

Musical Concepts

PS-220

Thank you for purchasing our Musical Concepts PS-220 high-performance power supply modification circuitry.

The PS-220 is versatile. It facilitates an easy installation to fit a high-performance dual-mono power supply reservoir to your amplifier. It forms the heart of any power amp(or even a preamp) providing the real linear, dynamic power of the circuit. It is easy to set up with your original transformer or with dual transformers. Clearly it allows a cost-effective, high-performance power supply upgrade.

APPLICATION

The intended “home” of the PS-220 was envisioned to be the Hafler DH-200, DH-220 or XL-280. The PRO models can work too. One can see that, room allowing, it will be useful in many power amps where it’s small size would make installation a breeze.

DESIGN PROCESS

In many ways the PS-220 is the result of years of listening and experience but the impetus for this particular design is the result of more recent changes in the landscape of high-performance power supply capacitor technology. The PS-220 is adaptable to two types of capacitors. There is accommodation for caps with directly soldered pins instead of older style mounting screws. The board layout fully exploits large high-performance, low ESR capacitors. This board makes installation of such capacitors an easy task removing the confusion of hand wiring.

The “inverted” circuit board design of the PS-220 leads to shorter, more direct wiring which is always important in reducing the inherent inductance of circuit wiring thereby improving the sense of speed and focus. The copper tracks on the PS-220 board can accept solder flow to “fatten” the circuit foils for higher current flow.

We use superior Hyper-Fred rectifier technology in a new, convenient packaging that facilitates the small size, yet powerful impact of the PS-220. The compact, yet powerful diode bridges use soft-recovery technology and very fast switching. The rectifiers are so efficient that there is very little heat rise even after hours of hard use.

POWER SUPPLY CAPACITORS

The standard capacitor package consists of **four** 10,000uF/80V(or 100V) capacitors which replace the original **pair** of 10,000uF/75V capacitors(Hafler DH-200/220). Alternate “Premium” capacitors are high-performance 15,000uF/80V(or 100V) parts. The Jensen 4-pole and Mundorf AG 2-pole caps can also be used. We no longer sell Jensen caps, but we still have a stock of pull-out parts. Those are still covered in these instructions. Modern capacitors are nearly a revolution in terms of performance and size reduction. We can now pack a real wallop into small spaces.

Then there is a second version of the board, the PS-200M, that support the premium four-pole Mundorf capacitors. These exotic capacitors have exotic performance according to our ears. Some amps, like Hafler DH-120 or Adcom GFA 543/535 for example, only require lower voltages so those may be equipped with 63VDC parts.

DISCLAIMER

Musical Concepts accepts no responsibility for damages, direct or consequential, resulting from this modification. The user solely determines his or her own ability to properly install this product. Installer must understand electronic assembly safety. Musical Concepts accepts no responsibility for personal injury or death resulting from electrical shock hazard.

SOLDERING NOTES

You should have soldering experience to do this modification. We remind the veteran that solder should be **fresh**. We provide 63/37 eutectic rosin core solder. **So-called audio-grade solders that we have evaluated can devastate the sweet delicate sound of the PS-220. Make sure you are a "total solder genius" before substituting for the supplied solder.**

TOOLS REQUIRED

- Three prong, grounded, 25 to 45+ watt(preferred) soldering iron which has quick heat recovery ability. No gun!
- Fresh 63/37 eutectic rosin core solder--provided (**This solder contains lead - use in well ventilated area.**)
- Needle nose pliers, diagonal cutting pliers, wire stripper, screwdrivers(mainly #1 Philips)
- 1/4 inch nutdriver or 1/4" socket with extension(may be needed with some amp, not all)
- Multi-meter (not required but suggested)

INVENTORY - WHAT'S IN THE BOX

1 - PS-220 circuit board
4 - 15,000uF/80V 4-pin or 10,000uF/80V 2-pin caps or Mundorf 2-pole caps rated at 10kuF or 15kuF - **if ordered**
2 - 5-pin rectifier - **if ordered (in pack with 2- #4-40x3/8" screw, 2- #4-40 KEP nuts, 2 - metal mounting clips)**
4 - bleeder resistors, 10K Ohm, 2 watt
5 - #4-40 thread, 1/2" tall metal standoffs
5 - #4 star washers
5 - #4-40 x 1/4 inch **black** screws for attaching standoffs to chassis
5 - #4-40 x 1/4 inch **silver** screws to attach PS-220 to standoffs internally
MISC - lengths of hookup wire(**not with bare board**), length of eutectic solder, heatshrink tubing

BIG CAN CAPACITOR NOTE: 4 pin, snap-in capacitors have two active pins with internal connections. The remaining two are mechanical connections for strength. The PS-220 version also supports 2-pin snap-in capacitors and superb performing **Jensen 4-pole capacitors**.

