PAS3 Solid State R*egulated* Power Supply Upgrade

Assembly and Installation Instructions, vSS1a, 07-2025

Introduction

- This power supply replaces the original power transformer, PA211, the multi cap capacitor and any other original circuitry for the B+ and filament supply.
- For those who prefer to have an all solid-state power supply, we have designed this vSS1 regulated power supply, using a diode bridge and Thermistor to replace the 12X4 rectifier tube.
- ***This means you can remove the 12X4 rectifier tube and its socket.***
- The 24VDC filament supply has been updated using a LM350 voltage regulator, which will give a fully regulated and much more stable 24VDC for the tube filaments!
- Our PAS3 *regulated* power supply upgrade also uses two new transformers with much higher current capability than the original under-powered transformer.
- The raw B+ from the rectifier bridge is fed through a high voltage regulator circuit and then split to individual supplies for the Phono Preamp and the line Preamp.
- In addition, the Phono amp and the line amp adds additional power supply filtering for each channel (left and right) directly on their individual circuit boards.
- **NOTE: This power supply IS NOT suitable for the original Dynaco PC6 or our clone PC6 Phono Preamp!**

Important! Do This Step First!

- ***This revised power supply can now be used with either 120VAC or 220-240VAC mains!***
- ***Before mounting ANY OTHER components, you need to install the relevant jumper links for either 120VAC or 220-240VAC operation.***
- ***For 120VAC mains operation, install jumpers J1, J2, J4 & J5 ONLY!, using the supplied wire.***
- ***For 220-240VAC mains operation, install jumpers J3 & J6 ONLY!, using the supplied wire.***

Grounding

- If everything is connected as shown in the diagrams then there should be no noise or hum problems.
- Ground loops though can potentially be a problem especially in any Preamp project.
- For example, if the RCA jacks are not isolated from the chassis, then the twisted pair of wires that connect the PCB to the jacks will each define a ground loop. The solution is either to isolate the jacks or use only a single hot wire from jack to PCB (the wire can be shielded, as long as the shield only attaches at one end).
- Thus, the best plan is to plan ahead and do it correctly the first time.
- Three different schools of thought hold for grounding a piece of audio gear.
- The **Old-School** approach is to treat the chassis as the ground; period.
- This was especially common on the older Dynaco amps and Preamp's.
- Every ground connection is made at the closest screw and nut.
- This method is the easiest to follow and it produces the worst sonic results.
- The Z-H20 was designed to help eliminate any ground loop problems by careful design of the PCB traces, and by following good wiring practices when connecting the PCB's to each other and to the volume/balance controls, and RCA input-output jacks.

