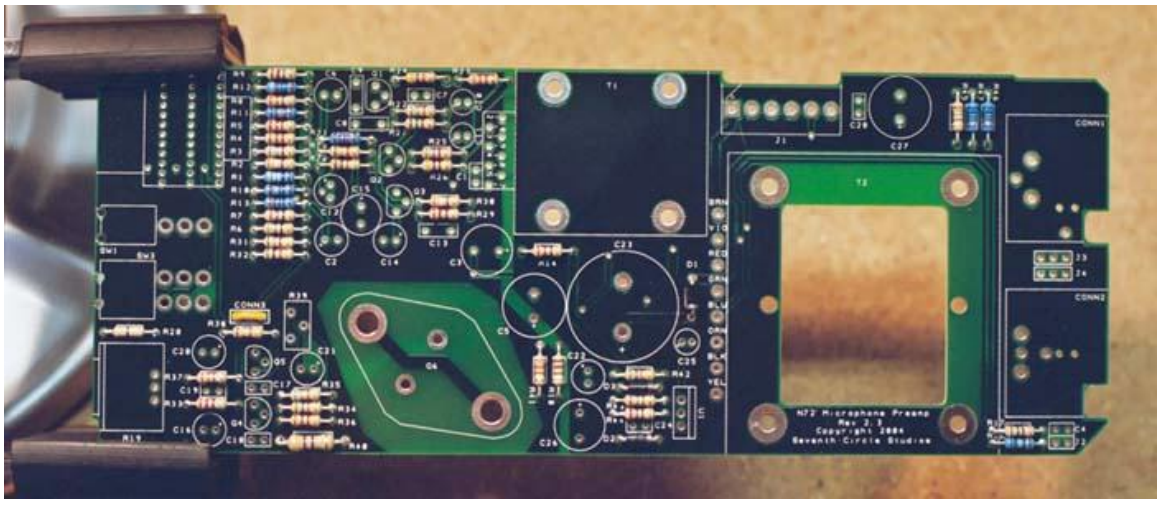
3. Before installing the resistors, prepare the leads using small needle nose pliers or a lead-forming tool as shown below. Whatever you do, don't bend the leads at the resistor body and force them into the board. This not only results in an ugly job, it can damage the parts.



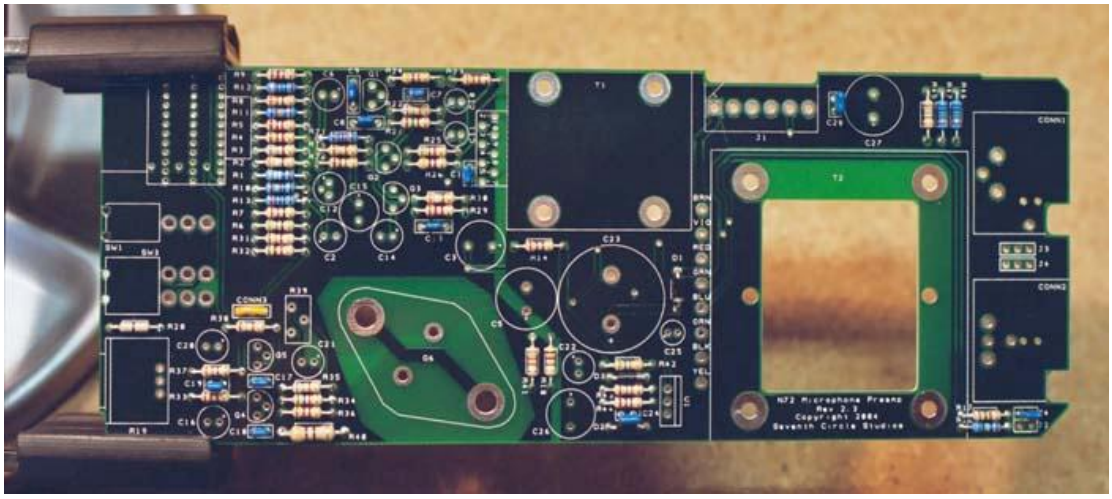
4. Insert the 1/4-watt resistors. Check the Bill of Materials (BOM) for help in reading the resistor color bands. It's also a good idea to actually measure each resistor with your DMM as you place it on the board, just in case you've decoded it incorrectly. Don't rely on the photos for component placement. If the resistor value silk-screened on the board doesn't agree with the value on the schematic or parts list, follow the schematic.



5. Add the lone 1/2-watt resistor, R40, and diodes D1 to D3. **Diodes are polarized and must be installed the right way round!** The colored band on the diode matches the white band on the silkscreen.

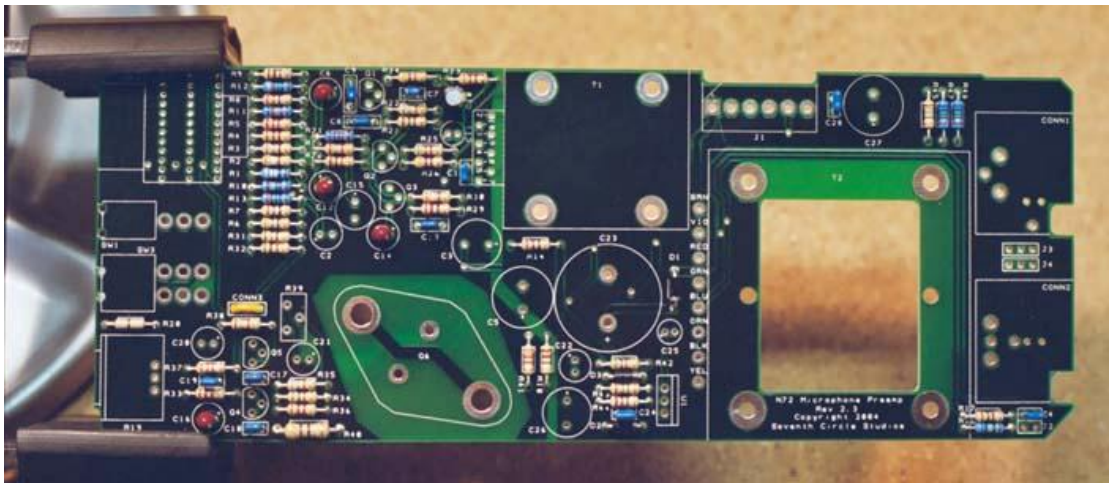


6. Add the ceramic capacitors. These capacitors are not polarized and can be installed in either direction, **but pay close attention to the capacitor markings!** These parts look very similar, but they are not interchangeable. Putting one in the wrong spot will not prevent the N72 from passing signal, but it can seriously impair its performance in a number of ways.