INSTALLATION INSTRUCTIONS

Do not stuff board now!! You will use it to mark the mounting holes!! These instructions pertain to the installation of the PS-220 into Hafler amplifier or for custom installations. They are adequate to give you an understanding of how to use the board in other installation situations if you are an experienced builder.

We recommend that you read through the instructions before beginning to determine if you'll need the assistance of an experienced friend or professional installation by Musical Concepts. **WARRANTY STATEMENT: INSTALLED VERSION: Musical Concepts installed mods include a 1 year Parts and Labor warranty which excludes additional mods by other vendors or owner installed mods. KIT VERSION: Parts contained in this kit do not have a warranty after being soldered. Parts contained in the kit cannot be returned for refund or credit after being soldered. Kits do not have a labor warranty.**

IMPORTANT: These instructions presume that you are modifying a stock amp power supply. If yours is modified you still follow the basic procedures. **Read each step completely before starting work for that step.**

DEFINITION OF TERMS: >>>>>>References to left/right/front/back/up/down assume you have the amp right side up and you are facing the front of the amplifier.<<<<<<<<

CUSTOM APPLICATIONS: If you are using the PS-220 for special purposes such as a tubed amplifier, doubling up on capacitance, etc. you will want to go directly to page 9 to see special installation notes!

Installation: You might want read “The rest of the procedure” below to formulate your plan.

- 1.() Turn unit off, remove all connecting cords and disconnect AC plug from wall socket. Put on comfy work bench.
- 2.() Using 1/4” nut driver to remove screws between the heatsink fins, the upper four on each side. Now remove the cover. Set the top cover aside with its screws until you’re finished.

You’ll need to remove the original power supply caps, their clamps and the bridge rectifier(s), i.e. square block with four lugs, before proceeding with installation. See Figure A now to get an overview of the installation

- 3.() First remove the two screws on top of each large can cap. There are two screws on the side of the clamps that holds each can into the amp. Loosen those and remove the caps. Then remove the clamps. If those side clamp screws are too hard to get at then remove the caps with the clamps attached. **Note only for those using the original Hafler module boards: In the next actions you should record where you removed wires, i.e. one goes to the capacitor ground link and two go to the rectifier block, ground wires go to the center “star ground”, etc. Digital camera or a smart phone camera are handy here.** Now remove the two connected power transformer wires at the rectifier block. If these wires are plenty long you can just clip them off. They will be connected later to the PS-220 near center front of the of the board as shown on Fig A. It will be necessary to add some wire length if they’re too short. There is adequate wire in the kit plus some heatshrink tubing. There is a third red/yellow transformer wire which is connected to the wire link that previously connected the two big cans. Remove it from the link. It should be plenty long to connect as in Fig A. While you’re at it you can clip all the other wires loose from that link. Finish this step by removing the bridge rectifier.

The rest of the procedure will be easier for you if you remove the four remaining screws from between the heatsink fins on each module, completely detaching them. A small towel can protect the cosmetics if you wish. You may need to unsolder certain wires for this depending on how the amp was originally built. Just keep track of the original attachment points for reattachment purposes. Take a few pictures with your digital camera for reference if you like. Now you should be able to have the module lie beside the main chassis. The easiest way is to remove the modules completely, temporarily if you want to take the time to mark the wiring and do the work.

- 4.() **In case of original Hafler driver boards:** If you have any of our Musical Concepts driver boards already installed model PA-1 thru PA-6 then you may have already removed the two dual fuse holders from the floor(inside bottom cover) of the amp. If you left them in, though not needed with our mods then remove them now. **Keeping original Hafler driver boards: The original Hafler driver boards require that the fuse holders remain.** Leave all the wires connected to the fuse holder solder lugs cutting them loose from the lug that once connected them to the big caps. If you want to use our provided wire you can remove the front ones later. Leave original wiring there to speed installation and connect to PS-220 later. **Leave all the wires connected to the front-most lugs of the original fuse holders.**

Hint: If you are going to install new RCA jacks or binding posts - now is the time.

