
**Shaka-8** Voltage-Controlled Stereo Matrix Mixer

**Shaka-4** Stereo Matrix Expander

User's Manual v0.1 - Eurorack

*Final specs subject to change*

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Hello and thank you for using the Shaka-8 Voltage-Controlled Stereo Matrix Mixer and Shaka-4 Stereo Matrix Expander for Eurorack. We hope you will find it to be a joy to explore.

The Shaka-8 is a Stereo Matrix Mixer with an all-analog signal path, meant for use with Audio signals. While it is similar in function to other Stereo Matrix Mixers, the Shaka-8 allows for voltage control over each matrix patch point, i.e. the send level of each L/R pair of inputs to each L/R pair of outputs.

In addition to the 4 input and 2 output channels on the Shaka-8, the Matrix may be expanded to a 4x3, 4x4 or more matrix mixer by chaining Shaka-4 Stereo Matrix Expanders to the main unit via the 12-pin connector labeled “EXPANDER” on the back of the Shaka-8.

**Shaka-8 Technical Specifications (Eurorack standard)**
Width: 12hp
Depth: 25mm
Peak Current Draw: 60mA @ +12V, 60mA @ -12V
Control voltage range: 0-8V p-p (-100dB to Unity Gain); 0-10V p-p (-100dB to +20dB)
Exponential/audio taper control voltage response
Input Impedance (All Inputs): 100kΩ
Output Impedance: 1kΩ
AC-Coupled Input Cutoff Frequency (-3dB High Pass): 5 Hz approx.

**Shaka-4 Technical Specifications (Eurorack standard)**
Width: 6hp
Depth: 25mm
Peak Current Draw: 25mA @ +12V, 25mA @ -12V
*Note: due to current draw and signal integrity considerations, we do not recommend using more than 5 Shaka-4 modules per main Shaka-8 module.*

1. Connecting your Shaka-8 and Shaka-4

To power the main Shaka-8 unit, connect a standard 2.54mm pitch 10-to-16 pin ribbon power cable to the header at the top of the Shaka-8 pcb. The -12V/red stripe side of the connector must be aligned with white stripe silkscreen indicator labeled “-12V” for proper use. This module is reverse diode protected, but it is still not recommended that you plug it in backwards to see what happens. *Do not attempt to connect or disconnect the power cable or any expander cables while your modular power supply is turned on.*

To connect a Shaka-4 to the back of a Shaka-8, attach the 2mm pitch 12-pin ribbon cable provided with the Shaka-4 to both the header on the Shaka-8 labeled “EXPANDER” and to either of the two headers on the back of the Shaka-4 labeled “EXPANDER I/O”. Make sure that the red stripe on this ribbon cable matches the stripe orientation on both modules.

To connect additional Shaka-4 units, simply attach another 2mm, 12 pin ribbon cable to the unused “EXPANDER I/O” header on the first Shaka-4, and to either “EXPANDER I/O” header on the back of the last Shaka-4 module in the chain. Multiple Shaka-4 units may be attached this way to provide extra output channels and matrix points for the Shaka-8.

## 2. Theory of Operation

The Shaka-8 and Shaka-4 are affordable, high quality Matrix Mixers with voltage control. These modules operate in much the same way as a typical stereo audio matrix mixer, with the send level of each input to each output controlled by the corresponding knob, and the resulting “mix” being a sum of the knob settings in each column, added to the CV input corresponding to each knob.

Each matrix point controls the level of a stereo pair, which is to say each pair of L and R inputs is “linked,” with the gain level of each side being the same, but applied independently to each side so there is no mixing of the two inputs and stereo image is preserved. Each channel is also transparent (more or less flat EQ response) over the whole audio frequency spectrum, with as little distortion as possible. With the Shaka, what you put in is what you get out.

The Shaka modules use the excellent SSI2164 VCA chip (datasheet here), in a variation of the circuit detailed in “Figure 8: 4-into-1 Mixer” to provide tightly matched, high-performance audio mixing. The response of the gain cells is Exponential, with the Initial knobs able to provide a gain range from -100dB at full Counterclockwise to Unity gain at fully Clockwise, in other words an equal amplitude presented at the output as at the corresponding input.

Any CV input patched to a Matrix jack is added to the corresponding Initial control setting, with the range of the knob corresponding to an input voltage of 0-8V. If a full-range control signal of 0-10V is fed to the CV input, or a high enough control signal is added to the Initial level, the VCA can provide a gain of up to +20dB, or approximately 10x that of the input signal. As you will surely notice, this can be pretty loud depending on the input source, so be careful of your hearing and when in doubt use external attenuators on incoming CV if range is important. The Shaka’s Exponential response means the VCAs’ sensitivity is higher with a greater CV input.

All techy talk aside, Matrix Mixers are an amazing way to expand the capabilities of one’s sound sources and modulators by introducing many different routing options. The Shaka-8 and Shaka-4 are intended to take this idea one step further with the addition of CV modulation, allowing for automation of any and all matrix points with your favorite modulation sources to create dynamic and interesting patches in stereo even with just a few audio modules.

## 3. Summary of Functions

**L/R Audio Inputs 1-4:** AC-coupled stereo input channels. All content below 5 Hz is removed from each input for highest quality audio response. If a signal is patched to a channel’s L input and the R input is left unpatched, the R input will be normalized to the signal patched to the L input so that mono and stereo signals may be summed and used together.
**Initial Level Controls:** Sets the initial gain level of each stereo Audio Input pair as it is routed to the corresponding stereo Audio Output pair, with a maximum Initial gain of 1:1 or Unity gain. Note that the input signal can be pushed *past* unity gain if the Initial Level control is turned up while external CV is also applied to the matrix point.
**CV Inputs**: Exponential Control Voltage inputs which are summed with the related Initial Gain knob to control the level of the matrix point. The Shaka-8 and Shaka-4 can accept bi-polar voltages at the CV inputs, with the Initial Level control used to compensate.
**L/R Audio Outputs:** Stereo mix outputs. The audio present at each pair of Outputs is the sum of all the input signals, at the gain levels controlled by the column of Initial knobs and CV inputs directly above it.

5. Patch Ideas

**Basic Effects Send/Return:** Patch an Audio Output channel to the Audio Input of an effect such as a delay or reverb, and patch the fully Wet output of the effect to an Audio Input of the Shaka-8. Patch up to three audio signals to the other inputs of the Shaka-8. Use the knobs and CV inputs for each audio signal to control the send level to the effect, and use the knob and CV input between the effects module's input and output to control feedback amount.

**Parallel filtering:** Patch a stereo filter in an "effects loop" style as detailed in the previous patch idea. Turn up the resonance or use feedback to create interesting spectral content related to the main audio inputs.

**Snappy Percussion**: Patch an oscillator or other sound source into an input and turn the Initial knob all the way down going to one output. Patch an envelope with a quick attack such as an ADSR or slope generator to the corresponding CV input, and monitor the output. Due to the exponential response of the VCAs, this will create emphatic notes with a quick onset and release.

**Stereo Amplitude Modulation**: Patch a stereo audio signal to an input audio channel and feed a simple audio-rate oscillator waveform to the CV input, then monitor the output. Adjust the Initial knob to offset the CV signal for best response.

**Simple Stereo Mixer:** Ignore channel B and all CV inputs entirely. Patch Stereo or Mono audio signals into each input of the Shaka-8 then twiddle the knobs in Column A until the desired mix is achieved.

These are just a few patch ideas, and a few sessions with the Shaka-8 and Shaka-4 can surely reveal many interesting combinations. Thanks for reading, and we hope you enjoy the modules.