ZEBRA² USER GUIDE

version 2.5.4

Howard Scarr 2011 - 2012

Contents

Introduction

About Zebra2

Zebra2 is a wireless modular synthesizer. Designed for flexibility, ergonomy and low CPU usage, it has also earned a reputation for consistently great sound quality. Zebra2 is the right choice for composers and players who need an uncompromising workhorse synthesizer – practically all parameters in Zebra2 are available as modulation targets.

Modules only appear if they are in use: Add an oscillator to the central patching grid and it will appear to the left, use an LFO for any modulation and it will appear to the right. After having gained a little insight into how it all works, you should find Zebra2 exceedingly fast and easy to operate. Which in the end translates to... more fun!

Online resources

For u-he product information, downloads, support etc., go to the u-he website
For a lively discussion about u-he products (including Zebra2), go to the u-he forum
For video tutorials and more, go to our youtube channel
For thousands of u-he presets (commercial and free), go to PatchLib

Installation and updates

Go to the zebra2 page of the u-he website, download the appropriate installer for your system (Mac or PC), double-click on the downloaded file and follow further instructions. For additional information, please refer to the *ReadMe* file included with the download. Updates are as easy as fresh installs: simply install over the older version.

Here's the single most common support question:

Q: *Why does Zebra goes out of tune after about 15 minutes?*
A: *Zebra's demo mode! Right-click on the data display and enter your registration code.*

File locations

The Zebra2 installer doesn't write anything into e.g. the Windows registry, nor does it create hidden files or otherwise modify your system. To uninstall, delete the plugin itself, then the associated files from the following directories.

Win	Presets	*...\VstPlugins\u-he\Zebra2.data\Presets\Zebra2*
	Preferences	*...\VstPlugins\u-he\Zebra2.data\Support* (*.txt files)
	Themes	*...\VstPlugins\u-he\Zebra2.data\Support\Themes*
	MSEG/OSC	*...\VstPlugins\u-he\Zebra2.data\Modules*
Mac	Presets	*MacHD/Library/Audio/Presets/u-he/Zebra2/*
	Presets (user)	*[you]/Library/Audio/Presets/u-he/Zebra2/*
	Preferences	*[you]/Library/Application Support/u-he/com.u-he.Zebra2...*
	Resources	*MacHD/Library/Application Support/u-he/* (*Zebra2/* and *Themes/*)
	MSEG/OSC	*MacHD/Library/Application Support/u-he/Zebra2/Modules/*

Note: The precise locations depend on your installation paths.

↓ Hyperlinks ↓ for quick navigation when using this manual for reference only

Quick and Easy Tutorial

Load Zebra2 into your preferred plugin host / sequencer / DAW. If you're not sure how to do this, please refer to the documentation belonging to that application.

Click on the **Patches** button in Zebra's upper bar. You will see a patch browser, with folders to the left and individual sounds to the right. Click on the OSC 1 tab to reveal the extra parameters and Wave Editor for oscillator 1. The window should look like the image below – perhaps with more preset folders visible in the left pane...

overview of the Patches window, Local folder contracted

In the left pane, click on **Local**. This is the top level of Zebra's patch directory, containing 20 or so demo patches plus a patch called '**initialize**' – as well as all the other patch folders. The small square to the left expands and contracts the folder.

In the right panel, click on one of the patches and play your keyboard. In many hosts, you can now switch patches using the up/down cursor keys on your computer keyboard. Several of the presets make use of keyboard velocity, pitch bender, mod-wheel and aftertouch – you should try these out while auditioning patches. Some patches have names ending with a '**+**': these use the on-screen X/Y performance pads (click the Perform button).

Now that you know how to audition existing patches, it's time to familiarize yourself with the Zebra2 way of creating your own. Start by loading the last entry in the Local directory (the one called **Initialize**), then click on the **Synthesis** button:

Synthesis window of the 'initialize' patch

Zebra's main programming window! Only three modules are visible because *initialize* only uses one oscillator (OSC1 in the left pane), one envelope and one LFO (both in the right pane). Play your keyboard – it sounds even simpler than it looks, but it is precisely this simplicity that makes *initialize* a great starting point for designing your own patches.

Grab the green-highlighted square at the bottom of Zebra's window (below the waveform editor), and move it to the right while playing some notes. You will see (and hear) the waveform turn from a **saw** into a **square**, then increasingly narrow **pulse** waves. Move it to the far left to check out the **fin** wave (a kind of triangle), then go back to wave 5.

Click in the central grid immediately below OSC1 and select OSC2 from the list. Another oscillator appears in the left pane. Turn the Detune knob in one of the oscillators up to around 20.00, and play a few notes. Take the Vibrato knob of the other oscillator up to around 30.00 to add a little more movement.

Now click below OSC2 and select VCF1 (a multimode filter) from the list. The default VCF mode is *LP Xcite*. Click on that word and change it to *LP Allround* – a more resonant low-pass model.

Move the Cutoff knob while playing the keyboard (you have two hands, right?), then leave it at about 75. Click on the unlabeled knob to the right of Res (resonance) and select Env2 from the list. That knob is now labeled Env2 – turn it up to 70.00 and play the keyboard.

In Envelope 2 (did you notice when it appeared?), change the Attack to 20...

view of the Synthesis window and Global panel after following the tutorial

Click on the Global button in the lower bar. The small grid in the center of the Global pane is for adding and routing effect modules.

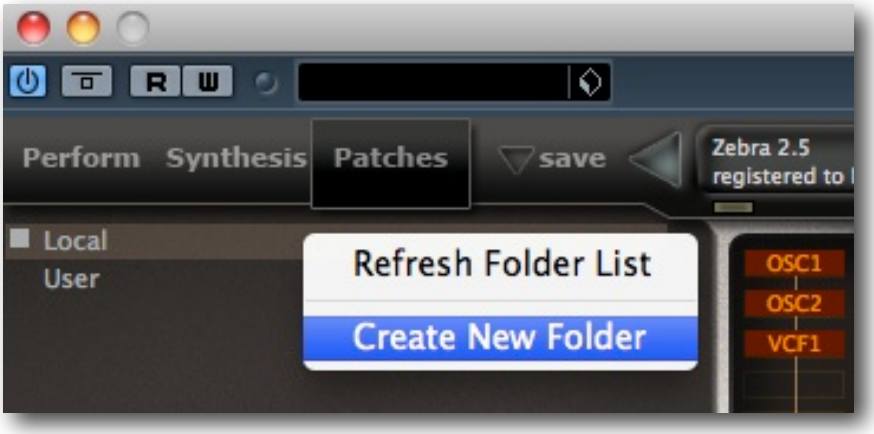
Click on the top-left cell and select **Rev1** from the menu: Reverb parameters will appear in a panel to the right, replacing whatever is already there. Add an EQ immediately below [Rev1]: An EQ control panel will replace the reverb panel.

Click on the [EQ1] in the grid, and drag it upwards: It will swap places with [Rev1] – the reverb effect will not be equalized now, only the pre-reverb dry signal. Experiment with all the settings in those effects panels. To switch between effect panels, click on the corresponding [cell] in the grid.

Now would be a good time to learn more about Zebra's GUI – see the next section...

If you're feel slightly overconfident, however, you could refine this extremely simple patch – while looking up the appropriate information in the reference chapters. Note that you can hold down SHIFT on your computer keyboard for finer control, and that right-clicking often gives you access to some useful options.

Whenever you come up with an interesting sound, press the **save** button. Patches are stored in the *current folder*, so you should always check which folder is currently selected before saving patches.



right-clicking in the Folders pane reveals these two functions

If you prefer to keep all your patches in one place, go to the Patches window, right-click on the *Local* directory and select 'Create New Folder'. Give it a suitable name (e.g. your first name) and click on Apply. Select the new folder and save your patch. Otherwise click on the *User* folder (Mac OSX) and save all your own creations there.

If you want to delete patches, you will have to use Finder / Explorer – see file locations. The browser functionality is likely to be extended in future versions.

A personal note from the author: After a slow and slightly shaky start, I found programming Zebra2 a thoroughly satisfying experience – it does what I tell it to, and it does it very well! Zebra2 has already given me more pleasure over a longer period of time than I dared hope for... I must have clicked on that Save button 10,000 times already.

User Interface

Basic Operation

Standard controls

Values are adjusted via click-and-drag, often allowing finer resolution via the SHIFT key on your computer keyboard. Note that many of the knobs are bipolar i.e. zero is in the center so you can set negative values. Knobs can be reset to default values via double-click. Tip for wheel-mouse owners: Unless you need fine control, you don't even have to click on knobs and switches to change values – just 'mouseover' and roll the wheel.

Definable controls (…)

Most of Zebra's modules include user-definable modulation knobs, which are only labeled after you have selected a source via right-click (left-click also works, but I prefer consistency). The definable controls let you define modulation that you can see immediately in each module's panel.

The target for a '…' knob is usually the parameter to its immediate left. For instance, the second knob from the left in the upper half of an oscillator panel modulates the wave index (Wave), and the one between Tune and Detune modulates the Tune parameter. The two filter modules (VCF and XMF) are exceptions to the above rule. By all appearances, the two unlabeled knobs should affect Resonance – in fact they both modulate Cutoff. The order of those particular knobs may change in future versions of Zebra2.

Once a modulation knob has been defined / labeled, it is not immediately recognizable as such. When in doubt, right-click on the knob – if the list of mod sources appears, that knob is definable. After having programmed Zebra2 for a while, you will get to know where all the definable knobs are and which parameters they modulate.

Buttons & switches

Most of the buttons are selectors i.e. they open drop-down menus. Like the knobs, most of the switches also react to mouse wheels (particularly useful in the Arp/Seq panel).

Handles

Throughout this manual, small movable objects (e.g. in several of the waveform editors, MSEGs, EQs, X/Y) are called *handles*.

Modulator panels

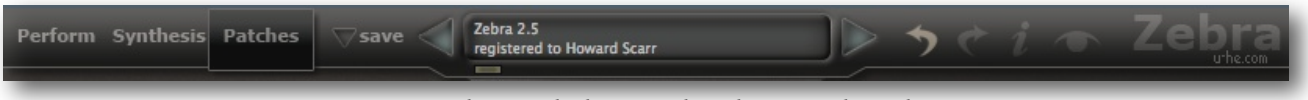
Generator panels appear when a cell in the grid is defined, modulator panels only appear when those modules are used to modulate something. To take a quick peek at an unused modulator, you will simply have to "use" it – click on any definable knob (...) and select that modulator from the dropdown list.

Context menus

Zebra2 uses the righthand mouse button to open context menus. On the Mac, ctrl+click is an alternative. The context menus of most controls include MIDI-learn functions.

Upper Bar

At the top of Zebra's window you will see this bar:

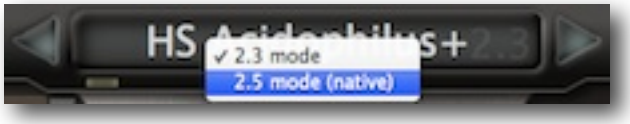


upper bar, with the 'Patches' button selected

The **Perform**, **Synthesis** and **Patches** buttons to the left of the upper bar are for selecting Zebra's three main windows.

The **save** button (the word 'save' is part of the button, you don't have to click on the small triangle) is for storing patches in the current directory – so you should always remember to select an appropriate folder *before* saving your patch.

The central **Data Display** serves three distinct purposes:



- It shows the name of the currently selected patch. Clicking on the triangles to the left and right of the display steps through patches. Clicking on the name will open a drop-down list containing all the patches in the current directory – a convenient method of jumping to another patch without having to open the Patches window.
- It shows the current edit parameter and its value. Watch the data display whenever you need to set specific values. After about 2 seconds, it will revert to the patch name.
- Right-clicking on the display lets you toggle between normal 2.5 and 2.3 compatibility mode (in which case '2.3' will appear in the righthand side of the display). If you're editing a 2.3 preset, please note that this mode does not support the more recent features and improvements. Note also that the sound can change when you switch over to 2.5 (recommended anyway!), mainly due to the improved 'XMF' module.

The small rectangle below the left edge of the display is a MIDI activity indicator.