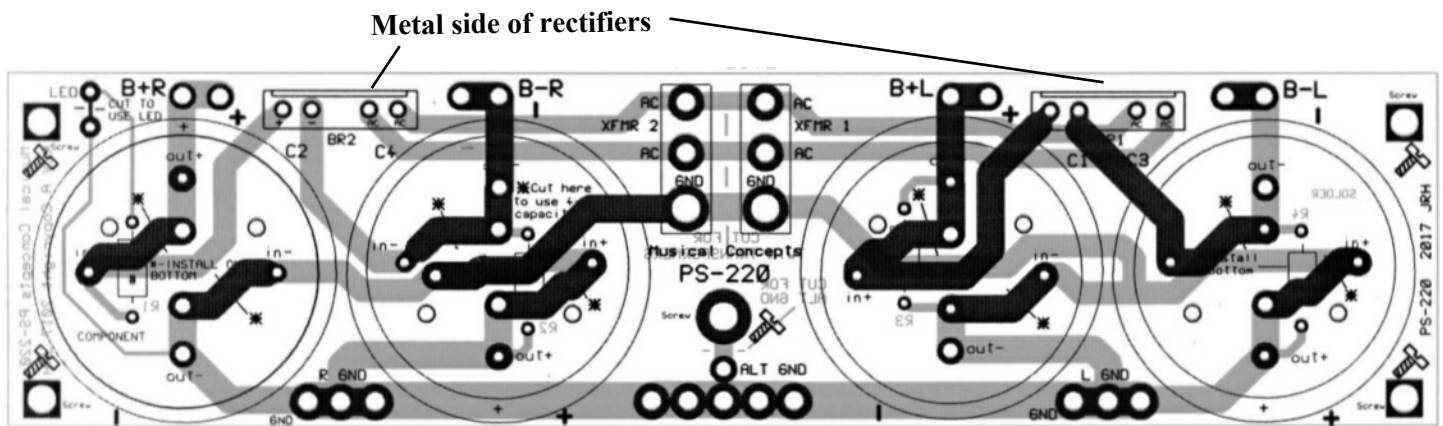
- 5.() Clean out the area where the caps and rectifier were installed and select the PS-220 board. Place it into this area with the silkscreen legend MUSICAL CONCEPTS PS-220 closest to the back of the amp. With the DH-200 and DH-220 you will find that the front holes in the PS-220 line up with the outermost holes for the original capacitor clamps. It was designed this way so you already have two holes that you don’t have to drill. Keeping the board in line with these holes take a pencil and draw outlines for the two rear holes and hole near the center rear of the board. These have a screw icon beside each hole. Remove the board and drill out these marked holes with a 1/8” or 9/64” bit. Deburr the holes by using a larger drill bit, Dremel, etc. Use your preferred tool to scrape the paint from the inside surface of the chassis around the ‘center’ hole you just drilled to make a good ground point. With the XL-280 you will have to mark out all the holes as you see fit. The photo gallery should help you visualize the installation.

IMPORTANT REFERENCE: See the picture gallery to visually understand the details of the installation. This will help give more context in the next several steps.

6.() Select 5 - #4-40 x 1/4" black screws, 5 - #4 star washers and 5 - threaded 1/2" tall standoffs. Install the screws from below the chassis. On the inside put the star washers over the screw and then spin the standoff onto the screw. Slightly finger tighten the screw so that it can still move horizontally within the holes. Repeat for the other four standoffs using the 1/4" screws and star washers.

7.() Temporarily put the PS-220 board over the standoffs to make sure everything lines up. Now temporarily install five #4-40 x 1/4" screws on the top side of the board to hold the PS-220 in place. Finger tight will be fine. You should know now if everything lines up and nothing shows undue binding or bad alignment. Keep the PS-220 in place as you tighten each of the five screws on bottom cover. **NOTE:** Make them tight but don't get too forceful and strip threads. Hopefully the PS-220 can now be removed easily or maybe you'll have to slightly adjust a few of the screws to make removal easier. Once the fit is good then remove the screws holding the bare board.

