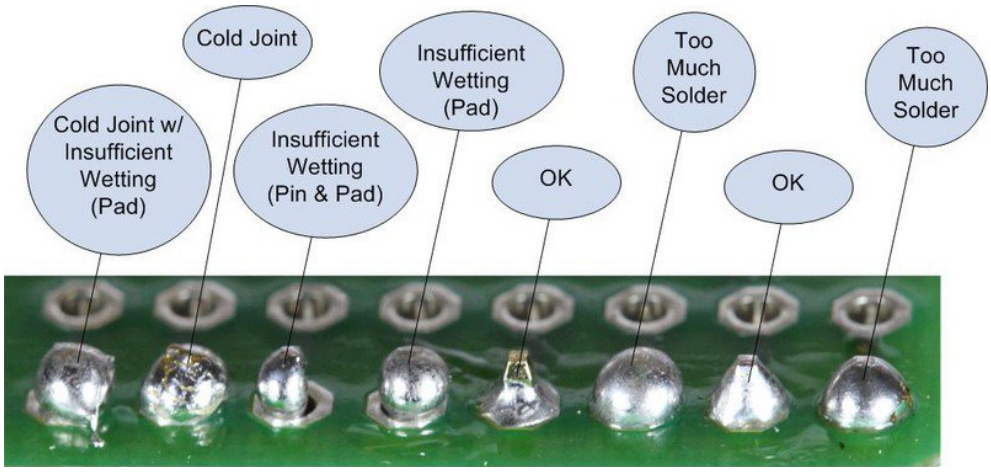
PAS3 - TCLA Tone Control preamplifier Upgrade kit

assembly and installation instructions
v3 12-2022

Overview
*The **TCLA** preamplifier is a **T**one**C**ontrol**L**ine**A**mp circuit using high quality tone controls.*
The circuit uses four 12AX7 tubes for voltage gain and tone circuit buffering.
It has been designed as a plug-in replacement for the PAS3 PC5 line amp.
The **PAS3 version** has tube filaments setup for **24vdc** same as original PC5 board.
The gain of the circuit with the tone controls centered is 4X or 12db.
The tone controls have an adjustment range of up to 12db boost and cut for both bass and treble frequencies, and at the center position gives flat frequency response through the circuit.

Power Supply
The raw B+ is double RC filtered and then uses additional RC filtering using large value capacitors.
We use modern high-speed fast recovery silicon diodes and low ESR quality capacitors to supply the DC power for the tube filaments.
We also incorporate a noise limiting feature that references the heater power supply to a voltage divider on the high voltage B+ rather than tying it to common ground.

PCB Assembly
First, solder all the resistors in place, and then solder the tube sockets.
Finally solder the smaller capacitors, and then the larger capacitors.
See the specific assembly directions below in a later section.
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.



Testing
Before testing, visually inspect the PCB for proper parts placement and soldering quality connections. Wear safety eye goggles, as an exploding power-supply capacitor will spray hot caustic chemicals.
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.
1 - If possible, use a variac and slowly bring up the AC voltage, while looking for smoke or part discoloration or bulging.
2 - Measure the voltage between ground and the B+ pads.
The voltages should be within about 5% of the values marked on the schematics.

Grounding

If everything is connected as shown in the diagrams then there should be no noise or hum problems.
Ground loops 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.

House Ground
The third prong on the wall outlet attaches to the house's ground, usually the cold water pipe, and this attaches to the chassis on the preamp end.

Another good idea is to plug all components into a common power strip.

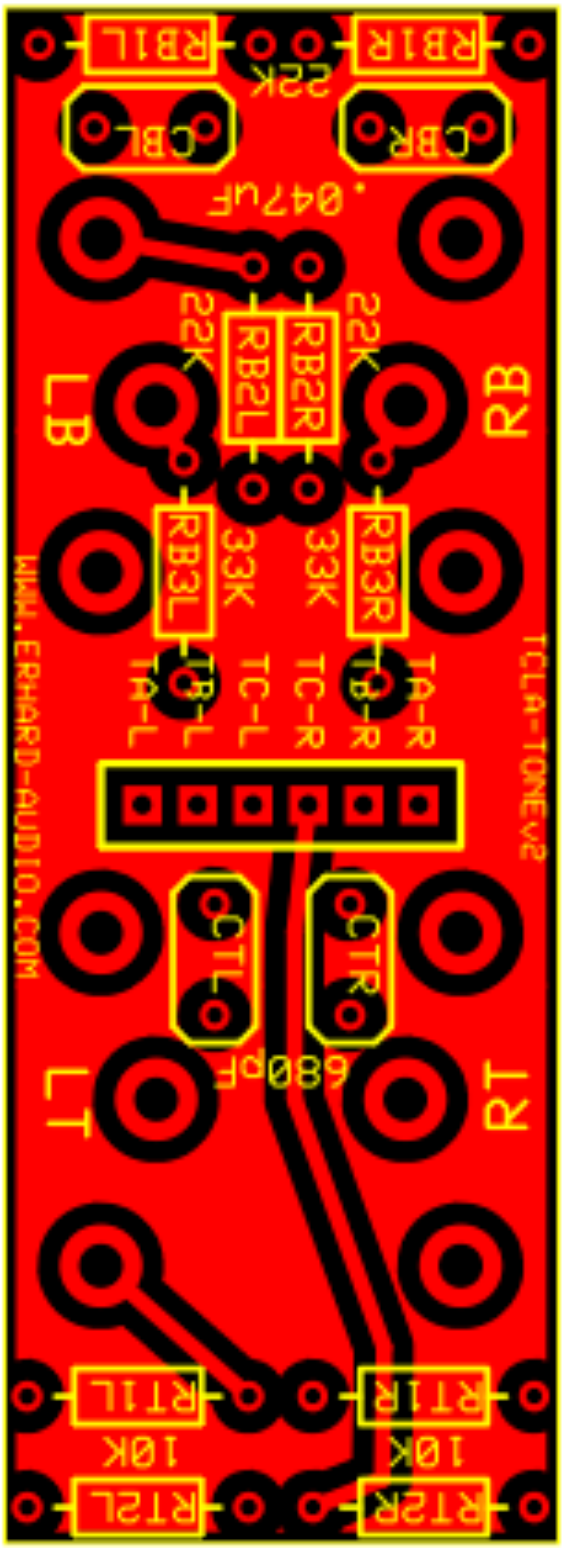
PCB ASSEMBLY DIRECTIONS

refer to the PCB layout and parts list below.

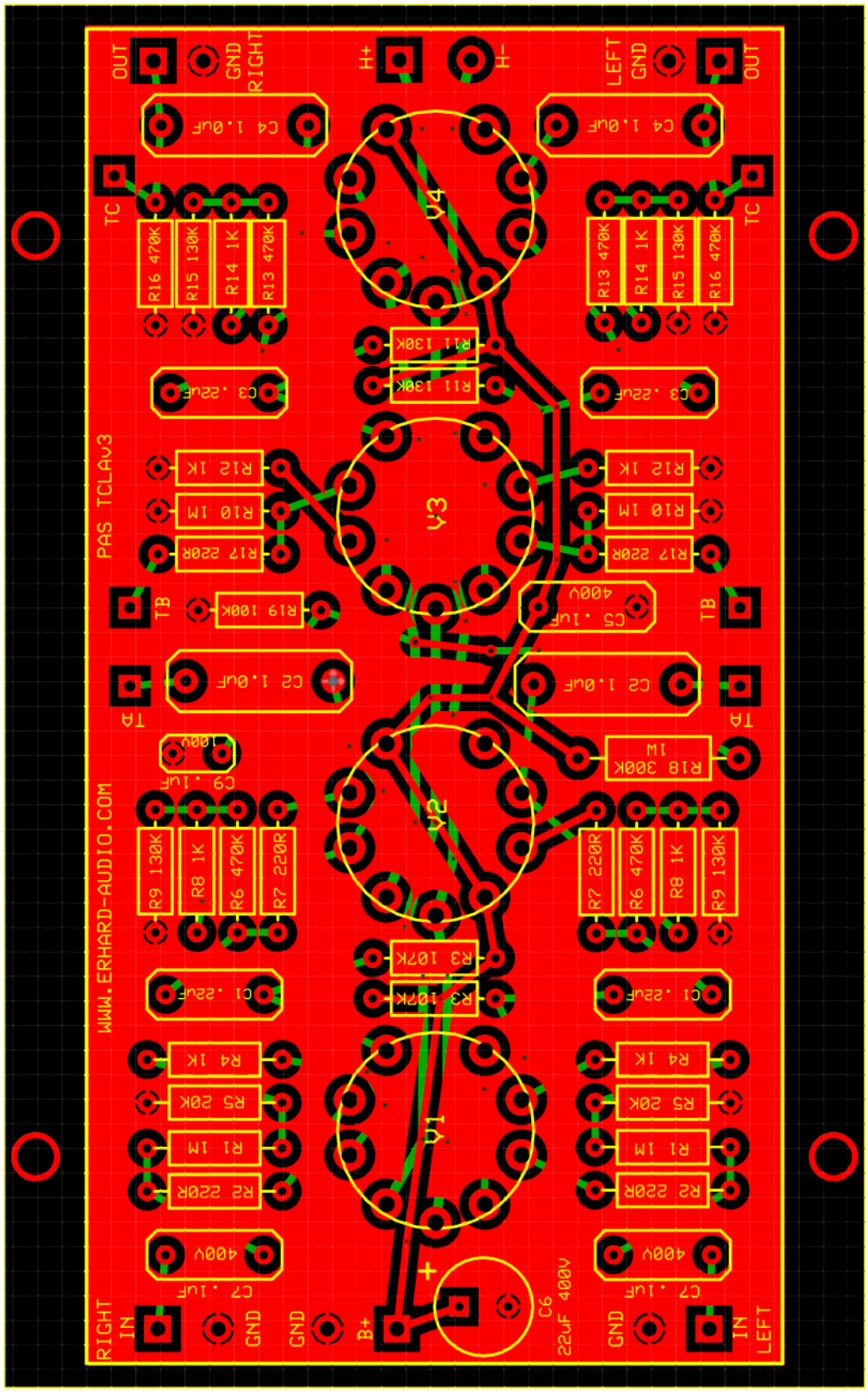
1 - start by inserting the resistors onto the PCBs and solder them in place.
2 – next insert the tube sockets and solder them in place
3 – next insert the smaller capacitors and solder them in place
4 – then insert the larger capacitors and solder them in place
5- assemble the auxiliary tone control PCB
6- connect the auxiliary tone control PCB to the main PCB

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 placing's.
Also, a 1W resistor may be the size of a 1/2W resistor, with modern and different materials, manufacturers are able to decrease the size of a component.

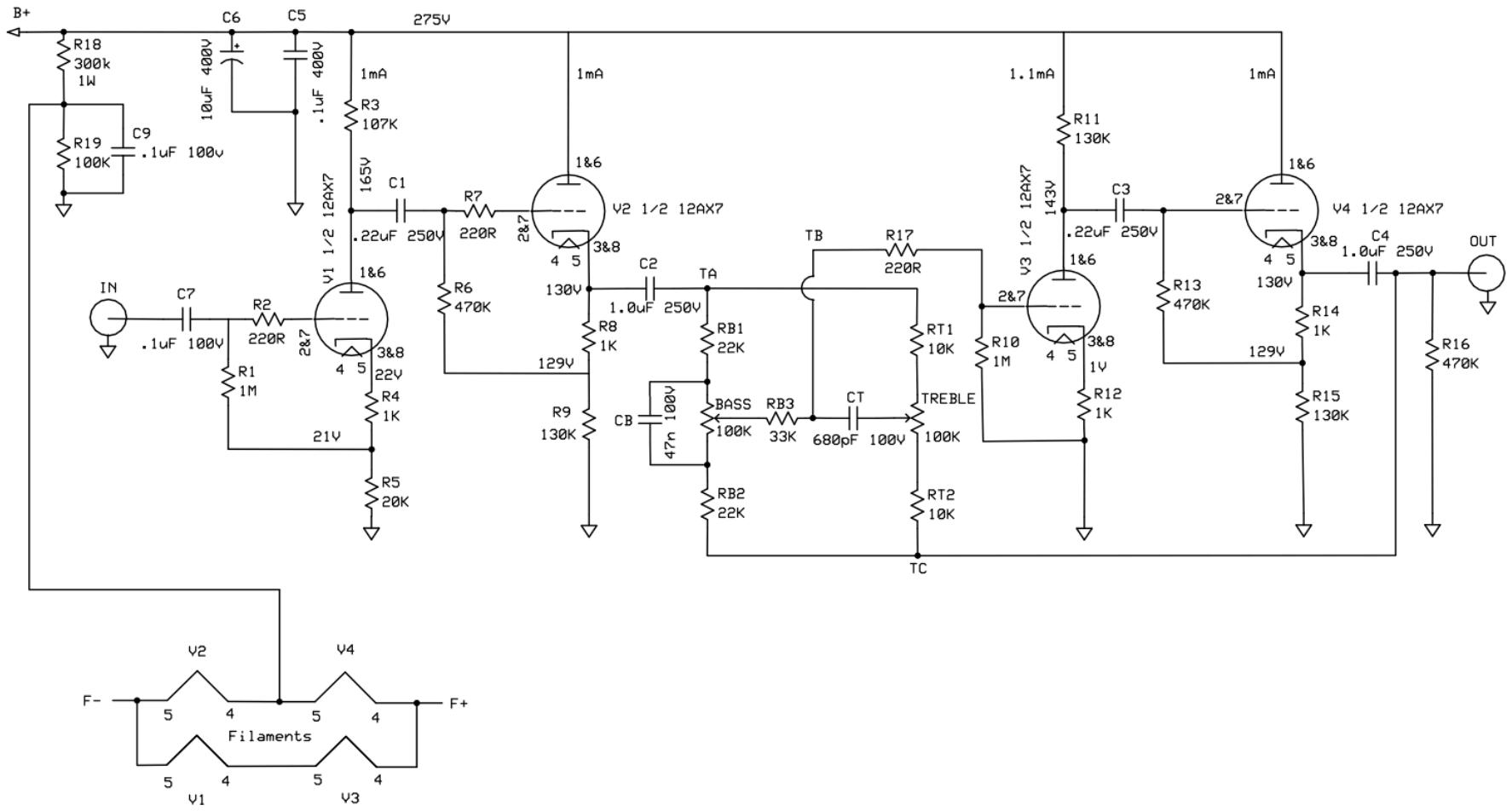
PCB LAYOUTS



Tone Control pcb



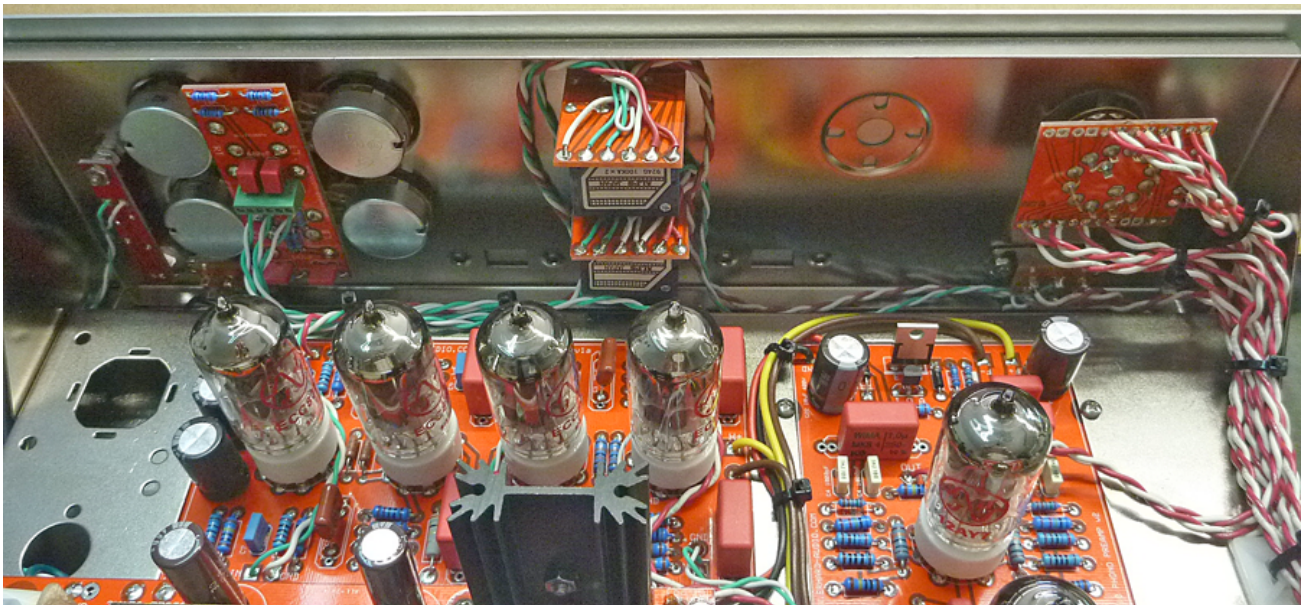
Main TCLA pcb

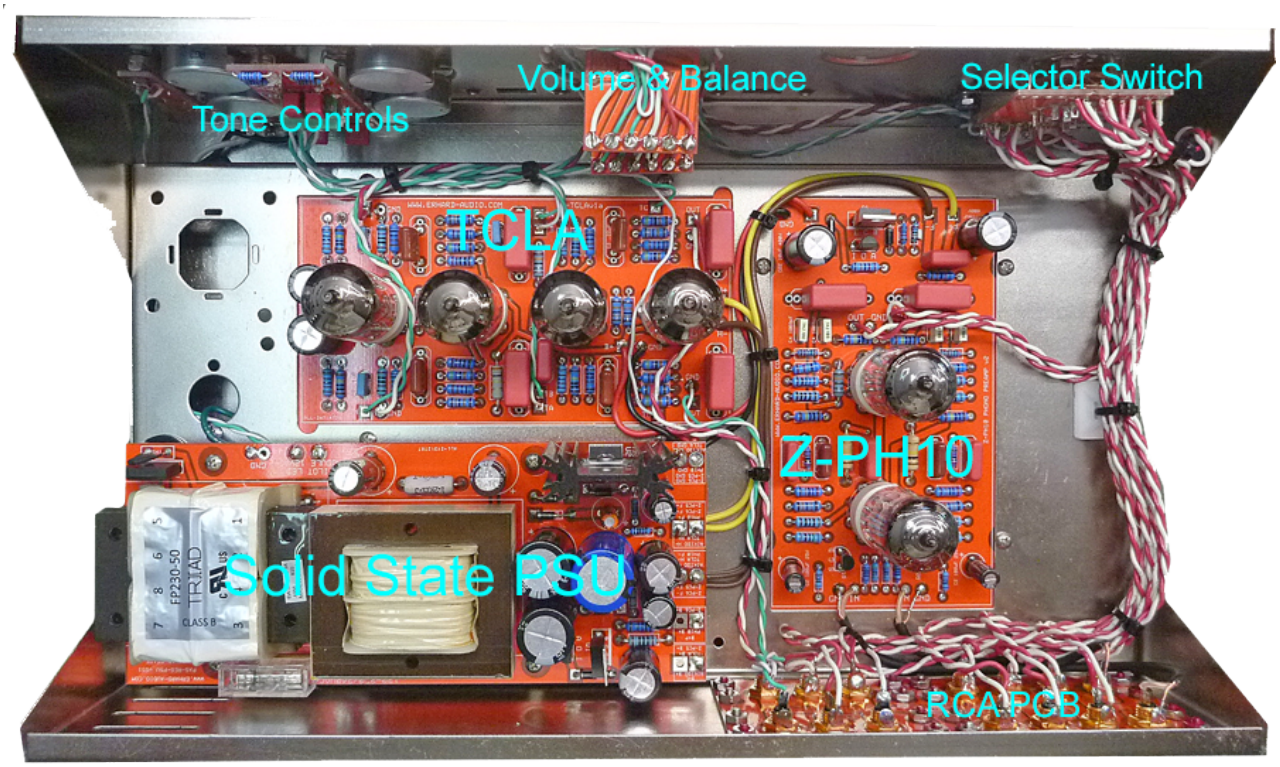


PAS3 Upgrades		
Z-Mod TCLA Tone Preamp v1a		
HS	Rev 1.0a 9/12/2019	1

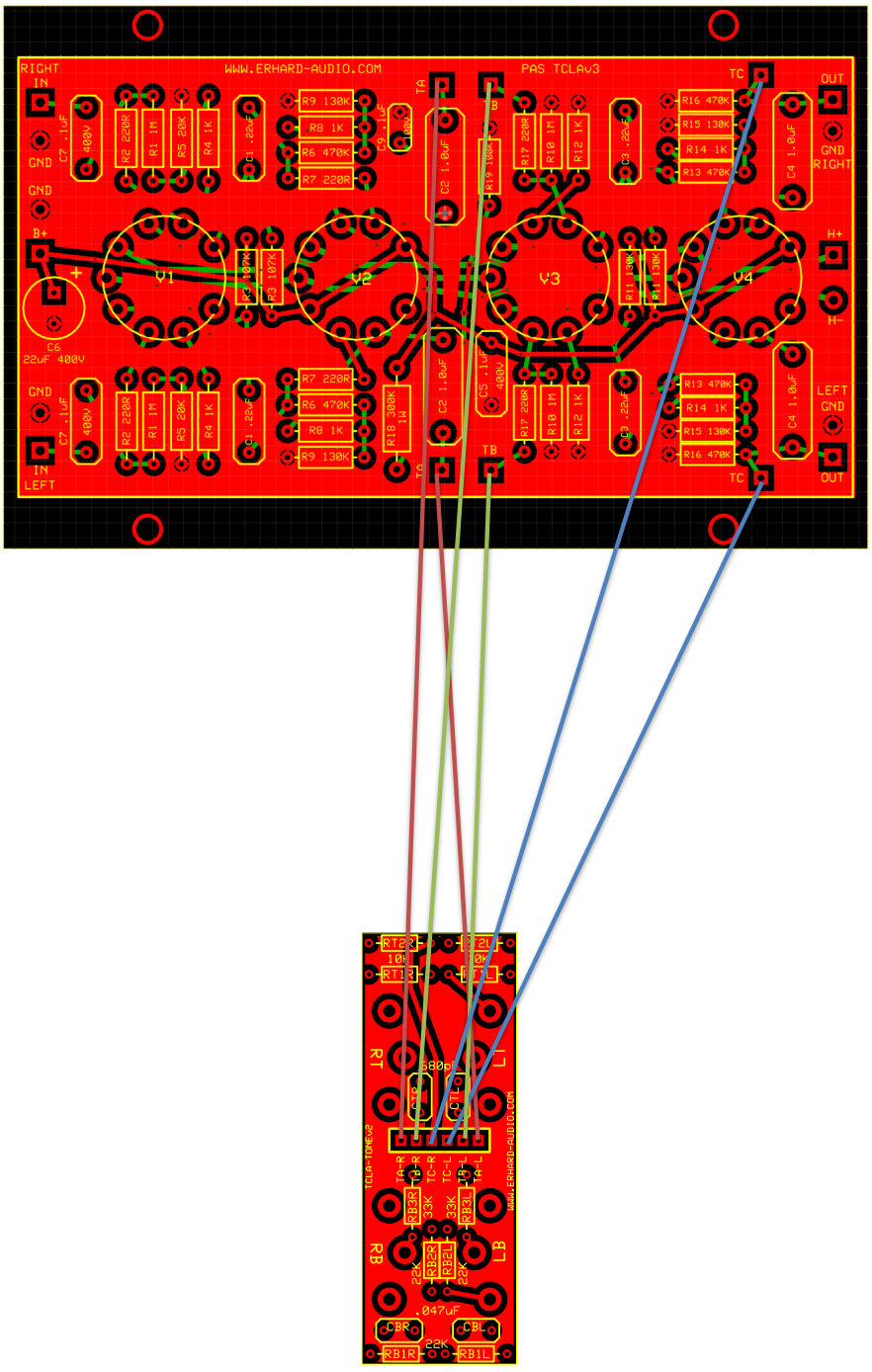
TCLA v3 Parts						
Resistors			Qty			
R1,R10	1M 1/2W		4			
R2,R7,R17	220R 1/2W		6			
R3	107K 1/2W		2			
R4,8,12,14	1K 1/2W		8			
R5	20K 1/2W		2			
R6,13,16	470K 1/2W		6			
R9,11,15	130K 1/2W		6			
R18	300K 1W		1			
R19	100K 1W		1			
	Capacitors	Type				
C1,C3	0.22uF 250V	Film 10mm	4			
C2,4	1.0uF 250V	Film 15mm	4			
C5	0.1uF 400V	Film 10mm	1			
C7	0.1uF 400V	Film 10mm	2			
C6	22uF 400V	Electro	1			
C9	0.1uF 100V	Film 5mm	1			
	Aux tone pcb					
RT1,2	10K 1/4W		4			
RB1,2	22K 1/4W		4			
RB3	33K1/4W		2			
CB	0.047uF 63V	Film 5mm	2			
CT	680pF 63V	Film 5mm	2			
	100K linear pot		4			
	PCB					
	Z-TCLAv3		1			
	Tone pcb		1			
	Tube socket					
	9 pin		4			

TYPICAL PAS3 CHASSIS LAYOUT USING THE TCLA PCB & TONE CONTROLS



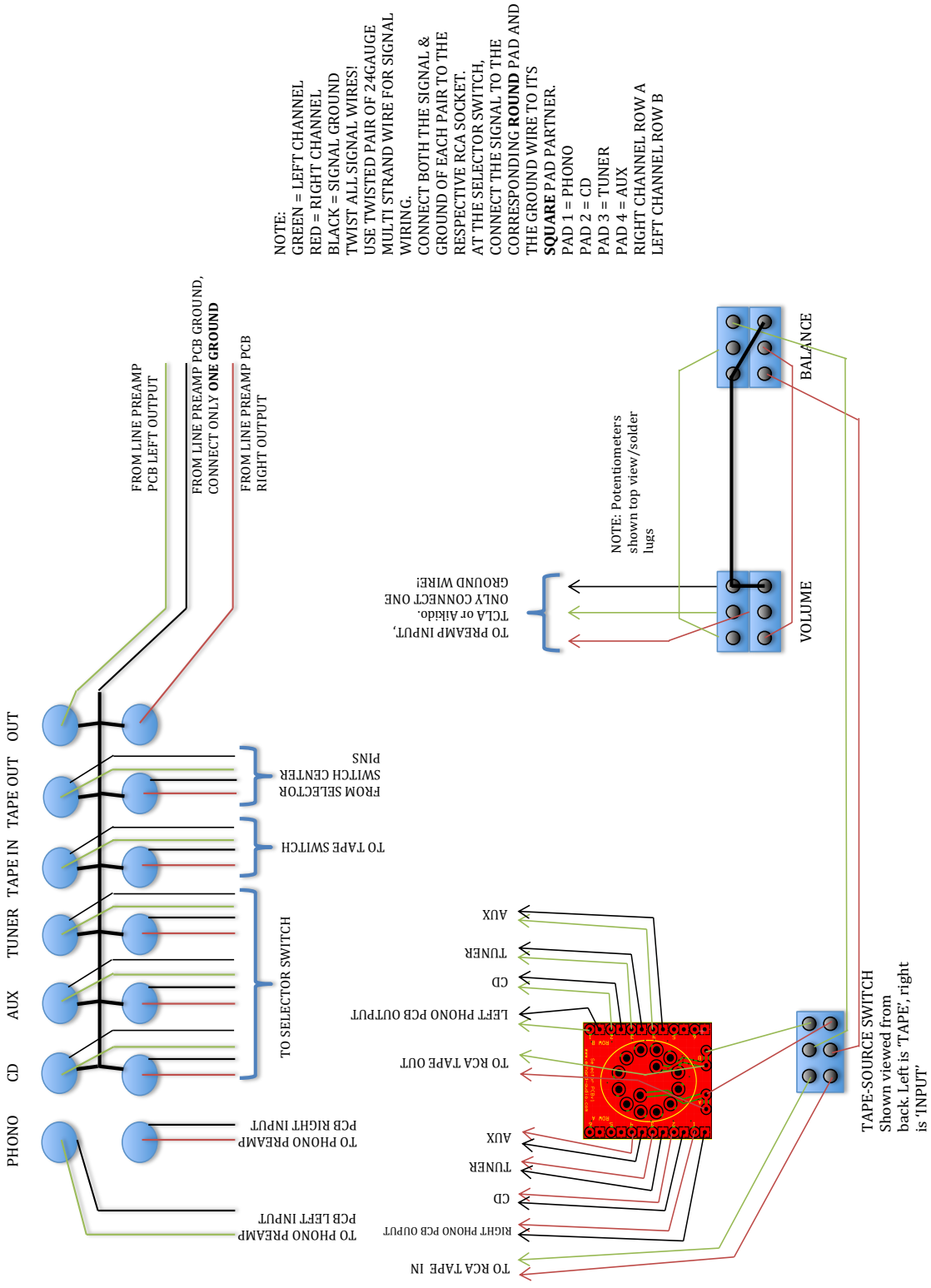


TONE CONTROL WIRING



Mounting of the tone control pcb to the 4x tone control potentiometers

SIGNAL WIRING SCHEMATIC



This shows how the signal wiring on a modern upgraded PAS using our kits should be wired up

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 capacitor 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 1st and 2nd 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 .1 uF 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!