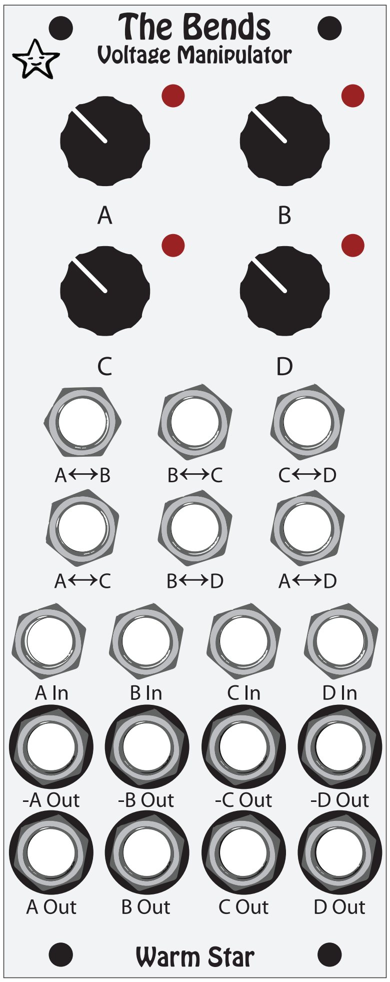
The Bends

Voltage Manipulator

by

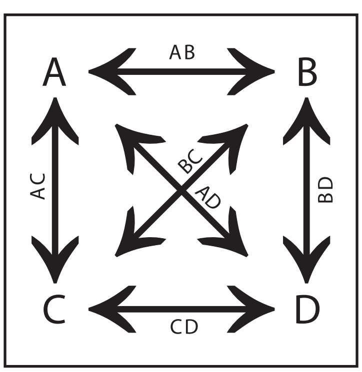
Warm Star



The Bends is a hub of voltage interaction. The blending of four channels is controlled using a matrix of six CV inputs. The Bends can be used to combine, invert, offset, and attenuate voltages. It can be used to voltage control the mix of audio, or to voltage control the routing of audio to multiple destinations. Patched some ways, it's like a VCA matrix. Patched other ways, it can turn a few CV signals into many simultaneous combinations, or combine many CV signals into one or more complex outputs. Using its many outputs simultaneously, the user can tie complex functionality to the knobs of The Bends, so that turning one knob has diverse, complex results in interaction with the rest of the system.

Each of The Bends' four channels has an input, an attenuator, an output, and an inverted output. Outputs are marked with a black circle, for visual reference. The inputs are normalized to 9.75V (If no input is patched to a channel's In jack, 9.75V is internally patched to the input of that channel).

The six Mix CV inputs (A↔B, B↔C, C↔D, A↔C, B↔D, A↔D) each control the cross-mixing between a pair of channels. As CV to a Mix CV input rises, the two channels associated with it are averaged (mixed) with each other. The input range of the Mix CV inputs is 0V-5V.



The mixing is bi-directional. If a 1V input is patched to Mix CV A↔B, some of channel B is mixed into channel A, and some of channel A is mixed into channel B . If the voltage of the input rises, the amount of channel B that is mixed into the A out will rise, and the amount of channel A that is mixed into the B out will rise. If the module is processing fixed voltages, a rising Mix CV signal brings the two channel voltages toward their average. If the module is processing audio, a rising Mix CV signal mixes the two audio signals into each other.

Uses & Patch Possibilities

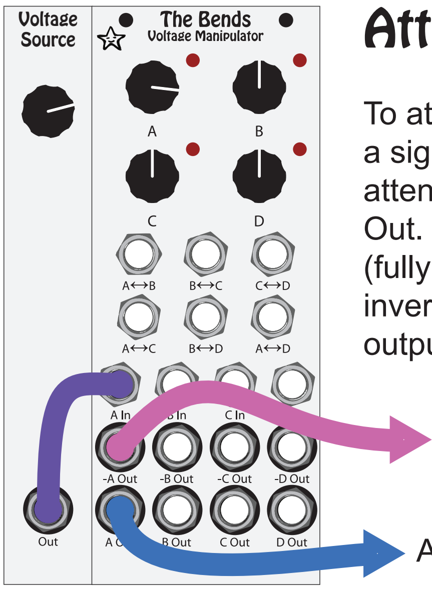
Illustrated here are some of the ways to use The Bends to perform various tasks in your system. Consider these a starting point. Many of these tasks can be accomplished several different ways, and all can be adjusted and combined for a huge variety of outcomes. Out and Inverse Out jacks whose output is being affected by an input are colored. Fictional generic modules are used for illustration purposes.

