A LOOK AT THE YAQIN MC-100B

By Les Carpenter G4CNH – December 2019

This is the Authors 100B fitted with Full Music 6SN7 (Gold Band) and Full Music 12AX7, later replaced with Brimar boxed anode CV4004 military spec. 12AX7’s. He has since replaced the KT88’s with KT90EH which appear more stable with bias voltages and they sound very good too.
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This is more than just an entry level amplifier; using a pair of KT88's in Push-Pull on each channel it has plenty of power to drive all but the most in-efficient speakers. It is dual mono-block in design, that is to say, it has separate power supplies for each channel and only the bias circuit is shared, having its supply derived from the Left hand channel power transformer. Switches on the top plate allow the amplifier to run either in Triode mode or Ultra Linear mode though the Author prefers Ultra Linear many like Triode instead. There are some bad points to the amp but these are easily corrected.

**Bad points:**

One very noticeable feature is the front panel toggle switch, used to select either the adjacent RCA sockets (0.6V) or any of the four 0.25V inputs on the rear panel, as selected by the right hand rotary switch. The toggle switch is a little confusing as it gives the impression that it by-passes the input stages and drives the 6SN7’s directly. **THIS IS NOT THE CASE!** There isn’t even an input attenuator to take the 0.6V input down to the 0.25V levels expected on the other four rear connectors. What the switch does is just apply more negative feedback inside the amplifier to reduce its gain as a form of compensation, not exactly the most succinct way of doing this, after all the negative feedback should already be optimised for best performance? The Author regards these inputs as just a sales gimmick but OK, that is a personal thing.

110V/220V Operation, as with most Chinese equipment you may find 110V or 220V is too low for your local power supplies. Make sure when you order that you insist on 120, 230V, 240V or whatever you require, it may take a little longer for the factory to fit the necessary transformers but the wait will be worthwhile. We will cover other aspects as we go and where others have applied modifications to make the 100B even better!

**Original Yaqin schematic.**
The Author has never liked the way all of the inputs are lumped together with just one overall screen. He had cross talk in a similar arrangement on his Yaqin MC10-L and now uses an external selection box with motorised volume control, with the MC-100B volume control set to maximum.

Removing Base Plate - text and photos by Bob Drinkall.
First remove all tubes for safety, remove the bottom cover and it’s at this stage I hope you have an electric screw driver for removing all the screws/bolts. The type of screws may vary between serial numbers so map out what type of screw it is as you remove them; first remove all the rubber feet.
Re-draw of circuit with component identifiers added.
The first stages comprising of the 12AX7’s V1 and V2, form a SRPP circuit and directly couple to the phase splitter 6SN7’s V2 and V3. If you want any more info on the front end circuits then I recommend reading the Valve Wizards excellent article to be found at: www.valvewizard.co.uk/SRPP_Blencowe.pdf

These circuits have been well used by Yaqin, even the long tail pair splitters but there is an exception here in that both anode resistors (R6, R7 & R106, R107) are the same value at 47k. Text books will tell you that to obtain the same amplitude outputs to drive the output stage will require R7 and R107 to be slightly higher, around 51k, the MC10L for example uses these values. Checks on this have found that any errors are not as severe as that of variance in valve gains so the present values have been kept.

**Coupling Capacitors and a Guide for replacement, text and photos by Bob Drinkall**

The coupling caps on the 100b are .47uf at (500v min) C6, C7, C106 & C107), early 100b’s used .22uf, but .47uf can be fitted. On newer 100b’s Yaqin have changed the cap voltage to 630v instead of 500v, so use 630v caps if you can, if not 500v should be OK.

**Before doing the work leave amp unused for 30 minutes min, so power caps drain.**

First remove all the valves noting which socket the KT88’s came from as this will save re-biasing when they are replaced. Turn the amp upside down onto a soft cloth, remove the most outer bolts & place in one container (Mark as Outer), then remove the next array of bolts set about 10mm further in and place in second container (Marked as Inner), next remove the two rubber feet in the centre, the bottom panel should now come off.

Undo the small black 3mm bolts that hold the pcb to the chassis, there are quite a few, some will be hiding under wires, once you have them all look for a earth wire which goes to the front plate from the pcb, unbold it from the front plate.

Take a few photos before you unplug cables in this next section.

