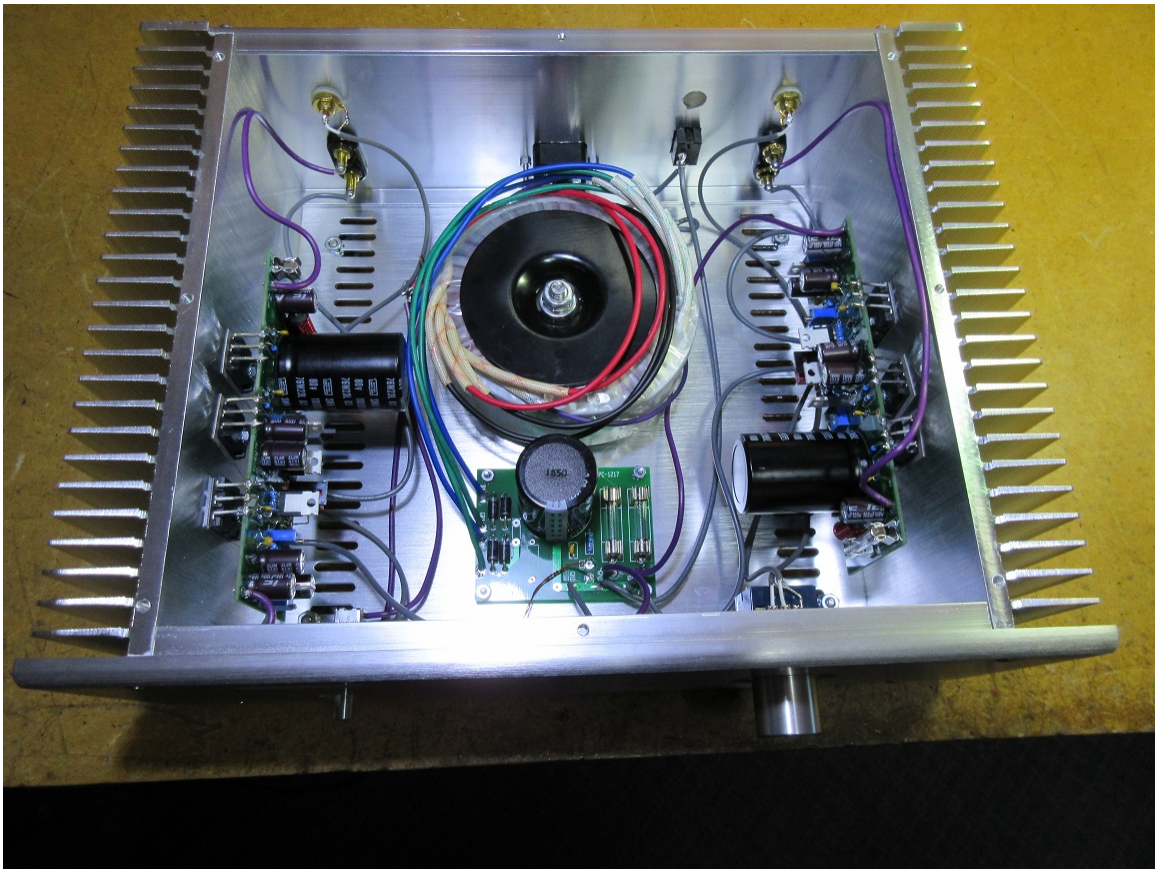
Zkit60 Introduction

The Zkit60 design was originally done in 1981 by an employee of Audio by VanAlstine, Woodbury MN. Nothing became of it, and the one page, hand drawn schematic sat in a file cabinet for 35 years. Recently, Frank VanAlstine found the schematic and wondered what it would sound like. He had me, Dan Kuechle of Dan Kuechle Engineering Services, Ramsey MN, build a "one-off" prototype, upgrade any out of production parts, and add changes found in the last 35 years to the design. The prototype, dubbed Amp81 for the year of its original design, was very nice sounding, but thought to not fit in with the amplifiers being offered by Audio by VanAlstine. At a mere 60 watts per channel, Frank didn't think he could sell any of them. I sought and received permission to sell the amp through Decware as a kit, and also offer it in assembled form.

The simplicity of the design fits in well with the Zen "less is more" philosophy. It is truly a remarkable little amplifier that seems to sound better the more you listen to it. It's warm, it's smooth, and has a very similar tone to tubes. I hope you enjoy it.

Build options currently available:

1) 0, 1 (dual), or 2 (left and right) volume controls
2) system ground switch (connects/disconnects analog ground to IEC/chassis ground)
3) LED pilot light, no pilot light, or on/off switch with built in neon pilot light
4) Option to use an old Dynaco 120 transformer, if you just happen to have one.
5) Can be wired for 110/120 or 220/240 vac



Finished Zkit60 with cover off, one volume control, built in an Ebay "DIY" chassis

Zkit60 Instruction Part 1: Build & Assemble

The Zkit60 kit is NOT intended for the novice kit builder. Soldering experience is expected. If you have to buy a soldering iron or DMM to build this kit you might be in over your head. If you don't know what a DMM is, you might be over your head. At a minimum you will need the following tools to complete a Zkit60 build into a chassis of your choice:

1) drill and a set of drill bits up to ½ inch (by 64ths is best, by 16ths will do)
2) good soldering iron (25 watt) or soldering station with appropriate tip(s).
3) pliers, needle nose pliers, wrench, screw drivers, sharp knife, wire cutter, etc
4) DMM (digital multi-meter). Most any quality will do, but it must work. You are expected to know how to measure ohms, volts, and milliamps. You are expected to understand that ohms are measured with the power off and measuring milliamps involves running the current through the meter and usually involves changing jacks on your meter. Your meter must work on all ranges / functions and not have a blown internal fuse.
5) Couple of small metal files of different size and shape if you are going to cut square holes for components in the front or back panel.
6) A set of nut drivers will help, but is not absolutely necessary.
7) The ability to clip your DMM leads onto component leads will help a lot. Either screw on (press on) alligator clips for the DMM leads or a set of alligator clip jumpers.

A chassis with finned heat sinks is recommended. Heat sinks on both sides is ideal. Minimum recommended INTERNAL dimensions are: 280 mm (11") wide, 84mm (3.3") high, 260mm (10.25") deep. Any smaller and it will be harder to build or may not fit at all. Chassis with a heat sink on one side will work if there is enough room for both amp boards on the heat sink, roughly 75mm x 300 mm (3" x 12") or 150mm x 150 mm (6" x 6") minimum. If a chassis with no heat sinks or just a board or bottom plate is used, there must be enough additional room for internal heat sinks.

The most cost efficient unit found so far is a "2412" enclosure, also labeled B2412, 2412B, 2412C, B2412B-2, etc. It is small, usually measuring around 190 mm (7.5") wide, 110mm (4.3") high, and 260mm (10.25") deep internally, but it will work if you are VERY careful about placement. Ebay units run around $90 total and can be found supporting zero or one volume control. A one volume control unit can also be found at jjjaudio.com under aluminum chassis.

You will encounter some soldering challenges when building a Zkit60. Wires soldered to the banana jacks take A LOT of heat, whereas wires to the switches and volume control MUST be carefully and QUICKLY soldered or damage can result. The recommended solder is a 60/40 tin/lead electronic solder with a rosin flux core, .031" in diameter. It should not be exceedingly old, as an oxide can form that makes it very difficult to use.

If using a soldering iron, I would not use anything other than a 25w unit, preferably a Weller (I've had really good luck with Weller). Good soldering stations are different in that they sense and adjust wattage to keep the tip temperature constant so a higher wattage unit doesn't necessarily use all that wattage. I would also never touch a copper tip that is not coated, preferably double coated. If you run into trouble with too little heat on the banana jacks or too much heat on the volume control a different size tip is

probably needed. There is nothing wrong with using two different tips depending on what you are soldering (I do).

Items that bolt to the chassis should have the screw heads on the outside and the nuts (usually kep nuts – a nut with captive lock washer) on the inside. This provides a smoother surface for hands when moving the unit around.

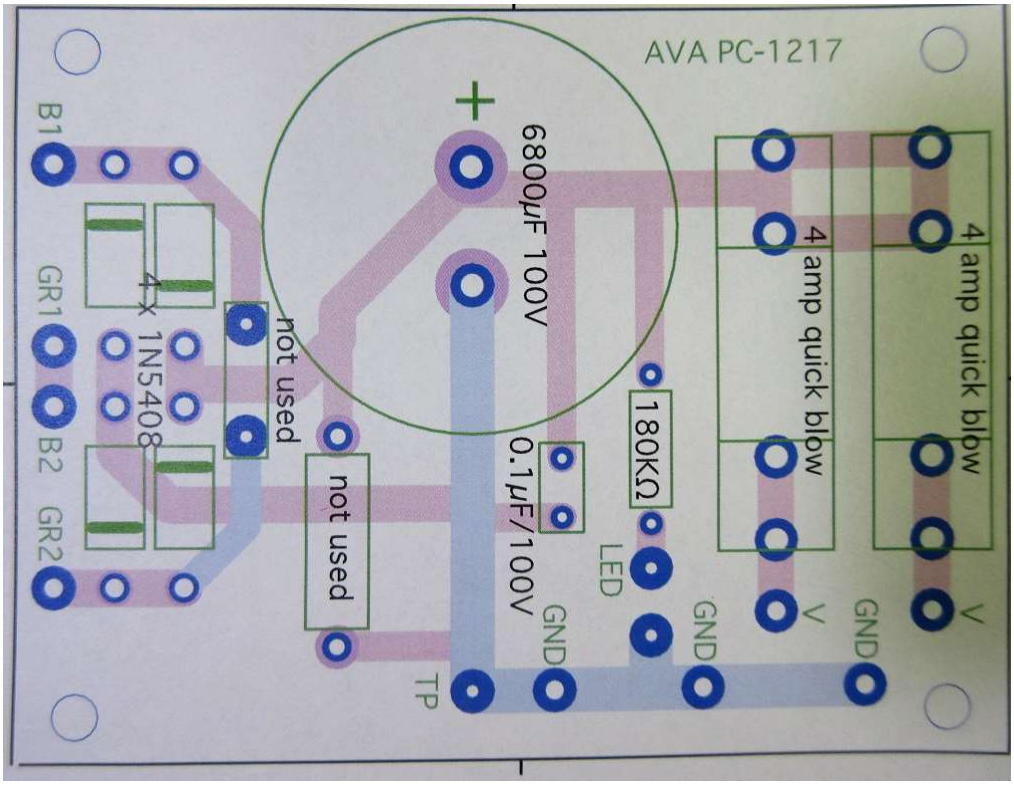
A number of different transformers can be used to build a Zkit60. A "re-purposed" Dynaco120 transformer will work quite well, although it will be just a bit noisier than a toroidal transformer, especially a shielded toroidal transformer. Care must be taken to assure the "raw Vcc" at the fuses on the PC-1217 power supply board does not exceed 100vdc as most every large capacitor in the design could be at risk. The 100vdc limit should correspond to a transformer output of 71 vac. Be aware that a transformer sold as a XX volt transformer will have an output voltage higher than XX at no or minimal load and it's the (usually) unpublished peak output voltage at minimal load that you need to consider. There is a list of acceptable transformers at the end of the Zkit60 wiring instructions. The current "best" transformer is the Antek AS-2234. It's the most bang for your buck, unless you have an old (free) Dynaco 120 transformer lying around.

STEP 1: BUILD THE INDUCTORS:

Find the two 1 ohm 5w resistors and cut the magnet wire into two 22" pieces. Using a sharp knife, scrape the insulating coating off both ends of the two magnet wire pieces. You want about 1/3" of bright shinny copper on each end when finished scraping. Using a wire cutter, needle nose pliers, soldering iron, and solder – scrape, bend, crimp, and solder one end of the magnet wire to the resistor as close to the resistor body as possible. Wrap the wire around the resistor body and then cut, bend, crimp, and solder the other end of the wire to the other side of the resistor body. Repeat for the second resistor. The finished product should look like this:

Inductor

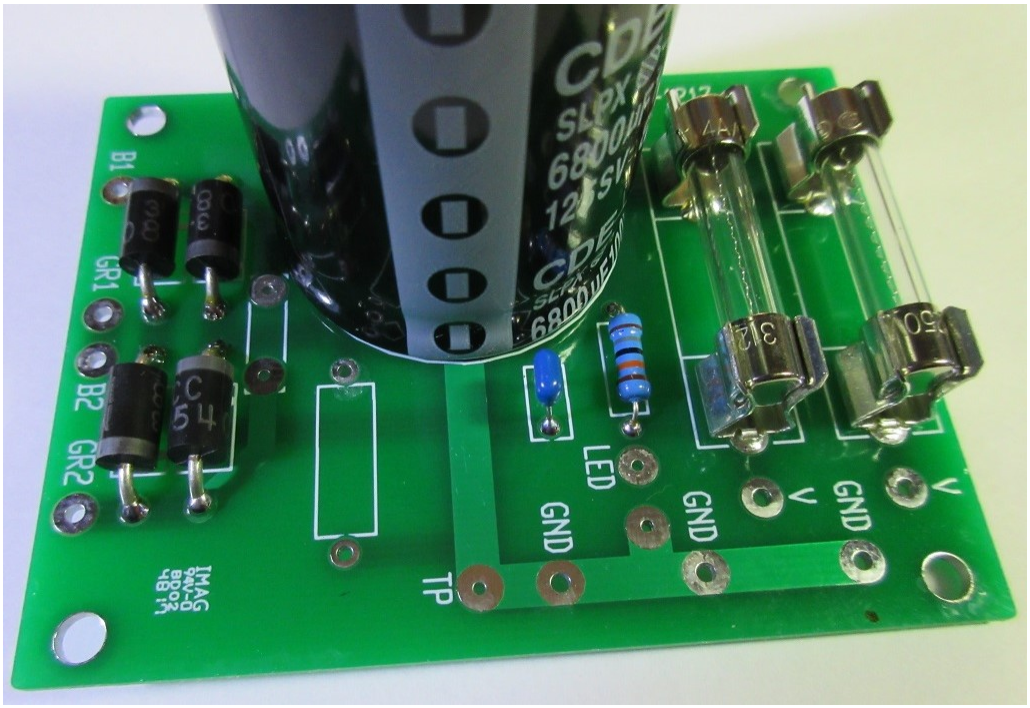
STEP 2: BUILD THE POWER SUPPLY PCB



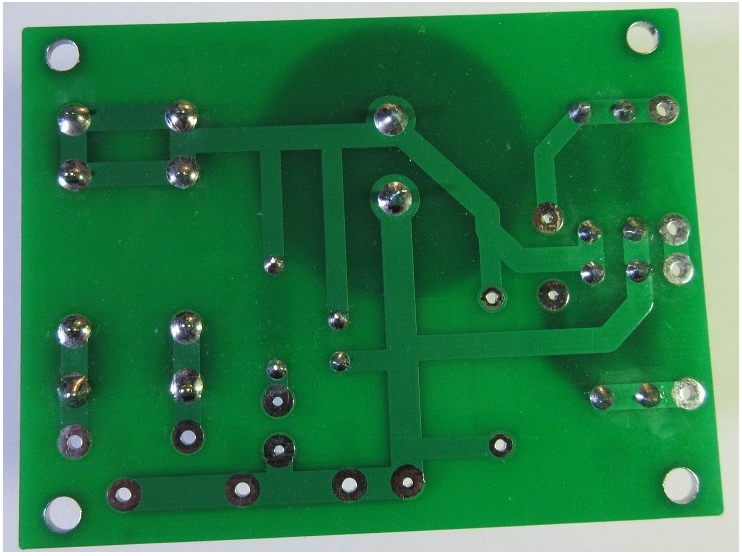
PC-1217 power supply component placement

