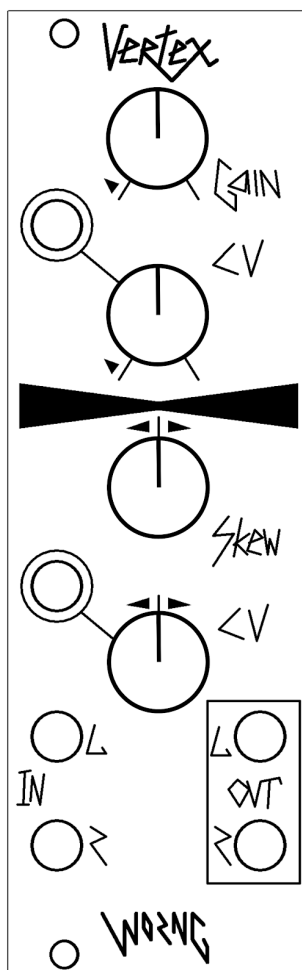# WORNG Electronics Vertex manual

Thank you for purchasing a WORNG Electronics Vertex stereo VCA, we hope it's just what you need to bring your modular system into the world of stereo.

Connecting your Vertex:

Vertex requires 8hp of space in your Eurorack system, and a depth of 25mm. Connect the included power cable to the back of the module and to your power busboard. The connection on the module is shrouded and can only go one way, but is also marked with a line to let you know which way the red stripe should be facing. The module is also protected against damage from reverse power connection, but you should still always be careful connecting power.

Vertex essential concepts:

Vertex is much more than just two mono VCAs with common controls to perform stereo duties, it uses a combination of four linear and exponential VCAs to give you convenient and powerful control of stereo signals.
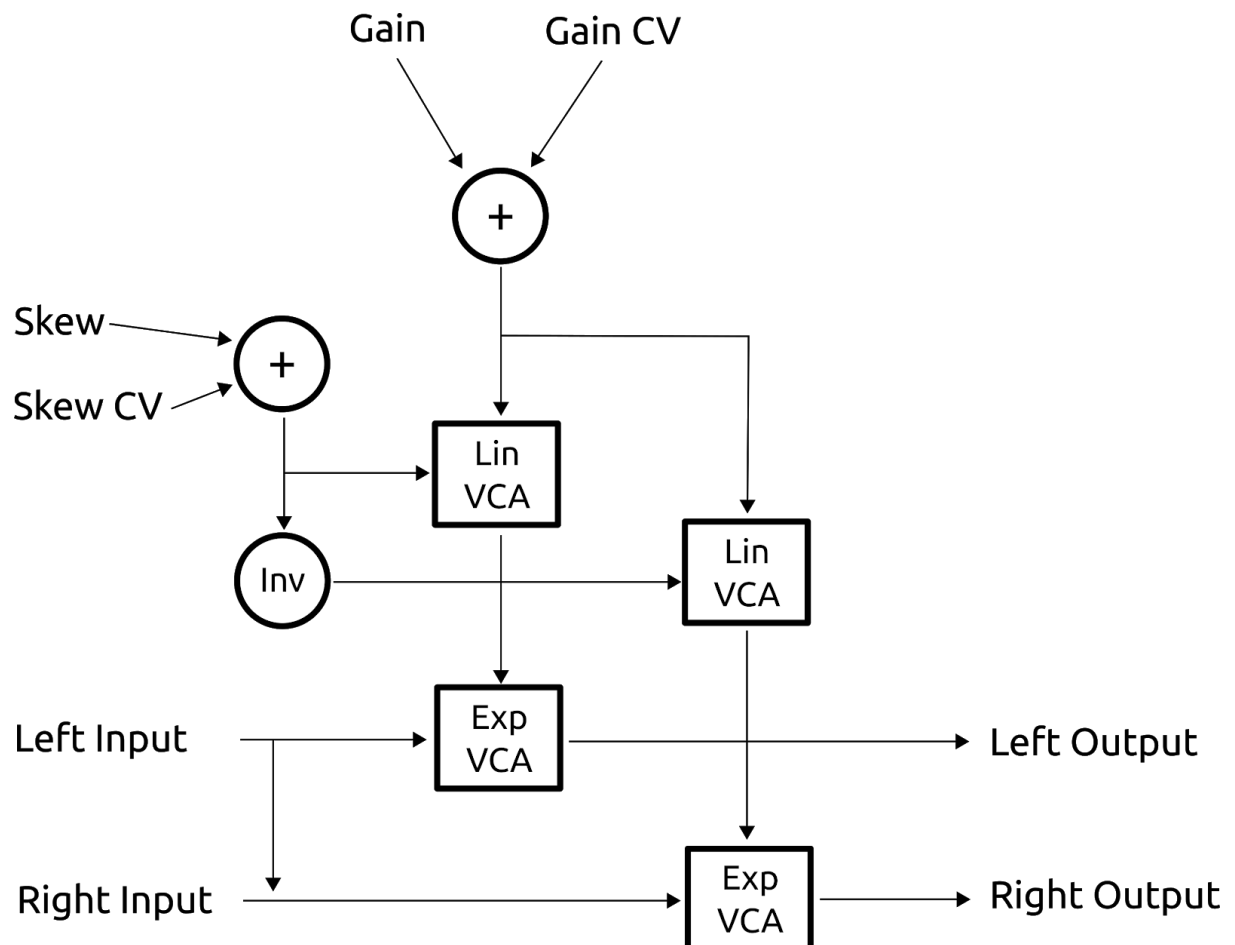
At the top of the module you will find the Gain and Gain CV amount controls, along with a Gain CV input. These set the gain for both L and R channels together. The CV amount has enough range to use with envelopes from 5V to 10V, as well as bipolar CVs.

