

Odin 2 Synthesizer Plugin

Manual for version 2.2.0

TheWaveWarden



www.thewavewarden.com

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Chapter 1

Introduction

1.1 Overview

panel overview wie bei europa


1.2 Installation

1.3 Routing

Chapter 2

Oscillators

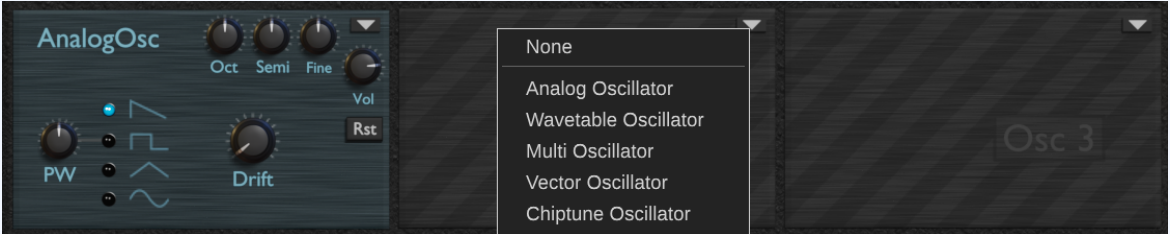
Three oscillators form the basis of sound generation in Odin 2. You can choose from a wide variety of different modules, which are capable of a wide palette of sounds, even without any further processing. Initially, Odin 2 starts out with an Analog Osc in slot 1 and none in slot 2 & 3.



Osc Type

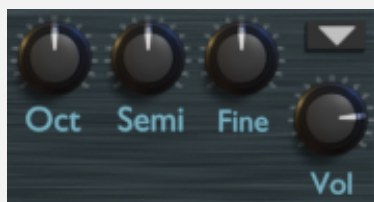
Modulation: ✗ Automation: ✗

You can change the module being used with the small dropdown button on the top-right of the osc-module:



2.1 Common Parameters

There are some controls which are common to all oscillator modules:





Osc Octave

Modulation: ✓

Automation: ✓

Detunes the oscillator in whole octaves.



Osc Semitones

Modulation: ✓

Automation: ✓

Detunes the oscillator in semitones.



Osc Finetune

Modulation: ✓

Automation: ✓

Detunes the oscillator in cents.

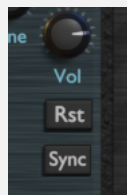


Osc Volume

Modulation: ✓

Automation: ✓

Regulates the volume of this oscillator in deciBels. Can be used to shut the oscillator entirely. Modulating this parameter from the modulation matrix with -100 will always shut the sound. Modulating this parameter with +100 will raise the sound to 0dB if the current value is smaller than -12dB. If it is bigger than -12dB, it will modulate to +12dB from the current value.



Osc Reset (Rst)

Modulation: ✗

Automation: ✓

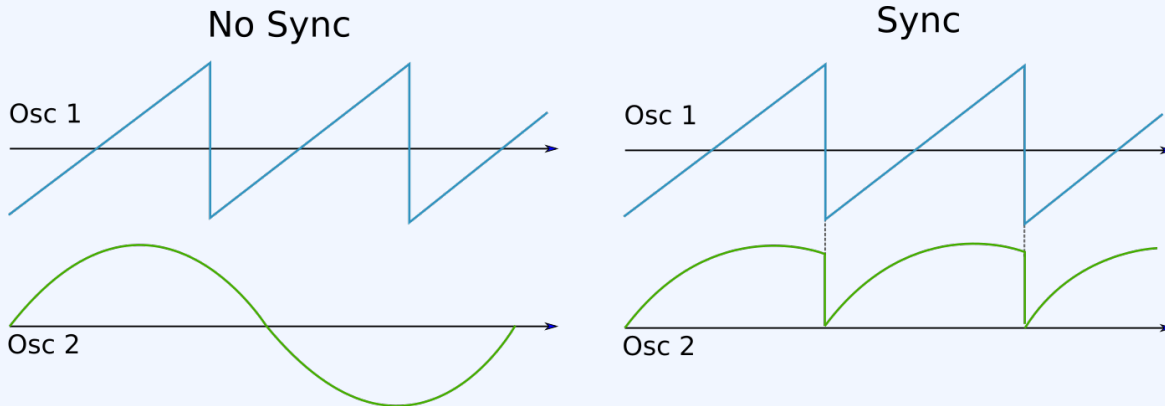
Resets the waveform to its initial position each time a key is pressed. This is usefull to get more consistent sounding notes, for example for tight basslines. If this is turned off, the wave will continue where it ended on the last note.



