

Simple Car Preamplifier and Artificial Earth

Rod Elliott (ESP)

Introduction

Prompted by a reader's question, this is a useful addition to a car audio system, especially if one wants to use a crossover circuit and other low level amplifiers. The circuit contains two audio preamps, with a maximum gain of 21dB (this can be reduced, as it may be too high for many applications).

Also provided is an "artificial earth" ("ground" for US readers), which can be used to supply a centre voltage for crossovers and other additions - such as a parametric equaliser, or even a simple graphic equaliser.

The input impedance is a minimum of 15k (it will be much more than this for most control settings), and output impedance is 100 Ohms - low enough to drive any line level input.

Description

The preamp circuit is completely conventional, and by necessity is AC coupled throughout. The artificial earth is derived by two resistors (R1 and R2), which will set the "earth" at exactly 1/2 the supply voltage. This is nominally 13.8V in all cars, since this is the proper charging voltage for a 12V battery.

To reduce the maximum gain, simply reduce the values of R5 and R105. For example, reducing these to 4k7 will provide a maximum gain of 3 (10dB), which in reality is probably enough.

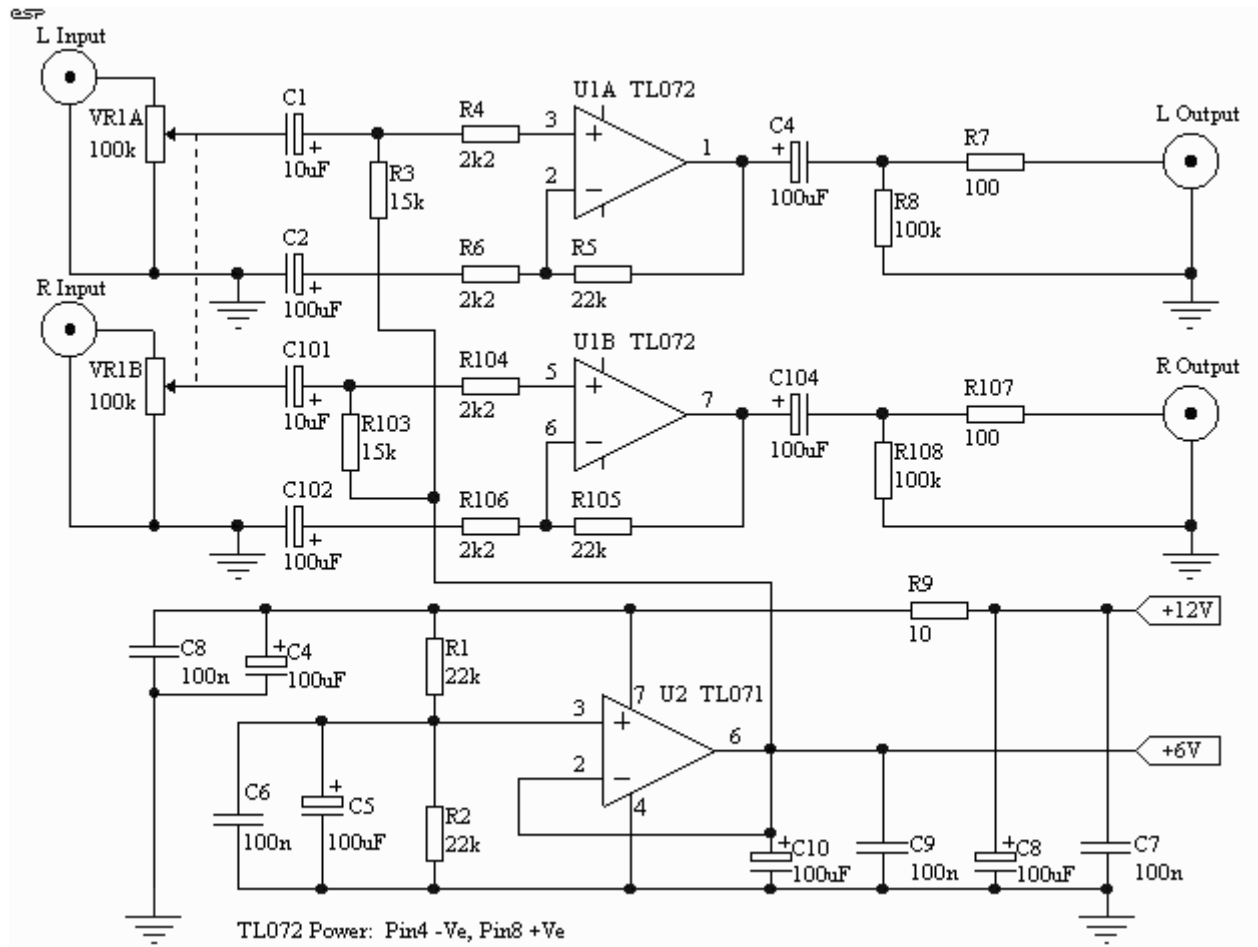


Figure 1 - The Circuit For The Preamp

There is quite a lot of filtering, because the vehicle supply is notoriously noisy. In some instances it might be necessary to replace R9 with a suitable noise filter module, or an inductor.