From left to right: the four diodes are 1n5408 (observe polarity). The next two components are not used (capacitor across incoming AC and bleed resistor). The big capacitor is 6800uf /100v (observe polarity). The little capacitor is 0.1uf / 100v. The LED resistor is 180k and is only needed if the LED pilot light is used (although it doesn't hurt anything to be there). Finally, 4 fuse clips for two 4A quick blow 3AG fuses, one for each amplifier channel. Place 4 fuse clips in fuse clip holes and plug 2 fuses in to ensure proper fuse clip alignment. Once aligned properly, remove fuses and solder one pin of each clip in from the TOP of the PCB. Inspect clips for proper seating, then turn PCB over and solder in remaining pins from the back of the PCB. Touch up other fuse pins as needed from the back side of the PCB.

Once all parts are soldered in, clip the leads off, scrape off the flux deposits, and clean the board with rubbing alcohol and a tooth brush. The completed pcb should look like this:



PC-1217 assembled, component side


PC-1217 assembled, solder side

If you cannot get your completed PC-1217 or your inductors looking like the photos you may want to consider getting help to complete this kit build.

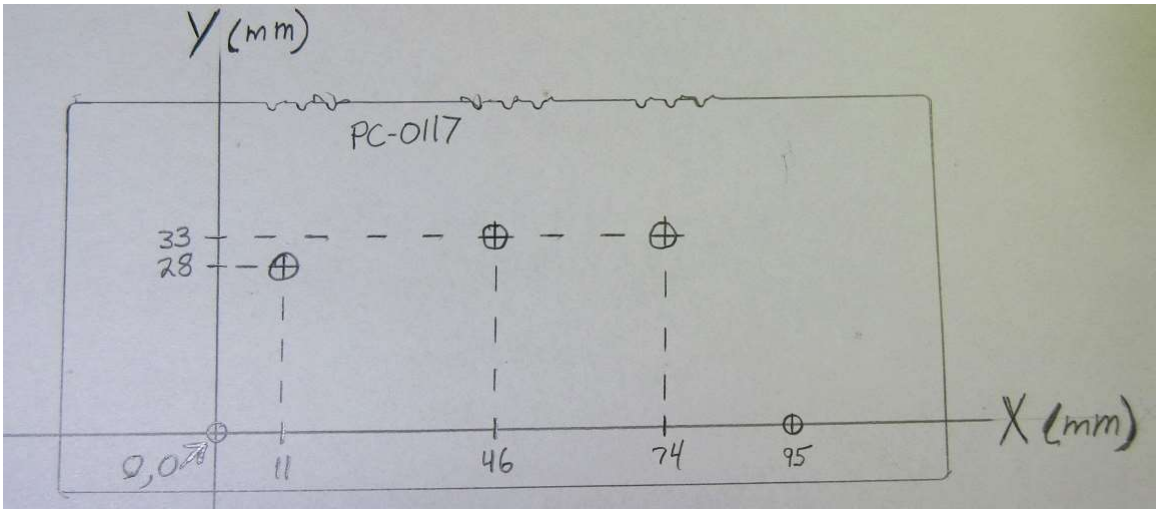
STEP 3: MOUNT TRANSISTORS AND PCB

This step involves drilling 5 holes in the heatsink material you are using. The 3 transistors / mosfets (Q's) and the PCB mount to the same heatsink. The 9 electrical connections between PCB and Q's are soldered after mounting. These 9 connections support the upper portion of the PCB, while the lower portion is supported by two #4 machine screws. It is **IMPERITIVE** that the transistors / mosfets are electrically

isolated from the heatsink. Silicon insulating pads (silpads) for TO-3P packaged devices are used to do this. No heat sink silicon grease is required with silpads.

Place the amp PCB on the heatsink where you want it to go. With a pencil, draw the PCB's outline and mark the two lower PCB mounting holes onto the heatsink. If the lower left mounting hole is designated as X, Y coordinates (0,0) then the PCB's lower right mounting hole will be very close to (95,0) mm = (3.75, 0) inches.
The hole for the NPN transistor will be at (11,28) mm = (0.433, 1.1) inches.
The hole for the N channel mosfet will be at (46,33) mm = (1.8, 1.3) inches.
The hole for the P channel mosfet will be at (74,33) mm = (2.9, 1.3) inches.

#4 machine screws will be used to mount all transistors and the PCB, so all holes can be 7/64" (or 1/8"). It may be helpful to draw up a "to scale" template on a piece of paper showing the location of the 5 holes to drill.

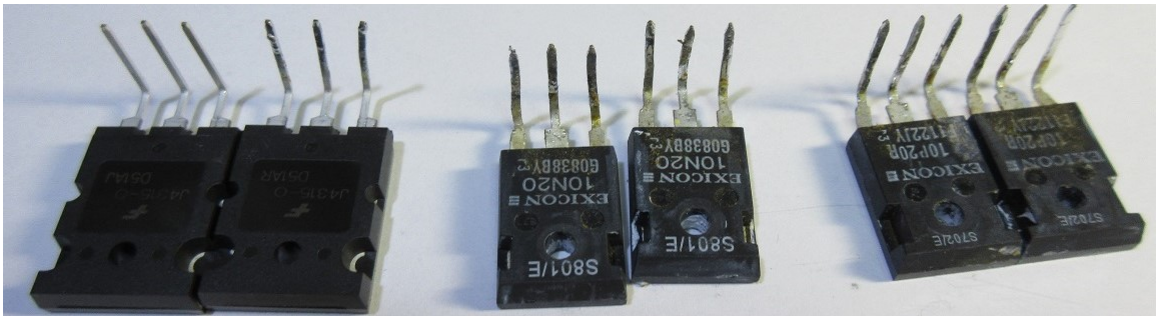


drill template

Place the template on the heatsink over the PCB outline and mark the holes. If you are using a non-finned heatsink material, at least where the Q's go so there are no restriction on Q placement, you can drill the holes now. Be sure to de-burr them so they don't cut the silpads.

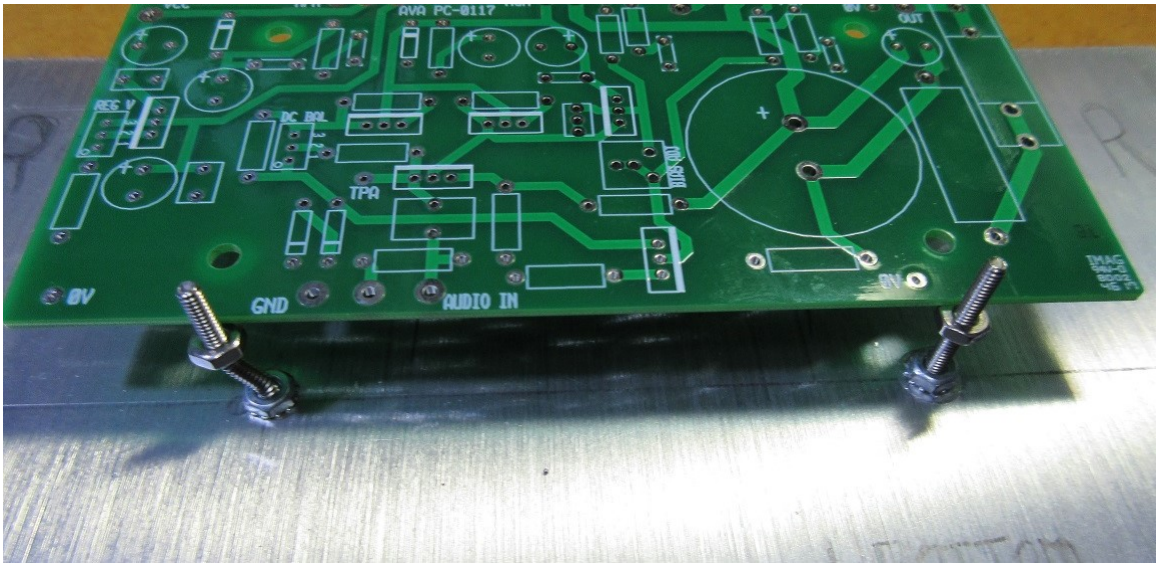
If you are using a finned heatsink material, things get a little more complicated. The machine screws cannot be placed over a fin, they must go in the space between the fins. My heatsink material had 3mm (0.12") wide fins and 7mm (0.28") space between fins. Since a #4 machine screw head is 5.5mm (.22") wide, it pretty much has to go in the center of the space between fins. Place the template on the heatsink over the PCB outline. Shift the template slightly left or right so the (0,0) hole is positioned between heat sink fins. Mark that hole on the heatsink. This is your new (0,0) point. Using the template, mark the other 4 holes then shift each hole left or right so it lines up with the closest space between fins. Mark these "slightly shifted" locations on the heatsink. Verify all 5 holes are between heatsink fins and drill 5 holes with a 7/64" (or 1/8") drill bit (for #4 machine screws).
With static electricity in mind (DO touch a ground point before handling transistors / mosfets, DO NOT shuffle on wool carpet and then touch things, etc, etc) bend the

transistor and mosfet leads up at a 90 degree angle. DON'T bend them right at the package (easier to break off), bend them after they narrow down as shown below:

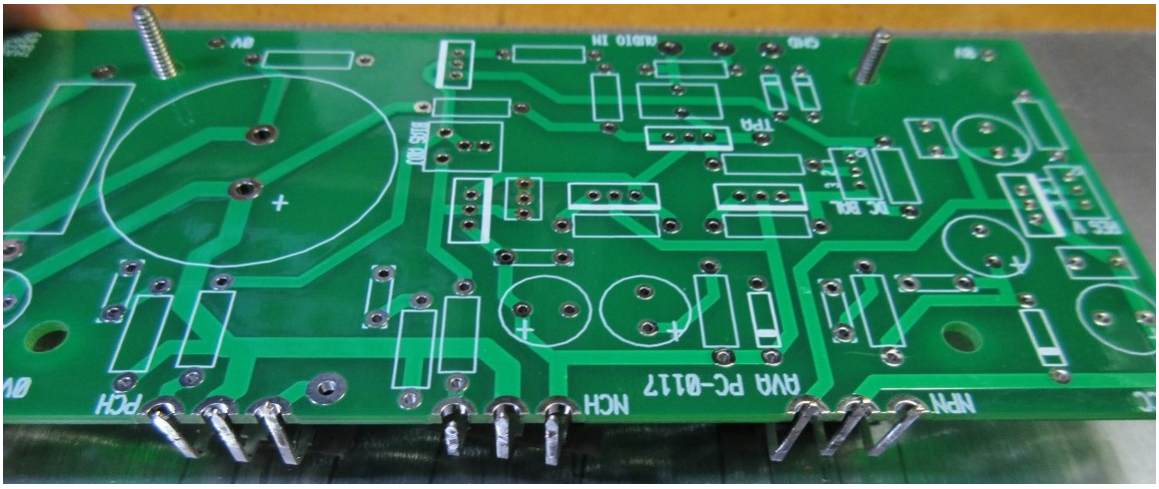


transistor bent lead

The next part involves fitting the Q's to mate with the PCB. There will be more "fitting" involved with a finned heat sink where the drill holes are not in their ideal location. The pictures may be easier to grasp than the words. Mount two 1 ¼" #4 machine screws with two #4 kep nuts in the two holes used to mount the PCB. Tighten the kep nuts, then thread two #4 standard nuts onto the studs about 1/3" down. The PC-0117 will rest on these nuts. Temporarily place the Q's on the heatsink using just their #4 x ½" mounting screws (so they can now rotate around their mounting hole). Place them in their proper order, from left to right NPN transistor FJL4315 (bigger), N channel mosfet 10N20, and P channel mosfet 10P20. Place the PCB on one of its mounting studs. It should fit onto both mounting studs if it's a non finned heatsink and probably won't fit on both studs if it's a finned heat sink. See how the 9 electrical connections mate up with the transistor leads. Try the other PCB mounting stud if it's a finned heat sink. One stud should be a better fit with the transistor connections. Keep that stud straight and bend the other stud to fit. See below:

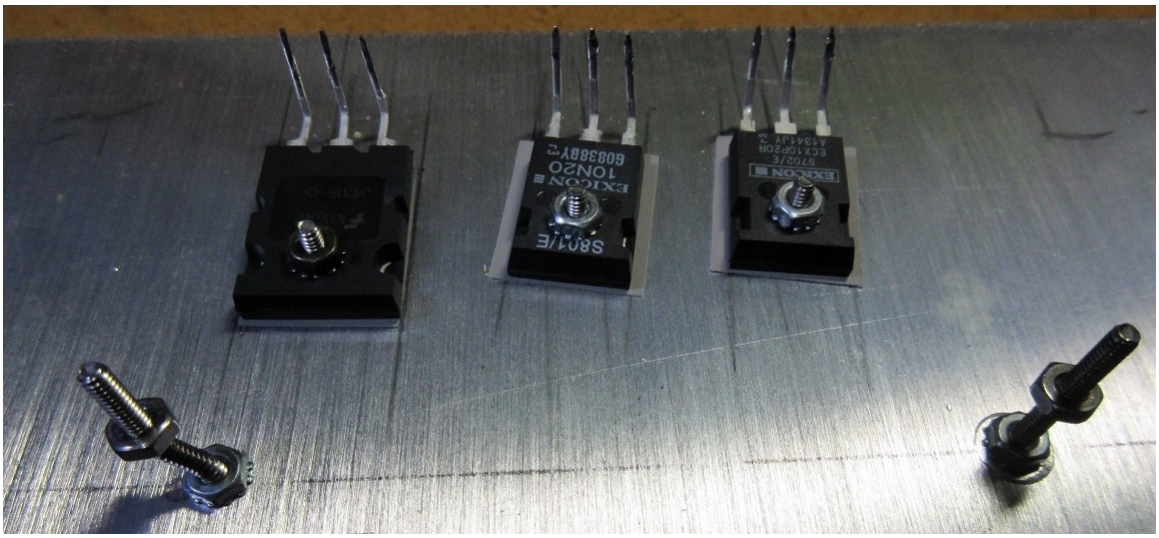


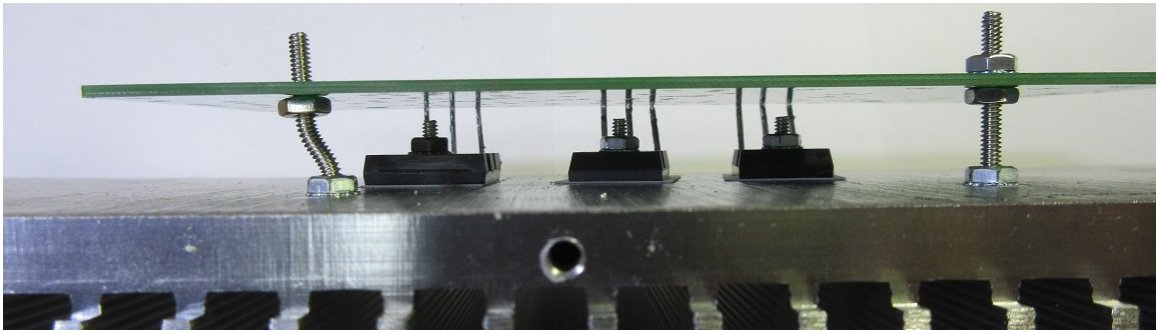
PC-0117 mounting stud bent to mate with the PCB on a finned heat sink



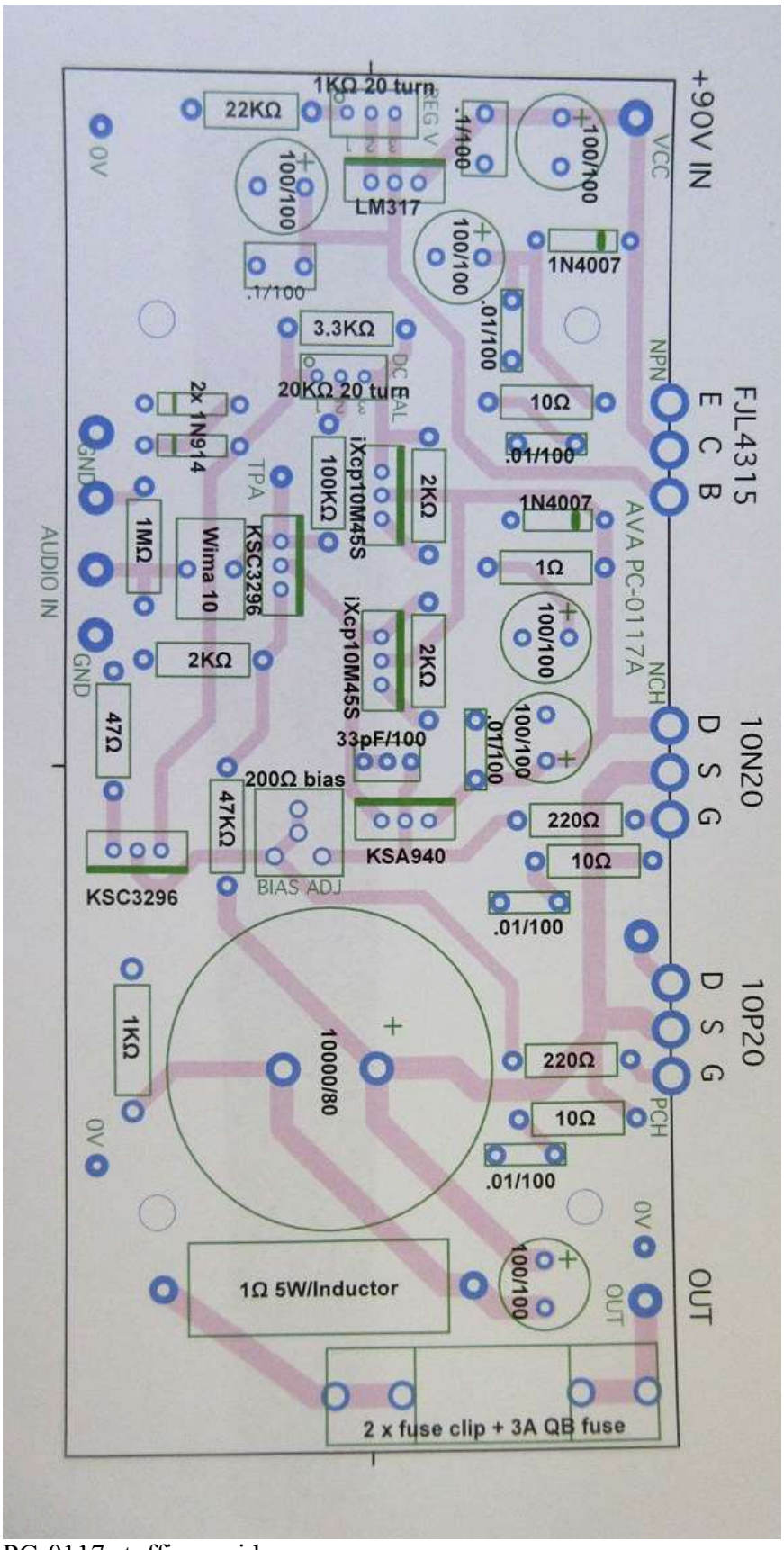
PC-0117 test fit of transistor / mosfet pins

Note how far the middle mosfet has to be rotated. With the three Q's aligned for best pin fit, remove the PCB and draw the outline of the Q's onto the heatsink in their "best" position. Extend the vertical body lines so proper rotation can be achieved when the silpad covers the package outline. Mount the 3 transistors/mosfets using #4 x 5/8" machine screws, kep nuts, and silpads. The kep nut goes on top of the Q with the silpad between the Q and the heat sink. Ensure transistors are in correct order and silpad is completely under Q (very important with bigger NPN transistor). Ensure screw is not too long (need a gap between the top of screw and bottom of PCB).

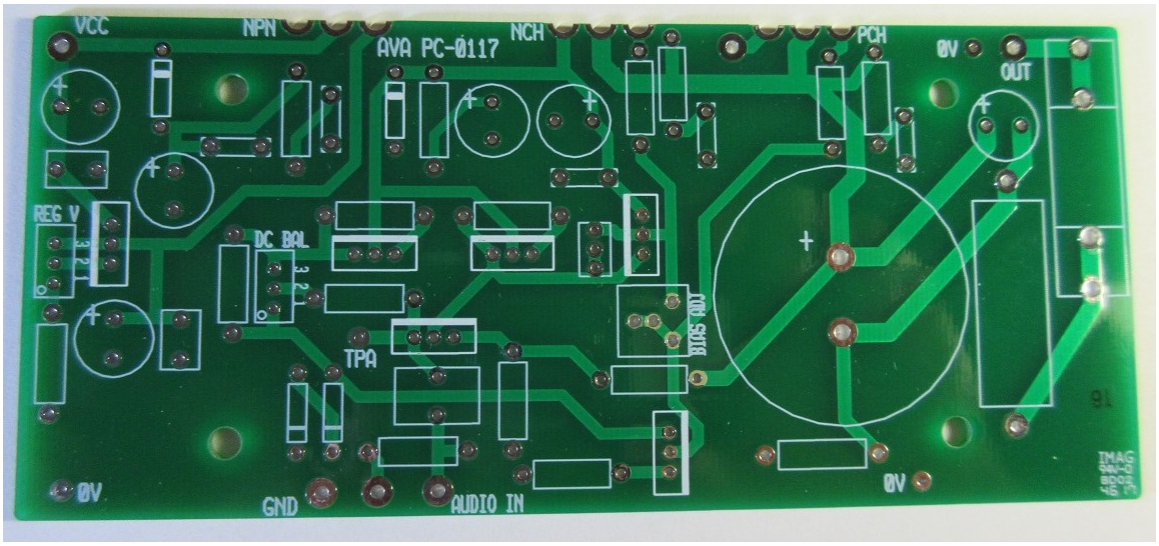

PC-0117 Q's mounted and studs in: ready for the amp PCB


PC-0117 mounted and checked for clearence

STEP 4: ASSEMBLE THE PC-0117 AMP BOARDS



PC-0117 stuffing guide

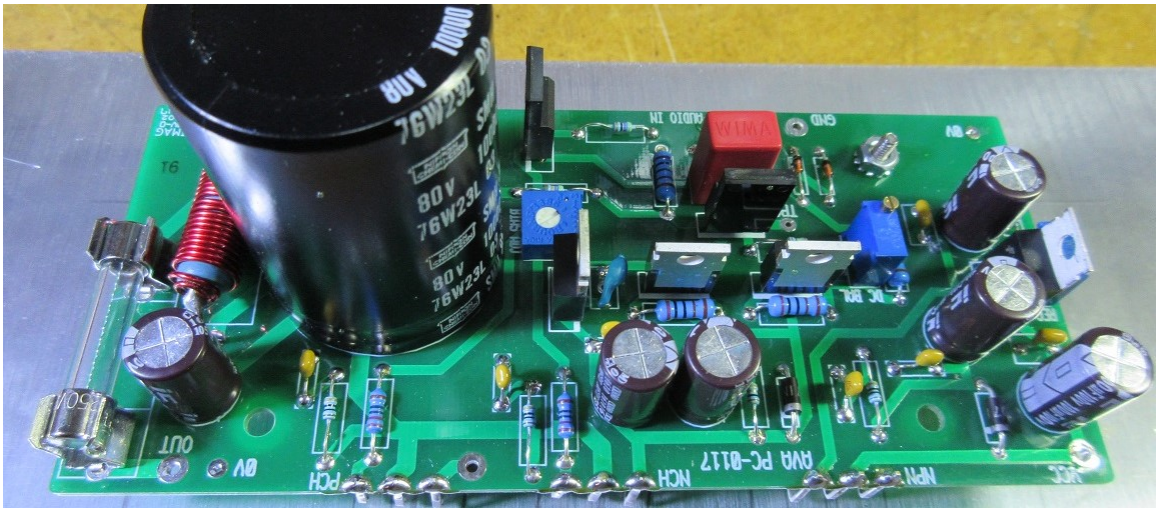


PC-0117 PCB

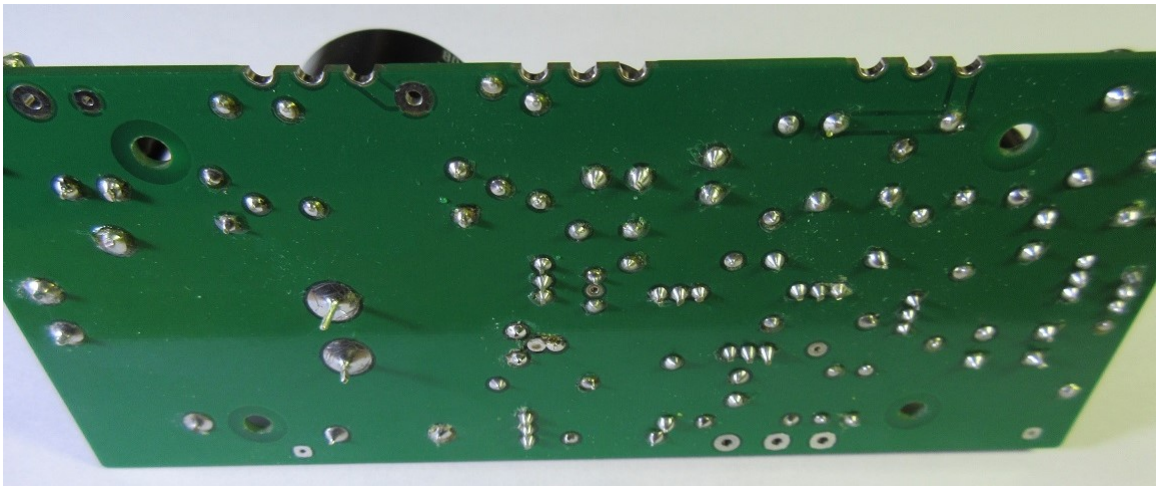
It is easiest to do the lowest profile parts first and then the taller parts. The following order is suggested:

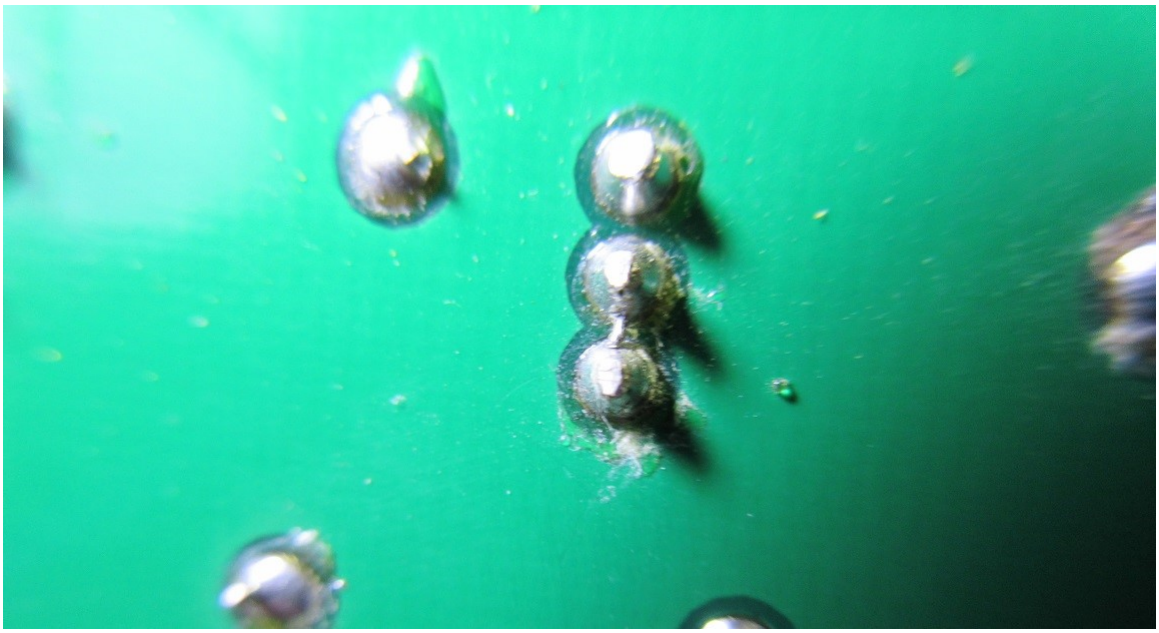
1) 16 x 1/2w resistors (use ohm meter to verify every one)
2) diodes (2 x 1n914, 2 x 1n4007) (observe proper polarity)
3) 8 small capacitors: 2 x .1uf, 5 x .01uf, 1 x 33pf capacitor.
4) 200 ohm single turn potentiometer (pot)
5) 1 ohm 5w resistor with wire inductor wrapped around it
6) fuse clips (ensure proper orientation) – insert 2 fuse clips in the 4 holes with the tabs to the outsides. Plug a fuse into the clips to ensure they are positioned properly. Remove fuse, and then solder in one pin of each clip from the TOP of the PCB. Inspect clips for proper seating, then turn PCB over and solder in remaining pins from the back of the PCB. Touch up other fuse pins as needed from the back side of the PCB.
7) 1kohm/20 turn and 20kohm/20 turn pots (the dot represents the adjustment screw). On each pot, solder 1 pin, inspect and adjust if necessary, solder other 2 pins.
8) 10uf non polarized film cap (Wima 10, no polarity), and 6 x 100uf/100v capacitors (ensure correct polarity on these 6: longer lead is the positive pin)
9) to-220 package devices: 1 x KSA940, 2 x KSC3296, 2 x IXcp10M45S, 1 x LM317HV (heavy line on pcb silk screen is back of the device – be sure to install correctly) Again, solder 1 pin, inspect, correct, solder remaining pins
10) 10,000uf 80v capacitor (ensure correct polarity, push in, twist slightly until seated against pcb).

Once parts are soldered in and the leads clipped, scrape off the flux deposits, and clean the board with rubbing alcohol and a tooth brush. Pay close attention to the 3 pin TO-220 package devices and 3 pin multi turn pots: scrape between the pins to ensure no solder short exists, it is quite easy to short these pins (speaking from experience). The finished pcb should look like this:



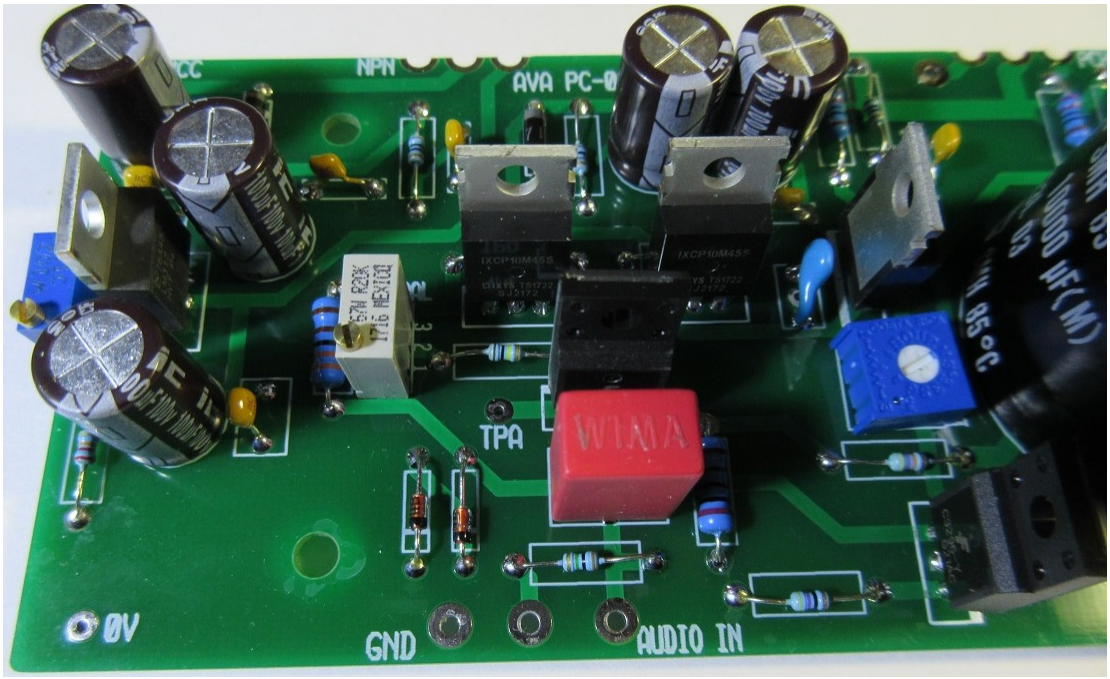
PC-0117 assembled, component side


PC-0117 assembled, solder side


PC-0117 solder short on a TO-220 package device. Scraping between pins would have caught this.

STEP 5: PRE-ADJUST THE PC-0117 AMP PCBs

Before applying power, the PC-0117 amplifier boards must be adjusted to get them close to where they need to be for proper operation. It is likely that an un-adjusted or improperly adjusted PC-0117 PCB will have no output at all. Final adjustments will be made under power with a voltmeter and ammeter. Preliminary adjustments are made without power and an ohmmeter.

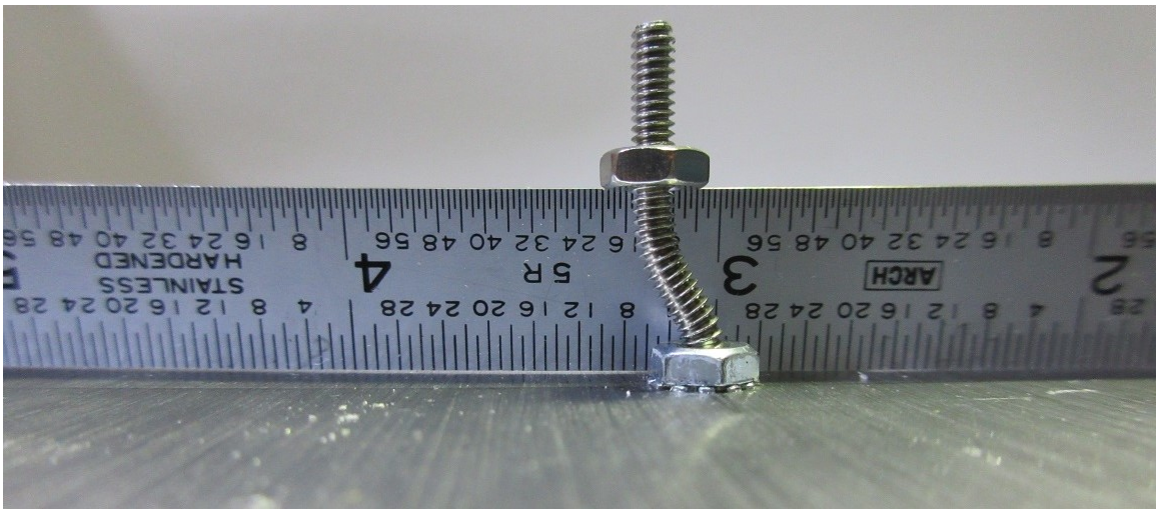


PC-0117 adjustments

1) Pre-adjust the bias by turning the square single turn pot by the big capacitor until the resistance between the bottoms of the two 220 ohm gate resistors is **75 ohms** (within 1 ohm). This should correspond to the slot positioned as shown in the picture. The 220 ohm gate resistors are located below the rightmost electrical connection for each mosfet, labeled "G" on the stuffing guide.
2) Pre-adjust the DC balance by turning the 20k, 25 turn, middle pot until the resistance between the left side of the 100k ohm resistor (just above TPA) and the bottom of the 3.3k ohm resistor (just left of the pot you are adjusting) is **4.30 k ohms** (within 0.1 k ohm).
3) Pre-adjust the voltage regulator by turning the 1k, 25 turn, left pot until the resistance between the bottom pin of the LM317HV and the metal back tab of the LM317HV is **362 ohms** (within 2 ohms).

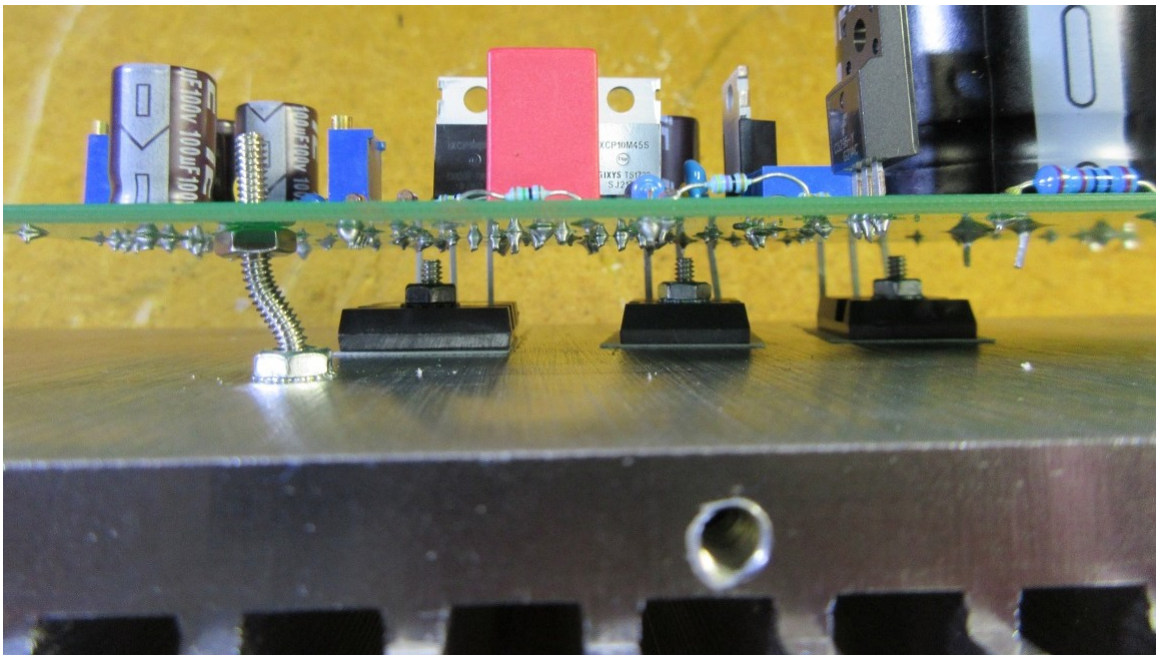
STEP 6: MOUNT ASSEMBLED PC-0117 PCB

Check with ohm meter that none of the 9 transistor / mosfet pins is making electrical contact with the heatsink. Check that the mounting stud nuts that PC-0117 will rest on are perpendicular to the heatsink and are not "cocked" at an angle, correct if necessary.



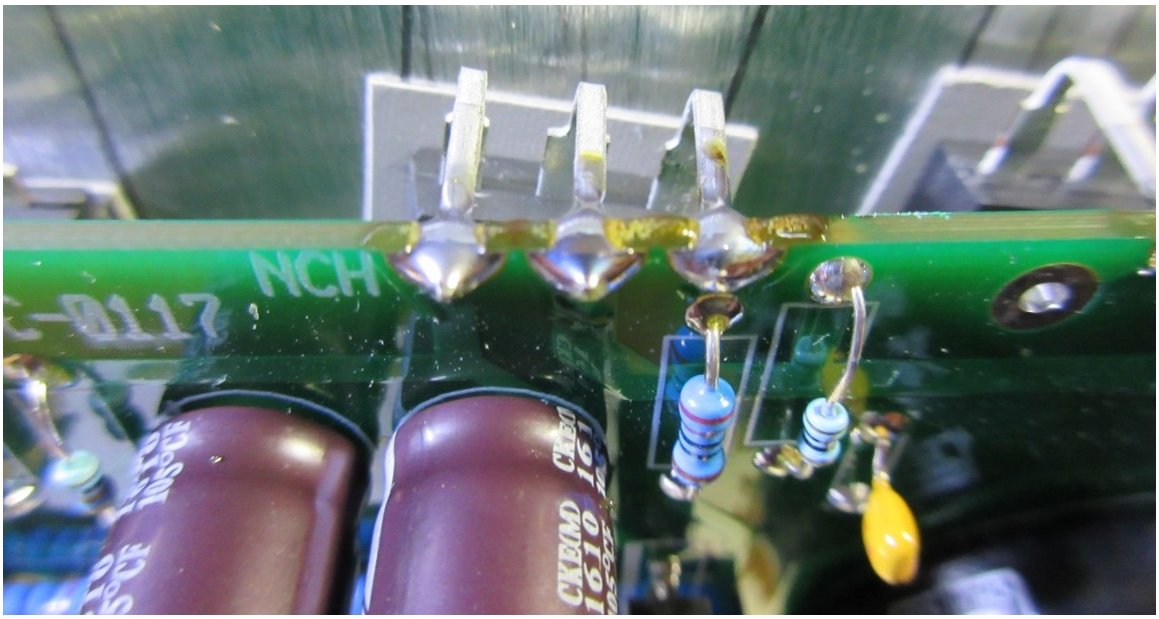
PC-0117 mounting stud nuts must be perpendicular to heatsink or the PCB will bend

Place PC-0117 on its two mounting studs and tighten with kep nuts. If the PCB bends as the kep nuts are tightened, correct mounting stud nut angle until no noticeable bending occurs. With the PC-0117 positioned for soldering to the transistors, do a final clearance check to be sure the transistor mounting bolts don't touch the bottom of the PC-0117.

