

# ZEEON synth

## User guide

version 1.0

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# Introduction

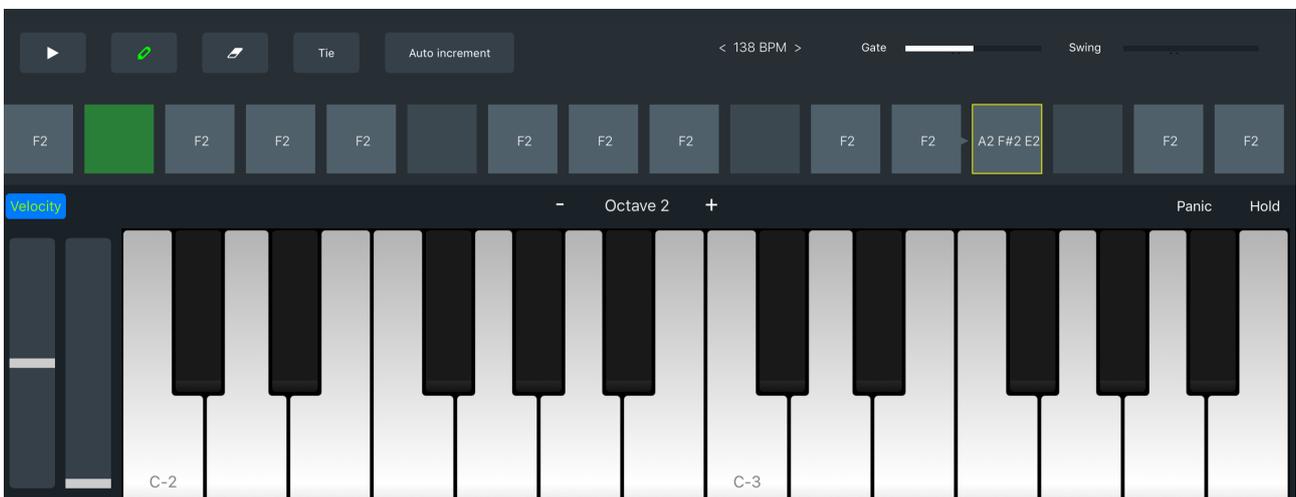
Zeeon is a virtual analog synthesizer, powered by an advanced analog circuit modelling engine. We spent a lot of time analysing iconic analog synths, both vintage and modern, to find out which parts of the circuit contribute most to their specific character. We used this knowledge to create a unique synth, with focus on what's most important - the pure, organic and detailed sound. Many analog synth emulations sound dull. Not Zeeon. We take care of the entire spectrum range from deep lows to sweet highs. All audio and modulation signals are processed at 176 KHz (4x oversampling).

*Zeeon solves millions of nonlinear equations in every second. Despite of heavy optimisations (DSP engine is written in assembly language for powerful ARM Neon) this comes at the cost of quite a high CPU-hit (40-50% on older devices), but we think the sound is worth it.*



# Application

Zeeon is intended to be used as an Audio Unit hosted by DAW applications. Some users prefer standalone applications, so we added a simple AU host containing piano keyboard and a small step sequencer.



The upper part contains a handy 16 steps polyphonic sequencer. Press 2nd button (crayon) to activate editing mode. Select one or several steps and press some keys on the piano keyboard to set step notes. 3rd button (eraser) erases selected steps. Tie - causes note glide in mono mode. On the right side you can set sequencer tempo, gate length and swing.

The bottom part contains piano keyboard and modulation wheels. You can set octave, simulate velocity (vertical tap position) or a pedal by activating Hold button. Press Panic button when something goes wrong (we hope it won't happen :).

# Audio unit

## Control panel

The panel at the left of Zeeon's window is for global control and monitoring. Tap on the black display to open Presets window.



**MONO / POLY / UNISON** buttons - set one of 3 available modes: monophonic, polyphonic and unison

**LAYER 1 / LAYER 2** buttons - Select active layer. Each button has corresponding ON button, that enables / disables layer. Using 2 layer decreases polyphony.