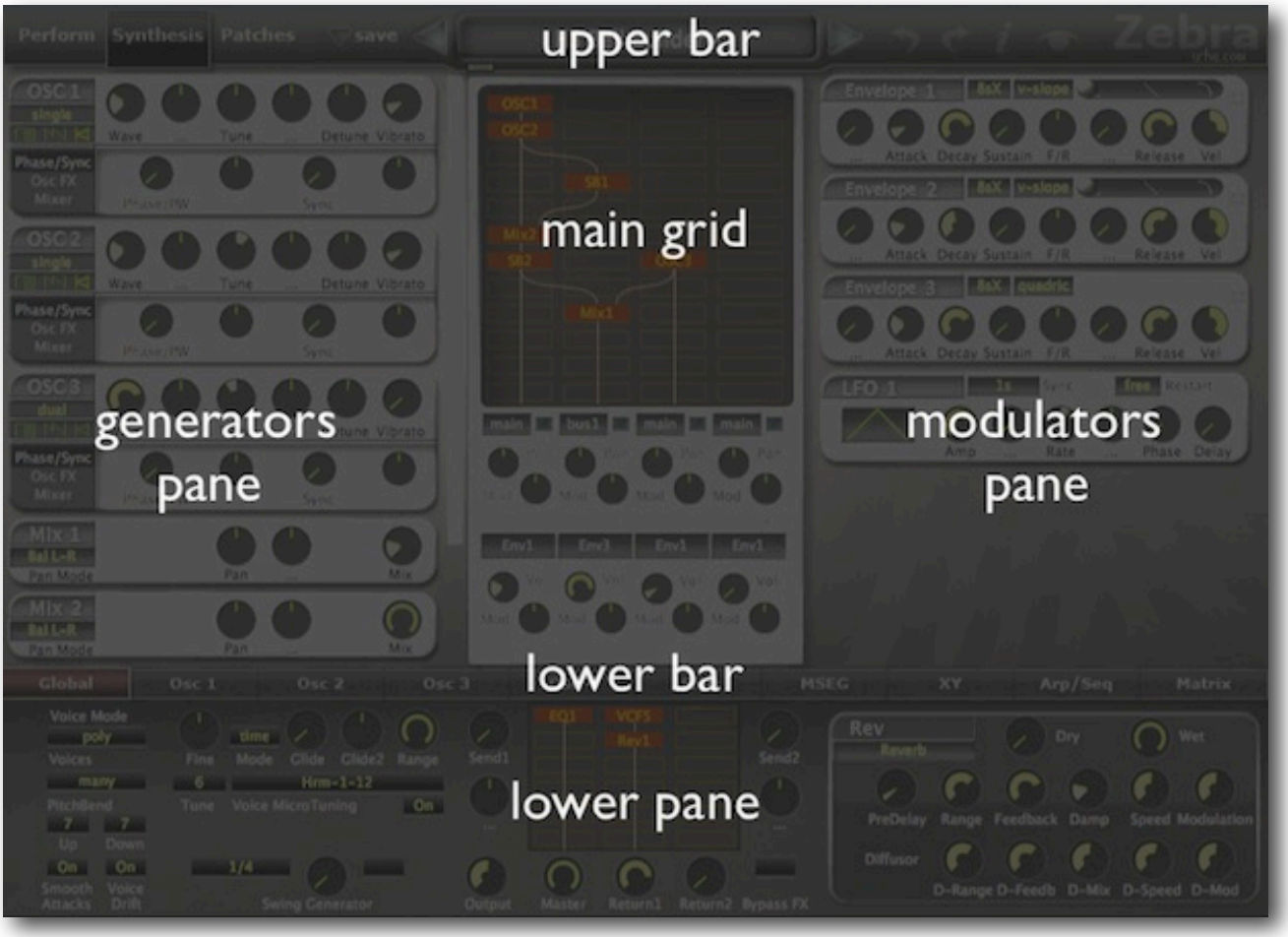
The two curved **arrow** symbols call Zebra2's undo and redo functions. The **info** (***i***) symbol opens a floating window displaying text written by the author of the patch.

The **eye** symbol is for selecting GUI skin and size. This list also appears if you right-click on any blank area in Zebra2 – which can be handy if e.g. the largest (Cinematic) size is too big for your monitor and you can't reach the button to change it back! On larger monitors with high resolution, even the 'Cute' size can be fine for performing on the X/Y pads.

At the time of writing, the only skin that supports all 2.5 features is 'Original'

Synthesis Window

Click on the **Synthesis** button in the upper bar...



Areas of the 'Synthesis' window

Generators pane

The lefthand part of the window contains control panels for each active module in the main grid (see next page). Note that, because the arrangement of these panels is strictly vertical, the generators pane will seldom reflect the patch structure as set up in the grid. However, generator panels can be reordered by clicking on the dividing line between them.

Modulators pane

The righthand part of the window contains all envelopes, LFOs, ModMappers and ModMixers that are currently in use. Modulators are not defined in the grid, they automatically appear as soon as they are used as modulation sources (or audio envelopes). Modulators can also be reordered by clicking on the dividing lines between them.

If there are more modules than will fit in a pane, a slider will appear. Right-click in an empty part of either pane to open a context menu offering ***auto scroll*** (the default setting – scrolls down to reveal the hidden panel) or ***selected on top*** (moves the hidden panel to the top of the pane). Note that the two panes can have different settings.

Main grid

The center of the Synthesis window is a grid consisting of four vertical **lanes**. This grid is used for patching generators together, whereby the signal flow is **strictly from top to bottom** (well, maybe from side to side every now and again!)

To add a module, click on an empty cell and select from the list. Drag modules around the grid, deactivate via **double-click** (or Mac: **cmd+click**, PC: **ctrl+click**), specify input routing or remove the module via right-click. Clicking on a module will highlight the corresponding control panel in the generators pane.

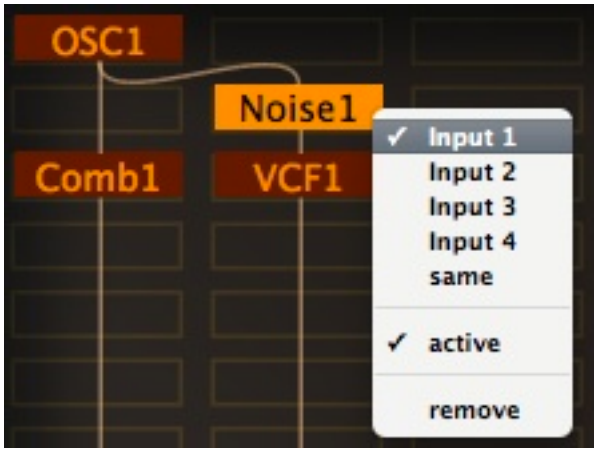
IMPORTANT: Oscillators and noise generators (as well as FMOs in certain modes) don't process audio, so when placed on top of one another in the same lane, the signals are simply mixed together...

In this example, both OSC1 and OSC2 flow into XMF1 (a filter). The XMF1 output is then mixed with (not processed by!) OSC3, and sent further down lane 1. OSC4 modulates XMF1 cutoff, and OSC4 is also available as unprocessed signal in Lane 2.

Any module can be used to route signals between lanes. To select the source ('Input') lane for a module, right-click on its [cell].

In this example, OSC1 is comb-filtered in lane 1. Both OSC1 and Noise1 are filtered by VCF1 in lane 2.

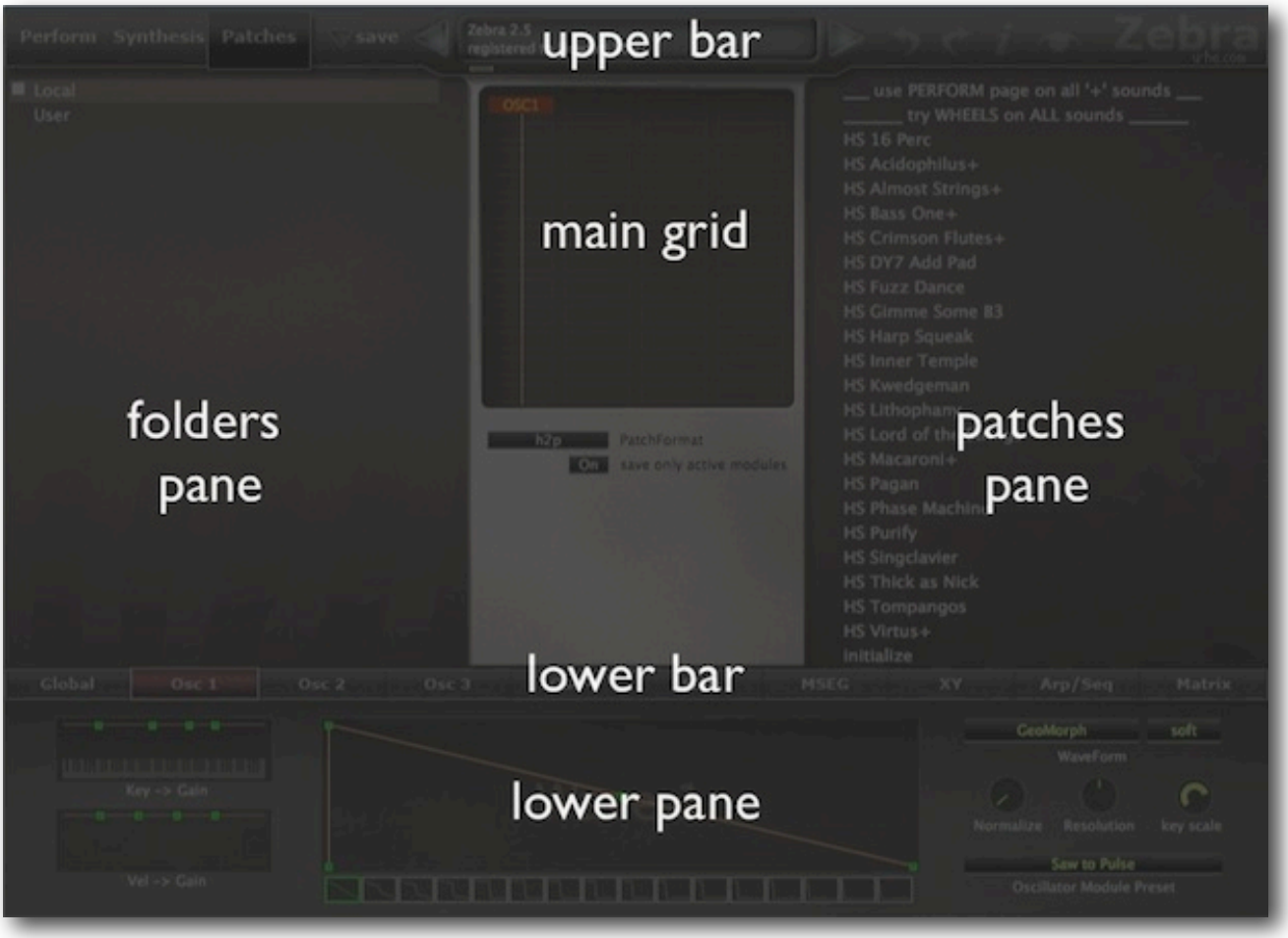
By the way: If Noise1 and VCF1 had been just one cell further down lane 2, the Noise module would have taken its input from Comb1. Try it!



Note: For the sake of consistency and brevity, the names of modules as they appear in the grid (which often differ from the titles of panels) are used throughout this manual.

Patches Window

To open Zebra's browser, click on the **Patches** button in the upper bar:



Areas of the 'Patches' window

Folders pane

The lefthand pane contains all folders within Zebra's patch directory. To display the contents of a folder, click on the name. A small (square) symbol to the left of a folder name means that the folder contains at least one sub-folder: to view or hide sub-folders, click on this symbol.

The MIDI Programs folder

Local also contains a special folder called MIDI Programs, which is initially empty. If you put a bunch of patches (up to 128) in there, they are all loaded each time Zebra2 starts.

Individual patches are activated via MIDI program change messages.

As patches are accessed in alphabetical order, it is a good idea to put a number at the beginning of each name: '000 rest-of-name' to '127 rest-of-name' or similar.

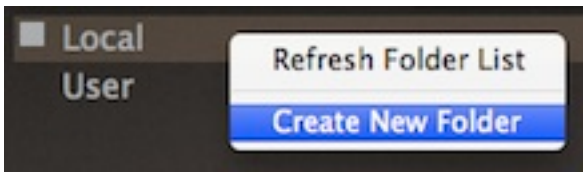
Banks: The MIDI Programs folder can contain up to 128 sub-folders (of 128 patches each), and these are switchable via MIDI bank select messages.

Patches pane

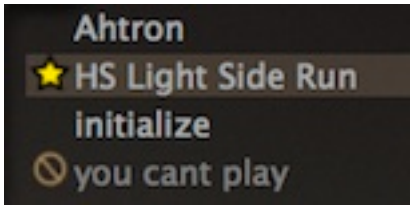
The righthand pane displays all patches in the currently selected folder. Note that the root directory ('Local') contains a selection of demo patches plus *initialize*. To load a patch, simply click on the name. Note: After selecting a patch in this way, you should be able to use the up/down cursor keys on your computer to step through all the others.

Patches functions

To create a new folder or refresh the list, right-click in the folders pane. To rename or delete patches, use the Finder (Mac) or Windows Explorer then refresh the list – see below for patch directory locations. Future versions may include these functions.



To mark patches as 'Favourite' or 'Junk', right-click in the files pane. All junked patches can be made visible by selecting the 'Show Junk' option in the same context menu.



To move a patch to a different folder, drag-and-drop from the patches pane into your chosen destination folder.

Patch directory locations

Windows *...\VstPlugins\u-he\Zebra2.data\Presets\Zebra2*
Mac OSX *MacHD/Library/Audio/Presets/u-he/Zebra2/*

Patch formats

Below the main grid in the Patches window is a switch which specifies the format in which patches will be saved. The default setting is u-he's proprietary **.h2p**. To save patches in your plugin version's native format, select 'native'. We recommend using .h2p because it allows you to exchange patches directly between the various computer platforms (Mac, PC) and plugin types (AU, VSTi, RTAS).

All **.h2p** files are editable text (except for a block of compressed data at the end). More readable still is the **.h2p extended** format, which includes comments for each line. Why not save a patch as .h2p extended, load into a text editor and have a look!

