Small custom four input mixer/preamp

This is about a preamp I made for personal use with our home made busking amp but it will work happily with any amp or PA system and it is also excellent for recording. It works fine with our Behringer B208D for example, and with a home made adaptor, it works fine to record onto my Iphone.

The Mixer/preamp in it's "working for a living" situation

Requirements

- Small size
- Battery Driven
- Low consumption
- Fuss free.
- Suitable for performing or recording.

Small Size

It is all contained in a 2″ x 4″ die-cast box which can be attached to the mic stand (I use a piece of an old motorcycle inner tube) or simply laid on the floor.

Battery driven

It is powered by a 9V PP3 battery.

Low consumption

It takes about 1.2mA from the battery when in use, slightly more if the clipping LED operates.

Fuss Free

There is no on/off switch, the preamp is switched on when one of the mics is connected

There is a single volume (or gain) control knob.

There is a mute button, which can be hand or foot operated.

There is a level indication LED which glows as the signal approaches saturation (at around 3.5V p-p) at the output

The preamp has four inputs and although there is an overall gain control, the relative channels gains are preset for our voices (when close miking), and our instruments.

Suitable for performing or recording.

We perform either using balanced miking (we don't plug the instruments in)– where we each have a mic around 12" away and positioned so that it picks up the sound from the instrument as well as the voice. Plug it into the amp, set the volume and go.

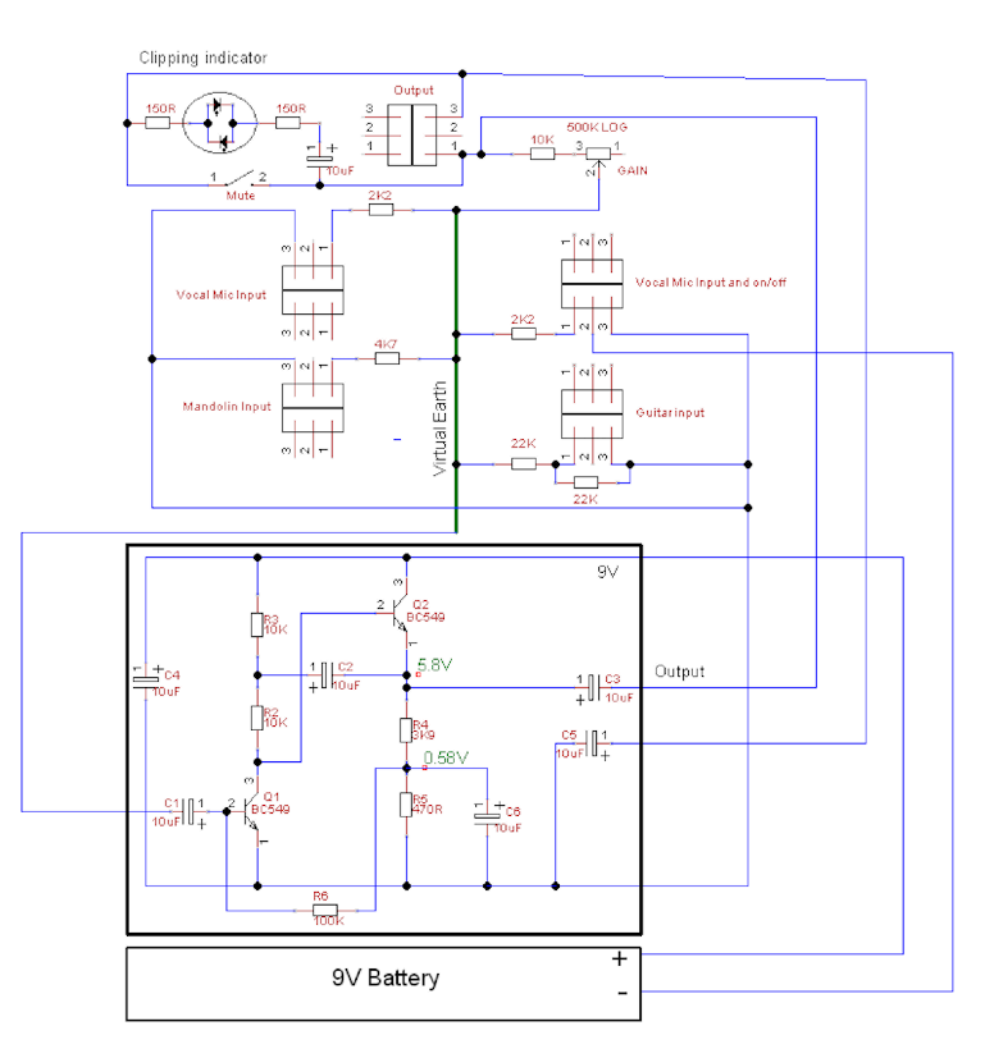
Or we use close miking where we have the mic 1-2" away from our faces, and plug in the instruments. Plug it into the amp, set the volume and go.

For recording we usually use my iphone, and balanced miking.