+ (small plus button) - Edit both layers

**1 MIX 2** knob - Mix between first and second layer.

**AMP** - Final volume control, after the layers mix

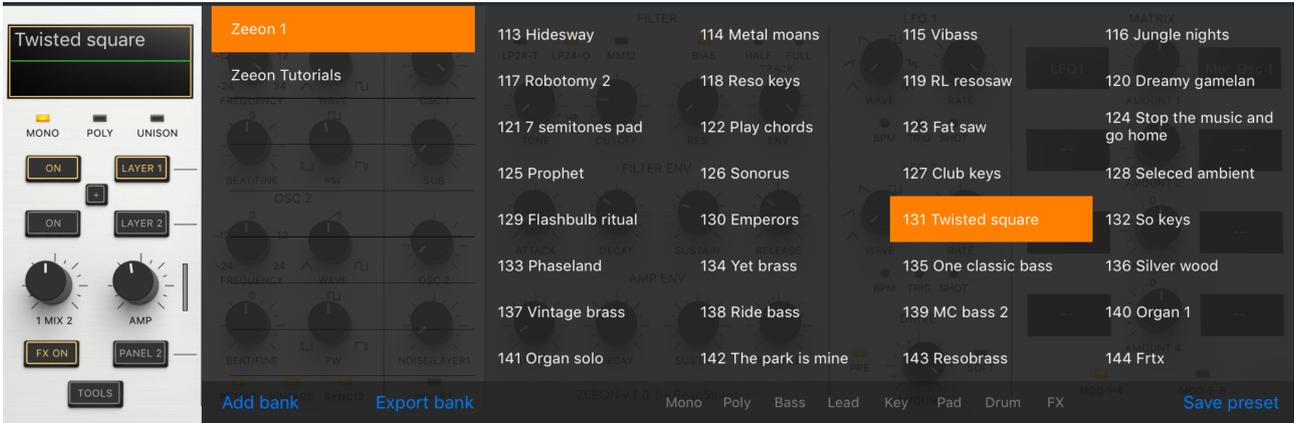
**FX ON** - Enables / disables effects section

**PANEL 2** - Shows second panel, where you can edit voice and effect settings.

**TOOLS** - open tools / settings control panel, when you can perform some useful actions: Init, copy layer, swap layers or clear matrix.

# Presets

Tap on the top-left display to open the presets panel.



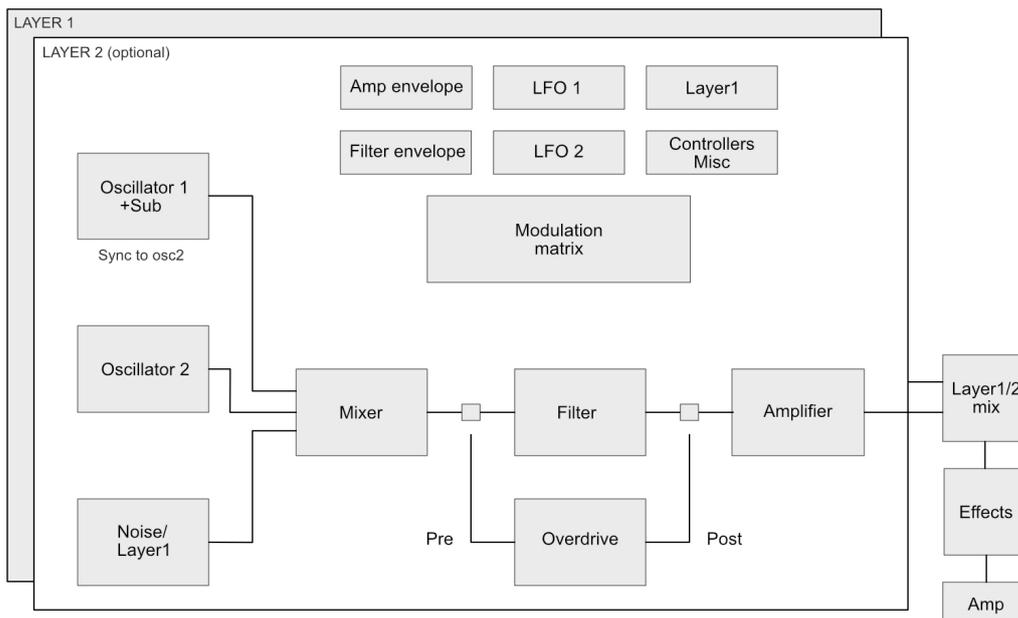
Here you can browse and select active bank and its presets, create a new bank, export bank (via email) or save preset by pressing one of keys on the bottom bar.

