

ZOA 1.2.x User Manual

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Contents

Introduction	2
New in Version 1.2	3
Overview	4
Grid	5
Sequencer Panel	6
Grid Settings	6
Life Settings	7
Voice Panel	8
Pattern Control	10
Top Bar	11
Settings	13
MIDI Behavior (Audio Unit)	15
Thanks	17

Introduction

ZOA is a fully generative MIDI sequencer for iOS and macOS that produces melodies and control signals based on a creative implementation of John Conway's Game of Life. ZOA can run as a standalone app or as an AUv3 plug-in.

What makes ZOA unique is that it has four independent voices that are decoupled from the underlying sequencer model. Each voice can have its own pace, length, pitch offset, and rhythmic pattern, among other things. Because of this, ZOA is capable of creating complex, evolving musical structures that simultaneously include melody, harmony, bass, and rhythm.

ZOA is also designed to be easy to use, with a focused set of parameters that is nearly completely visible all at once. Simply start the clock, tweak the parameters to your liking, and ZOA will play your synths for you while your hands are free to explore endless sonic possibilities!

For best results, please check out the tutorials on [YouTube](#). Otherwise, read on.

Note:

The standalone app comes with a toggleable "Sidekick Synth" that lets you experiment with ZOA right out of the box. You can also send MIDI from the standalone app. The AUv3 version of ZOA does not produce sound. Instead, it generates MIDI notes that can be used to "play" other instruments, devices, or apps that can receive MIDI.

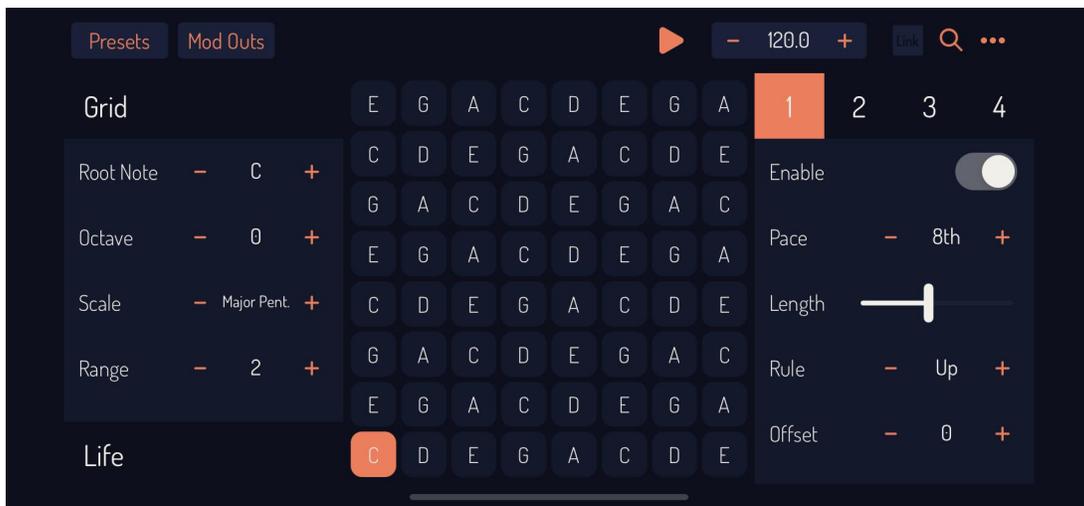
New in Version 1.2

- Improved pattern control with “step options” lets you add per-step holds, ties, accents, ratchets, and trig conditions for greater rhythmic variation and expression. Long press on a pattern step to edit its step options.
- Added eight MIDI CC outputs that feature unique control signals generated from ZOA’s game of life simulation: population density, fertility, mortality, stability, and per-voice random values.
- Added ten factory presets to the preset manager. The preset manager is now available in the AUv3 plug-in, too.
- Generally improved the user experience.
 - User controls and touch points are bigger.
 - You can now persist the parameter selection menus.
 - Settings are saved between launches in standalone mode.
 - The screen won’t turn off while you’re using ZOA in standalone mode.
- Added MIDI clock out to the standalone (experimental, your mileage may vary).