Unplug the input leads from the pot on the pcb, (small white connectors, 3 wires), you will need to remove the volume pot and the centre input board (so call pre amp input) & unsolder wires to phono sockets, remove the input selector board as well. It’s not normally necessary to disconnect all the cables, but unplugging them may give a bit more movement. You may also need to cut some of the cable ties that keep the wires together at the rear of the board.

Now the board should lift out, pull it backward a little then up from the front, look out for the front LED it can break if you’re not careful, pull it out of its hole with small pliers.

The caps you’re looking for are the four Blue ones (.47uf) near to the white 5 watt bias resistors, the edge ones nearer the front are the cathode caps. Some people replace the cathode caps as well (same value) opinion is divided as to if this helps the sound, if you have enough caps you may as well do them.

If you’re going to use the Russian PIO caps wrap them in shrink wrap or insulation tape, to ensure they don’t short out on anything. You will need to solder on extension wires to one of the caps so they reach, use solid wire, the centre of coaxial aerial cable is ideal, then use shrink wrap over the wires, but for the end 5mm’s, once soldered in place tie them down to the legs of other local components with small cable ties (not too tight), as their a bit heavy & you don’t want them flapping around.

Once all is done reassemble the amp but before refitting the bottom cover, test it out to ensure all is well. Once done, be careful when refitting the bottom cover not to touch anything inside after testing as the power caps can still hold a charge.

Up grading the coupling caps is the best improvement you can make to a Yaqin amp!

Good luck.
As Bob pointed out, where the Russian paper-in-oil (PIO) capacitors have been fitted (see below), the cases of these are metallic with just Green paint to insulate. An outside covering of heat shrink tubing is not just recommended but should be considered mandatory. Not only the four coupling capacitors have been changed but also the C5/C105 tail capacitors of the phase splitters.
Bob also found another photo that shows the small PCB’s which hold the volume, input & front input board removed. Also note there is a Black ground wire which is connected to the front panel, which must be undone, (shown disconnected on right in photo, by case edge).

Some real high quality ones fitted here, so large they had to be stood away on long leads.
Yaqin MC100B Power supply smoothing capacitors.

The front one can dry out as it has to put up with a lot of heat from the KT88’s either direct or re-radiated from the transformer covers. The values seem to change but the most common appears to be the Hitachi HU3 560uF 400V which I think is a fake device as it comes with an unusual jacket and poor logo.

There are 3 other sources, all meeting the required 35mm diameter, some offer as little as 2000 hours life, others go for 17000 or more, all at 105 degrees centigrade.

Best but a bit lower in value is EPCOS B43547 (RS838-5028), 470uF/450V at £14 each.
175000 hours at 105deg/c.

Going the other way (up) we have EPCOS B43544 (RS838-4993), 680uF/400V at £11 each.
175000 hours at 105deg/c.

Cheaper options:-
Nichicon LGX2W561MEC50, 560uF at 450V, (RS 270-880) £8.78 each, 5000 hours at 105 deg/c.
Nippon EKMQ451VSN561MA50S, 560uF at 450V, (RS 841-4794) £5.93 each, 2000 hours at 105deg/c.

When things go POP!
It can be frightening when it happens; speakers go barmy with loud crackles then nothing! Sometimes you just get a plop, then nothing.
Chances are only one channel went down and a pretty good 99.9% chance it was one of the large output valves. This will be V1 or V2 if Left channel or if it was the Right channel then V3 or V4.

Was it both channels?  Where is the supply fuse?
If both channels have gone then possibly one of the output valves has blown the supply fuse and this will be most evident by the loss of the Blue front panel light and none of the valves warming up.
Many newcomers have difficulty finding it; it is hidden in a small drawer which is part of the power input connection. To open the drawer you must first remove the cord from the connector, then with a small screwdriver, pull on the tab located on upper side of the drawer.

![Diagram of fuse with tab and spare fuse]

The inner compartment is the working fuse and if blown replace with same type. Take care not be fooled by the spare fuse as it may be of wrong amperage and meant for use with 120V supplies. Fitting this higher amperage fuse in place of the lower rated 220V fuse could place the power transformer in jeopardy, if for example it is a 2Amp fuse, then fit another 2 Amp fuse and not the spare which may be rated at 4 Amps.

**Was it just one channel?**

Let us pretend it was the Left channel.

Ok – is there still sound albeit lower in volume on the Left channel?

If Yes, then the Left rear panel mounted HT fuse is still intact.