7. Add the tantalum capacitors, C6, C12, C14, and C16. **Tantalum electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when installing these parts. The **positive leads** of the tantalum caps are marked with a small "+" sign. The **positive pads** on the circuit board are marked with a small "+" sign.

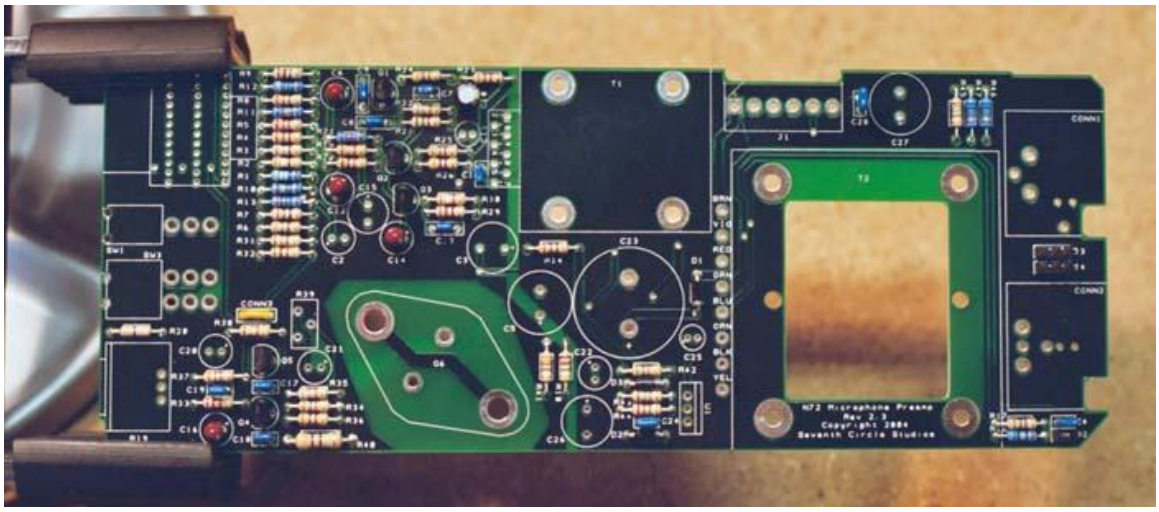
8. Add electrolytic capacitor C10. **Electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when installing these parts. The **negative leads** of the electrolytic caps are marked with a colored stripe. The **positive pads** on the circuit board are marked with a small "+" sign.



9. Add the 0.1" headers for J2 through J4. J2 connects a 604-ohm load resistor across the output. Unless you'll be connecting the N72 to a piece of older gear with 600 ohm input impedance, connect a shunt across J2.

J3 and J4 connect the XLR cable shields as shown in the table below. Unless you encounter issues with ground loop hum, jumper pins 2 and 3 on both headers. **A jumper must be installed at J3 to complete the phantom power circuit.**

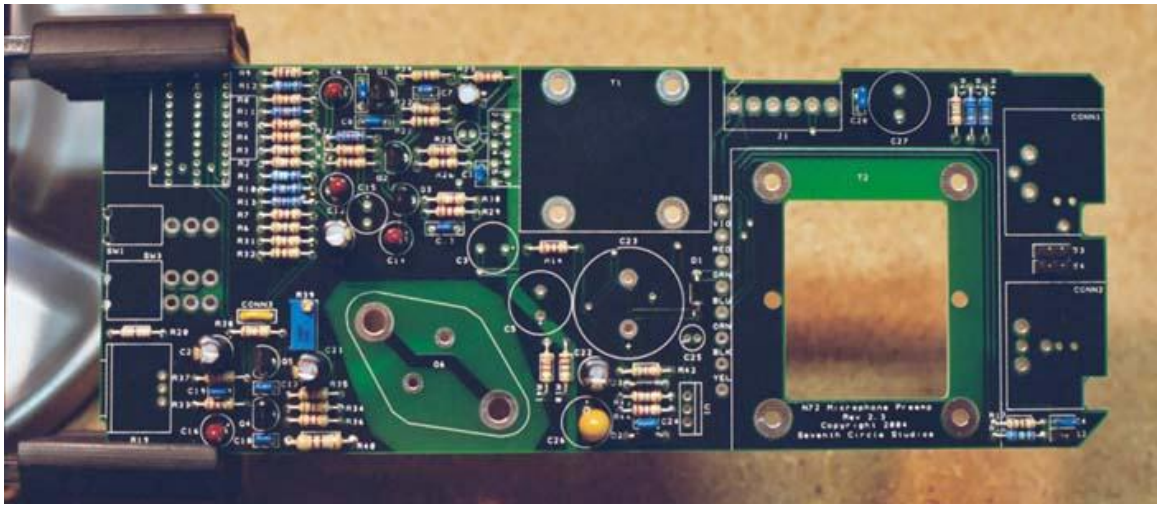
Jumper Location	Pins 1 and 2	Pins 2 and 3	No Jumper
J3 - Mic input	Power Ground	Chassis Ground	Floating
J4 - Line output	Power Ground	Chassis Ground	Floating



10. Add C2, C20, C21, C22, and C26. Again, **electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when installing these parts. The **negative leads** of the electrolytic caps are marked with a colored stripe. The **positive pads** on the circuit board are marked with a small "+" sign

11. Add Q1 through Q5, the BC184C transistors. Save Q6, the 2N3055, for later. Align the flat side of the transistor with the flat side of the silkscreen outline.