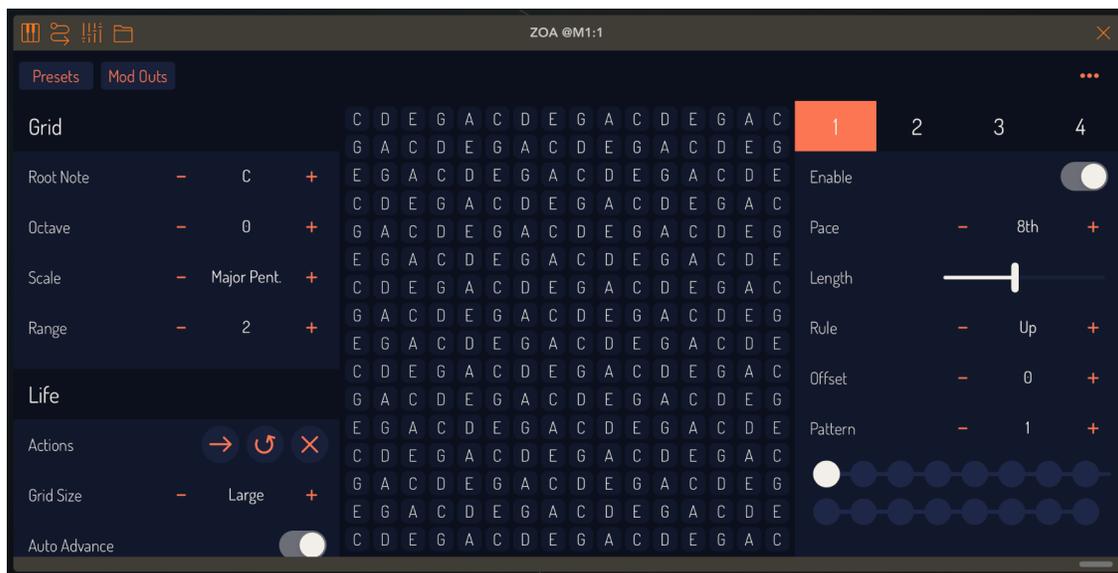
Overview

ZOA has four main views, the top bar (top), the sequencer panel (left), the grid (center), and the voice panel (right).

Standalone on iPhone 11:



AUv3 on iPad Pro 12.9" in AUM:

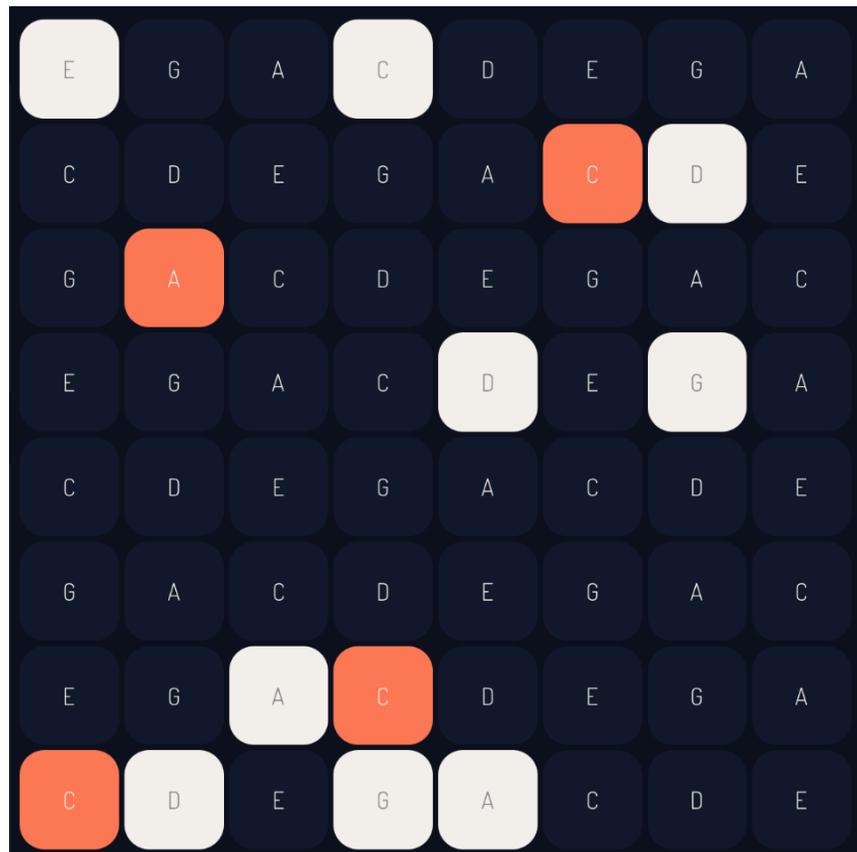


Grid

In the center of ZOA's window is a two-dimensional grid of cells. Each cell has the ability to play a note, which is displayed in the center of the cell. The bottom left cell is the lowest note. In general, as you move up and to the right, the notes get higher. (See Sequencer Panel for details.)

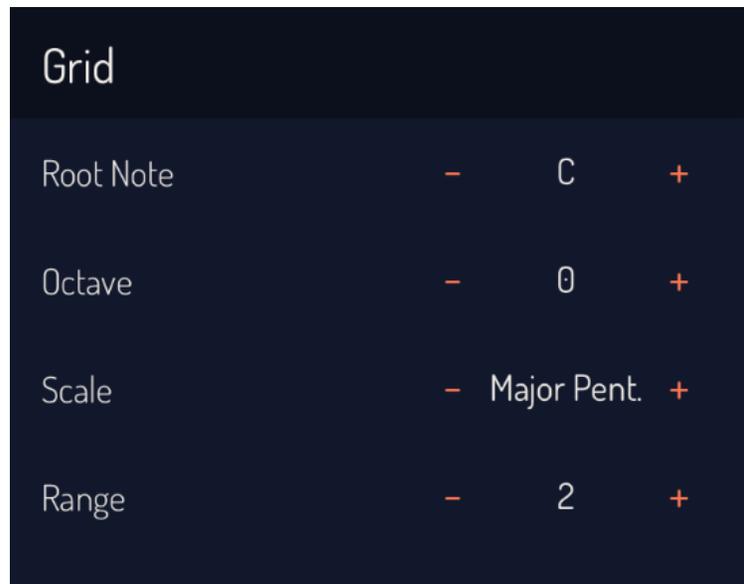
Cells can be either alive or dead. Dead cells are blue, and alive cells are white. You can toggle a cell's state by touching it.

ZOA has four "voices" that can move through the living cells based on various rules and play their notes. Notes that are being played are orange.



Sequencer Panel

The sequencer panel contains two banks of settings: the “Grid” settings, which control how the grid behaves musically; and the “Life” settings, which control how ZOA’s Game of Life simulation works.