Osc Sync

Modulation: ✗ Automation: ✓

This parameter is only available for Osc 2 & 3. Activating sync will sync this osc to Osc 1. That means each time Osc 1 completes a cycle, this osc is reset to its initial position. The pitch of the oscillator is thereby controlled by Osc 1. This can introduce lots of harmonics, even for soft waveforms like the sinewave.



Internally, any osc with activated sync will use 3x oversampling to prevent aliasing on the hard resets. Additionally, any osc with enabled sync uses a DC-blocking filter to remove constant offsets in the wave.

2.2 Analog Osc



The analog osc aims to emulate the sound of classic analog synthesis. The first obvious choice you have is the waveform:



Analog Waveform

Modulation: ✗

Automation: ✓

Sawtooth:

The classic sawtooth wave. It is very rich in harmonics and forms an excellent starting point for a wide variety of sounds. This particular Sawtooth emulates the way analog syntheizers generate saw-waves. The result is a (phase-corrected) "fat-saw". This variant doesn't rise linearly as the icon would suggest, but in a slight curve, providing a different tonal character.

Pulse Wave:

The pulse wave has a thinner sound than the savetooth, sometimes giving the impression of a "hollow" sound body being emulated. The pulse still has a lot of harmonics, making it a common alternative to the sawtooth. The width of the pulse can be adjusted, see the next parameter **Pulse Width**.

Triangle:

The triangle wave is much gentler than the saw and pulse waves. It still has a lot of harmonics present though. This wave is well suited for flute like sounds.

Sine:

The purest of all waveforms. The sinewave (by its very definition) has no harmonics at all. The resulting sound is very easy on the ears.

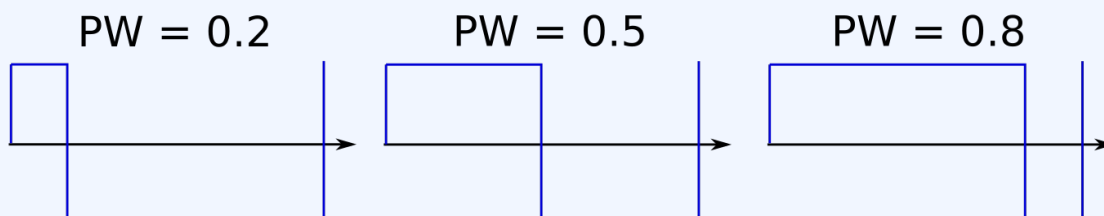


Pulse Width (PW)

Modulation: ✓

Automation: ✓

This parameter has no effect if the waveform selected is not a pulse. It shiftst the duty cycle of the pulse wave, making it stay longer in the lower section for higher values.



The pulse width control can not be used to shut the sound completely ($PW = 0$ or $PW = 1$), but that can be achieved when modulating via the modmatrix.



Drift

Modulation: ✗ Automation: ✓

Analog oscillators tend to not be stable in their frequency. Drift emulates this behaviour by randomly shifting the pitch up and down just a little bit over time. For a single osc, the effect is not very apparent, but becomes clear once two oscillators are used.

2.3 Wavetable Osc



The Wavetable Osc allows you to create evolving sounds, which feature more than one waveform. Each of the 35 selectable wavetables consists of four waves itself. You can sweep through these easily by hand or with pre-setup modulation.



Wavetable

Modulation: ✗ Automation: ✗

Selects which wavetable to be used. A wide variety of sounds is available, starting with analog waveforms, human voice like sounds, additive waves, waveforms taken from instruments and many, many more.



Wavetable Position

Modulation: ✓ Automation: ✓

Fades through the four waves in the selected wavetable. A value of 0 will give the first wave, 0.333 the second, 0.666 the third and 1 the last wave.



Modulation

Modulation: ✗ Automation: ✗

Selects a modulation source, which can be used to modulate the Wavetable Position. Modulation Envelope and LFO1 are selectable. Please note that arbitrary modulation sources can be selected when working with the modulation matrix. This slot is merely for a fast and convenient way to set up modulation.



Amount

Modulation: ✗ Automation: ✓

Sets the amount of modulation being used to modify the Wavetable Position. Positive and negative values are possible.

2.4 Multi Osc



The Multi Osc is four oscillators disguised as one. These can be arbitrarily detuned and can even use different waveforms, which results in a thicc, rich sound.



Detune

Modulation: ✓ Automation: ✓

Detunes the four sub-oscillators against each other. The detune values are calculated to avoid beating (random phase-cancellation).