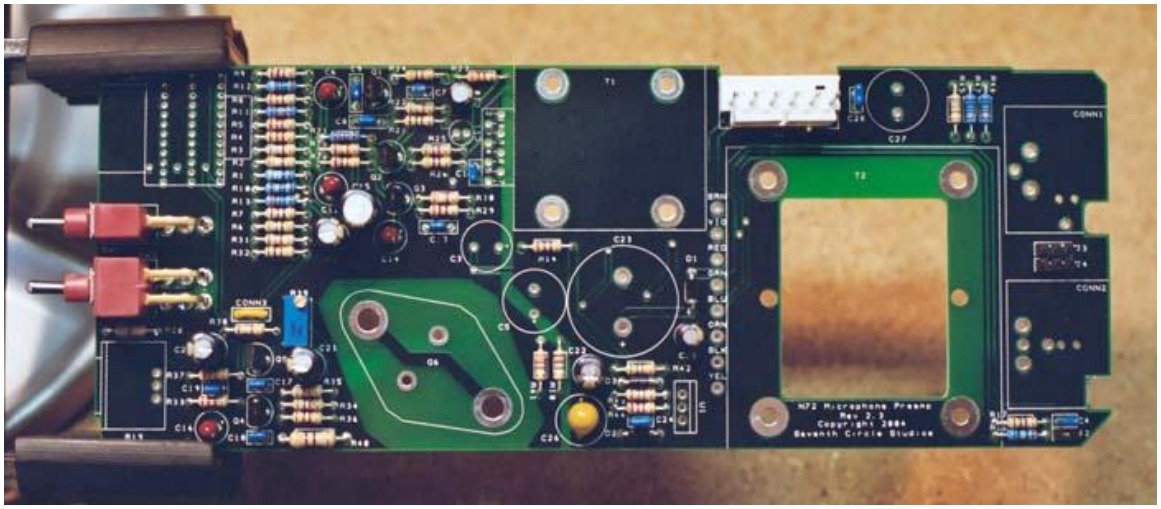
12. Add R39, the bias trim potentiometer.



13. Add C15, and C25. Again, **electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when installing these parts. The **negative leads** of the electrolytic caps are marked with a colored stripe. The **positive pads** on the circuit board are marked with a small "+" sign.

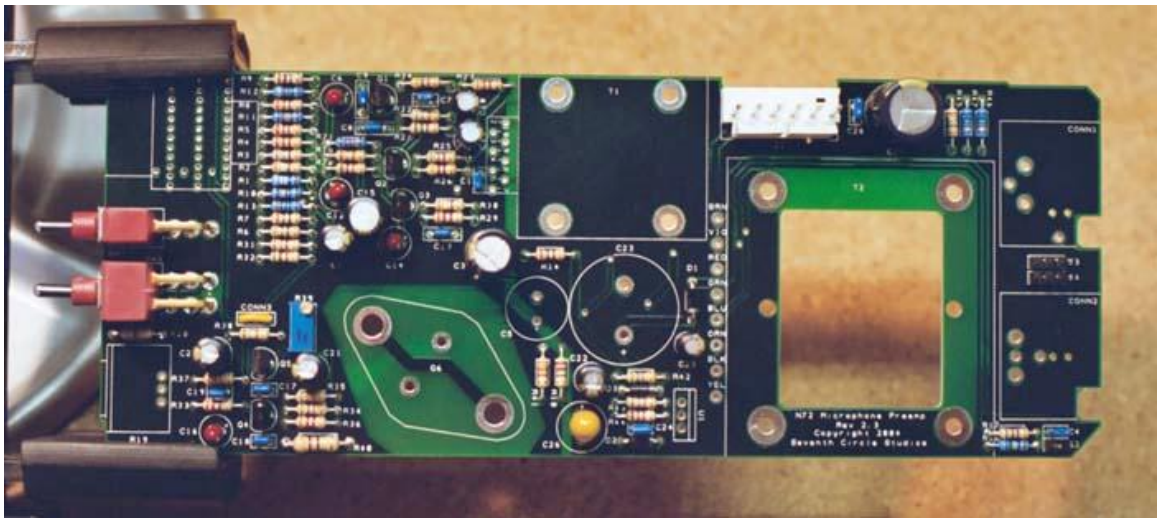
14. Carefully mount the toggle switches. Be sure they're seated flat on the board before soldering all of the pins. You may find it easier to solder the first pin with the board component side up.

15. Add J1, the MOLEX power connector. Be sure to orient it as shown, with the locking tab away from the edge of the board.



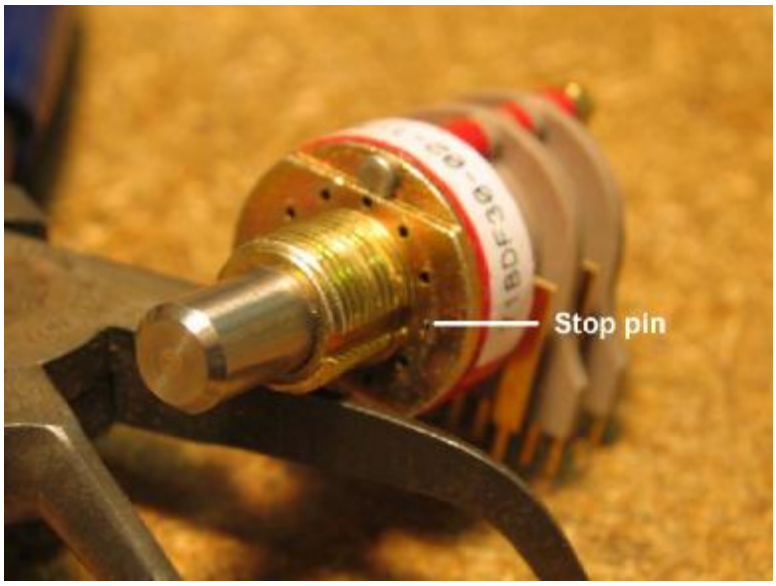
16. Add C3, C11 and C27. Again, **electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when

installing these parts. The **negative leads** of the electrolytic caps are marked with a colored stripe. The **positive pads** on the circuit board are marked with a small "+" sign.