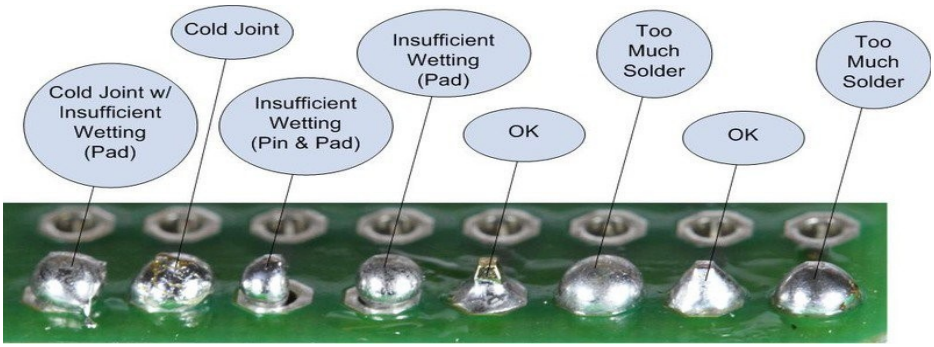
House Ground

- The third prong on the wall outlet attaches to the house's ground, usually the cold water pipe.
- In the original Dynaco Preamp a two-line power cord is used, which means the chassis itself is NOT connected to the AC power ground. This is usually not a problem, but potentially it can allow some sort of ground loop problem when other system components (CD player, turntable, amplifier) are connected to it.
- Usually with a two-line power cord you can eliminate or resolve this problem by unplugging the power cord and then reversing it's direction into the AC outlet.
- Another good idea is to plug all components into a common power strip.
- The pre-amplifier CAN use a 3 wire cord and attach the chassis to ground, which is certainly the safest approach, as it provides a discharge path should the B+ short to the chassis.
- Unfortunately, this setup often produces a hum problem. Some simply float the ground, which is the way we usually wire our Preamp's, and others use a 10-ohm resistor parallel shunted by a small capacitor, say 0.01µF 250V, connected from chassis to AC ground.
- A good test procedure is to detach all the signal inputs and all the output connection from the pre-amplifier.
- Then measure the AC voltage between the pre-amplifier chassis and the house ground. If it reads more than a few volts, try reversing the pre-amplifier plug as it plugs into the wall socket.
- Use which-ever orientation that results in the lowest AC voltage reading. Then measure the chassis ground to the first signal source's ground (while the signal source is turned on). Once again flip the signal source's plug until the lowest AC voltage setting is found. Then do the rest with the rest of the system.
- The results can prove far more satisfying than what would be yielded by buying thousand-dollar cables.

Solder Examples

We cannot stress more the importance of good soldering practice. 95% of all issues with a build that we come across is bad soldering. Dry/Cold solder joints are most of the issues.

Please Ensure That Your Soldering Skills Are Very Good, See The Below Examples.



PCB Assembly

- To ensure that the transformers sit evenly, install these jumper links on the under side of the pcb. If you do install them on the top, you will need to 'lift' each transformer slightly as you solder them in to allow for the thickness of the jumper link.
- Now, solder all the resistors and diodes in place, followed by the high voltage regulator, LR8 – U1 and the rectifier bridge KPB210G.
- Next add the power transistor, TIP50 – Q1, then the smaller capacitors, followed by the larger capacitors, and the transformers.
- Mount the low voltage regulator, LM350 – U2 to the heat sink with the supplied screw & nut and install both.
- The idea is to install all low profile components first, followed gradually by the higher profile components.
- See the specific assembly directions below.
- Be consistent in orienting the resistors; keep all the parts labels the same so they can all be read
- from the same side when the PCB is finished. This will pay dividends later, if you need to locate a resistor or capacitor in the wrong location.
- Be sure to confirm all the electrolytic capacitor orientations, as a reversed polarized capacitor can easily vent (or even explode) when presented with high-voltage.
- Confirm twice, solder once!
- Make sure you use the grey thermal pad supplied with the kit when you mount the LM350 regulator to the heat sink.

Testing

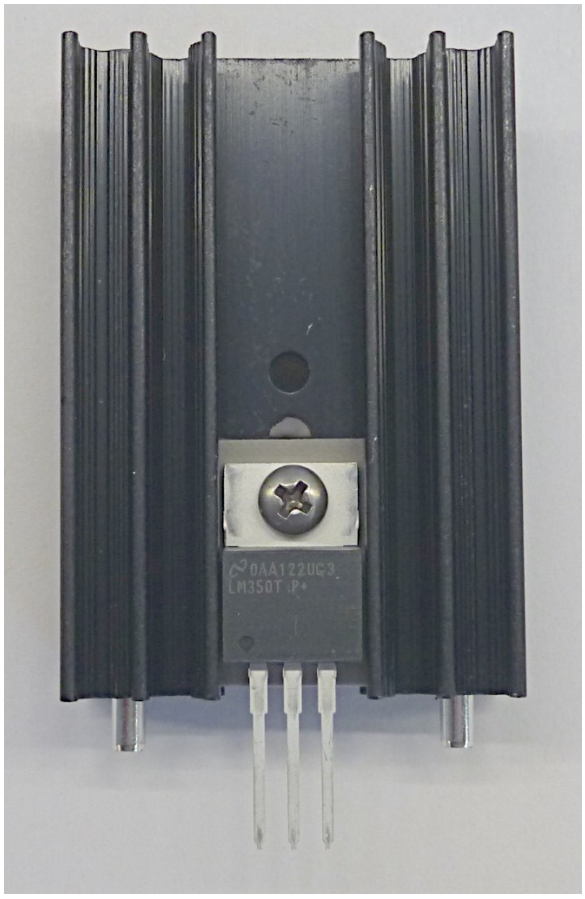
- Before testing, visually inspect the PCB for proper parts placement and soldering quality connections.
- Make a habit of using only one hand, with the other hand behind your back, while attaching probes or handling high-voltage gear, as a current flow across your chest can result in death.
- In addition, wear rubber-soled shoes and work in a dry environment.

