8 CHANNEL VOLUME CONTROL

**Inputs:**
8 LINE LEVEL RCA INPUTS (5V RMS maximum, 10 V RMS with jumper)

**Outputs:**
8 VOLUME CONTROLLED RCA OUTPUTS (5 V RMS Max)

**Attenuation Range:**
-70 dB to +10 dB

**Step Size:**
1 dB per step

**Trim Range:**
26 dB in 1 dB size steps

**Options:**
Channel mixing
Optional low pass filtering
Audio and Home Theater applications
Master Slave Configuration for 16+ channels or remote locations
Thank you for purchasing the powerful MVC. We are sure you will be very pleased with it.

*At least 100 hours of burn-in is recommended on most MSB products. Customers generally recommend one month.*

**Setup and Quick Start**

The front panel is quite simple with few user controls. Plug in analog inputs and outputs and adjust the volume with the volume up and down buttons.

**Power**

The MVC comes with a desktop power supply. It is either 120V or 240V and is not switchable. The MVC operates with the MSB P1000 heavy duty power supply. A switch on the back allows it to be switched between 240V and 120V. Please check your setting before plugging the unit in. Leave the MVC powered on all the time.

**Inputs and Outputs**

The MVC has 8 inputs and 8 outputs. In the factory configuration, each input corresponds to the output with the same name. They have been labeled with Home Theater style names but are all of equal quality and can be used interchangeably.

**Theory of operation**

Like most of MSB’s products, the design and technology of the MVC is unique in the industry. Volume controls, or preamps fall into two categories: active and passive.

Passive volume controls are usually simple products which use a variable resistor, or a series of resistors (stepped attenuator) to reduce the audio signal amplitude by creating a resistive divider between the signal and ground. A 2 volt input can be reduced to near zero with infinite steps as with a variable resistor, or discrete steps as with a stepped attenuator. These volume controls do not provide any gain and normal listening levels are usually near full volume, depending on speaker efficiencies. These controls are also usually manually controlled with little or no features. Passive preamps do very little to color or change the quality of the sound, but at the price of inconvenient use.

Active volume controls (preamps) are usually based on a voltage-controlled amp (VCA). Many IC makers provide integrated volume control packages; other products are made discretely. They usually include gain, so a higher-level signal can be output than the input signal. They also usually include many automated and remote functions. The problem with all active preamps is that they always color the sound, and the vast majority produce significant degradation in sound quality.
MSB has been producing DACs (digital-to-analog converters) for 15 years and is very familiar with the quality issues associated with this interface. Simply, some DACs create an analog voltage by applying a reference voltage to resistors of different values. The application of the voltage is turned on and off with a switch, and the resistor is an analog element very much like the resistors used in a stepped attenuator volume control. By applying a DAC to volume control, MSB has created the “4096 level digital stepped attenuator”. The volume control is actually a ladder of resistors that are switched in and out using the digital information provided to the DAC. A buffer with 6 dB is provided on the input and output of the DAC so 12 dB of gain is available, but as far as the signal is concerned, resistors are being switched in and out to change volume. In keeping with MSB’s minimalist design approach, the signal path is very short, and at no time does the audio pass through a capacitor, a serious source of phase error. Unlike most volume controls, the MVC’s digital control is shut down when playing music. It only becomes active when the volume is changed. It is not constantly updating the volume, creating digital noise as some VCAs do.

As shown on the block diagram, the first four channels pass cleanly through the MVC. The second include a summing feature allowing the mixing or duplicating of channels and an optional low pass filter. These additional features have no effect on the quality of the main four channels. This manual will describe many applications for these features.

Testing and Development

The MVC has been over 2 years in development. We set a very stringent requirement that in our most revealing system, the MVC had to be indistinguishable from a cable with a resister to ground. We built such an A/B test system and started listening. We tried all the “favorite” chipsets but always could spot the volume controls contribution to the sound. Finally the MVC we are now producing was created and extensively tested. Over and over in blind A/B testing, the group could not tell which was the cable and which was the MVC. We encourage you to use and enjoy the MVC in the most demanding applications with confidence.

Front Panel Controls

Mute – Mutes the audio outputs of all channels immediately. Can be activated on the front panel or remote. Causes the volume indication LED to blink fast, and allows the volume to be adjusted up and down quickly. A second press releases the mute mode.

Volume Up and Down – These buttons adjust the main volume control, changing all the channels at the same time. Can be activated on the front panel or remote. They are also used to adjust the trim levels while in the setup mode. Each button click is 1db change. Each LED is 5 db so the button must be pressed 5 times to see an LED change. Holding the button continuously steps the volume.