Swipe left on bank or preset name to delete. Hold your finger on preset name to reorder presets.

In order to import Zeeon bank use itunes file sharing and restart the app.

## Voice signal flow

Zeeon is built upon a familiar subtractive synth design. Each voice consists of 1 or 2 layers. (Using 2 layers decreases polyphony). The following diagram shows the audio signal paths in each layer. Layer 1 can be mixed in before the filter of layer 2 (Noise/Layer 1 knob in mixer section). TIP: You can change audio routing using “Mixer input”, “Amp input” targets in the matrix.



# Oscillators



Zeeon has 2 identical oscillators.

**FREQUENCY** - sets the base oscillator frequency over a 4-octave range (-2 + 2 octaves). Adjustment in semitones. With Transpose knob (Panel 2) it operates in 8-octave range.

**WAVE** - Selects the wave shape generated by oscillator: Triangle, Sawtooth, Pulse. Wave shapes are continuously variable and smoothly transition from one shape to the next as you turn Wave knob. This parameter can be audio-rate modulated.

**BEAT/FINE** - Controls oscillator's fine tuning. Turning clockwise from zero works like a classic VCO detuning with a range of a quarter tone up. Turning counter-clockwise is a beat frequency detuning. Detuning is constant regardless of base frequency.

**PW** - Changes the width of the pulse wave from a square wave when the pulse width knob is at center position, to a very narrow pulse wave when the pulse width knob is full left or right. \*PW can be

**RETRIG:** Oscillators phase is reset on every key down.

**VINTAGE:** Adds a vintage behaviour to oscillator. Two different effects are being simulated: drift and low quality comparator influenced by PSU.

**SYNC12:** Turns Oscillator 1 hard sync on. Sync forces Oscillator 1 (the slave) to restart its cycle every time Oscillator 2 (the master) starts a cycle.

# Mixer



**OSC 1, OSC 2** - Amount of oscillators mixed

**SUB** - Amount of sub oscillator mixed (square wave 1 octave below Osc 1 tuning)

**NOISE/LAYER 1** - Depending on layer. On 1st layer its a white noise, on 2nd layer its layer 2 mixed. You can still use noise in layer 2 using mod matrix.

Tip: you can mix other signals using matrix and "Mixer input" target

# Filter

Zeeon offers 3 filter models, each of them based on components found in some famous analog synths. This is where a lot of Zeeon's magic happens!



**TONE** - Filter tone control. Depending on filter model.

**CUTOFF** - Sets the filter cutoff frequency

**RES** - Sets the filter resonance. Resonance can be set to negative value using Matrix.

**ENV** - Adjusts the amount of cutoff modulation from the filter envelope.

**TRACK HALF/FULL** - The amount of cutoff modulation from the keyboard - the higher the note, the higher the cutoff frequency. Tracking can be half or full.

## Filter models

**LP24-T** Original 24db/oct transistor ladder model designed for famous Dagger synth. The **Tone** knob controls filter drive. Tip: Use different INVERT and BIAS settings to achieve various tonal character.

**LP24-O** OTA 24db/oct cascade filter model known from some famous polyphonic analog synths. **Tone** controls positive feedback around the filter.