*(NOTE: early 100b's may not have this extra level of protection; recommend it is fitted as page 13)*

OK **Switch Off** and pull both output valves from this channel, **making a note from where they came from, in our pretend example by marking them either V1 or V2.**

Treat both of these valves as suspect, guilty until proven innocent!

**1st Check, bias monitor resistor. NO POWER ON!**

It is quite possible that a flash over in one of the output valves has blown its cathode resistor, these are easy to check without dismantling by using the bias monitor points.

Using a Multimeter, check that there is a resistance of approximately 10 Ohms between the bias monitor points for each of the two valve locations

![Image of multimeter measuring 10 Ohms between points]

As you can see, the resistors are both intact although the monitor resistor for V1 is a little high in value. This would result in a bias measurement error.

One of the reasons why the Author advocates the use of an external bias monitor box.

OK, so far you have proven that the errant valve has not blown the bias resistor.

If for example the resistor is blown on V2, then we know that V2 is the culprit and V1 probably innocent or vice versa.

In order to give the amplifier a clean bill of health, output stage wise on each Channel, we need to do just three more checks **on each valve position**, starting with V1.

These will be:-

2) Bias voltage,
3) Anode or Plate supply and
4) Screen Grid supply.
2nd Check, Bias Voltage: - Apply Multimeter –ve probe to any bias monitor point marked – which is normally the left hand one. Apply the Multimeter +ve probe to pin 5 of V1 (see below), switch on amplifier, note the reading and switch back off immediately.
To be around the value shown, its value will depend on the last setting of the bias control for V1. The main purpose is to check it is actually there and should be a **Negative voltage** greater than -35V. If it is a large Positive voltage then this is serious and could be due to a faulty coupling capacitor.

![Bias Voltage Measurement](image1)

3rd Check, Anode or Plate supply: - Keeping the Multimeter –ve probe in any of the – bias monitor points as before, apply the Multimeter +ve probe to pin 3 of V1 (see below), switch on amplifier, note the reading and switch back off immediately.
To be around the value shown unless perhaps the rear mounted fuse has blown. The main purpose is to check HT fuse is intact and transformer winding is not open circuit.

![Plate Supply Measurement](image2)
Allow voltage to drain away before placing +ve probe onto pin 4 as shown below.

4th Check, Screen Grid supply: Keeping the Multimeter –ve probe in any of the – bias monitor points as before, apply the Multimeter +ve probe to pin 4 of V1 (see below), switch on amplifier, note the reading and switch back off immediately.

To be around the value shown, having ascertained that the rear mounted fuse is in order, loss of any voltage here can only be due to either an open circuit screen resistor or an open circuit output transformer ultra-linear tapping. This can be verified by switching the left channel to Triode mode as this should bring back the voltage if the transformer tapping (Heaven forbid) is open circuit. However, before condemning the transformer, check that the Triode/Ultra-Linear switch is not faulty in the U/L position.

![Multimeter and valve](image)

It would be most unlikely to find loss of the negative 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.**

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, I 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!
Fitting HT (B+) fuses to the MC100B.

Early 100b's were not fitted with HT fuses on the rear panel, there was no protection at all apart from the power input fuse. It was hoped to be able to mount these extra fuses on the rear panel but the metalwork here is very thick and makes mounting of a standard 20mm fuse holder impossible.

An alternative location is on the much thinner side rails where the power switch is located. It is hard to believe but Yaqin have used more than one place to mount the power switch, either towards the rear as shown in the photo below or further forwards in the next available space between the support bracket and the printed circuit board. So the actual position of the two extra fuse holders will no doubt depend on where Yaqin have mounted the power switch in your particular MC100b.

Unlike the MC10 series, the top cover is not easy to remove and therefore doing this modification in no way limits access to other parts of the amplifier. The 100b seems to have been built from upper to lower levels, finishing with the bolting down of the base plate so it is assumed that any work on the printed circuit board will require its complete removal from the underside. A rather daunting prospect to the Author but if the Chinese wiring operative has done the work correctly, the circuit board should hopefully fold back on its wiring loom for access.