Fixed Voltage Source

With nothing patched to any input, The Bends provides fixed voltages from its outputs. The voltage from the positive outputs is 0V to 9.75V, adjusted by the position of the channel's knob. The voltage from the inverted outputs is 0V to -9.75V, adjusted in the same manner.

Attenuate and / or Invert

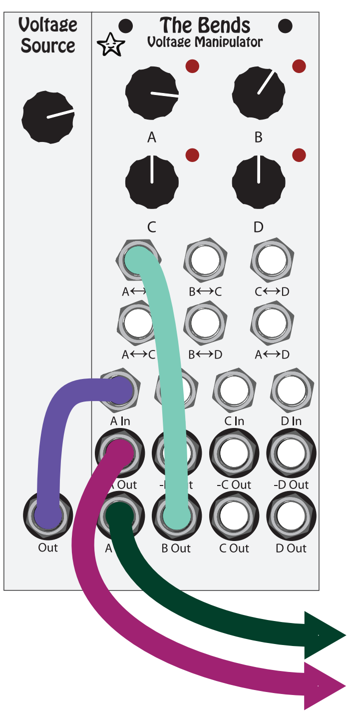
To attenuate a signal is to reduce it in scale. To attenuate a signal with The Bends, patch an input signal to A In. An attenuated version of that signal will be available from A Out. The amount of attenuation is adjustable by knob A (fully clockwise is no attenuation). The same signal inverted across the 0 line (if the input is positive, the output will be negative) will be available from -A Out.



Offset

To Offset is to add or subtract voltage to a signal. One way too add an offset voltage is to patch an input signal to A In. Optionally, adjust knob A to attenuate the input signal. Patch B out to A↔B. Adjust knob B to adjust positive offset. A version of the same signal, inverted across the 0 line and offset negatively, will be available from -A Out.

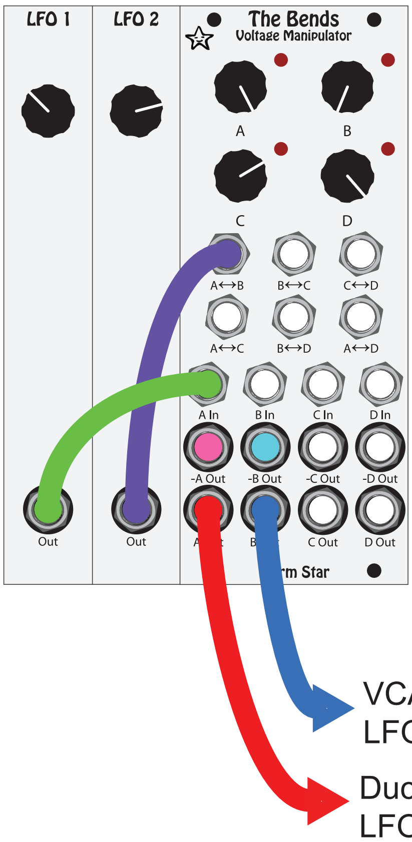
Another (not illustrated) alternative: Patch an input signal to A↔B. Turn knob A fully counterclockwise and knob B fully clockwise. Patch A out. Adjust knob A to adjust the lower boundary of the output wave. Adjust knob B to adjust the higher boundary. -A Out, B Out, and -B out will provide variations of the same output.