The artificial earth is obtained from the "6V" terminal, and is used in place of the real earth connection for the additional circuitry. It may (will) be necessary in some cases to either:

- Add input and output capacitors to the added circuitry
- Reverse the polarity of existing polarised input / output capacitors. The +ve lead of all electrolytics must be connected to the circuit, with the -ve lead as the input, output or chassis earth as appropriate.

In addition, electrolytic capacitors in feedback circuits that are connected to earth should be connected to the actual earth, not the artificial earth, or performance may suffer.

As an example, I have included the circuit for my parametric equaliser and subwoofer equaliser ([Project 28](#)), with the required modifications shown. The same principle applies to crossover networks or any other signal processing circuit.

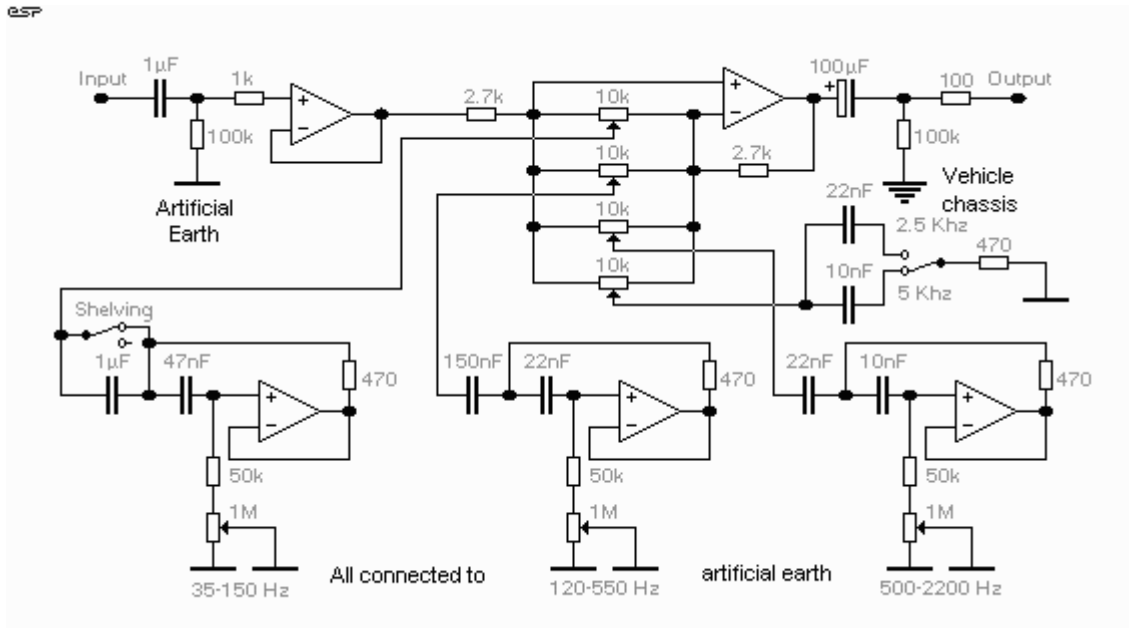


Figure 2 - Modified Version Of Project 28

As can be seen, all the original earth connections except the one new one (the "Vehicle Chassis" connection) go to the artificial earth. If this is not done, the circuit simply will not work, as it will be trying to function with the input at the same potential as the negative supply terminal on the opamp.

One word of warning - if the device you are connecting to the artificial earth is expected to have significant AC or DC earth currents (> 10mA), this system will not work. It is designed for low current (preamp) type applications only. A higher powered version could be developed from the basics presented here, but as long as speaker type currents are kept away, this design should be quite acceptable.

By the way, the above circuit would be an ideal addition to almost any car sub-woofer installation, leaving out the upper midrange and treble controls (they are not useful for a sub). Alternatively, you could have two of the 35-150Hz controls, which will give much better control of the lower bass region. The 120-550Hz control is likely to be useful to eliminate unwanted peaks (or dips) over the crossover region. You may want to lower the frequency, by increasing the value of one or both capacitors for this control. Doubling the value of either cap will halve the frequency (i.e. from 60 to 225Hz).