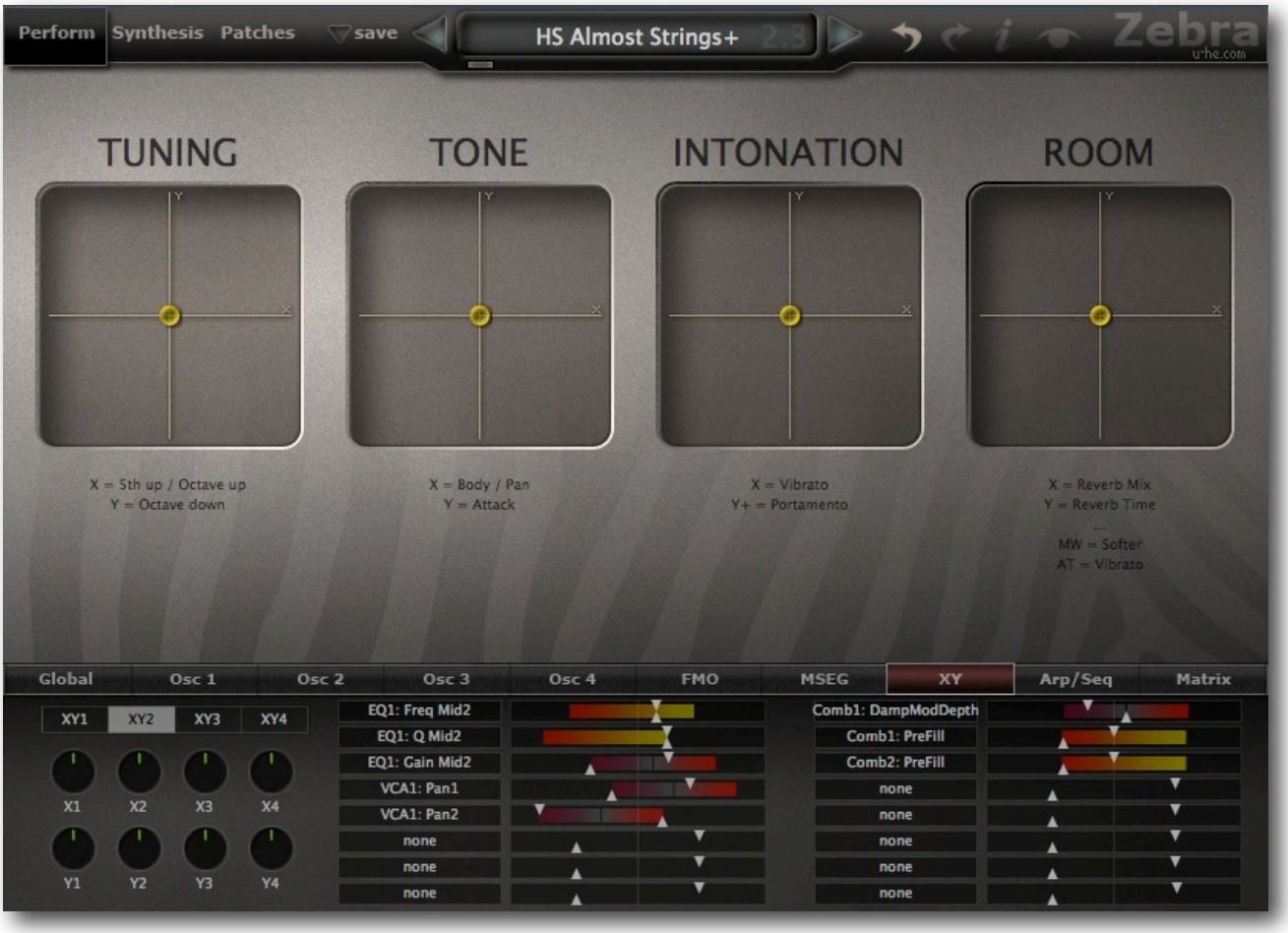
If *save only active modules* is switched on, inactive modules will not be saved with the patch, so the resulting .h2p files are smaller.

Scripts

All recent u-he plugins are based on a 'virtual machine' which can interpret scripts within the patches. The possibilities are practically limitless, but for several reasons this powerful feature has not (yet) been made public. We plan to document the script language, together with practical examples, in the not too distant future.

Performance Window

Zebra's performance window is opened by clicking on the **Perform** button in the upper bar. The four X/Y pads can control up to 16 parameters each, all at the same time. By convention, all patches ending with a '+' character make use of X/Y pads...



Perform window, with an 'XY' panel (XY2) selected

- Click anywhere to jump to a new position – find different variations of the sound
- Click and drag to move smoothly – for realtime performance
- Double-click to reset to the center
- Right-click for additional functions (MIDI-learn, X/Y presets)

For a details about how to program the X/Y pads go here.

Lower Bar and Lower Pane

The lower bar switches the contents of the *lower pane* (see the next page for an example):

Global

Output levels, the FX grid and FX panel, miscellaneous patch settings. Go there

OSC1, OSC2, OSC3, OSC4

Wave Editor, oscillator load/save, miscellaneous oscillator settings. Go there

FMO

Additional FM oscillator settings. Go there

MSEG

Multi-Stage Envelope Generators. Go there

XY

For programming the X/Y pads. Go there

Arp/Seq

For programming the arpeggiator / sequencer. Go there

Matrix

The modulation matrix. Go there

Note: The lower bar and lower pane remain active in all window modes.

Global Settings

Click on the **Global** button in the lower bar:

lower pane with 'Global' selected, including reverb panel

Note: Even if the FX grid is empty, the control panel belonging to the most recently used effect will still appear to the right.

Voice Mode

Poly: normal polyphonic (see Voices parameter below).

Retrigger: monophonic, each new note triggers the envelopes.

Legato: monophonic, envelopes continue i.e. they are not retriggered until you leave a space between consecutive notes. Enables more interesting musical phrasing.

Arpeggiator: polyphonic, triggers and pitch offsets etc. are defined in the Arp/Seq panel.

Duophonic: emulates an interesting feature of a few classic analogue synths. Most early mono-synths had either low note (e.g. Moog and Roland) or high note priority (e.g. Yamaha and Korg). A few, notably the ARP Odyssey and OSC Oscar, offered both – you could actually play two notes at the same time – wow!

In hindsight, duophony may have only been a small step towards the kind of polyphony we expect today, but the quirky charm of its limitations makes it well worth emulating.

Zebra's duophonic mode distributes modules like this: odd-numbered OSC, FMO, Comb, VCF and XMF modules follow the lowest note, while even-numbered modules follow the highest note. Glide rates (see Glide2 on the next page) can also differ, and there is a even a 'KeyFol2' modulation source that includes the Glide2 offset.

Voices

To prevent audio glitches while running complex, CPU-intensive patches, you can reduce the maximum number of notes that Zebra2 will attempt to play at the same time. As Zebra2 features intelligent voice allocation, the following are approximations:

Few: 4 notes
Medium: 8 notes
Many: 16 notes

Note: High *Resolution* oscillators and XMF filters are especially CPU intensive.

Voice Drift

When set to On, each new note is slightly detuned, emulating the imprecise pitch of classic analogue oscillators. Switch this off for absolute precision.

Microtuning

Zebra2 supports standard .TUN microtuning tables. Tuning tables are available online, and most of them are free. Put .tun files into the following folder on your hard drive...

Win: *C:\Program Files\vst plugins\u-he\Zebra2.data\Tunefiles*
Mac: *~/Library/Application Support/u-he/Tunefiles*

...or equivalent locations in accordance with your VST and Zebra2 installation paths.

Pitch Bend

Defines pitch bend range, from 0 to +/- 12 semitones.

Tune

Shifts the overall pitch within a range of +/- 24 semitones

Fine

Shifts the overall pitch within a range of +/- 50 cents.

Glide, Glide2

Glide or 'portamento' is a smooth pitch transition between consecutive notes. Glide affects the 'Key Follow' modulator, so it is directly applied to all modules that include this parameter (OSCs, FMOs, Combs, VCFs and XMFs).

Glide2 is a bipolar offset for even-numbered OSCs, FMOs, Combs, VCFs and XMFs. The modulation source 'KeyFol2' is the same as KeyFol, but includes Glide2 offset.

Glide Mode

time: However far apart notes are, glide will take exactly the same amount of time.
rate: When notes are further apart, glide is proportionally slower.

Range

Full-range portamento in polyphonic synths is often an 'overkill' effect, and therefore not generally useful. The Range parameter addresses this problem: Lower values shift the beginning of the slur closer to the target note – great for 'sloppy' intonation effects!

Smooth Attacks

Instantaneous attack times allow clicks at the start of each note to become audible. To avoid this (quite natural) effect, switch Smooth Attacks on.

Swing Generator

In most synthesizers, 'swing' is only applied to the timing of an arpeggiator or mini-sequencer. In Zebra2, it also affects any synchronized LFOs. Set a rhythmic basis in the popup menu and a swing factor using the knob. Trial-and-error is often the best strategy here. Note that the indicator will stop flashing if swing is set to zero.

Bypass FX

Click on this button to deactivate all effects in the grid. A patch already drenched in effects can be difficult to edit methodically, and in such cases it's a good idea to temporarily dectivate them. Tip: I often catch myself forgetting to reactivate the effects – so if all your patches sound strangely lifeless today, check the status of Bypass FX!

Generators

OSC main panel

To say that the Zebra2 oscillators are ‘highly flexible’ is an almost laughable understatement. They are so powerful that the Zebra2 package includes an extra instrument called Zebralette (just one oscillator transplanted into a much simpler synth framework). The Zebra2 ‘OSC’ module looks like this:

oscillator panel, ‘Mixer’ sub-panel selected

Switches

single / dual / quad / eleven

Selects single or stacked (2, 4 or 11) oscillators. The *eleven* mode could be called a superwave (not a supersaw, hypersaw, terrorsaw etc.) because the stacking effect works with any wave the oscillators can deliver.

Invert 

Adds an upside-down copy of the waveform. Invert plus phase modulation sounds similar to classic PWM, as only the phase of the original wave is shifted around, while the phase of the inverted copy remains fixed.

Sync 

Activates oscillator-internal hard sync – see the *Sync* parameter a few pages down.

Reset 

Activates oscillator reset, which causes the oscillator to start at the same phase position every time a note is played. See the *Phase/PW* parameter a few pages down.

Main controls

The upper half of the oscillator is home to a few controls that should be familiar to any synthusiast:

upper half of the oscillator panel

Wave

Position (index 1–16) in the waveset. Unlike the row of selectors below the wave editor, this knob lets you set intermediate values. The next knob to the right is for wave modulation (+/-16). How smoothly or precisely waves are interpolated depends on the oscillator's Resolution setting.

The true center of the waveset is actually 8.5, and a modulation depth of 7.5 from a bipolar source is enough to reach both limits of the waveset: (8.5 - 7.5 = 1 and 8.5 + 7.5 = 16). The knob to the right is for wave index modulation – right-click to select a source.

Tune

Oscillator pitch offset (+/- 48 semitones). Of course you can hold down SHIFT for even finer control, but there is also a Detune knob to the right. The next knob to the right is for Tune modulation (+/- 48 semitones). Right-click to select a source.

Detune

Detune actually has two slightly different meanings, depending on whether the oscillator is stacked. In single mode, it is for fine tuning (+/- 50 cents). In Dual, Quad or Eleven modes it does not lower or raise the overall pitch of the oscillator, but spreads detuning equally. Of course you can still do normal fine tuning via Shift+Tune.

Vibrato

The amount of pitch modulation directly from LFO1 (0 – 100). The maximum depth here is only +/- 50 cents – for deeper vibrato, click on the definable '…' control to the right of the Tune knob, and select LFO1 from the list.

The oscillator panels in Zebra2 seem fairly harmless, but there is more under the hood than meets the eye. Apart from all the parameters in the lower panel, the oscillator has three switchable sub-panels, *Phase/Sync*, *Osc FX* and *Mixer*, which are selected via the buttons to the left...

Phase/Sync sub-panel

To see this sub-panel, click on the **Phase/Sync** button:

lower half of the oscillator panel, 'Phase/Sync' sub-panel

Phase/PW

Adjusts the phase of the oscillator (from 0° to 180°, but you can modulate it up to 360°). Rapid phase modulation audibly affects pitch, but if the Invert switch (see above) is on, the effect is similar to pulse width modulation (PWM).

Sync

Offset for the oscillator-internal hard-sync effect. This classic 'analogue' sync adds a lot of upper harmonics, and is probably why it was often used to imitate screaming guitar sounds back in the shoulder-padded and hairsprayed 1980s...

Osc FX sub-panel

To see this sub-panel, click on the **Osc FX** button.

lower half of the oscillator panel, 'Osc FX' sub-panel

The oscillators can process the waveform via a pair of internal **spectral effects** routed in series (left > right). To select an effect, click on the **label**. Adjust the value and/or modulate to taste. The speed/smoothness of most spectral effects, when modulated, is highly dependent on the value of oscillator Resolution.