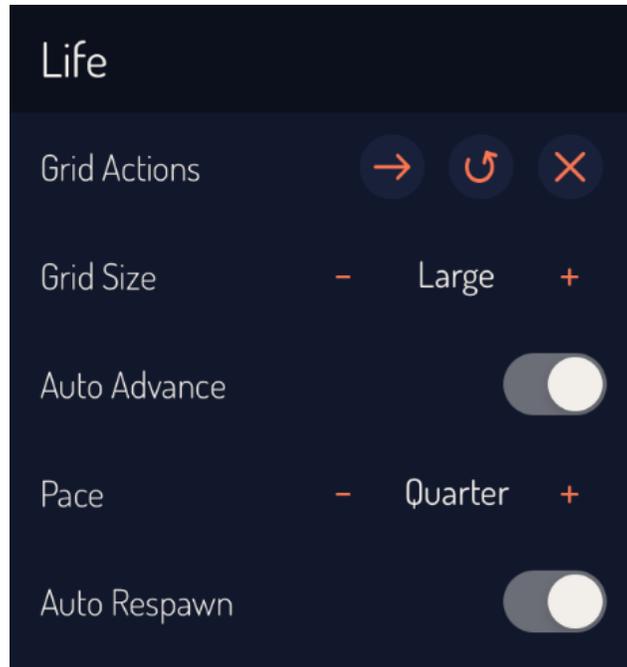
Grid Settings

Root Note: Sets the identity of the bottom left note. This will be the root note used by the scale setting. *Range: C to B*

Octave: Sets the octave shift of the root note. *Range: -4 to +4*

Scale: Sets the scale used to fill the grid with notes. *Range: Major Pent., Minor Pent., Major, Dorian, Phrygian, Lydian, Mixolydian, Minor, Locrian, Blues, Whole Tone, Harm. Minor, Mel. Minor, Chromatic.*

Range: Sets the range of the grid in octaves. As you move up and to the right, notes get higher, but once the end of the range is reached, if there are still notes in the grid, then the range wraps back around to the beginning. *Range: 1 to 8.*



Life Settings

Grid Actions: Provides buttons for advance, respawn, and clear grid actions.

Grid Size: Sets the size of the grid. *Range: Small (8x8) to Large (16x16).*

Auto Advance: Sets whether the Game of Life simulation advances according to the pace setting.

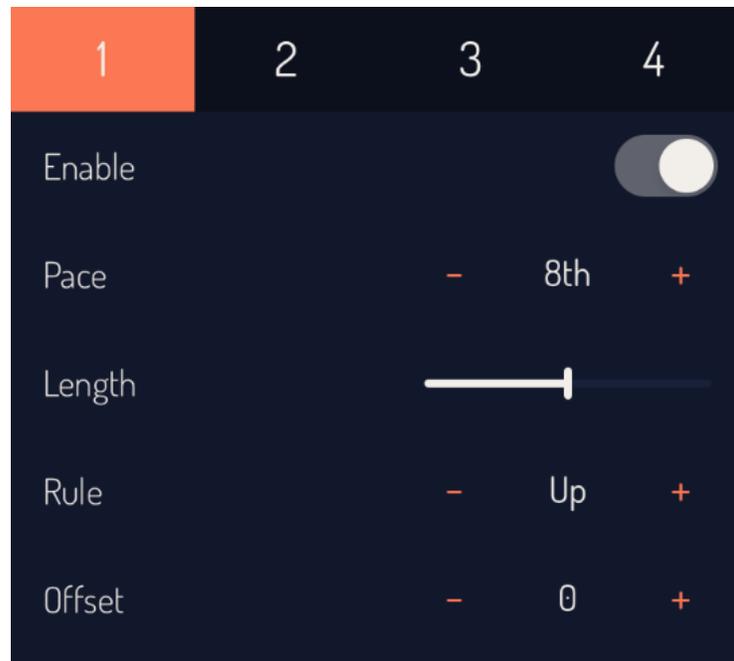
Pro Tip: You can turn ZOA into something more like an arpeggiator than a sequencer by disabling Auto Advance.

Pace: Determines the speed at which the Game of Life advances to new generations. This happens in units of beat time based on the host clock. *Range: 16 bars to 32nd T.*

Auto Respawn: Sets whether Game of Life simulation automatically respawns. With this switch enabled, ZOA will respawn if 1) All cells are dead, or 2) the next generation of cells is the same as the current generation.

Voice Panel

ZOA has four voices that can independently move through and play the living notes in the grid. You can select and edit a voice by tapping on its number at the top of the panel.



Enable: Sets whether or not the voice will produce notes.

