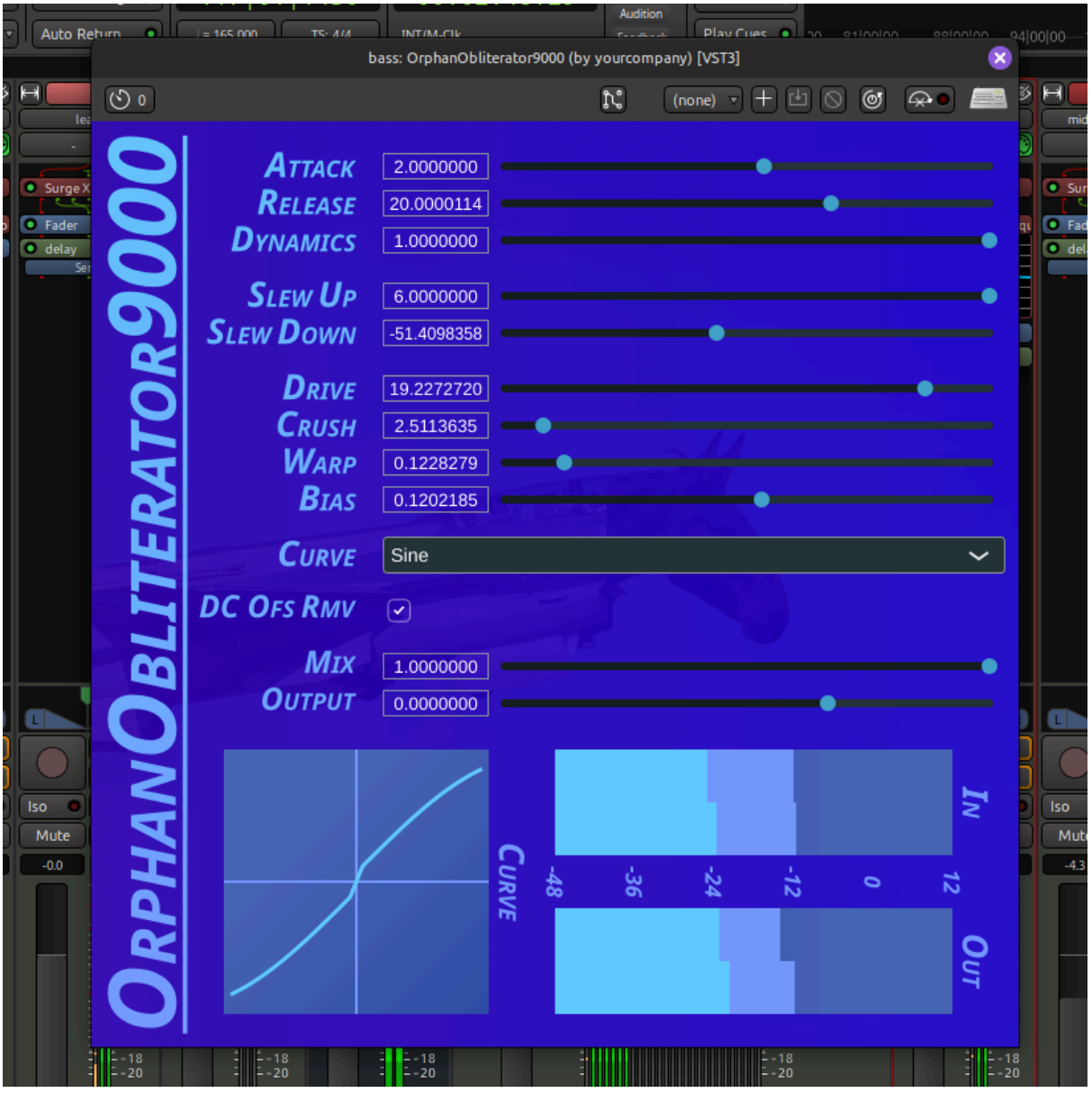
OrphanObliterator9000
Technical Reference Manual

OrphanObliterator9000 is a multi-function distortion plugin. The two primary signal processing components are a slew limiter and a highly configurable waveshaper, but it also contains a dynamics matching system, DC offset removal, 4x oversampling, and of course, level meters.



Don't mind the horse. He's chill.

INSTALLATION

Place the .vst3 file in the search path of your DAW of choice, then instruct the DAW to re-scan for plugins. OrphanObliterator9000 should appear in the plugin list. For Max/MSP, directly load the file from wherever you put it using the vst~ object.