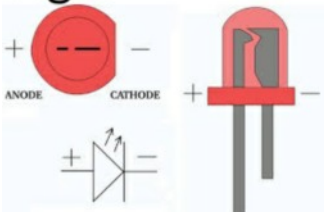
Below you see the PS-220 from the top or capacitor side as if the board were transparent or you have x-ray vision. Top foils black, bottom foils are gray. Note the four resistors with reversed lettering denoting their bottom side position.



Now is the time to partially populate your PS-220 board.

8.() **Do these steps before installing the large can capacitors.** **1ST:** If you have bought Jensen capacitors you will need to cut 8 circuit foils on the top side of the board. This separates the 4-poles of the caps so they function as intended. Use a razor knife, tedious, or a Dremel tool with cutoff wheel or ceramic tile bit. Cut where you see a * and straight line **2ND:** On the underside of the board, the side with the no painted silkscreen labeling, you'll see that there is provision for four resistors, R1 thru R4. These are designed to "bleed down" energy from the power supply capacitors if you were to have a fuse failure on the voltage rails. It can be a nasty surprise to see a big flash when you install a new fuse even though your amp may have been turned off all night or even days. By "nasty", we mean amp failure. Most of you will never need the resistors, but "better safe than sorry" as they say. Tip: If you plan to "build up" the solder on the bottom side foils you can do it now. Install(solder) the four included resistors from beneath the board(labeled the solder side) while making sure that there is a bit of space, about 1/8", between the board and the resistors. This space will minimize any heat build-up. Remember, you don't want these to hit the amp chassis when you permanently install the board. Solder resistors in place and trim the lead wires flush(even) to the top side of the board.

Fig 4

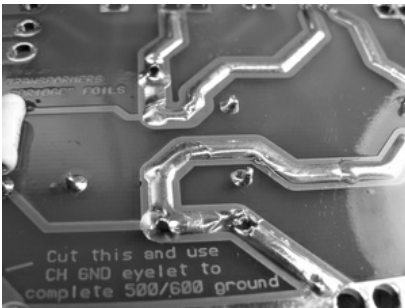


9.() **For custom mods only:** Hafler amps have a lighted AC power switch so don't do this step for Haflers. Near the left top you see two empty holes with the legend "LED" near them. These eyelets are provided in case the PS-220 is to be used with other amps or even custom projects. An LED can be provided with operating current from those eyelets. To use the LED cut the sliver of circuit foil connecting these two empty holes on the top side of the circuit board. Now you are ready to use the LED, just observe proper connection polarity. A is anode, C is cathode.

10.() Now select the four main filter capacitors. You will install them at C1 thru C4. The 4-pin filter caps can be easily installed because it has a distinctive pin pattern so they cannot be confused, but if your caps have only two pins pay close attention the the + and - signs and install each cap appropriately.

>Okay you decide how you want to do the following - we give one way.

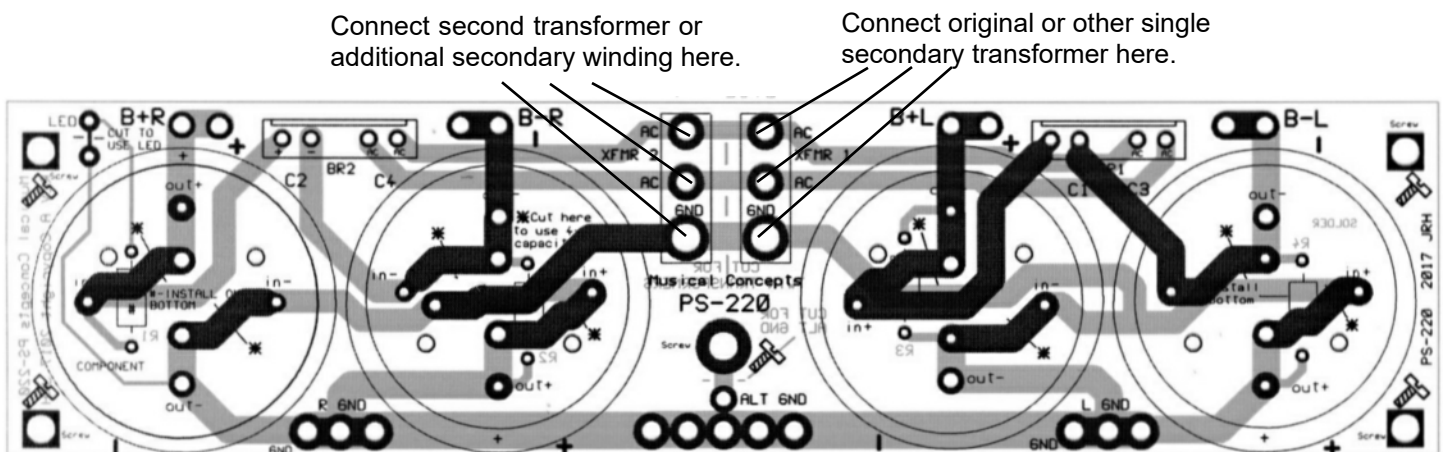
You can install all four, invert the board and solder. Straighten any pins that require it. While holding the board as perpendicular as you can, solder one of the pins. Now inspect the assembly and see if the position needs any adjustment. Now solder the remaining pin(s). Repeat for other caps. As you install the caps look them over carefully and adjust for best appearance. You know, make it look nice. We will put off installation of the rectifier until a later step.