Pace: Determines the speed at which the voice will play notes. This happens in units of beat time based on the host clock. *Range: 16 bars to 32nd T.*

Pro Tip: ZOA has six irrational paces based on the golden ratio: golden whole, golden half, golden quarter, golden 8th, golden 16th, and golden 32nd. The golden notes are longer than their standard note by a factor of ~ 1.618 . This makes them a little slower than dotted notes.

Length: Sets the gate length of played notes as a percentage of the pace. Gate length is how long between “note on” and “note off” events. Moving the slider to the left makes the notes sound shorter and more staccato, moving the slider to the right makes them sound longer and more legato. *Range: 10% to 100%.*

Rule: Sets the rule the voice uses to choose new notes (from among living cells).

- Options:
 - **Up**, go right to the end of the row, then move up to the next row.
 - **Down**, go left to the beginning of the row, then move down to the next row.
 - **UpDown**, start at the bottom, do Up until the top, then do Down.
 - **DownUp**, start at the top, do Down until the bottom, then do Up.
 - **First**, always play the first (most bottom-left) living note.
 - **Last**, always play the last (most top-right) living note.
 - **Random**, randomly choose a note.
 - **Walk**, randomly play the same note, the next note up, or next note down.
 - **Rise**, start at bottom, follow pattern up 2, down 1.
 - **Fall**, start at top, follow pattern down 2, up 1.

Offset: Sets the pitch offset of the notes played by the voice in semitones. *Range: -24 to +24.*



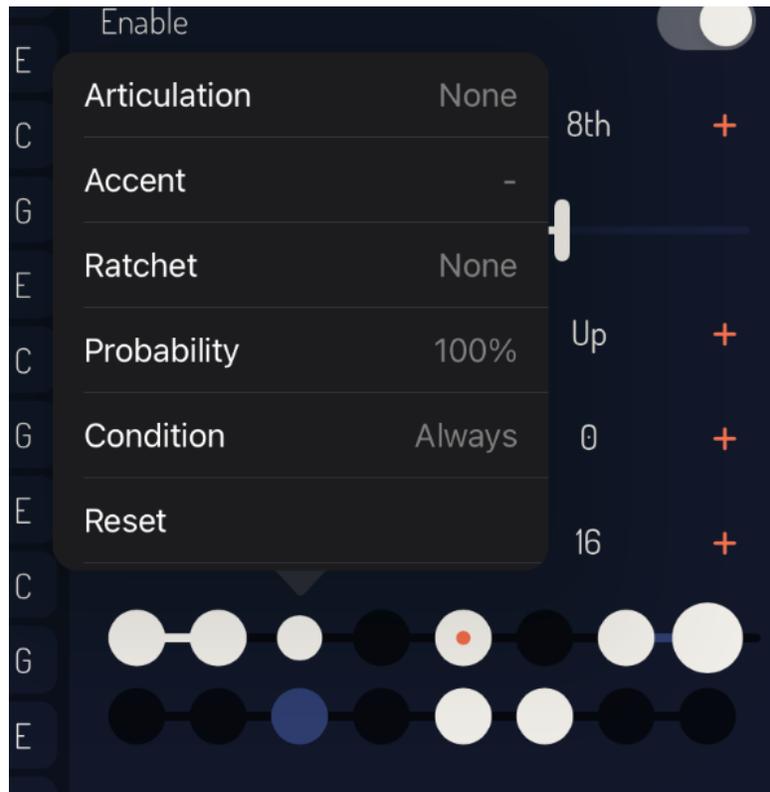
Pattern: Sets the voice's rhythmic pattern. The stepper sets the pattern length from one to sixteen steps, and tapping the circles toggles whether the voice plays or rests on that step. Long press on a step to access its step options menu. Tap to cycle through options. *See next page for details.*

Pro Tip: Use patterns of different lengths for each voice to create complex, evolving polymeters.

