Modifying my Behringer MX400 Mixer

Introduction

The Behringer MX400 as standard.

I bought this little mixer maybe 8 or so years ago and used for a while. But then I made **my own mixer.** After watching bands, groups, duos, or even solo artist spending lots of time setting up their PA system I wanted to make something that was preset. Just switch on, adjust the volume to suit the location and play.

And it worked. It was fine for balanced miking - where each of us (we are a duo) only have one mic and it picks up the instrument and the vocals. Typically if the mic is equidistant between the instrument (usually a guitar) and the mouth then it sounds fine. Around 9" (or 20-25cm) seems to work for us. We can also use one mic between us. This used to be standard in folk clubs where they only had one mic.

But in a noisy environment, there is a sharp limit to how far the gain can be turned up before feedback howl sets in. Moving the mic closer to the mouth will increase the vocal volume and reducing this distance to around 3" makes a huge difference. But now the vocals will vastly overpower the guitar. The first solution is to use a separate mic for the guitar. This is very common in open mics in pubs where the instrument does not have a pickup.

The Modified Mixer

But feedback howl can still come in if the gain is turned high, This is not helped by doubling the number of mics on the stage.

The next step is to move even closer, and some performers sing with their lips actually touching the mic. The guitar microphone cannot compete, so an electronic pickup is the next step.

Now most acoustic guitars sound much better through a microphone than they do through a pickup. But, for us, as the pickups would only be used in a noisy environment, the reduction in quality is unlikely to be noticed.

Requirements

I wanted the mixer to be able to handle all of the above situations, and be able to provide a pro line level output and be battery powered. With such a range, it is quite possible to inadvertently run into clipping, so a level indication was also needed.

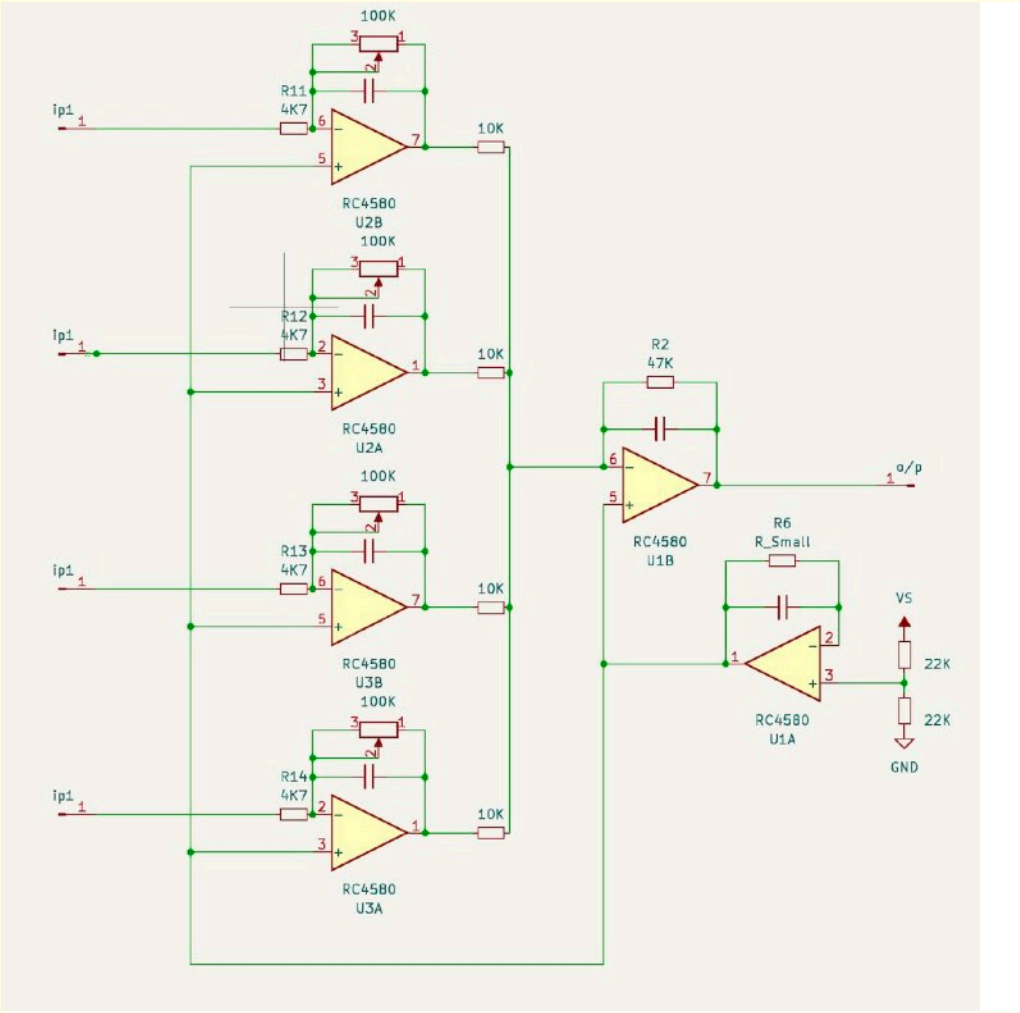
Power

The mixer preamp is battery driven from a PP3 internal battery. The Behringer mixer is usually powered from an external 12V supply. I found it worked quite happily from 9V. I fitted a PP3 battery into a battery box which I attached with nuts and bolts to the front of the mixer.