List of spectral effects

Fundamental	Adjusts the level of the fundamental. Range = -200% (inverted) to +200%. At the central position, the fundamental is inaudible.
Odd for Even	Even-numbered harmonics are cross-faded into odd harmonics. This results in a more 'squarish' waveform (square waves contain only odd harmonics). With negative values, the opposite applies – odd harmonics become even harmonics.
Brilliance	Boosts (positive) or attenuates (negative) higher harmonics, resulting in brighter or darker waveforms.
Filter	A combination of lowpass (negative values) and highpass (positive values) filters. Because in reality the 'filter' code only manipulates amplitudes, its slope is more than 100dB/octave.
Bandworks	A combined bandpass (positive) and notch filter (negative).
Registerizer	Boosts any octaves of the fundamental while attenuating all other harmonics, often resulting in an organ-like sound.
Scrambler	Similar to operator feedback in FM synthesizers: the phase of the waveform is modulated by the wave itself, creating many new overtones. If you need dirty-sounding digital oscillators, this is the one.
Turbulence	Periodically shuffles the harmonics at random. Even if not modulated, the speed of this effect is dependent on the oscillator Resolution. Turbulence is useful in SpectroBlend mode with only a few harmonics.
Expander	Expands (or contracts when negative) the spectrum. Similar to brilliance if the harmonics are distributed evenly.
Symmetry	Contracts the waveform towards the beginning or end of its cycle. Often sounds like pulse width modulation – and for a square wave, that's precisely what it is!

Phase Xfer	A variant of PD (phase distortion) synthesis. The original waveform is not output directly, but is used as the phase response of an extra sine wave – which you can hear when the value is zero.
Phase Root	The original wave multiplies the phase response of the sine wave.
Trajector	The original wave adds to the phase response of the sine wave. Like phase modulation in 'FM' synthesizers – try Trajector on a pure sine.
Ripples	Multiplies the waveform with a variable harmonic, resulting in quasi-resonant sounds.
Formanzilla	Multiplies the spectrum of the waveform with a variable harmonic, resulting in formant-like spectra with several strong peaks and troughs.
Sync Mojo	Simulates hard sync by contracting the time axis then writing the waveform back into wave memory.
Fractalz	Like Sync Mojo, except that the already contracted wave is contracted again etc.. This results in a fractal waveform with even more harmonics than Sync Mojo. Fractal structures can be found in nature (try googling the word 'fractal').
Exophase	A classic 7-stage phaser is applied to the original wave. This effect is equally useful for static coloration or resonant sweeps.
Scale	The relative amplitudes of harmonics are scaled, either to the power of 2 (negative, softer) or 3 (positive, brighter). This results in finer resolution of quieter harmonics, and therefore more precise control over the overtone structure.
Scatter	Similar to the Scrambler effect (see above), but in this case the phase of the waveform is modulated by itself squared (i.e. to the power of 2). An FM triangle or square from a pure sine or absolute chaos from a sawtooth – Scatter is flexible.
ChopLift	Negative values raise an amplitude threshold below which all harmonics are faded out (Chop). Positive values raise the levels of fainter harmonics (Lift).
HyperComb	Adds 3 copies of the original wave to the wavetable. For positive values (only), the phases are randomly shifted, resulting in a subtle to dramatic effect similar to chorus. Even when not modulated, positive HyperComb is dependent on the value of oscillator Resolution.
PhaseDist	Phase distortion, as in the '80s Casio CZ series of synthesizers. The wave acts as a function for the phase of an inverse cosine. The amount knob crossfades between no effect and full effect, so the most dramatic uses of this effect involve modulating the Wave index.
Wrap	Inverts parts of the wave that extend above or below a variable threshold. The limits for multiple wrapping are greater with negative values.

Mixer sub-panel

To see this sub-panel, click on the **Mixer** button...

Lower half of the oscillator panel. 'Mixer' sub-panel

Pan

Panorama shifts the stereo position of oscillator output towards the left or right.

Volume

Oscillator output level. Tip: If you are sending this through a filter with plenty of Drive, you should also experiment with oscillator Volume, or even try modulating Volume with an envelope.

Width

If the oscillator is in dual, quad or eleven mode, this knob controls the stereo separation of the stacked oscillators. Does nothing if the oscillator is in Single mode.

OSC Lower Panel

Center-stage in the oscillator's lower panel is of course the mighty Wave Editor, but to its left and right are several other important elements...

Oscillator Module Preset

This button is for loading / saving complete oscillator templates. Left-click to select a preset from a small browser window. Right-click to open a drop-down menu instead. To store the oscillator, select **save oscillator settings** from this menu.

Note that all modulation assignments (e.g. Wave modulated by LFO2) *are* oscillator settings, but the settings in the modulation sources themselves are *not*. This means that an oscillator preset might not sound the same as when you saved it – for instance if the original LFO2 was a 1/16 square wave but the current one is a 10s triangle.

Oscillator presets belong in the following locations:

Win: *C:\Program Files\u-he\Zebra2\Modules\Oscillator*
Mac: *~/Library/Application Support/u-he/Zebra2/Modules/Oscillator/*

Key > Gain

For oscillator volume scaling according to MIDI note. The horizontal axis is MIDI note (see the keyboard graphic?), the vertical axis is gain/volume. Note that Key > Gain can be used to create keyboard splits between oscillators...

Vel > Gain

For level scaling according to velocity. The horizontal axis is MIDI velocity and the vertical axis is gain. Note that this feature can be used for velocity-switching (as in this image) or velocity cross-fades between oscillators.

Normalize

The output level of the generated wave is analysed (RMS), then low-level waves are boosted so that the final level would be 0dB if Normalize were at 100%.

High normalization values are OK for boosting most low-level waves, but please keep them lower on very spiky waves – unless of course you enjoy blasting a lot of high frequencies through your system!

Resolution

This parameter controls the interval (in time) between successive waveform calculations. This trick ensures that Zebra2 is still very CPU-efficient compared with other synthesizers that calculate their waveforms in realtime.

The range is from 4 seconds (at 1.00) to less than one millisecond (at 9.00). Theoretically, high resolution leads to more precise transitions **at the cost of higher CPU load**.

Low resolution can actually make transitions smoother (intermediates are interpolated), but can also introduce other unwanted effects (e.g. during rapid pitch-modulation). For most purposes, the default value of 5.00 is best.

Key Scale

MIDI note to oscillator pitch, centered around the note E2. Effectively a bipolar 'KeyFol' for the oscillators. Leave at 100.00 for semitone steps (a double-click takes you straight to 100%).

Soft / Crisp

Affects how brilliant/sharp the oscillator is. Only switch to Crisp if you really need those extra spikes and are not overly concerned about aliasing.

Waveform Mode

This button selects the basic mode for the current oscillator: *Geomorph*, *SpectroMorph*, *GeoBlend* or *SpectroBlend*. All will become clear in the next few pages...

OSC Wave Editor

The Wave Editor is where you can create your own wavesforms. As the editor needs to manage up to 16 different waves per **Waveset**, it includes a **Wave Selector** bar immediately below the main editing area:

the wave selector bar, wave 7 selected

The wave selector has (almost) the same function as the Wave knob in the oscillator's main panel – if you adjust one, the other will move accordingly. Unlike the Wave knob, however, the wave selector doesn't allow intermediate values (e.g. wave 1.5).

Several extra features make working with multiple waves very comfortable:

Mouse operations in the Wave Selector

rearrange

(Mac) alt + drag
(PC) ctrl + drag

morph (or blend)

(Mac) cmd + click on the desired target wave
(PC) alt + click on the desired target wave

duplicate

(Mac) alt + cmd + click on the desired target wave
(PC) ctrl+ alt + click on the desired target wave

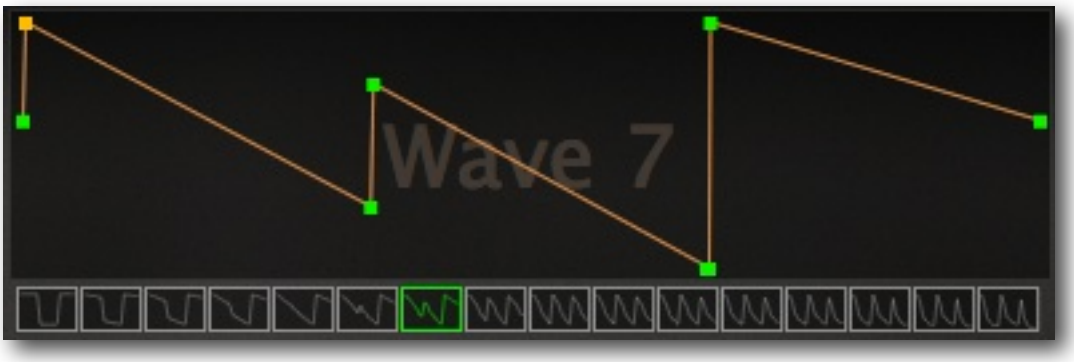
context menu (right-click)

Morph, duplicate or exchange the right-clicked wave with the currently highlighted one.

GeoMorph & SpectroMorph

Although there are four oscillator modes, only two editing methods are required. This section describes the two 'Morph' waveform modes, and how to edit them...

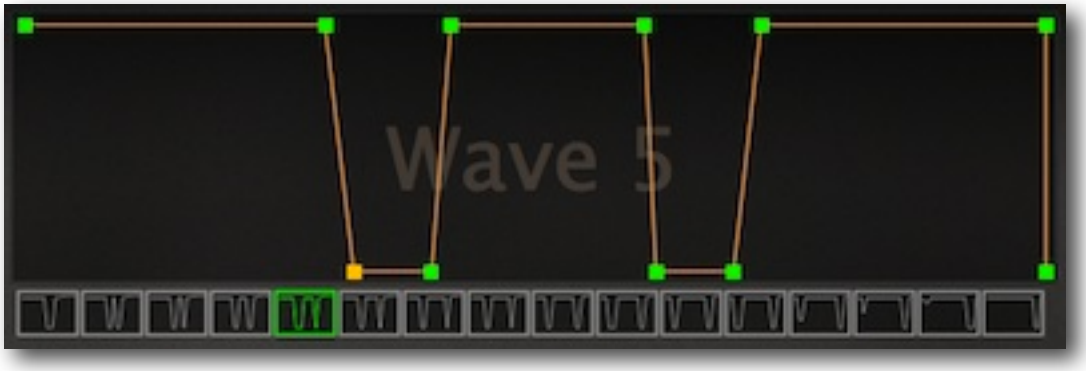
GeoMorph



typical GeoMorph wave

GeoMorph mode lets you draw waveforms by positioning up to 32 handles, and adjusting the curvature of the lines between them. Note that the first and last handles cannot be deleted or moved horizontally – they define the level at 0° phase. The minimum number of handles is 4, and all waves in the waveset adopt the same total number.

SpectroMorph



typical SpectroMorph wave

Although it looks and feels like GeoMorph, SpectroMorph is a completely different animal! It does not depict a waveform directly, but rather its spectrum. 1023 harmonics in the horizontal axis are scaled logarithmically for a total range of about 10 octaves. In this mode, a horizontal line spanning the width of the editor (i.e. all harmonics have equal levels) describes a bright saw wave. By the way, the example above is a bright saw (the upper horizontal line) but with two rather wide troughs – practically a dual band-reject filtered saw.

Mouse operations in GeoMorph and SpectroMorph modes

create or remove a handle

(Mac) cmd + right-click
(PC) alt + right-click

multiple selection

Click in the background and drag over one or more handles
Shift + click on a handle to add or remove it from the selection
To move all selected handles, click and drag one of them

adjust curvature (left, right)

(Mac) alt + drag, cmd + drag
(PC) ctrl + drag, alt + drag

Experimenting with the curvature is better than a (necessarily) long-winded explanation.

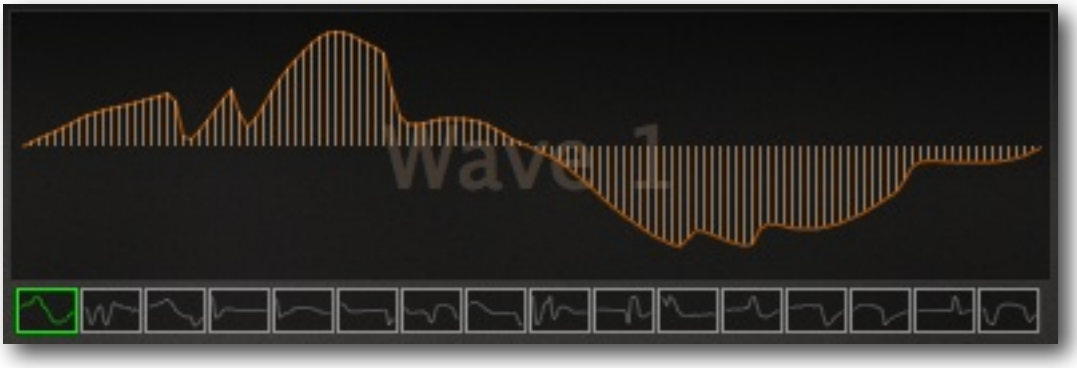
context menu (right-click in the editor window)

insert point..... creates a new handle (appears in all waves in the waveset)
smooth..... adjusts all curves in the selection for minimum spikes.
linear..... straightens all curves in the selection
peaks..... adjusts all curves in the selection for maximum spikes
distribute all..... adjusts the horizontal positions of all handles for equal spacing
line up selected.....line up all handles with the leftmost / rightmost in the selection
clear..... resets all handles to minimum level
copy / paste..... transfers wavesets between oscillators (also between patches)

GeoBlend & SpectroBlend

This section describes the two ‘Blend’ waveform modes, and how to edit them...