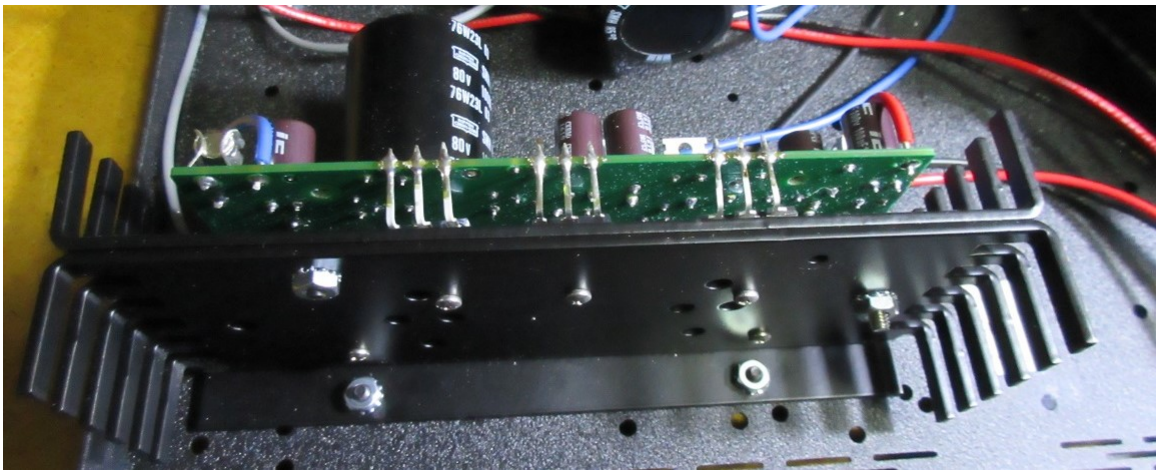

Verify PC-0117 clears transistor mounting bolts

Solder the 9 pins to the PCB. Heat both the pin and the pad. Use enough heat / time / solder to do a good job. The transistor pin should be pressed all the way into its half

pad connection point and held there with a tweezers or similar tool, as the soldering iron is removed and the connection cools. Alternate between devices rather than soldering 3 pins in a row on the same device to allow for better cooling. Re-check with the ohm meter for pin to pin shorts and pins shorted to heat sink. Clean off the flux and visually verify you have made good solder joints.



PC-0117 Q's soldered


PC-0117 mounted on a non finned (where transistors mount) heat sink

STEP 7: BUILD THE BACK PANNEL

Zkit60_backpannel_outside

Zkit60_backpannel_inside

You are kind of on your own here. Many panels from DIY chassis have pre-drilled holes. Some of these holes should work, others won't, and some new holes will probably have to be drilled. The panel pictured had a cutout for an IEC (International Electrotechnical Commission) power connector with integrated fuse. On one side of the IEC were 2 holes (speaker banana + and - output) and on the other side were 4 holes (speaker banana + and – output and left and right RCA input). The banana jack holes were too far apart for the dual banana jacks I was using, which require two ½" diameter holes spaced ¾" apart. I used the lower banana jack hole on either side for the banana + and drilled new ½" holes ¾" below them for the banana -. The banana jacks must be tightened firmly and must not make electrical contact with the back panel (check with DMM ohm meter). The RCA jacks fit in the upper holes intended for the + banana jacks. This left 2 holes. The top one I plugged with 5 minute epoxy glue and a piece of electrical tape on the back, and the bottom one was turned into a ½" x ¾" square hole that the system ground switch fits into. The system ground switch is an optional switch that either connects (on = up) or disconnects (off = down) audio ground to IEC ground (IEC ground is always connected to chassis ground). In many audio systems the lowest amount of hum can be achieved by having audio ground connected to IEC ground at only 1 point in the system. This switch gives you options. It's kind of like cutting the ground pin off your power cord without losing your chassis ground safety connection.

STEP 8: BUILD THE FRONT PANNEL

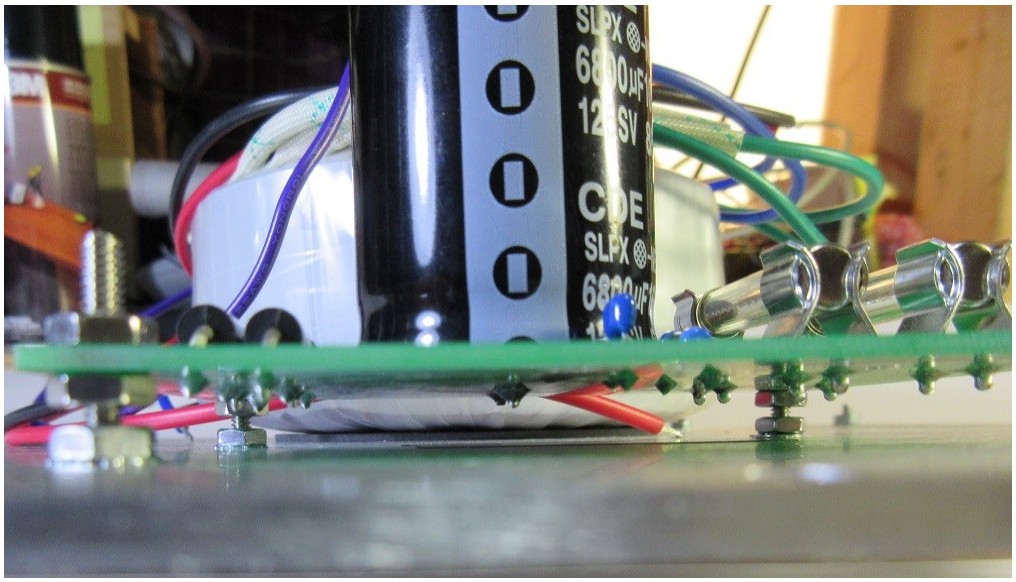
Again, you are kind of on your own, as what goes on the front panel can vary a lot. Mine came pre drilled for a single (dual) volume control, an on/off push button switch, and a hole for a 3mm LED pilot light. The volume control had an orientation hole, but if used the pot would be positioned with the electrical connections on the bottom which would make it very hard to wire. An additional orientation hole, drilled on the other side of the main volume control shaft hole allowed the pot to be mounted electrical connection side up. The LED is held in place with a dab of hot melt glue (I have never had any luck with epoxy and LED's…I think it might do something when it cures that is fatal to LED's, expansion/contraction? heat?).

STEP 9: MOUNT TRANSFORMER AND PC-1217

This step requires drilling four 7/64" (or 1/8") holes for the PCB's #4 mounting screws, one 7/64" (or 1/8") hole for the chassis ground screw, one 21/64" (or 5/16") hole for the transformer, four holes for the rubber feet, and one hole for the optional three position solder lug terminal strip.

The transformer should bolt to the bottom of the chassis, be centered left to right, and be slightly away from the back panel and anything mounted on the back panel (like the IEC jack). The transformer assembly order is: bolt thru the chassis, rubber pad, transformer, rubber pad, metal top piece that centers transformer to bolt, washer, lock washer, nut. Use a wrench to "reasonably tighten" the transformer bolt. A drop of Loctite, if you have it, is not a bad idea, especially if you will be shipping the Zkit60 (subjecting it to extreme vibration).

PC-1217 goes in front of the transformer. Once holes are drilled, using PC-1217 as a guide to mark where the holes go, use four #4 x 3/4" machine screws bolted to chassis with four #4 kep nuts, then 4 plain #4 nuts adjusted to be about 1/4" above the chassis, followed by the PCB and four more #4 kep nuts. Make sure the PC-1217 is mounted high enough to not short out on the bottom panel.

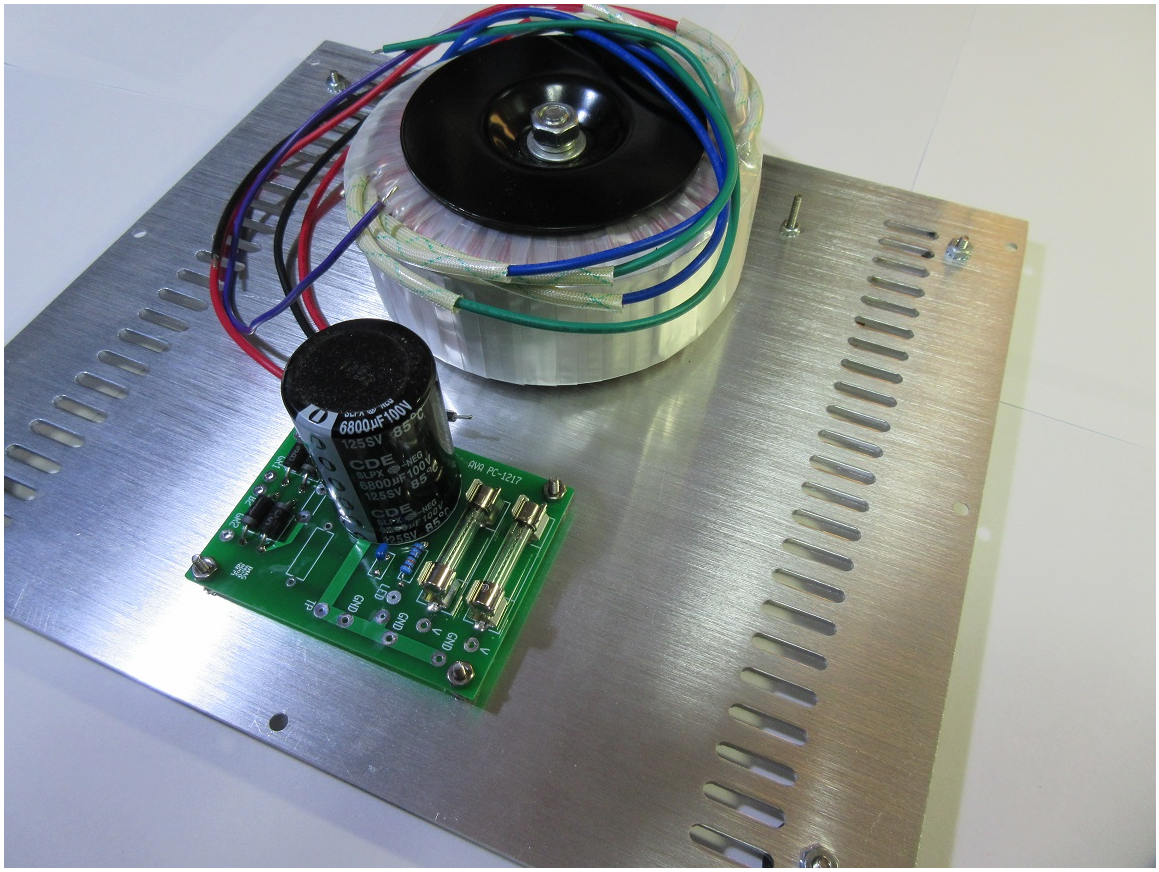


PC-1217 clearance check

The hole for the chassis ground screw should be an inch or so away from the transformer, an inch or so away from the back panel, and fairly close to the IEC jack. The kep nut on the ground stud is what makes electrical contact with the chassis, cutting through any coating or paint the chassis might have, so be sure to use one.

Next, drill a hole in each corner and mount the rubber feet with kep nuts.

Finally, if desired, mount the three position solder lug terminal strip. The terminal strip is used as a place to join wires together. It should be used for 220/240 volt wiring, where the two primary transformer coils must be connected (series connection). It can also be used to join two wires together and to a third (110/120 volt wiring where both primary coils must connect) so only one wire has to attach to connect both coils. Mount the terminal strip by drilling a 7/64" (or 1/8") hole and using a #4 machine screw and kep nut. It should be mounted by the transformer, possibly on the opposite side as the ground screw. Note that the center lug of the terminal strip is connected to chassis ground by the mounting hardware and should not be used.