Velocity: Sets the velocity of the notes played by the voice. *Range: 1 to 127.*

Channel: Sets the MIDI channel the voice sends its notes on. *Range: 1 to 16.*

Pattern Control



ZOA 1.2 features an improved pattern control that supports “step options” for increased expression and deeper rhythmic variation. The step options are: articulation, accent, ratchet, probability and condition. Long press on a step to reveal its step options. Tap on any cell in the revealed menu to cycle through the values for the step options.

- Articulation: none, hold, tie.
- Accent: none, +, -.
 - The amount of the accent is determined by the value in the settings menu.
- Ratchet: none, 2x, 3x, 4x.
- Probability: 100%, 10%, 25%, 33%, 50%, 67%, 75%, 90%.
- Condition:
 - Always, 2:2 (second of two), 3:3 (third of three), 4:4 (fourth of four), 1x (once on, once off), 2x (twice on, once off), 3x (three on, once off), Last (Did the previous condition/probability succeed?), Not Last (Did the previous condition/probability fail?)

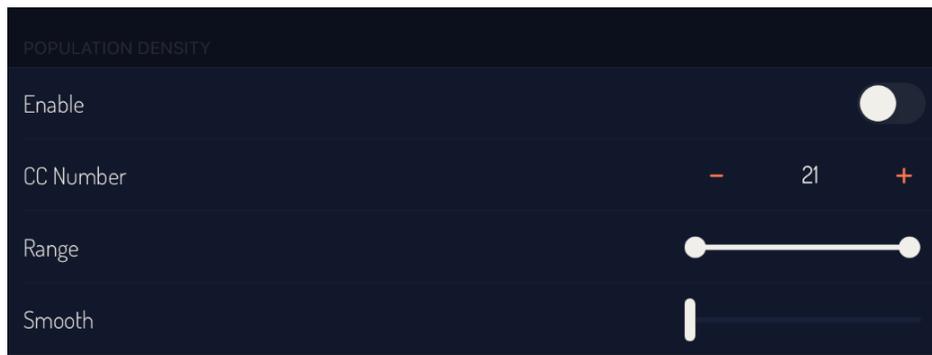
Note: The probability and condition options are both evaluated on each step and both must succeed in order for the voice to play.

Top Bar

Presets button: Displays a simple menu for saving, loading, and deleting presets. Tap the “save button” to save. Tap on a preset to load. Swipe left on a preset to delete.

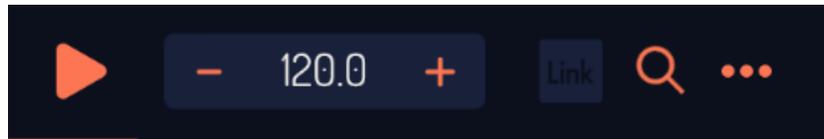
Note: User presets are shared between the standalone and the audio unit, this means that if you save a preset from a host like AUM, it will be visible in the standalone. Likewise, if you delete a preset in the standalone, it will no longer be visible to host apps like AUM.

Mod Outs button: Displays the modulation outputs menu. ZOA can send MIDI CC messages derived from its game of life simulation. Each output has its own enable, CC number, output range, and smoothing parameters.



- Population Density
 - Number of living cells as a fraction of the total number of cells in the grid. For the large grid, 25% is considered “high” while for the small grid, 33%.
- Fertility
 - Number of born cells as a fraction of the last generation’s population.
- Mortality
 - Number of died cells as a fraction of the last generation’s population.
- Stability
 - One minus the relative change in population between the last and current generations. Higher when the population stays about the same from generation to generation.
- Voice 1–4 Random
 - New random value each time the corresponding voice plays a note.

Note: Don’t send two modulation outputs to the same CC number! This will result in strange behavior at the destination.



Transport button: Start and stop ZOA's internal clock. (Standalone only.)

Tempo control: Set the tempo of ZOA's internal clock. Touch and drag to set quickly. Tap "+" and "-" to increment by 0.1. Double tap to round. Long press to type in a value. (Standalone only.)