**MM12** Multimode 12db/oct filter with morphable characteristics. The **Tone** knob controls continuous transition from Low Pass, through Notch to High pass and Band Pass. Tone can be audio-rate modulated using modulation matrix!

# Envelope generators



Classic 4 stage ADSR envelope generators.

FILTER ENV controls shape of the envelope applied to filter cutoff frequency.

AMP ENV controls shape of the envelope applied to layer amplifier.

## Low frequency oscillators



Zeeon offers two independent LFOs per voice. They are available as modulation sources in the matrix. LFO 2 rate can be modulated.

**Wave** - select one of 6 available waveforms: triangle, saw up, saw down, square, sample & hold and random triangle (with varying frequency)

**Rate** - sets LFO speed

LFO can work in 3 modes:

**BPM** - LFO rate is synchronised with host tempo

**TRIG** - LFO cycle will be restarted each time you play a new note

**SHOT** - LFO will generate only one cycle each time you play a new note.

## Drive



Circuit modelled overdrive.

**PRE** When its active overdrive is applied before the filter

**SOFT** Activates mild distortion

## Additional parameters

Some parameters are available only via modulation matrix. Use **Const 1** as modulation source to set a parameter to a constant value.

**Pitch** - Layer pitch

**Amp** - Layer volume level

**Panning** - Layer panning

**Osc 1 linear freq** - Oscillator 1 linear frequency modulation

**Osc1,2 const PW** - Oscillator 1/2 constant pulse width. If you set osc PW to 0 or 100% (pulse disappear) and use this modifier, pulse wave will have constant width (e.g. 1ms) regardless of frequency.

**Osc1 retrigger phase** - Sets initial wave cycle phase for oscillator 1, when oscillators are in **Retrig** mode.

**Filter env amount** - Sets filter envelope gate amplitude. Use this target to modify envelope by key velocity.

**Amp env amount** - Sets amplifier envelope gate amplitude. Use this target to modify envelope by key velocity.

**Mixer input** - Adds modulation source to audio signal before the mixer.

**Amp input** - Adds modulation source to audio signal before the amplifier.

## Matrix overview



The heart of the Zeeon is its unique matrix that allows you to create your own routings. 17 signal sources and 41 targets available, both from modulation modules and audio signal path. This takes Zeeon into semi-modular territory. All modulations are processed at audio-rate (4x oversampling)

The matrix contains 8 modulation slots organised in rows. Each row has 3 parameters: modulation source, bipolar modulation amount and modulation target. Signal from source is multiplied by bipolar amount and added to selected destination.

It looks simple, until you realise that **each slot can modulate other slots** (Use “Mod X amount” modulation target). This opens a doorways of endless modulation possibilities.

Modules are processed in a specific order:

**LFO1 >**  
**FILTER ENVELOPE >**  
**LFO2 >**  
**AMP ENVELOPE >**  
**OSCILLATOR 2 >**  
**OSCILLATOR 1 >**  
**MIXER >**  
**FILTER >**  
**AMPLIFIER**

Modules can modulate only targets processed after them. e.g. Oscillator 2 can modulate oscillator 1, but not the opposite. Unsupported modulations will appear grey on the list. Self modulation or modulation loops won't work.

# Modulation examples

Below are several modulation scenarios that illustrate how to use the modulation matrix. The following format is used: [Slot number:] [ Source ] -> [ Modulation amount ] -> [ Destination ].

## Use mod wheel to add vibrato

Set LFO 1 wave to triangle and rate to 6 Hz

1	LFO 1	0	Pitch
2	Mod wheel	10	Mod 1 amount

## Modulate envelopes by keyboard velocity

1	Velocity	100	Amp env level
2	Velocity	100	Filter env level

## Basic layer panning

1	Constant 1	100	Panning
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## Frequency modulation

1	Osc 2	70	Osc 1 freq
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## Oscillator self amplitude modulation

Its a great way of thickening up basic saw wave. Experiment with Mixer Osc 1 setting (e.g. set it to 50 and set modulation amount to -100 or 100).