Setup – This button places the MVC in the setup mode. The red Setup LED turns on when in this mode. In the setup mode, the first channel, the LF channel is indicated by the farthest left LED being lit. The trim level is also indicated starting at the 13th LED from the LEFT. 8 LEDs worth of trim can be adjusted for each channel using the volume up / down buttons. Pressing the button again shifts to the C channel, the second LED is now lit and again, the level is indicated. The process is repeated 8 times until all channels are set. The unit is back in the normal mode and the new trim settings will be remembered until changed. To reset all trims, hold setup and mute together for 15 seconds.

Volume Display – A long row of LEDs indicates the volume setting. Each LED actually represents 5 volume steps. To reproduce an exact setting, count the number of button clicks from the change in LED. Each button press is 1 dB, each LED is 5 dB. The range of the MVC is reduced by trim increases. See section on this topic.

LED response to single volume steps

Display showing the Setup Mode

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<tr>
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<th>C</th>
<th>RF</th>
<th>RR</th>
<th>LR</th>
<th>S</th>
<th>A1</th>
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Initial Volume 3 dB
Click, volume = 4 dB
Click, volume = 5 dB
Click, volume = 6 dB
Click, volume = 7 dB
Click, volume = 8 dB

4096 level digital stepped attenuator
**Rear Panel Details**

8 Analog Inputs – The 8 inputs have an impedance of 50K. They are all equal although some can be mixed and some cannot.

8 Analog Outputs – The 8 outputs have an impedance of 50 ohms. They are designed to drive any high end Amplifier directly.

Microphone – The microphone input is provided to support a future auto setup feature. It is not activated on this product release.

**MSB Network** – This CAT5 connector allows a second MVC to be attached in a slave mode. It can be independently set up with each trim separately set, but will follow the “master” unit in setting master volume control and mute commands. This feature is very useful in a large home theater when it is an advantage to place a second MVC in the rear of the room. A digital signal can be run the full length of the room, and one or more DACs and the “slave” MVC are placed in the rear to decode and control the rear channels, subwoofers and sides if used. The MSB Network connection can also be used as an input making this unit into a slave. With the addition of a Network DAC, the Network input can also input 6 or 8 channels of 192K digital audio.

DB-25 -- This connector becomes a second 8 channel input when the Network DAC is installed. The input is automatically sensed an switched when audio is present.

**Toggle Switch** – Controls switching with optional Network DAC.

**Setup Operations**

Setup involves two parts. First, the overall configuration is chosen and any internal switches can be set as shown. Then the final levels are set.

**Configuration Options**

The MVC can be configured for audio and home theater applications. We have listened to this product in the most demanding audio systems and are confident that you will not find a more neutral 2 channel volume control.

Configuration is accomplished with user settings inside the product.

**Opening the MVC**

Place the MVC on a soft surface like a tablecloth or carpet. Disconnect the power supply. Remove the three philips screws on the back edge of the cover. Turn the MVC over and remove the three philips screws from the front edge of the cover. Carefully separate the base from the cover. Pick up the base and flip it over, placing it inside the cover. Take care not to disconnect the ribbon cable to the front panel. Place the MVC so that the RCA connectors are facing AWAY from you. This way all the diagrams will be oriented correctly.

The photo shows the location of the switches and jumpers. The following diagrams and switch settings show what can be done. First we show the standard factory settings in a stereo application:

### Stereo - Standard Configuration

![Stereo Standard Configuration Diagram](image)
Bi-Amp and Tri-Amp configurations can be supported. In these cases, the outputs shown all have the same inputs duplicated on two and three pairs of outputs. Each channel of output has an independent trim volume and is adjusted using the master volume control.

If separate subs are used with a stereo system we can make both stereo and mono subs. The low pass filters can be implemented which have a 3 dB point at about 120 Hz. Notice that the AUX C channel is made by mixing the R and L front channels. This sum results in a higher level signal. The 6 dB cut feature is implemented with a jumper which reduces the combined level to a level equivalent with the others.
Home theater applications are equally flexible. The basic 6 channels are provided and the extra two can be used for extra subs, center, or sides.

Bass management is always one of the biggest challenges with a home theater system. If the subs are only attached to the sub channel, no bass is heard when a CD is played. The MVC allows bass from multiple sources to be blended. In the following case the sub channel is derived from the sub input as well as the bass from both front channels. The AUX outputs are stereo subs from the front R and L blended with the extra sub channel. The mix balance is set using the L and R main trim pot next to the switches.

