

Using VCU Volume Control Module with B1 Korg Nutube Preamp

By Dr. Lenny Novikov

Many DIY electronic enthusiasts are building these days a great tube preamp kit from Nelson Pass. This preamp brings warmth and smooth texture to otherwise somewhat analytical sounding solid state amplifiers.

Those familiar with the transparency and purity of the High-End audio sound also know how much it depends on the quality volume control. One of the great solutions would be to use a resistive ladder with a multi-position rotary switch. While it provides ultimate sonic purity, the large physical size, high cost and the lack of reasonable remote control options renders this solution impractical.

A great audio volume control chip from the NJR MUSES team provides a dual channel resistive ladder with 0.5dB steps and a digital control. It was highly praised and successfully used by Nelson Pass in several highly acclaimed preamps. The VCU module from AcademyAudio.com makes use of the MUSES72320 chip the most clean way with no extra elements in the audio path, and provides Volume, Balance and Mute functions from a single knob and a dedicated IR remote control unit.

For best results the VCU unit requires a clean dual +/-10V - +/-16V power supply to operate, which may be seen as a challenge while using it with a single polarity +24Vdc operated B1 Korg preamp board. This Application Note provides one of the ways to integrate the VCU volume control board with the B1 Korg preamp circuitry.

The original B1 Korg Circuit.

The original B1 Korg circuit as published by Mr. Pass is shown below at Figure 1.

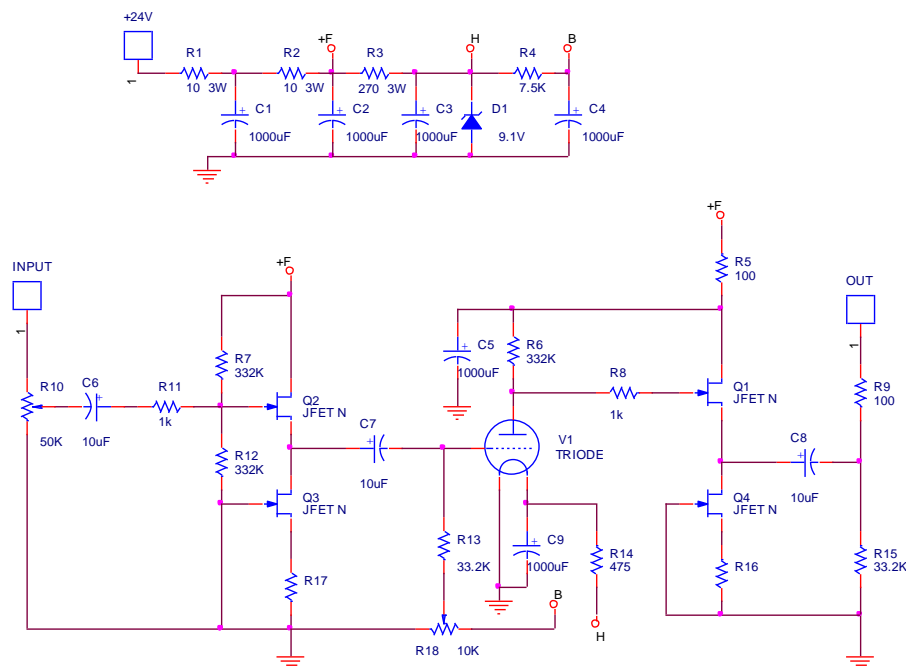



Figure 1. Original B1 Korg preamp circuit.

We took the liberty of adding reference designators to the original circuit components to simplify the discussion. They have no relation to the reference designators found on the PCB of the kit.



It is understood that the PCB carries two identical circuits for the Left and Right audio channels, that share the Nutube dual triode and the power supply circuitry.

Please note the +24V power input at the top of the diagram, and a volume control potentiometer R10 connected between the Input terminal, the common Ground and a DC blocking capacitor C6.