Chassis bottom

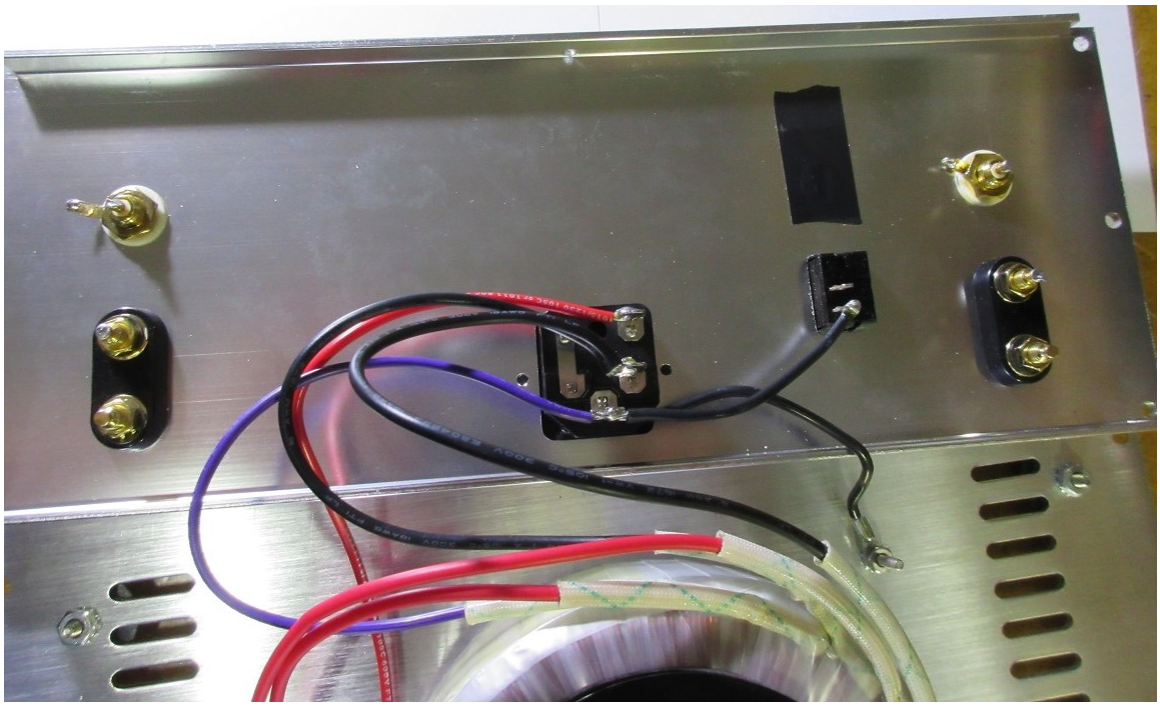
End of part 1. Continue with part 2, Zkit60 wiring & bringup.

Zkit60 Instructions Part 2: Wiring & Bringup

This kit is NOT intended for the novice kit builder. Soldering experience is expected. You should have completed Zkit60 instructions part 1 before starting part 2.

STEP 1: START WITH THE BACK PANNEL:

Wire the transformer, IEC connector, system ground switch (if there) and ground stud as shown:



IEC wiring

The bottom IEC lug is earth ground ("E" or ground symbol), the middle IEC lug is the neutral ("N"), and the top IEC lug is the hot ("L" for load). The IEC connector has an integrated fuse.

For 220/240 volt operation connect the IEC power connector as follows:

1) The IEC ground lug ("E" or ground symbol) should connect to three places:
    a) To the transformer purple shield wire (if your transformer has one)
    b) To the chassis ground screw
    c) To the system ground switch, if present, or to the middle "GND" eyelet on the PC-1219 power supply board if there is no system ground switch.
2) The IEC neutral lug ("N") connects to one black primary transformer coil wires.
3) The IEC hot lug ("L") connects to the fuse, if your IEC connector does not have an integrated fuse. The other side of the fuse, or your IEC hot lug ("L") if your IEC connector has an integrated fuse, connects to the on/off switch.
4) The other terminal of the on/off switch must connect to the one red primary transformer coil wire that is not continuous with the black primary wire connected in step 2.

5) Use the terminal strip to join the two different primary coils red and black wires together.
6) Check your work: First - ensure that no power cord is attached to the IEC, then turn the power switch on and make the following resistance measurements:
    a) measure resistance from IEC "L" terminal to the place you joined the two different primary coils red and black wires together in step 5.
    b) measure resistance from IEC "N" terminal to the place you joined the two different primary coils red and black wires together in step 5.
    c) measure resistance from IEC "L" terminal to the IEC "N" terminal.

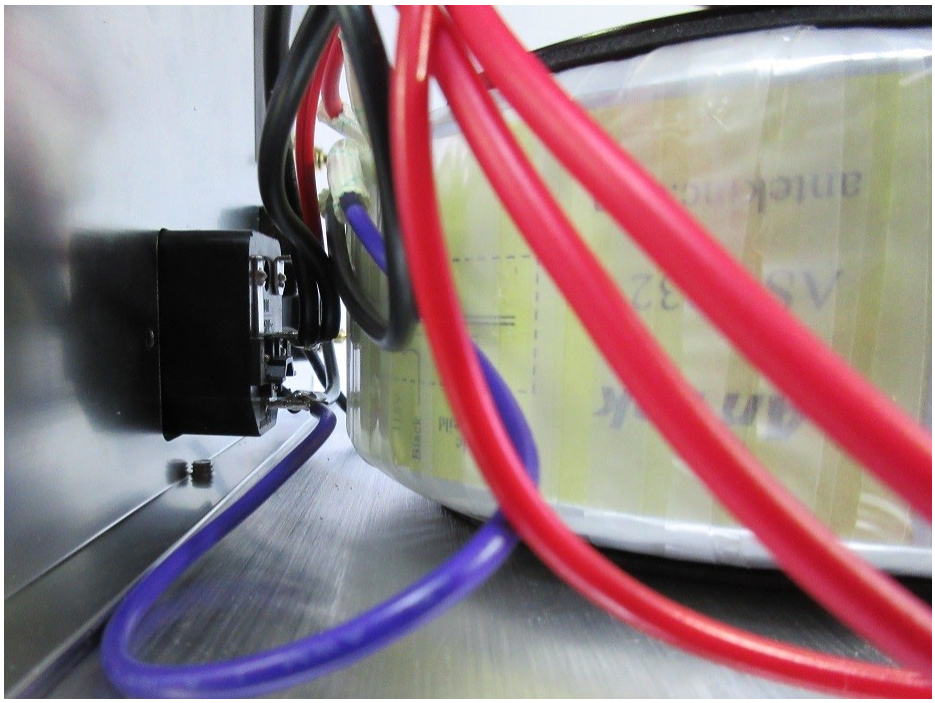
   Measurement a) should be about the same as measurement b): maybe 4 ohms or so. Measurement c) should be double measurement a) or b): maybe 8 ohms or so.
7) Turn power switch off.

For 110/120 volt operation connect the IEC power connector as follows:

1) The IEC ground lug ("E" or ground symbol) should connect to up to three places:
    a) To the transformer purple shield wire (if your transformer has one)
    b) To the chassis ground screw
    c) To the system ground switch, if present, or to the middle "GND" eyelet on the PC-1219 power supply board if there is no system ground switch.
2) The IEC neutral lug ("N") connects to two black primary transformer coil wires. You may find it easier to use the terminal strip to join two black primary coil wires to a third wire so only one wire has to connect to the IEC neutral lug ("N").
3) The IEC hot lug ("L") connects to the fuse, if your IEC connector does not have an integrated fuse. The other side of the fuse, or your IEC hot lug ("L") if your IEC connector does have an integrated fuse, connects to the on/off switch.
4) The other terminal of the on/off switch must connect to both red primary transformer coil wires. You may find it easier to use the terminal strip to join two red primary coil wires to a third wire so only one wire has to connect to the on/off switch lug.
5) Check your work: First - ensure that no power cord is attached to the IEC, then turn the power switch on and measure the resistance from IEC "L" terminal to IEC "N" terminal: It should be quite low but **not** zero: probably 1 to 2 ohms.
6) Turn power switch off.

If the transformer you are using has additional secondary coils, make sure those wires don't make electrical contact with anything.

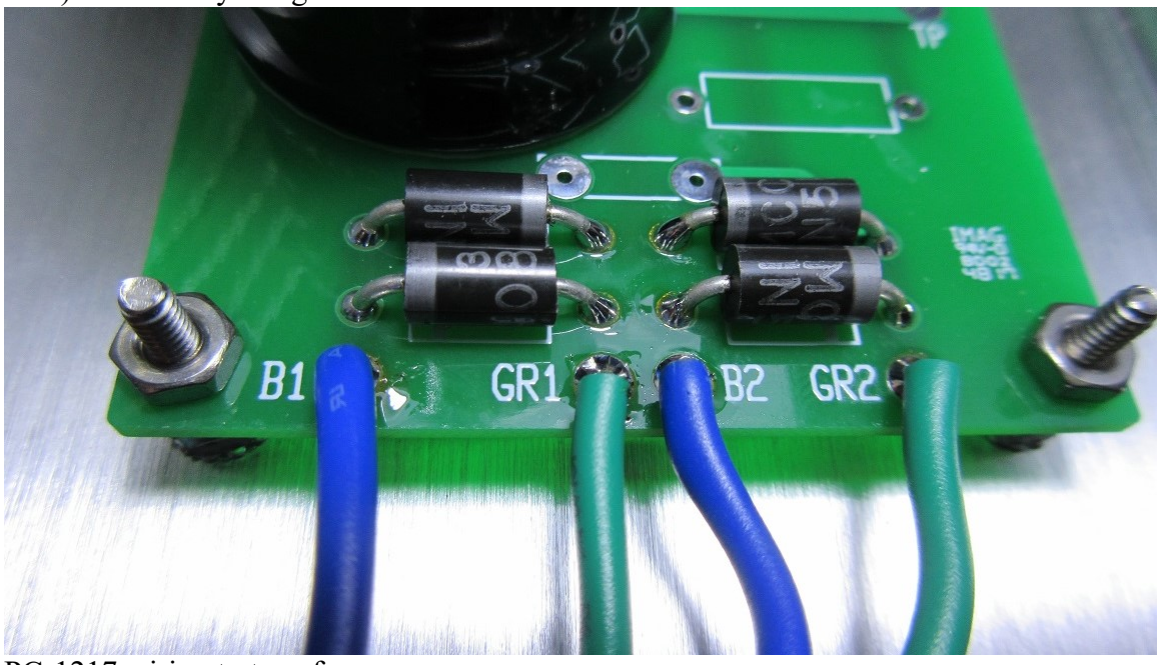
Fasten the back panel into position and check that nothing is touching:



IEC clearance check

STEP 2: WIRE UP THE POWER SUPPLY PC-1217:

With ohm meter, find which secondary green and blue wires are continuous (less than ½ ohm). Arbitrarily designate them as coil 1 and coil 2. Connect and solder as shown:

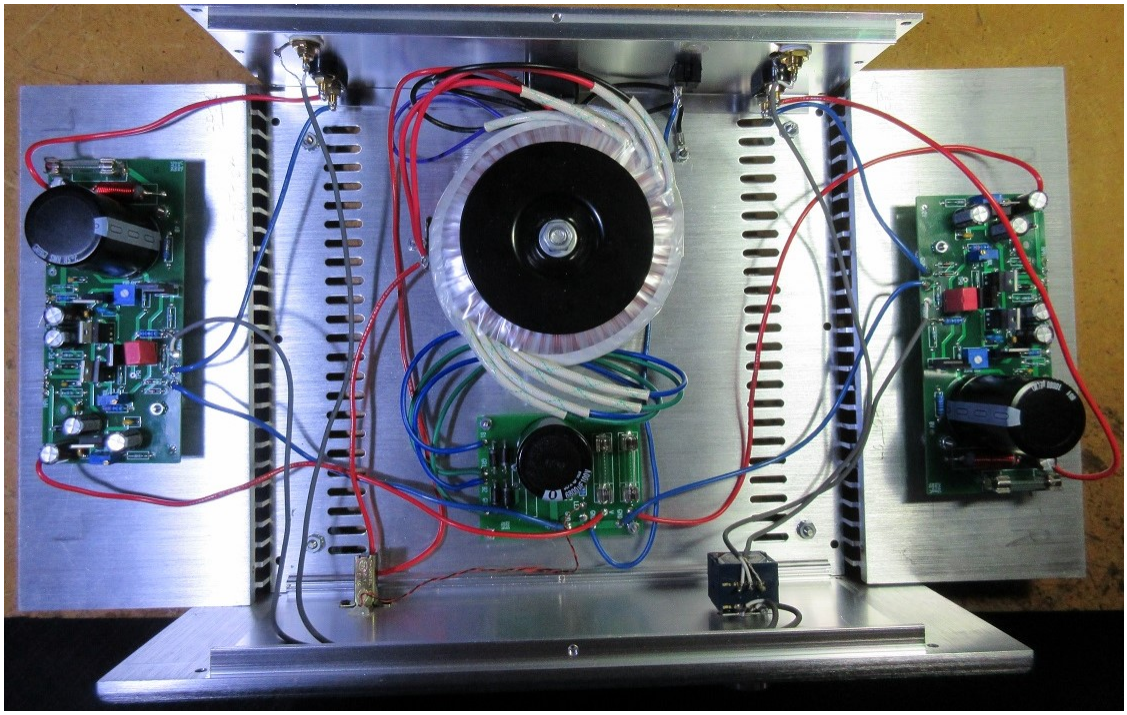


PC-1217 wiring to transformer

Check by verifying resistance between “B1” and “GR2” is close to, but not quite, zero. (0.8 ohms for AS-2234 transformer)

STEP 3: WIRE WITH HOOK UP WIRE

When finished, the completely wired, laid open amplifier chassis should look similar to:

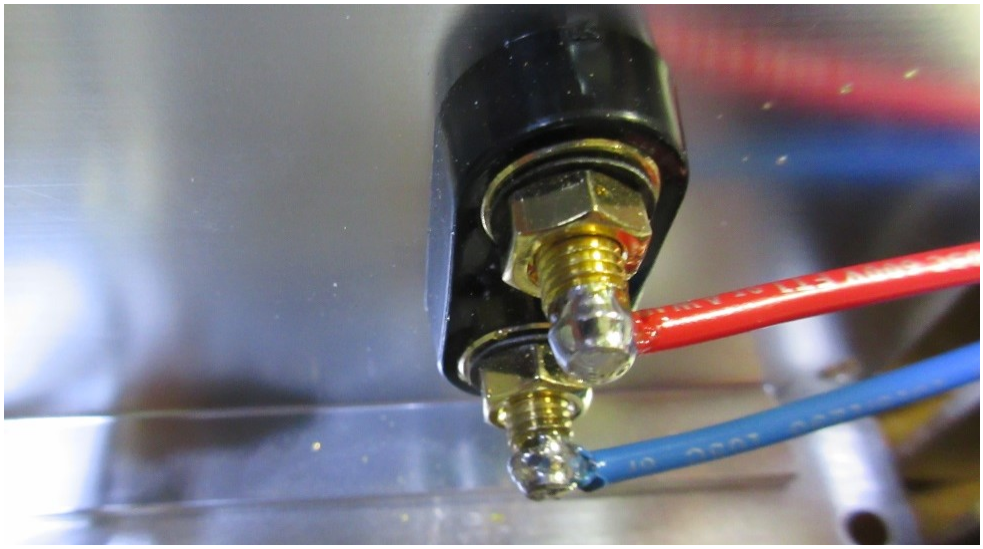


Zkit60 exploded view after wiring

There are four 18 AWG “hook up” wires and a coax wire going to each PC-0117 amp board: Beware of shadows.