Wavetable

Modulation: ✗ Automation: ✗

The same as in Wavetable Osc: Selects which wavetable to be used. A wide variety of sounds is available, starting with analog waveforms, human voice like sounds, additive waves, waveforms taken from instruments and many, many more.



Wavetable Position

Modulation: ✓ Automation: ✓

The same as in Wavetable Osc: Fades through the four waves in the selected wavetable. A value of 0 will give the first wave, 0.333 the second, 0.666 the third and 1 the last wave.



Wavetable Spread

Modulation: ✓ Automation: ✓

Spreads the four sub-oscillators over the wavetable: The first sub-osc wavetable position will be shifted to the left, the last will be shifted to the right. These shifts happen around the value chosen by Wavetable Position.

2.5 Vector Osc



The Vector Osc gives even more options for evolving sounds than the Wavetable Osc. Four freely definable waves can be interpolated in a very intuitive graphic way via an XY-pad.



A, B, C & D

Modulation: ✗ Automation: ✗

Select the waves to be used. Each of the four letters mark one corner of the XY-pad, as the graphic suggests. Virtually any waveform from the entire synthesizer can be chosen for any of the corners. This also includes any of the (see Draw Oscillators).

When selecting Draw Osc 1, 2 & 3, the waves you have drawn in osc slots 1, 2 and 3 respectively are used.



X & Y

Modulation: ✓ Automation: ✓

Moves the handle over the XY pad. Each of the corners represent the waveform chosen from the A, B, C and D dropdowns. Moving closer to a corner will make the sound closely relate the waveform of that corner. When being in the corner, the resulting waveform is purely the one selected for that corner. Uses bilinear interpolation to fade through the four tables.

2.6 Chiptune Osc



The Chiptune Osc is an easy way to get nostalgic for your childhood. It aims to emulate the sound of yesteryear while emulating the processing capabilities of a 4-Bit sound-chip, like it was used in the Nintendo Entertainment System NES or original Nintendo Gameboy. It also features a simple arpeggiator, with two or three steps being selectable. Whilst being able to produce harmonic sounds, it also features a dedicated chiptune noise module.



Waveform

Modulation: ✗ Automation: ✗

Lets you select from a variety of waveforms, like you would typically find on the soundchips of yesteryear. Available are a bunch of pulse waves, a triangle, saw and sine variant. All of these waves are limited to a 4Bit resolution (16 steps) on the Y-axis. On top of these, you can select any of the ChipDraw waves.

To clarify: ChipDraw 1, 2 & 3 refer to the waves you have drawn in osc slots 1, 2 and & 3 respectively. You need to apply changes in the ChipdDraw Oscs for the change to take effect (see ChipDraw Osc).



Arpeggiator

Modulation: ✗ Automation: ✓

Turns on an internal arpeggiator module, which makes the oscillator jump over predefined semitone values. See the next parameters for specifics.



Arp 1, 2 & 3

Modulation: ✗ Automation: ✓

Select the semitones to be played by the arpeggiator module. For the third step to be used, the next parameter Step 3 needs to be active.



Step 3

Modulation: ✗ Automation: ✓

Enables the third step in the arpeggiator. When Step 3 is not active, the arpeggiator will only loop between the first two steps.



Speed

Modulation: ✓ Automation: ✓

Sets the speed of the arpeggiator in Hz.



Noise

Modulation: ✗ Automation: ✓

Enabling Noise will change stop the output of the selected waveform. Instead, the oscillator will generate a random value to be output each time a cycle is complete. This creates a classic noise effect like it was used on early game consoles. Internally, 3x oversampling is used to remove aliasing on the jumps between values. Note that this noise is dependent on the note being played and has a perceived pitch. It is also possible to use the noise module while the Chiptune arpeggiator is enabled.

2.7 FM Osc



The FM Osc is a convenient way to set up Frequency Modulation, or FM. The basic idea behind FM is that you have two oscillators: The carrier and the modulator. The modulator is solely used as a modulation source for the frequency of the carrier. The carrier is the oscillator you will actually hear. While you can set up FM via the modulation matrix as well, the FM osc is the easy way to do it. The theory behind FM is very well documented in other literature, for example on Wikipedia.

FM will usually produce a metallic, bell-like sound.



Waveform

Modulation: ✗ Automation: ✗

Both carrier and modulator can be assigned a waveform. This will be the actual waveform that the sub-osc is using. Virtually any waveform from the entire synthesizer can be chosen. This also includes any of the (see Draw Oscillators).

When selecting Draw Osc 1, 2 & 3, the waves you have drawn in osc slots 1, 2 and & 3 respectively are used.