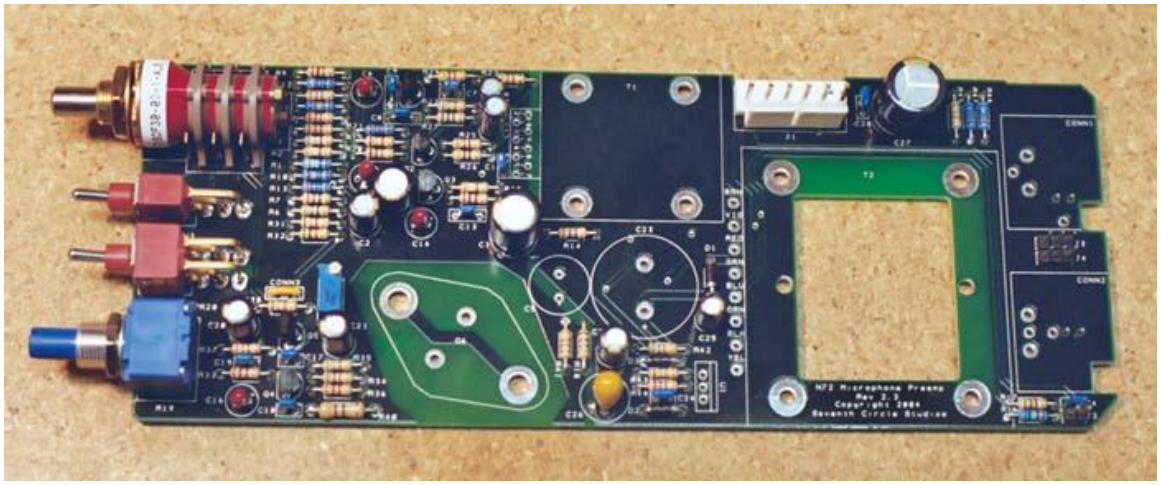
17. Attach gain trim control / output fader R19. Make sure the control is seated flat to the board before soldering the leads. You may want to add a small dab of silicone adhesive to the bottom of the control to hold it more securely, but it isn't necessary. If you want R19 to act as a 6dB trim control instead of a full fader, install a 10K resistor at R20 instead of a jumper.

18. Insert the stop pin in rotary switch SW2 at the position shown. Push the pin in completely.



19. Secure the pin with the adhesive foil supplied.

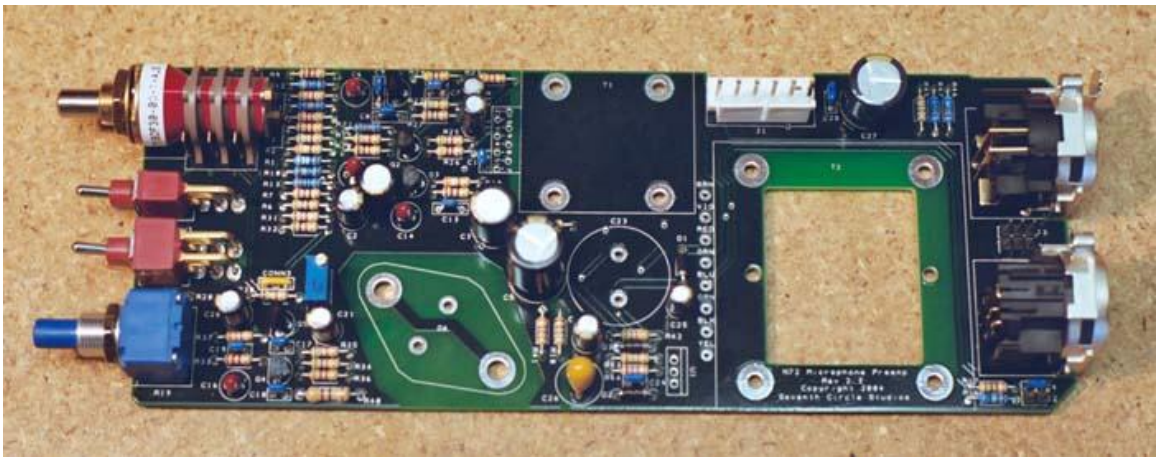
20. Make sure the switch is fully seated and solder it to the board. Try to make your solder joints as neat as possible, and don't use too much solder.



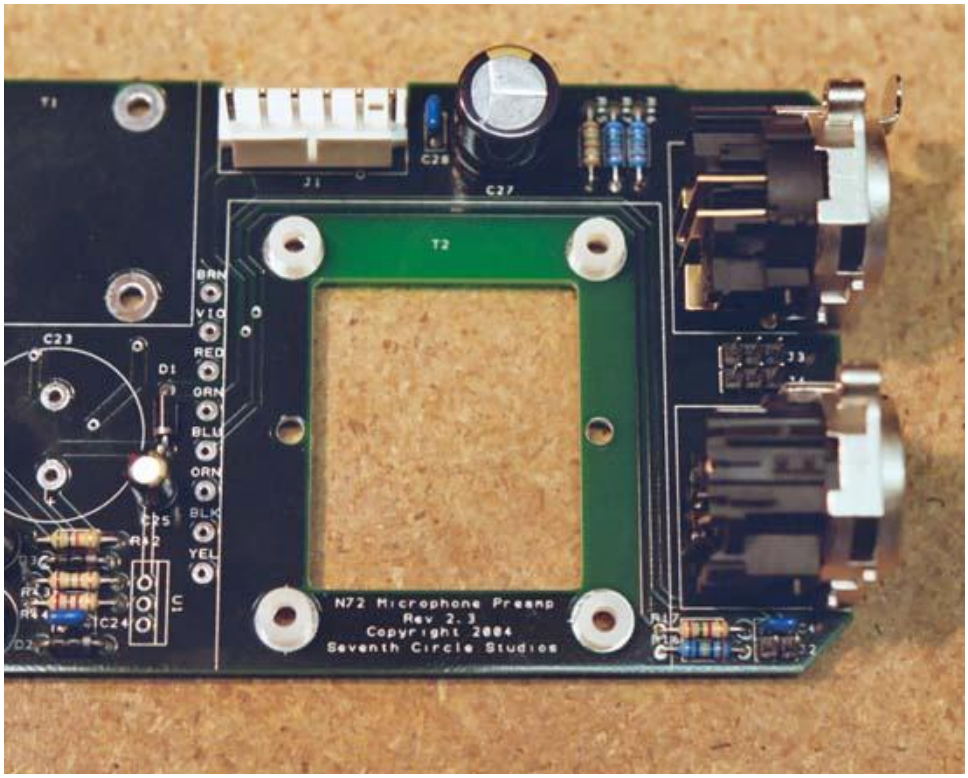
21. Add C5. Again, **electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when installing these parts. The **negative leads** of the electrolytic caps are marked with a colored stripe. The **positive pads** on the circuit board are marked with a small "+" sign.

22. Carefully thread the mounting holes of CONN1 and CONN2 using one of the included 4-40 screws or a tap as shown. This prevents any possibility of damage to the connectors during final assembly.