QUICKSTART

Place OrphanObliterator9000 on your track of choice, set the curve to soft clip 1, and crank up the gain until it sounds good. That's it! You've distorted something!

If you wanna get more advanced, play around with the crush and warp settings. You can see how these affect the waveshaping curve in the Curve window in the bottom left. Also, try playing around with the other curve options. The harsher ones like the rectify options can sound very good when you really want to destroy a sound, while the sine option is surprisingly complex, even with crush and warp turned up high.

Next, reset the plugin and have a play with the slew limit controls. These limit the amount the input signal can change between successive samples, with a different limit in each direction. Try setting the limit in one direction quite low (say, -40 to -60) while leaving the other high. This can create some interesting distortion without much muffling of high frequencies.

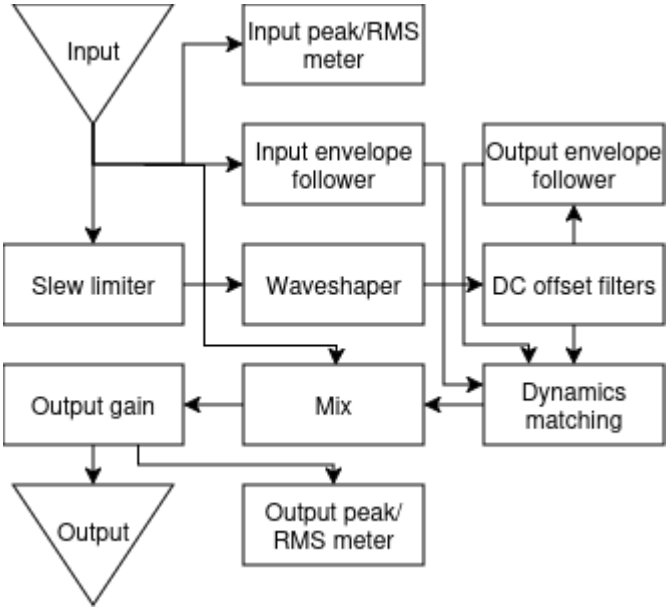
Finally, have a look at the attack, release, and dynamics controls. These comprise the dynamics matching system. Turn up the drive, and then turn the dynamics control all the way to 1. You should see (and hear!) the output level drop to close to the input level. If you have a very transient-rich signal like drums, you may need to tweak attack and release to get it working right, but for most things the default settings work just fine.

PARAMETER OVERVIEW

Attack	Controls the attack of the envelope followers.
Release	Controls the release of the envelope followers.
Dynamics	Controls how much the output level is adjusted to match the input.
Slew Up	The maximum amount the signal value can increase between samples, measured in dBFS.
Slew Down	The maximum amount the signal value can decrease between samples, measured in dBFS.
Drive	This does exactly what you think it does.
Crush	Controls the slope of the linear region.

Warp	Controls the size of the linear region.
Bias	Adds intentional DC offset to the input signal to the waveshaper.
Curve	Selects the curve used by the waveshaper.
Dc Ofs Rmv	Toggles the DC offset removal filter.
Mix	Controls how much of the wet and dry signals are present in the output.
Output	Controls how much gain is applied to the output signal, after dynamics matching.

Signal Flow Diagram



Slew Limiting

The slew limiter is something you might not have seen before. It limits the amount that the input signal can change between successive samples, with a different limit in each direction. The limit is measured in dBFS, meaning if you set it to -6, the signal can only change by 0.5 between samples.

Note that unlike a lowpass filter, which also limits rate of change, a slew limiter creates distortion. This is because it replaces any slope greater than the limit with a simple linear change, rather than exponentially following it like a filter. If you think about it, it's like putting a hard clipper on the derivative of the signal.

WAVESHAPER

Waveshapers are a common class of artistic effect that function by passing audio through a non-linear mapping (or a "curve"). The effect originated with overdriven guitar amplifiers way back in the early days of rock and roll, and remains popular to this day. When the audio passes through the nonlinearity, additional harmonic overtones are created, leading to a harsher sound.