Here side channels are derived from the front and rear on each side. The percent of front and rear are adjusted using the Main Trim pots. The 6 dB cut equalizes the levels.
Here a center rear channel is made by blending the rear channels. This works if you have a rear center speaker but your processor does not support the center channel yet. Alternatively, if you purchase an add-on outboard center channel processor, the AUX I and AUX 2 output can be selected to duplicate the R and L Rear channels and can be hooked up to the processor to create a new trimmable center without changing the rear channels. If you want to run all the rear channels through the outboard box, then the R and L Rears are hooked directly to the outboard processor, and all three new outputs are input to the MVC.

One of our favorite setups for home theater is two fronts and two rear channels. Here the center is downmixed into the fronts. In large screen applications it is rarely advantageous to have the center channel narrowly focused in the center of the screen, even when the action is moving. The problem can be eliminated by downmixing the center to the fronts, or by installing two centers, also an option with the MVC.

The MVC can also be used for other kinds of applications. Here is a 6 channel mixing board. Three stereo pairs are input. The volume of each can be set independently in the mix. The blended mix is output on the AUX outputs. Notice that 1A and 1B the fixed inputs with no trim adjustment. The level of 2A and 2B are set with the MVC rear channel trims and can be further cut using the 6 db cut jumper as shown. Inputs 3A and 3B have their levels set using the internal pots L Main and R Main trim. Although not designed for mixing, the MVC is very flexible with many applications.
**Master Slave Mode (Optional)**

An MVC can be set up to act in a slave mode. This requires a different microprocessor. You may convert an MVC back and forth between SLAVE and MASTER mode by replacement of the microprocessor. It is a simple matter to replace the chip in its socket.

A slave MVC ignores volume and mute commands it receives directly from its front panel or remote, but looks only to the MSB Network on the back for volume directions. It will always match the master MVC. It is separate, however in setup. You set up the volume trims on the slave unit just like you do on the regular unit. This allows you to set the Aux outputs differently in the slave unit.

**To convert the MVC**

Place the MVC on a soft surface like a tablecloth or carpet. Disconnect the power supply. Remove the three philips screws on the back edge of the cover. Turn the MVC over and remove the three philips screws from the front edge of the cover. Carefully separate the base from the cover. Pick up the base and flip it over, placing it inside the cover. Take care not to disconnect the ribbon cable to the front panel. Identify the large microprocessor chip installed in a socket U13. Remove the chip by prying up on each end equally. Insert the new chip and press in firmly. Close up unit. Keep the Master Microprocessor in an antistatic bag or on antistatic foam.

**To Operate**

Connect the Slave MVC to a Super DVD Audio Player or another Master MVC unit with a MSB Network cable. Change volume on the master unit, and the volume will track on the slave unit. If a network DAC is installed, audio will be produced in the slave unit that exactly matches the master unit.

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**Network DAC Option**

MSB has developed a 6 channel DAC. This is used to convert digital audio signals to Analog signals. Four upgrade headers can be found inside the MVC as shown. To install this optional DAC, press the DAC firmly in place on these connectors. (See disassembly instructions above).

**To Operate**

Connect the MSB Network input on the MVC with any MSB source using an MSB Network cable. MSB offers Network outputs on its CD and Super DVD Audio players as well as upgrades to any digital source such as CD players, DVD players or Surround Processors. The MSB network takes priority over any other input, so you will always hear the Network input when it is active. This upgrade also activates the DB-25 input on the back of the MVC. This is an additional 8 channel analog audio input. It has auto sensing so it takes priority over the standard 8 RCA inputs only when audio is present.
The Toggle Switch

The toggle switch has three positions and places the DB-25 input switching in a manual and auto mode.

* When the switch is down, the standard RCA connectors are selected as the input.
* When the switch is in the center position, the DB-25 input is automatically selected only when audio is present. The Network input is selected if it is active.
* When the switch is up, the DB-25 input is always selected, unless the Network is active.

In this case the Network is always selected.

REMOTE

The MSB remote contains two functions. The top bank of 4 buttons exactly duplicate the function of the equivalent buttons on the front panel of the MVC. The button labeled MODE on the remote is equivalent to the SETUP button on the front of the MVC. The lower bank of buttons control the basic functions of MSB's CD player. The buttons will have no effect on the MVC. Batteries are not shipped in the remote. Two AA batteries are required.