Ratio

Modulation: ✓

Automation: ✗

The numbers above/below the waveform describe the base-frequency relation modulator and carrier have to one another. The frequency of the modulator will always be

$$f_{mod} = f_{car} \frac{Ratio_{mod}}{Ratio_{car}} \quad (2.1)$$

So for example using the values $Ratio_{mod} = 2$ and $Ratio_{car} = 1$ will put the modulator one octave (double the frequency) above the carrier. The base freq of the carrier is the pitch played for the note.

Using fractions which are not reducible to "simple" fractions, like $\frac{11}{7}$ will yield wilder results than "simple" ones like $\frac{1}{2}$.

Note that modulating these values from the modulation matrix, allows for fractions which are non-rational (continuous modulation).



FM

Modulation: ✓

Automation: ✓

This is where the magic happens: The FM amount controls how deep the modulator modulates the frequency of the carrier. A value of zero will show no modulation at all, so the carrier is playing like a normal osc. When increasing the amount, the sound gets more and more metallic. The range of this parameter can be extended over its natural range via the modmatrix.

2.8 PM Osc



PM or Phase Modulation, is closely related to FM or Frequency Modulation. Like the FM Osc, it features a modulator and a carrier oscillator, but this time the modulator

modulates the phase of the carrier. When only using sine-waves, the frequency contents generated by FM and PM are indistinguishable.



Waveform

Modulation: ✗ Automation: ✗

Both carrier and modulator can be assigned a waveform. This will be the actual waveform that the sub-osc is using. Virtually any waveform from the entire synthesizer can be chosen. This also includes any of the (see Draw Oscillators).

When selecting Draw Osc 1, 2 & 3, the waves you have drawn in osc slots 1, 2 and & 3 respectively are used.



Ratio

Modulation: ✓ Automation: ✗

The numbers above/below the waveform describe the base-frequency relation modulator and carrier have to one another. The frequency of the modulator will always be

$$f_{mod} = f_{car} \frac{Ratio_{mod}}{Ratio_{car}} \quad (2.2)$$

So for example using the values $Ratio_{mod} = 2$ and $Ratio_{car} = 1$ will put the modulator one octave (double the frequency) above the carrier. The base freq of the carrier is the pitch played for the note.

Using fractions which are not reducible to "simple" fractions, like $\frac{11}{7}$ will yield wilder results than "simple" ones like $\frac{1}{2}$.

Note that modulating these values from the modulation matrix, allows for fractions which are non-rational (continuous modulation).



PM

Modulation: ✓ Automation: ✓

The PM amount controls how deep the modulator modulates the phase of the carrier. A value of zero will show no modulation at all, so the carrier is playing like a normal osc. The range of this parameter can be extended over its natural range via the modmatrix.

2.9 Noise Osc



The Noise Osc provides a source of noise in Odin 2. The initial noise generation produces white noise. The noise can be further preprocessed by the included lowpass and highpass filters.



Highpass

Modulation: ✓ Automation: ✓

Sets the cutoff frequency for the included highpass filter. The filter is a first order (6dB / Oct) virtual analog highpass filter.



Lowpass

Modulation: ✓ Automation: ✓

Sets the cutoff frequency for the included lowpass filter. The filter is a first order (6dB / Oct) virtual analog lowpass filter.

2.10 WaveDraw Osc



The wavedraw osc lets you experiment with waveforms by letting you draw them yourself.

The changes you make to the waveform will have no effect until you press the apply button on the bottom-right of the oscillator. If this button is red, then there are still unapplied changes to the waveform.

The drawn waveform is sampled using 200 discrete steps. When you press the apply button, the waveform is processed into the spectral domain to create a usable wavetable.

2.11 ChipDraw Osc



The ChipDraw Osc lets you draw a custom chipdraw waveform. It resembles the capabilities of the "custom waveform" on an Nintendo Entertainment System, NES soundsystem. The waveform consists of 32 steps in horizontal direction, which can be offset to 16 values (4Bit) in vertical direction.

The changes you make to the waveform will have no effect until you press the apply button on the bottom-right of the oscillator. If this button is red, then there are still unapplied changes to the waveform.

When you press the apply button, the waveform is processed into the spectral domain to create a usable wavetable.