In removing the Base Plate, the Author encountered many difficult screws due to thread locking compound and damage to threads due to poor alignment of fixing holes. Some screws came out with virtually no thread on them and one even lost its head as soon as an attempt was made to remove it. It gave the impression that some screws had been forced home regardless of torque limits. Drilling the sides was at first quite difficult and the Author wondered if the top was a sheet of pure Titanium, obviously Stainless Steel and the holes were started with a 1.5mm drill and slowly worked up in size. The key here is speed, the faster the drill bit was worked then the easier it seemed to be. After 6mm a stepped conical hole cutter was used which worked surprisingly well to take the hole to the size required for the fuse holder.

The Author tried to use 200mA Ultra Rapid Blow fuses to provide maximum protection for the output transformers but these occasionally gave nuisance blowing. The difference between these fuses and the Yaqin quick blow ones, in the time they take to actually operate, is shown below.

<table>
<thead>
<tr>
<th>CURRENT</th>
<th>TIME FOR YAQIN 500mA FUSE</th>
<th>TIME FOR RS 188-6524 200mA FAST BLOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>300mA</td>
<td>NEVER BLOW</td>
<td>NEVER BLOW</td>
</tr>
<tr>
<td>400mA</td>
<td>NEVER BLOW</td>
<td>4 SECONDS</td>
</tr>
<tr>
<td>500mA</td>
<td>NEVER BLOW</td>
<td>100 MILLISECONDS</td>
</tr>
<tr>
<td>600mA</td>
<td>GREATER THAN 1000 SECONDS</td>
<td>25 MILLISECONDS</td>
</tr>
<tr>
<td>700mA</td>
<td>GREATER THAN 100 SECONDS</td>
<td>15 MILLISECONDS</td>
</tr>
<tr>
<td>800mA</td>
<td>5 SECONDS</td>
<td>10 MILLISECONDS</td>
</tr>
<tr>
<td>900mA</td>
<td>800 MILLISECONDS</td>
<td>7 MILLISECONDS</td>
</tr>
<tr>
<td>1A</td>
<td>100 MILLISECONDS</td>
<td>6 MILLISECONDS</td>
</tr>
</tbody>
</table>

The fuse found to be the best, though quite expensive, is the Ultra Rapid Blow fuse rated at 315mA. These are RS 188-6546, Mersen Z084018P, £1.70 each and come in a pack of 10 (Gulp!)

Still cheaper than a replacement output transformer.
Surge limiter and delay circuit

This is how somebody else incorporated one of these circuits.

Here are the photographs associated with the above circuitry.

As one can see, a lot of effort is required including the manufacture of a custom circuit board.

Further thoughts of the Author

The Author's idea is to use a ready-made mains operated Timer Relay to do the 1 minute delay, choosing a 4 pole device so that 3 poles are used for switching, with the fourth being used as an indicator on the front panel. The price of the above 80 Ohm NTC resistors is double that of the 120 Ohm so these latter ones were used instead. The original circuit used 10 x 80 Ohm = 800 Ohm starting resistance. This resistance drops to 8.61 Ohms if the NTC’s reach full operational temperature. The new circuit uses 7 x 120 Ohm = 840 Ohm starting resistance. This resistance drops to 6.93 Ohms if the NTC’s reach full operational temperature. It pays to watch auction sites such as eBay, the Author obtained two 1-10 minute timers, with bases, for just £6 each. As the relay is switching an inductive circuit, particularly after a period of operation when the NTC’s will be cold, it makes sense to add a snubber network across its contacts such as the Kemet PMR209MC6100M100R30, RS 206-7881. The only drawback is that for 115V working a new Timer relay will have to be purchased, but this was not expected to be a problem for the Author and besides, having the relay plugged into its own base certainly helps in changing the relay.

Although the circuit reduces the switch-on surge, it does little for the protection of the KT88 cathodes as these will have to warm up with a high voltage on their anodes. Over time this can result in what is known as cathode stripping and was usually prevented by switching on HT (B+) after the valves had fully warmed, usually after 1 minute. Special thermal switching valves were developed for this operation in conjunction with a relay that not only applied HT but also, thanks to thermal lag, turned off the heater inside the thermal delay valve. Another contact (RL1b) took over the task of maintaining the relay supply, normally through a power saving resistor as the current required for an energised relay is less than that required to energise it.
How they used to do it - Thermal Delay Switch

The best place to switch the HT will be after the smoothers such that high in-rush currents will be avoided. Placing it before the smoothers would not only circumnavigate our surge limiting circuit but also might otherwise damage the 3A contact rating of the Timer relay we are using.