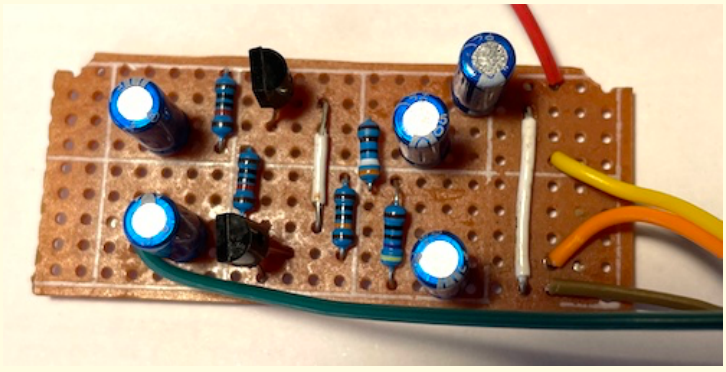
A bit battered,
it's been used quite a bit

Design

The amp is based on Rod Elliots simple mic amp. It is a very elegant, high performance, and low cost design.



I altered the biassing to make it work from 9V. A side effect of that is to increase the feedback via the biassing path. Taking into account the biassing path feedback and the open loop gain of the amp, the maximum gain of the preamp calculates out around 140 or 43dB.



Rod Elliot's Simple Mic Amp built on Veroboard

The input resistors are all “off board” for easy modification. This has proved very useful for experimentation. As the box is so small, and the connectors and battery take up so much room it would have been difficult to incorporate any more pots; but that would have defeated the object of being fuss free.

Mic interface

I use two mics, a very old and battered ElectroVoice 257A, and a Behringer X8500. Both sound good to me, and they have similar sensitivities. They both have an impedance of 150 ohms. With an input impedance of 2K2 I can get a gain of around 44dB (160).

Guitar interface.

K&K say:-

“the Pure Pickup is the best choice for achieving a rich, natural guitar sound -- even without a preamp!”

The Guitar is a Freshman FA350FBF fitted with K&K pure mini piezo pickup.

There are lots of mentions on line that it works well without a preamp. This implies they are plugging into a line input, which usually has around 10K input impedance. But strangely, most of the advice on the web says that piezo pickups should be fed into a high impedance, greater than 1M.

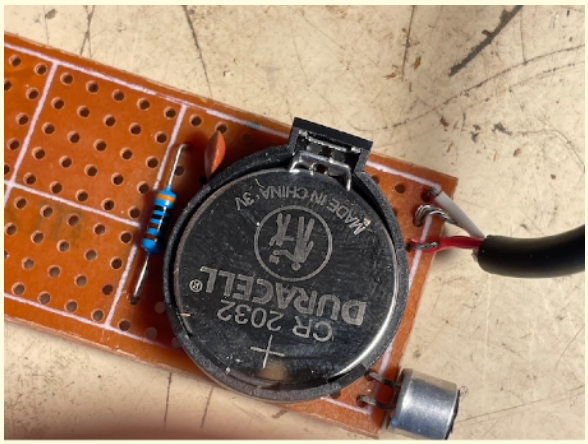
I experimented with the pickup, firstly to get an idea of its capacitance. I did this simply by measuring the open circuit output then measuring it again terminated it with a known capacitor. Using the ratios, I estimated that the pickup capacitance was 3-4nF. I assumed 3.5nF Now combined with a 10K resistor that gives a 4.5KHz turn over frequency. With a 1M resistor it’s 45Hz.

Some articles on line show the sensor as a voltage source in series with the capacitance. This would give a high pass filter. With a 4.5KHz high pass filter, very little of the bass frequencies of the guitar would come out, and it would be very tinny unless extensive EQ is applied.

The pickup is really like a current source in parallel with the capacitance. The combination with the input resistance makes it a low pass filter. With a 10K input resistance, response is flat over most of the guitar frequencies, reducing above 4.5KHz. With a 1M resistor output would be reducing with frequency over the entire audio range making the guitar sound very bassy, unless extensive EQ is applied.

But simply using a 10K resistor results in the guitar overpowering the mic. The answer is to use a 30K resistor but shunt in with a 15K resistor to ground. This reduces the input from the guitar by a factor of three, while preserving a 10K Rin.