The Final Circuit.

The original B1 Korg preamp is powered from a 24Vdc 500mA plug-in power supply, which is connected between the +24V terminal and the Ground terminal . The power filter circuitry on the PCB reduces the ripple and noise coming from the power supply to usable levels.

This simple and elegant solution, nevertheless, can be improved upon. The improvement involves using a Low Noise dual power supply board **LPS9** to power the B1 Korg circuitry, which makes the use of the VCU volume control board very straight forward. Please refer to **Figure 2** for a complete circuit diagram.

IMPORTANT: We introduced a new ground (GND) symbol , which is **not equivalent** to the kit Ground .

The kit Ground is now connected to the **-14V** terminal of the LPS9, and the **+24V** terminal of the kit is connected to the **+14V** terminal of the LPS9. That brings the total voltage at the **+24V** terminal with respect to the kit Ground terminal to +28V, which makes the **+F** anode supply voltage 4V higher than before. This change does not adversely affect the circuit operation, since the bias voltage **B** and the heater filament voltage **H** stay the same as before.

The newly introduced GND  terminal becomes a reference point for the audio signals. It is also used as a power ground for the VCU volume control board and a MUTE relay circuit.

To accommodate the audio reference point change we need to change the original B1 Korg circuit as follows (Refer to the Figure 1 circuit.) :

- Remove resistors R7 for both channels.
- Short out C6 caps for both channels.
- Change C8 caps for a non-polar audio type.
- Connect resistors R12 and R15 to the COM_L for the Left channel and to the COM_R for the Right channel as shown on Figure 2.
- Connect capacitors C12 and C13 between the GND and the kit Ground as shown on Figure 2 to eliminate the noise pick up from the wiring.