2.12 SpecDraw Osc



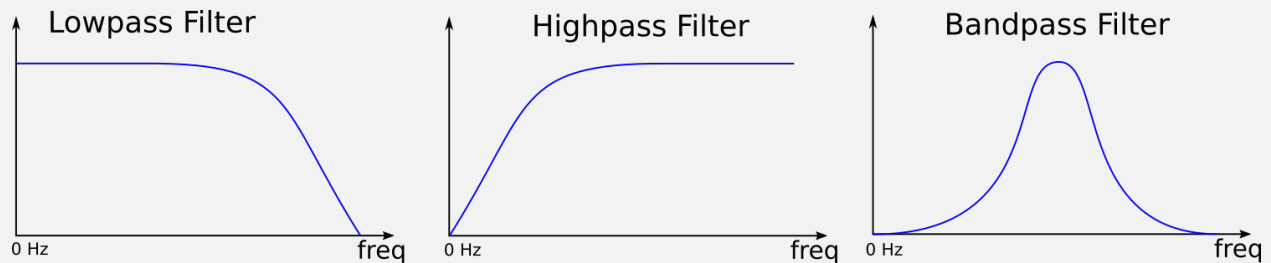
The SpecDraw Osc opens the sonic capabilities with some **additive synthesis**. Unlike subtractive synthesis, where you filter frequencies from harmonically rich waves, additive synthesis lets you build a sound by stacking up individual harmonics. The n -th harmonic is a sinewave which has n -times the frequency of the base note. The Specdraw Osc lets you draw the amplitude of these sinewaves. The left-most bar represents the fundamental. In the initial state, only this bar is present, resulting in an overall sinewave osc. As you bring more overtones, the sound gets richer. Additive synthesis is capable of creating timbres which are not possible with subtractive synthesis.

The changes you make to the waveform will have no effect until you press the apply button on the bottom-right of the oscillator. If this button is red, then there are still unapplied changes to the waveform.

Chapter 3

Filters

Signal filters are one of the basic tools to shape your sound in subtractive synthesis. While the oscillators in Odin 2 are already capable of a wide array of sounds, unprocessed oscillators usually sound very sharp and not pleasing to the ears. So what is a filter? A filter selectively removes frequencies from the spectrum, usually with some dials for the user to control the rolloff. Filters can be characterized by their frequency response, which tells us which frequencies are being attenuated or boosted:



Odin 2 has three slots for filters which can be filled with a extensive selection of modules to shape your sound. A wide array of high quality virtual analog filter emulations is available, which emulate various analog filter circuits from synthesizer history.



Filter Type

Modulation: ✗ Automation: ✗

To change the filter module, use the dropdown to the top-right of the filter module:



3.1 Common Controls

Some of the controls are shared among most filter modules:



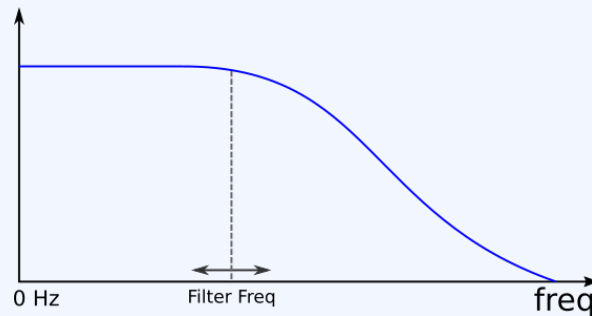


Filter Frequency

Modulation: ✓

Automation: ✓

Controls the cutoff point of the filter. The frequency value marks the point where the frequency is attenuated by 3dB.

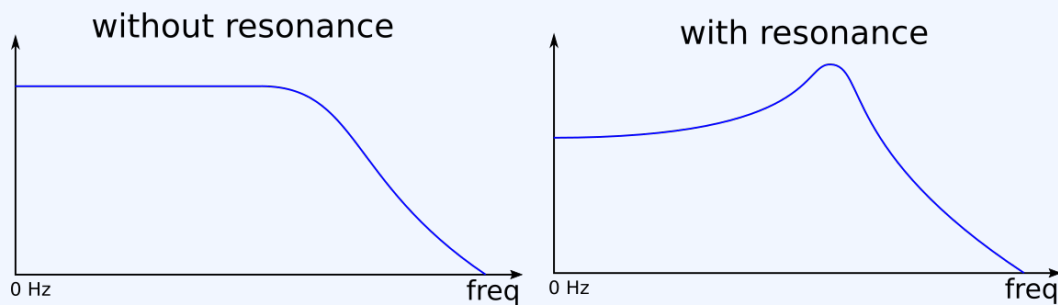


Filter Resonance

Modulation: ✓

Automation: ✓

Increasing resonance creates a peak in the spectrum at the position of the filter cutoff.



Note also that the frequencies which were previously unaffected by the filter are being attenuated by the resonance parameter.
None of the filters in Odin 2 are capable of self-oscillation for the sake of your ears and speakers.