Remember, safety first, second, and last.

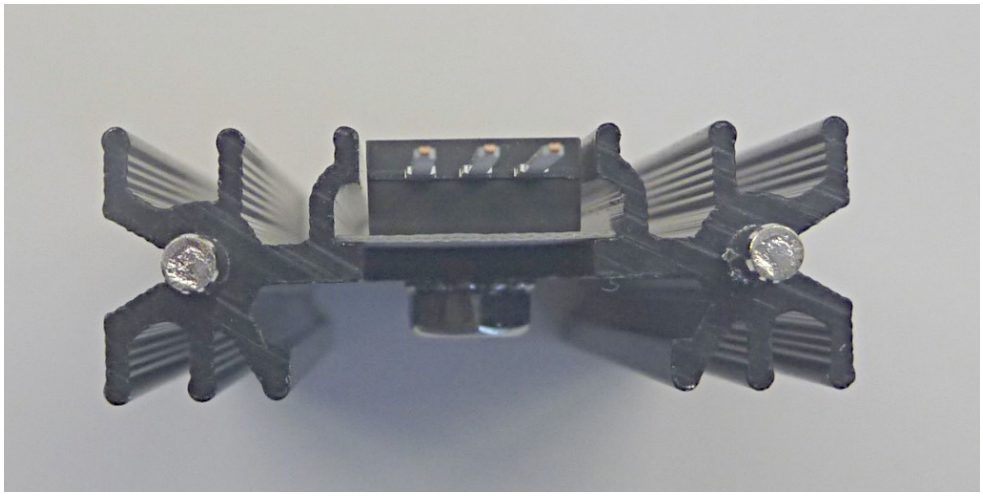
- If possible, use a Variac and slowly bring up the AC voltage, while looking for smoke or part discoloration or bulging.
- Only after you are sure that both heater and B-plus power supplies are working well, should you attach the line-stage amplifier to a power amplifier.

Important Heat Sink Notes

If you have the heat-sink which has a narrow-finned side, you MUST install the LM350 to that narrow-finned side, otherwise, it will interfere with diode D9! Sandwich the grey insulator between the LM350 and the heat-sink, see photo's below.



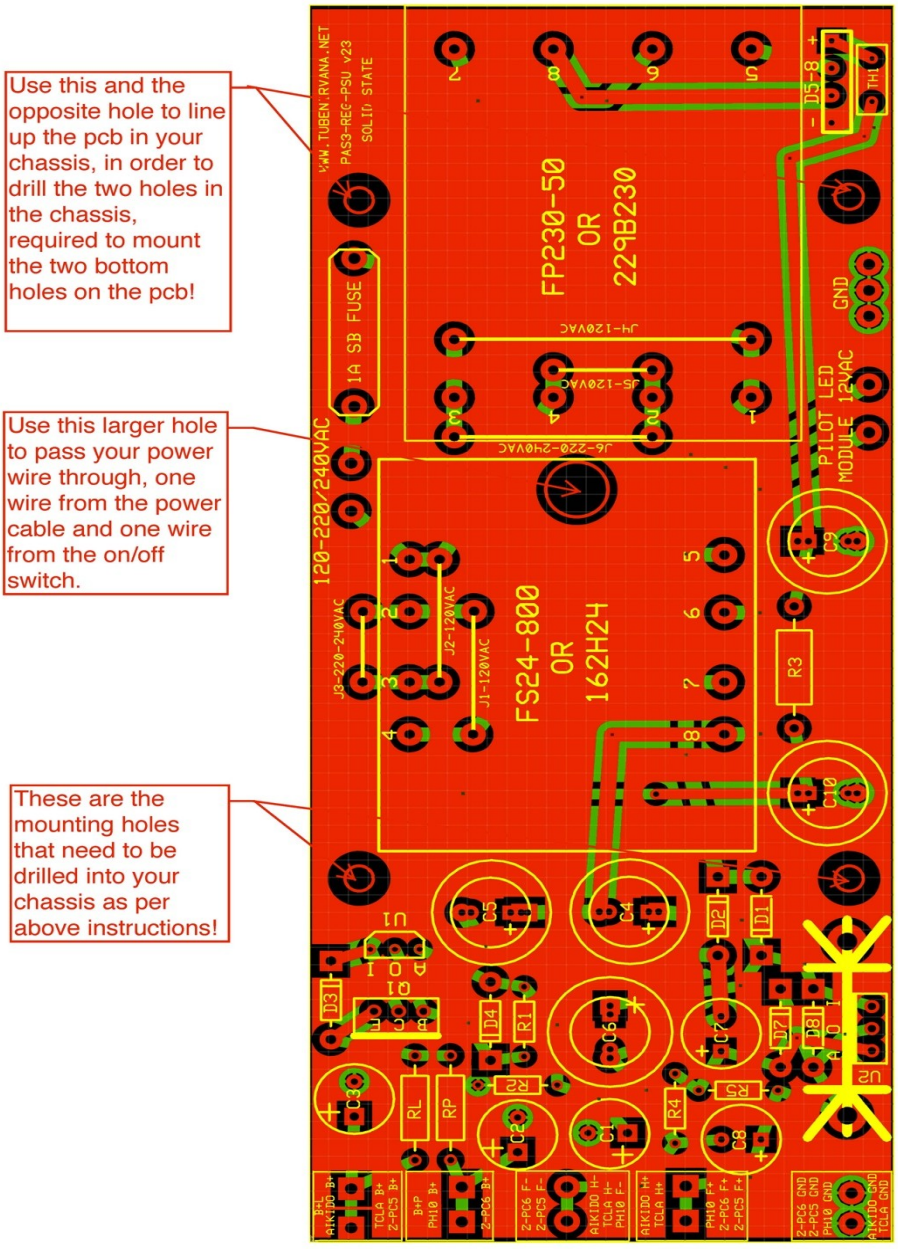
Note one side of the heat-sink has narrowed fins, install the LM350 on THAT SIDE!



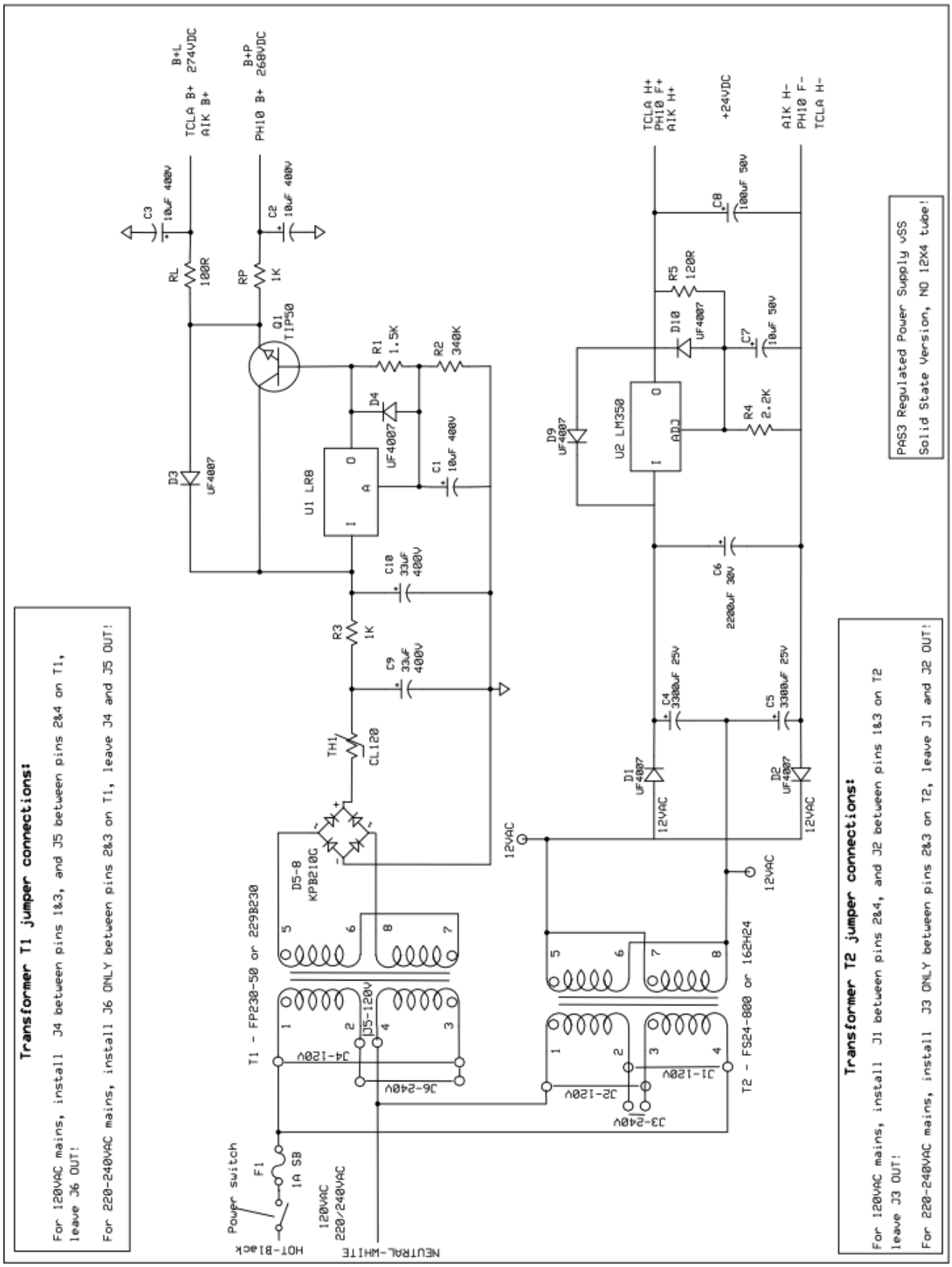
Regulated Solid State Power Supply PCB Mounting Instructions

As an alternative to drilling holes in your chassis, you can use the optional self adhesive PVC printed circuit board standoffs included in the kit!

- Use the supplied 4-40 washers to mount the aluminum spacers in the ORIGINAL holes, as they are quite large and the spacers could simply fall through those holes. Use one washer with a 4-40 screw and one washer under the spacer.
- Do the positioning of the pcb BEFORE you populate it, IE the blank pcb! NOTE: refer to the PCB layout.
- You will need to drill two new mounting holes. Use a 1/8” drill bit. Line up the bare PCB so that the original transformer holes line up with the two holes on the right end of the PCB, then mark and drill two holes on the other end so they line up with the other two holes on the PCB.



Regulated Solid State Power Supply - Schematic Diagram (C6 Is Actually 50V)

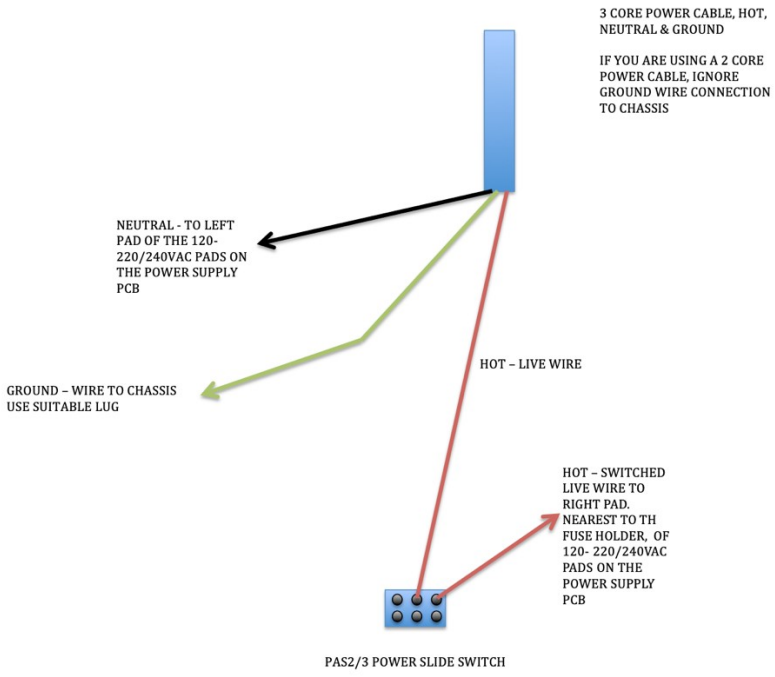


Power Supply Wiring

Before installing the power supply PCB into the chassis, connect the following wires either to top or bottom side of the PCB. It is up to your preference if you wish to run the power supply wires from the top or bottom:

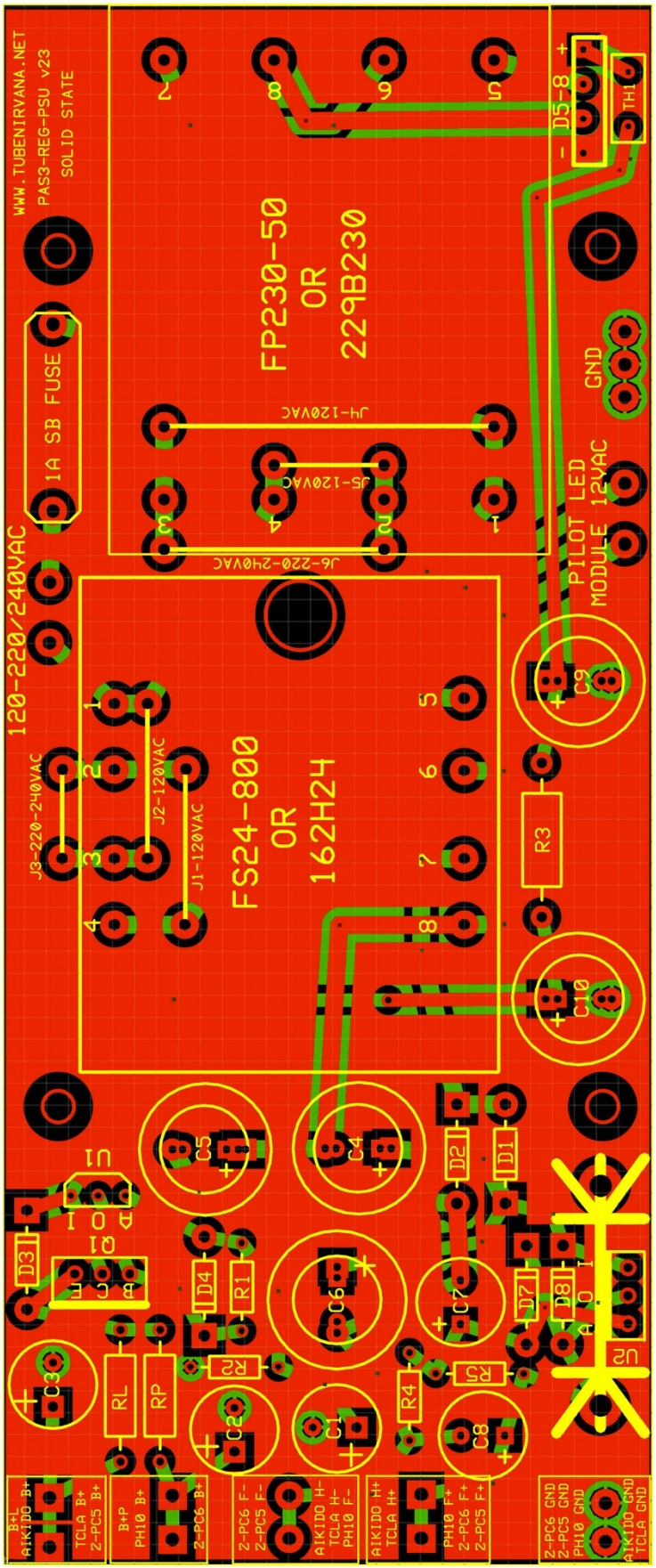
- After soldering all the parts onto the PCB, you'll need to add the following wires:
- A pair of twisted wires about 8" long connected to the two holes marked 120-200/240VAC. Connect the switched hot/active wire to the right pad nearest the fuse holder, the neutral wire to the remaining 120-220/240VAC pad, see below/next page for details.
- A pair of twisted wires about 10" long connected to the relevant B+, GND, H+/H- and F+/F- eyelets depending on the type of Preamp PCB's you use.
- *Quoted wire lengths allow for twisting of wires, with ample reserve length.*
- *Try and keep all AC wires away from the DC wires, use small zip ties to hold the wires neatly and securely in place.*
- *A note about resistors: Some 1/2W resistors look like the size of 1/4W, but they are in fact 1/2W and can generally be told apart from 1/4W as they tend to have thicker gauge leads. They are perfectly fine to be used in 1/2W placings.*

Suggested Power Cord Wiring



PAS3-Reg v23 pick list						
	Resistors	Qty		Hardware		Qty
R1	1.5K 1/4W	1		4-40x1/4" screw		9
R2	340K 1/4W	1		4-40x1/2" spacer		4
RP	1K 1/2W	1		1A SloBlo fuse		1
RL	100R 1/2W	1		Fuse holder		1
R3	1K 1W	1		TO-220 Heat Sink		1
R4	2.2K 1/4W	1				
R5	120R 1/4W	1		4-40 hex nut		1
				Jumper Wire		
	Capacitors			Thermal Pad		1
				Adhesive		
C1,2,3	10uF 400V	3		PCB Standoff		4
C4,5	3300uf 25V	2				
C9&10	33uF 400V	2		Misc		
C6	2200uF 50V	1				
C8	100uF 50V	1		TH1 - CL120		1
C7	10uF 50V	1				
	Semiconductors					
Q1	TIP50	1				
U1	LR8	1				
D1,2,3,4	HER108/UF4007	6				
9,10						
D5-8	KPB210G	1				
U2	LM350	1				
	PCB					
	PAS3-PSU-SS v21	1				
	Transformers					
	FP230-50/229B230	1				
	FS24-800/162H24	1				

Regulated Solid State Power Supply PCB Layout



5 Band Resistor Color Coding

COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
BLACK	0	0	0	x1Ω	
BROWN	1	1	1	x10Ω	±1%
RED	2	2	2	x100Ω	±2%
ORANGE	3	3	3	x1000Ω	
YELLOW	4	4	4	x10000Ω	
GREEN	5	5	5	x100000Ω	±0.5%
BLUE	6	6	6	x1000000Ω	±0.25
VIOLET	7	7	7	x10000000Ω	±0.10
GREY	8	8	8		±0.05
WHITE	9	9	9		
GOLD					±5%
SILVER					±10%

How To Read Capacitor Codes

Large capacitors have the value printed plainly on them, such as 10.uf (Ten Micro Farads) but smaller disk types along with plastic film types often have just 2 or three numbers on them?
First, most will have three numbers, but sometimes there are just two numbers. These are read as Pico-Farads. An example: 47 printed on a small disk can be assumed to be 47 Pico-Farads (or 47 puff as some like to say)
Now, what about the three numbers? It is somewhat similar to the resistor code. The first two are the first and second significant digits and the third is a multiplier code. Most of the time the last digit tells you how many zeros to write after the first two digits, but the standard (EIA standard RS-198) has a couple of curves that you probably will never see. But just to be complete here it is in a table.

Third Digit	Multiplier (this times the first two digits gives you the value in Pico-Farads)
0	1
1	10
2	100
3	1,000
4	10,000
5	100,000
6 not used	
7 not used	
8	.01
9	.1

Now for an example: A capacitor marked 104 is 10 with 4 more zeros or 100,000pF which is otherwise referred to as a 0.1uF capacitor.

Most kit builders don't need to go further, but I know you want to learn more. Anyway, Just to confuse you some more there is sometimes a tolerance code given by a single letter. I don't know why there were picked in the order they are, except that it kind of follows the middle row of keys on a typewriter. So a 103J is a 10,000 pf with +/-5% tolerance

	Tolerance of capacitor
D	+/- 0.5 pf
F	+/- 1%
G	+/- 2%
H	+/- 3%
J	+/- 5%
K	+/- 10%
M	+/- 20%
P	+100% ,-0%
Z	+80%, -20%

Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code	Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
10	0.01	0.00001	100	4700	4.7	0.0047	472
15	0.015	0.000015	150	5000	5.0	0.005	502
22	0.022	0.000022	220	5600	5.6	0.0056	562
33	0.033	0.000033	330	6800	6.8	0.0068	682
47	0.047	0.000047	470	10000	10	0.01	103
100	0.1	0.0001	101	15000	15	0.015	153
120	0.12	0.00012	121	22000	22	0.022	223
130	0.13	0.00013	131	33000	33	0.033	333
150	0.15	0.00015	151	47000	47	0.047	473
180	0.18	0.00018	181	68000	68	0.068	683
220	0.22	0.00022	221	100000	100	0.1	104
330	0.33	0.00033	331	150000	150	0.15	154
470	0.47	0.00047	471	200000	200	0.2	254
560	0.56	0.00056	561	220000	220	0.22	224
680	0.68	0.00068	681	330000	330	0.33	334
750	0.75	0.00075	751	470000	470	0.47	474
820	0.82	0.00082	821	680000	680	0.68	684
1000	1.0	0.001	102	1000000	1000	1.0	105
1500	1.5	0.0015	152	1500000	1500	1.5	155
2000	2.0	0.002	202	2000000	2000	2.0	205
2200	2.2	0.0022	222	2200000	2200	2.2	225
3300	3.3	0.0033	332	3300000	3300	3.3	335

We cannot take ANY responsibility for mains, and for that matter, ALL high voltage AC and DC wiring you carry out. We have described in this, and all of our other manuals, as best as we can, on how to wire up these high voltage connections. You MUST take EXTREME care, that no wires are shorted together, or to the chassis, or any other part of the assembly and PCB's. All these high voltages can be life threatening, and can hurt you or others if carried out incorrectly. Use your meter in the continuity setting to make sure no high voltage wires are shorted together or to chassis ground.
Apart from bodily harm, incorrect high voltage wiring can and will damage components! You are totally and solely responsible for all high voltage wiring and the general assembly of this kit! We have wired our prototype amp exactly as described in this and all of our other manuals, so we know that the amp will work as designed and intended!

If you are unsure of how to carry out some of our instructions, PLEASE contact us via e-mail, we provide, as part of our service, full support for this and all of our kits! No question is stupid. The ONLY stupid question is the one you do not ask!