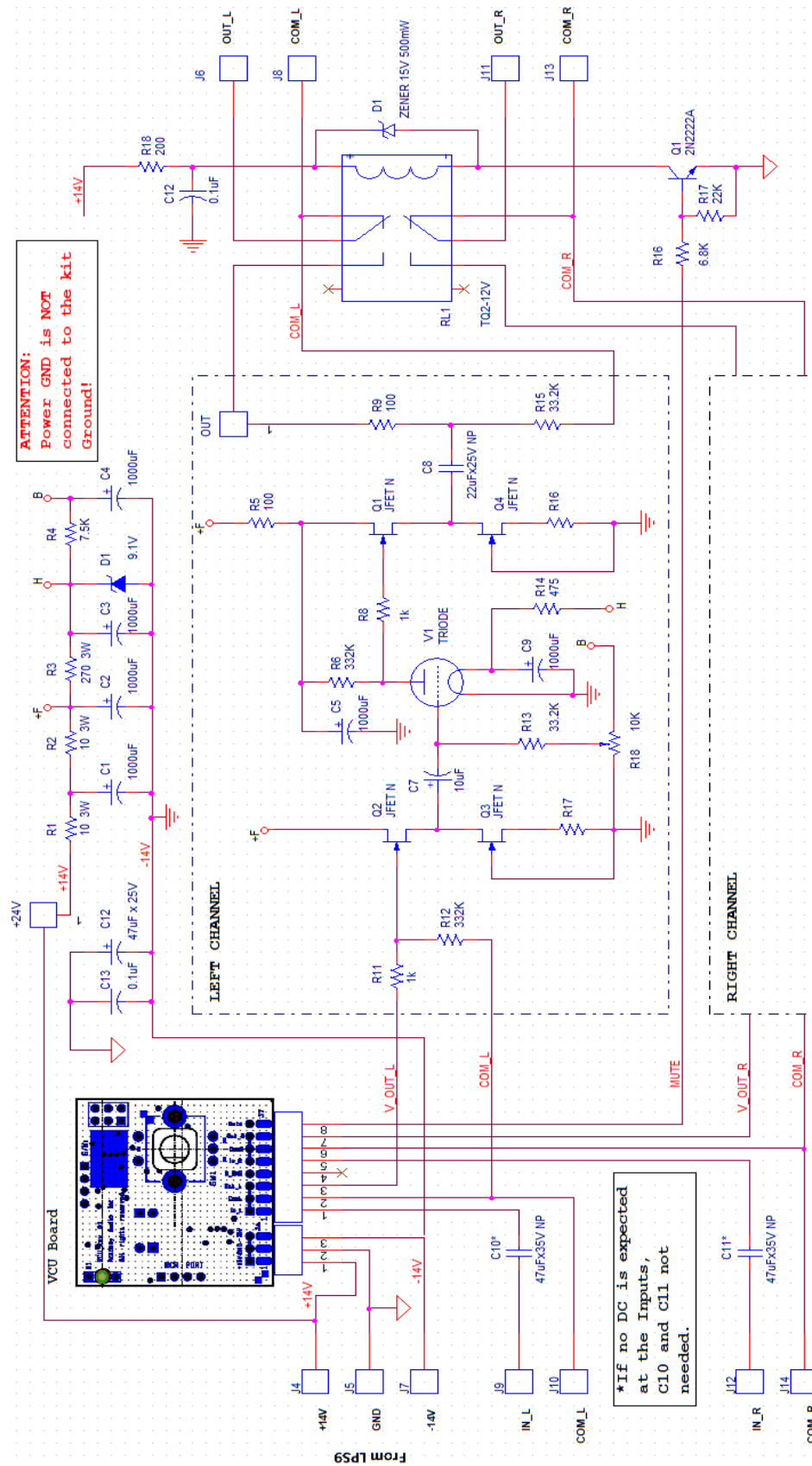


Figure 2. Complete Circuit.

Muting Relay Circuit

The B1 Korg circuit provides an audible “thump” at turn on while the capacitors get charged. This is typical of single supply audio amplifiers. Using a dual power supply changes the magnitude of the “thump” but does not eliminate it completely. A Muting relay with a delayed turn on is a proven solution to this problem.

The VCU board provides a control signal (active High) for the Muting relay with a 1.5 seconds delay at start-up and turns off the relay immediately when powered down. Any good quality 12V rated signal relay can be used as RL1. The TQ2-12V non-latching signal relay from Panasonic is widely available and proven to work well for this application. The relay takes less than 12mA to operate and does not degrade sound quality. The proposed circuit was calculated for this particular relay type.

A low power NPN transistor Q1 drives the Muting relay RL1 from the +14V power through the voltage drop resistor R18. A Zener diode D1 with a capacitor C14 take care of the inductive properties of the relay coil.

Any 12Vdc DPDT signal relay with working current less than 60mA can be used in this circuit. R18 value should be adjusted to accommodate the relay current change as follows:

$$R18 = 2V / (\text{relay current})$$

Note on Power Supply

Some of the LPS9 low noise power supply properties make it a great match for this application. It provides sufficient current in excess of 300mA per rail, while keeping the noise below 10uV and providing very low output impedance in the audio frequency range. Any electromagnetic artifacts that may be picked up by the audio circuitry lie well above 200 kHz, and do not affect sonic quality. Any substitute power supply should provide similar specs to achieve comparable sonic results.

Circuit Setup

Mr. Pass in his article provides recommendations on the test point voltages that refer to the +24V power supply. With the proposed dual power supply arrangement, some of the test point voltages will change as follows (Note, the voltages are taken referenced to the kit Ground):

T1 = 28V

T5, T6 = approx 0.6V

T2 = 27.2V

T7, T8 = approx 15.3V (the 2nd harmonic null point)

T3 = 26.5V

T7, T8 = approx 12.8V for the reference settings.

T4 = 9V

Conclusion

If you liked the sound of your B1 Korg preamp before, you will like it even better now. Enjoy the added benefits of the remote control.

Happy Listening!