Modulation algorithms

Crossfade

The carrier and modulator are crossfaded, using a constant-power law. **TIMBRE** controls the crossfading position – both signals are equally mixed at 12 o'clock.

Crossfolding

The carrier and modulator are summed, a tiny bit of cross-modulation product is added to spice things up, and the resulting signal is sent to a wavefolder, the amount of which is controlled by **TIMBRE**.

Diode ring-modulation

The carrier and modulator are crudely multiplied, using a digital model of a diode ring-modulator.
TIMBRE post-processes the resulting signal with a variable amount of gain (and emulated diode clipping).

Digital ring-modulation

A gentler version of the previous algorithm which uses a proper multiplication operation in the digital domain.
TIMBRE post-processes the signal with a gain boost and soft-clipping.

Exclusive-or modulation

Both carrier and modulator are converted to 16-bit integers, and the two resulting numbers are XOR'ed bit by bit. **TIMBRE** controls which bits are XOR'ed together.

Comparison and rectification

A handful of signals are synthesized through comparison and rectification operations typical of octave pedals. **TIMBRE** morphs through these signals.

Vocoder

A digital model of a classic analog vocoder, with a bank of 20 analysis and 20 synthesis third-octave 48dB filters. The modulator sub-band signals are processed by envelope followers which control the gains of each of the carrier sub-band signals. **TIMBRE** warps the connections between the modulator's envelope followers and the carrier's gain elements – effectively shifting up or down the formants extracted from the modulator signal.

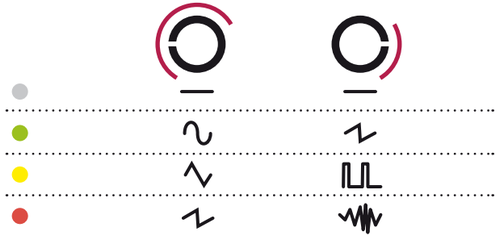
As the **ALGORITHM** knob is turned clockwise, the release time of the envelope followers is increased.

By turning the knob fully clockwise, the release time becomes infinite, and the spectral envelope of the carrier is frozen.

Internal oscillator

Press the **INT. OSC** button **(C)** to enable the internal oscillator or select its waveform.

Because cross-modulation algorithms work best with harmonically simple signals, while vocoders work better with harmonically rich signals, the available waveforms are different depending on the active algorithm: sine, triangle and sawtooth for the former, and sawtooth, pulse and low-pass filtered noise for the latter.



Some of the inputs, outputs or controls operate differently when the internal oscillator is enabled:

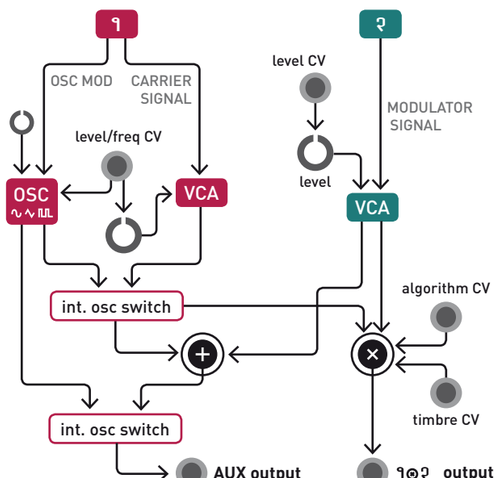
- The **LEVEL** knob **(D)** and CV input **(1)** control the oscillator frequency.
- The **carrier audio input** **(5)** phase-modulates the internal oscillator, or feeds an external source of noise into the low-pass filter.
- The **AUX** output **(8)** contains the signal generated by the internal oscillator.

Warps

Meta-modulator

About Warps

Warps blends and combines two audio signals through a variety of cross-modulation algorithms. Most of these sonic transformations make the distinction between a carrier signal and a modulator signal: the former will be filtered or modulated to acquire some of the characteristics of the latter. Warps also includes a digital audio-rate oscillator which can replace the external carrier signal.



Installation

Warps requires a **-12V / +12V** power supply (2x5 pin connector). The red stripe of the ribbon cable (-12V side) must be oriented on the same side as the "Red stripe" marking on the board. The module draws **5mA** from the **-12V** rail and **110mA** from the **+12V** rail.

Online manual and help

The full manual can be found online at
mutable-instruments.net/modules/warps/manual

For help and discussions, head to
mutable-instruments.net/forum

Front panel

Controls

A. Modulation algorithm. Selects which signal processing operation is performed on the carrier and modulator.

B. Modulation timbre. Controls the intensity of the high harmonics created by cross-modulation (or provides another dimension of tone control for some algorithms).

C. Internal oscillator state. Enables the internal oscillator and selects its waveform.

D. External carrier amplitude or **internal oscillator frequency**. When the internal oscillator is switched off, this knob controls the amplitude of the carrier, or the amount of amplitude modulation from the channel 1 **LEVEL** CV input **(1)**. When the internal oscillator is active, this knob controls its frequency.

E. Modulator amplitude. This knob controls the amplitude of the modulator, or the amount of amplitude modulation from the channel 2 **LEVEL** CV input **(2)**. Past a certain amount of gain, the signal soft clips.

Inputs and outputs

1. **External carrier amplitude** or **internal oscillator frequency** CV input.

2. **Modulator amplitude** CV input**.** This CV input controls the gain of the modulator input. When a signal is patched into this input, the amount of CV modulation is controlled by the **Modulator amplitude** knob **(E)**.

3. **Algorithm** CV input.

4. **Timbre** CV input.

5, 6. **Carrier (1)** and **modulator (2)** audio inputs (modular level).

7. **Modulator output (1×2)**. This is the main audio output.

8. **Auxiliary output**. Signal from the internal oscillator (when it is enabled) or sum of the carrier and modulator, post VCA.