Below the Gain controls are a pair of LED indicators to clearly show you the amount of CV being sent to the L and R VCAs. These amounts are controlled by both the Gain and Skew controls, as well as their CVs.

The lower two controls of Vertex are Skew and Skew CV amount, along with the Skew CV input. The Skew controls vary the amount of CV coming from the Gain section to the L and R channel VCAs, allowing you to manipulate the amounts of signal through each and control the stereo image.

Finally Vertex has stereo inputs and outputs on the lower part of the module. These are a pair of mono 3.5mm jacks marked L and R to make the stereo pair, as per the eurorack standard. If you wish to use a signal on a stereo 3.5mm TRS cable be sure to break it out into individual L and R signals before patching into the Vertex.

The L input is normalled to the R, so if you patch to L and leave R unpatched the signal will go to both outputs, allowing you to make stereo patches from a mono source.
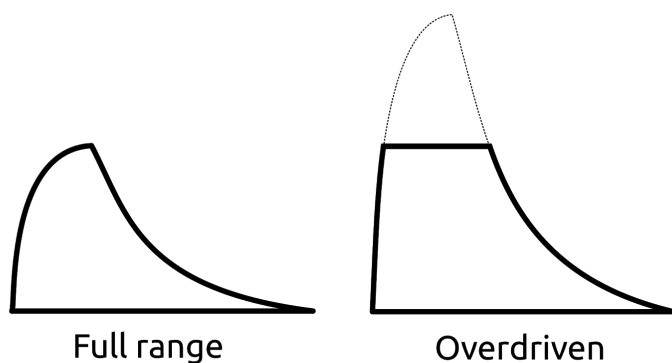
Vertex Controls:

Gain

The Gain control sets the baseline Gain of both L and R signal VCAs in the Vertex. When fully counterclockwise no signal passes through, when fully clockwise the signal can pass through at unity gain, depending on the settings of the Skew control.

Turn this control up for manual control if you want your patch to drone, or you'd like a baseline amount of signal to pass through when the other controls aren't being used.