GeoBlend

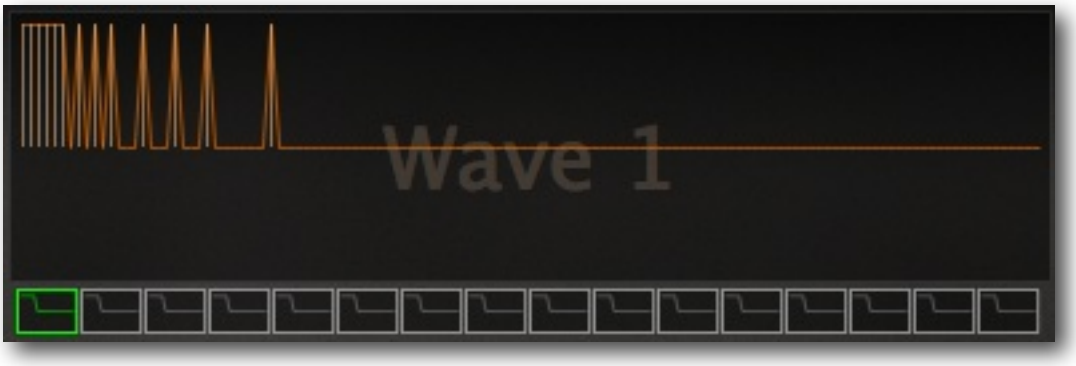


Typical GeoBlend wave

A single cycle is defined by 128 columns. GeoBlend is similar to GeoMorph in that it reflects the actual shape of the wave. However, when the morph function is used or the wave index is modulated, waveforms are not morphed, they are *blended*. The main advantage of GeoBlend over GeoMorph is that waveforms can be drawn freehand.

GeoMorph wavesets can be extracted from audio sources. A few third-party utilities are available for this purpose – try googling ‘Wav2Zebra’ and ‘Blueberry Thing’.

SpectroBlend



Typical SpectroBlend wave

The spectrum is represented by 128 (bipolar) columns. Similar to SpectroMorph except that it has fewer harmonics, and these are scaled linearly for a total range of six octaves.

The lower half is ‘antiphase’, so the same harmonic in adjacent waves (e.g. 1 and 2), but with opposite phases, can cancel each other out (at exactly 1.50 in this example). This cancellation effect can be put to good use – see the oscillator preset ‘Bells Flipper’.

The main advantage of SpectroBlend over SpectroMorph is that you have total control over individual harmonics, including polarity. Waves are not morphed in this mode, they are *blended*.

Mouse operations in GeoBlend and SpectroBlend modes

draw freehand
click + drag

draw a straight line
(Mac) alt + drag
(PC) ctrl + drag

reset sections to zero
(Mac) cmd + drag
(PC) alt + drag

context menu (right-click)
blur.....softens transitions between columns
sharpen.....accentuates transitions between columns
maximize.....sets the highest column to maximum, scales the rest accordingly
copy/paste.....transfers wavesets between oscillators (even between patches)

Zebralette

Making your own sounds in Zebralette (freeware!) is the best way to become a real Zebra2 oscillator expert, as there is zero risk of being distracted by all the other Zebra2 features. Note that you can load Zebralette programmes into Zebra2. Zebralette comes bundled with the Zebra2 package, but has its own separate manual...

FMO main panel

FMO stands for Frequency Modulation Oscillator, and this module is indeed closely related to the famous Yamaha DX7. Compare the Zebra2 preset *HS DY7 Add Pad* with the typical DX7 e-piano sounds of the 1980s, which were often layered with analogue pads.

FMO module panel

Input Modes

The green-labeled switch lets you select one of five different input modes:

FM by input: The FMO is modulated by its input, and the FM knob controls input level.

FM self (+): The FMO modulates itself, producing a brighter tone approaching a sawtooth. Note that FM values above 50% start to produce interesting digital noise.

RM input: The FMO is ring-modulated with its input. No FM here!

Filtered FM: Like FM by Input mode, except that the FM knob opens a lowpass filter instead of setting the input level (which is fixed at 100%). This results in a warmer tone.

FM self2 (+): Like FM Self (+) except that the input signal is the output squared. Great for triangular / squarish tones, including a wonderfully pure 'shark-fin' wave when the FM depth is between 25 and 30.

Mono / Stereo

FMO can also be stereo – click on the small blue circle(s). Only noticeable if the FMO is detuned and the Width is non-zero. Unlike OSC modules (which are free-running unless the Reset option is on), the phase of an FMO is always reset.

FM

Generally FM depth / input level – see *Input Modes* above for details.

Tune

FMO pitch offset (+/- 48 semitones).

Vibrato

The amount of pitch modulation directly from LFO1 (0 – 100). The maximum depth here is only +/- 50 cents. If you need very deep vibrato, click on the definable knob next to 'Tune', select LFO1 from the list and set the amount to about 1.00.

Pan

Shifts the stereo position towards the left or right.

Volume

Output level.

Detune

If the FMO is in mono mode, Detune lowers or raises the pitch by +/- 50 cents. In stereo mode, this parameter is a detune *spread* – it sharpens the left channel and flattens the right channel. Normal fine tuning is still do-able via Shift+Tune, of course!

Width

Stereo spread when the FMO is in stereo mode.

FMO lower panel

Like the standard oscillators, the FMOs use the lower pane for additional parameters. Unlike the standard oscillators, all four FMOs share the same panel:

key > gain

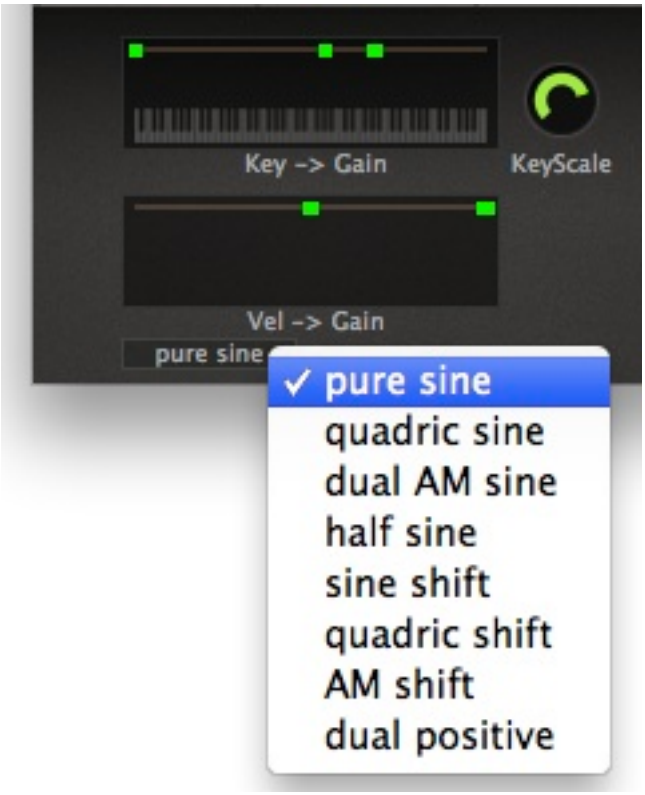
For FMO volume scaling according to MIDI note. The horizontal axis is MIDI note, the vertical axis is gain. Note that this feature can be used to create keyboard splits between FMOs (and OSCs).

vel > gain

For level scaling according to velocity. The horizontal axis is MIDI velocity and the vertical axis is gain. Can be used for velocity-switching or cross-fade between FMOs.

key scale

MIDI note to FMO pitch, centered around the note E2. Effectively a bipolar 'KeyFol' for the FMO modules. Set to 100.00 for normal semitone steps.



FM waveform select

Click on this unlabeled button to open a menu offering several alternatives to the standard pure sine FM.

Noise

Noise has traditionally been used for percussive sounds, wind effects, explosions etc.. A simple but very useful addition to the arsenal of generators in Zebra2.

Noise module panel

The green-labeled switch lets you select one of four different noise types...

Noise Mode

White is a random signal with equal power across the spectrum.

Pink is darker, higher frequencies are attenuated by 3dB / octave.

Digital is a square wave with random polarity, a very lo-fi sounding oscillator. Can be played in tune if Filter1 is modulated by KeyFol, with amount = 64.00.

Crackles produces random impulses, like a Geiger counter or a worn-out record.

Mono / Stereo

Even the noise modules can be stereo – click on the blue circle(s). See *Width* below.

Filter1 & Filter2

Noise has two integrated 6dB/octave filters. In White and Pink modes, Filter1 is a low-pass and Filter2 is a highpass. In Digital mode, Filter1 is pitch and Filter2 adds more irregularities. In Crackles mode, Filter1 is a lowpass and Filter2 reduces the probability of impulses occuring.

Pan

Shifts the stereo position towards the left or right channels.

Volume

Noise output level.

Width

Controls stereo spread if the stereo switch is on. See *Mono/Stereo* above.

VCF

VCF stands for Voltage Controlled Filter. Of course there are no high voltages in Zebra2 pushing and pulling electrons around, but most of Zebra's VCF types are just as 'alive' as their analogue forbears. The VCF modules are more CPU-friendly than the XMF modules (see 2 pages down).

VCF module panel

Cutoff

The Cutoff parameter determines the filter's edge-frequency. Like all frequency parameters in Zebra2, the scale is in semitones – tuning cutoff in musical terms makes more sense than the more scientific 'Hertz'. Cutoff values correspond to standard MIDI note numbers minus 12 (one octave), so 81.00 means a middle A (440Hz) before any modulation.

Resonance

Resonance is an internal feedback loop that emphasizes the cutoff frequency. In some filter types (e.g. EQ Peaking), this parameter is actually a Q-factor, the slope of a band centered around the cutoff frequency.

KeyFol

The key-follow parameter controls the amount of cutoff modulation from MIDI note / keyboard – the higher the note, the higher the cutoff. At 100%, it follows semitones precisely. Note that the breakpoint (the key that doesn't change) in KeyFol is E2.

Drive / Gain

The Drive or Gain parameter of a filter usually adds some kind of distortion. In Zebra's filters this should be understood as a generic 'flavour' parameter – see the remarks in the following list.

Filter Types

LP Xcite	24dB lowpass, with a frequency-dependent exciter as Drive, adding high frequencies.
LP Allround	CPU-friendly 24dB lowpass, with a strong resonance and smooth coloration via Drive.
LP MidDrive	Boosts mid-range frequencies via Drive, good for leads that can cut through the mix.
LP OldDrive	Adds even-numbered harmonics, for a vintage sound bordering on 'cheesy'!

LP Formant	Vocal filter type. Combines a non-resonant 12dB per octave lowpass with a resonant formant stage. The Formant parameter replaces resonance, and the Vowel (Drive) parameter morphs between five formants (A-E-I-O-U). This filter model is great for 'singing' voices and vocoder-like pads. Note that the modulation target of the righthand definable knob is the Vowel parameter here.
LP Vintage	CPU-friendly analogue-modeled transistor ladder with 24dB rolloff. Sounds nice and old
LP 12dB	A 12dB version of LP Allround
LP 6dB	A simple lowpass with a very shallow rolloff, non-resonant
BP RezBand	A resonant 12dB bandpass model
BP QBand	Another resonant bandpass, with a different character
HP 24dB	Resonant 24dB highpass
HP 12dB	12dB version of the above
BR Notch	24dB band reject
EQ Peaking	Peak / reject filter, like parametric 'mid' on a mixing desk. The Res parameter controls the slope of the peak. Gain has a range of -20dB (deep notch) to +24dB (strong peak). Gain is a very important parameter in this mode – if set to 0.00, the filter has little or no effect.
EQ LoShelf *EQ HiShelf*	Two shelving models, to complete the trio of 'parametric EQ' filters. Like in EQ Peaking, Gain attenuates or boosts the frequency range (low or high), and the Res parameter controls the slope.
AP Phaser4 *AP Phaser8*	The two phasing models use 4 or 8 stage all-pass (AP) filters to generate typical phasing effects. Cutoff controls the center frequency, and Res controls intensity. In the Phaser8 model, the Split parameter detunes the 8 stages. Tip: For plenty of 'whoosh' at low resonance, mix an AP filter in parallel (use another lane) with the main signal, at the same level.
LP Vintage2	More CPU-intensive version of LP Vintage, capable of self-oscillation.
SR Decimate	Not really a filter, this is a sample-rate reduction processor. The Cutoff parameter controls rate, meaning it can be tuned harmonically (set KeyFol to 100). Neither Res nor Drive are used.

XMF

The XMF (cross-modulation filter) module is an extremely flexible multimode filter featuring self-oscillation, input level dependent distortion and audio-rate FM via its extra input. Note that the XMF is considerably more CPU-intensive than the VCF.

XMF module panel

The XMF offers a choice of 15 filter types / combinations, but perhaps it isn't obvious that you have **two of these** – in stereo and with variable cutoffs. So if you ever need a 3-pole allpass in parallel (or series) with a 2-pole bandreject / lowpass combination... no problem!

Cutoff, Resonance and Key Follow should already be familar, the other controls might need a bit more explanation. Note that both the upper definable knobs modulate cutoff.

Distortion is highly dependent on the level of signals being fed into the filter. Input levels affect the sound as much as Overload, so try oscillator volumes even as low as 10%!

Switches

The four buttons on the left are (from top to bottom): *Type1*, *Routing*, *Type2*, *Character*...