11.() You've already noticed the bare foil areas on the solder side of the circuit board. They are bare so that you can melt/flow solder on them and greatly reduce the resistance of the foils and increase instantaneous peak current to recharge the filter capacitors. The PS-220 already has good size foils considering the current requirement but no harm in making it even better. Make it look neat!

Now it's time to decide how to install the board. Some of you may want to proceed in your own way. We have left the rectifier bridges off until now, because this board is very small, working room is tight and you may want to install the rectifiers after you have connected the wires from the power transformer. It's recommended that you read some of the next page before you wire the transformer to form your strategy.

Here's how we proceed: *If you have the standard Hafler transformer or another transformer with only a single secondary winding installation is simple. This might include a transformer with two separate secondary windings where you combine two of the wires to make a "center tap". If you have dual transformers with center taps or a center tapped dual secondary transformer then you will want the true dual mono style connection.*

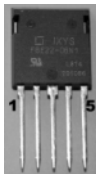


12.() If you have a dual secondary transformer or pair of transformers you must cut three foils on the bottom, "solder side" of the board. In the layout of the board shown you cut the three foils with the AC, AC and GND labels identifying them on the topside of the board. On the bottom the foils are indicated with the dashed lines. . **DO NOT CUT THESE WITH ORIGINAL TRANSFORMER OR ANY TRANSFORMER WITH SINGLE SECONDARY WINDING.**

Special Note: You might wonder why the transformer connection holes are so big. Well some transformers may have two wires twisted together for some connections, especially the ground(center tap) wire. Remember that the PS-220 was designed with custom installations in mind too. If your wiring is much smaller than the holes just solder as best as you can. You need not fill the entire hole with solder.

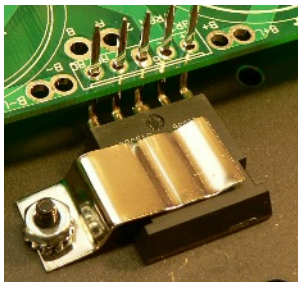
13.() If you have a single secondary transformer, like the stock Hafler, it's three secondary wires will be connected from the top(bottom if you prefer) of the board to eyelets labeled "AC", "AC" and "GND", as shown in the illustration on last page. Trim excess wire length from the solder joints. If you have dual-wound or separate transformers you will connect the other winding to the remaining eyelets labeled "AC", "AC" and "GND". Make sure you have the proper wires in each eyelet!!! For the stock Hafler transformers you have two reds for AC and a red/yellow for ground(GND).

Decision point: We have provided some metal 'clips' to securely hold the rectifiers against the bottom chassis for heat extraction. You can even place some silicone heat sink compound in a thin layer beneath the rectifier for a higher performance interface. Don't worry the metal backing of the rectifiers are not electrically connected at all, they're just for effective heat sinking. **Our recommendation:** When the PS-220 is installed in-house we always use the chassis for heat sinking, maybe that's enough said.



+ - ~ ~ ~
~ = AC
voltage

14.() Now you have the transformer connected so it is time to install the bridge rectifiers. Select the rectifiers. Cut the center pin off about 1/4" from the body of the part. The pinout is shown with Pin 1 at left proceeding in order to rightmost Pin 5. You'll see that the silk screen outlines on the PS-220 board indicate Pin 1 as +. Form the rectifier lead wires by bending the four at 90 degrees 'upward' about 1/4" away from the body of the part. See illustration in next step. Remember they are bent so that the labeled side of the part is facing upward. Now make sure you insert pin 1 of rectifier to pin 1(+) indication on the PS-220. Bend two end leads lightly in opposite direction to temporarily hold it in place. Don't solder yet.