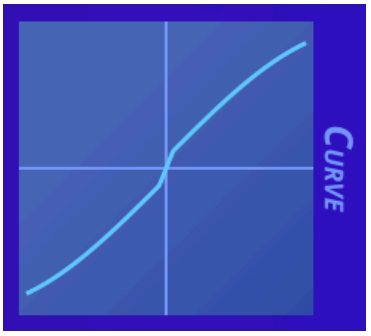
This waveshaper features two controls you might not have seen before, named "crush" and "warp". If you followed the quickstart, you'll already have some idea of what these do, but they'll be explained in detail anyway. OrphanObliterator9000's waveshaper curve has a linear region injected into the middle. Warp controls the size of this region, and crush controls its slope. On its own, a linear section doesn't change the sound much, as almost all the curve options available are linear in the centre anyway. However, when the slope of this region is changed, it puts a massive dent in the curve and can create some really rather gnarly sounds, even with quite low drive.

Drive and bias, however, are pretty standard on waveshapers the world over. Drive does exactly what you think it does. Bias adds an offset to the input signal, resulting in an asymmetrical distortion. Bias is interpolated using a one-pole lowpass filter to avoid audible clicks when changing it.

The curve options are enumerated thusly:

Clip	clamp(x, -1, 1)	The classic "hard clipping" effect.
Soft clip 1	x / (1 + 0.25x^2)	A softer "saturation" or "valve" style distortion.
Soft clip 2	x - (4x^3 / 27)	Variations on a theme, really.
Sine	sin(x)	A sine wave! Perhaps better than you might think, for complicated maths reasons.
Rectify	abs(x)	This one's nasty.
Soft rectify	sqrt(x^2 + 0.04) - 0.2	A smoother curve means a softer sound. It's simple arithmetic.
Half rectify	max(x, 0)	This one's also nasty.
Half rectify (-ve)	min(x, 0)	In case your signal is very asymmetrical, like those weird FM operator waveforms you get sometimes.

The DC offset removal is implemented as a pair of one-pole highpass filters with a cutoff of 5hZ. This removes any offset created by the slew limiting or waveshaper (particularly the bias control) without impacting audible frequencies at all. This works because DC offset is essentially a sine wave with a frequency of zero. If you want to keep the DC offset because you're some kind of deviant, that's an option too.



The waveshaper also features a graphical visualisation of the current waveshaping curve. You can see here the effect of crush and warp on the shape of the distortion.

Dynamics Matching

The dynamics matching system is another thing you might not have seen before. In short, it uses a pair of stereo envelope followers to match the output level of the distortion to the input, meaning you can crank the drive as high as you like without blowing your head off.

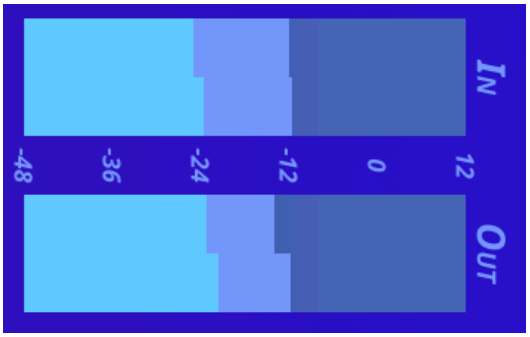
The input level is measured right at the input of the plugin, before any processing, but the output is measured before the mix and output gain. Additionally, the output level is always measured without DC offset, even if DC offset removal is turned off.

Attack controls the rate at which the followers respond to an increase in level, and release controls the rate at which they respond to a decrease - the same as the similarly named controls on a compressor. To be specific, the listed numbers are time constants: the time it takes for the envelope to move ~64% of the way to the input value. The followers are implemented as a pair of one-pole lowpass filters with coefficients selected based on whether the absolute value of the input signal is increasing or decreasing.

Dynamics controls the amount that the output level is adjusted to match the measured input level. With dynamics set to zero, the output is left unchanged, and with it set to one, enough gain is applied (usually negative) to match the input.

Auxiliary Stuff

The mix control is a simple linear interpolation between the dry and wet signals. At 0, only the unprocessed dry signal is output, and at 1, only the processed signal is output.



The plugin features two stereo combined RMS and peak meters, one on the input and one on the output. These are also implemented as one-pole lowpass filters. The RMS meters use time constants of 50ms in each direction, whereas the peak meters use 0ms upwards and 1000ms downwards.

The plugin also features 4x oversampling. What this means is that the input signal is upsampled by a factor of 4 on the way in, and then downsampled on the way out, with all the processing happening at a higher sample rate. This reduces any unwanted aliasing frequencies created by the non-linear processing. The oversampling is handled by JUCE's builtin Oversampling class.