Filter Velocity (Vel)

Modulation: ✓

Automation: ✓

Adds velocity from MIDI-Notes to the filter frequency. This allows for expressive play, as harder key-hits move the filter freq up. Note that the value is added on top of the current value, so to achieve a similar resulting timbre, you might need to lower the filter frequency accordingly.



Filter Envelope (Env)

Modulation: ✓

Automation: ✓

Controls the amount of Filter Envelope which is applied to the filter frequency. To see how the Filter Envelope itself is operated, see section 6.



Filter Keyboard (Kbd)

Modulation: ✓

Automation: ✓

Controls how much the MIDI-note is put on top of the filter frequency. Increasing this value makes the filter open up more for higher notes. This allows for more consistent notes across the keyboard, since higher notes are filtered differently more by static filters. Note that the value is added on top of the current value, so to achieve a similar resulting timbre, you might need to lower the filter frequency accordingly.



Filter Gain

Modulation: ✓

Automation: ✓

Regulates the volume of this filter in deciBels. Can be used to shut the filter entirely. Modulating this parameter from the modulation matrix with -100 will always shut the sound. Modulating this parameter with $+100$ will raise the sound to 0dB if the current value is smaller than -12dB . If it is bigger than -12dB , it will modulate to $+12\text{dB}$ from the current value.



Filter Saturation

Modulation: ✓

Automation: ✓

Introduces a slight distortion by shaping the signal with a hyperbolic tangent function. Depending on the filter module being used, the saturation stage is in a different position of the signal loop, yielding different results.

3.2 Lowpass, Bandpass, Highpass



The staples of sound-design in Odin 2. These filters are virtual analog emulations of a certain, famous **ladder filter** which has had a big impact in the history of synthesizers. Each of these filters is available in a 12dB/Oct and a 24dB/Oct variant. These values determine the slope of the filter rolloff. The 24dB/Oct variants filter more frequencies than the 12dB/Oct counterparts.

3.3 SEM-12

TODO SEM BILD.

Another emulation of a classic synthesizer filter. This filter has the speciality of being able to shift between a lowpass and a highpass filter, with a notch-filter in between. The filter slope of this filter is 12dB/Oct.

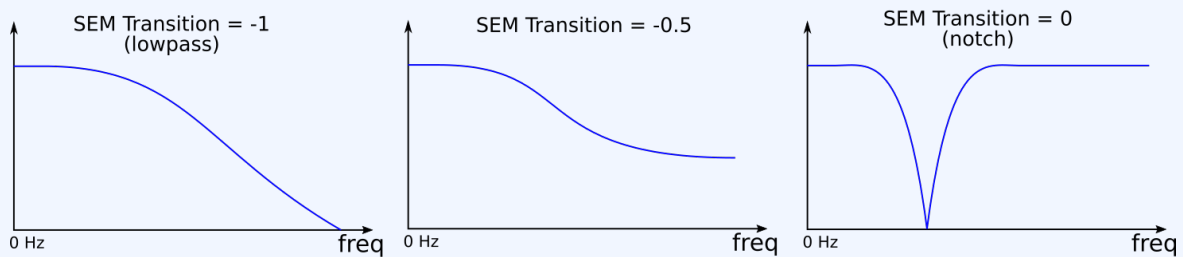


SEM Transition

Modulation: ✓

Automation: ✓

Fades from a lowpass filter over a notch filter to a highpass filter. This allows for special filter variants which still leave some of the frequencies that were filtered before.



3.4 Diode Ladder



The Diode Ladder is a virtual analog emulation of another classic analog synthesizer filter. Its analog pendant was originally developed to work around a patent on the well established ladder filter. While still being 24dB/Oct, the characteristic of this filter is said to be more aggressive and wild compared to the classic ladder, especially when invoking resonance.

3.5 KO-35



Yet another virtual analog emulation of one of the legendary analog filters of the past. This filter comes in a lowpass and highpass variant. Cranking up the resonance on these filters reveals a dirty, aggressive sound. Note that while the filters are named KO-35, their slope is 12dB/Oct.

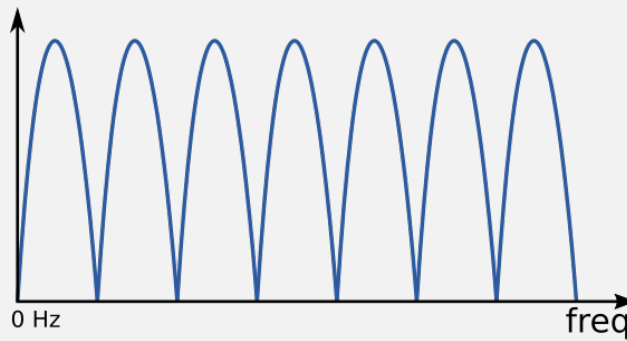
3.6 Comb Filter



A comb filter is essentially a tuned delay module. The input signal fed into a delay-line, which echos the sound back after a set amount of time. The delay time is the inverse of the filter frequency:

$$t_{delay} = \frac{1}{f_{freq}} \quad (3.1)$$

The frequency response of this filter usually resembles the shape of a hair-comb, hence the name.