The following description and picture explains how to properly connect the 18 gage hookup wire to the banana plug. Do not cut or solder any wire until told to do so after the description.

A proper soldering job to the banana plugs starts with the wire wrapped tightly around the stud, just under one revolution, and then soldered properly. Result is a shiny connection that completely covers the bare wire and stud end and does not melt the wire insulation. This takes quite a bit of heat with the soldering iron moving around so all parts of the stud end is heated enough to melt solder over the entire joint.



Banana plug soldering

.

Note: The PC-0117 amp PCB has two large ground eyelets: The one labeled “GND” and the one next to it, between “GND” eyelet and “AUDIO IN” eyelet. The two ground eyelets may be used interchangeably.

Wire ground (blue wire was used for ground in wiring picture):

1) from PC-1217 power supply leftmost “GND” eyelet to the left channel PC-0117 amp “GND” eyelet
2) from PC-1217 power supply rightmost “GND” eyelet to right channel PC-0117 amp “GND” eyelet
3) from the PC-1217 power supply middle “GND” eyelet to system ground switch, if present, or to ground lug if not.
4) from the left channel PC-0117 amp PCB eyelet next to “GND” to the left banana black / negative.
5) from right channel PC-0117 amp PCB eyelet next to “GND” to the right banana black / negative.

Wire Vcc power (red wire was used for Vcc power in wiring picture):

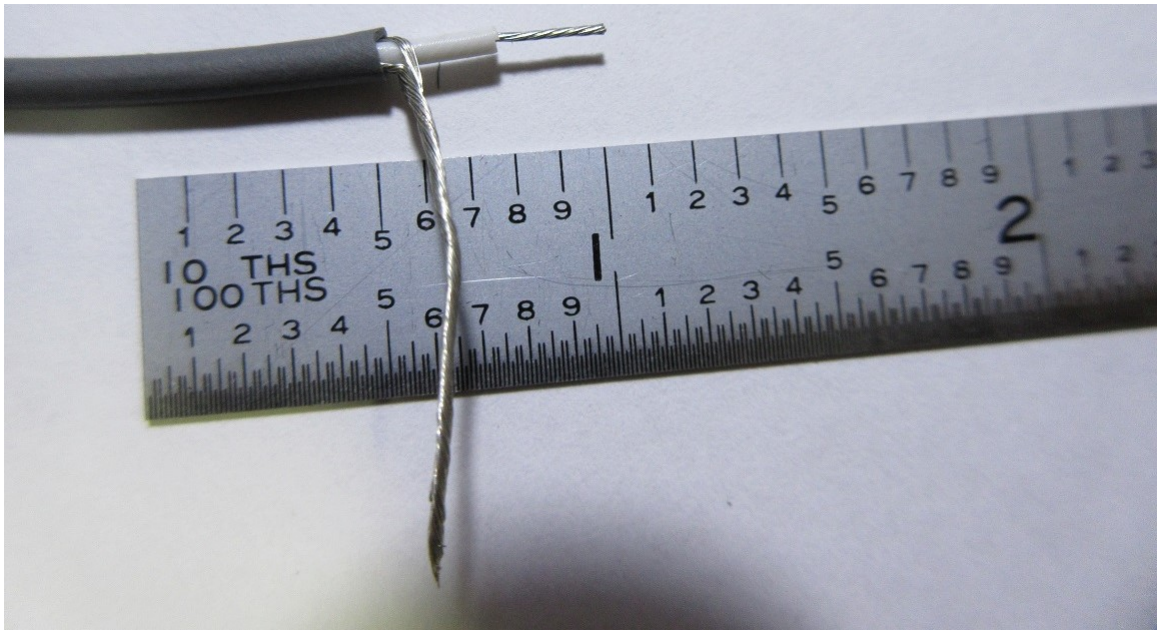
1) from the PC-1217 power supply leftmost “V” pad to the left channel PC-0117 amp “VCC” pad in the upper left. This also assigns the left fuse on the PC-1217 power supply board to the left channel amp board.
2) from the PC-1217 power supply rightmost “V” pad to the right channel PC-0117 amp “VCC” pad in the upper left. This also assigns the right fuse on the PC-1217 power supply board to the right channel amp board

Wire audio out (red wire was also used for audio out in above picture):

1) from the left PC-0117 amp “OUT” eyelet in the upper right to the left banana red / positive.
2) from the right PC-0117 amp “OUT” eyelet in the upper right to the right banana red / positive.

STEP 4: WIRE WITH SHIELDED COAX WIRE

To prepare each end of the coax wire: The outer jacket must be stripped off; the shield braid untwisted, pulled away from the center conductor, and then twisted back together. Finally, the center conductor insulation is stripped away. The result should look like this:

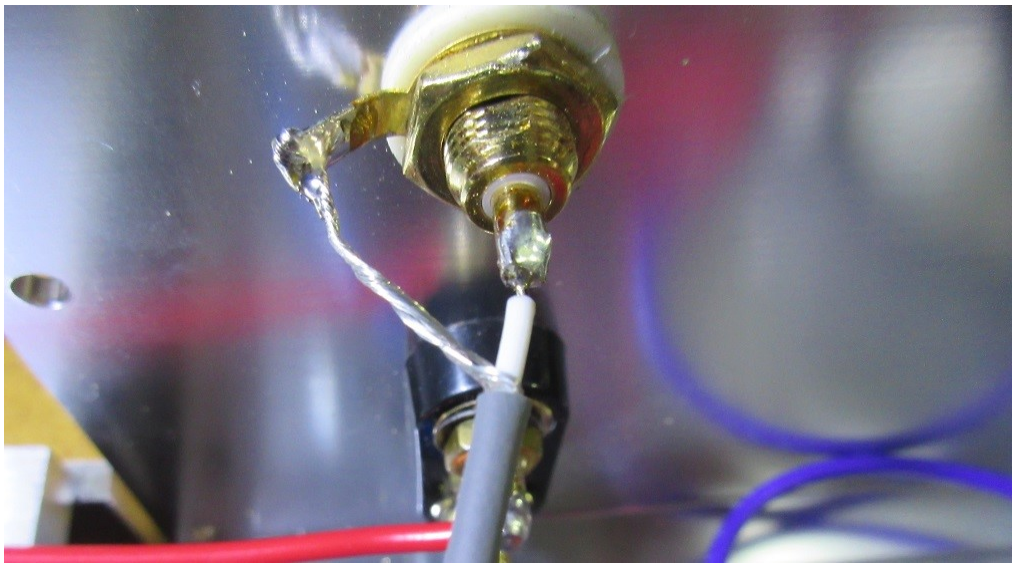


coax stripped

A touch of solder on the center conductor and the braid will hold things together nicely. You must be careful to not use too much heat as it is quite easy to melt the insulation, especially the braid getting hot enough to melt into the center conductor insulation where the braid twists around the center conductor.

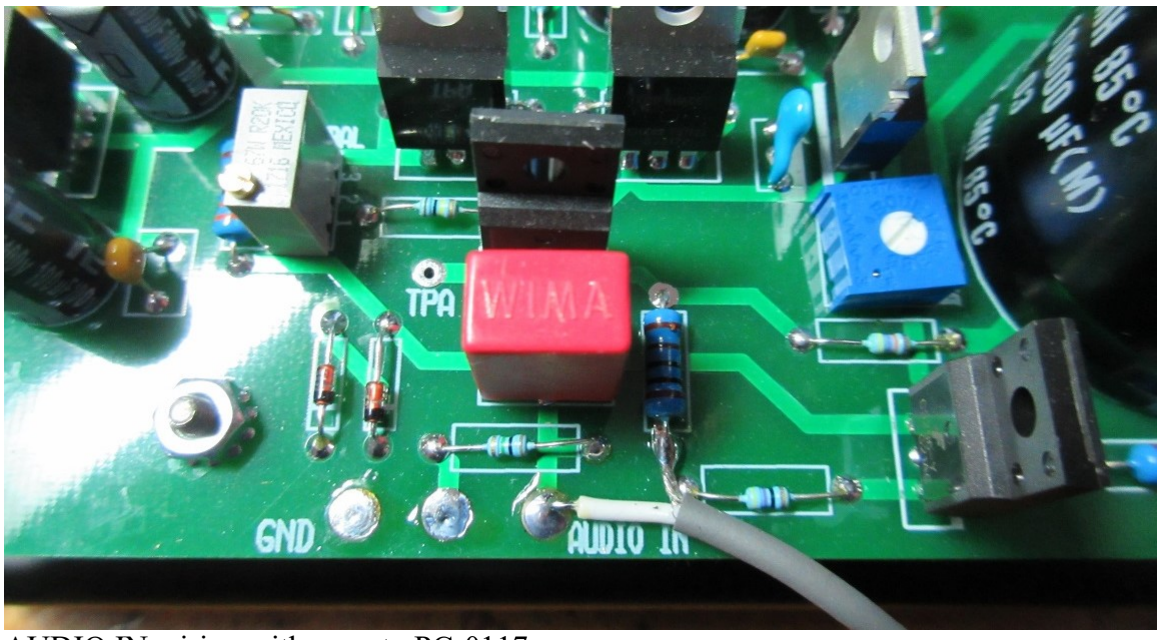
The next page shows and describes how to connect the coax wire to the various places it must be connected to. Do not cut or solder any coax wire until told to do so after these descriptions.

Soldering coax to the RCA jacks involves rotating the jack so the "solder cup" at the end of the RCA is pointing up (so it will hold molten solder), tightening the RCA connector firmly, and orientating the coax so the braid lines up with the RCA (isolated) ground lug. Heat the RCA solder cup and melt solder into it. With the soldering iron still on the RCA, the previously tinned coax center conductor is inserted all the way into the solder cup, the iron removed, and the coax held steady until the solder solidifies. Hint: blow on the RCA to speed up this cooling. The braid can then be attached and soldered to the ground lug. Visually verify ground braid cannot short to center conductor, or anywhere else.

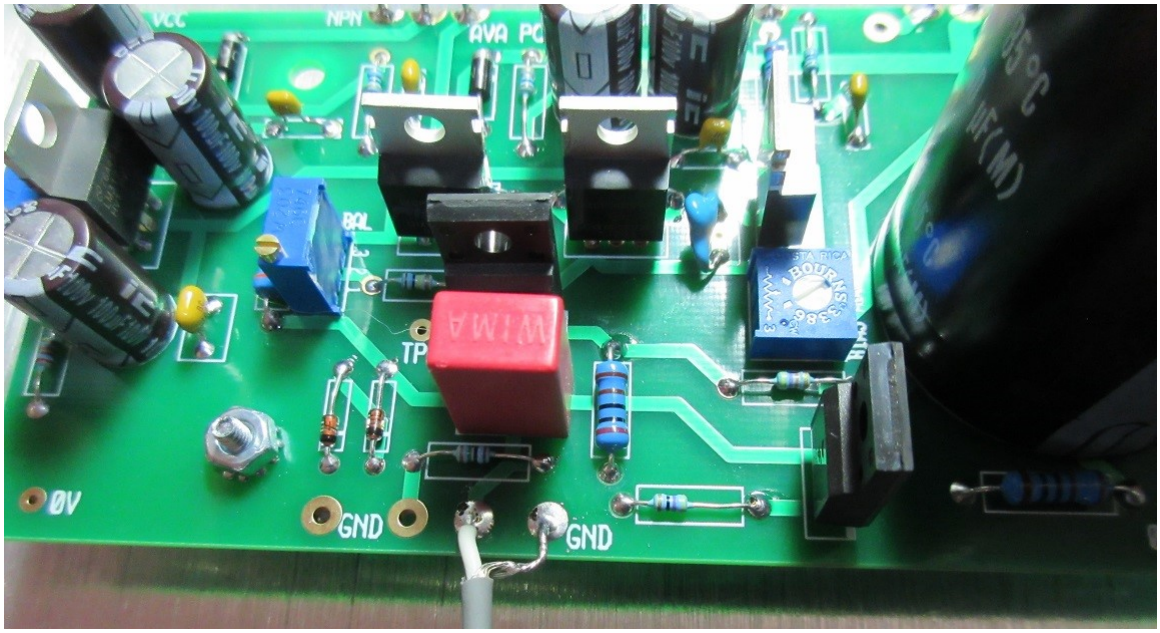


RCA jack wiring with coax

Soldering coax to the PC-0117 amp board involves soldering the center conductor to "AUDIO IN" and the braid to ground at either the 2k resistor bottom lead or the 47 ohm left lead. Both of these resistor leads are just to the right of "AUDIO IN". I found it easier to use the physically larger 2k resistor bottom lead. PC-0117B has an additional "GND" eyelet for the coax braid.



AUDIO IN wiring with coax to PC-0117



AUDIO IN wiring with coax to PC-0117B

Keep coax wires short and away from the transformer, at least as much as possible.

If you do not have a volume control:

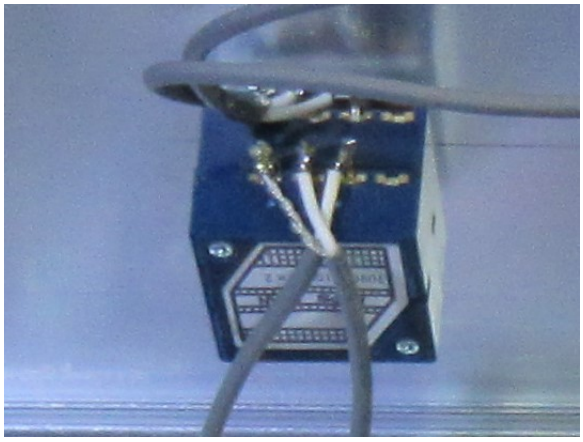
1) Solder one end of a coax wire to the left RCA jack (and isolated ground lug), solder the other end to the left PC-0117 amp PCB "AUDIO IN" (and ground).
2) Solder one end of a second coax wire to the right RCA jack (and isolated ground lug), solder the other end to the right PC-0117 amp PCB "AUDIO IN" (and ground).