1	Osc 1	70	Mix: Osc 1
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## Oscillators cross amplitude modulation

1	Osc 1	100	Mix: Osc 2
2	Osc 2	-100	Mix: Osc 1

### Filter bypass (change audio routing)

1	Osc 1	70	Amp input
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### Mix other noise types (pink or hiss)

1	Noise (pink)	70	Mixer input
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### LFO 1, that modulates filter, is modulated by LFO 2, that is modulated by white noise :)

1	LFO 1	0	Filter cutoff
2	LFO 2	80	Mod 1 amount
3	Noise (white)	10	Mod 2 amount

### Audio-rate madness

Use Oscillator 2 or Layer 1 to modulate: Oscillator 1 waveform or pw, panning, filter cutoff, resonance or LP-HP tone of MM12 filter.

### Abusing parameter ranges

You can set negative value to filter resonance or envelope sustain level (Use Const 1 source). Just check what is going to happen :)

# Voice settings

Voice settings are available on Panel 2. (Press corresponding button in control panel section).



## PITCH

**GLIDE** portamento speed when synth is in mono/unison mode. **AUTO** enables portamento only when 2 or more keys are pressed.

**PB RANGE** controls Pitch bender range from 1 to 24 semitones

**TRANPOSE** sets preset base frequency (-24 - 24 semitones)

## VINTAGE OSC MODE

Here you can tweak oscillators behaviour in vintage mode.

**SLOP** adds randomized detuning to the oscillators to emulate the tuning instability of vintage analog

oscillators.

**PSU** simulates behaviour of a low quality power supply. AC current leaks to comparators and causes reset point modulation.

## AMPLIFIER

**BASS BOOST** enables a bass booster circuit emulation known from one famous vintage synths :).

## UNISON

**SPREAD** controls unison voices frequency spread

**LEVEL** sets level ratio between main voice and detuned voices

## ENVELOPES

**SATURATION** modifies shape of the envelope curves. They get saturated and rounded.

# Effects

Zeeon is equipped with 4 effects: chorus, phaser, delay and reverb. You can turn off / on the whole effect section by tapping **FX ON** button on the control panel. To access effects settings press **Panel 2** button. Every effect can be enabled/disabled by pressing **ON** button. **MIX** knobs control proportion between dry and wet signal.



## CHORUS

Accurate emulation of vintage analog chorus and more. 2 analog delay lines (BBD) are modelled with all of their warmth and complexity. Their clock is modulated by sine or triangle LFO. Thanks to extended parameter ranges and additional options you can achieve other effects like vibrato, doubling or start speaking alien languages.

**TRI** - Delay line is modulated by triangle waveform, or sine when button is disabled.

**MONO** - Turns on monophonic processing

**LPF** - Filters out high frequencies of wet signal

**256/1024** - Set delay line length. Shorter delay means more BBD artefacts.

**MOD SPEED / MOD DEPTH** BBD delay line clock frequency modulation speed and depth

**OFFSET** It's a offset between dry signal and the minimum of the LFO's oscillations

**NOISE** Simulates noisy BBD.

## PHASER

Clean digital 6-stage stereo phaser, modelled using zero-delay-feedback technique. Adds strong formants, when feedback value is high.

**MOD SPEED / MOD DEPTH** Modulation speed and depth

**FREQUENCY** Base frequency range

**FEEDBACK** Feedback amount (bipolar). Increasing feedback results in deeper peaks / notches.

## **DELAY**

Classic stereo delay.

**SYNC** Synchronizes delay length with host tempo.

**FEEDBACK** Delay feedback amount.

**FILTER** LP/HP filter

## **REVERB**

Classic digital stereo reverb.

**LOW CUT / HIGH CUT** filters out low and high frequencies of the input signal (band-pass).

**SIZE** controls room size (reverbation length).

**PRE** controls pre-delay size.

**HIGH DAMP** controls damping of high frequencies in inner reverb processing loop.