Combine Control Voltages:

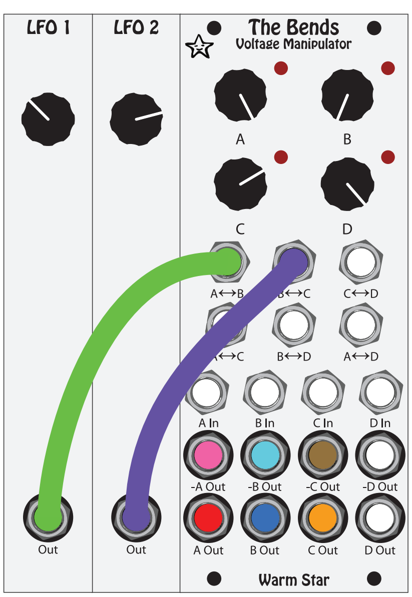
VCA Syle:

To combine two LFOs, one method is to plug one LFO (LFO1) into input A, and the other LFO (LFO2) into the A↔B Mix CV input. Turning knob A fully clockwise and knob B fully counter-clockwise will result in the output at B Out being a curve that is similar to LFO2 used as a VCA control on LFO1. An inverted version of that output will be available from -B Out. From A Out, a copy of LFO1 will be available that drops whenever LFO2 rises (inverse VCA behavior, AKA “ducking”). And the inverse of that signal will be available from inverted output A. All four of these will have different values at any given time; though all are derived from the same two input curves, no two of the four are the same. The outputs from all four jacks will be affected by manipulation of knobs A and B: knob A will attenuate the height of the output waves, and knob B will adjust the value toward which the A In input is “pulled” when the voltage at A↔B rises. Any manipulation of knob B will make the output result less VCA-like, but regardless of knob positions, all four channel outs will output interactions of those two waves.



VCA-Like Output (and its inverse on the jack above)
LFO1 x LFO2

Ducking VCA Output (and its inverse on the jack above)
LFO1 x (1-LFO2)

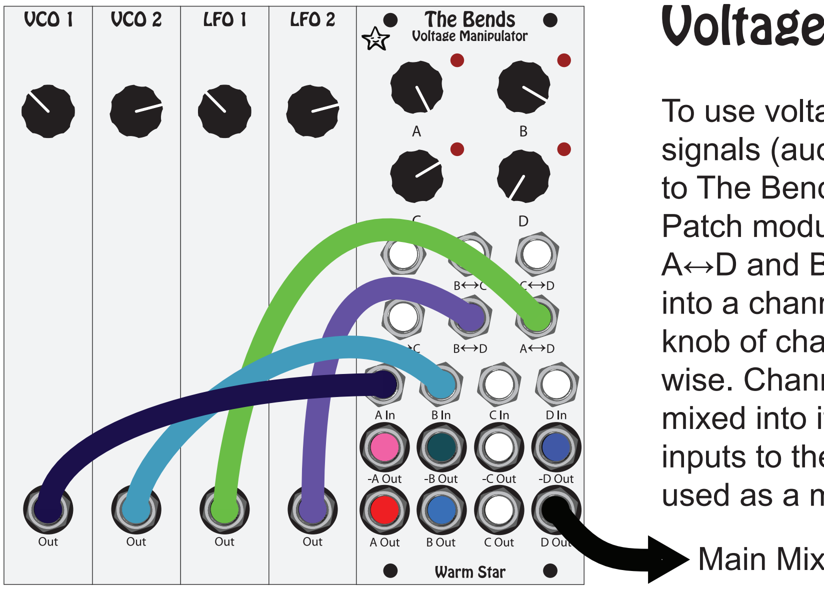


Intersecting Offset Squiggle Style:

Plug LFO1 into the A↔B Mix CV input and LFO2 into the B↔C Mix CV input. This will result in six different combinations of those two waves (from outputs A, B, and C, and their inverse outputs), with heights determined by the relative positions of the knobs associated with those three channels. The output waves will be taller if the knobs are farther apart from one another in position, and the output waves will be shorter if the knob positions are closer together. The position of each knob will determine the “center” from which that channel’s output deviates, as well as the value toward which the other channels are “pulled” when the voltage at the Mix CV crossing the two channels rises.

Both of these techniques can be repeated or combined to make many pieces of incoming modulation interact with each other. With three modulation input sources, eight different simultaneous outputs can be achieved (patching modulations to A↔B, B↔C, and C↔D is one way to achieve this; there are others).