The resonance parameter for the Comb Filter controls how much of the delayed signal is fed back into the delay line again, creating a feedback loop. Comb filters can sound from subtle to metallic. When automating or modulating the frequency with high resonance values, a psychedelic smearing effect can be produced.



Comb Polarity (+/-)

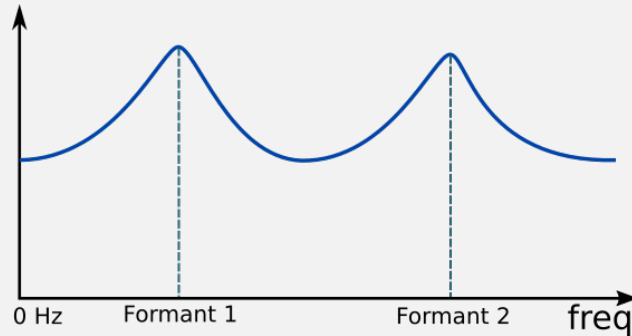
Modulation: ✗ Automation: ✓

Controls whether the insertion of the signal into the delay line is positive (+) or inverted (-). This changes the frequency behaviour. Inverted operation tends to eliminate deep frequencies.

3.7 Formant Filter



The Formant Filter tries to emulate vowels as they are produced in human speech. A tone is perceived as a vowel if two characteristic frequencies are dominant. These are called formants. The Formant Filter emulates this by using a combination of two resonator filters, which increase the frequencies around the two formants.



The Formant Filter allows you to choose two vowels and freely move the formant peaks between the according formant peaks.



Vowel 1 & 2

Modulation: ✗

Automation: ✗

Select the vowels to the left and right of the transition. Selectable vowels are: A, E, I, O, U, Ä, Ö, Ü



Formant Transition

Modulation: ✓

Automation: ✓

Transition between the two selected vowels. The transition is not a simple interpolation of the two vowel sounds, but actually moves the resonant formant peaks in the spectrum from one vowel to the next.

The parameters Filter Velocity and Filter Envelope are applied to this parameter for the formant filter.

3.8 Ring Modulator



The ring modulator is an oscillator disguised as a filter. The function of this module is to multiply the input signal with an internal sine-oscillator. This is formerly known as amplitude modulation.



RingMod Freq

Modulation: ✓

Automation: ✓

Controls the frequency of the internal oscillator.



RingMod Amount

Modulation: ✓

Automation: ✓

Controls the amount of ringmod to be applied. This interpolates between the input signal and the processed signal, effectively working like a Dry/Wet control.

Chapter 4

Amplifier & Distortion



The Amplifier and Distortion sections form the only parts in the signal flow in Odin 2 which are both polyphonic and stereo.

4.1 Amplifier

The amplifier section plays an important gain-staging role in odin. The sound can be boosted or attenuated, as well as panned.



Amp Gain

Modulation: ✓ Automation: ✓

Changes the volume in in deciBels. Can be used to shut the sound entirely. Modulating this parameter from the modulation matrix with -100 will always shut the sound. Modulating this parameter with $+100$ will raise the sound to 0dB if the current value is smaller than -12dB . If it is bigger than -12dB , it will modulate to $+12\text{dB}$ from the current value.

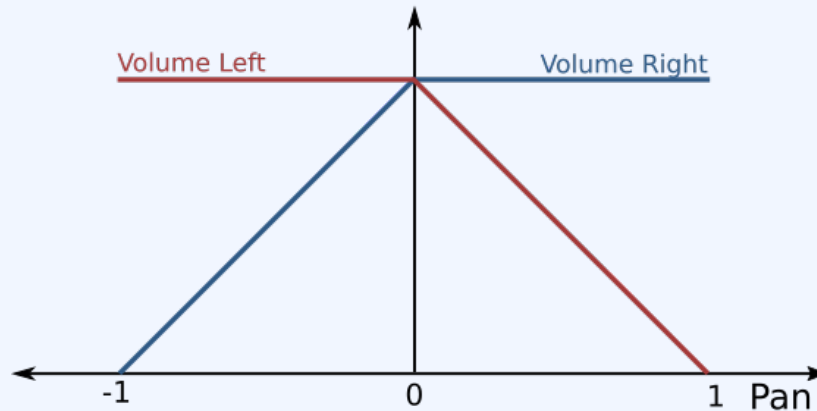


Amp Pan

Modulation: ✓

Automation: ✓

Pan or Panorama can be used to move the sound over the stereo field. The default value of zero will leave the sound centered. Moving the pan towards -1 will attenuate the right stereo channel, moving towards 1 does the same for the left channel.