Type1

LP4, LP3, LP2, LP1..... Lowpass modes, 4 slopes (24, 18, 12 and 6 dB per octave). Note that the 1-pole mode is also resonant.
HP3, HP2, HP1..... Highpass modes, three different slopes
BP4, BP2..... Bandpass, two different slopes.
BR2..... Bandreject, 2-pole only
AP3..... Allpass, 3-pole only
HP3LP, HP2LP..... Combination of 3-pole or 2-pole highpass + 2-pole lowpass
BR2LP..... Combination of 2-pole bandreject + 2-pole lowpass
AP3LP..... Combination of 3-pole allpass + 2-pole lowpass.

Routing

Each XMF module has two stereo filters, which can be routed in four different ways:

single..... Standard mode. Actually two filters with stereo-splittable cutoff values for spectacular panning effects – try modulating Offset with an LFO.

serial..... Type1 filter is fed into the Type2 filter.

parallel..... Type1 and Type2 filters are output separately.

diff'ed..... The difference signal (Type1 minus Type2). Note that if the two types are the same and there is zero offset, the result is total cancellation.

Type2

Same..... Type2 adopts the Type1 setting. For all other options, see the *Type1* list.

Character

The XMF filters include 5 options for the resonance/overload character. Note that output volumes can vary depending on the Res and Overload values (see below).

XMF.....Standard high-quality – plenty of bite.

analogue.....Classic ladder filter overdrive – warm / dark.

biased.....Diode-like asymmetrical distortion, for more even-numbered harmonics.

eco.....CPU-friendly version of *analogue,* lower quality Overload (see below).

folded.....Positive peaks that would otherwise clip are folded back down.
Note: Even if Overload is set to zero, this mode sounds rather different.

Controls

Cutoff

Cutoff determines the filter's edge-frequency. Like all frequency parameters in Zebra2, the scale is in semitones – tuning cutoff in musical terms makes more sense than the more scientific 'Hertz'. Cutoff values correspond to standard MIDI note numbers minus 12 (one octave), so 81.00 means a middle A (440Hz) before any modulation.

Res

Resonance is an internal feedback loop that emphasizes the cutoff frequencies. High resonance is very interesting in combination with Overload. Set Resonance to maximum, and the filter will self-oscillate (see *Click* below).

KeyFol

The depth of cutoff modulation from MIDI note / keyboard. At 100%, it follows semitones. Note that the breakpoint (the key that doesn't change) in KeyFol is E2.

Overload

Pushes the filter 'too far'! For interesting distortion effects and general oomph. Note that high overload can amplify the signal a lot – you might need to reduce the level elsewhere e.g. the volume control of the lane you are using. See also *Character* above.

Offset

Splits the cutoff values of the two channels, in semitones (+/-48). Modulatable, great for panning effects with the standard *single* routing, or for multiple resonances in *serial*, *parallel* or *diff'ed* mode (see *Routing* on the previous page).

FilterFM

For audio-rate cutoff modulation from the XMF's second input. By default, the FM source is the same as the input signal, but using a different FM source can be highly rewarding: right-click on the [XMF] cell to change the sidechain input to another lane – and put something in that lane!

Click

Injects a short impulse into the filter at the start of each note. Turn up for harder attacks or more instantaneous self-oscillation.

Comb

Comb filters are based on ultra-short delay lines with a feedback pathway. Even if the input is a very short impulse, the feedback loop can turn this into a slowly decaying tone. The frequency response curve resembles a regular row of spikes – hence the name.

Comb module panel

You can create envelope-driven polyphonic flangers, realistic plucked and bowed strings, flutes, mallet and other percussion instruments, strange metallic ambiences... in fact a whole bunch of 'acoustic' sounds that would be very difficult or impossible using only first-generation synthesizer modules.

Switches

Mode

Zebra2 has what you might call a 'multimode' comb filter. Four delay lines are interconnected in various ways, but always in stereo...

***Comb**:* A simple stereo delay tuned to the played note. In this mode, neither Tone nor Flavour have any effect.

***Split Comb**:* Any input is summed to mono and fed to the first of two delays, which then cross-feed each other. In this mode, Tone is the ratio between the delay times and Flavour controls the amount of input signal fed (directly) into the second delay. The output is completely split: the left channel is delay 1 and the right channel is delay 2.

***Split Dual**:* The same as *Split Comb* except that input signal is not summed to mono.

***Diff Comb**:* The same as *Split Dual* except that the second delay is an allpass filter. Especially good for strange, complex sounds. The Flavour parameter is the feedback of the allpass filter. Non-harmonic frequencies can dominate the sound, so you have to tune this one rather carefully.

***Dissonant**:* A 4x4 feedback delay network, this mode always sounds metallic. The Tone and Flavour parameters both affect delay time ratios (i.e. the pitches).

***Cluster**:* Experimental mode. Left in for the moment, but very likely to be removed (or at least modified) in future updates. Use at your own risk!

***Blown**:* This mode uses a bandpass filter in the feedback path to accentuate harmonics (modulate the Flavour parameter) rather than the fundamental. You can get very realistic flutes and trumpets etc. but it does require careful tuning.

Impulse

Zebra's comb filter includes an internal impulse generator so it can be used without any input signals from other modules. To select a waveform, click the button to the left of the PreFill knob:

Noise.....a short burst of white noise – bright, different characteristics for each note
Saw.....one cycle of sawtooth – full / warm
Square.....one cycle of square wave – hollow / nasal

Main controls

Comb module panel - main controls

PreFill

The level of the internal impulse signal. See *Impulse* above.

Tune

The Comb filter's basic pitch. The range is +/-24 semitones.

Detune

In *Split Comb* mode this is fine tuning. In all other modes it detunes the delays in both directions.

Vibrato

The amount of pitch modulation directly from LFO1 (0 – 100). The maximum depth here is only +/- 50 cents – for deeper vibrato, click on the upper '…' knob and select LFO1 from the list.

Input

Input level. Often redundant because all audio sources have output levels. However, the Comb includes an unprocessed (Dry) output – allowing low input and higher level 'throughput' at the same time. This *would* be possible using sidechains, but it doesn't hurt to make things easier!

Damp

A 6dB lowpass filter in the feedback path simulates how the oscillation of e.g. a plucked string is naturally dampened by various physical constraints.

Feedbk

Bipolar feedback level control. Negative values lower the pitch by an octave.

Sound controls

*Comb module panel - **Sound** sub-panel*

Tone

The function of this parameter changes from mode to mode. Usually a ratio between delay times. For details, see *Mode* on the previous page.

Flavour

The function of this parameter changes from mode to mode. Usually a level within one or more feeback paths. For details, see *Mode* on the previous page.

Distort

Distortion adds harmonics into the feedback. Use with caution!

KeyScale

MIDI note to pitch, centered around the note E2. Effectively a bipolar 'KeyFol' for the comb. Leave at 100.00 for semitone steps (a double-click takes you straight to 100%). For Flanger and resonator effects, set KeyScale to 0.00 and take the Tune value down.

Output controls

*Comb module panel - **Output** sub-panel*

Dry

Unprocessed 'throughput' from whatever is fed into the Comb.

Vol

Comb output volume. If the output reaches zero via e.g. Vol modulation or simply turning down the Vol knob, the Dry signal suddenly goes to 100%. Whether this is a feature or a bug, it can make interesting rhythms – try modulating Vol from an LFO, and adjusting the Vol knob.

Pan

Panorama shifts the stereo position of the processed signal towards the left or right. Pan does not affect the position(s) of the Dry signal.

Width

Stereo separation of the processed signal. Does not affect the Dry signal.

SB

The Sideband module is a stereo frequency shifter, the origins of which go back to the early days of radio. Related to ring modulation in which two signals are multiplied, resulting in two 'sidebands'. The Sideband module can also lend the signal a metallic character, as frequencies are shifted by a constant (e.g. 100Hz) instead of a factor (e.g. 2.00 times). While the 'beating' effect of mild oscillator detuning can become irritatingly fast when you play higher up the keyboard, frequency shifting keeps this effect constant.

SideBand module panel

Range

The SB module offers 3 bipolar frequency range options, which all start at 0Hz (center):

10Hz - for relatively slow-moving cyclical effects e.g. stereo phasing.
200Hz - for low-frequency effects e.g. deep bells, rumbles... or even phone dial-tones
4kHz - for high-frequency or very wide range effects

Freq

Bipolar frequency shift. If set to positive values, the upper sideband is louder than the lower one.

Offset

Bipolar offset between left and right channels. Great for stereo rotary effects – Offset can be used for a special kind of phasing that continually rises in the left channel, while continually falling in the right channel. Check this out in headphones: Set the range to 10Hz, Freq to zero, Offset to only 2.00, Mix to 50 – and feed it a medium dose of pink noise.

Mix

Bipolar cross-fade between the original signal and the frequency-shifted signal. Negative values invert the processed signal. For maximum phasing effects, set to +/-50.

Shape

The Shapers are input level-dependent distortion units with a choice of four quite different algorithms. Further distortion types might be included in the next version of Zebra2.

Shaper module panel

Tip: Using a Shaper *in parallel* with the untreated signal often sounds best, as this adds any amount of grunge while preserving the original sonic character.

Modes

Shape: Classic waveshaper. The Depth parameter adds a DC bias before the shaper, making the shaper asymmetrical (for even-numbered harmonics like 'tube' distortion). Note that DC bias can considerably reduce signal level.

T-Drive: Frequency-dependent waveshaper, works like a transformer. Use small doses to boost 'presence'.

Crush: Bit-reduction via Depth knob. Neither Input nor HiOut are used in this mode.

Wedge: A high-order waveshaper with foldback function (loud signals can become silent or even phase-inverted). The Depth parameter boosts the input signal, for locally modulatable distortion amount. The beefiest mode – placed after a resonant filter, it can emulate 'acid basslines'.

Depth

Controls distortion threshold (effectively a distortion amount control). Like a guitar amplifier, every knob in this module affects 'the amount of distortion' in some way or other!

Edge

Main tone control.

Input / Output

Attenuate / boost the input and output signals. Also affects tone...

HiOut

Attenuates / amplifies high frequencies – the last tone control in this module!

Ring

Ring modulation is a variant of amplitude modulation (AM): Two input signals are balanced so that they disappear completely, leaving only the sum and difference frequencies. The frequencies are seldom harmonically related, so ring modulation is often used for bell-like sounds. Use sine waves for the purest results, but feel free to experiment with other waveforms.

The ring modulator in Zebra2 doesn't require a panel, but it does need two input signals. The image to the right is the result of right-clicking on the 'Ring1' cell. Here, SideChain 2 is selected so that FMO1 is being ring modulated with FMO2 from lane 2.

The circuit originally used to implement this technique in analogue devices had the shape of a ring, hence the name. In today's digital world, ring modulation is quite easy to compute: the two signals are simply multiplied.

Tip: If one of the original signals is also audible (e.g. in the above example by turning up lane 2), the result is classic *amplitude modulation.* The relative levels of ring-mod and original signal need to be right: use an oscilloscope, or simply let your ear be the judge.

Mix

Mix module panel

The Mixer module not only does what the name implies i.e. mixes two signals together, it is also handy for cross-fading between them: the 'Mix' parameter is available in the matrix as modulation target.

Mixer modules can also reduce the stereo width of the sidechain signal: Select the mode 'Pan Mono' and take Mix to maximum – you will only hear the sidechain now, but the output is 100% mono.

Mixers can often be avoided. For instance, in the lefthand image here, the Mix1 module was added (as an afterthought) to send some unfiltered signal out of lane 2 for separate effects processing. The arrangement in the righthand image does exactly the same job, but without using a mixer.

Pan Mode

Pan mode has the following options: *Bal L-R*, *Pan L-R, Bal R-L, Pan R-L* and *Pan Mono.*

With the Pan knob set to the centre, the two *Balance* modes have 0dB of gain for both channels – only one channel is attenuated as the control is moved away from the centre position. The *Pan L-R* and *Pan R-L* modes, however, mix one channel onto the other while adhering to the *Pan Law* (google those two words!)

Pan

Shifts the stereo position towards the left or right.

Mix

The relative levels of the two inputs.

Modulators

Modulation is what we use to turn static tones into interesting instruments or soundscapes. Zebra2 lets you modulate practically any target parameter in the synth. As well as LFOs and envelopes, the available modulators include some standard MIDI messages for external control: pitchbend, mod-wheel (CC#01), polyphonic or channel aftertouch, expression (CC#11), velocity and gate. Note that practically all the controls in Zebra2 can be automated, and that using the X/Y performance pads is the best way to control a bunch of parameters at once.

List of Modulation Sources

ModWhl	modulation wheel, CC#01
PitchW	pitch wheel / pitch bender
Breath	breath control, CC#02
Xpress	expression control, CC#11
LfoG(1,2)	global LFOs
Gate	note on/off
KeyFol	note number with glide, center = E2
KeyFol2	note number with glide2 **offset**, center = E2
Velocity	MIDI note velocity
ATouch	channel or key (polyphonic) aftertouch – whichever is received first *note: Atouch is sent through a lag processor, it is always smooth!*
ArpMod	arpeggiator modulation, upper
ArpMod2	arpeggiator modulation, lower
Env(1-4)	standard envelopes
MSEG(1-4)	Multi-Stage Envelope Generators
Lfo(1-4)	voice LFOs
MMap(1,2)	modulation mappers
MMix(1-4)	modulation mixers

For a complete list of all modulation **targets**, go here.

Modulation Matrix

All generator panels include definable knobs for setting up local modulation. The mod matrix, on the other hand, is a switchboard where you can set up any kind of (non-audio rate) modulation. The image below shows just three of the twelve available modulation slots...