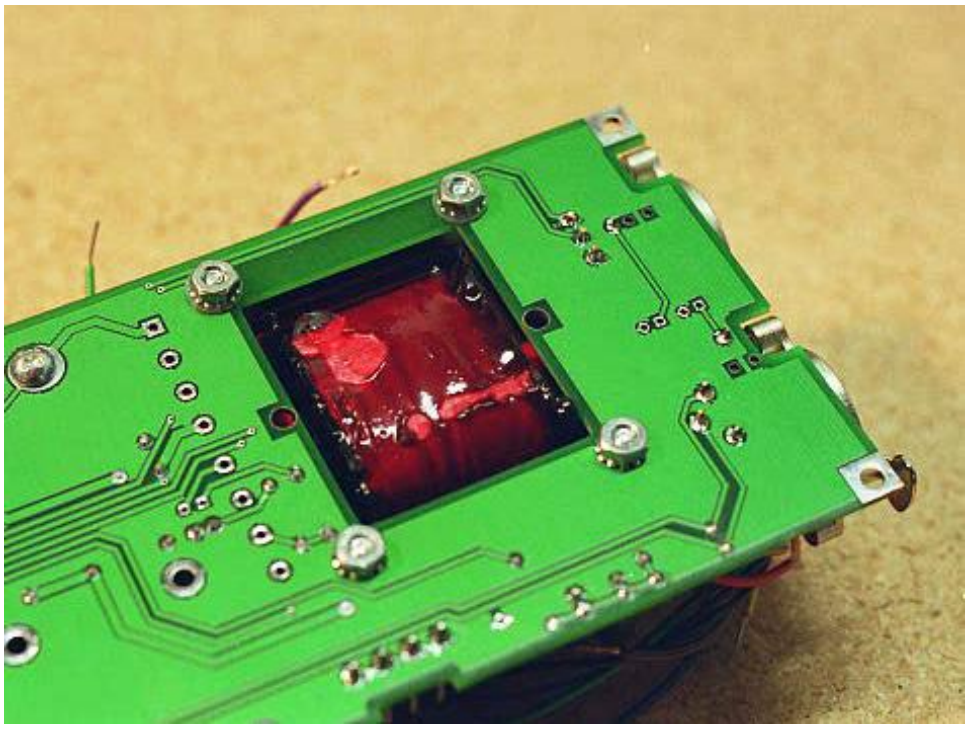
23. Add CONN1 and CONN2 to the board. Make sure they're fully seated before soldering.



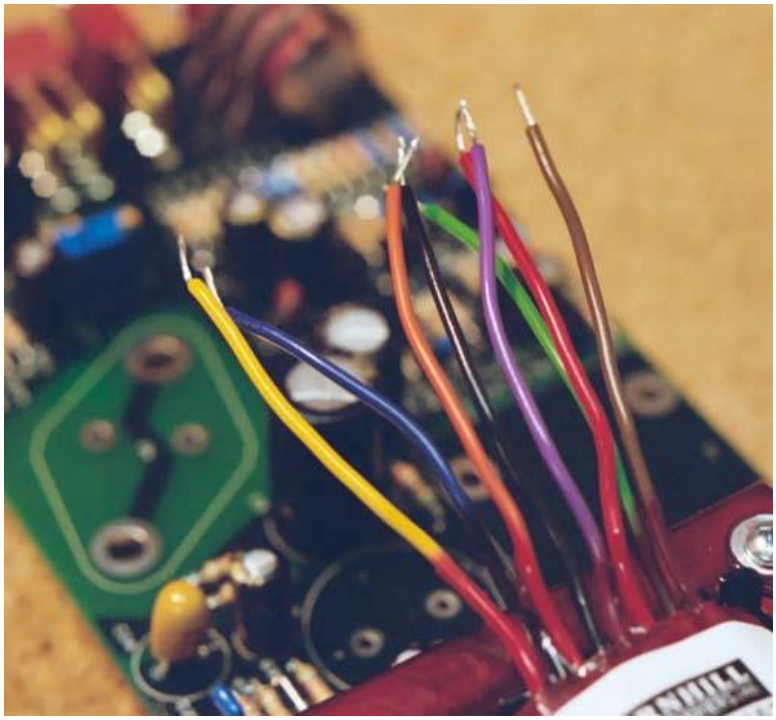
24. Lay the board on the bench and place a 1/8" nylon spacer over each mounting hole.



25. Mount the transformer to the board with four #4 X 1 1/4" round head machine screws, and use #4 Kepps nuts to secure it.



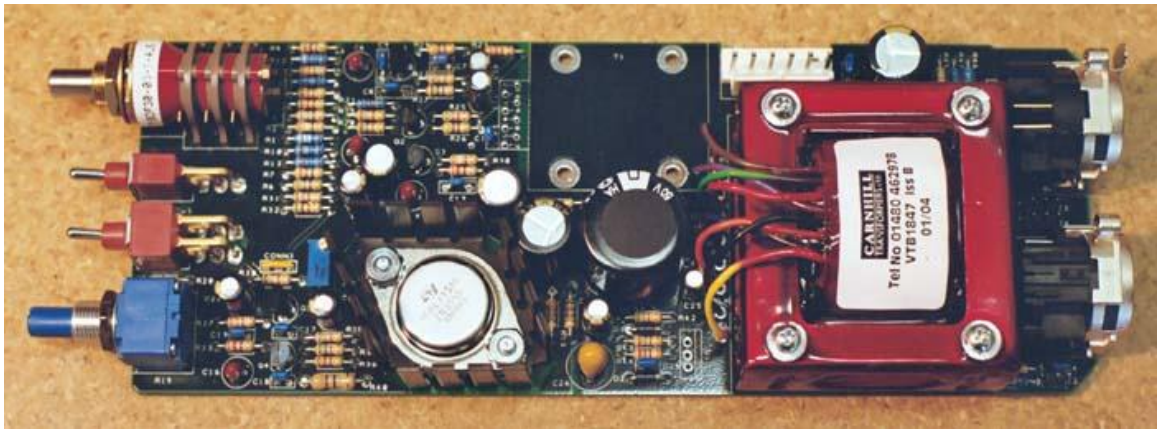
26. Trim the leads to length, and strip about 1/4" of insulation from the ends. Twist the strands together, and tin each lead with solder.