Example: From a PS-200 install.
You will be 'missing' fifth pin.

15.() Now carefully install the PS-220 over the six standoffs. Make sure the rectifiers are still fitting loosely in their solder eyelets and don't bind up the installation. Put in a few of the #4-40 screws to hold the board down. Roughly position the rectifiers like the photo at left. **NOTE:** It is important that if the clamps should ever rotate they won't contact the rectifier leads. Position the clamp far enough 'forward' to avoid this. Select the metal rectifier clips. Place them onto the rectifier body as shown. Mark the hole in the clamp onto the chassis bottom. Again remove the PS-220 temporarily. Use a 1/8 or 9/64th inch drill bit to drill holes at the points just marked. Deburr the holes. Make the clamps the very last thing you install and tighten down in the final stages of installation. Again with the board temporarily in place and the rectifiers placed flat against the chassis you can solder each in place to the PS-220 board. If you want put off this soldering until all wires are soldered.

Evaluate your options and decide. You can install the board and then solder wires(from each channel driver board) to it while it is in place or pre-solder new wires to it and simply remove and replace the original power supply connection wiring. We strongly recommend the latter. If you have installed our driver boards though you might have some nice wire already.

16.() **Prepare wire lengths: Heavy-gauge wires:** 5.5" red (+) for Lch, 5.5" green (-) for Rch, 9.5" red (+) for Rch, 9.5" green (-) for Lch, 2 - 8.5" black (E7 each ch to GND), 11" black (left spkr GND to PS-220 GND), 13" black (right spkr GND to PS-220 GND)

If you're taking our advice and soldering the board before installation lets get started. Be careful to keep from burning the insulation on the filter caps while soldering. We want them pretty, right! While we could go on step by step here concerning the wiring, it seems that the info on the following pages is what you'll need to get the job done. Put some silicone heatsink compound on the metal side of the rectifiers if you wish before permanent installation of the board.

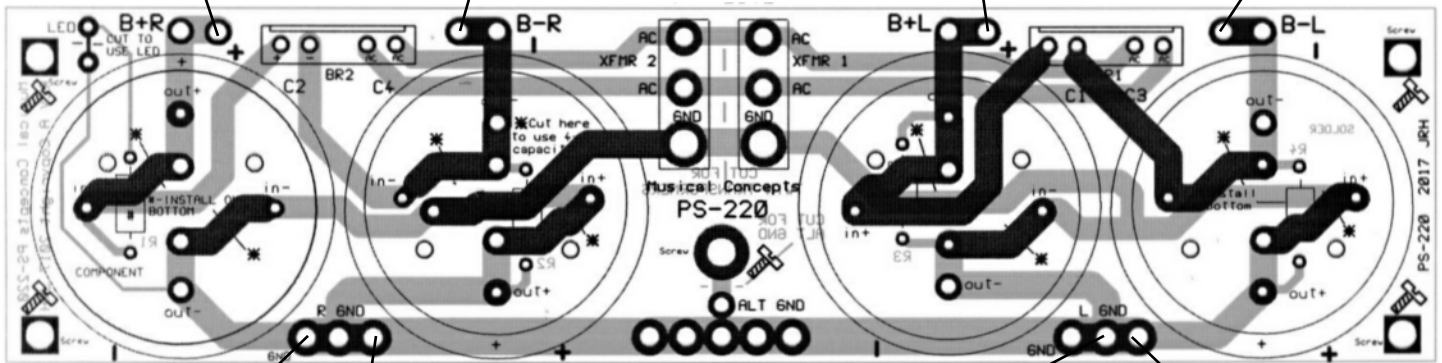
Note: With the **stock** DH-200/220 (no Musical Concepts driver boards) you leave the chassis mounted twin fuses in place. You connect the wiring from the PS-220 to the input side of the individual fuses. Make sure you get the polarity right. **Proper connection is a life and death issue for your amp.** You could just shorten the original front four wires and solder them appropriately to B+ and B- outputs for a quicker install.