FINAL SETUP

Once the configuration is set up, it is time to set the trim levels. It is best to leave all the trims at the LOWEST possible volume. That gives you the maximum resolution and range for the master volume control. As the trim levels are increased, the total range of the master volume control is reduced. Why is this you may wonder. For two reasons: First, we want to offer the best performance for audio users with trims off straight out of the box. We use the full range of the volume controls with trims off. The logical way to make trims would then be to trim down any channel that is too loud. But the second reason we did it the way we did is that most home theater users are used to trims going up, not down. When they hear a quite channel they expect to increase it, not reduce all the others. So when you increase the trim of one channel, you are actually reducing the volume of all the others instead. So that you do not hear this change, we re-map the channels, but simply shift the display so you can see what has happened. That is why when a trim is set to full volume, the master volume setting will not display the lowest setting even though the MVC still operates at the same setting.

Here are the setup steps:

• Start by listening to test material, either using tone generators in a processor, or better using a test disc. Use an SPL meter for accurate measurement of level. In the case of a Bi-Amp application, you must use test tones that fall in the middle of each frequency range for the driver you are setting up.

• Set the master volume control to a comfortable level.

• Review all the channels separately by pressing the Setup button once for each channel. If the trim is not at the lowest setting, press the volume down button until it is. Each setup button press jumps to the next channel. The Setup LED remains on through all the channels and turns off when you have completed the cycle. When each channel is selected, all the other channels are muted so you can hear the one channel alone.

• With all the channels set at the minimum trim, you can now determine the highest, or loudest channel. This will be your reference channel. All other channels will be raised to meet it.

If the highest level, or loudest channel or channels is much higher than the rest, it would be worth removing the cover and inserting a jumper in the 6 dB cut position on that channel to bring it in line with the others. For example, if the center channel is much louder than the rest, reduce it internally so setup is easier, and less trim volume is required.

• Assuming you have identified the loudest channel and all the channels are close, you are ready to begin the setup. Play your test tone and toggle to the loudest channel using the setup button. Measure the level with your meter.

• Now without changing the position of your meter or anything, toggle to the next channel and use the volume up button to adjust the level to give you the same reading.

• Repeat the step for all remaining channels.

When you toggle to through the last channel, the MVC will leave the setup mode and the setup LED will turn off. The MVC is now ready to use. Any time you wish to change a channel trim, you may enter the setup mode again and toggle through your settings. They will not be reset or lost. Adjust the channel in question, and the others will remain unchanged. Too reset all the trims, press Setup and Mute at the same time for 15 seconds.
Troubleshooting

No LEDs lit on the front - The unit is not getting power. Check the outboard supply, check the AC power. Make sure the power DIN cable is oriented correctly and plugged in firmly. Make sure the voltage is correct.

No sound any channel - Make sure you are not in the setup mode. The Setup LED should be out. Turn the volume up, if you hear nothing, you probably do not have your connections right, or your AMPs are off. Double check the Inputs are on the left (from front of unit) and outputs on right. Unplug one input and output and touch them together only with a very soft passage playing! If you do not hear anything, the problem is not the MVC.

No sound from some channels - Swap the output from a working channel with the output of a nonworking channel. If it still does not work, the problem is not the MVC but the AMP or Speaker. If it does work, then put them back and swap the inputs on the same channels. If it still does not work, the problem is the source on that channel. If it does work, the problem is with the MVC. See next item.

No sound from the Cent. and Sub. Outputs - One of the DIP switches for those channels may not be on. If no switch is selected, no output will be heard.

All LEDs are lit on power up - After a long time (many weeks) with no power, the trim memory may be lost. Hold down setup and mute for about 15 seconds and the unit will reset and all but one LED will turn off. The unit is now ready to use or setup.

The volume will not turn all the way down - The lower volume LEDs are always lit when the trims are turned up. This is normal.

At the lowest volume I still here something - This is normal. The lowest volume is -70 db

The volume goes up and down very slow - To move the volume fast, first press mute. Then the volume goes up and down very fast.

Troubleshooting with Network DAC or SLAVE mode installed

The controls do not work - SLAVE mode disables the volume controls.

No Sound - Check the toggle switch. It should be in the center position. Check Network connection. When source is turned on, you should here relays click on Network DAC.

Warranty

All MSB products carry a one year warranty. No returns accepted without an RMA. Upon receipt, MSB will repair or replace any defective product. All product shipped FOB La Honda. Shipping and shipping damage is the responsibility of the consignee.