Mandolin Interface

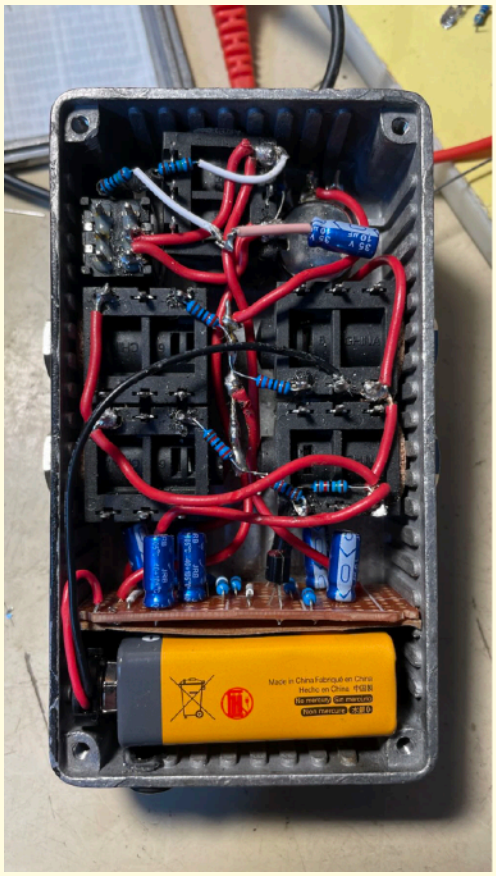


The other input suits my wife's Mandolin, which is a Kentucky KM-140S fitted with an electret mic on a home made interface board tucked under the finger guard.

It feeds into a ¼" jack socket mounted in an f hole.

I found by experiment that a 22K input provided a nice balance with the mic.

What's in the box



As can be seen, the connectors (all 1/4" jacks) take up most of the room. The inout resistors are all mounted from their socket to a virtual earth "busbar" running down the middle of the box. The battery is changed about once a year.

The innards of the mixer preamp

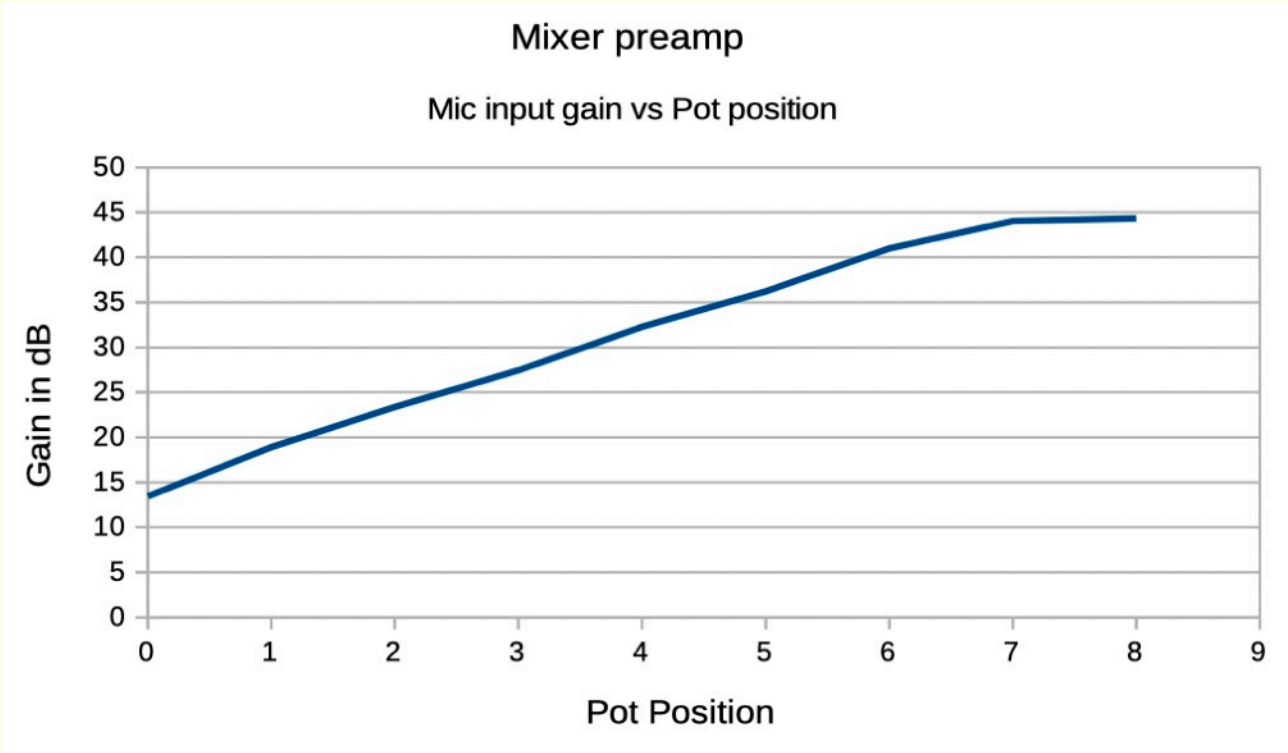
Results

I measured the maximum gain in the mic input as 44dB, which given the tolerance in the components, and the fact that my oscilloscope is decades out of calibration is not bad. I can get 3V p-p out of it (Not quite pro line level) before clipping.

We don't have a any percussion, and for the way we perform (an acoustic duo playing folk music), the peak to average signal ration will not be very high.

Rod's design is amazing, at maximum gain, the frequency response is flat to well over 20KHz and is 6dB down by 100KHz.

At the gain where it usually operates – around 25dB-30dB, it is flat to over 100KHz.



We have used it quite a bit. It is fast to set up - no soundcheck involved. Simply turn it up until we either get positive acoustic feedback or negative verbal feedback.

NOTE:- The mixer **has been modified** lately

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