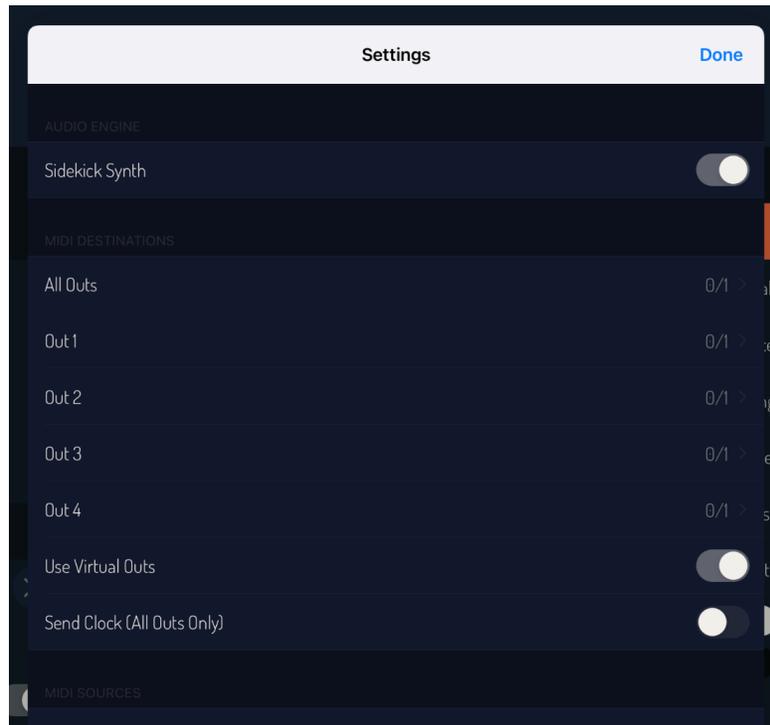
Link button: You can sync ZOA's clock to other devices and apps using Ableton Link. Tap on this icon to display the Link settings. Orange when enabled, dark blue when disabled. (Standalone only.)

Important: ZOA's audio engine will stay on in the background whenever Ableton Link is enabled AND the "Sync Start/Stop" switch is enabled. This will cause increased battery usage! It is recommended only to enable Ableton Link when you are using it.

Bluetooth MIDI button: Displays a menu for connecting to Bluetooth MIDI devices. You will still need to activate the device in the settings menu after connecting. (Standalone only.)

Settings button: Displays the settings menu.

Settings



Audio Engine:

You can enable and disable the bundled synth with the “Sidekick Synth” switch. ZOA’s MIDI engine will still work when this switch is turned off. (Standalone only.)

MIDI Destinations:

ZOA has five MIDI outputs. One for all the voices together, and one for each voice by itself. You can set the MIDI destinations for each output by tapping on the appropriate cell and selecting where you want the MIDI to go.

The “Use Virtual Outs” switch determines whether ZOA sends MIDI on its virtual output ports.

The “Send Clock” switch determines whether ZOA sends MIDI clock on its “All Outs” output. *Note: this feature is still somewhat experimental, your mileage may vary.*

(Standalone only. Use your host for MIDI routing when using ZOA as an audio unit.)

MIDI Sources:

You can select a MIDI input for ZOA by tapping on the “Active Sources” cell and choosing an input.

Note: Currently MIDI receive is limited to note messages, which are used to set the root note and octave settings. This is useful for changing keys on the fly.

You can sync ZOA’s internal clock to an external MIDI clock by enabling the “Receive Clock” switch. *Note: ZOA can only sync to whole BPMs as of version 1.0.x.*

Set the MIDI receive channel with the channel stepper. Infinity is omni mode.

(Standalone only. Use your host for MIDI routing when using ZOA as an audio unit.)

Other:

Set the accent amount using the “Accent Amount” stepper.

You can toggle whether or not the parameter selection menus stay visible after you release your finger using the “Persist Menus” switch.