B+ right ch. - connect to:
PA-XX = eyelet 3
For stock front-end boards -
DH-200 = eyelet 4, via fuse
DH-220 = eyelet 3, via fuse
XL-280* = eyelet 4

B- right ch. - connect to:
PA-XX = eyelet 12
For stock front-end boards -
DH-200 = eyelet 13, via fuse
DH-220 = eyelet 10, via fuse
XL-280* = eyelet 11

B+ left ch. - connect to:
PA-XX = eyelet 3
For stock front-end boards -
DH-200 = eyelet 4, via fuse
DH-220 = eyelet 3, via fuse
XL-280* = eyelet 4

B- left ch. - connect to:
PA-XX = eyelet 12
For stock front-end boards -
DH-200 = eyelet 13, via fuse
DH-220 = eyelet 10, via fuse
XL-280* = eyelet 11



To eyelet 7(ground)
of right ch. driver board
PA-XX. **If you have
the stock front-end
boards -**
DH-200 = eyelet 6
DH-220 = eyelet 7
XL-280 = eyelet 8

To right ch. speaker ground
binding post(black post)

To left ch. speaker ground
binding post(black post)

To eyelet 7(ground) of left ch.
driver board - PA-3(X). **If
you have the stock front-end
boards -**
DH-200 = eyelet 6
DH-220 = eyelet 7
XL-280 = eyelet 8

***Due to the B++ and B-- power supplies of the XL-280 it is required to clip the wires off eyelet 5 and 10 at each driver board and leave them off.**

17.() Make sure no wires will get pinched by the standoffs in the final tightening of the board mounting screws. Fit the 5 - #4-40 x 1/4" silver screws into the standoffs through the PS-220 board and tighten them securely.

18.() Finally you can install the rectifier clamps with the provided #4-40 x 3/8" screws and nuts. If you haven't soldered the rectifiers then do that now, clip and discard the eight leads.

Turn the amp upside down, whack the bottom and shake it around a bit to dislodge any clipped wires remaining in the chassis to avoid an embarrassing episode in the near future.

19.() Testing: Just for safety we recommend that you temporarily remove the four fuses from the dual fuse holders if you have the original driver boards in your amp. Remove the board mounted fuses of our Musical Concepts PA-XX boards.

If you have access to a Variac(Google it if not familiar) it would be great to slowly ramp up the rail voltages as you monitor them. If not then power up the amplifier and inspect the voltages at the B+ and B- outputs of the PS-220. You should see something near **+65VDC referenced to ground**. If that's what you get then great. **Power it down and let it set for five minutes to discharge.** Now for safety's sake trace the path through the fuses back to the PS-220 and double check that the connections are true to chart above. Put those four fuses back where they belong.

It would be advisable to turn on the amplifier without the speakers or preamp connected. Power up the amp and measure the voltages across each pair of speaker posts. Just connect your voltmeter like a speaker at the binding posts and check the DC voltage from black(+) to red(-) on one channel. Repeat for the other channel's pair. If you measure less than 125mv millivolts (0.125VDC) that's good. If you have a Musical Concepts PA-XX mod the voltages should be even lower and adjustable. If you measure several volts - **DO NOT CONNECT THE SPEAKERS.**

If it all looks good then you are ready to rock! Have fun!

Don't forget to send in your owner satisfaction card after you have had some time to evaluate the results.

Figure A

This pictorial covers the installation with Musical Concepts PA-XX series driver boards. See table / diagram in instructions for installing with standard Hafler boards.