Conveniently the box has a switch.

The opamps used in the the mixer are RC4580s which work down to +/-2V. One is used to split the rail so even with a well used PP3 running down to 7V I have +/- 3.5V.

Gain



The MX400 internal (part schematic)

The MX400 has an op amp for each input with a maximum gain of 100/4.7 followed by a mixer stage with a gain of 47/10. So maximum overall gain is 100/4.7 x 47/10 or 100.

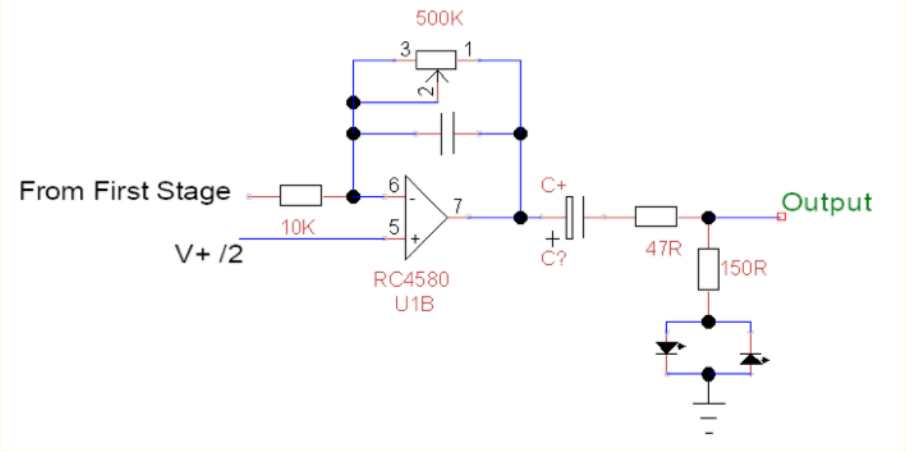
I managed to increase the gain and provide a volume control by replacing R2, the 47K feedback resistor on the mixer stage with a 500K pot.
Max gain is then 100/4.7 x 500/10 or 1064.

OR it would be if the GBW product of the mixer op amp did not reduce the gain from 50 to 47. So max overall gain is now 1000. I can get a line level (1.228Vrms) signal from a 1.2mv signal.

Magnets on the bottom of the mixer

Clipping

I did not want to providing a clipped signal into an amplifier so a clipping indication was needed. I decided to use two green LEDs connected in parallel,



The Modified MX400 output stage and the clipping detector

anode to cathode in series with a 1.5K resistor.

These leds start to come on an output of 1.6Vrms, but the output does not actually clip until 2.3Vrms by which time the leds are very bright. In practice non symmetrical signals may only light one led. As the supply voltage drops, the maximum signal will drop too, but clipping indication should still work.

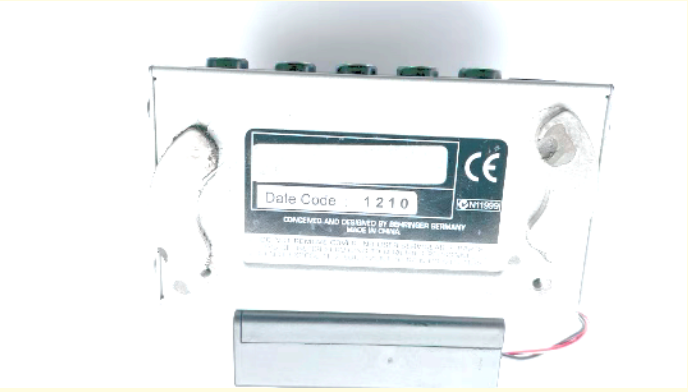
Using the clipping indication for balance

This is a nice bonus. Balance is impossible to set by ear from the playing position.

1. Disconnect the output or switch off the PA
2. Turn the Volume control to max.
3. Sing or play into one output and increase the channel gain until one or both leds are just flashing occasionally.
4. Do the same with all inputs.
5. If a particular input needs to dominate then turn the others down by a quarter of a division. This is around 3dB.
6. Turn the volume control down to zero and connect to PA
7. start singing and playing and increase volume until satisfactory, or until feedback howl occurs, then back it off a little until it stops.

Mounting

A couple of neodymium magnets (removed from an old hard drive) fix the unit quite securely to a microphone bracket. The same bracket can be used for the instrument mic.



Magnets on the underside.

The mixer on the mic bracket

The mixer and two mics in situ.

In practice

For **balanced miking**, forget about the mic on the bracket. Use either one mic between us, or two stands with a mic each. Position the mic around 9” from instrument and mouth. Turn up mic inputs to max then turn up volume till either clipping starts, feedback howl starts, it’s loud enough, or we are maxed out.

For **semi close miking**, use the mics on the brackets, Sing around 2-3” from the vocal mic and play with the instrument mic around 2-3” from where the neck meets the body of the instrument. Use the clipping indicator as detailed above.

For **close miking**, plug in the instruments, Sing with lips almost toughing the mic. Set up the balance as above.

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