Mod

Selects the primary modulator and sets its (bipolar) amount.

Via

Selects a secondary modulator and sets its (bipolar) amount. 'Via' controls how much of the primary modulator actually reaches its target. See the examples below.

Target

The parameter that will be modulated. the image here includes three examples: In the upper slot, Aftertouch is negatively modulating envelope 2 decay – the harder you press, the shorter it becomes. The lower slot is unused.

The middle slot in this example is more complicated: Envelope 2 is modulating an oscillator's detuning, at maximum level. However, this level is being partially *scaled* by the modulation wheel – the amount of Env2 actually reaching its target will be less than maximum until the mod-wheel is all the way up.

If the 'Via' value had been +100%, no amount of Env2 would reach its target unless the wheel was pushed at least a little bit...

Understood? If not, you should try e.g. modulating pitch (Tune) with LfoG1 via ModWhl.

Tips:

You should not head straight for the Matrix whenever you want to modulate something: Most of the control panels include definable knobs which are already connected to their most useful targets (note that the update rate is a bit faster than if you use the Matrix).

Realtime modulation e.g from aftertouch or the mod-wheel is more controllable if you don't make a habit of setting amounts to maximum. Go for *optimum* instead!

Setting precise pitch intervals in the matrix can be tricky. For example, if you want to make your mod-wheel take the pitch of an oscillator up an octave, don't set the amount to 12.00 – you need to set **12.50** instead.

Why? Because the 96 semitone range (+/- 4 octaves) is mapped to +/-50 (100 steps)

12 semitones (octave)..... 100 / 96 x 12 = 12.50 (absolutely precise)
7 semitones (fifth)..... 100 / 96 x 7 = 07.29 (07.30 is fine)

ENV

Whenever you load the *Initialize* patch, envelope 1 is immediately visible in the modulators pane. That's because in this patch, envelope 1 has been designated as the audio envelope for all four lanes of the main grid:

ENV module in v-slope mode (Slope slider visible)

Although it looks like a fairly simple ADSR with just a few extras, the ENV module also has a few tricks up its sleeve. It is syncable, loopable, and offers 2-stage attack or release.

Switches

Range

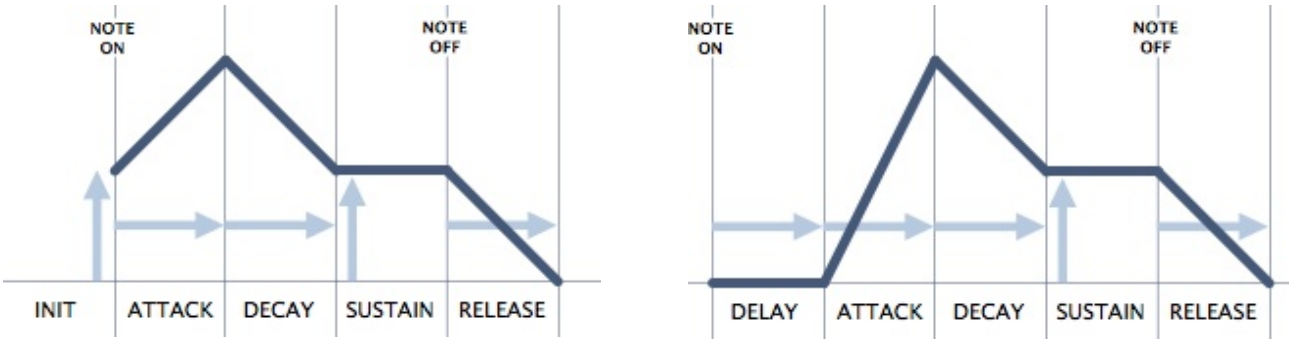
The smaller of the two switches sets the range of all time-based envelope stages:

***8sX**:* Up to eight seconds. The knob scale is exponential (mid-position is 1 second)
***16sX**:* Up to sixteen seconds. The knob scale is exponential (mid-position is 2 seconds)
***10s**:* Up to ten seconds. The knob scale is linear, so 20.00 means 2 seconds etc.
1/4, 1/1, 4/1: Times are relative to song tempo (beat, bar, 4 bars). Knob scale is linear.

Shape

The larger of the two switches determines the curvature of all time-based envelope stages:

***quadric**:* Exponential curves. Attack is convex, Decay and Release are concave.
***linear**:* Straight lines. Linear envelopes can sound unnatural.
***v-slope**:* Exponential curvature via a slider: the far left position is extremely concave, -50 is close to quadric, the center is linear, the far right is extremely convex.



Envelope stages including Delay or Init (see next page):

Controls

(...) delay or initial level

The top lefthand knob is NOT for definable modulation, it is one of the following:

Delay: The Attack stage is delayed (see righthand image above)

Init: Attack stage starts at a level other than zero (see lefthand image above)

Attack

The time it takes for the envelope to rise from zero (or the *Init* value) to maximum

Decay

The time it takes to drop from maximum to the Sustain level

Sustain

The level after Decay. Normally remains at that position until the note is released.

The extra envelope stages below can be rather tricky. If you prefer to use standard ADSRs only, simply ignore these options...

F/R (Fall / Rise time)

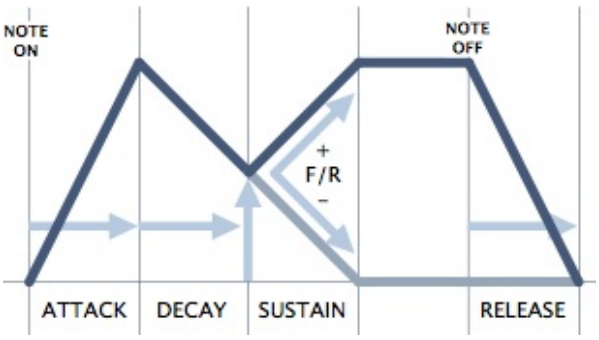
Negative values: either fall to zero, or fall/rise to the Sust2 level (if defined – see below)
Positive values: either rise to maximum, or fall/rise to the Sust2 level

(...) additional stages or loops

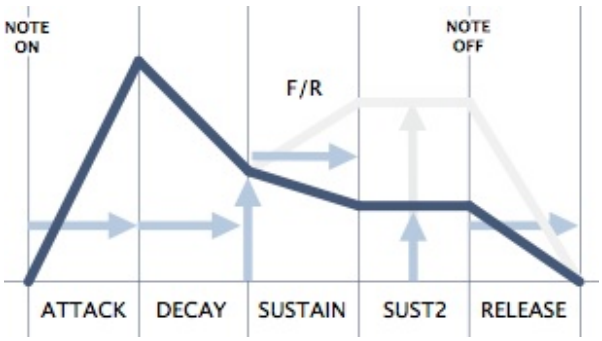
This selects and controls one of the following additional envelope stages:

Sust2..... A second Sustain level, after F/R
LoopA..... Loop back to Attack
LoopD..... Loop back to Decay
LoopS..... Loop back to Sustain
Rel(nn)..... Extra release stage (the 'nn' numbers are percentages of maximum level)

Note: The diagrams below are simplifications. For example, Release (or Rel25/50/75/100) can start at any point within the envelope, as it is initiated by a MIDI Note Off message.



Normal F/R behaviour, no Sust2 stage

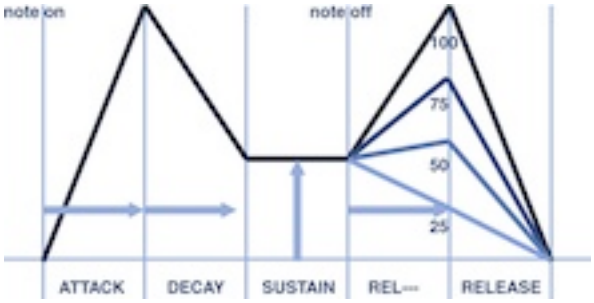


F/R behaviour when there is a Sust2 stage (two possible Sust2 values are shown here)

LoopA: Time to return from end of F/R (100 or zero) to zero (start of Attack).

LoopD: Time to return from end of F/R (100 or zero) to 100 (start of Decay)

LoopS: Time to return from end of F/R (100 or zero) to Sustain level.



Rel25/50/75/100: Time to rise or fall from Sustain to 25/50/75/100, followed by the normal Release stage.

Release

The time it takes to drop to zero after a note is released. See also *Rel(nn)* above.

Vel

For dynamic envelopes – keyboard velocity scales the envelope's output level.

Velocity Scale, Key Scale

To see another 14 controls, open the sub-panel by clicking on the small '+' symbol in the top righthand corner of the panel:

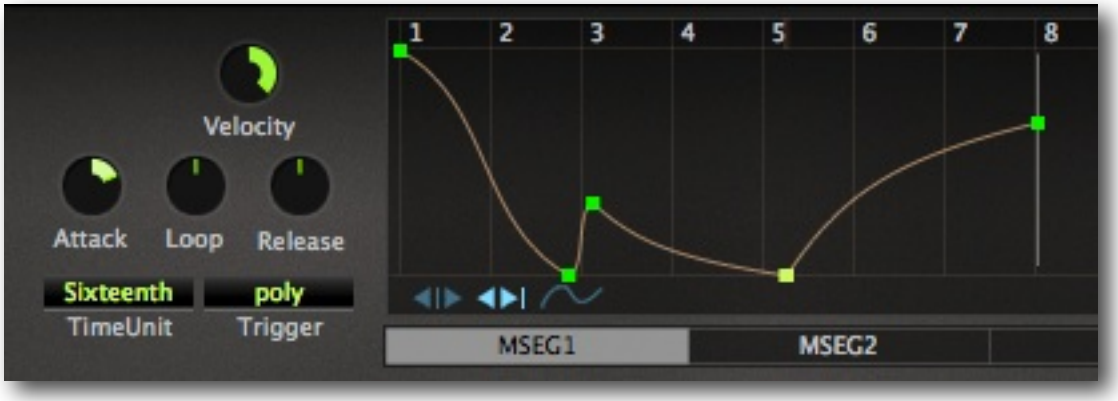
ENV module, with scaling sub-panel open

These are velocity and key follow scaling controls for each parameter in the upper panel. For instance, setting a positive value for the Velocity Scale knob below Release will make the release time longer the harder you play. Setting a negative Key Scale for Release will shorten the release times of higher notes etc. etc..

Tip: For unusual envelope shapes, try setting extreme Slope values in ***v-slope*** *mode.*

MSEG

The Multi Stage Envelope Generator is a complex modulation source offering total control of the shape as well as continuous control over the timing. Click on MSEG in the lower bar:



left half of the MSEG panel, with MSEG1 selected

Many different uses for MSEGs can be found in the factory presets. If you find shapes you would like to use elsewhere, simply save them as Presets (see below). The following examples are all from the Two Point Five folder of the factory patches:

Rhythms..... *Twangle*
Pitches..... *Seven of Eight*
Complex attack..... *Drums of Mordor+*
Combinations..... *I am Zebra*
Snappy envelopes..... *How Money More Times*
Regular chaos..... *Combotor*

Controls

MSEG Selector

Below the edit window are four MSEG buttons used for switching between the MSEGs.

Preset

Like the oscillators, individual MSEGs can be loaded and saved. Click on the button to load, right-click to select from a drop-down menu or save to the current folder. The module presets are in the following locations:

Mac: *~/Library/Application Support/u-he/Zebra2/Modules/MSEG/*
Win: *C:\Program Files\VstPlugins\u-he\Zebra2.data\Modules\MSEG*

TimeUnit

Selects the unit that will correspond to integer steps in the editor's time-line. Note that the timing can always be shifted by setting non-zero Attack, Loop or Release values.

sixteenth / quarters / note: Note lengths, synchronized to song tempo
seconds: Absolute time, non-synchronized

Trigger

poly: standard polyphonic
single: only retriggers after all notes are released (useful for e.g. 'organ percussion')
mono: standard monophonic

Velocity

For dynamic envelopes – velocity scales the level of MSEG output.

Attack

Slows down / speeds up everything before the loop.

Loop

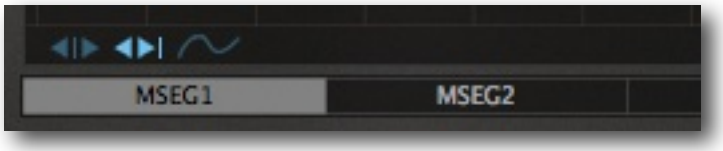
Slows down / speeds up the loop.

Release

Slows down / speeds up everything after the loop.

Editor functions

Switches



Above the MSEG1 selector button are three small icons. From left to right, these are:

Single.....moves individual handles, the other handles remain fixed
Shift.....moves individual handles, all following handles also move
Draw.....moves multiple handles vertically – click on a handle and 'draw'

Note that handles jump to the nearest *unit snap* and *value snap* positions (see *Context Menu* below).

Create New Handle *(max. = 33)*

Mac.....cmd + click on the background
PC.....alt + click on the background

Curvature

To adjust line curvature, click on a line and drag it away. S-curves are also possible: Again, hands-on experience is better than a long-winded explanation here.

Zoom & Scroll

To zoom in or out, click on the background and drag up / down. For 'optimum' zoom, double-click. To scroll to invisible sections of the envelope, click and drag left / right.