Voltage-Controlled Mixing

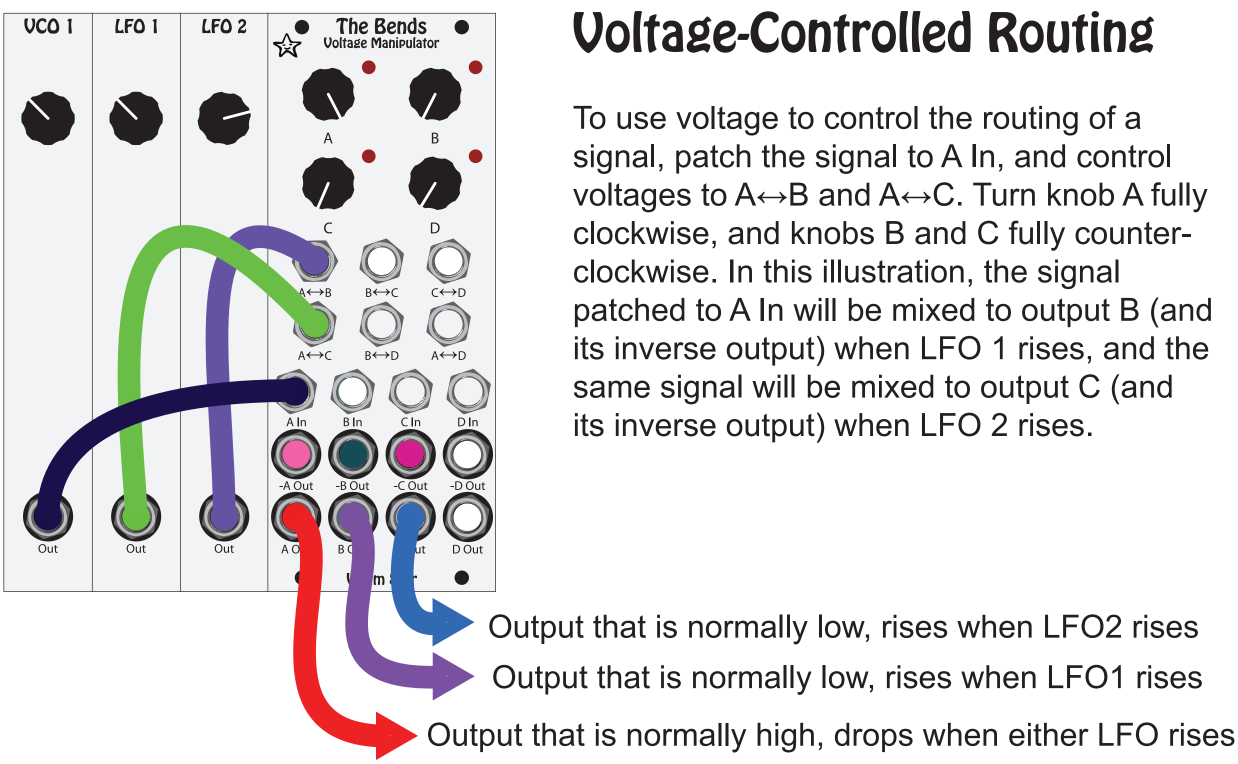


To use voltage to control the mix of two signals (audio or CV), patch the signals to The Bends' A and B channel inputs. Patch modulation to the Mix CV inputs A↔D and B↔D, mixing those channels into a channel with no input . Turn the knob of channel D fully counterclockwise. Channel D now has A In and B In mixed into it in proportion to the voltage inputs to the Mix CV inputs, and can be used as a mix output.

Outputs are also available from all other output jacks associated with channels A, B, and D. -D Out provides an inverted version of the mix. A out and -A Out provide versions of signal A which are intermingled with signal B whenever both modulation voltages are sufficiently high. B out and -B out provide versions of signal B which are intermingled with signal A whenever both modulation voltages are sufficiently high.

In both these cases, the channel A and B attenuators can be used to adjust the relative levels of signals A and B in all mixes and channels. Channel C and Mix CV C↔D can be added to provide a third voltage controlled mix channel. D In can be used as a fourth channel (and knob D can be used as a mix attenuator for that channel), but with D out being used as the mix output, the amount of D In in the mix cannot be voltage controlled.

Voltage-Controlled Routing



To use voltage to control the routing of a signal, patch the signal to A In, and control voltages to A↔B and A↔C. Turn knob A fully clockwise, and knobs B and C fully counter-clockwise. In this illustration, the signal patched to A In will be mixed to output B (and its inverse output) when LFO 1 rises, and the same signal will be mixed to output C (and its inverse output) when LFO 2 rises.