

# Academy Audio Inc.

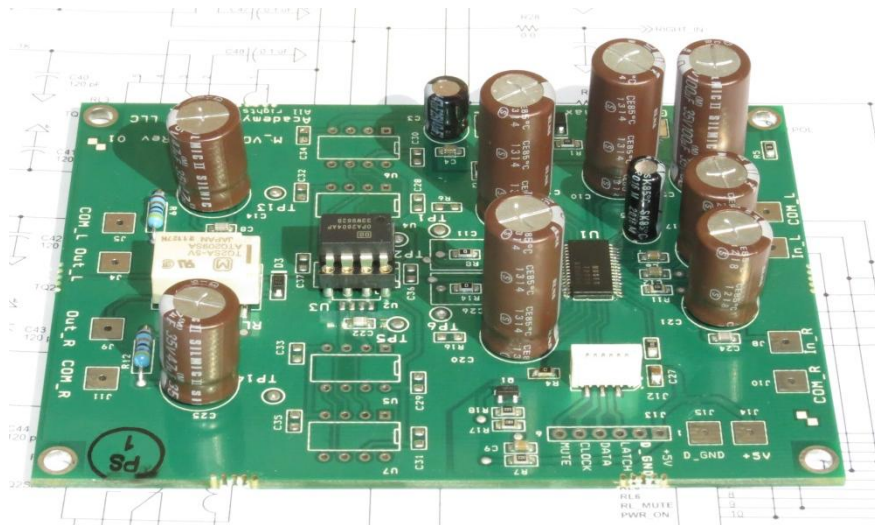
discovering the soul of music®

## Hi-End MUSES® Electronic Volume Controls

Ver. 01

## User Manual

Rev. 02



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## 1. Introduction

Thank you for purchasing the Hi-End MUSES® Electronic Volume Control Board from Academy Audio Inc.

The Hi-End MUSES® Electronic Volume Control board is a complete ready to use two channel volume control unit that requires a power supply and control signals to operate.

The unit is built using a unique NJR MUSES®72320 volume control chip. Unlike other electronic volume control chips, this chip does not include any active circuitry, and therefore provides vanishingly low level of noise and distortions.

The high quality output opamp is installed in a socket, and may be replaced by any dual JFET opamp with the standard pinout. The bipolar type opamps can also be used with a few extra components placed in the provided footprints. The board also features extra footprints for single opamps, and dual ones with just one section used. The board can be used with an outboard amplifier/buffer section or without any active amplifier/buffer.

A high quality MUTE relay is provided to eliminate any unwanted noises from power-up/power-down processes.

## 2. Mechanical Installation

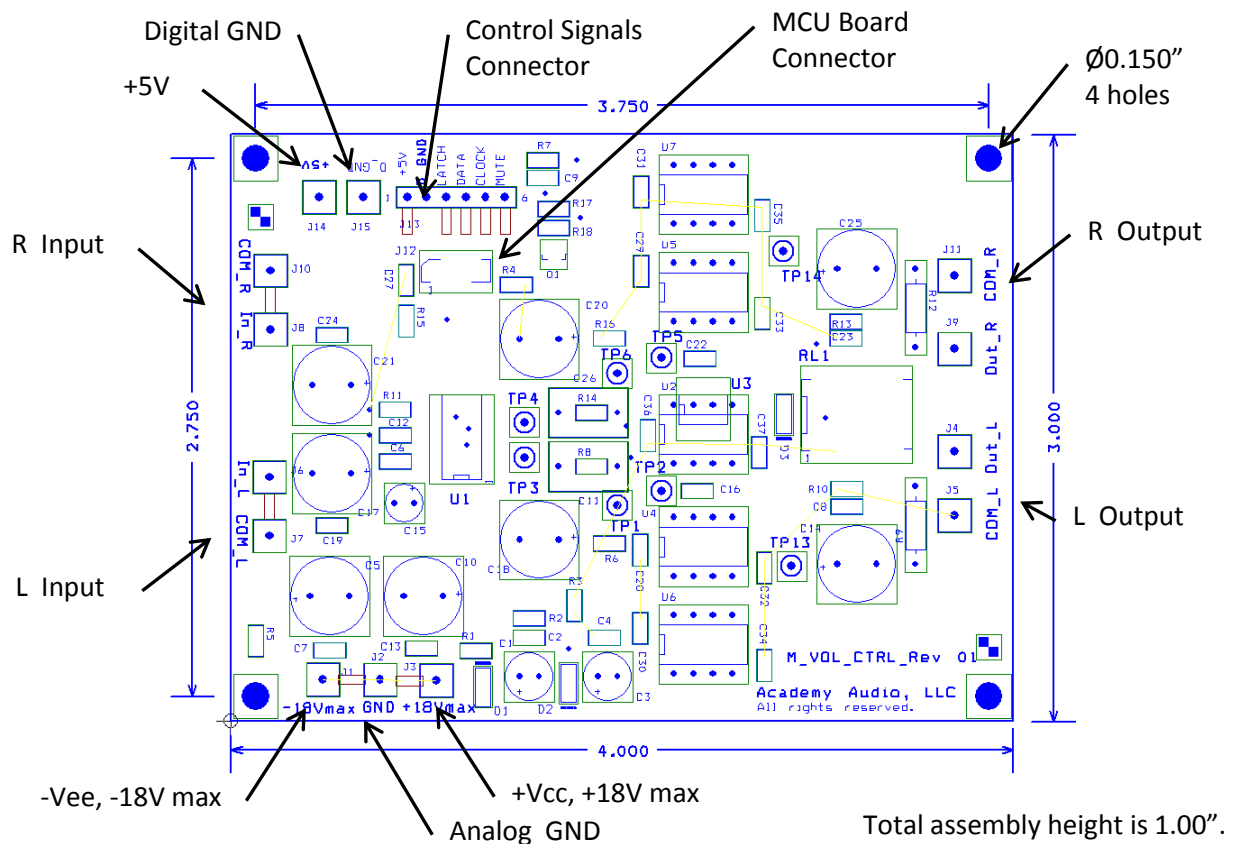


Figure 1. Volume Control Board Connections.