27. Solder the leads as shown. The color code is screened onto the PC board.

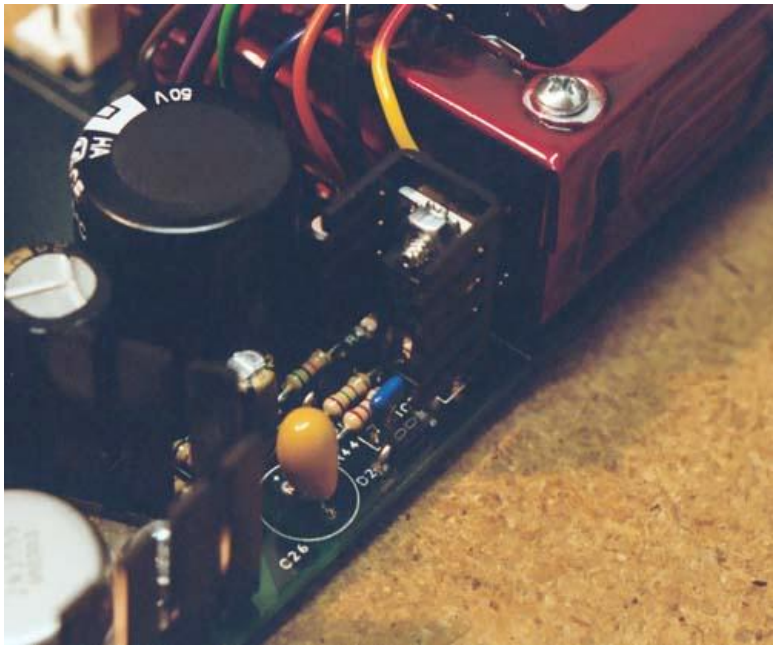
28. Q6 and heat sink. Since the N72 output circuit is biased class-A, current is always flowing in Q6 and the primary of the output transformer. This requires the use of a heat sink for long-term reliability. Place the transistor into the heat sink first, and then maneuver the leads into the PCB. Note that the leads on the 2N3055 are offset, and so are the holes in

the heat sink. **They're not symmetrical!** It's possible to mount the heat sink the wrong way round and cause a short, so pay attention. Insert two #6 x 3/8" round head machine screws **from the bottom of the board** and secure with Kepps nuts for a good electrical connection.



29. Install the bulk filter capacitor C23. Push it in firmly until fully seated against the board. Again, **electrolytic capacitors are polarized and must be installed the right way round!** Be absolutely sure to observe the correct polarity when installing C23

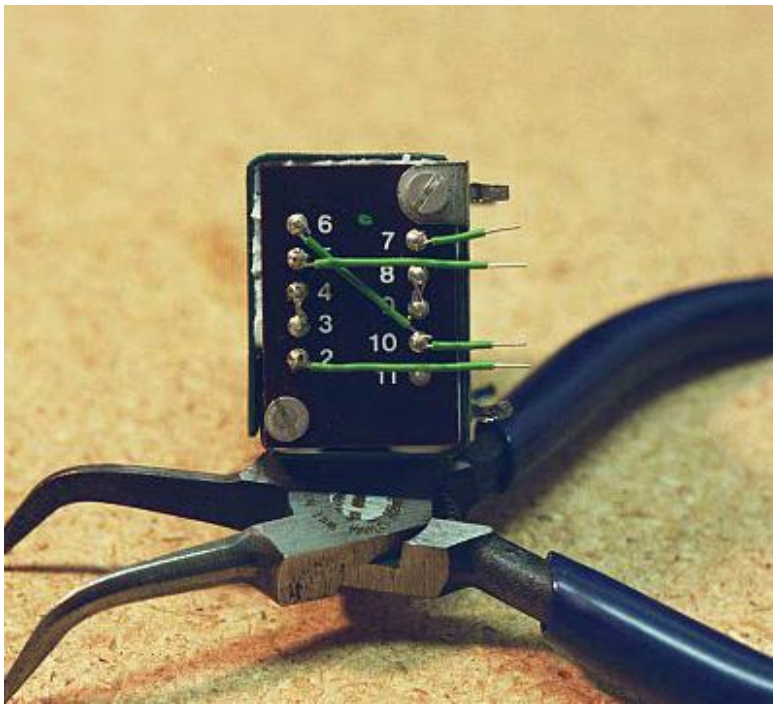
30. Using the hardware supplied, attach the small heat sinks to U1 and solder in place. Align the regulator tab with the double line on the silkscreen outline.



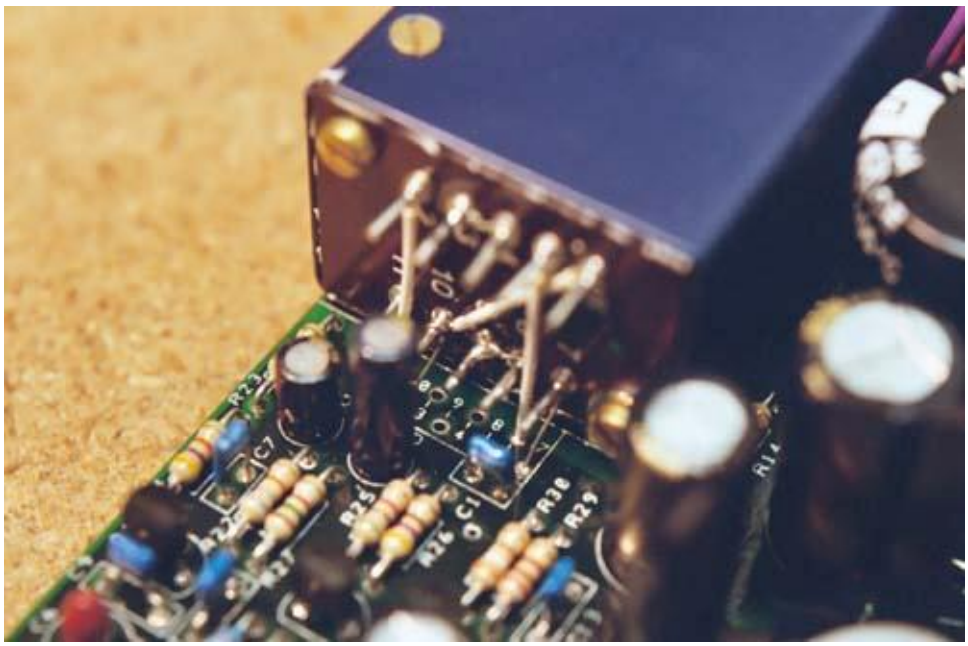
31. Attach the input transformer to the mounting bracket with the three screws supplied.