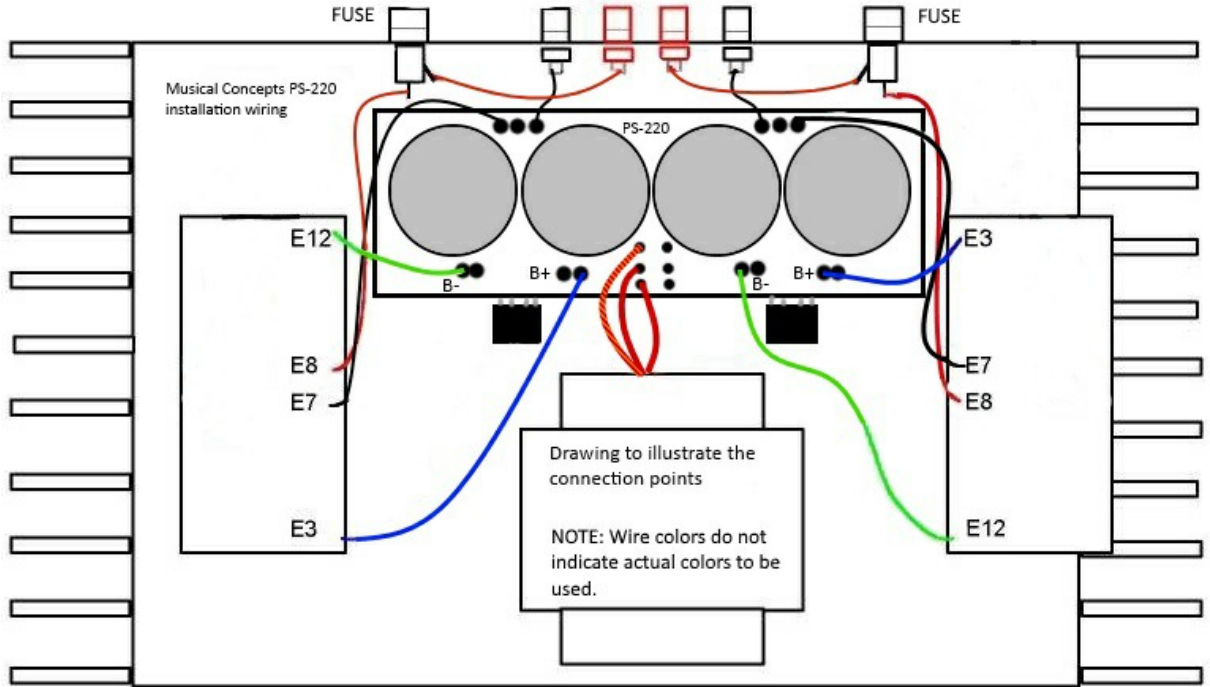
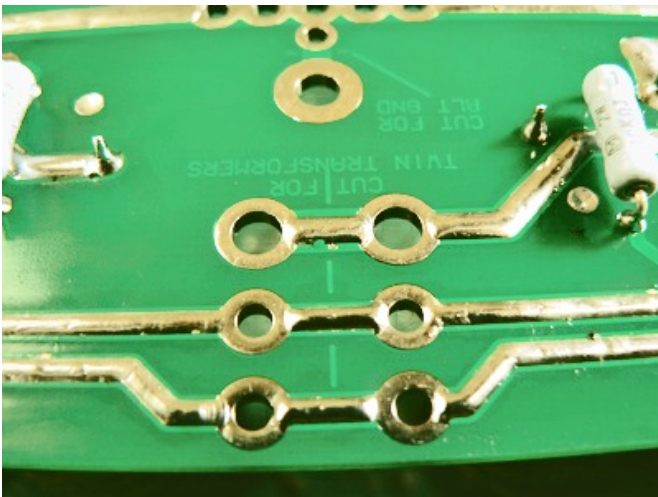
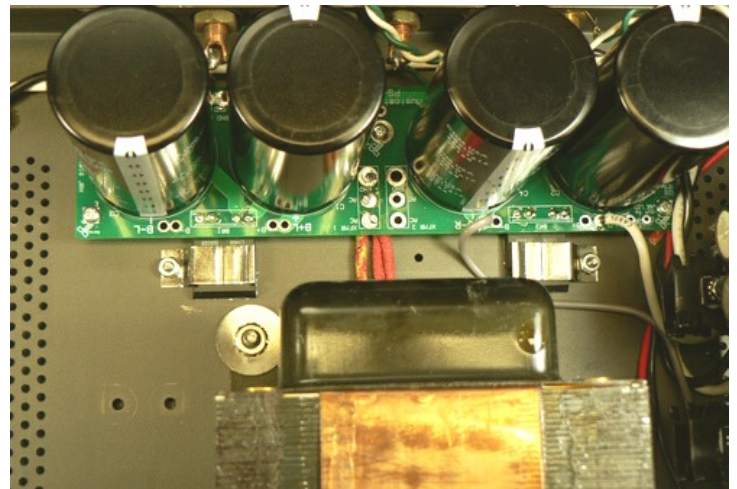


Photo Gallery

Cuts for Jensen 4-pole capacitors



Fatten the foils! Cuts mark indicators for dual power transformers.



The Big Picture

YOUR NOTES: