A LOOK AT THE YAQIN MC-10 Series

Les Carpenter G4CNH – Nov 2021

Any comments or suggestions? You are welcome to e-mail the Author via lez at ntlworld dot com

Introduction

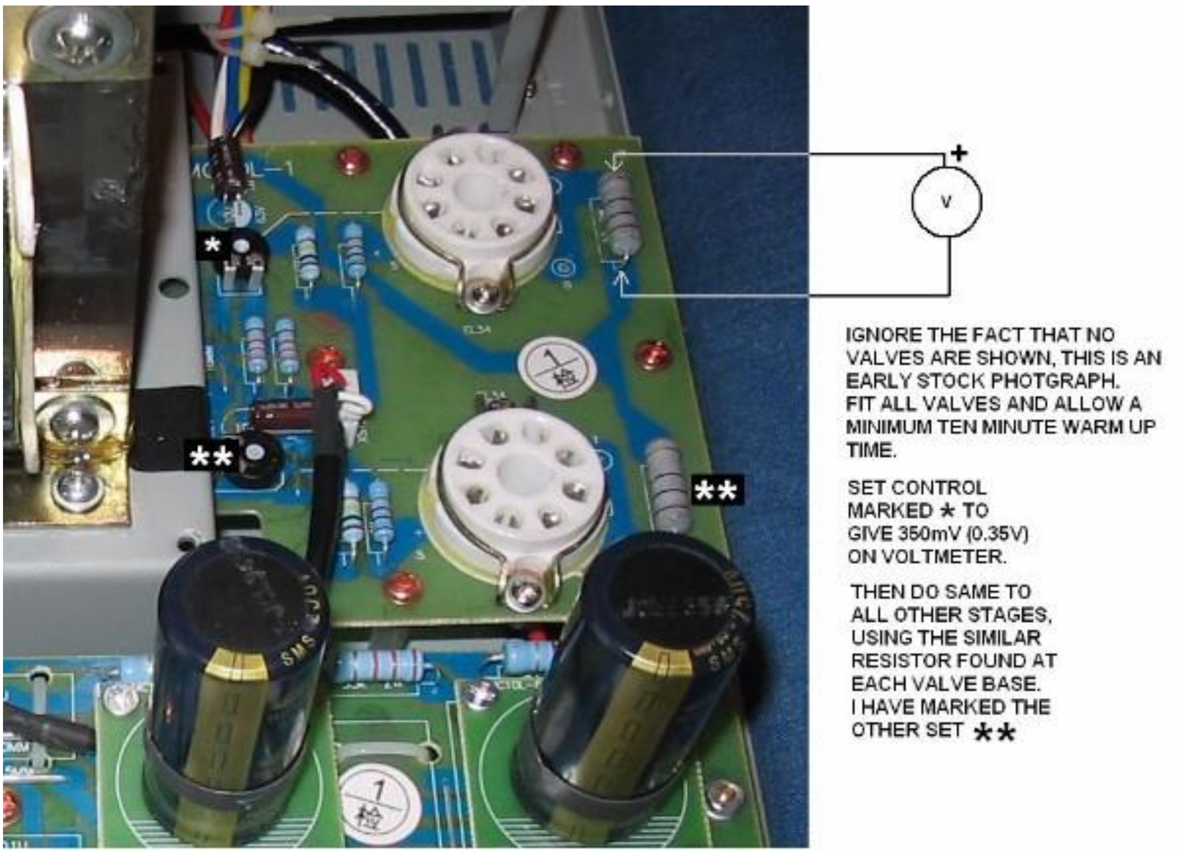
The front picture shows an early Yaqin MC-10L purchased by the author in 2007 and shows how well the amplifier was packed. The valves were all given identification numbers so that when installed in their designated places, they would produce the same bias conditions as when despatched from the factory.
His first impressions were of a very bright sound, plenty of air and a much improved sound stage that instantly relegated his Yamaha Solid State Amplifier to the spare room. The level of Bass was a little lower yet somehow the overall sound seemed very natural. He does not use any pre-amp or EQ which probably would have helped here. Why did he buy a valve amplifier? Well his Brother Tom decided to build one and when he heard the sound from it he was quite amazed. His brother listened to Rock Music most of the time and he told the Author "Guitarists use valve amplifiers so surely you need one to reproduce their sound?".
It was enough to make him start thinking about valve amplification.
Not wishing to digress too much from the Yaqin, sufficient to say that adding up the cost of power supply transformer, components, chassis and output transformers, the cost began to look very daunting.
His finished creation would not look very good in a domestic setting so it would probably have to be built into some kind of box and hidden out of sight.
Enter the Yaqin, advertised at a very reasonable price even with the very expensive carriage fee added on, he decided to take the plunge and very glad that he did.

Expecting the worst!

Yep, the Author was expecting the worst, an amplifier like this for such a low price, surely something is going to break so better get prepared.

Bias

His first task was to measure the voltages across the 10 Ohm cathode resistors to determine what value of bias was set up by the factory for the EL34 output valves and seemed to indicate 35mA i.e. 0.35V across each resistor. On newer models you do not have to lift the top cover as access points are provided for easy bias adjustment and contact to the monitor points.
Bias? Well the Author was so carried away writing this guide without thinking of those of you who have not been into valve amplification before. So he will attempt to give a little in-sight to each section as we go along.



It really is not a black art setting the bias but what is it for? Well there is plenty of info on the internet but simply stated it is like you controlling the water from a tap. By adjusting the little controls, called potentiometers, you are setting the tap to deliver a certain flow of water. Turn it too far one way and you turn it off, not much good! Too much and you get a flood, which in the case of a valve will cause it to get very hot and fail, probably burning out something else in the process like the very expensive output transformer which feeds it. In our water analogy we would use a flow meter to set the correct rate of water from the tap. In our valve amplifier, the valve currents will produce voltages across each of the 10 Ohm resistors for us to measure with a Multimeter. In the 10 series, the flow will be correct when the voltage is 0.35V or alternatively we can state it as 350 thousandths of a volt or milli-volts, abbreviated as 350mV.

Why do we need to have this flow?
We can use another analogy here, suppose you are holding one end of a rope which is coiled on the floor which you want to use to send a message to a partner holding the other end. Obviously, any movement you make to your end of the rope will not be felt at the other end so it will be impossible to send a message. OK, so we take out the coil and have the rope hanging loose between you and your partner. Your partner would only receive something of a message if you jerked the rope really hard with big swings of your arm, the message would be rather distorted and we don't want that. But if we arranged for the slack to be taken up and a slight steady pull applied (bias?), then your partner would be able to perceive the slightest of movement of the rope so any rope message will now be read without distortion. Too much steady pull (bias) will do nothing more than make both of you feel hot and tired, even when no message was being received, very wasteful. So there is your bias in a nutshell, just enough to keep everything in control and allow the valve to respond to its input signal with the least distortion.

If you are non-technical it is hoped the above helps you to understand in a simplistic way, what bias is and why it is important to set it up correctly. You should do this whenever you change the EL34 output valves located as shown in the photo, two on each side of the amplifier. Valves have a tendency to alter their characteristics slightly as they start to clock up running hours so it is a good idea to check the bias settings every now and again. The Yaqin employs what is called fixed bias and as each valve has its own control there is no need to waste money buying so called Matched Quads or Matched Pairs. Other amplifiers, particularly guitar amplifiers, use what is called Auto bias which is self made by each valve so it is more important to buy Matched Quads or Pairs for these amplifiers. This is so that they all self-bias to approximately the same level.
The best advice is to try and purchase four valves from the same manufacture that have been made at around the same time. Feel free to try all four from different manufacturers but it is not recommended to mix them as there may be very slight changes between brands and you do want the best sound? Yes?

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Whilst the top cover was off, the Author took various voltage measurements to aid fault finding later should this ever be required. He has placed this information in the Fault Finding section so he can concentrate here on describing the rest of the amplifier.

Construction

Physically, the amplifier is built up on a metal base, the two main printed circuit boards being mounted onto the base using insulating pillars. The top cover has cut outs for the valves and on early versions like the Authors, cut outs for the four main smoothing capacitors. He suspects that these capacitors were hidden out of sight on later amplifiers for three possible reasons.

1) Safety, as these components have approximately 450 volts on them and though well insulated they do pose a possible safety hazard, though a fairly unlikely one.
2) The style of capacitor i.e. its physical size, has been discontinued by manufacturers in exchange for a shorter but fatter size, probably dictated by other markets where their improved immunity to mechanical shock would be appreciated and their shorter height ideal for compact power supplies.
3) The sight of four bland capacitors poking out of the top panel does not exactly add to the aesthetic qualities of the amplifier.

The top cover also carries three large Green circular transformer covers that have made many to believe that the transformers are toroidal. Toroidal transformers are specially wound on large donut shaped cores and have special qualities like better efficiency, smaller size, lower weight and a lower exterior magnetic field so screening or special placement onto the chassis is not required. These things come however with one big disadvantage and that is cost. The Yaqin does not use toroidal transformers, probably due to cost and instead the transformers are of the usual laminated metal frame type of construction. It is usual to mount the power transformer at 90 degrees to the output transformers to reduce magnetic coupling between them. Yaqin have mounted all transformers in the same direction to each over and the very substantial metal covers are given the job of providing the magnetic isolation. The transformers are wound on a single bobbin which, with the power transformer in particularly, is alleged to improve its regulation.

You will also note on the front cover photo that there is a small square MC-10L badge located between the two sets of capacitors. This badge has been attached to hide a hole but what was it originally for? The reason will become apparent when we look at the history of the amplifier and its earlier brother the MC10-K. Appreciation is given to **Bob Drinkall on the Yaqin Tube Valve Amplifiers Facebook Forum** for the following 10-K photographs.

First of the line?

The MC10-K sported a total of 11 valves, two of which were Magic Eye indicators. Notice that there is a small double Triode sitting where the plastic badge now resides.

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This is the MC10-K but in the 10 Tube format. The small double Triode has gone, its mounting hole hidden by the plastic badge. So we have finally arrived at the reason for it, to allow old chassis tops to be used with later models.
The Magic Eyes were next to go, substituted by double Triodes. This allowed the octal based Triodes to go, making room for an extra pair of smoothing capacitors.
The fancy aluminium mounts were also added to the capacitors to hide the large holes left in the chassis top.

The front panel requires little comment, it carries a mains supply on/off switch, a volume control and a 4 position input selector switch. You may suffer from cross talk here, this being the ability to hear for example a Tuner input, faintly in the background when one of the other inputs is in use. One of the main reasons for this is the fact that the inputs are not taken to the switch on separate screened leads, this would make eight in all, four for the left and four for the right. Instead, all four inputs on each channel are lumped together into a single screened lead which may provide some degree of isolation between left and right but does nothing for the four individual inputs on each channel. Because the Author uses a remote switch box and hence only one input to the Yaqin, he does not suffer from cross talk but for those of you who do, then it may be possible to reduce this to a satisfactory level by re-wiring with separate screened leads.

This is part of a Yaqin catalogue photo and shows the layout of the rear panel. The RCA input sockets require no comment except that which has already been described. Likewise the speaker output sockets which have generous entry holes to accept very heavy gauge speaker wires. The Authors speakers are rated as being 6 Ohm impedance which was tricky for him as the Yaqin only provides either 4 or 8 Ohms. All enquiries on the internet gave the indication that the 4 Ohm output was best suited for 6 Ohm speakers but after many hours of listening he still cannot decide which is best. 8 Ohm output seems to provide a firmer bass but at the loss of top 'air' which seems to come back on the 4 Ohm output. He has subsequently been told by many to use the 8 Ohm outputs.

Earthing and Earth loops

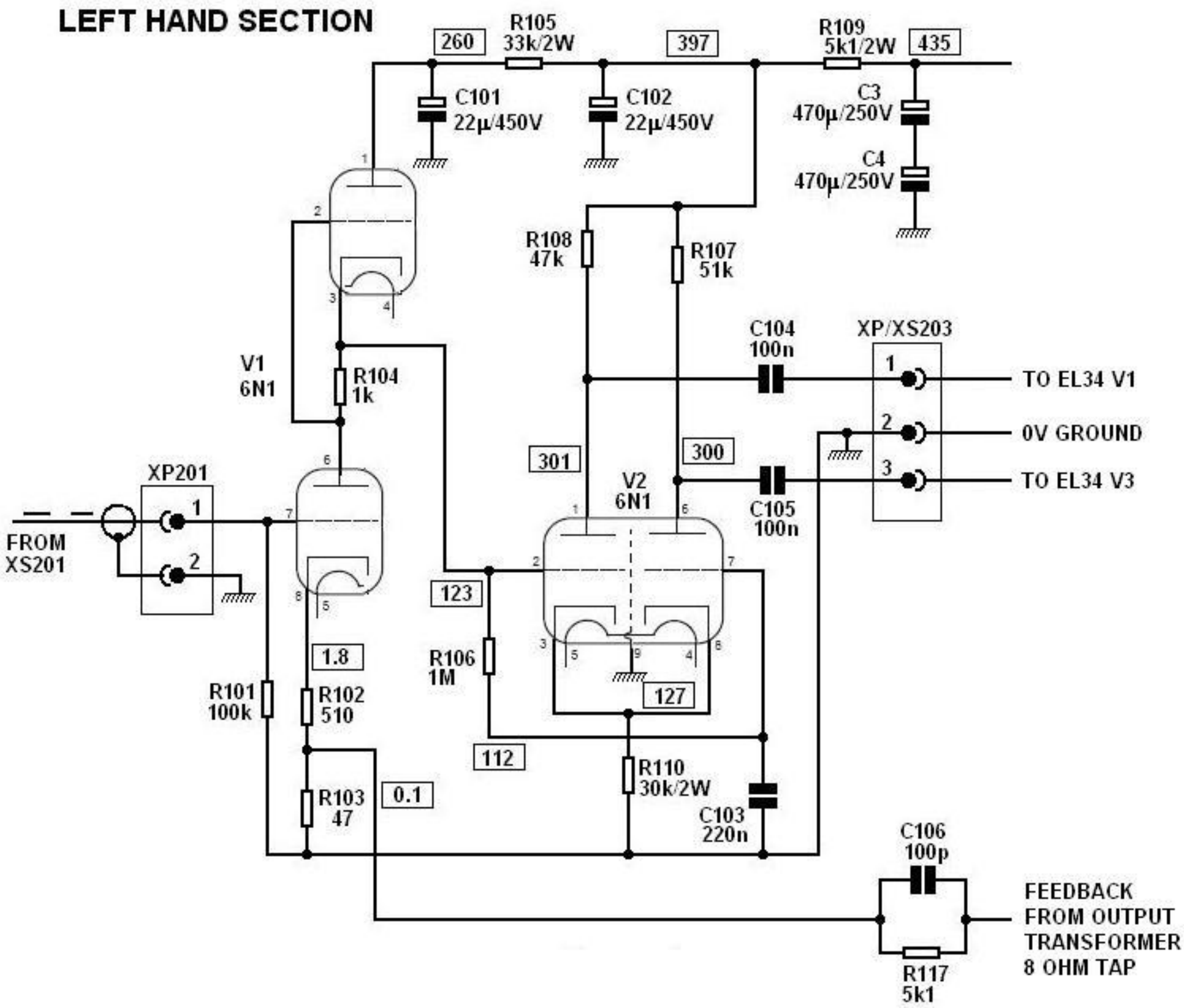
The mains input connector is a standard IEC type with a small drawer that contains the mains fuse plus a spare. But the Author discovered something here; the earth pin was not connected to anything and left completely open circuit. He was not happy with this arrangement as this equipment is viewed in the UK as being Class 1 and implies that a safety hazard would exist if there was a short circuit of any mains wiring to chassis. Also he originally had an audio feed from a cable TV box plugged into the DVD inputs and this caused the Yaqin chassis to attain an unpleasant voltage, presumably from the cable box supply filters.
When a PC soundcard was plugged into the Yaqin it caused the soundcard to ground this induced voltage and led to failure of the soundcard so something had to be done.

He fitted a good quality earth bond between the IEC earth pin and the base chassis plate. This does not cause any earth loops except when the PC is connected but the level of hum is so small that it is generally un-noticeable. It can easily be cured by fitting audio isolating transformers at the PC but he has not needed to do this. For those who do not know what an earth loop is, it is simply the fact that two pieces of equipment, for example the Yaqin and a PC may have a slight difference in potential on their chassis earths due to for example the existence of a mains input filter. When you connect them together via the audio leads, a small current at mains frequency (50 or 60Hz) will pass between the chassis of the two units and this can be induced onto the signal lines and cause hum to be heard.

He informed Yaqin of this serious 'non earth' error and subsequently all Yaqin equipment is now properly Grounded.

Front end

Here is the circuit of the re-drawn front end, which are the stages using the small 6N1 valves, between the source selector switch and the larger EL34 output valves. On the right channel V1 is V4 and V2 is V3. Also the valve pins used are reversed so for example, pins 6, 7 and 8 on the left channel become pins 1, 2 and 3 on the right channel, this applying to both valves.

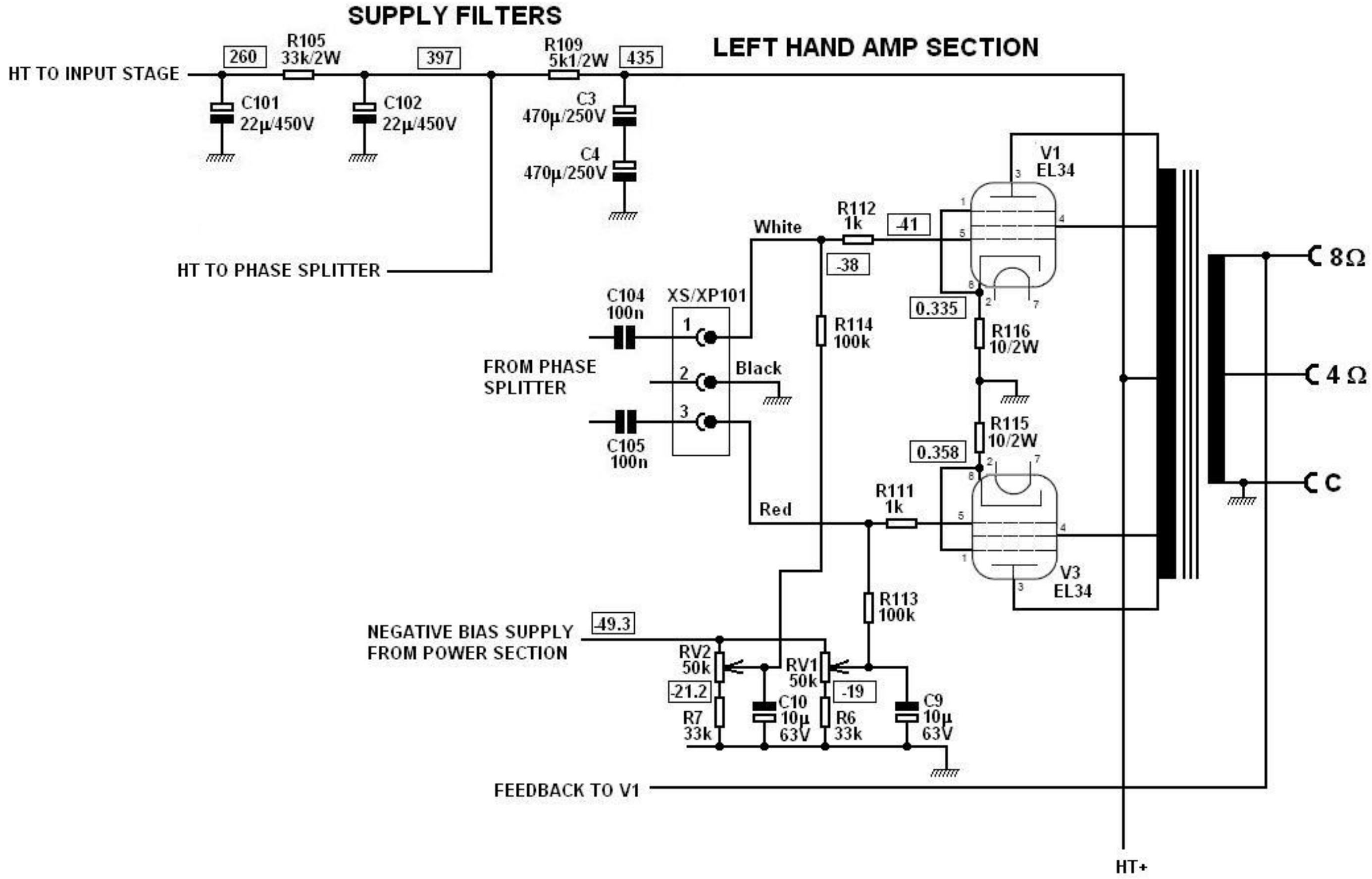


The first half of V1 consists of a voltage amplifier using its second half as a kind of infinite anode load (but by voltage values approximately 40k Ohms) with the overall current set by R104. This is approximately 3.5mA and biases the top halves grid at minus 3.5V with respect to its cathode. The circuit allows direct connection of the second valve V2, without any capacitor which could otherwise produce unwanted phase shifts. It also improves the low frequency stability when feedback is applied to R103 via C106 and R117.

Intermediate Stage

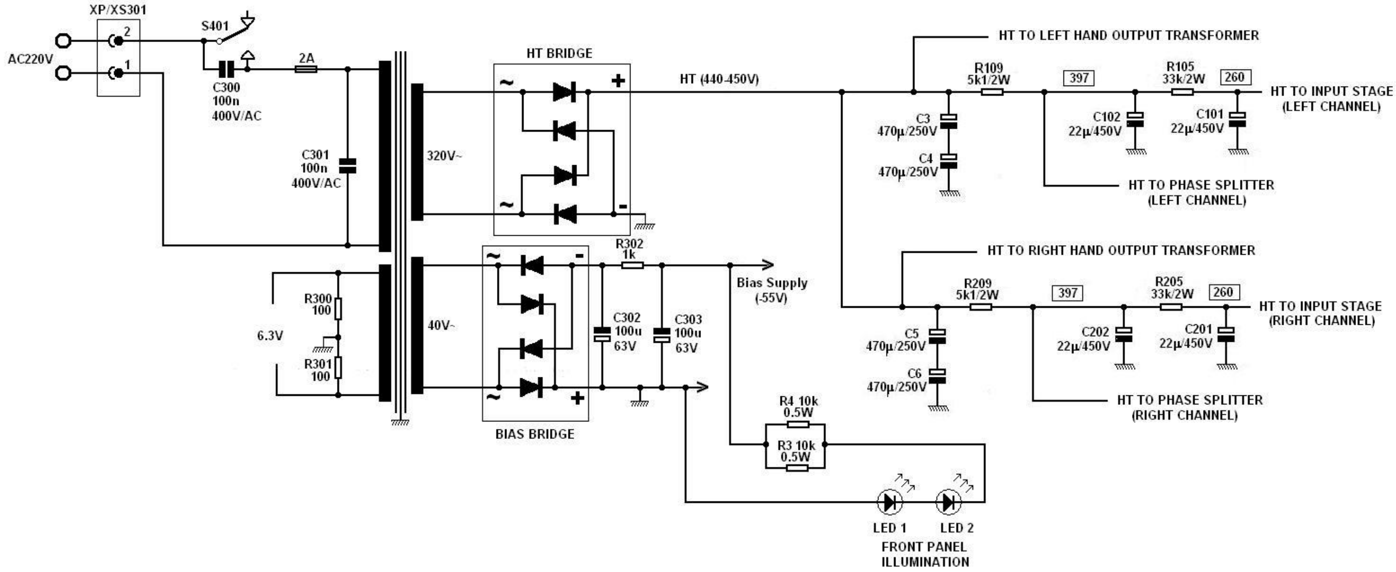
The intermediate stage consists of a cathode-coupled phase-splitter often called a Schmitt phase splitter and provides a push-pull drive voltage for the output stage. It is necessary in a cathode-coupled phase splitter for the anode load of the right hand section to be slightly higher than that of the first section if reasonable balance is to be obtained. Thus R107 is made 51kΩ and R108 47kΩ. At low frequencies, the presence of C103 and R106 in the grid circuit of the right hand triode produces both phase and amplitude unbalance. The frequency at which the lack of balance becomes significant depends on the time constant of these components and in the MC10L it is less than 5Hz. The cathode voltage on the upper section of the first 6N1 (V1 Pin 3) determines the operating conditions of the phase splitter. The task of the phase splitter is to take a single input signal and produce two versions of it, one of which is a mirror image of the other. When applied to the output valves, the two signals will make one valve turn off as the other turns on and vice versa. That is what is meant by the term Push-Pull.

Output Stage



The output stage consists of two output pentodes, type EL34, in what is called a fixed bias circuit. This means that each valve has its bias independently controlled by its own adjustable control; here they are RV1 for V3 and RV2 for V1. Matching of the output valves is therefore unnecessary whereas other amplifiers employing the alternative self-bias have to be fitted with matched valves in the hope that each arrives at the similar bias points. The anode (Pin 3) supply voltages are taken from the reservoir capacitors C3 and C4 (which will be discussed later) via the output transformer. The screen grids (Pin 4) are fed from taps on the transformer and this arrangement is called Ultra Linear Mode or Distributed Load. Basically it makes the Pentodes appear almost like Triode valves, which are very linear and consequently the distortion is lower. Bias is supplied to the valves via R113 and R114 with the 1k resistors R111 and R112 included as a normal measure to prevent parasitic oscillations. The inclusion of the 10 Ohm resistors R115 and R116 allows measurement of the valve currents, using a standard voltmeter, without having to break into any of the circuits. The method for setting up the bias was discussed on pages 3 and 4. Audio signals are coupled to the output stage by capacitors C104 and C105. These two components are favourites of the ‘modification brigade’ who either up the values to something like 220 - 470nF and fit paper in oil types of capacitor in an attempt to tailor the sound to their preference. There is however a much more useful modification to be made here as will be discussed later.

Power Supply



The power-supply stage shown in the circuit diagram above uses two bridge rectifiers to provide all of the direct current (DC) supplies. The first bridge fed with 320V AC produces the main HT rail of approximately 450V. The first set of smoothing electrolytic capacitors, sometimes referred to as Reservoir capacitors, require some explanation. These are C3, C4, C5 and C6 which are arranged as two sets of series connected capacitors. The reason for series connecting them is the fact that each capacitor is only rated at 250V and yet the supply rail is at 450V. By connecting the capacitors in series the working voltage is doubled to 500V but at the same time the effective value is halved, so we finish up with a 235uF 500V capacitor. By fitting an identical pair in parallel we once again achieve 470uF at the higher working voltage of 500V. There is a very important modification we need to do here, as will be discussed later and which Yaqin themselves have fitted on their latest amplifiers.

Because the output stage does not have a great deal of gain by itself, the level of smoothing provided so far is adequate but the other stages will require more smoothing. Additional smoothing is achieved using the resistors R109/R105/R209/R205 and the capacitors C102/C101/C202/C201 (22 µF) so that the expense of smoothing chokes is avoided. With the power supply under load, the voltage across C102 and C202 should be close to 400V whilst that across C101 and C201 will be 260V. The capacitors are rated for 450V which must not be exceeded, but could possibly happen if all valves are removed and power is applied to the amp. So when fault finding try to keep some valves in circuit or arrange for the amplifier to be powered with a lower mains supply so that the main HT does not go above 450V.

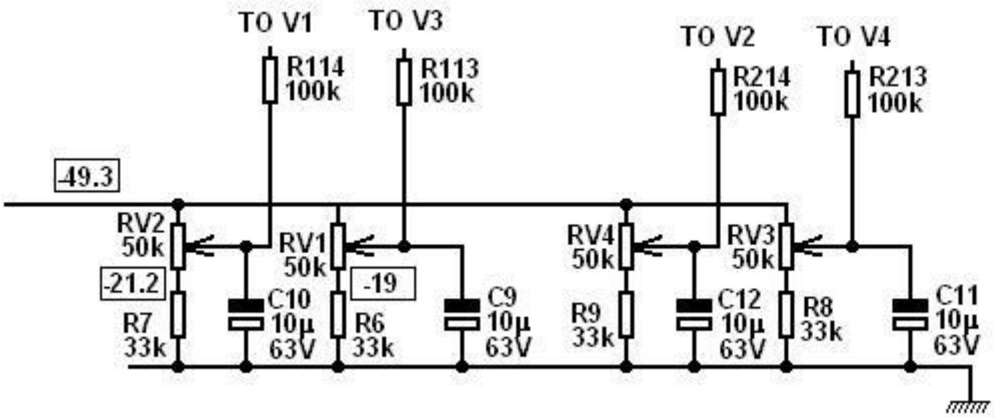
Bias Supply

The second bridge rectifier is fed with 40V AC from the mains transformer and with the pi smoothing circuit provided by the 1k resistor and two 100µF capacitors; it provides a negative voltage of around -55V for the bias circuits.

This voltage is conveniently used to illuminate the front panel Logo using two Blue light emitting diodes (LEDs), series wired with R13 and R14 doing the current limiting of around 10mA. The value for R13 and R14 is 10k but in later models this was reduced to 6k8 to obtain a brighter light.

The actual current drawn by all four bias control circuits is roughly 5mA.

The circuit is drawn on the next page.

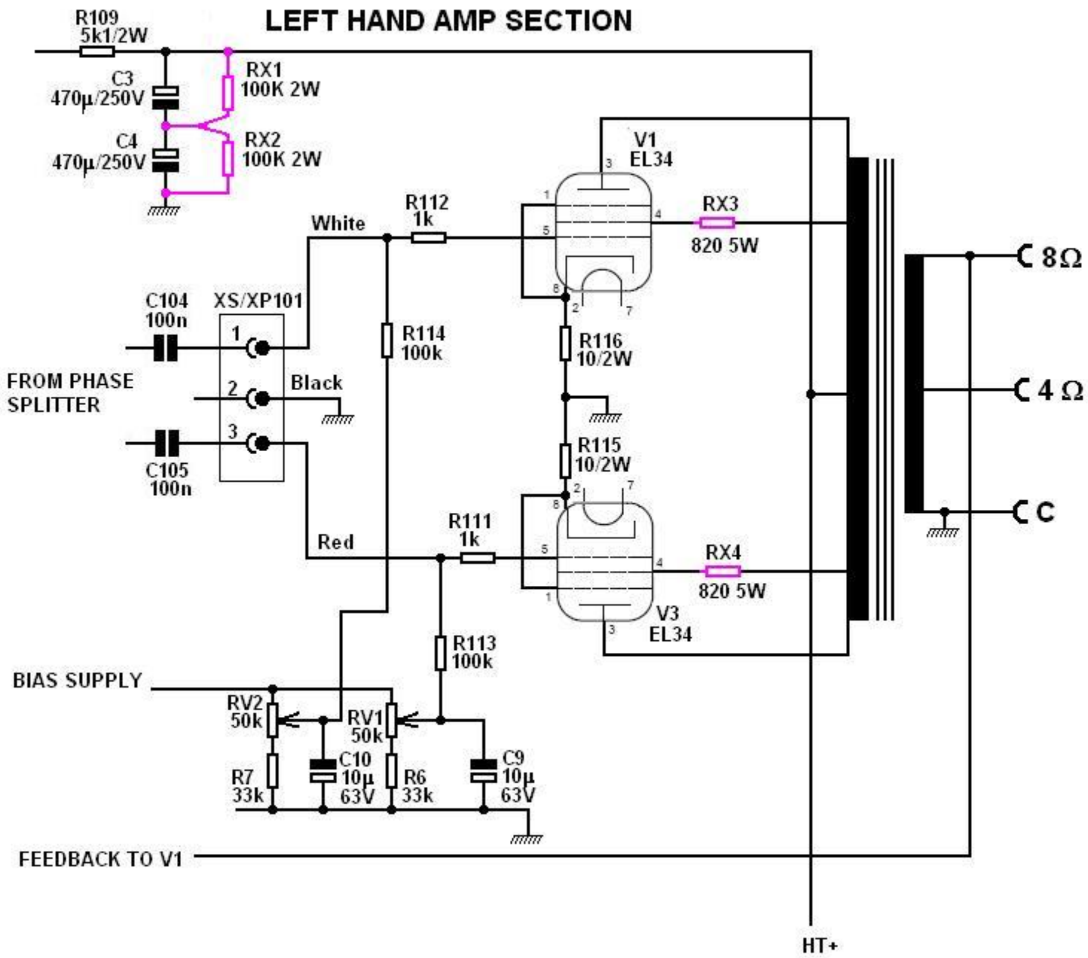


Pretty self explanatory, the -55V (-49.3V actual measurement) is fed to all four preset controls RV1 – RV4, each having a 33k resistor and a decoupling capacitor of 10µF. The grids of the output valves are fed with the bias, as required, via 100k Ohm resistors R113, R114, R213 and R214 as shown.

Modifications and changes made to later models.

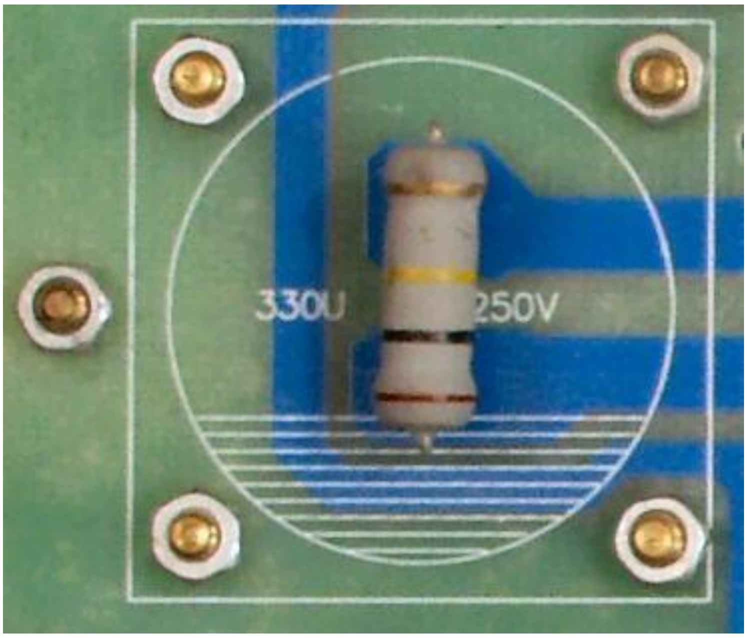
Here is a list of some changes you can make to the MC-10L, first however the most important ones and regarded as very necessary:-

Voltage Equalisation Resistors

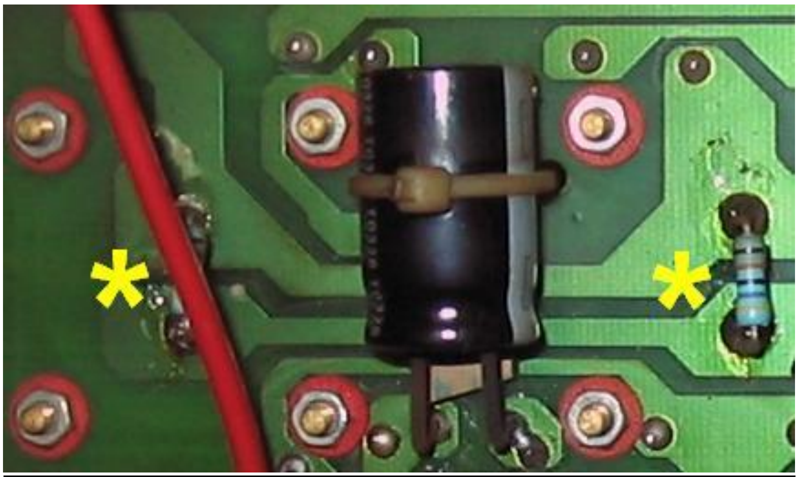


Leakage currents within the capacitors C3 and C4 could cause the voltage sharing to go astray with the result that one of the capacitors may have more than 250V across it. This can be prevented by fitting voltage equalising resistors shown as RX1 and RX2. This is a modification that Yaqin now fit on their latest models as shown in the photo on the next page.

Position of the 100K resistor on later MC-10L amplifiers



On older models, these resistors have to be mounted beneath the pre-amp board.



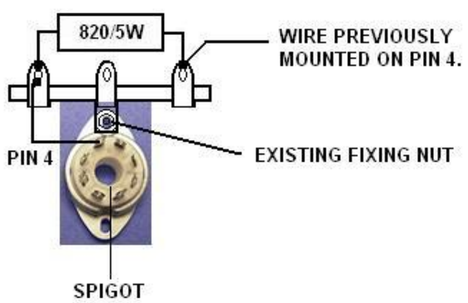
The left most resistor is partly hidden by the Red wire. By using a higher value of resistance the Author was able to use 1 Watt resistors that were to hand at the time. He would probably use the 100k 2 Watt resistors if he was fitting them now because there is an additional advantage.

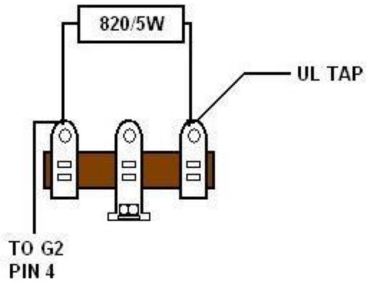
This is the fact that 100k resistors provide a quicker discharge path when the amp is switched off so the capacitors do not hold any charge waiting for your fingers!

Screen Grid Stoppers/Current Limiters

In the diagram on Page 10, RX3 and RX4 as far as the Author can tell, are not fitted to latest models and was a modification he decided to do after reading about failures in EL34 valves due to excess screen currents. The articles concerned recommended the fitting of limiting resistors but he had also read that they assist in the stability of amplifiers and help reduce the chance of parasitic oscillations. Later he found some documentation on the internet that was produced by Philips (Mullard) that recommends the fitting of 470 Ohm to 1k Ohm resistors in series with the screens of EL34's. One particular high end amplifier that came his way had a very similar output stage to the MC-10L, using ultra linear screen taps on the output transformers, but including a 750 Ohm screen resistor on each EL34. He modified his MC-10L using the more easily obtainable 820 Ohm resistors.
They are not so easy to install on the MC-10L so he mounted his on four small tag strips.

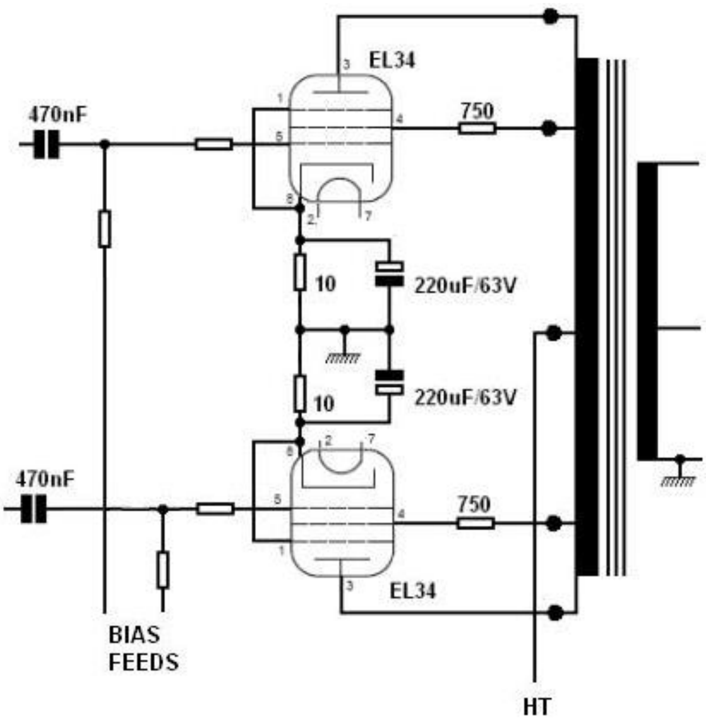
You can buy the tag strip in one length and just cut it to suit. He used the outer most screws of each valve holder as they were easier to get to and also meant the least disturbance to wiring. Hopefully these rather crude sketches will give you some idea of fitting.





Having mounted a tag strip at each valve position, simply remove the wire from pin 4 of each EL34 and connect it to one end of the resistor.
In one of the above sketches it is marked as UL TAP.
Then using a short piece of insulated wire, connect the other side of the resistor to Pin 4, i.e. the pin you removed the original wire from.

He was convinced that fitting these resistors had improved the bass response of his amplifier but he had no measurements to be able to back this theory. Here is the circuit of the high end amplifier on which the modifications were modelled.



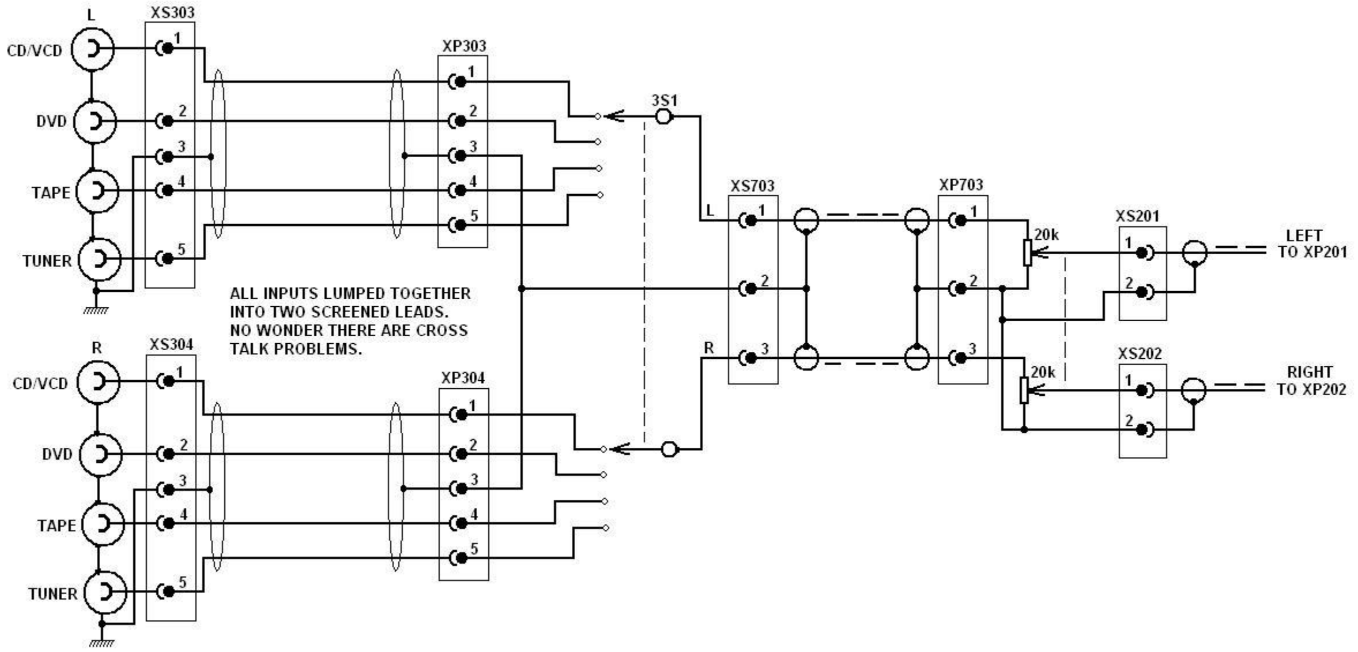
Cathode de-couplers

Notice in the high end amplifier circuit shown above that it also has 10 Ohm resistors in each of the EL34 cathode circuits, just like the MC-10L. However, the resistors have a 220uF 63V electrolytic across them. While he was fitting the screen resistors the Author added the capacitors at the same time, there is plenty of room for them on the underside of the circuit board. Unfortunately, he did this modification at the same time that he added the screen resistors so he cannot tell which of the two modifications resulted in the slight Bass improvement.

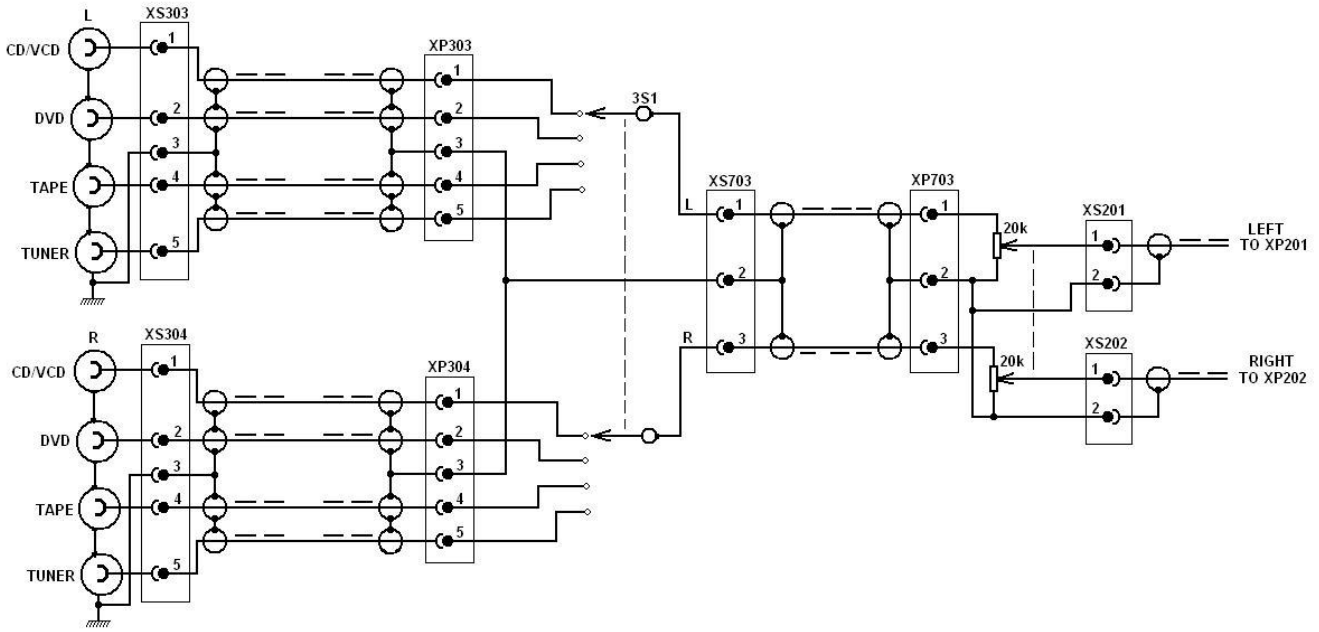
Cross Talk

(Slight hearing of what's on another source whilst switched to another)

Another weakness in design no doubt brought about by cost saving especially in the wiring stages of construction. All four inputs of each channel are combined into one screened cable instead of being separate. This is bound to cause cross talk on such a high impedance circuit.



If you suffer from cross talk (and you probably do) then this may provide at the very least a reduction to acceptable levels.

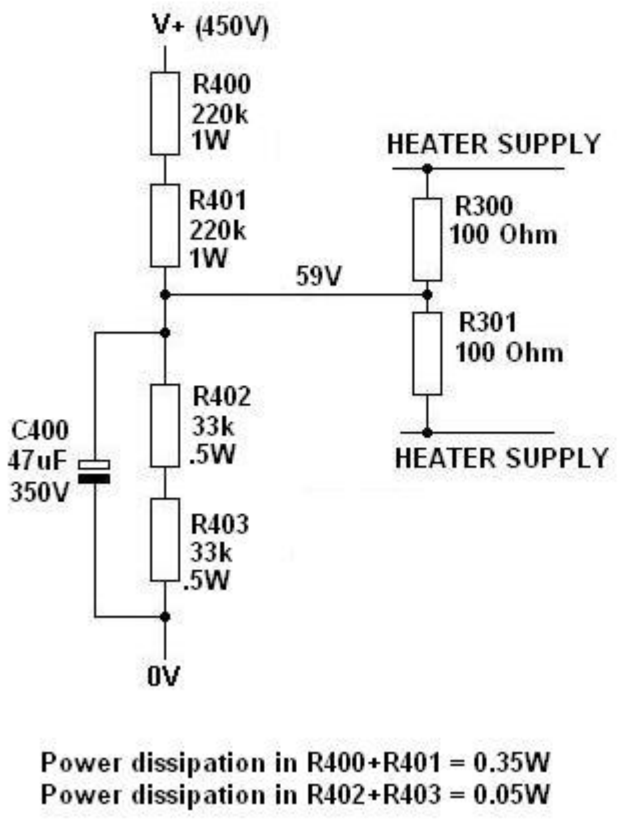


Floating the Heaters

Not too many problems seem to have beset the pre-amplifiers and phase splitters apart from defective 6N1's producing nasty crackling on the output or mains hum due to defective cathode/heater insulation. The cathode/heater insulation is really pushed hard in the MC-10L and looking at the specifications of the 6N1 makes one feel that the design is really asking a lot of these valves. It has been suggested that a potential divider should be constructed from the HT line such as to float the heater supply at a fixed voltage,

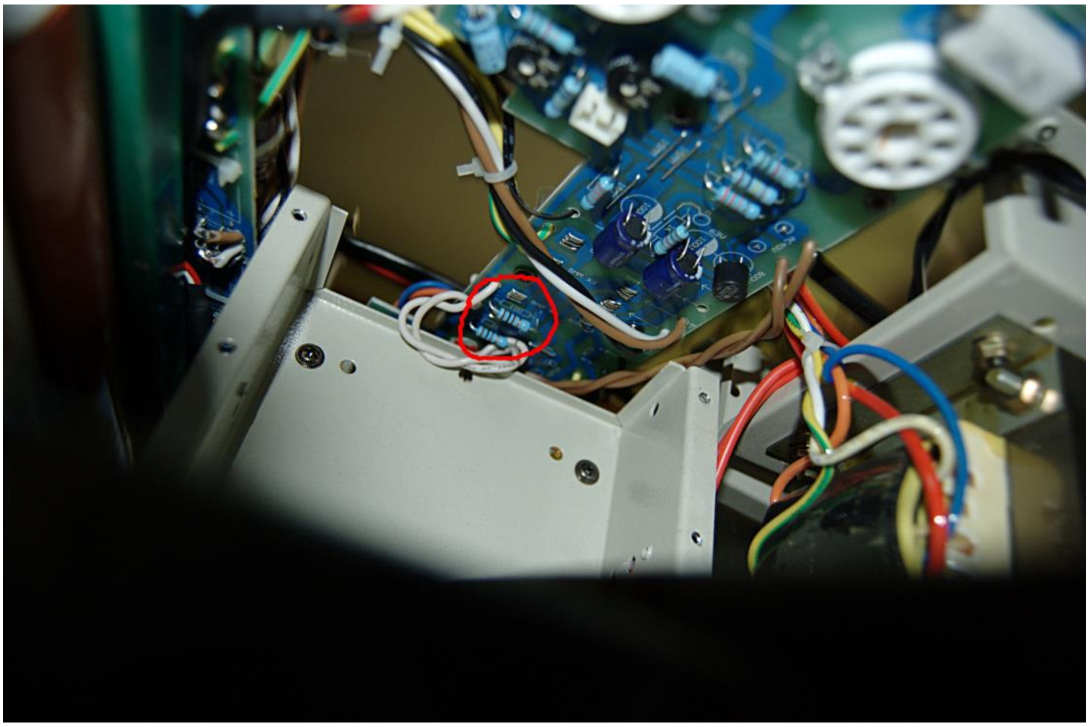
say 60V. You would have to lift the fixed resistors presently fitted on the heater lines from earth (these are shown as 100 Ohm resistors R300 and R301 on the page 9 schematic) prior to doing the modification. The 60V float would effectively do the job of hum reduction and reduce the potential difference between cathode and heater of the 6N1's. The Author has only tried this modification once himself as it does require quite a bit of work and besides, he has not had any 6N1 failures in the years he has owned his MC-10L.
However, **Matthias Günther** has sent me some information on how he implemented this modification.
Many Thanks Matthias.

The Circuit

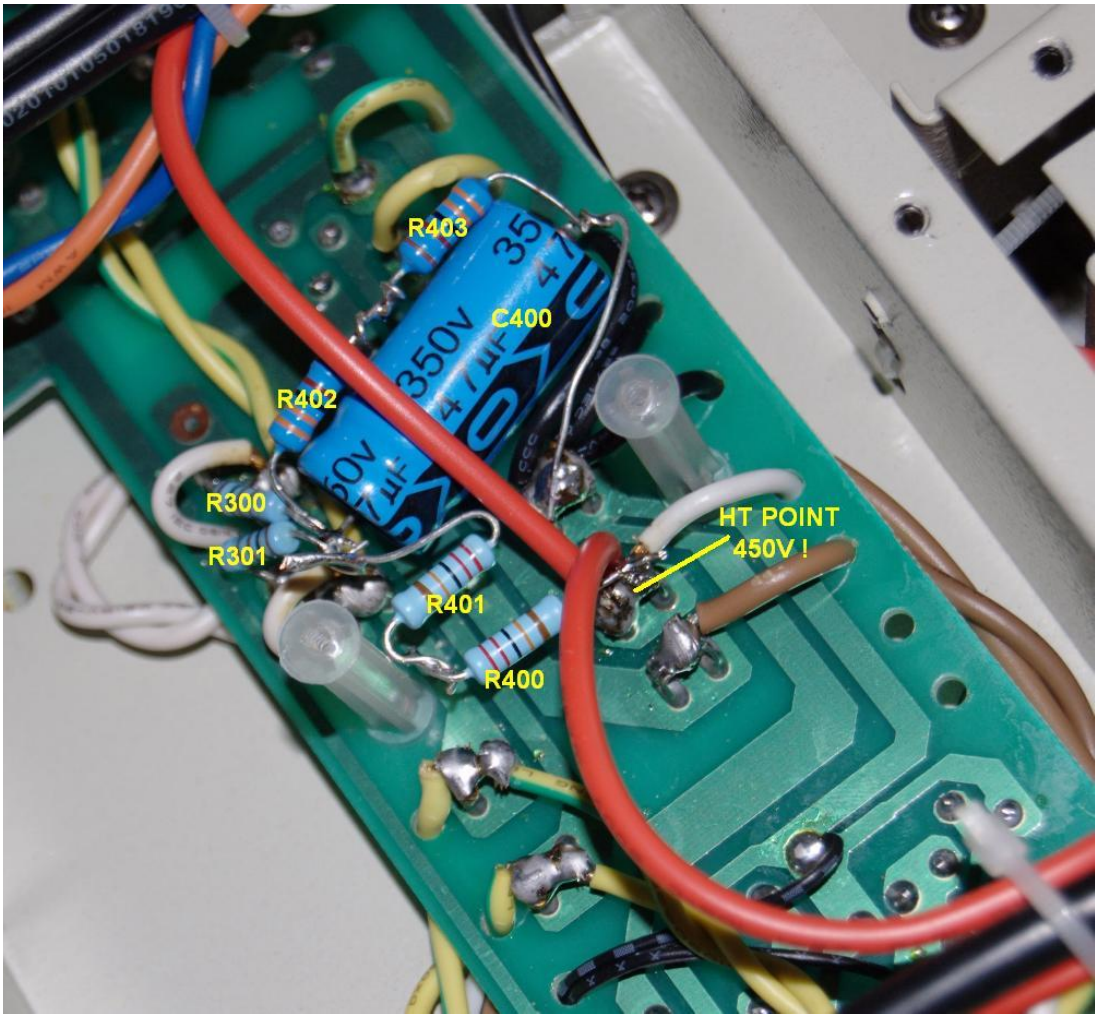


It does require complete removal of the base panel in order to access the power supply section of the rear board.

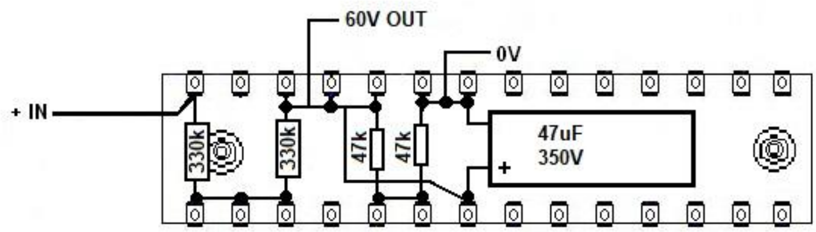
Location of the 100 Ohm resistors R300 and R301

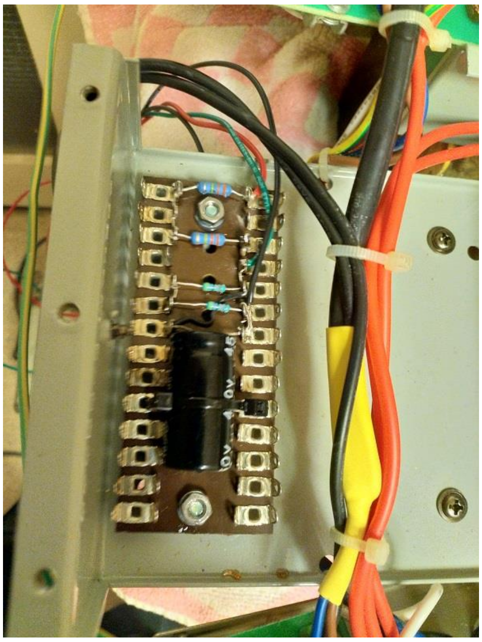


Fitting the Mod

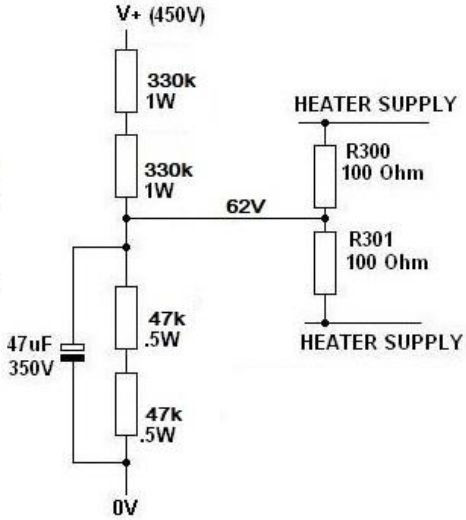


Alternative method used by the Author, A tag board is mounted under the L/H output transformer. Different resistor values used from the spares box but result was the same.





CUT TAGBOARD RS433-703 TO SIZE AND OPEN HOLES AS SHOWN TO 4.2mm. REMOVE TRANSFORMER M4 FIXING BOLTS AND REPLACE WITH LONGER BOLTS FITTED IN REVERSE, i.e. FIXING NUTS UNDERNEATH. LOCATE TAG BOARD ON THE NEWLY FORMED STUDS AND FIT TWO M4 NUTS WITH THREADLOCKING COMPOUND.

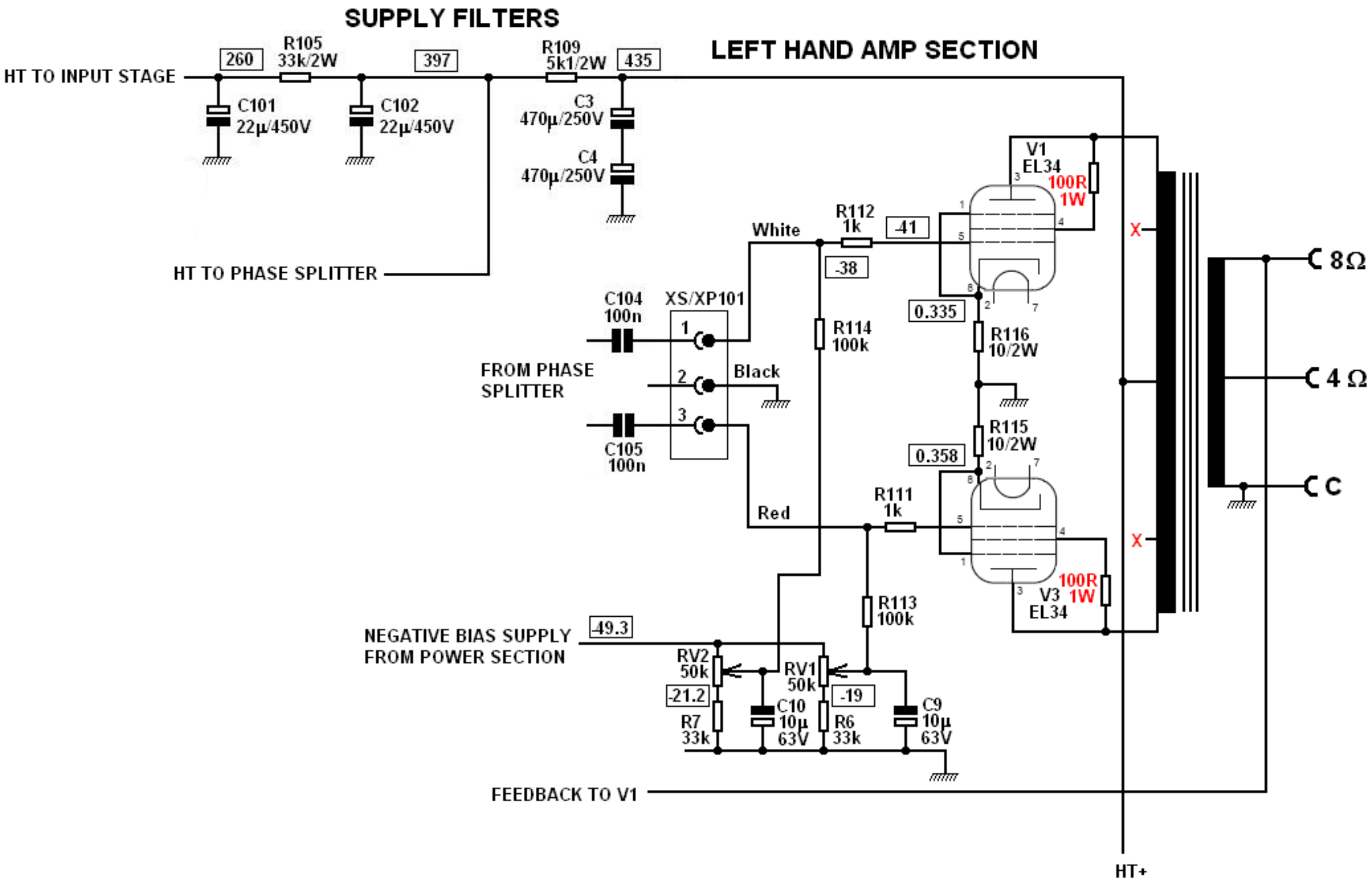


Triode Mode

The Author has often been asked if it is possible to wire the MC-10L in Triode mode?

Well he doesn’t think there is much more to do other than disconnect the ultra linear output transformer tapping from pin 4 of each EL34 and well insulate it as you don’t want it accidentally shorting to chassis or for that matter anywhere else. The now vacant pin 4 is now connected to the anode of the EL34 (Pin 3) via something like a 100 Ohm 1W resistor. These are minimum values and could be higher, say up to 470 Ohms with a 2W rating for better reliability, especially under fault conditions.
The suppressor grid at pin 1 stays connected to the cathode at pin 8. For true triode emulation it would seem at first sight that tying it to the Anode would be the best thing to do. However the grid structure is not designed for that and it would be very unhappy! The Author has looked over other circuits where a Pentode has been wired as a Triode and the suppressor grid is always connected to the cathode.
He has not tried this mode himself on a 10L, the main reason is the daunting task of taking the amp apart to revert to UL mode should he not like the Triode mode ☺.
Don’t forget you will have a lot less power available in Triode mode so your speakers need to be reasonably efficient.

The circuit appears on the next Page.



Mains input voltage

The Author would like to start here with a problem that has been blamed for premature failures of other Yaqin amplifiers as well as the MC-10L. This is the worrying problem of mains supply voltage and the fact that a lot of amplifiers from China have been manufactured with 220V instead of the 240V here in the UK. Perhaps the Author was lucky with his amplifier as all voltages around the amplifier seemed to be as expected with the HT supply being around 450V DC and the valve heaters being run at 6.3V AC. Running a 220V Yaqin on the UK supply of 240V will cause the heater supply to rise to around 6.8 to 7 volts but more importantly, the HT supply is likely to rise to close on 500V which is the maximum that the smoothing capacitors are rated to handle. If you have a high HT or measure the heater voltage as close to 7 volts AC then there is a good chance that your amplifier was meant for a 220V mains supply. It has been suggested on the Yaqin Face Book Forum that the mains transformer has its mains input voltage stencilled on its upper surface. You will have to remove the top, complete with attached round cans, to get a glimpse of this. It may save you the trouble of trying to ascertain its input rating by measurement. The main worry is that the mains transformer may be running a lot hotter than normal and may suffer insulation failures in the long term. 50 deg C is about the hottest you want the mains transformer to increase by and there is a simple way of getting a rough idea of your amplifiers mains transformer temperature increase. It involves a little maths but is really quite simple. You need to use your digital Multimeter to measure the resistance of your amplifier WHILE IT IS COLD.
Before you use your MC-10L for the evening, unplug the amplifier from the mains and apply the Multimeter across the pins of the mains plug, making sure of course that the mains switch on the amplifier is set to ON. We will take the Authors MC-10L as an example and it measured **5.8** Ohms.
We now use the formula –
Maximum allowed resistance rise = (measured resistance x 0.1965) + measured resistance.
Which in the Authors case was (5.8 x 0.1965) + 5.8 that works out as 1.1397 + 5.8 = **6.9397** Ohms.

The **6.9397** Ohms is the maximum resistance you want to see when you repeat the measurement exercise when the amplifier is hot.

Now connect your amplifier back into the supply socket and run the amplifier for the evening so it is nice and hot.

Switch off the amplifier and measure the resistance as before, the Authors MC-10L measured **6.7** Ohms, close but OK! Phew!
The increase in the resistance reading is due to the resistance of the copper wire in the transformer rising with temperature and now you have the two readings we can do some more easy calculation.
For example; we can find the % change in the transformer resistance which must not ideally exceed **20%**.
Once again taking the Authors MC-10L as an example, the formula here is –
Percentage rise = ((Hot resistance divided by Cold resistance) times 100) minus 100 or
((6.7/5.8) x 100) – 100 or
(1.155 x 100) – 100 or
115.5 – 100 = **15.5%**

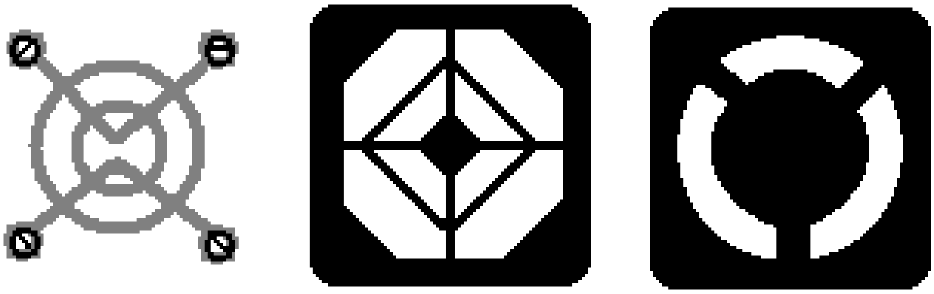
Finally we can use this % figure to deduce the temperature rise (which we don't want to see above 50°C) with the formula:-
Temperature Rise = Percentage rise divided by 0.393 or
15.5 / 0.393 = **39.44**°C.

So if you suspect over heating of your MC-10L mains transformer then the above may either calm your nerves or shatter them!
Please note that the formulas are not precision but given to me by the Author by a friend who suggested that they just gave a reasonable guide as to what is going on inside the transformer.

The Author found the metal can surrounding the mains transformer was getting very hot indeed and reckoned that a bit more ventilation would be in order. So he decided to add a ventilation grille to the round can that surrounds the mains transformer.

You can buy various grilles for miniature fans and after cutting a suitable hole he installed one at the upper rear of the can, invisible from the front. The wire type is the easiest to fit but be sure to use the shortest possible screws so they do not interfere with the transformer.

40mm FAN GRILLE



One can certainly feel the heat being ejected from the improved air flow around the transformer.
The Author inserted this modification here as he thinks it is worthwhile, even for a Yaqin fitted with a 240V transformer.

But what do you do if you are unfortunate enough to have a 220V version?

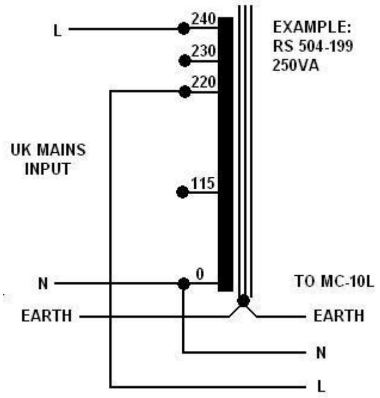
Certainly measure the heater voltage to confirm or allay your worst suspicions.

Variac

This is a well-known trade name for a variable Transformer, similar to Hoover when talking about a vacuum cleaner. It is the easiest way to get around the over voltage problem and you simply place it in line with the power feed to the amplifier. Common manufacturers are Claude Lyons or Zenith but they can be expensive which is why many search for a cheaper option. Ideally you need something in the region of a 250/500 Watt handling device but with it you can reduce the output to a safe 220V using either its hand wheel or knob.
It should come with a scale which you can mark the 220V position on; this has the advantage of allowing you to slowly turn up the power from zero to 220V without the need to measure the voltage, preventing that nasty sounding power surge through the amplifiers mains transformer.

Auto Transformer

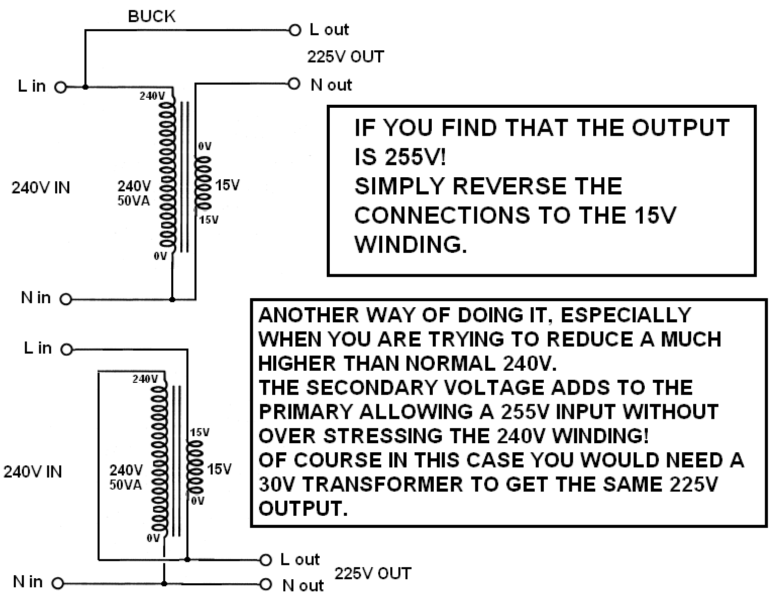
If it is a 220V model and the budget is tight, then the Authors own preferred arrangement would be to buy what is called an AUTO Transformer. These devices consist of one winding with taps, mainly manufactured to provide a simple way of getting 115V from the UK's 240 system. A typical transformer would be the RS components 504-199.



You may be able to get away with a smaller transformer but for just a little extra outlay it is worth getting one with an adequate VA rating. As you can see from above, you may apply the mains supply to either the 240 or 230 Volt tap and still obtain 220V for the MC-10L.
Some people advocate the use of a simple 15V transformer wired in series with the mains input. The Author has not tried this himself but seems plausible provided it has adequate ratings and it would have to be fitted into a well earthed enclosure. Because it was not designed to be used like this, the Author cannot recommend it as being fit for purpose and can only promote the auto transformer as being the correct way to go. He understands of course that owners in the USA or other countries using 120V supplies have had similar problems with some MC10-L's being over-run. He has also heard of power resistors being used to drop the odd 10 to 15V but remember that these will be getting quite hot so a suitable well ventilated and insulated enclosure must be used.

Buck and Boost Transformer with link to build your own Les_Buck-Box

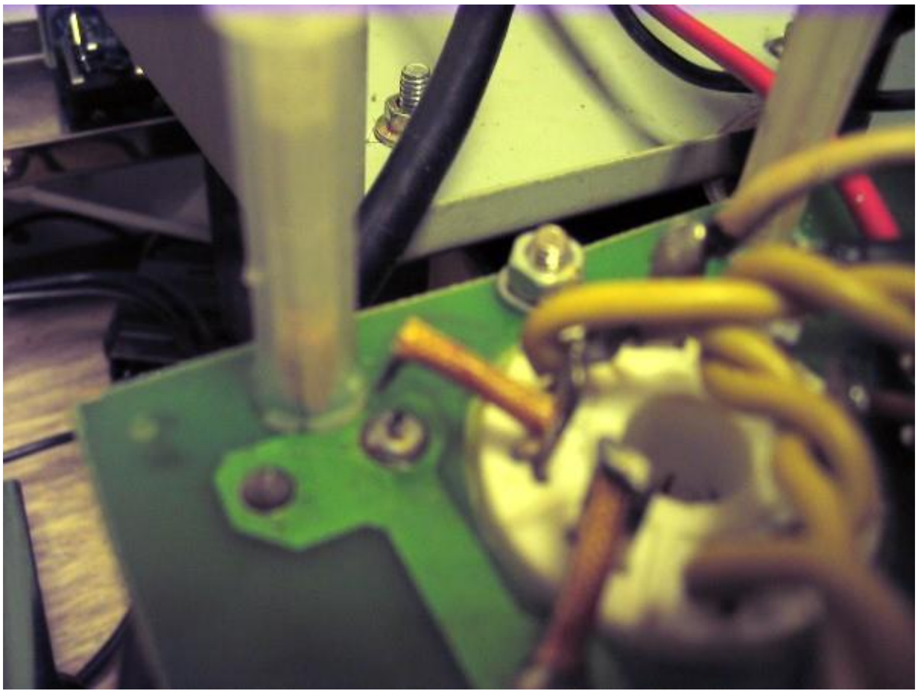
If it is not possible to obtain an auto transformer with appropriate inputs then the alternative method of using the low voltage windings of a mains transformer may be a solution. Anyway, if you want to use a 15V transformer here is how you wire it, make sure you make the 225V Buck version! The circuits are for UK 240V supplies but will work for 115V supplies with suitable alternative transformers. Confirm correct output with a Multimeter before connecting to your amplifier!
See also the build instructions for the Les_Buck-Box http://www.g4cnh.com/public/Buck_Box.pdf



When things go wrong!

Arcs and Sparks!

Yes, this does seem to occur a lot in valve amplifiers and not just the MC-10L. The main culprit in the MC-10L seems to be in the output stages and somehow, it occurs more in the left hand channel than the right. This is indeed quite puzzling as there is no apparent reason why the left hand channel should be more prone to such failures. It is possible that the failures may be due to 'tube rolling', a term given to trialling various types of output valve to achieve improvement in sound. As such it is very easy to fit a valve that may have an unknown defect and when it fails the MC-10L gets the blame. It could however be R6 - see page 27.

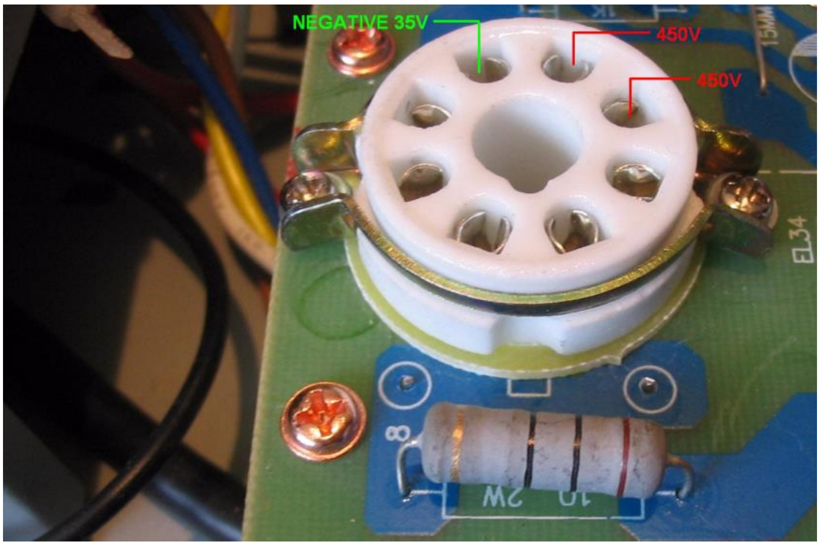


The above photo shows a poorly soldered connection between an EL34 base and the circuit board, cause was a very poorly tinned wire prior to soldering. There are a number of similar connections around each EL34 and are definitely worth a check, perhaps the loss of one of these could cause dramatic failure around this part of the amplifier.
Another possibility is the lack of screen resistors as previously mentioned. The worst case scenario here is failure of the actual grid structure causing it to short to the adjacent control grid. Because the screen grid is at a very high potential you definitely don't want it shorting to the control grid where its effect may also disturb the bias to the other valves. The increase in valve current produces a failure contest between the cathode resistor (the one you measure the bias at) and the output transformer. Some owners have shorted out the cathode resistor in order to get a little more from the amp! The improvement (if any) would be extremely small and takes away the safety feature of the cathode resistor, which is a metal film resistor and acts like a fuse, hopefully blowing open circuit and saving the expensive output transformer. If you used the special bias setting up box (described on Page 36), you do not need accurate cathode resistors and you could replace them with 150mA quick blow fuses. The Author has not tried fitting fuses here, it is just another of his 'food for thought' ideas.

Let's get back to the scenario then where one channel has smoked and the cathode resistor has burnt out.

<u>The first thing to do is remove both EL34's for that channel and treat them as suspect, totally guilty until otherwise proven innocent!</u>

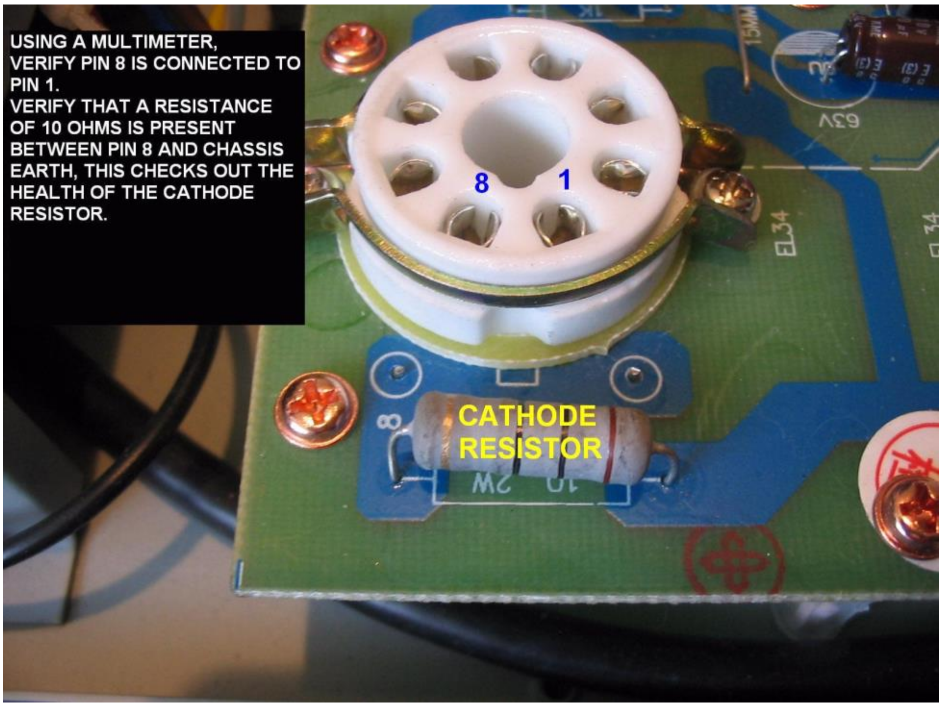
By all means keep the EL34's in the working channel as this will help keep the HT from rising too high due to light loading. Now on the faulty channel, check both empty valve holders and confirm that the following voltages can be obtained. **DO TAKE CARE AS THERE IS AT LEAST 450v ON SOME CONNECTIONS!**



Loss of 450V on either of the above connections may indicate an open circuit output transformer, especially if the other channel is working correctly.

It would be most unlikely to find loss of the negative 35 bias voltage on both vacant valve holders unless serious damage had been done to the bias components. You should be able to see this voltage vary with adjustment of the bias control for the valve holder you are measuring. Check that the voltage change is smooth and there are no control settings that give intermittent readings as for example the control had a damaged internal track.
If you set the control for maximum negative voltage than you will be preparing the circuit to give minimum current through the valve when it is replaced and its final setting point can be set later.

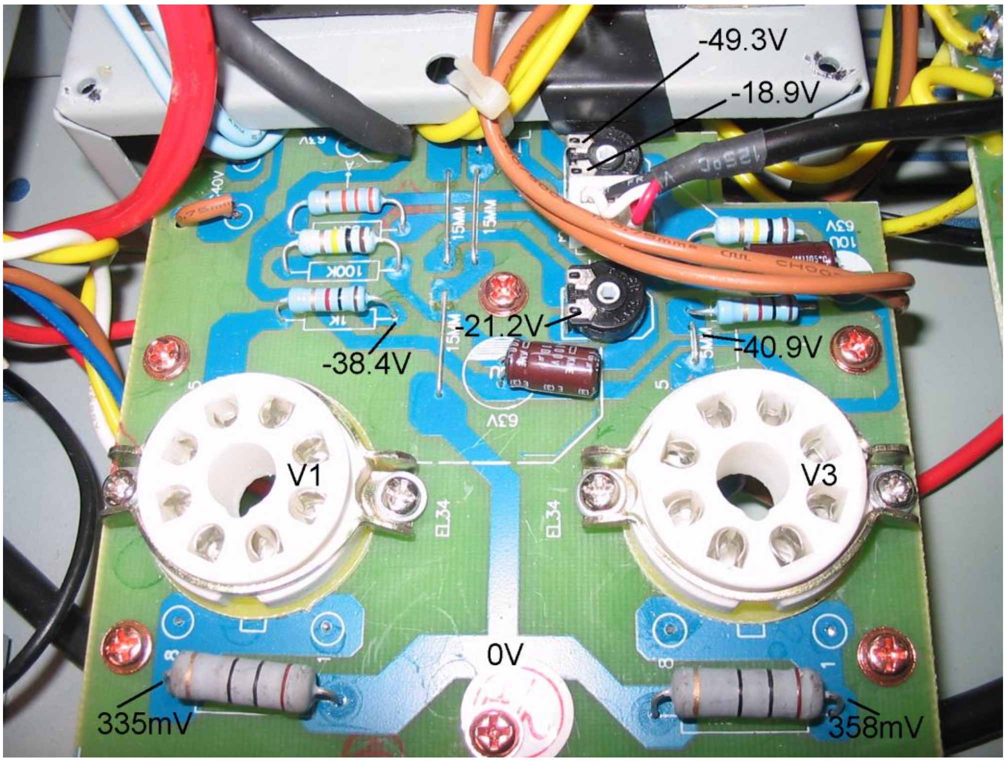
Finally, with all power removed from the amplifier, check out the remaining pins of both valve holders which are pins 1 and 8, located either side of the spigot as shown in the photo. They should be connected together and then go to chassis earth via the cathode resistor. This should measure 10 Ohms though you may find it open circuit if there has been a large surge current through it.
Only by taking off the top cover will you be able to see if it has become a charred relic.



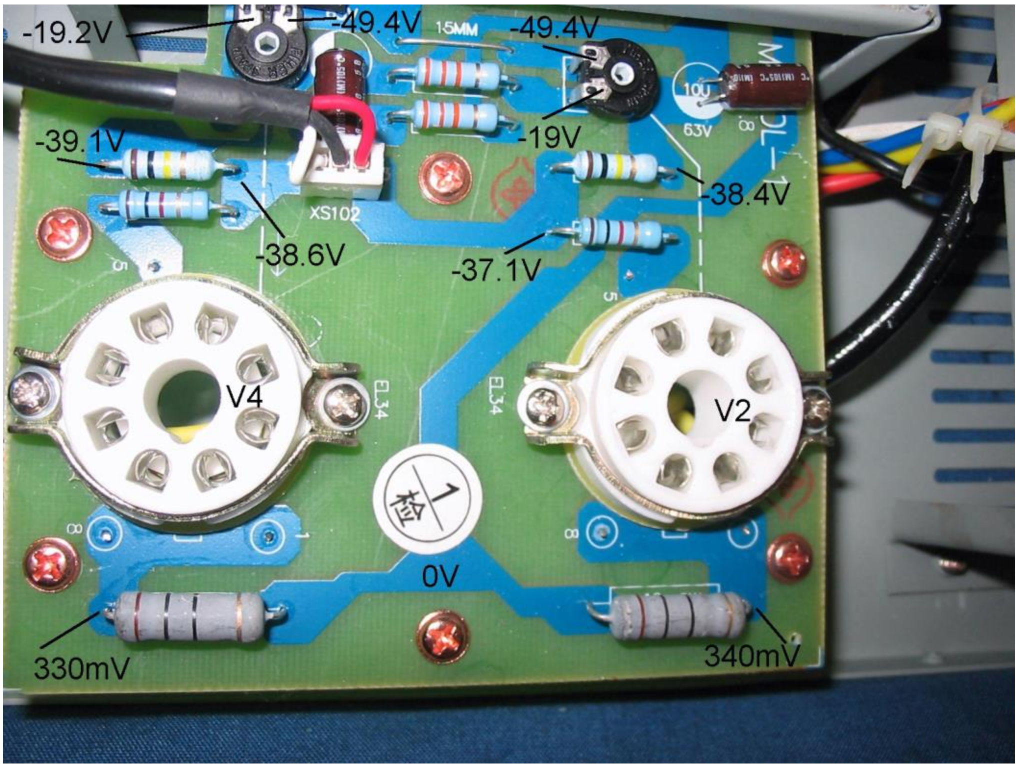
So let's assume all voltages are correct and you have, or have not, needed to replace the cathode resistor. It all points now to a defective valve that has caused the problem and these are best checked on a valve tester designed for the job. You could of course check for shorts inside the valve using a Multimeter but it is quite likely that the short circuit is intermittent and is not really a good test. For peace of mind, the Author would definitely recommend the replacing of both valves which hopefully will restore proper operation. But remember of course that for testing purposes you still have a good known pair in the working channel!

Listed are some typical voltages taken from a working MC-10L. Notice that there are no valves shown in the photographs as these were taken prior to fitting them, the voltages however are those obtained with valves fitted.

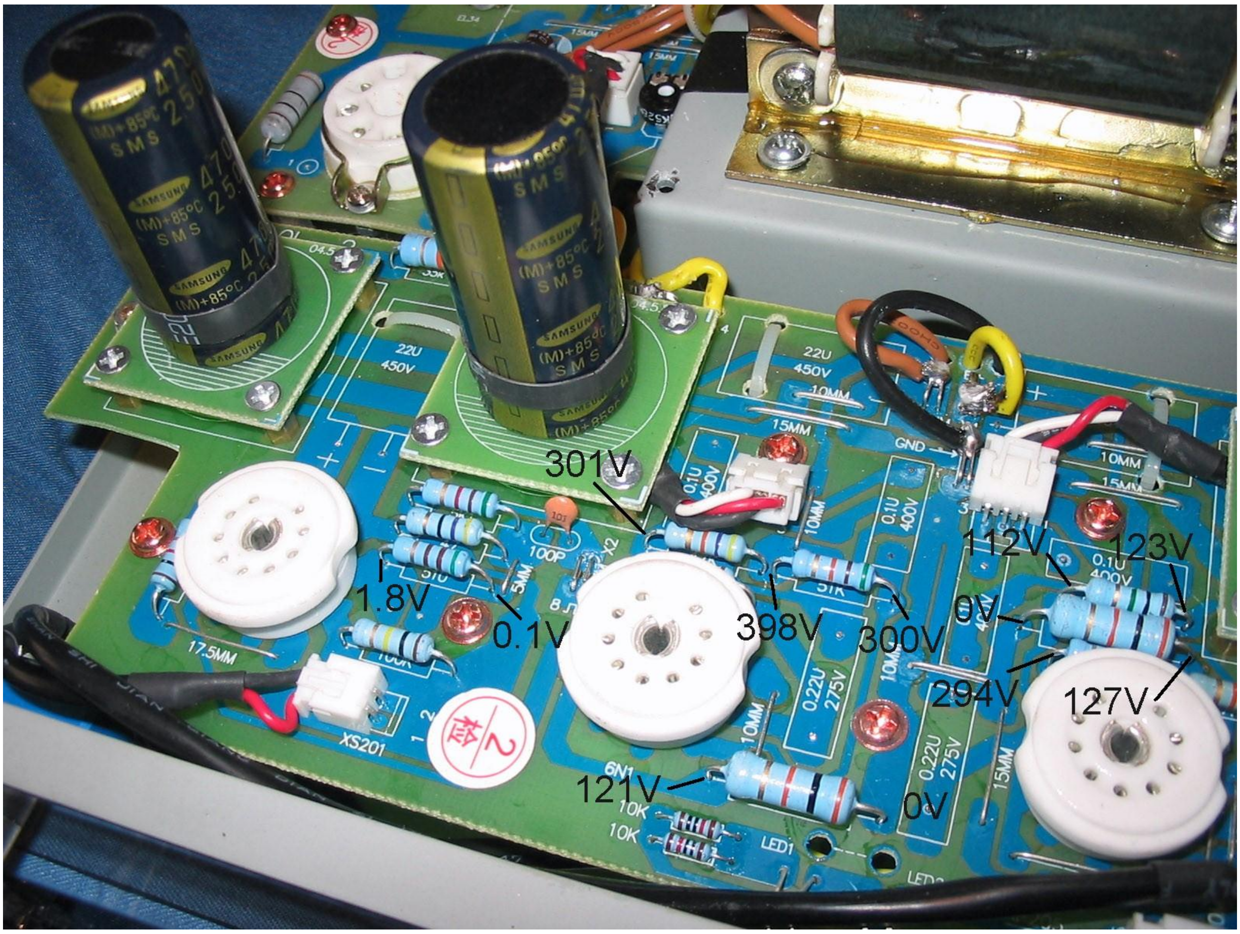
Left Channel Output Voltages



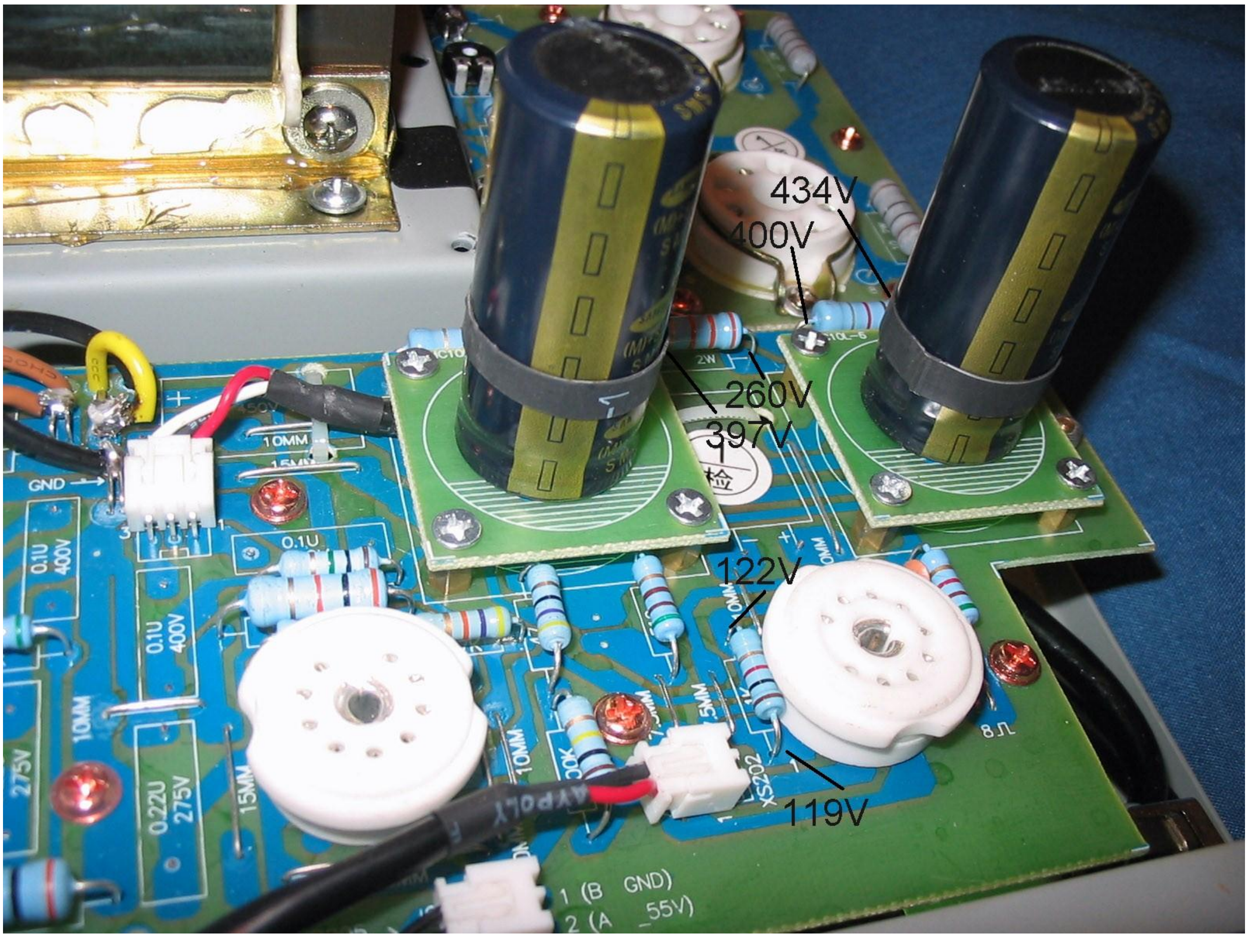
Right Channel Output Voltages



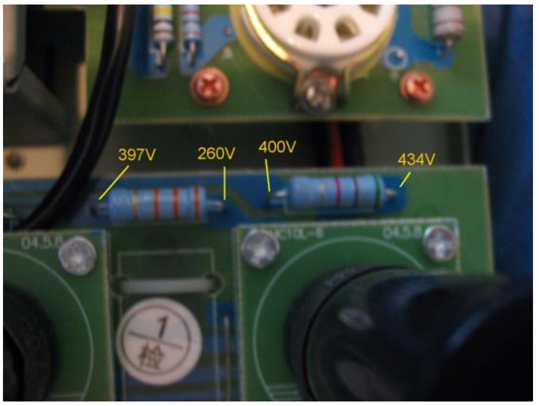
Pre-Amps and Phase Splitter Voltages



Pre-Amps and Phase Splitter Voltages



HT (B+) on the Right Hand Side.



OK, if you are faint hearted you may want to skip this part as it involves measuring high voltage. The important ones are fairly low voltage but you have to take care you do not accidentally touch some of the high voltage points. You MUST use good quality well insulated probes and please take care! Cross check your actions 3 times before you make them!

You don't really need to measure the 450V as all circuit paths have already been checked, so avoid the high voltage points unless you want to verify that you do actually have HT/B+.
The 450V HT/B+ has enough capacitive punch to easily kill,

We are going to power up the amplifier with all four output tubes pulled! This may sound risky but after all, it is the same scenario the amp sees before the valves light up.
However, we are partially loading the high voltage line with the pre-amplifier valves but none the less; you should try to **take measurements quickly**, just to ascertain you have the correct voltages. By all means power down in between measurements if you wish, this would enable you to make safe connections before power is applied.

REMEMBER – The high voltage capacitors will without doubt hold a lethal charge until the bleed resistors have taken this down. **WARNING: THESE BLEED RESISTORS ARE NOT FITTED TO EARLY AMPLIFIERS – FOR SAFETY'S SAKE – ASSUME THEY ARE NOT FITTED**. You can do a controlled discharge as described earlier by using an INSULATED link between pin 1 and pin 9 of the **pre-amp** valve V1.

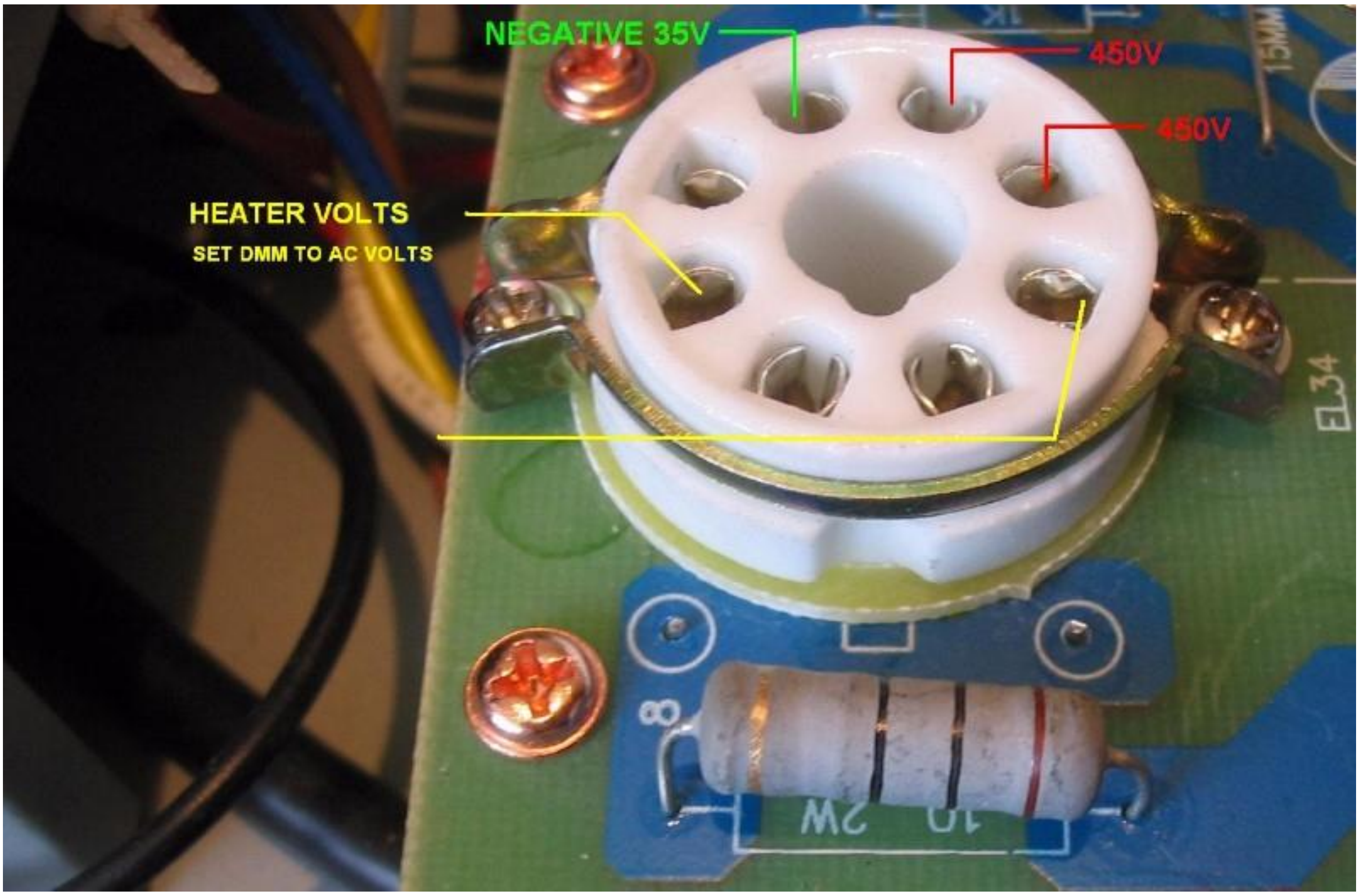
The following photo shows the cover removed – **you do not have to remove the cover** for these tests, it was just convenient for the Author to use an old stock photograph.

Don't forget to switch the Multimeter to AC Volts when measuring the Heater Voltage.

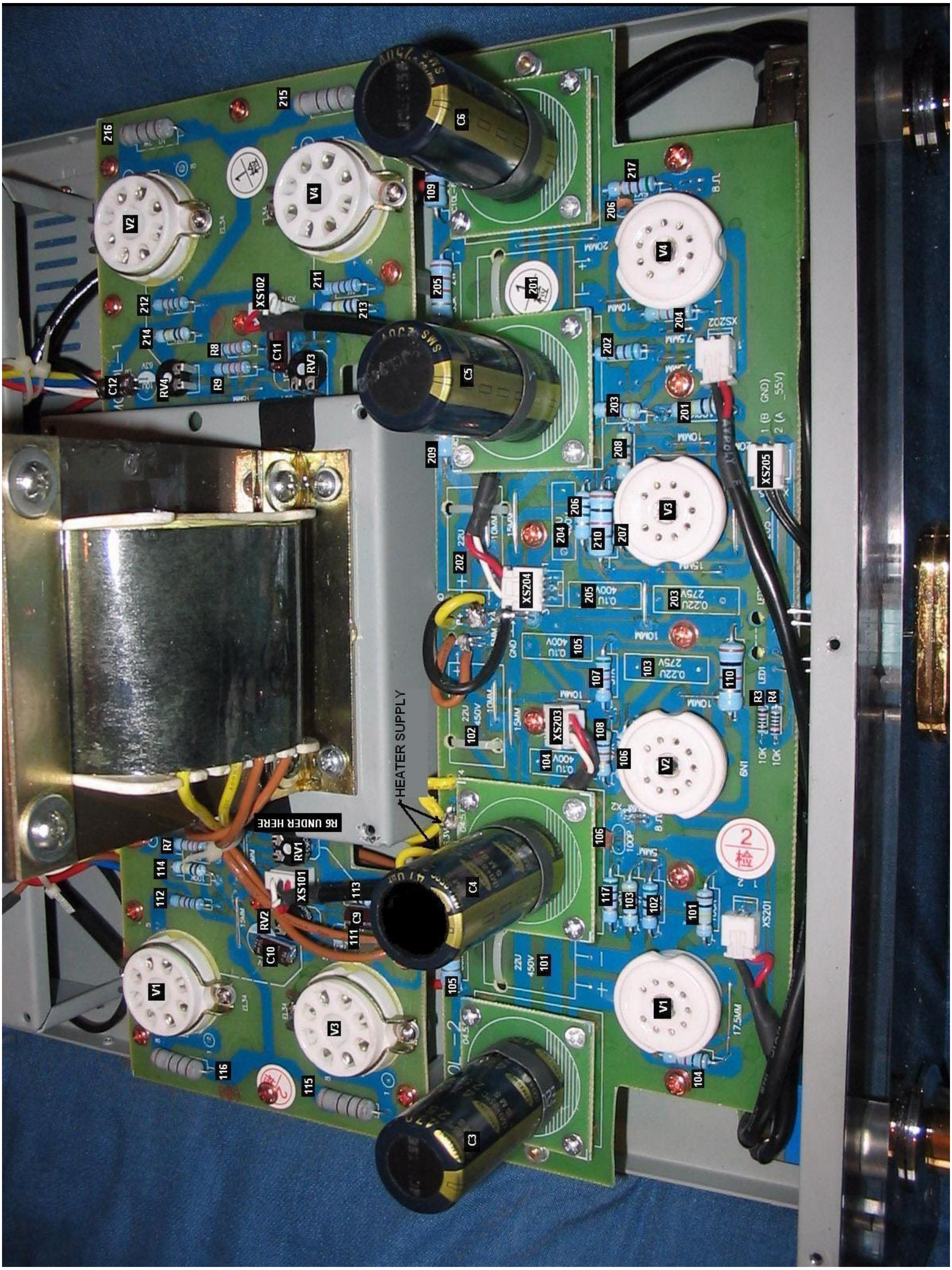
You must verify that the all important Negative 35V is present.

The Multimeter 0v (Ground) connection is unfortunately not shown; just simply use the same chassis ground points you used for the cathode resistor checks. Just make sure it is secure! Obviously you do not need this connection for measuring the heater voltage should you wish to do so.

Output Stage Voltages



Component Identification



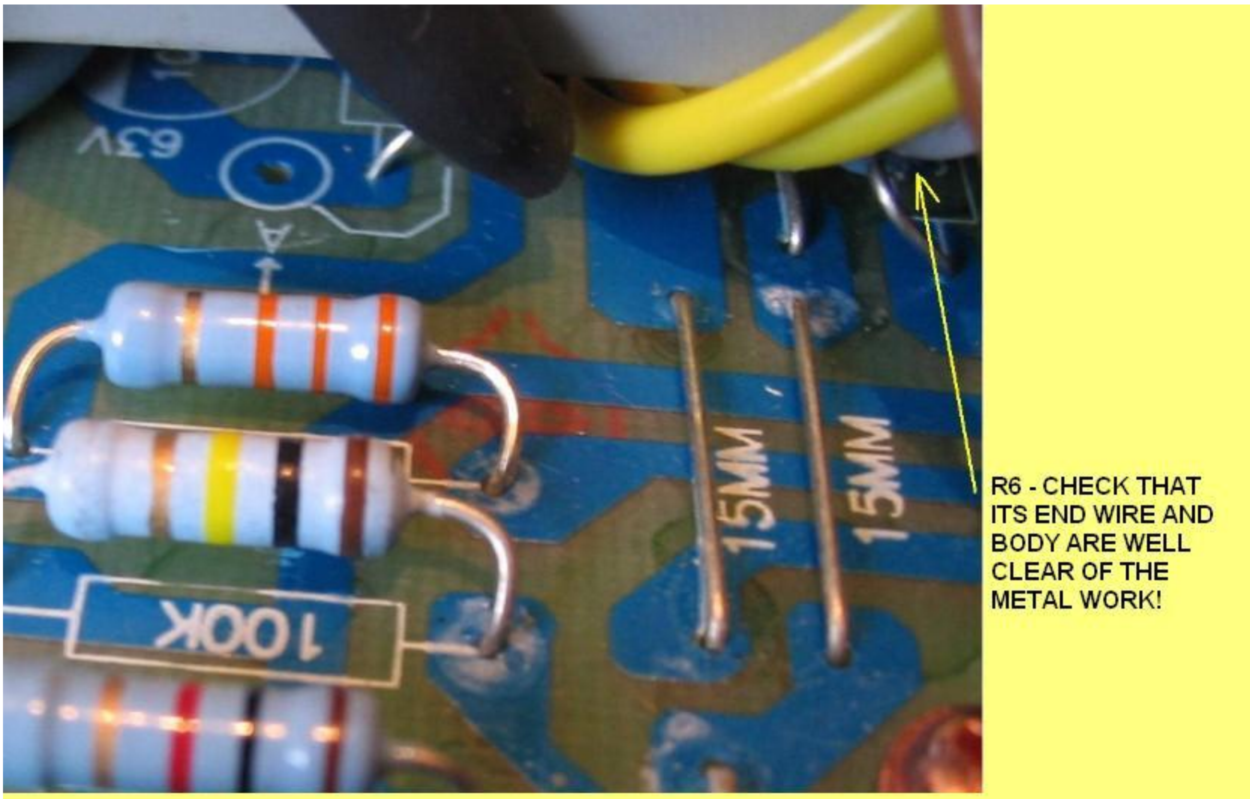
USE ZOOM 200% TO SEE MORE DETAIL

A New Build Quality Issue

From audiokarma.org member TonyMc.
I have been having an issue with my Yaqin since I bought it that I finally figured out last night. I noticed that the L channel would cut out once in a while. I thought it was a bad cable so I swapped it out and all was well until last night it did it again. So now being a bit more concerned I took the amp to the ol' work bench and opened it up. I looked at the RCA in-puts and all looked well. The R and L sockets are one unit on a black plastic block then soldered to a small circuit board and plugged into a couple of nice computer style cables, all very clean. The layout of the amp looks very nice so I could not figure out what the problem was. Then I saw what looked like a hair sitting in the chassis. Low and behold it was a piece of metal from the manufacturers putting the small machine screws in the aluminium side rails. I found a couple more and then a couple more so I grabbed a small light to shine under the RCA circuit board and what do you know... One of those little shards of aluminium was touching the little pin for the L RCA tuner jack that comes out of the bottom of the circuit board. So far all is well since removing all loose shards.

R6 (And it being a suspect for LH Channel failure).

Yes, R6 is part of the bias circuitry and that associated with V3, the lower EL34 on the left hand channel. This resistor is not mounted in the visible area of the circuit board but rather mounted beneath the power transformer. You can just see one end of it in the following photo.



If R6 (33k) was shorted to chassis the grid bias voltage could be dropped from say -35V to -23V. Looking at the EL34 graphs, the EL34 anode current could rise from 35mA to over 200mA and places the anode dissipation very much over the dissipation curve. It only takes a few moments to check and could save you a lot of bother later on.

Quickie fault finding tests.

It sometimes helps to be able to isolate stages when trying to locate a fault. In most cases of course, a fault in the power stages usually shows itself by lots of smoke and some components trying to glow like the valves ☺.

The following helped an owner locate a fault due to wire whiskers shorting out the left hand channel audio. Having no Left Channel output, he first tried plugging the right hand preamp/splitter output to the left hand channel by swapping over the feed cables associated with XS203 and XS204. The cable lengths allowed him to temporarily connect XS101 (Left hand output stage - IN) to XS204 (Right hand preamp/splitter output). Having now obtained audio on the Left Channel, proving that the Left output stage was OK, he then put all the former plugs and sockets back into their proper places. He then tried swapping XS205 (Right hand pre-amp input) into the board connector usually fed by XS201 (Left hand pre-amp input). He found that this rewarded him with audio and thus suggested the fault was indeed in the circuitry before XS201, whereupon he found shorting wire whiskers on the input selector switch. The same technique could be used if you suspect a fault in either of the channels preamp/splitter stages as well as the input circuitry.

Hopefully the above proves to be a useful tip for you.

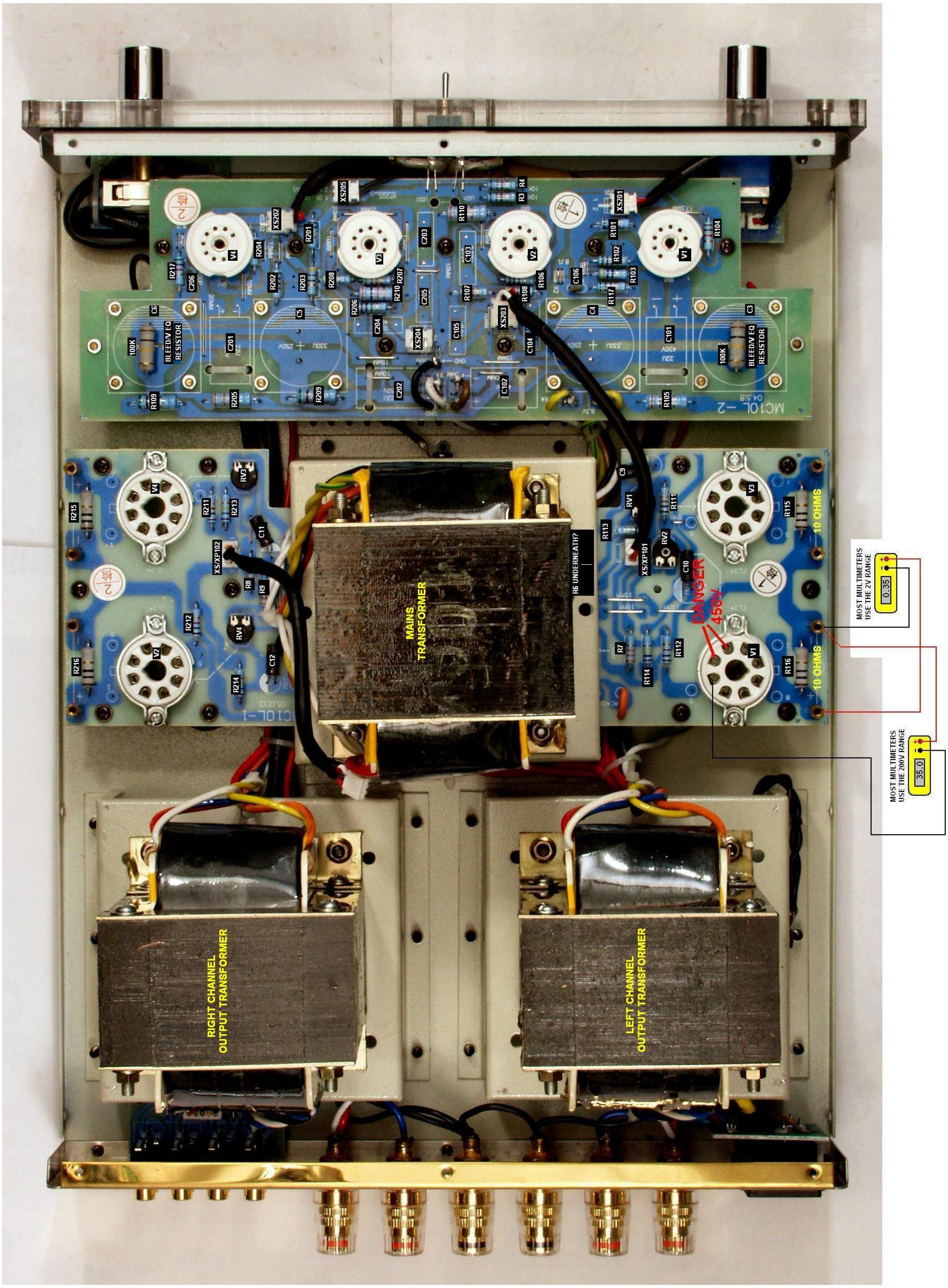
Later MC-10L Models.

As mentioned earlier, there now seems to be a Mark II and Mark III version in addition to the new arrival MC-10T.

The Mark II did away with the four high voltage smoothing capacitors showing above the top panel, these being hidden below out of sight. The 100k voltage equaliser/bleeder resistors were added at the same time and there was some slight adjustment in layout of components on the left and right hand output circuits. To avoid the necessity of having to remove the top panel to reset valve biases, access was made to the measuring points and at the same time extra access points for adjusting the preset bias controls.

The Mark III appeared to be identical except that the mains toggle switch was replaced with a push button type and some amplifiers came with aluminium front panels instead of the Black plastic ones.

Later circuit board layout with component identification.



Front View of the later MK.III model

Sporting push button supply switch and silver front panel.

The MC-10T

The following photo was taken from the Yaqin web site and advertised as the MC-10T.
It appears physically identical to the one shown above.

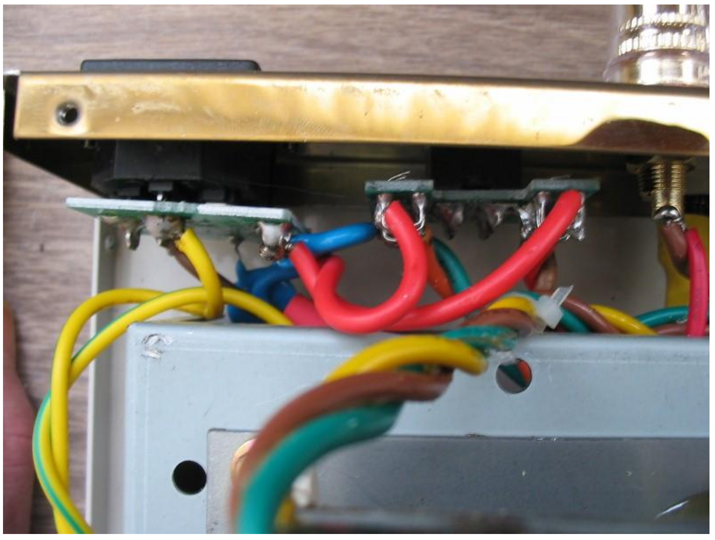
The MC-10T appears to be similar to a MC-10L Mark III except that the 6N1 valves have been replaced with 12AT7. What sonic improvements are to be gained from this change is uncertain, it would leave the input valves without an internal screen and the Author is not too certain about the difference between the Heater to Cathode maximum voltage ratings.

He had the chance to look into the MC-10T and took a few photographs, the one he had to review had a Black front panel like the original MC-10L. Basically it is also the same circuit as the MC-10L, even the output transformers are labelled 10L. The only component changes he could see were the LED feed resistors going from 10k to 6k8 even though the board is silk screened 10k. Perhaps Yaqin wanted a brighter Logo light but it has the advantage of Blue light leaking out to shine on the bases of the centre two 12AT7's, kind of cool!

The HT (B+) balance resistors across the smoothing capacitors are increased from 100k 2W to 150k 2W. If it wasn't for the heater wiring being different you could plug 12AT7's in place of the 6N1's on your MC-10L. As mentioned earlier, the 12AT7 does not have an internal screen like the 6N1, instead pin 9 is used to centre tap an otherwise 12V heater on pins 4 & 5. By connecting pins 4 & 5 together as one heater feed and using pin 9 as the other heater feed then you could do it. First of all you have to make sure that pin 9 is **fully isolated** by cutting the track if necessary and check with a Multimeter that the pin is definitely isolated from Ground**.**

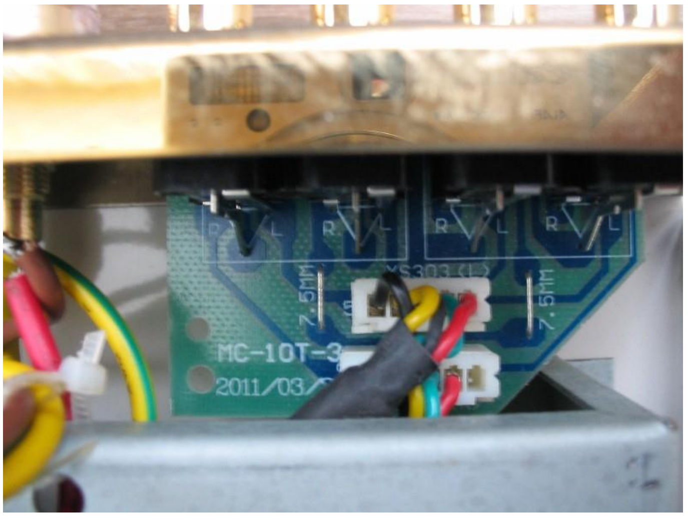
With pin 9 fully isolated from ground, you can now use it as one half of the heater wiring. You can take either of the Yellow wires presently on pins 4 and 5, you just need one of them to be taken to the now isolated pin 9. Having done this, you need to connect both pins 4 and 5 together so both are now served by the remaining Yellow wire.

The amp gives a clean 45W per channel before the peaks start to round off, both + and - peaks rounding nicely at the same time and the output started to fall as we approached 100kHz! There is now a voltage selector on the rear panel for US/Europe power and a significant amount of extra Earthing (Ground wiring) has been incorporated.



MAINS INPUT AND VOLTAGE SELECTION SWITCH

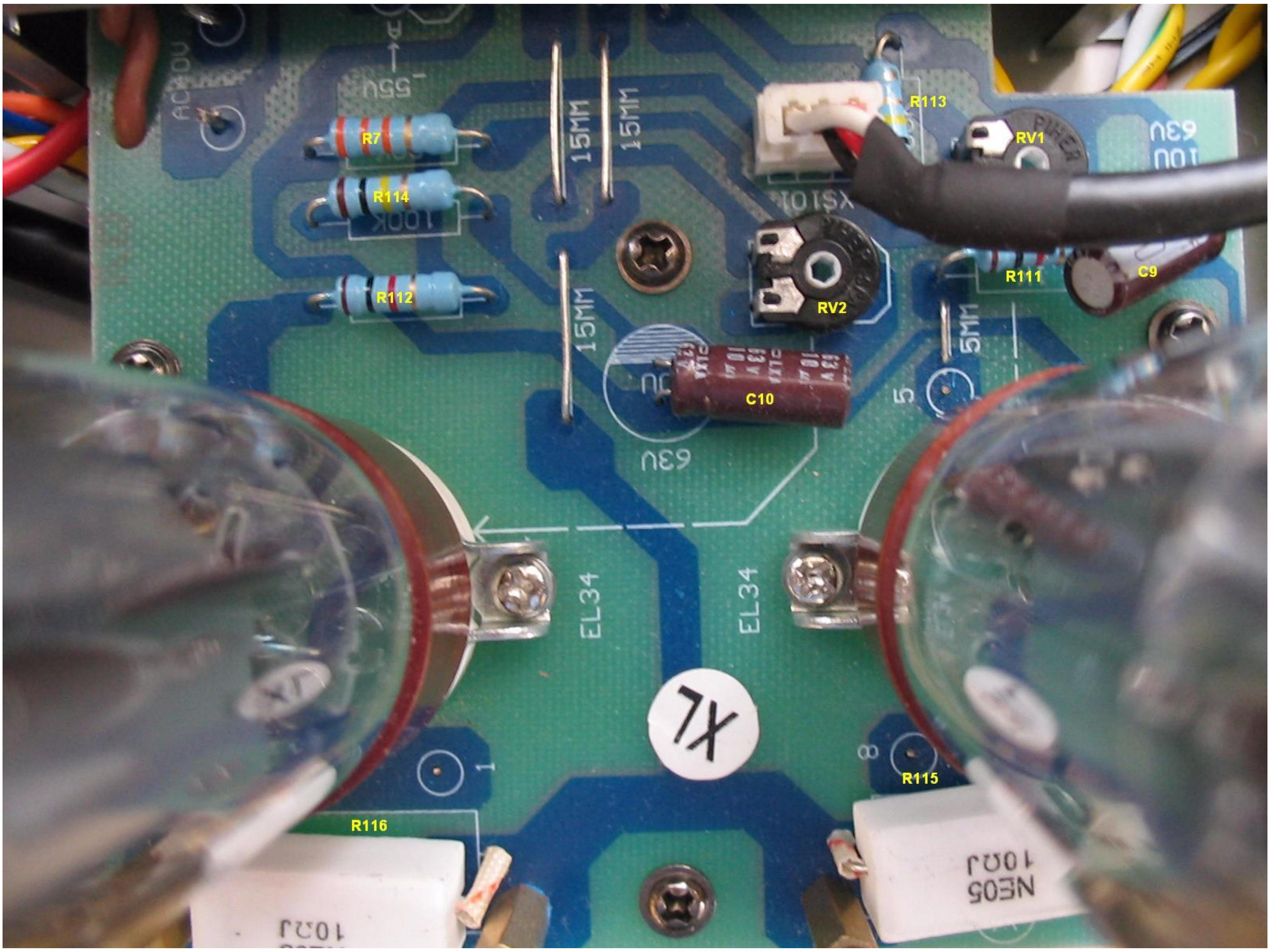
It was nice to see that metal structures carrying mains supply, like the mains transformer mount, has its own separate Ground connection. There are no screen grid resistors on the EL34's which the Author would have liked to see. Also the 4 channel inputs are still lumped together which may give the usual crosstalk problems.



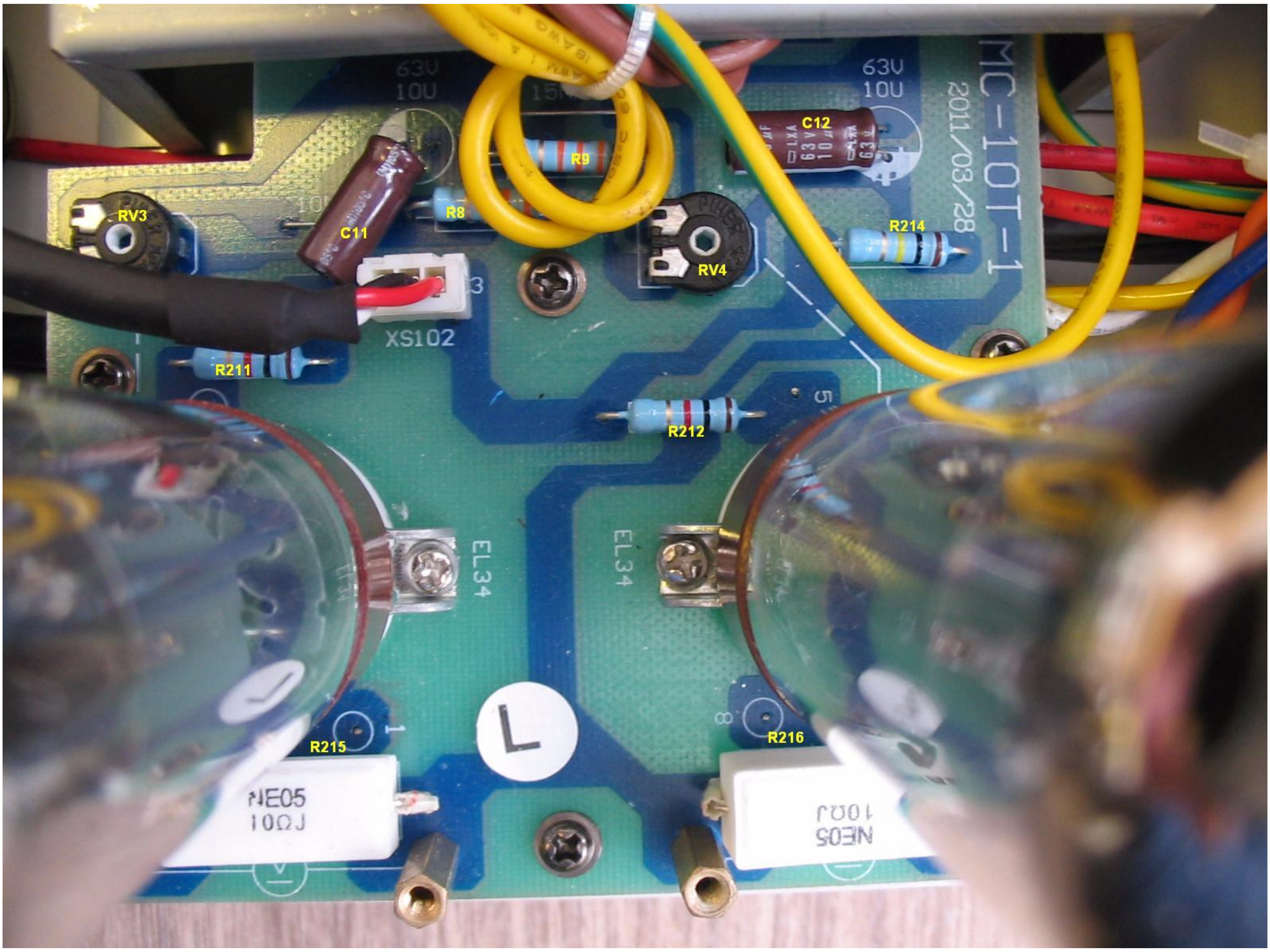
The only slight defect with this MC-10T is the ALPS? Pot. It is a 20k control but whilst the Left Channel measures 20.3k the Right Channel measures 21.5k. This is well within the specification for this potentiometer but the difference results in one channel being 2dB louder than the other! Wiring both channels from just one side of the control gives equal output so the problem appears to be with the control and not the amp. Normally these controls are much better matched but this control was different from the norm.

Because the circuitry of the MC10-T is virtually identical to the MC10-L, the same component identifiers can be used.

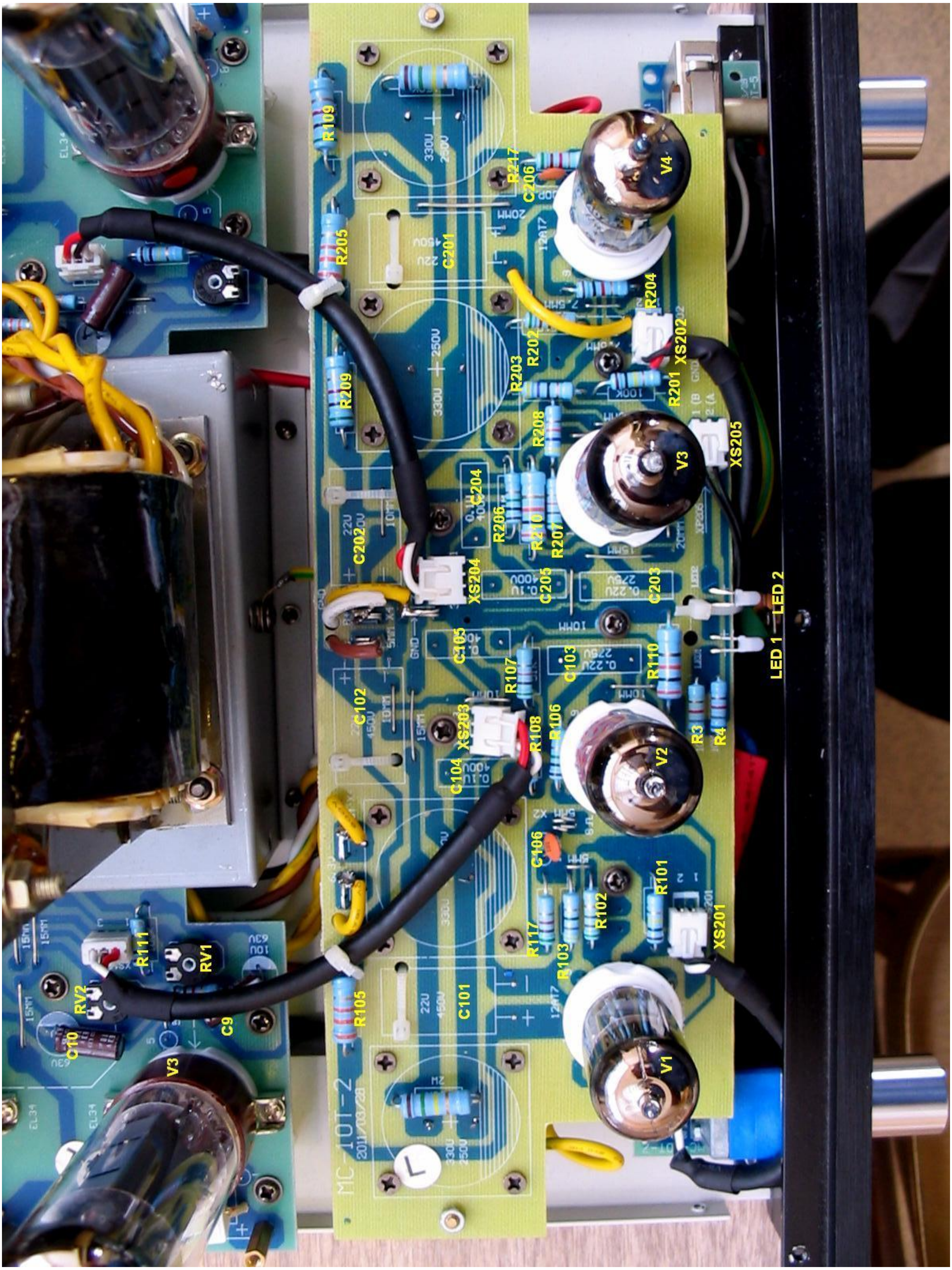
Left Channel Output



Right Channel Output



Front End


R109
R205
R209
C201
R217
C206
V4
R204
XS202
R202
R203
R201
R208
XS205
V3
C204
R206
R210
R207
C202
XS204
C205
C203
LED 2
LED 1
C105
R107
C103
R110
C102
XS203
R108
R106
R3
R4
V2
C104
C106
R101
R117
R102
R103
XS201
R111
RV1
RV2
C9
C10
R105
C101
V3
V1

Turn a MC-10L into a MC-10T?

So the next burning question? Can you modify a 10L into a 10T?
Well **Matthias Günther** had a try at this too!
Well you may think so too after removing the base plate for the heater lift mod?
After rewiring the heaters and fitting 12AT7's he remarked "The amp sounds very sweet with 12at7eh, new production, nothing special. Also very dynamic, 6n1 were cold, sterile and boring in comparison."

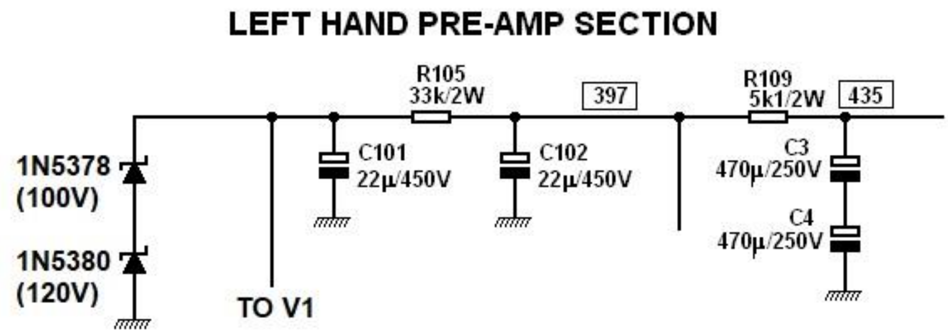
Basically, you have to lift the front circuit board and locate Pin 9 on each of the valve holders. This will be connected to the Earth Tracking and has to be well isolated. Next look to the valve holder Pins 4 and 5, these will be carrying thick heater wiring. At each of the four bases, you have to remove the wire from either pin 4 or 5 and relocate it onto the now vacant and isolated pin 9. Next you need to apply a shorting link so that the remaining wire connects to both pins 4 and 5. When you have done this you can insert the 12AT7 valves and you will have a MC10-T!

Turn a MC-10L into a MC-13S?

This involves a bit more work but not too much, you have to do the heater wiring changes as outlined in the 10-T conversion above.
It would then seem that to comply with the MS-13S schematic, you need two 50k 2W resistors, four 2k 0.5W resistors, two 470uF 25V Electrolytic capacitors and two 330pF Mica capacitors.
The 50k resistors replace the two 30k phase splitter tail resistors R110/R210, the 2k resistors replace the 1k Resistors R104 and R204 and the two 510 Ohm resistors R102 and R202. Then remove the ceramic 100pF capacitors C106 and C206 and replace with the 330pF and finally fit the 470uF capacitors.
BUT WAIT! The author tried this sometime after writing this article and found that it was not quite that easy. Trouble was encountered with the phase splitter only working properly on one side and that the side with the 47k gave terrible drive. The grid voltage was measured as 202V which is way too high. The first stage was suspected as drawing too low a current and a redesign was attempted at making the input valves draw at least 2mA as this positioned the signal on a nice part of their characteristic curve. R104/R204 were kept at 1k and the cathode resistors R102/R202 were made 1k2. This turned out to be the same values fitted to the MC-100B but why did Yaqin quote 2k resistors in the original schematic?
The 470uF capacitors are mounted at the circuit board mounting holes (unmarked) close to R101/R102 and R202/R203. Mounted below the board, the sketches on the following page should help, just remember to mount the 470uF capacitors **the correct way round**, with the positive terminal going to Pin 8 of V1 on the Left channel and the positive terminal of the other going to Pin 3 of V4 on the Right Channel.
However, all was still not well with the 13S conversion the author tried, the HT (B+) was far too high being 468V instead of the expected 435V. Even with the 100B components added as above, the phase splitter tail voltages were at 200V which is far too high! The supply to the first stage was 377V instead of the expected 260V that is over 110V extra! The next thing to try in order to bring these excessive voltages down was to add two series connected Zener diodes across the 22uF capacitors C101/C201. The ones found best were

a 1N5380 120V 5W Zener in series with a 1N5378 100V 5W Zener. This did the trick with very nice sine waves now available at both outputs. The question one has to ask:-
Does this fault appear on other 10L's or even 10T's and 13S's?

The amp may even sound correct or does it?
What you may have to do is measure yourself the voltage on the splitter tails, i.e. the voltage across the now 50k tail resistor. If it is anything like 200V then you may have a similar problem.



MOD REQUIRED TO OVERCOME EXCESSIVE HT VOLTAGE

You can see the very strange behaviour of the phase splitter in this Video, made on the fly so don't expect a professional one. Yep the Author mentions 123V Zeners when really he should have said 223V!
There is a reluctance/lag in the action of the left hand (47k) side of the phase splitters, one feeding V1 on the Left channel and the other feeding V2 on the Right channel. It was more severe on the Right Channel than the Left and this fooled the Author at first into thinking the problem was only on that channel, it was the difference in HT voltage that caused that! The remaining output valves V3 (Left) and V4 (Right) seemed fine and very responsive but looking closely at them indeed showed a lesser reluctance in their operation.

http://www.g4cnh.com/public/all_videos_together.mp4

This strange phenomenon was only seen thanks to the use of a four valve monitor box like the one below.
The Author has seen this same problem on another 10T and used the same Zener technique to cure it. Again this problem showed servicing a 13S (Page 54) and cured the same way.

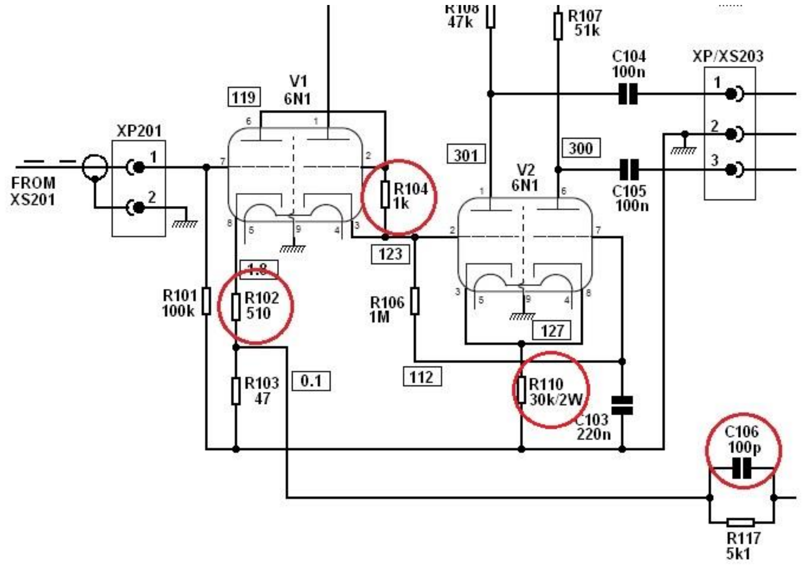
For info on the 4 valve bias box see:-
http://www.g4cnh.com/public/4_Tube_Bias_Box.pdf

Do Yaqin have a similar four valve monitor box like the one shown?

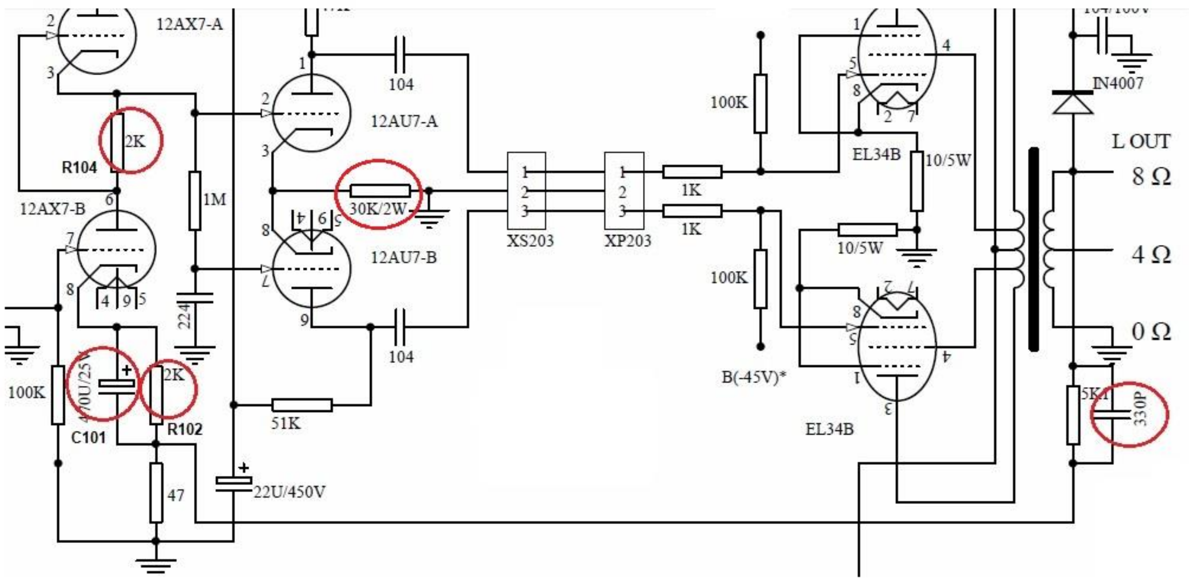
Maybe they don't?

Maybe they are unaware of this strange phenomenon in this driver stage?

The Circuit changes - MC-10L into a MC-13S.



NOTICE ON THIS EARLY 10L BOARD THAT THERE ARE TWO SETS OF HOLES (RINGED) CLOSE TO R102 AND R202.
THESE WILL ACCEPT THE EXTRA CAPACITORS REQUIRED FOR THE LATER MC13.



YAQIN MUST HAVE PLANNED FOR THIS WHEN THEY BUILT THE MC10L.

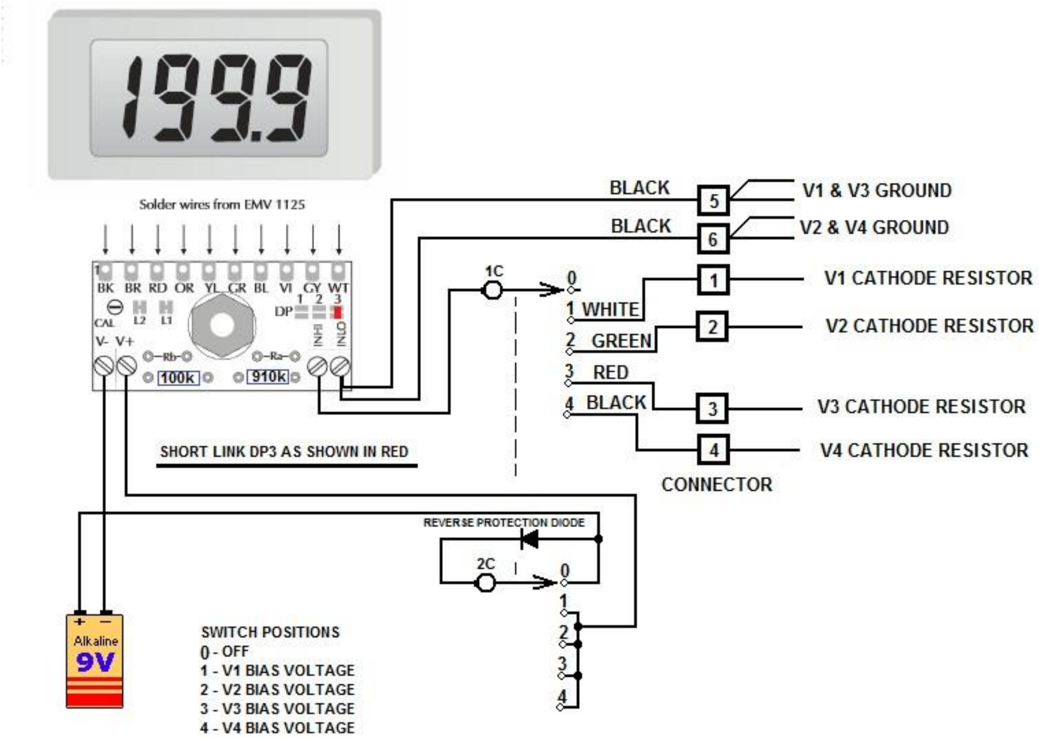
After doing this work, each channel will look like this schematic wise. All you have to do now is fit a 12AX7 at V1, 12AX7 at V4, 12AU7 at V2 and a 12AU7 at V3.

IMPORTANT One particular MC13S was kitted out with 12AT7's at every preamp stage.
Was this to cure the phase splitter problem? Anyway w.r.t. Page 47, R105/R205 is increased to 39k and R104/R204 is decreased to 1k, the phase splitter tails increased to 56k. The Author sometimes wonders if there are two amps in existence with the same actual build standard. ☺

Early 10L? How to avoid removing the top each time.

Here is the Authors story.

"This is such a chore for anyone with an early 10L as there are no adjustments or monitor access points on the top panel. I decided to use a remote monitor box that can be simply plugged into the 10L and allow me to see the bias voltages across each of the four output valves V1 to V4. I used the single hole mounting Lascar EMV 1125 which is easy to use and you don't have to hack a large rectangular hole in the box you are going to use. The EMV 1125 comes with a selection of attenuator resistors and you just need to solder in a 100k and 910k as shown in the sketch below. Also place a small blob of solder onto link 3 (shown in Red) as this places the display decimal point in the correct place. **Of course you could just use the switch and just have sockets for your general purpose Multimeter."**



"I used a box which had a compartment for stowing a PP3/6LF22/MN1604 battery. The switch is a standard 3 pole 4 way rotary switch; I used a switch with a 0.25" spindle so that I could fit a transparent skirted knob with numbers printed on it. A black circular paper stator was made with a white square to highlight the switch position chosen so that position 1 was V1, position 2 was V2 etc."

Parts used for bias voltage monitor box and interface socket

RS 261-5941 6 way 5A Series 723 cable mount Plug, BINDER 09-0121-25-06.
RS 261-6203 6 way 5A Series 723 chassis mount Socket, BINDER 09-0124-00-06
RS 773-3192 Case 140x66x28
RS 320-685 rotary switch 2P 6 way, Lorlin CK1030
RS 468-0644 knob skirt, figure dial 0-11
RS 463-8536 Cap for Knob
RS 463-8479 Knob, lined
FARNELL 3030740 M16 Cable Gland
RS 351-7567 Lascar EMV1125 single hole mount, +/- 200mV f.s.d.
RS 111-9234 Alpha Wire 6010C SL005, 3 pairs 22AWG Red/Black, White/Black, Green/Black.

"I used a short length of the 6 core cable to link the box to the 10L via a special 6 way connector. This was probably the most expensive part of the project but considered most necessary as:-
1) The socket is mounted from behind the top cover of the 10L. This allows the cover to be removed if ever it is required for servicing, simply by removing the single fixing nut.
2) The socket fits the large hole already made in the top but hidden by a plastic nameplate; owners of these early mc10L's will understand why that is there!
The badge detaches easily with light pressure from behind and the glue used is easily removed with some Isopropyl Alcohol. If there is no badge or hole on your MC10L then you could choose an easier option of mounting a smaller connector on the side of the cover. You will then not have to lower the main circuit board for clearance; just ensure it is clear of the bolt on side panels."

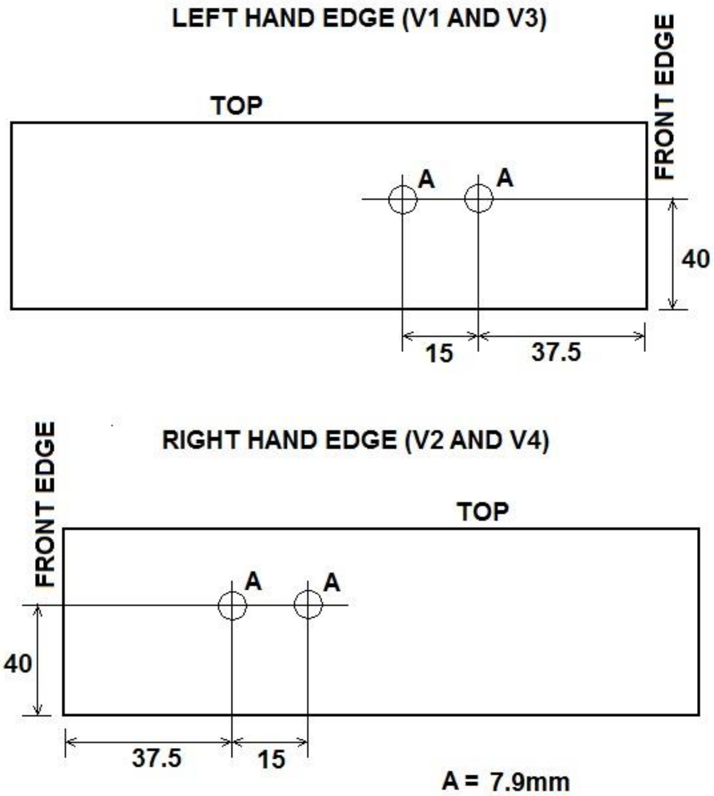
"It is most important that the rear contacts of this socket do not touch any high voltage points on the front board. As this is where all of the B+ (HT) smoothing takes place, there is a lot of voltage here! I decided to drop the pre-amp board down by 5mm, achieved by replacing all of the 40mm stand-off pillars with 35mm ones, this includes the 40mm Brass pillars at the board ends. The 35mm nylon were tricky to find so I used a studded (f-m) 15mm spacer in series with a 20mm straight (f-f) spacer. The brass 35mm replacements as well as the 15mm and 25mm Nylon types were all found on eBay.
The addition of suitable heat shrink tubing on the rear of the socket completes the task of isolation.

Now what about those bias adjustments?
I decided to fit four multi-turn trimmers to the top plate, two on the left side for V1 and V3 with the other two on the right for V2 and V4. I used a companion holder for these trimmers which enabled them to be bolted from the inside too so removal of top plate, if ever required, would not be a problem."

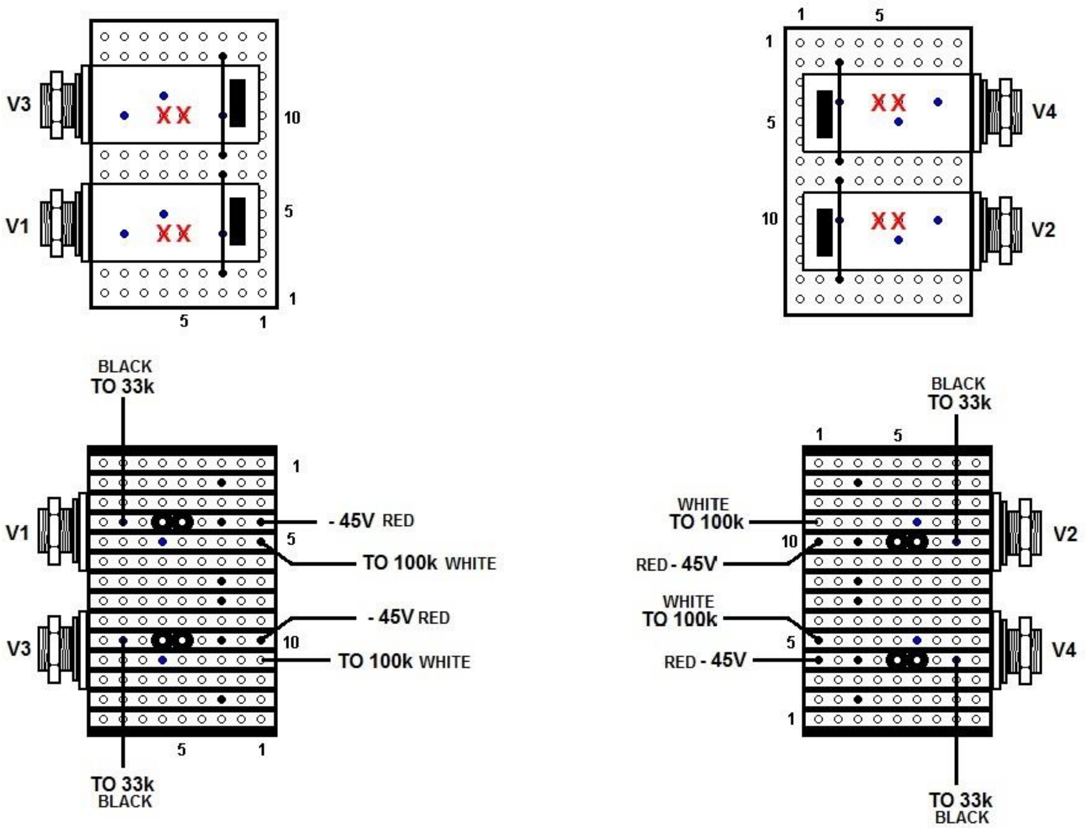
Parts used for bias setting trimmers

Trimmers (4 off) RS 521-9142, 50k Bourns 3006P-1-503LF
Holders (4 off) RS 107-6878, Bourns H83P
Small piece of strip board, 14 Tracks, 9 Holes per Track

The top plate needs to be drilled from the front edge on both sides to accommodate the trimmers and their boards.



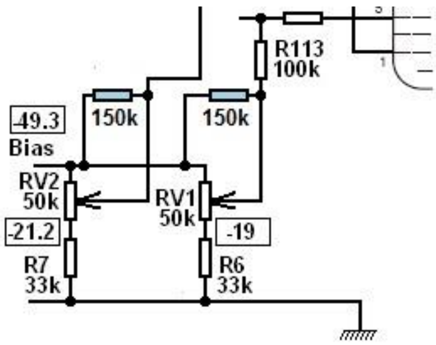
Two small circuit boards have the presets mounted onto them with the special holders. A wire loop across the rear end keeps them in place on the boards.



These are mounted into the top plate inverted such that for example, V1 is rear most to match the actual positions of valves V1 and V3. Likewise the other side control positions correspond with V2 and V4.

The labels for the controls could be something like this.

A modification has been made to the bias circuitry such that if the trimmers ever become open circuit then maximum bias voltage will be applied by the 150k resistors to prevent the output valves drawing excessive current. Some would say it is a worthwhile change even with the stock arrangement.



View of amp with the adjustment monitor box connected.

Adjustment Procedure:

Connect remote monitor box to the amplifier, observe keyway position of the plug prior to inserting into the top chassis socket.
Set the monitor box switch to position 1 (V1) and check the display is present and no low battery warning is indicated. This will happen if the battery has lost some of its voltage, normally due to being unused for a very long time and reaching its shelf life. No display would be the result of a flat battery due perhaps by the monitor box switch not being set to 0 before stowage. Note that the actual current taken by the meter is extremely small, actually in micro amps, so a good alkaline battery will last a long time if used correctly. Battery type is the 9V PP3 or equivalent, the alkaline type is recommended.

With the amplifier volume control set to minimum, switch on the amplifier and as it warms up, switch from positions 1 to 4 on the monitor box and check that all four valves are warming up with reasonable voltages being shown, none of them should show much above 0.4V!

Initially set each valve to give 0.35 on the monitor box as follows:-
With monitor box switch at position 1, adjust left hand side trimmer V1 for 0.35V
With monitor box switch at position 3, adjust left hand side trimmer V3 for 0.35V
With monitor box switch at position 2, adjust right hand side trimmer V2 for 0.35V

With monitor box switch at position 4, adjust right hand side trimmer V4 for 0.35V

Repeat as necessary until all monitor box positions read approximately the same 0.35V but don't try to get them all exact, just as close as you can get them is sufficient. You will find there is slight interaction between the controls due to the HT (B+) voltage varying from the four valves imposing a variable load as you adjust each one.

Recheck the readings when the amplifier has been on for a minimum of 20 minutes.

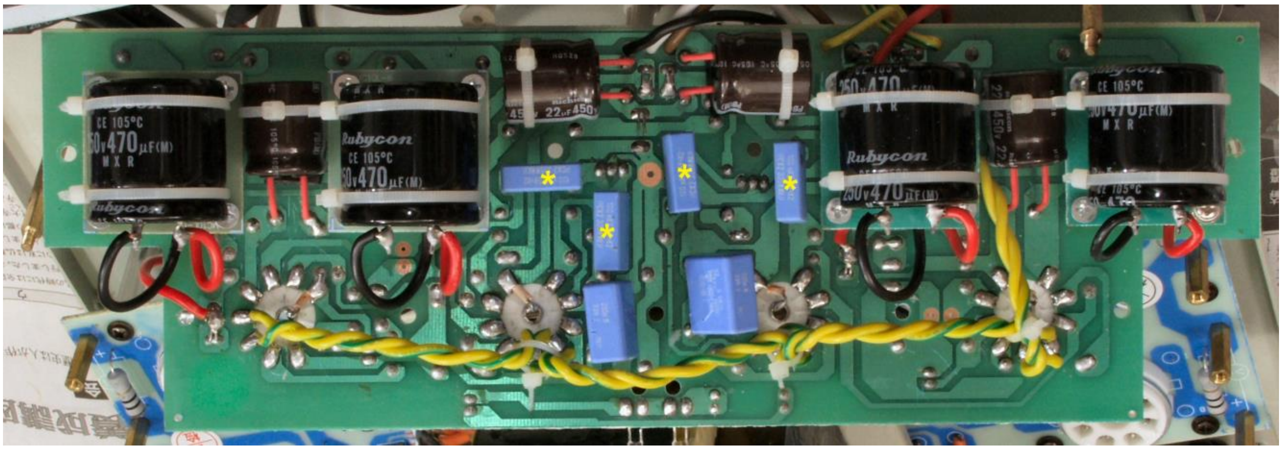
Unplug the remote monitor box; this has a retracting sleeve that disengages the plug from the socket.

Don't forget to set the monitor box switch to 0 which removes the internal battery from the meter circuit.

For those who do not appreciate the initial problem, the following page shows an early MC-10L that has no monitor or adjustment points. The incorporation of the monitor socket and trimmers make setting up bias a real pleasure, a pity that Yaqin did not fit similar circuitry on this and later amplifiers.

Coupling capacitor change.

Many swear to achieving a vastly superior sound by changing these, it seems the bigger the capacitor the better the sound. C104, C105 and their Right channel counterparts are the ones that require to be attended to, all 100nF high voltage types. Yaqin use their favourite blue blocks here and most folks replace them with the Green Russian 470nF paper in oil types (PIO). You should strive to buy the 630V types though the 500V will be acceptable but no lower! The target capacitors are marked with a Yellow asterisk, the other two larger Blue capacitors (220nF) need not be changed as they do not contribute to the sound improvement.



CAUTION!: If you use the Russian Green capacitors, be sure to cover them with insulating tape or heat shrink tubing. This is necessary because the coating on them is simply Green paint and it is very easy for them to short circuit areas of the circuit board.
If this is a high voltage point then obvious damage will result.

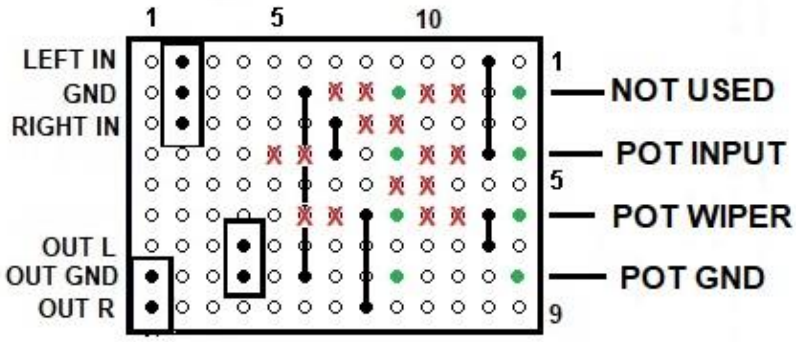
Volume control replacement.

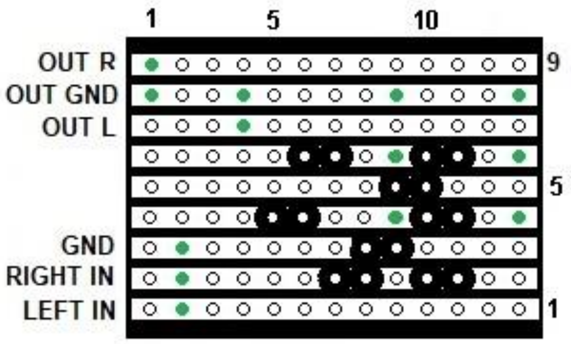
Some folks also report better sound if the original 20k volume control is replaced by an ALPS 50k model, just be sure to get one with the correct length splined shaft. Fitting usually involves cutting off all plugs that terminate with the existing circuit board attached to the old control. The Author had a 10L for repair where the owner requested a volume control change and he fabricated a small circuit board, made from prototyping strip-board, which allowed the original plugs to be retained. After the new control has been mounted to the board, one simply relocates the original connectors onto the strip-board. Note that the board will accept either the six tag or the 8 tag model of volume control.

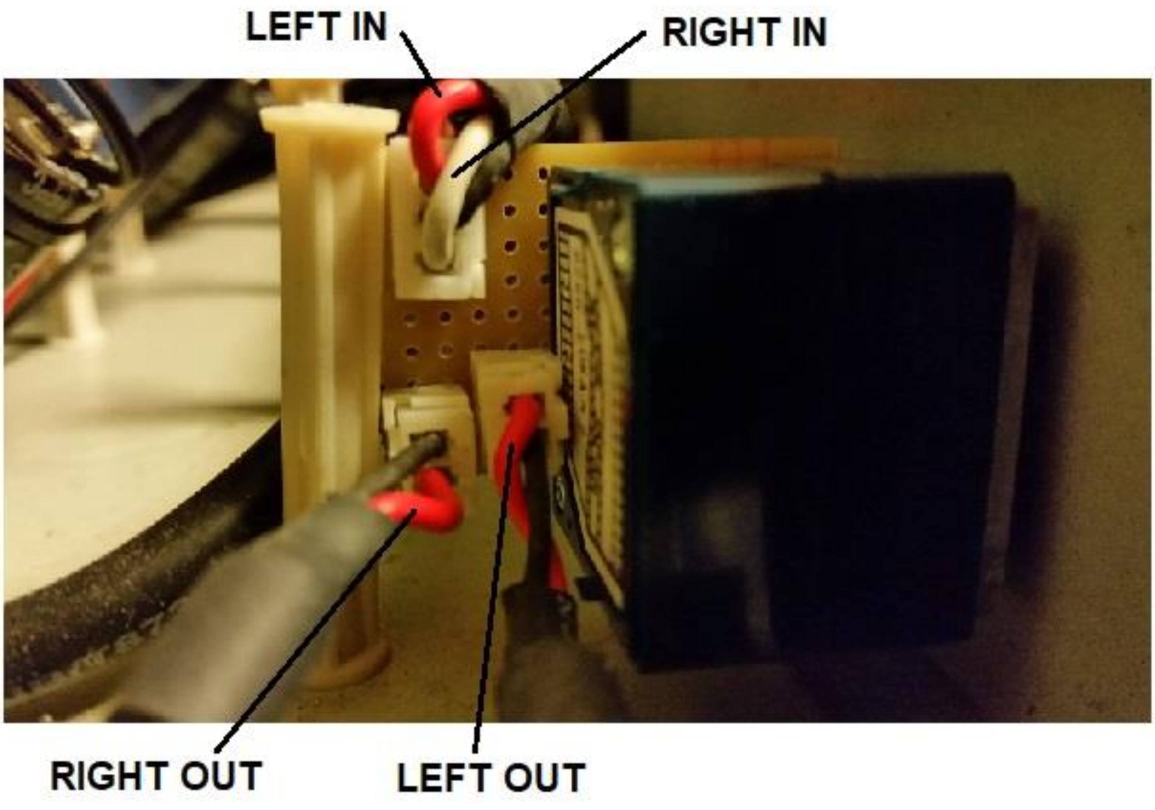
The drawings of the board on the next page should be self-explanatory, the top view shows the plugs and 22 SWG links with the Red crosses showing an x-ray view of where the track cuts are.
The Green dots show where the volume control tags are inserted.

The strip side shows where the track cuts are and the Green dots show where the Plugs and volume control tags are soldered.

NOTE: The shortest cable form with a 2-pin socket is for the Left Channel.

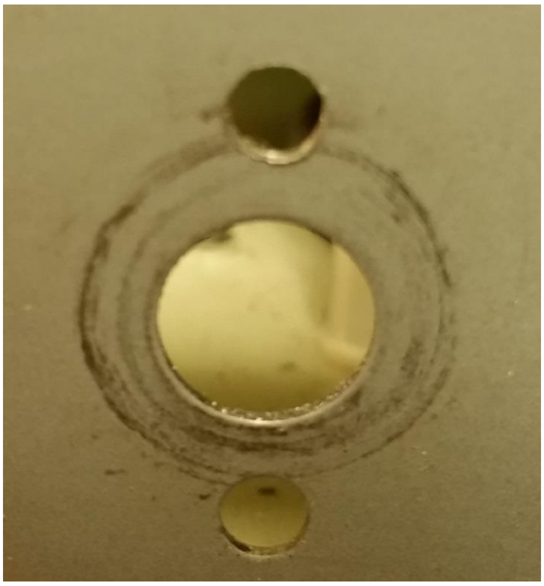




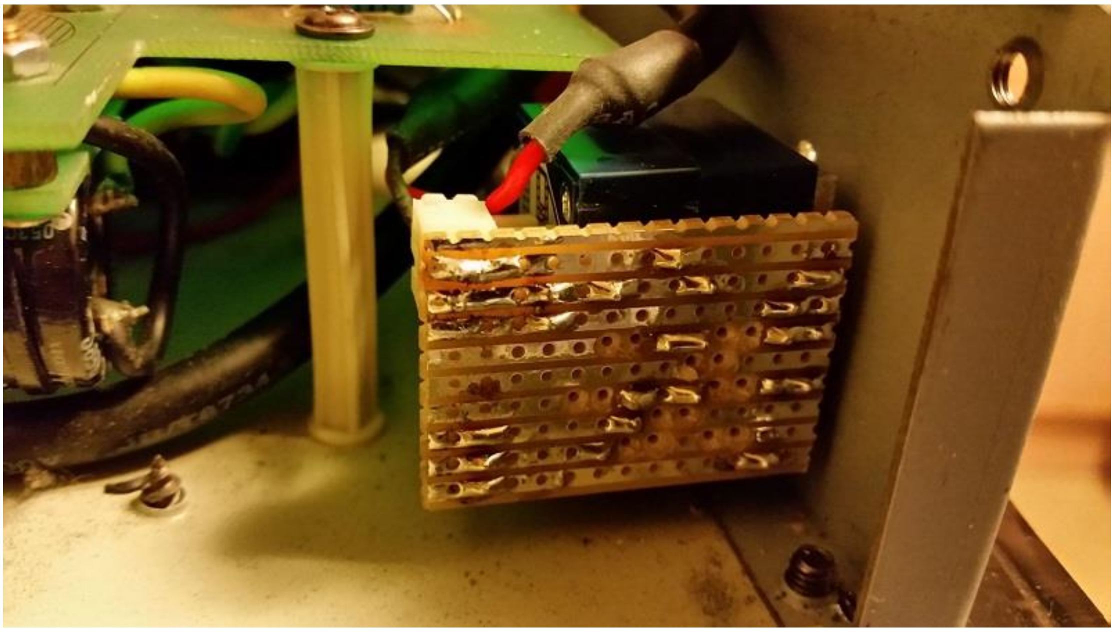


When refitting the assembly it was found that the cable feeding Right output to V4 was very tight.
The answer is to remove the front panel (four Allen bolts) using a 3mm key.
A 4mm keyway hole is drilled on the opposite side to the present one so that the whole assembly can be mounted 180 degrees from the original position.
This removes the need for the cable to lose length by having to go around the board.

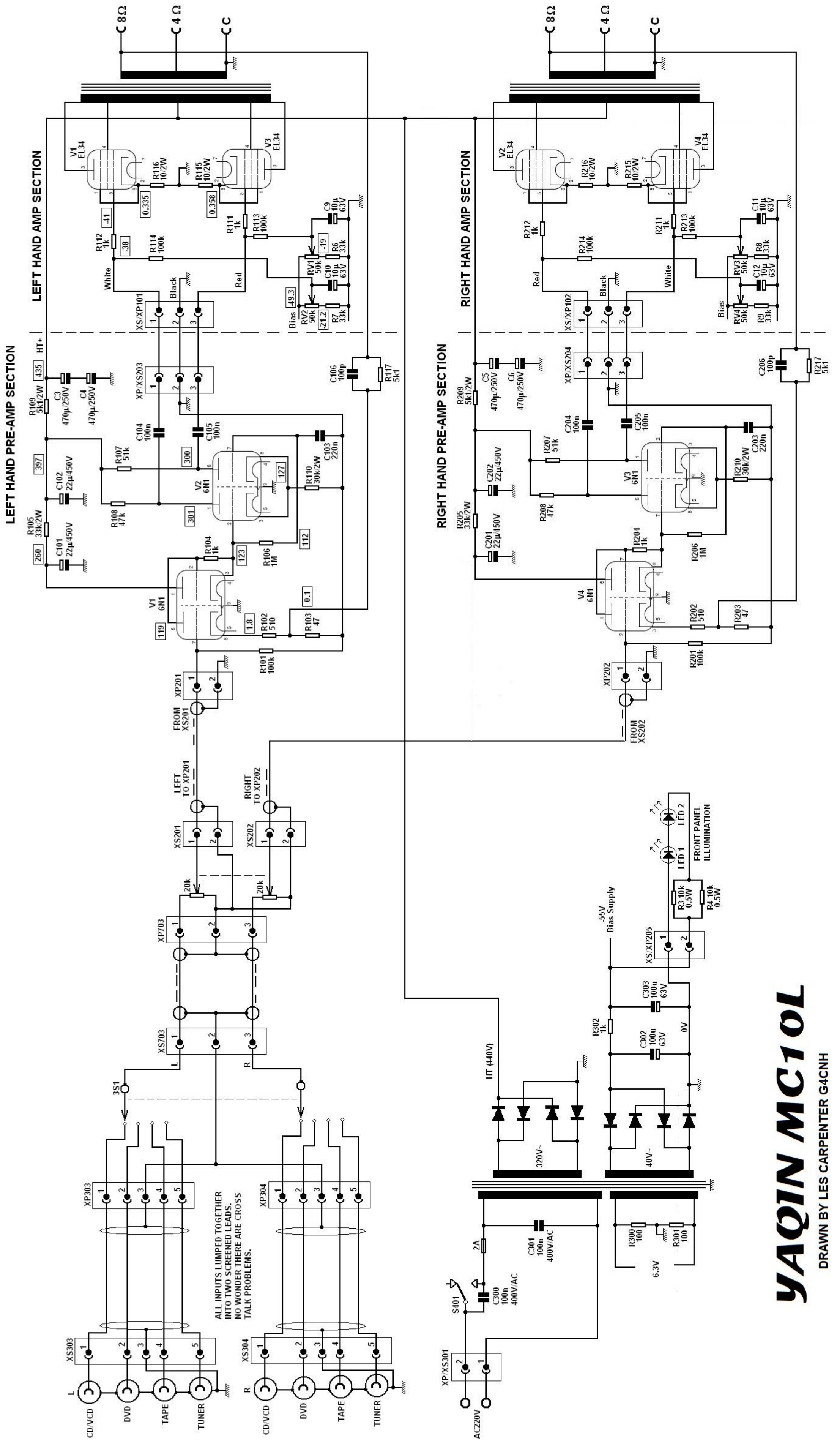
Keyway hole is drilled on the opposite side



The final board position will look like this:-



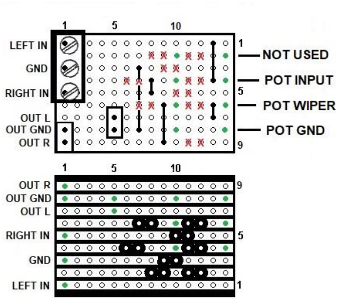
For reference – Full MC10L circuit re-draw

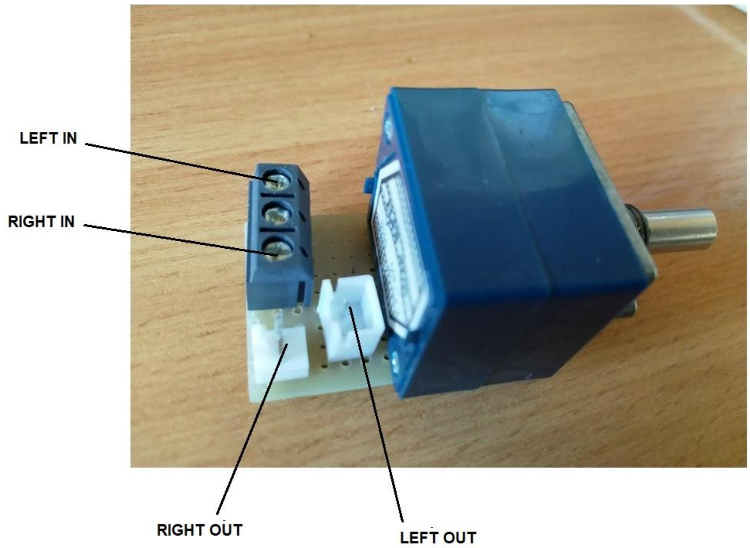


MC13S in for repairs/investigation.

This came in for repair because the fuse for the Right channel kept blowing and due to its intermittency, the owner could not narrow the fault down. All the valves were tested but the valve tester hinted at slight leakage on output valve V3.

The new volume control wiring was hard wired OK but it was decided to make it a little neater, easy if you have a supply of miniature 2 pin plugs, inserts and most importantly a crimper. A 3-way terminal block was used as input because the original plug and socket were not present. That was OK with boot lace ferrules crimped to the cable ends.





0.25” was cut off of the spindle to get a better fit of the control knob but it did not improve much.
The knob is meant to go on a splined shaft and not a plain one.
The spares box had a couple of 28mm Satin finish aluminium knobs that looked good on the front panel.
The owner of course can always refit the plastic ones if he so wishes.

The rear 500mA fuse for the Right Channel was found blown. After replacing the amp was slowly brought up on a Variac and all seemed OK. The output valves settled down at just over 30mA but I noticed the valve currents acting strange when the input signal was quickly applied or shut down. The Author had this before on a MS10-T and had to fit high voltage Zener diodes on the front end to get it all to work as it should. The cathodes of the phase splitters are around 190V and should be around 120V.
This is discussed earlier in this document on Pages 35 - 36 and there is a video link, repeated here for convenience.

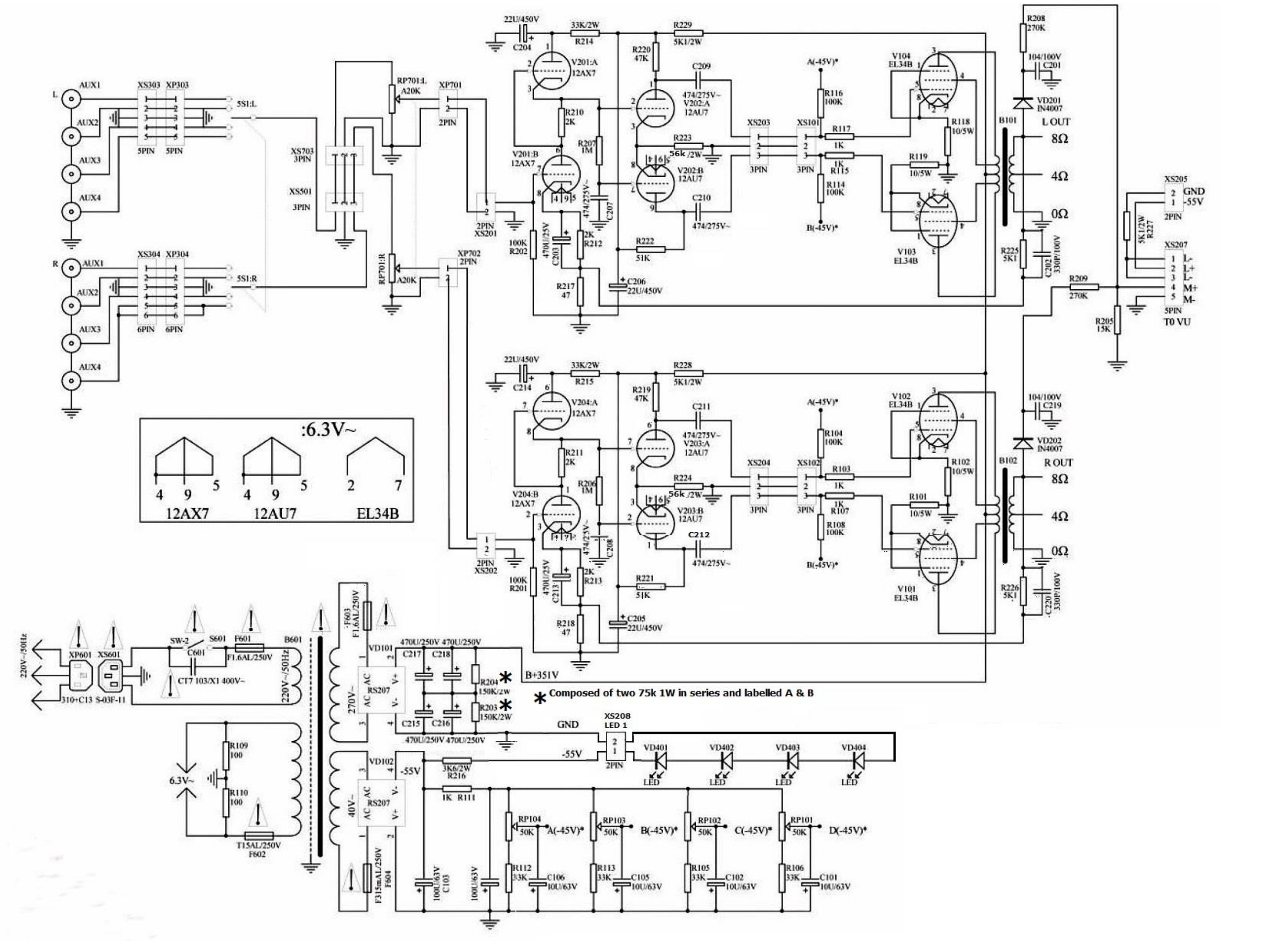
http://www.g4cnh.com/public/all_videos_together.mp4

The Zener diodes were tried again to see if performance improved, it did so we may have a design fault here.
(See Page 54)

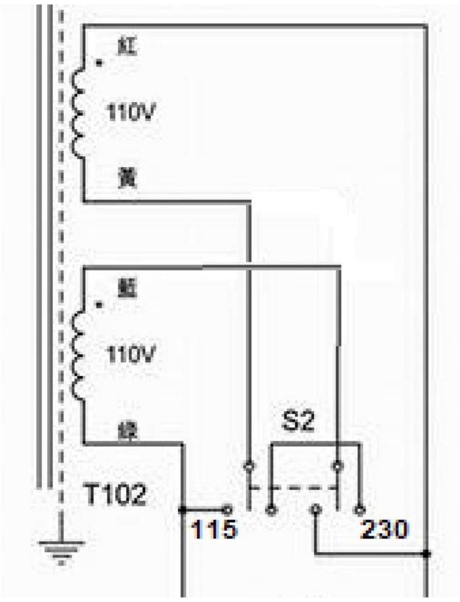
There are a number of circuit diagrams for the 13S, the original Yaqin has errors and unfortunately were carried over by people on their subsequent redraws.
At least one gives component values and references but the 30k resistors in the phase splitters are wrong and are now 56k. The Author has tried to make a more accurate drawing and also added the missing XS208 which supplies the front panel Yaqin logo.

The pin connections to V3 and V4 are reversed i.e. pin 1 is really pin 6 ☺
That’s an old Yaqin trick.

MS-13S Schematic



Correct 115/230V switching arrangement.



MS-13S Main preamp board inter valve link checks.

V201 pin 2-6 inter valve link.
V204 pin 1-7 inter valve link.
V201 pin 3- V202 pin 2 inter valve link.
V203 pin 7- V204 pin 8 inter valve link.
V202 pin 3- 8 inter valve link.
V203 pin 3- 8 inter valve link.

MS-13S Main preamp board resistor checks.

V201 pin 8 to 0V Ground, this checks R212 (2 k Ohms) in series with R217 (47 Ohms). It may not measure 2.047 Ohms due to the tolerance of R212 so expect something like 2.03 k Ohms.

V204 pin 3 to 0V Ground, this checks R213 (2 k Ohms) in series with R218 (47 Ohms). As for V201, it may not measure 2.047 Ohms due to the tolerance of R213 so again expect something like 2.03 k Ohms.

V201 pin 3 to pin 6, checks R210 measures 2.0k Ohms. (Typical 1.988k)
V204 pin 8 to pin 1, checks R211 measures 2.0k Ohms. (Typical 1.991k)
V202 pin 3 and 0V, checks R223 measures 56k Ohms. (Typical 55.54k Ohms.)
V203 pin 3 and 0V, checks R224 measures 56k Ohms. (Typical 55.54k Ohms.)
V202 pin 2 and pin 7, checks R207 measures 1 Meg Ohms.
V203 pin 7 and pin 2, checks R206 measures 1 Meg Ohms.

To check others without dismantling, two have to be measured in series so a large error could be the result of either one being defective or even both.
V201 pin 1 and V202 pin 1 checks R214 (33k Ohms) and R220 (47k Ohms) in series.
Should measure 80k Ohms. (Typical 79.9k Ohms.)

V201 pin 1 and V202 pin 6 checks R214 (33k Ohms) and R222 (51k Ohms) in series.
Should measure 84k Ohms. (Typical 83.8k Ohms.)

V204 pin 6 and V203 pin 6 checks R215 (33k Ohms) and R219 (47k Ohms) in series.
Should measure 80k Ohms. (Typical 79.9k Ohms.)

V204 pin 6 and V202 pin 1 checks R215 (33k Ohms) and R221 (51k Ohms) in series.
Should measure 84k Ohms. (Typical 83.8k Ohms.)

Final check on V201 pin 1 to V204 pin 6, this attempts to check R228 and R229 5k1 resistors in series (10k2 Oms) via the previously checked 33k resistors R214 and R215 in series (66k Ohms).
So the total should be 10k2 + 66k = 76.2k Ohms.

MS-13S A look at the VU Meter.

VU Meter measurements. (Stock) **With 100k for R208/R209**

Meter Reading	V RMS	POWER		Meter Reading	V RMS	POWER
-20	2V	0.5W		-20	.85V	0.09W
-10	4.7V	2.76W		-10	1.96V	0.48W
-7	6.5V	5.28W		-7	2.6V	0.845W
-5	8V	8W		-5	3.2V	1.28W
-3	9.5V	11.28W		-3	3.95V	1.95W
0	13V	21.125W		0	5.2V	3.38W
+1.5 before clip	14.5V	26.28W		n/a		
+3	n/a	n/a		+3	6.9V	5.95W
+6 fsd	n/a	n/a		+6 fsd	8.8V	9.68W

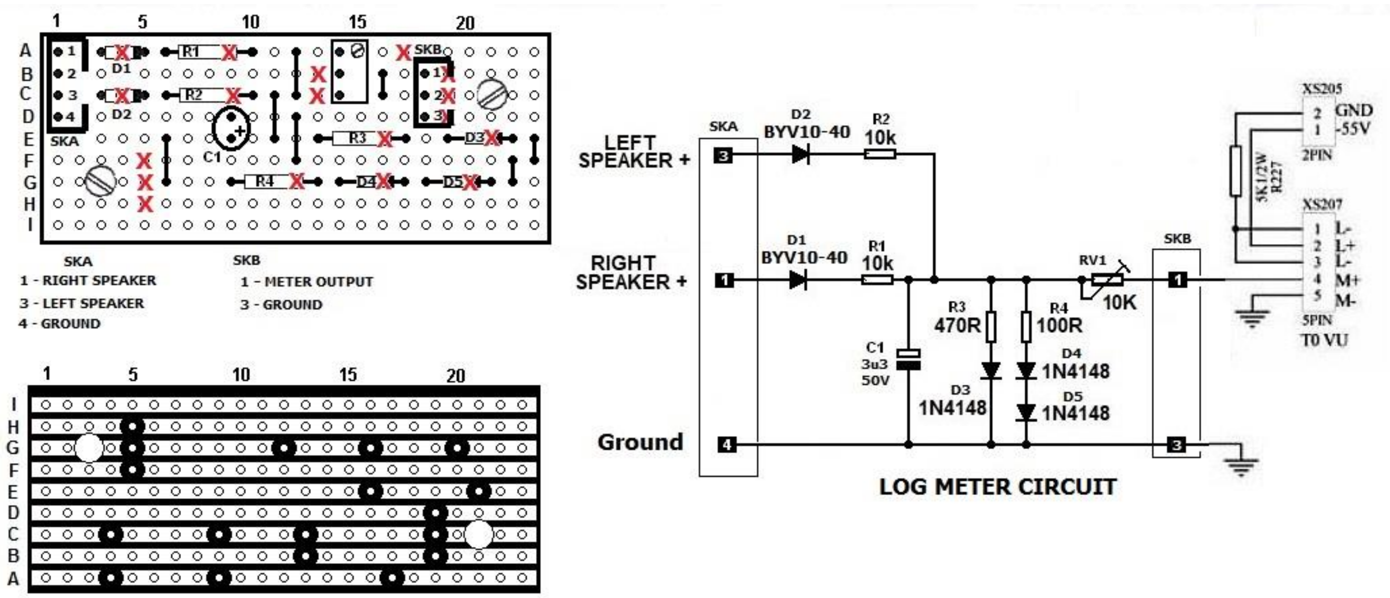
The 15k resistor R205 was placed in series with a resistance decade box but increasing its value had poor effect. A more promising increase in meter reading was found by placing 180k in parallel with the 270k resistors R208 and R209.
This effectively made R208 and R209 108k so a 100k was trialled.
The scale point aimed for is full scale deflection at +6 just as clipping starts to occur at around 26 Watts but as you can see, full scale was achieved at just under 10 Watts. ☺.

Final VU Meter measurements. (With 165k for R208/R209)

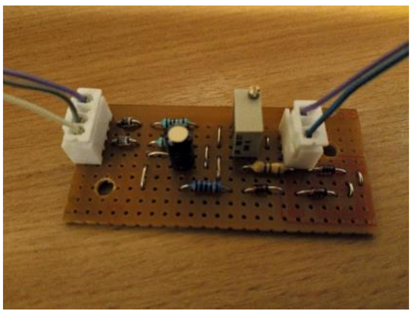
Meter Reading	V RMS	POWER
-20	1.1V	0.15W
-10	2.85V	1W
-7	4V	2W
-5	4.8V	2.88W
-3	5.85V	4.27W
0	8V	8W
+3	10.5V	13.7W
+6 fsd Just before clip	14.5V	26.3W

Interesting to note that the needle of the meter goes slightly over the fsd scale marking but stops increasing due to the fact that the amplifier output is now clipped almost into a square wave. So 165k is the one!

On test the VU meters still gave a disappointing amount of movement, maybe my speakers are more efficient than most as room shaking volume only gave a small meter movement. The construction again tries to defeat any real attempt at modification, but apart from the removal of some parts it’s worth a try.
Here is a logarithmic circuit that was tried, it was a circuit suggested by Giangrandi with some of my changes.
Designed to drive two meters but on the 13S we only need a single meter drive.
But the following is perhaps a good starting point.



At low volumes the diodes D3 to D5 will be non-conducting and thus all of the available output voltage would be present to drive the meter via the adjustment RV1. As the volume of the amp increased then D3 will start to conduct and introduce a 470 Ohm load at the summing point of R1 and R2. As the volume increased more, then diodes D4 and D5 will conduct and introduce a further 100 Ohm load at the summing point. So the diodes will allow maximum sensitivity at low volume but in effect apply a brake as the volume increases.
The one annoying thing is that the VU meter has no information as to its full scale voltage or current sensitivity. Looking on eBay, one possible match has a full scale deflection of 200 uA and internal resistor of 630 Ohms but the actual parameters are required to be confident of a proper working circuit.
A 100uA 1750 Ohm meter was trialled, shunted with a 2k2/8k2 in parallel which made it a 200uA meter at 830 Ohms. This requires 175mV for full scale deflection and was put to use as a temporary substitute.
This was connected to the Output wires whilst the Input wires were wired together and connected to a Sine Wave Generator set to 1 kHz.



Meter measurements, new circuit with 200uA test meter.
Series resistor RV1 set at minimum.

Meter Reading	V RMS	POWER	V on Meter
2	0.55	0.037W	29.8mV
4	0.92	0.105W	53.2mV
5	1.12V	0.156W	67mV
6	1.32	0.217W	79.7mV
8	1.9	0.45W	117.2mV
10	2.9	1.05W	181mV
>10	4	2W	0.253V
>10	5	3.125W	0.316V
>10	7V	6.125W	0.415V
>10	10V	12.5W	0.368V

Note how the meter gets slightly overloaded when the amp is delivering 2 Watts or more but at 12.5 Watts limiting started to occur. The Sine Wave Generator can only provide 10V which is equivalent to an amplifier output of 12.5 Watts so as an experiment the variable resistor was adjusted to give full scale on the meter at this voltage.
This was quite amazing as however much you tried, the limiting action of the circuit kept the meter pegged at near full scale deflection at 190mV. Of course it remains to be tried in the MS13 but it does look good.

Meter Reading	V RMS	POWER	V on Meter
2	0.67V	0.056W	31.5mV
4	1.18V	0.174W	56.3mV
5	1.33V	0.22W	68.6mV
6	1.62V	0.328W	83.4mV
8	2.55V	0.81W	118.7mV
10	6.5V	5.28W	176.7mV
10	7.5V	7W	184mV
10	8.5V	9W	188mV
10	9.5V	11.3W	186mV
10	10V	12.5W	178mV

Not wanting to remove the circuit board (again!) it was planned to cut component legs and attach wires to the stubs. But this is not professional, so the components were removed correctly and the wires soldered to the board.
R205 was also removed in case it loaded the Logarithmic Board Output too much.

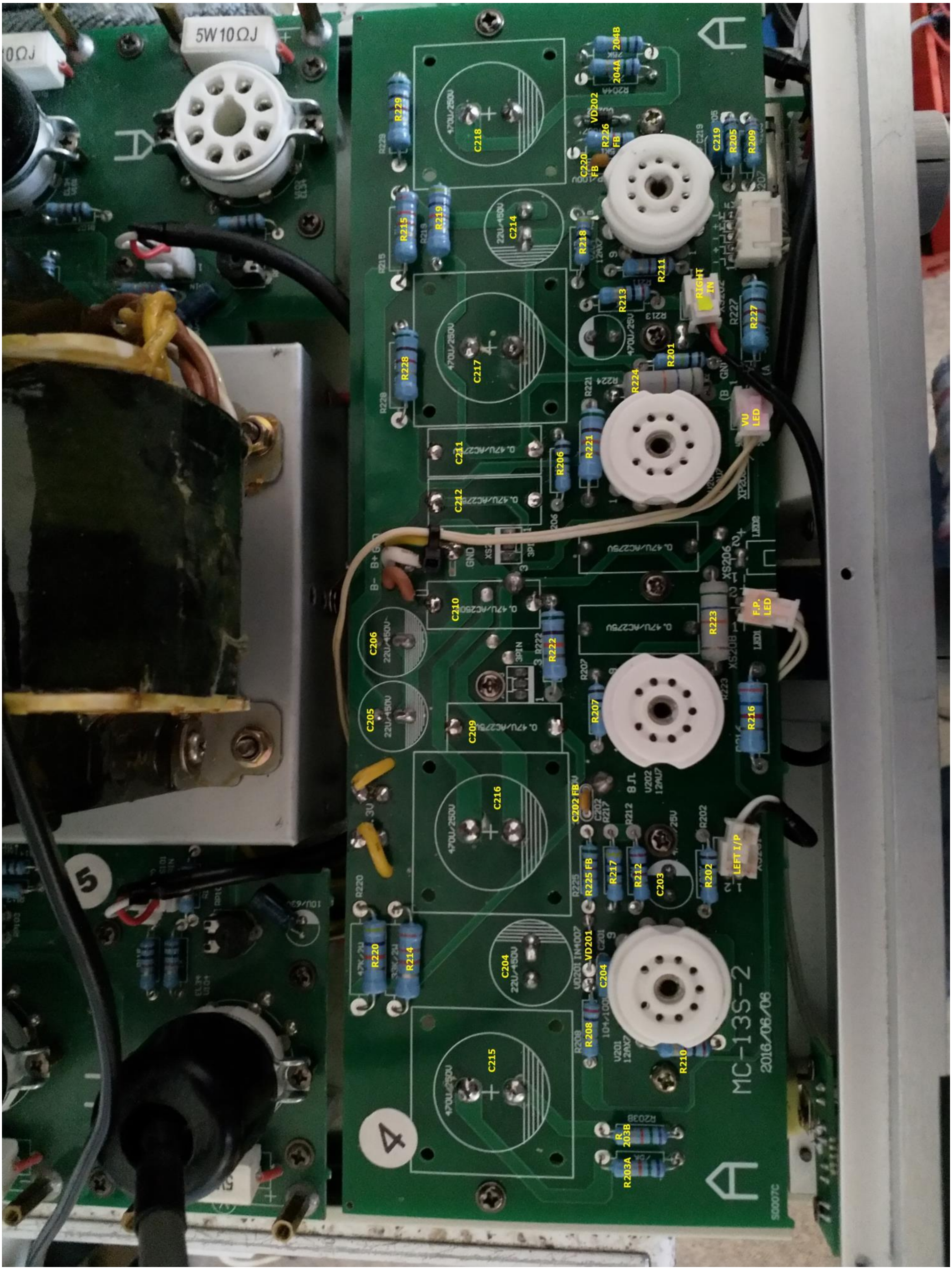
Having decided to bite the bullet, VD201, VD202, R208, R209 and R205 were removed.
The Logarithmic Board was mounted on the bottom metal plate between the Yaqin logo and the volume control using two 5mm M3 standoff spacers.
Rainbow wire was used for the wiring runs required and it is appreciated that not everyone will have suitable plugs and crimping tools so in these circumstances you will need to hard wire to the Logarithmic Meter Board.

Here are the results using the signal generator and the actual MS-13 meter, this was set to give a maximum f.s.d. at 10V Input. In fact going over 10V makes the meter pointer start to reduce as the extra stage of limiting comes into play.

Meter Reading	V RMS	POWER
-20	0.25V	0.008W
-10	0.74V	0.068W
-7	1V	0.125W
-5	1.22V	0.186W
-3	1.52V	0.288W
0	2.1V	0.55W
+3	3.2V	1.28W
+6 f.s.d.	5V	3.125W

In the meantime the very elusive 6CA7 that was Red plating and blowing the HT fuse was found.
It was V3, the very same valve that showed some leakage on the valve tester at the very start of this investigation.

***MS-13S parts location sketch for the front board*.**



MS-13S Zener's or no Zener's?

Taking the worst channel which is the Right, it has 192 volts on V203 cathodes.
The front supply resistor has 380 V on one side and 353 V on the other.
Thus it is dissipating 27V ^{2}/33000 = 729V/33000 = 22mW though the 33k is rated for 2W.
Suppose we place 220V Zener diodes on the 33k, the volts drop on it will now be 160V.
It is now dissipating 0.78W so still well within its 2W rating.
The current through the resistor will be 4.8mA and therefor the Zener dissipation will be
220V * 0.005 = 1.1 Watts but this is shared by two Zener diodes so 5W rated Zener diodes will be very comfortable.
Well that's the theory, we have not included the small current being drawn by the front end valve.
Placing the diodes across C204 and C214 would seem to be a good place for the test and perhaps, if successful, the final mounting place.

First some voltage measurements to see state of play now and perhaps later.

C204 = 355.1V
C214 = 352.8V

R210 2k V201A high side = 178.3V R210 2k V201B low side = 175.4 so V1 = 1.45mA
R223 tail 56k = 184V

R211 2k V204B high side = 186.7V R211 2k V204A low side = 183.9V so V4 = 1.4mA
R224 tail 56k = 191.3V

Main HT (Should be 351V) = 398V

With 210V Zener diodes

C204 = 226V
C214 = 216V

R210 2k V201A high side = 114.1V R210 2k V201B low side = 112V so V1 = 1.05mA
R223 tail 56k = 124.2V

R211 2k V204B high side = 119V R211 2k V204A low side = 117V so V4 = 1.0mA
R224 tail 56k = 139.7V

R214 dissipation = 364V - 226V = 138^2 / 33000 = 0.57W, current = 4.2mA
R215 dissipation = 366V - 218.5V = 147.5^2 / 33000 = 0.66W, current = 4.5mA

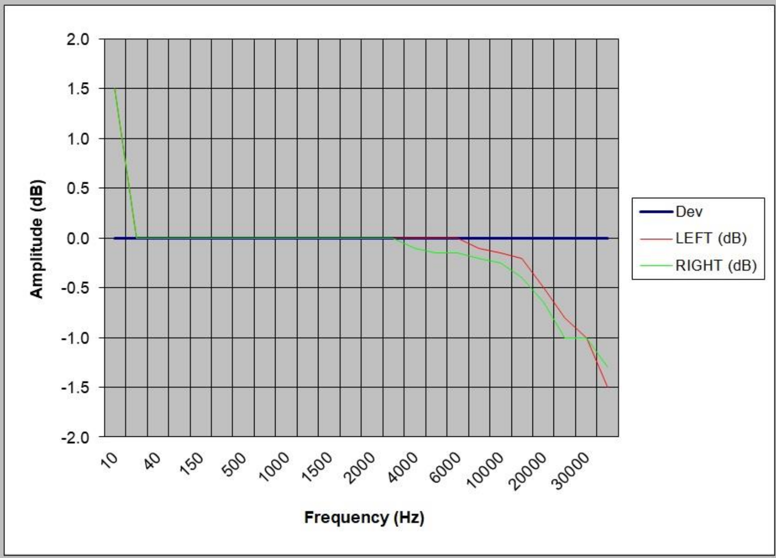
Zener dissipation worst case is 0.945 Watts shared between two 5W Zener diodes. No Problem.

This is a video made during investigation and shows again the problems in the phase splitters due to having too higher voltages coming from the first stages.

http://www.g4cnh.com/public/MC13S_Zener_trial.mp4

MS-13S Frequency response.

FREQ (Hz)	Dev	LEFT (dB)	RIGHT (dB)
10	0.0	1.50	1.50
20	0.0	0.00	0.00
40	0.0	0.00	0.00
80	0.0	0.00	0.00
150	0.0	0.00	0.00
250	0.0	0.00	0.00
500	0.0	0.00	0.00
750	0.0	0.00	0.00
1000	0.0	0.00	0.00
1200	0.0	0.00	0.00
1500	0.0	0.00	0.00
1750	0.0	0.00	0.00
2000	0.0	0.00	0.00
3000	0.0	0.00	0.00
4000	0.0	0.00	-0.10
5000	0.0	0.00	-0.15
6000	0.0	0.00	-0.15
8000	0.0	-0.10	-0.20
10000	0.0	-0.15	-0.25
15000	0.0	-0.20	-0.40
20000	0.0	-0.50	-0.65
25000	0.0	-0.80	-1.00
30000	0.0	-1.00	-1.00
35000	0.0	-1.50	-1.30



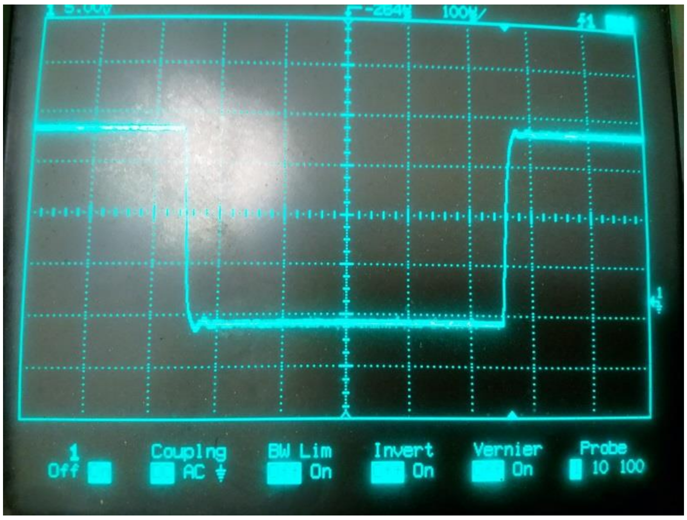
Done at 8 Watts - VU approximately at 0

Left -3db point is 47kHz

Right -3db point is 49kHz

Not sure if this should be better? Perhaps feedback needs checking? Could it be the valves?
Square wave views, 1 kHz and same setting as for Frequency response tests, i.e. 8 Watts.
It looks like the front edges could do with sharpening up, the Right being worst which probably accounts for its early start to dropping off at 4kHz . The scope display has been shifted to give a better view of the front edge.

LEFT



RIGHT

The Right channel has a +1dB gain difference compared to the Left channel.
This is not readily seen in the frequency response tests as the Volume control was adjusted to give the same output on the RMS Voltmeter at 1 kHz. It was decided to do a comparison of output voltages at different settings of the VU Meter using the volume control, you can see the extra gain difference the Right Channel has over the Left.

VU Meter setting	Left Output	Right Output	Difference
-20	0.87V	0.88V	0.01V
-10	2.8V	3.05V	0.25V
-7	3.9V	4.2V	0.3V
-5	4.65V	5.1V	0.45V
-3	5.9V	6.4V	0.5V
0	7.9V	8.5V	0.6V
+3	10.5V	11.6V	1.1V
+6 fsd	14.5V	15.0	0.5V

It is a good idea to take actual levels at various settings of the volume control.

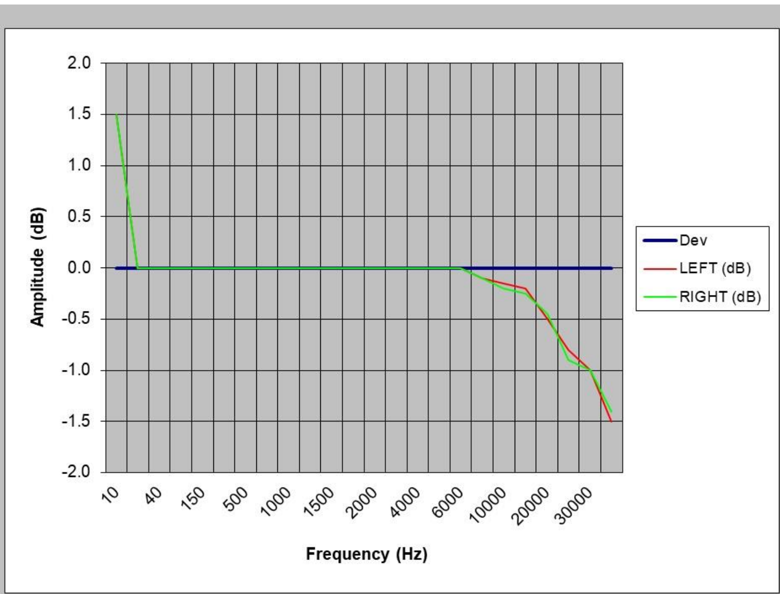
Control Position	Left	Right
9 o'clock	127mV	130mV
Between 10 & 11 o'clock	295mV	300mV
12 o'clock	900mV	925mV
Between 1 & 2 o'clock	1.79V	1.8V
3 o'clock	4.5V	4.4V

So on this particular model, there is a little extra on the Right hand control but not enough to cause the large output variation. Investigating further and having ruled out amplitude variation cause by the valves, it was decided to give slight adjustment to the Right Channel negative feedback resistor.
Adding 150k across the Right channel feedback resistor R226 (5k1), effectively making it 4.932k, brings the output down to almost the same level as the Left channel.

VU Meter setting	Left Output	Right Output	Difference
-20	0.87V	0.82V	0.05V
-10	2.8V	2.8V	0V
-7	3.9V	3.8V	0.1V
-5	4.65V	4.55V	0.1V
-3	5.9V	5.9V	0V
0	7.9V	7.9V	0V
+3	10.5V	10.6V	0.1V
+6 fsd	14.5V	14.6V	0.1V

The -3dB points are the same and adding more feedback has improved the flatness of the Right channel and brings it close to the Left channel.

FREQ (Hz)	Dev	LEFT (dB)	RIGHT (dB)
10	0.0	1.50	1.50
20	0.0	0.00	0.00
40	0.0	0.00	0.00
80	0.0	0.00	0.00
150	0.0	0.00	0.00
250	0.0	0.00	0.00
500	0.0	0.00	0.00
750	0.0	0.00	0.00
1000	0.0	0.00	0.00
1200	0.0	0.00	0.00
1500	0.0	0.00	0.00
1750	0.0	0.00	0.00
2000	0.0	0.00	0.00
3000	0.0	0.00	0.00
4000	0.0	0.00	0.00
5000	0.0	0.00	0.00
6000	0.0	0.00	0.00
8000	0.0	-0.10	-0.10
10000	0.0	-0.15	-0.20
15000	0.0	-0.20	-0.25
20000	0.0	-0.50	-0.45
25000	0.0	-0.80	-0.90
30000	0.0	-1.00	-1.00
35000	0.0	-1.50	-1.40



The designers probably have a swing jig for the board wired to a bench fixture to emulate the output stages.
They can alter components at will, a different story to working on a fully wired chassis.
There are design aspects that could be improved, especially those high front end voltages.
Choice of feedback capacitor? It is 300pF with a reactance of 21.2k Ohm at 25 kHz.
The more usual 50pF has a reactance of 127.3k Ohm but again not easy to experiment with due to the inability to easily try different feedback components, so things were left with 150k across R226. As mentioned, swapping valves around made only small differences and nothing like the +1dB error seen earlier. The owner can easily remove this resistor later if required.

It is doubtful anyone though, apart from their pet bat, would detect the loss of 0.5dB on both channels at 20 kHz. ☺

So to summarise:

Maximum output before clipping is 26 Watts per channel.
It would have been nice for a bit more HF beyond 20 kHz but pretty certain that Yaqin go by the -3dB point for advertising purposes so over 45 kHz must be deemed acceptable.

Channels are nicely balanced in both frequency response and output voltage over the range of the volume control.

Now distortion, the old rule of thumb is to have distortion less than 1% at all levels.
This was measured at different VU meter settings, the low distortion signal source (getting a bit old now), was set to 1kHz and with a measured distortion on its output of 0.045%.

VU Meter	Approx Power	Left	Right
-7	2W	0.096%	0.25%
0	8W	0.2%	0.5%
+3	13.7W	0.4%	0.68%
+6	26W	0.8%	0.85%

Swapping front end valves V1 and V4 and at 2W measured Left at 0.11% and Right at 0.3%.
Not much difference there so replaced in their proper slots and V2 and V3 splitters were swapped.
At 2W the measured distortion was - Left at 0.15% and Right at 0.26%.

Was the change in feedback resistor mod causing more distortion on the Right Channel?
It was temporarily removed and distortion measured Left at 0.1% and Right at 0.28% which proved it was definitely beneficial to have it in and it did not cause the slightly higher figures.