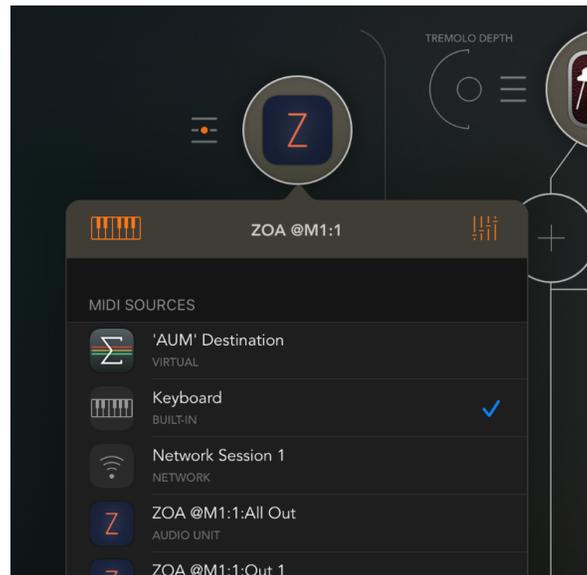
The manual cell displays this manual.

MIDI Behavior (Audio Unit)

ZOA comes with a MIDI Processor type audio unit. It must be loaded on a track that is able to load MIDI Processors. (Ex. ZOA must be on a MIDI track in AUM.)

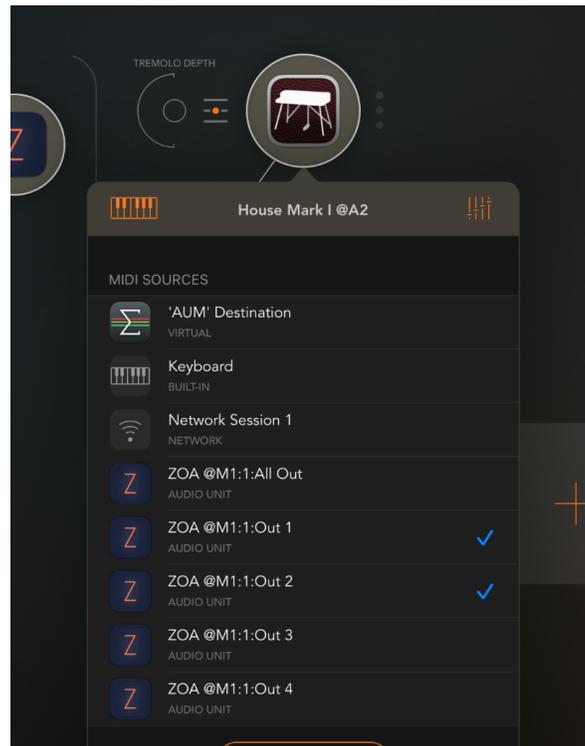
Once loaded in your host, ZOA can both receive and send MIDI.

MIDI Receive



Currently MIDI receive is limited to note messages, which are used to set the root note and octave settings. This is useful for changing keys on the fly.

MIDI Send



ZOA has five MIDI outputs for sending note and CC messages. One for all the voices together and one for each voice alone. This allows you to use ZOA to play multiple instruments simultaneously.

Note that as of version 1.1, additional logic has been added to ZOA's "All Out" output so that the note stream will be unambiguous to MIDI receivers.

How it works:

- If two voices attempt to play the same note (same channel and note number) at the same time, only one "note on" event will be sent.
- If a voice plays a note that is already being held (same channel and note number), then an implicit "note off" message is sent immediately prior to playing the new note.
- When multiple voices are holding the same note, the final "note off" message is not sent until the last voice releases the note.

This shouldn't result in any audible difference to the user, but it should make ZOA play more nicely with external synths and MIDI recorders.

Thanks

ZOA makes use of the open-source library AudioKit. Just want to give a huge thanks to all the developers who maintain it and their supportive online community!