32. Solder a jumper between pins 3 and 4, another jumper between pins 8 and 9, and a third between pins 6 and 10.

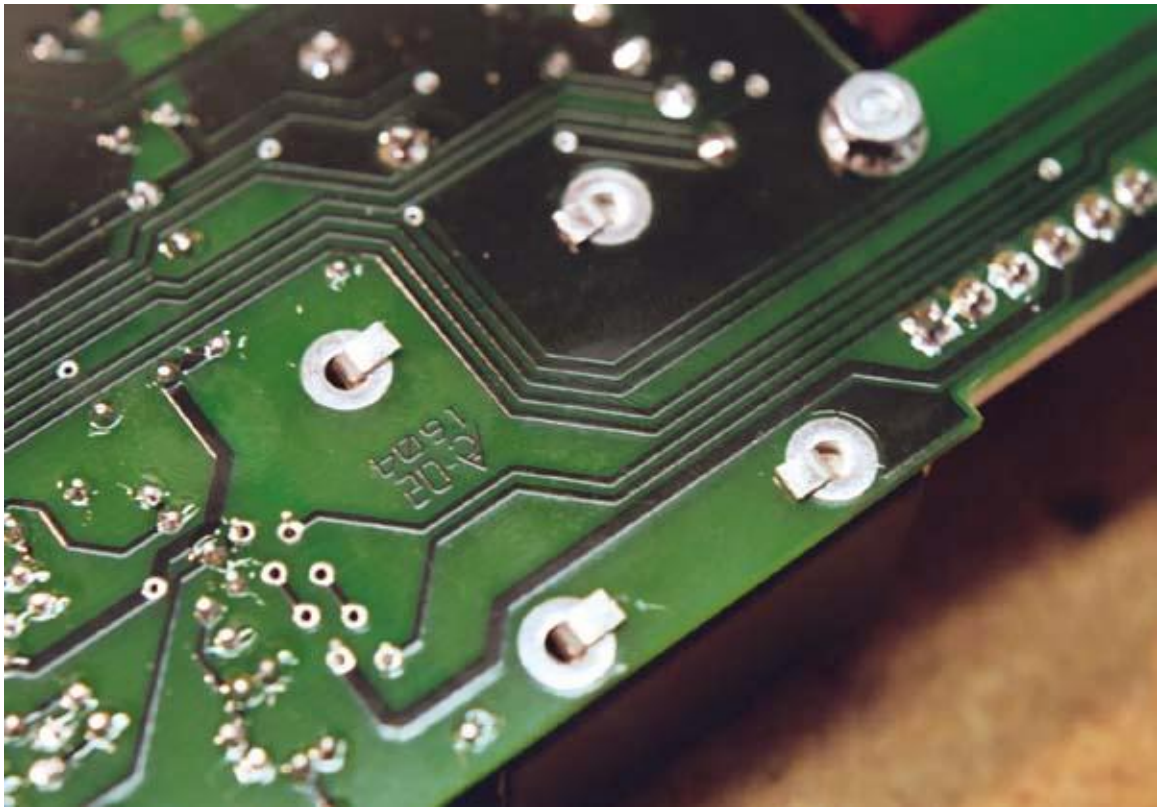
33. Cut two lengths of wire about 1 1/2" long. Strip 1/4" of each end and solder one wire to pin 2 and the other wire to pin 5. Cut another two lengths of wire, this time only about 3/4" long. Strip 1/4" of each end and solder one wire to pin 10 and the other wire to pin 7.



34. Tin the loose ends of each of these four wires, and maneuver them into their holes on the PCB. It is essential that these wires be as short and neat as possible. Try to make your wiring look like that in the photo.



35. Bend the mounting tabs over until the bracket is secure. Solder the tabs and the transformer leads in place.



36. That's it! Before going on to initial power-up, carefully check your work. Make sure you haven't created any solder bridges between pads, or between a pad and the ground plane.

Initial Power-Up and Testing.

37. Again, carefully check your work. Make sure you've got the right resistors in the right locations. Make absolutely sure you've got all the diodes and electrolytic capacitors soldered in the right way round! Double-check your input transformer wiring. Check for poor solder joints and solder bridges, and make sure you fix any problems before continuing.

38. Just to make sure you haven't created any blatant shorts, measure the resistance between pins 1 and 2 of J1. Do the same for pins 3 and 2. You should measure a very high resistance. If you measure a steady resistance under 100 ohms, don't apply power. Carefully check your work until you *find that short.*

39. **Turn R39 counter-clockwise 25 full turns, or until you hear a soft click with every revolution**. This turns the output transistors off; so when you apply power there will be minimal current draw.

40. Connect the output of your PS03 to J1. Wire the power supply connectors together in a 1:1 fashion. That is, PS03 J2, pin 1 to N72 J1, pin 1, pin 2 to pin 2, etc. Apply power while keeping your finger on R40. If R40 gets too hot to touch or starts to smoke, disconnect the power immediately and check for mistakes. Possible things to look for are a miswired output transformer, loose Q6 mounting screws, improperly installed Q5 or Q6, shorts around Q6's heat sink, or incorrect resistor values around Q4, Q5, and Q6.

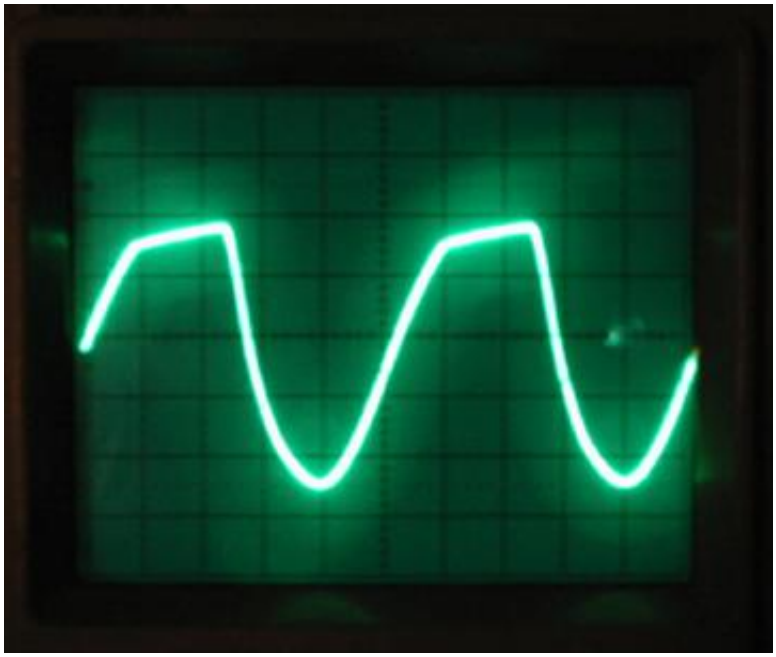
41. Set your DMM to read DC voltage of 24V or greater, and connect the negative lead to J1, pin 2 and the positive lead to the collector of Q6. The collector of Q6 is the transistor case, so it's easy to get a probe on it. Adjust R39 until the collector voltage drops to 21.4V. If you can't adjust the voltage to within 0.1V of 21.4, you've got problems. Go back and find 'em.