Gain CV Amount

This control sets the amount that the voltage present at the Gain CV input passes through to the signal VCAs. When the control is fully counterclockwise no signal passes through, with the control at 12 o'clock a 10V envelope will fully open the VCAs, with the control fully clockwise a 5V envelope will fully open the VCAs.

The extended range of the Gain CV control, combined with the choice of the VCAs used in this design, allows for some interesting creative patching. The 3320 VCAs used were chosen among other reasons for their characteristic of having their maximum gain being capped at approximately unity. As the CV amount increases past the point where unity gain is achieved, the amount of gain no longer increases. Overdriving the CV has the result of clipping the CV

Full range   Overdriven

shape, for example changing the response of an envelope from an AD shape to an AHD shape. Unlike overdriving audio using a VCA that has gain greater than unity, this doesn't result in unpleasant distortion of your signal and can be used in interesting creative ways in combination with the Skew controls, to get two different envelope shapes from a single envelope.

The Gain CV Amount adds to (or subtracts from) the Gain control.

Skew
Skew controls the amount of CV from the Gain and Gain CV controls to the audio VCAs. At its most basic level this can be thought of similarly to a pan or balance control, as it will skew the level of the stereo signal to the left or the right. With Skew positioned at 12 O'Clock the stereo image is evenly balanced between left and right, moving counterclockwise increases the left level and decreases the right, and vice versa.
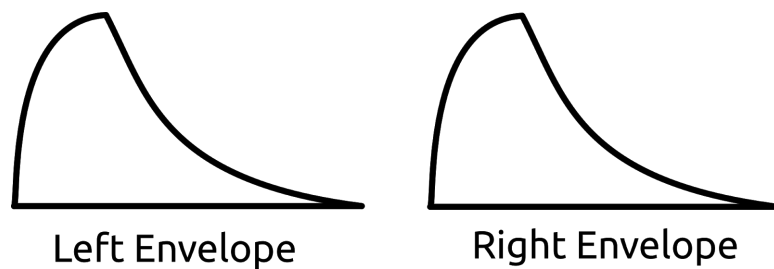
Skew CV Amount
The Skew CV Amount control is an attenuvertor which adds or subtracts the CV present at the Skew CV input to the Skew control. As an attenuvertor the amount is zero when the control is at 12 O'Clock, increasing as the control is turned clockwise and increasing an inverted voltage as the control is moved counterclockwise.

The Skew CV can be used at a basic level as a voltage controlled balance or pan, at any rate from DC all the way to audio rates, as the control is 100% analogue. However there are more advanced uses also.
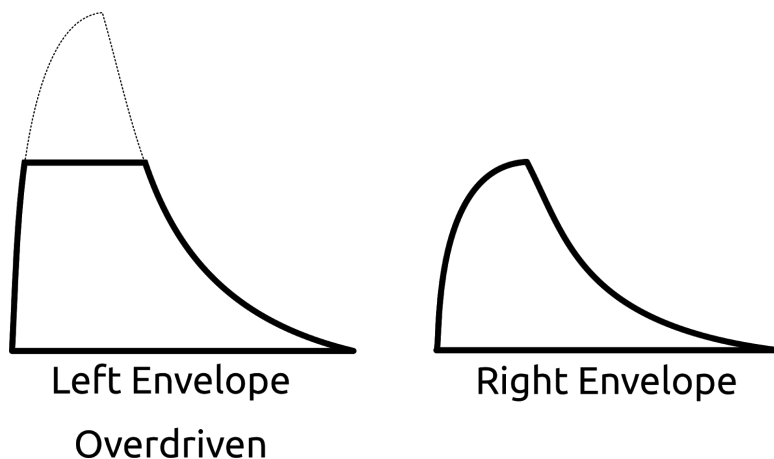
As mentioned in the Gain section above, the choice of VCAs used in the design of Vertex allows the CV amount to be clipped at unity gain, which means the Skew controls can dynamically alter the shape of an envelope stronger than 5V patched to the Gain CV input. This allows you to skew the stereo image of your signal not by increasing the