If you have one volume control:

Note: the Alps volume control has two sets of three pins. You will first wire the set furthest from the front panel to the left amp side and then wire the set closest to the front panel to the right amp side. It is VERY important to do a quick soldering job when soldering the pot. Use as little heat as possible and wait a few minutes between pins to allow the pot to cool (solder / strip the other end of the coax while waiting).

1) Solder one end of a coax wire to the left RCA jack (and isolated ground lug), solder the center conductor of the other end to the pot's pin 3 (rightmost pin in the picture) that's furthest from the front panel. Let the braid just hang for now.
2) Solder one end of a second coax wire to the left PC-0117 amp PCB's "AUDIO IN" (and ground). Solder the center conductor of the other end to the pot's pin 2 (wiper / middle pin in the picture) that's furthest from the front panel. Twist the braids of the two coax wires together, lightly tin with solder, and solder to the pot's pin 1 (leftmost pin in the picture) that's furthest from the front panel. Make sure the braid is not touching anything other than pin 1.
3) Solder one end of a third coax wire to the right RCA jack (and isolated ground lug), solder the center conductor of the other end to the pot's pin 3 (rightmost pin in the picture) that's closest to the front panel. Let the braid just hang for now.

4) Solder one end of a forth coax wire to the right PC-0117 amp PCB's "AUDIO IN" (and ground). Solder the center conductor of the other end to the pot's pin 2 (wiper / middle pin in the picture) that's closest to the front panel. Twist the braids of the two coax wires together, lightly tin with solder, and solder to the pot's pin 1 (leftmost pin in the picture) that's closest to the front panel. Make sure the braid is not touching anything other than pin 1.


pot wiring with coax

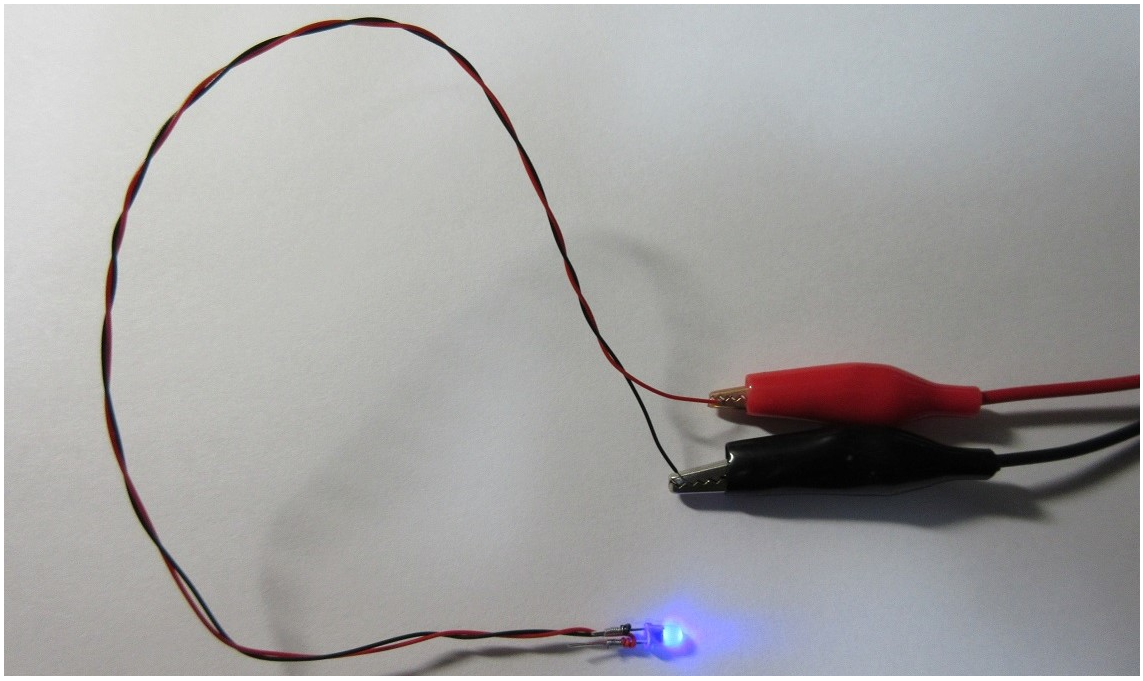
If you have two volume controls:

Note: Each Alps volume control has two sets of three pins. You will only be using the set furthest from the front panel. The other set is left no connect. It is VERY important to do a quick soldering job when soldering the pot. Use as little heat as possible and wait a few minutes between pins to allow the pot to cool (solder / strip the other end of the coax while waiting).

1) Solder one end of a coax wire to the left RCA jack (and isolated ground lug), solder the center conductor of the other end to the left pot's pin 3 (rightmost pin in the picture) that's furthest from the front panel. Let the braid just hang for now.
2) Solder one end of a second coax wire to the left PC-0117 amp PCB's "AUDIO IN" (and ground). Solder the center conductor of the other end to the left pot's pin 2 (wiper / middle pin in the picture) that's furthest from the front panel. Twist the braids of the two coax wires together, lightly tin with solder, and solder to the left pot's pin 1 (leftmost pin in the picture) that's furthest from the front panel. Make sure the braid is not touching anything other than pin 1.
3) Solder one end of a third coax wire to the right RCA jack (and isolated ground lug), solder the center conductor of the other end to the right pot's pin 3 (rightmost pin in the picture) that's furthest from the front panel. Let the braid just hang for now.
4) Solder one end of a forth coax wire to the right PC-0117 amp PCB's "AUDIO IN" (and ground). Solder the center conductor of the other end to the right pot's pin 2 (wiper / middle pin in the picture) that's furthest from the front panel. Twist the braids of the two coax wires together, lightly tin with solder, and solder to the right pot's pin 1 (leftmost pin in the picture) that's furthest from the front panel. Make sure the braid is not touching anything other than pin 1.

STEP 5: WIRE THE LED PILOT LIGHT

The LED can be tested with your DMM before soldering. This will verify LED functionality and polarity. With DMM on lowest ohms scale, connect positive DMM lead to red LED wire and negative DMM lead to black LED wire.



LED

Connect and solder the plus (longer lead, red wire) to the PC1217 power supply board "LED" pad. Connect and solder the negative (shorter lead, black wire) to the "GND" pad with the small hole on the PC1217 power supply board. The 180k ohm resistor should work fine in most applications, but the resistor can be made larger for a dimmer light and smaller for a brighter light. Lower limit is around 10k before damage to the LED could occur.

STEP 6: BRINGUP AND FINAL ADJUST

You may leave the chassis laid open or assemble the sides, front, back, and bottom. If left open, some of the adjustments might be a little easier to get to.

The bias current adjustment will be done twice, once for each PC-0117 amplifier board. We will do the left channel first, so remove the right fuse on the PC-1217 power supply board, which should prevent power from getting to the right channel. With nothing connected to the RCA inputs or the speaker output banana jacks, and assuming you have no test equipment (other than a DMM) and no variac to control the AC voltage into the amp, the only way to proceed is to cross your fingers, plug it in, and turn it on.

Assuming there is no smoke and no loud bangs, measure the raw Vcc voltage available at the one remaining fuse on the PC-1217 power supply board. The voltage will depend on the transformer and the line voltage, but it should be between 88 – 100 vdc. If not, find out why and correct before proceeding. Measure this same voltage at the "Vcc" eyelet in the upper left corner of the left channel PC-0117 amp PCB to be sure the correct PC-0117 is powered up. Power down the amp and wait 15 – 20 sec or until the pilot LED goes out.

Set your DMM to the highest DC milliamp range, probably around 2000 ma. Change the positive lead to the milliamps jack, if that's the way your DMM is configured. Remove the left fuse (only fuse) in the PC-1217 power supply PCB, and clip the DMM leads to the now empty fuse clips for a hands free current measurement reading. Power the amp up. The current should spike at turn on and then settle to around 50 – 100 ma within a couple seconds. Adjust the "BIAS ADJ" 200 ohm single turn pot by the big capacitor on the PC-0117 amp board to set the bias current to 45 – 50 ma. This number will creep up as the amp warms up, but a setting of 45 – 50 ma within the first few minutes of operation will work fine. If you read zero milliamps, even at turn on, I would suspect the DMM fuse, DMM leads plugged in the wrong jacks, or the PC-0117 amp PCB is not powered. If the bias current can't be adjusted to 45 – 50 ma, find out why and correct before proceeding.

Power down the amp and wait 15 – 20 sec or until the pilot LED goes out. Remove the DMM leads from the left channel fuse clips and connect them to the right channel fuse clips on the PC-1217 power supply PCB. Power up the amp and adjust the bias current on the right PC-0117 amp PCB in the same manor you just did on the left channel. Again, if the bias current can't be adjusted to 45 – 50 ma, find out why and correct before proceeding.

Power down the amp and wait 15 – 20 sec or until the pilot LED goes out. Remove the DMM and replace both fuses in the PC-1217 power supply board. Move the DMM lead back to the volt/ohms jack if that's the way your DMM is setup. Switch the DMM to DC volts. Connect the DMM negative lead to ground, which is available at the ground stud (be sure the system ground switch, if present, is on so the ground stud is connected to the "GND" eyelet on the PC-1217 power supply PCB).

Power up the amp, let it warm up for a couple minutes, and set two DC voltages based on the power transformer you are using: See table below. First set the regulated Vcc voltage by adjusting the "REG V" 1k ohm 25 turn pot. The regulated Vcc voltage is available on the emitter of the big NPN transistor, which is the closest pin of the 9

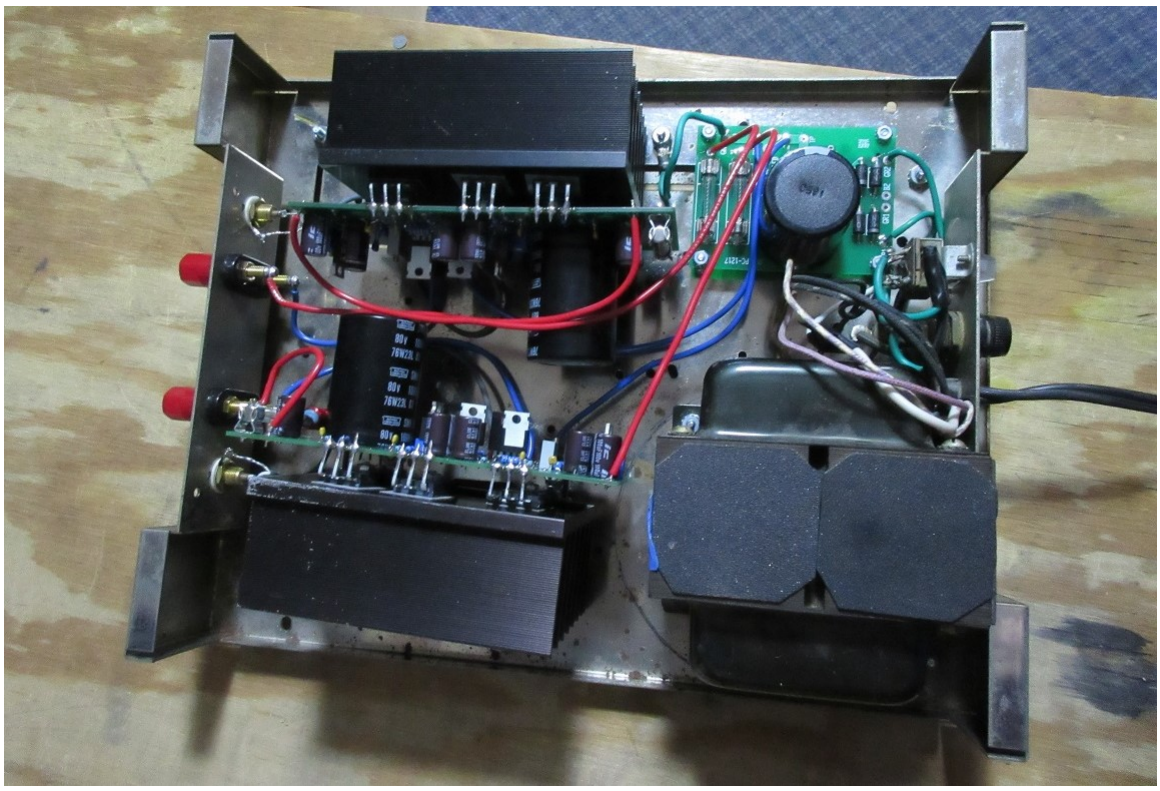
transistor / mosfet pins to the “VCC” wire in the PC-0117’s upper left corner. The pot is set up so turning clockwise turns the regulated voltage up and counter clockwise turns it down. Do the same thing on the other PC-0117 amp board.

Next, adjust the “DC BAL” 20k ohm 25 turn pot so the DC voltage at “TPA” matches the voltage given in the table below. Set “TPA” on each amp board. If either board can’t be adjusted for either of these voltages, find out why and correct the problem.

Transformer	Vreg	TPA
Antek AS-2232	77	2.80
Dynaco 120	80	2.85
Antek AS-2234	80	2.85
Antek AN-3232	80	2.85
Antek AS-3434	83	2.90
Antek AN-4434	83	2.90

Congratulations! You should now have a working Zkit60. Power down the amp, wait 15 to 20 sec or until the pilot LED goes out, remove any DMM probes, assemble the chassis if you haven’t already done so, and enjoy!

If you run into difficulty, a good visual inspection of soldering and wiring should be the place to start. Next would be to seek help on the Zkit60 forum on the Decware web site at www.decware.com. Finally, I can be emailed at engineer.danielgk@gmail.com



Dynakit / Dynaco 120 Rebuild using Zkit60 circuits, two large internal heat sinks, original Dynaco 120 transformer and chassis