42. This is a table of voltages measured at each lead of each transistor in the circuit, which you can use to troubleshoot your N72 if it does not pass a signal or otherwise misbehaves. Your N72 should produce similar voltages, but even if it doesn't, you don't necessarily have a problem. The important thing to recognize is the relationship between the collector, emitter, and base voltages. The collector will be the most positive, followed by the base and emitter. The base voltage should always be just about 0.6V higher than the emitter voltage. If you find a transistor with two voltages the same, or with 0V on the collector, for example, then you have a problem.

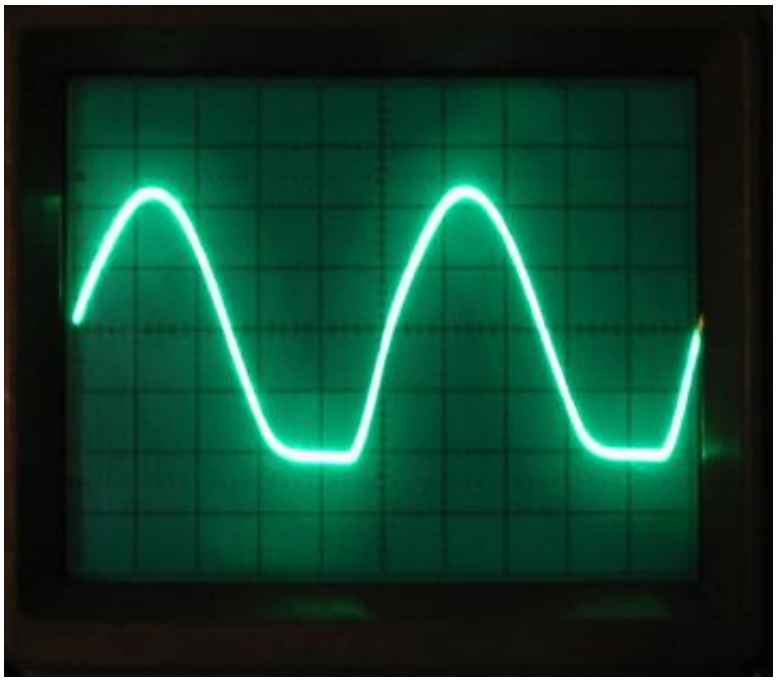
	Collector			Base			Emitter		
	Low	Avg	High	Low	Avg	High	Low	Avg	High
Q1	3.9	3.9	3.9	2.5	2.5	2.5	1.9	0.9	1.9
Q2	13.0	13.0	13.0	3.9	3.9	3.9	3.3	3.3	3.3
Q3	21.7	21.7	21.8	13.0	13.0	13.0	12.4	12.4	12.4
Q4	4.6	4.7	4.9	0.8	0.8	0.8	0.3	0.3	0.3
Q5	21.4	21.4	21.4	4.6	4.7	4.9	4.0	4.2	4.3
Q6	21.4	21.4	21.4	4.0	4.2	4.3	3.4	3.5	3.7

Fine bias adjustment (if you have an oscilloscope).

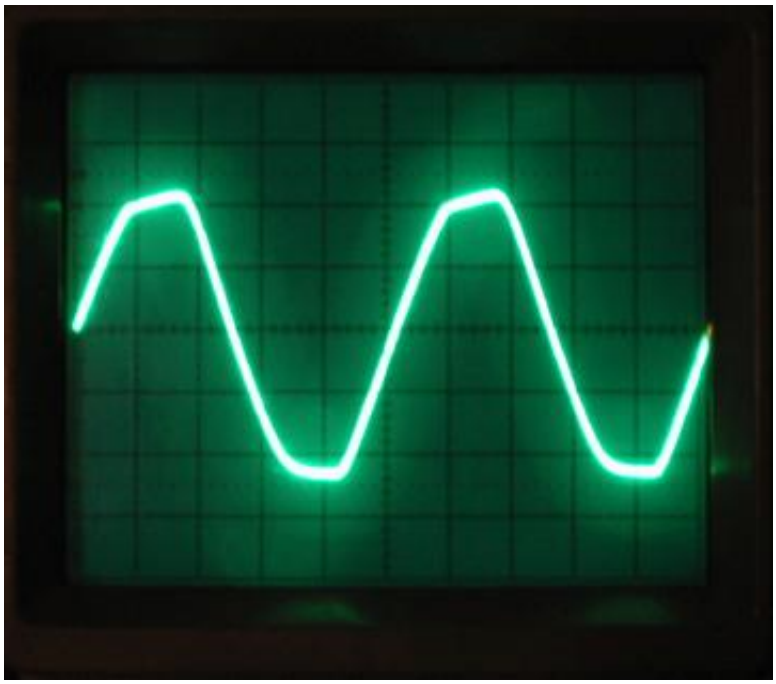
43. With a signal generator, apply a 0.5Vpp, 1KHz sine wave to pins 2 and 3 of CONN1, the XLR input connector. Rotate S1 fully CCW (minimum gain), then click back 5 positions CW. Connect an oscilloscope to the output connector CONN2. Connect the probe tip to pin 2 and the probe ground to pin 3. Set the vertical resolution to 10V/div and the horizontal resolution to 0.2mS/div. Rotate R19 fully clockwise. You should see a badly clipped sine wave. Back off R19 until the amp is just clipping both halves of the signal. Adjust R39 until the clipping is symmetrical. Note that the output at clipping is a whopping 49Vpp (27dBu). This is enough output to beat just about any tape machine or A/D converter into submission, or even to drive headphones to painful levels, so do be careful.



Positive Clipping



Negative Clipping



Symmetrical Clipping

44. Congratulations! You've got a working N72 preamp.