overall peak to peak level of one side, but by increasing the apparent hold stage of the envelope going to that side.
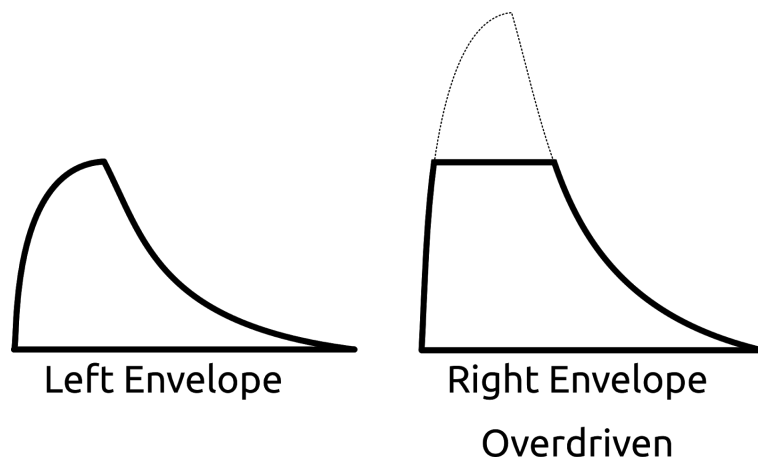
When the Skew is balanced to the centre the response of the Left and Right VCAs is even, so the stereo image stays even.

Left Envelope   Right Envelope

When the Skew control is to the left the envelope signal going to the Left VCA is clipped, resulting in an added Hold stage which increases the apparent loudness of the Left over the Right, Skewing the image to the left without increasing the peak to peak signal level.

Left Envelope   Right Envelope
Overdriven

Similarly, moving the Skew control to the right results in an increase in apparent loudness of the Right signal by clipping the right CV into having a hold stage without increasing peak to peak level above unity.

Left Envelope   Right Envelope
Overdriven

All of this control comes from analogue CVs and VCAs and is dynamically available to change in real time at audio rates, allowing you to shape the Left and Right envelopes in novel new ways.

Patch ideas:

Stereo Tremolo
Patch a stereo signal to the Left and Right inputs. Set Gain to between 12 O'Clock and 3 O'Clock, then patch an LFO to the Skew CV input. Adjust Skew CV Amount to around 1 O'Clock to swirl your signal around the stereo field. Try different LFO shapes for different tremolo feels.

Voltage controlled panning
Patch a mono signal to the Left input. Turn the Gain control fully up, now the Skew control acts as a pan pot to move your signal around the stereo field. Use the Skew CV to pan your signal with control voltage. Try this using an envelope to the Gain CV input rather than using the Gain knob to take advantage of Vertex's ability to shape the envelope to change the perceived loudness of a stereo signal.

Simultaneous control of two CV signals
Vertex is DC coupled and so can be used to control the amount of CV signals being used to modulate other modules. If you wanted to use a

single envelope to modulate the amount of an LFO modulating one thing and a sequence modulating another for example, just patch the CV signals to be modulated to the Left and Right Inputs and Outputs, and then send the Envelope to the Gain CV input. Fine control of the relative amounts of each of the modulated CV signals can be adjusted with the Skew control. Try modulating Skew CV with another modulation source to get even more complex and interesting CV modulation happening.

Simultaneous control of XY signals to Oscilloscope or Laser
Vertex makes controlling the amplitude of XY signals simple, for polar amplitude modulation or level control. Try modulating the amplitude of a sine/cosine pair with a synced audio rate signal for interesting polar modulations.

Vertex has a matte black panel which we think looks great, but over time it may develop an inconsistent finish due to oils from your hands collecting on the panel. To clean simply use a soft cloth and a little isopropyl alcohol and your module will look good as new.