The following shows the new circuit which, thanks to the relay being a 4 pole, can do all that is required including indication. The Author deleted C8 on his 100B because he decided to fit a filtered mains input plug to do the same task, a decision not to be taken lightly as will be revealed later. Also shown is the position of the two 4mm clearance holes required to mount the Omron relay base PYF14.

This is how the Author implemented the circuit.
Fitting a filtered power input plug.
This is definitely not recommended for anyone without experience to be able to fit this.
The Author selected a EPCOS B84773A (RS 780-5026) as this was sitting in the spares box.
You have to unsolder the tags that connect the circuit board so it can be removed from the power input connector. Then the stock power input plug can be extracted by removal of the two fixing screws.
You will then find that the filter plug will not fit into the hole vacated by the previous input plug, so a lot of filing will have to be done to achieve this. Not to be taken lightly as the rear panel is very thick alluminium and the fit has to be kept central, height wise, for the fixing screws to be replaced.
Even having achieved this, you will find it impossible to fit the new filter plug as one of its terminals will now foul the flange of the right hand output transformer. This is not load supporting so can be eased back with some heavy duty pliars to give adequate clearance as shown.

Flange to be bent back

The Problem

Flange bent back to clear

The thick cable with Yellow outer sleeving is the cable supplying power Live (Brown) to the side mounted switch which returns on the Blue. This is routed to one of the Red twisted wires on the original input plug board. The other Red twisted wire carries supply Neutral; they both go to the voltage selector switch.

All you need to do is connect the Chassis wire (Yellow/Green) to the Earth Tab (MOST IMPORTANT) on the filtered input Plug. The Red wire that went to Neutral on the original board goes to Neutral (N) on the filtered input Plug.
The other Red wire has to be connected to the Blue wire coming back from the switch and will need to be insulated with either heat shrink sleeving or large solder sleeve.
The Authors Surge limiter and delay circuit

Wiring is a different story if you decide to fit the Authors surge limiter and delay relay. At least the tag strip (RS 433-775) has the right spacing to enable it to be secured by the transformer cover mounting screws.

**Surge limiter fitted.** Note that the tag strip carries mains power supply even after the time delay relay has activated as it will be applying mains to both ends by its shorting contacts. The Author considered fitting some kind of insulating cover over the tag strip but as access required a lot of work with a screwdriver, this was considered unnecessary especially when one accepts the fact that the mains inlet is also un-shrouded.

Another view showing the wiring dressed away from the surge suppressors which run hot during the 1 minute warm up sequence. The HY3-4 relay is installed and held in by the special clips which strangely enough were difficult to source from the major distributors and the Author had to find them on eBay.
External bias monitor

It had been intended to fit an LCD panel meter but problems arose due to the supply ground being the same as the input LO terminal of the panel meter. Normally a floating power supply is required for the meter, it would not work with an internally generated +9V. So the Author decided to dispense with the panel meter. In its place went a single RCA jack onto the front panel, allowing an external Multimeter to be connected for monitoring purposes and a selector switch making short work of connecting to each monitor resistor. To improve accuracy even more, the original four 10 Ohm 3W 5% tolerance resistors were replaced with 10 Ohm 3W 1% tolerance types, e.g. RS Stock No. 124-9327. Also used was a 2 pole 6 way sub-minature rotary switch such as the RS 161-5114 with a 3mm shaft, fitted with a suitable control knob such as the RS 137-5478.

A large label had to be made to cover the holes that the previous front panel parts left behind, the easy monitoring of the output valves was considered far more useful than the previous switch and RCA sockets.

http://www.g4cnh.com/public/1.mp4 to see the monitor switch and delay in action.

Replacing the volume control

Many advocate doing this as the stock control is seen as being inferior to something like an ALPS Blue potentiometer. The Author has no problems with the stock control on his 100B as it is set permanently to its maximum position and control is undertaken by a remote motor driven ALPS control. However he was called upon to replace the control in a 100B and as he does not like soldering directly onto the potentiometer tags, he made a small strip-board to interface between the control and the amplifier wiring. Of course you do not have to adopt this method but the pictures show how the potentiometer is wired. Note that this particular control had four tags per channel, this was intended for use with a loudness circuit and is not used on the 100B and the board should be able to cater for either the 3 tag or 4 tag controls.
Board showing link locations and the input plug position. The plug was obtained from the old circuit board.

View of complete assembly.