Amp Velocity

Modulation: ✗

Automation: ✓

Makes the Amplifier gain sensible to the MIDI-Velocity. This allows for expressive play, where harder notes produce louder sounds. Increasing this value lowers the default gain of the amp, such that a MIDI-note with maximum velocity (127) will bring the level back to its previous level.

Please note that the Amp Envelope is not applied between the Amplifier and Distortion section, like the routing would suggest. The Amp Envelope is applied **after the Distortion section**.

4.2 Distortion

The Distortion module is capable of distorting the sound by various characteristic distortion functions. All the distortion types used in this section are threshold based: Once the wave surpasses a predefined value (in positive or negative direction), the processing will apply. Internally, 3x oversampling is used to prevent aliasing from the sharp cuts

made to the waveform.



Distortion On

Modulation: ✗

Automation: ✓

Turns the Distortion module on or off.



Boost

Modulation: ✓

Automation: ✓

Boosts the incoming wave, to make it surpass the internal threshold easier.



Dry Wet

Modulation: ✓

Automation: ✓

Interpolates the processed and unprocessed signals, thereby controlling the amount of distortion applied to the sound.



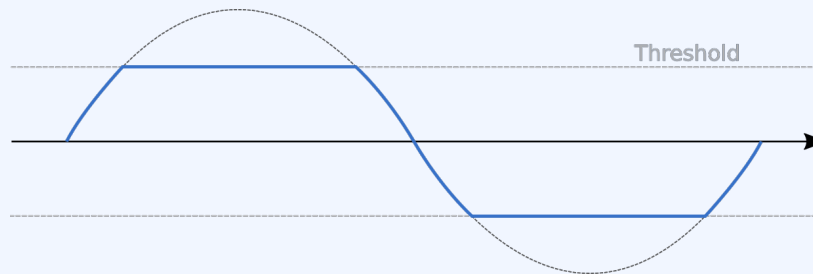
Distortion Algorithm

Modulation: ✗

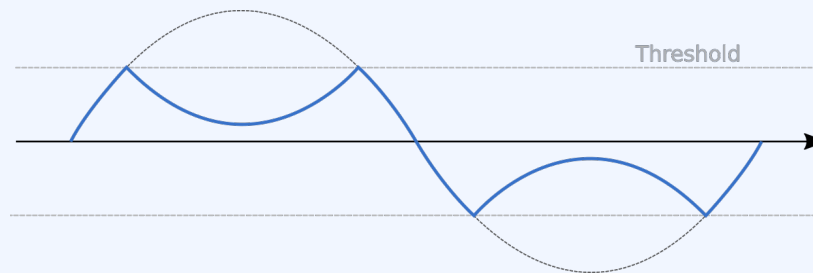
Automation: ✗

Selects which distortion algorithm is used. The options are:

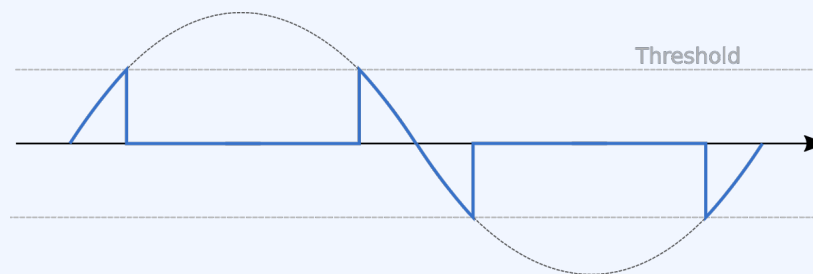
Clamp: Clamps the signal once it surpasses the threshold.



Fold: Folds the wave over once it surpasses the threshold. If the folded wave hits the threshold on the other side, it will be folded again (and so on). Produces more harmonic content than the Clamp algorithm.



Zero: Pulls the wave to zero once it surpasses the threshold. The strongest of the available distortion algorithms.



Chapter 5

FX

Chapter 6

Modulators

Chapter 7

ModulationMatrix

Chapter 8

GlobalSettings