Refer to Figure 1 for mechanical dimensions and mounting holes location. To install multiple Volume Control boards use at least 1.000" long spacers, and position the boards on top of each other.

### 3. Power Connection

The Volume Control board requires the following power sources to operate:

1. Digital power source of +5Vdc, 200mA (Including an optional MCU Control Module)
2. Clean analog bi-polar power source of  $V_{cc}=+12Vdc$  to  $+18Vdc$ , 100mA and  $V_{ee}=-12Vdc$  to  $-18Vdc$ , 100mA.

Use J14 and J15 connection points for Digital power. Use J1 – J3 connection points for Analog power.

Please note that the left bottom mounting hole of the board is connected to the digital GND. If this connection is undesirable, remove the resistor R5.

When multiple boards are installed in a stack, use a 20AWG bus wire to connect the power in parallel between the boards using the power pads center holes.

### 4. Control Signals Connection

The Volume Control board features a control connector J13 with the following connection points:

1. +5V	Digital Power for external controller
2. D_GND	Digital Ground for external controller
3. LATCH	LATCH MUSES Control Signal Input
4. DATA	DATA MUSES Control Signal Input
5. CLOCK	CLOCK MUSES Control Signal Input
6. MUTE	Mute Control Input. Active High – Mute Off

If an optional MCU Control Board is used, all control signals are provided through the connector J12.

For multiple boards installation the control signals may be paralleled using rigid pins installed in J13 pads.

### 5. Audio Signals Connection

Refer to Figure 1 for Audio signals connection. Note that the Left and Right common connections are routed independently throughout the board, and connected to the analog ground by resistors R3 and R4. It is recommended to use isolated ground audio connectors to ensure the lowest cross talk and noise pick-up. Make sure the input signals do not exceed 9Vrms at +/-15V analog power.

### 6. Using the Volume Control

The volume Control Board has a quality dual opamp installed and is ready to use. Use the Volume Control as a regular dual channel potentiometer based volume control. Use two boards for balanced operation.

IMPORTANT: When de-energized, the muting relay RL1 disconnects the outputs from the audio output circuitry and connects the board audio outputs to their respective common lines. It is recommended to energize the muting relay after a small delay of about 1 second from the application of power to the board.

Please refer to the MUSES®72320 volume control chip datasheet for detailed operation description. The Volume Control board has the MUSES®72320 volume control chip hard wired with the chip select address of 000.

## 7. Break-in Period

High-End audio enthusiasts are familiar with the “break-in” phenomenon: the sound gets better with time. In engineering terms that refers to reduced distortions of the audio signal. This distortion reduction may be attributed to priming of the capacitors and all the contacts in the audio path. A noticeable sound improvement is expected after about 100 hours of listening.

## 8. Advanced Use of the Volume Control

The Volume Control board is designed as a versatile “playground” for advanced users. The unique properties of the MUSES®72320 volume control chip open extensive possibilities for sound quality improvements.

### *Experimenting with Opamps.*

Feel free to experiment with any +/-15V powered standard pinout dual JFET opamp using the provided socket U2. It is also possible to use a SOIC-8 SMT dual opamp using a U3 footprint located under the socket U2, when the socket is removed.

Use U4 and U5 footprints for +/-15V powered standard pinout dual JFET opamps, when only one channel of each chip is used to improve channel separation. Install 0.1uF 50V 0805 capacitors in C32 and C33 footprints.

Use U6 and U7 footprints for +/-15V powered standard pinout single JFET opamps. Install 0.1uF 50V 0805 capacitors in C34 and C35 footprints.

To use bipolar input opamps in any of the mentioned above configurations, remove jumper resistors R8 and R14. Install quality polypropylene 1uF capacitors in C11 and C26 footprints, and 470K 0805 SMT resistors in R6 and R16 positions. The resistor values may require tweaking depending on a type of an opamp used. Do not use resistors below 150K.

For a completely passive volume control solution, remove the opamp from the socket U2 and connect Tp1 to TP2, and TP5 to TP6. Remove resistors R10 and R13. Note, that the gain section of the MUSES chip is unavailable in this mode and a high quality buffer should be used in the downstream circuitry.

### *Experimenting with Capacitors.*

It is well-known that capacitors in the audio signal path affect sound quality. The Volume Control uses high quality ELNA Silmic II electrolytic capacitors in the audio signal path circuitry.

Feel free to try other capacitor types in place of C14, C17, C18, C20, C21, and C25. Make sure the voltage rating is not lower than 25V. Good results may be obtained using quality bi-polar audio electrolytic capacitors and polypropylene film capacitors.

**Provide enough time for break-in before evaluating the results of your experiments.**

## **9. Technical Support**

For any questions regarding operation of the Volume Control board and for the latest documentation please visit us at [www.academyaudio.com](http://www.academyaudio.com).

Happy listening!