Context Menu (right-click in the background)

copy / paste..... clipboard functions
half size.....shortens the envelope
double size.....lengthens the envelope
upside down..... inverts the envelope
unit snap.....horizontally restricts new input to 3, 4, 6 or 8 steps per unit
value snap..... vertically restricts new input to 12, 24, 36, 48 or 15 levels
quantise to snap....quantizes all handles to the nearest step (see *unit snap*)
unit spacing.....distributes all handles to successive units
even spacing.....evenly distributes all handles between the leftmost and rightmost
pointer.....resolution of the position indicator – reverts to *Course* by default

Context Menu (right-click on a handle)

The *Remove Point (min. = 2), Loop Start* and *Loop End* functions are self-explanatory. To make a loop of zero length (you might need this from time to time), simply delete the handle that is currently set as 'loop end'. Note that MSEGs can continue looping during the release phase (of standard envelopes) if the loop end is set to the very last point.

LFO

Alongside envelopes, low frequency oscillators represent THE classic modulators – for vibrato or any cyclic movement e.g. a slowly drifting tonal change. Once again, the LFOs in Zebra2 have more under the hood than meets the eye:

LFO set to sine wave, quasi free-running

This module is called a 'voice' (or polyphonic) LFO because, unlike the GLFO, it is instantiated per voice – every note you play gets its own LFO. The main advantage over the GLFO is that different notes in a chord can have different amplitudes, phases and rates.

In all OSC, FM and Comb modules, 'Vibrato' is permanently connected to LFO 1. Whenever you want to set up traditional vibrato control via mod-wheel, click on the knob next to 'Amp', set it to 'ModWhl' and turn it all the way up... and turn up the 'Vibrato' levels!

Waveforms

sine.....pure sine wave
triangle.....pure triangle wave
saw up.....rising saw ('ramp')
saw down.....falling saw
sqr lo-hi.....square wave, restarted at the lower level
sqr hi-lo.....square wave, restarted at the higher level
rand hold.....random steps
rand glide.....random curves
user.....definable steps or lines – see **User mode** on the next page

Sync

Range / nominal rate options (to the left of the label):

0.1s, 1s, 10s..... absolute time, three ranges
1/64 – 8/1..... sync to song tempo, includes dotted and triplets, up to eight bars

Retrigger options (to the right of the label):

free: the LFO starts at a random position within its wave every time a note is played
gate: the LFO always starts at the same position in its wave (see Phase below)

Slew

off can produce clicks, *fast* and *slow* smooth out any sharp transitions.

Amp

Amplitude i.e. output level of the LFO. For typical “vibrato via modulation wheel”, click on the definable knob and select *ModWhl* as modulation source. Note that the definable control (...) *scales* the existing Amp value, it does not add to it.

Rate

LFO rate. This bipolar control *scales* the value set by the Sync parameter.

Phase

Sets the phase (i.e. the position within its cycle) at which the LFO will be restarted every time a note is played. This parameter is meaningless if Restart is set to *free*.

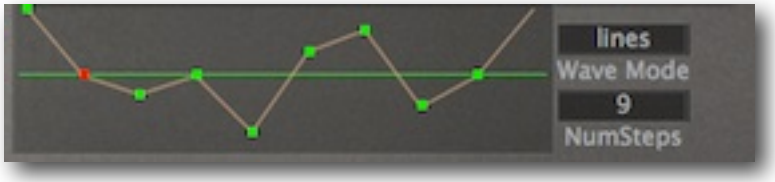
Delay

Actually the LFO fade-in time. Typically used for ‘delayed vibrato’.

User mode

LFO in user mode, 16 steps

The Sync value is the length of each step, so the length of one LFO cycle in this example is 16 x 1/16th = 1 bar in 4/4 time.



LFO in user mode, 9 lines

Right-click in the edit window for the following functions:

copy/paste..... for transferring user-mode waveforms, especially between patches
randomize..... add a random offset (+/-) to existing values
soften..... reduce jumps in the wave
normalize.....maximize the largest value, then scale all others accordingly
straighten..... draw a straight line between the first and last values
reset.....zero all values
quantize 4–24... quantize existing values to different ‘grids’. 12 is good for semitones.

GLFO

The global LFO looks simpler than the standard LFO – the Delay and definable modulation knobs are missing. However, the main difference is that the GLFO does not retrigger per voice. See above (LFO) for the list of waveforms and user mode options.

GLFO module, sine wave, synced to 'beats' but not retriggered

Sync

Range / LFO rate. The list of synced values includes dotted and triplet note lengths.

0.1s, 1s, 10s..... absolute time, three ranges scaled via *Rate*
1/64 – 8/1..... sync to song tempo, up to eight bars

Trigger

off, each bar...32 bars: The GLFO is automatically restarted after a defined number of bars. Future versions of Zebra2 may include gate-retriggering (as in the standard LFO module).

Slew

off can produce clicks, *fast* and *slow* effectively smooth sharp transitions.

Amp

Amplitude i.e. output level of the GLFO.

Rate

GLFO speed. This bipolar control *scales* the value set by the Sync parameter.

Phase

Sets the phase (i.e. the position within its cycle) at which the GLFO will be restarted according to the value of *Trigger*.

MMap

Zebra's modulation mapper is a general purpose table of 128 individual values. The MMap modules can be used for countless different tasks – e.g. tuning the *tone* of individual notes on the keyboard, as in this example...

modulation map used in the Ligetimat+ preset

...or for emulating round-robin effects. Old polyphonic synths had a limited number of voice circuits, and the tuning of e.g. pitch and cutoff was also fixed (via trimmers) for each one. This example simulates six of those trimmers...

*modulation map used in the **Poppington** preset*

...or for altering the 'law' of a modulation source. The example here affects aftertouch response: Aftertouch has no effect until you press the keys hard enough to reach the point where the curve starts ascending. The curve is concave for a better 'feel'.

*modulation map used in e.g. the **Seed** preset*

Mode

The larger of the two buttons selects the basic mode. Note that the two Map modes won't do anything if you haven't defined a Modulator.

Key..... the 128 possible MIDI notes (nobody owns a keyboard that long)
Map Smooth..... the 128 modulator values, interpolated for smooth transitions
Map Quantize....the 128 modulator values. Allows sudden transitions
Alternate..... a stepper – new notes increment the map index

Modulator

The smaller button selects a modulator (LFO, envelope, whatever) to be mapped in either of the two *Map* modes. In *Key* or *Alternate* mode, this setting is ignored.

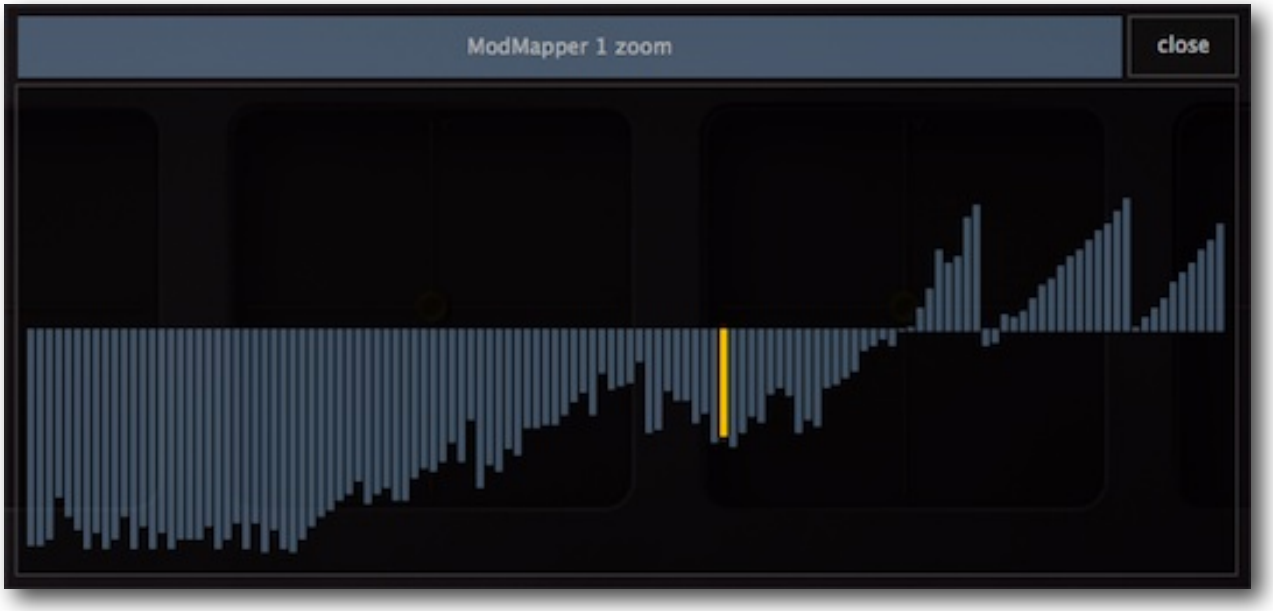
Context Menu

Right-click in the MMap editor for the following functions:

copy/paste..... for transferring maps, especially between patches
randomize..... add a random offset (+/-) to existing values
soften..... reduce jumps
normalize.....maximize the largest value, then scale all others accordingly
straighten..... draw a straight line between the first and last values
reset.....zero all values
quantize 4–24... quantize existing values to different 'grids'. 12 is good for semitones
2–128..... set / reduce the number of values used (see the middle image above)

Zoom

Click on the '+' button to open the map in a large floating window. This is especially useful whenever you need better horizontal precision while selecting points. In the (Key mode) example below, horizontal precision isn't a problem because points can be selected by playing MIDI notes (and are 'magnetic' enough).



the Ligetimat+ key map, zoomed

There is only one drawing function in the ModMapper: Cmd+click (Mac) or ctrl+click (PC) resets values. Modulation mappers are so useful that future versions of Zebra2 may include more ModMapper drawing functions, e.g. for straight lines and curves.

MMix

Zebra's **Modulation Mixer** processes up to 3 modulation sources in one of three ways...

the MMix panel

Mode

sum modulations: All modulation sources and the constant are simply added together. This mode can save you a lot of work (and Matrix slots) if you e.g. want to modulate several parameters at the same time from the same bunch of modulators.

scale sum by const: The same as *sum modulations*, except that Const scales the output instead of adding to it.

fade 1/2 by 3xC: Mod3 cross-fades between Mod1 and Mod2, Const scales the Mod3 amount.

Mod1, Mod2, Mod3

Select modulators to be 'mixed'.

Const

Adds to the output (*sum modulations*), scales the output (*scale sum by constant*) or scales the amount of Mod3 (*fade 1/2 by 3xC*). Note that Const itself can be modulated in realtime, it is available as modulation target!

Outputs and Effects

Immediately below the main grid are four connected panels, one for each lane. This is where you can adjust pan positions, volumes, amp envelopes – and where you route signals to lanes in the FX grid.

the four lane outputs, lane2 is muted

FX Bus Select

Where to route the signal from each lane:

main.....to the left lane of the FX grid
bus1.....to the center lane of the FX grid
bus2.....to the right lane of the FX grid

Mute

A handy mute button for each lane of the grid. In the image above, lane 2 is muted.

Pan, Mod

Lane pan and its definable modulation knob. The pan here is an *offset* to any pan in the generator modules. Right-click on the Pan knob to change its mode to Bal (balance).

Amp Envelope

Selects which envelope will be used for the lane...

env(n).....envelopes 1 to 4.
gate.....a slightly smoothed on/off whenever a note is played/released

Vol, Mod

Lane volume and its definable modulation knob. Note that modulation here *scales* the volume from 0% through 100% (center) to 200%. In the example above, the mod wheel fades out lane 1.

Tip: To crossfade two lanes, use a ModMapper as inverter – see page 70

The FX Grid

Whenever you select Global in the lower bar, you will see the FX Grid in the middle of the lower pane. The principle is the same as the main grid, but with effect modules.

To add a new module, click on an empty cell. Double-click a module to switch it on/off. Right-click to select input(s) or remove the module.

Five of the FX module types are actually the same as the 'processing' generators: *Shape*, *Mix*, *Ring*, *VCF*, *SB.* The other five are only available in the FX grid: *ModFX*, *Delay*, *Rev*, *Comp* and *EQ*.

FX Grid with example routing

Output controls

Bypass FX

Click on this button (it turns red) to temporarily deactivate all effects in the grid. Note that the Bypass FX switch is a truly global parameter – you won't hear any effects in any of your patches on any day of the week until you deactivate this again.

Output

This knob determines the overall volume. It takes the sum of the Master, Return1 and Return2 signals. *Output* is one of the few parameters in Zebra2 that cannot be modulated by envelopes, LFOs etc.. Of course it will still react to MIDI-learned controllers or automation data.

Master

Output level for the lefthand lane.

Return1 and Return2

The output levels for the center and righthand lanes.

Send1 and Send2

Both *Send1* and *Send2* take whatever is coming *into the master lane*, and route this unprocessed signal to the Return1 and Return2 lanes respectively. In the image above, Send2 is feeding the SB3 module. The amount (about 50% in the example) can be faded out completely via mod-wheel (Send2's definable knob). You might have to read this paragraph again...

Modulating effect parameters

Zebra lets you use *any* modulation source in the Matrix to modulate global parameters like reverb size or delay feedback. However, many of the available modulators are “per-voice” e.g. envelopes and LFOs. To avoid conflict, global modules constantly update their modulation input to the value provided by the latest voice (i.e. the last note played).

ModFX

Analogue purists may shudder at the mention of built-in chorus (which suggests a lack of ‘beef’ in other departments), but we believe no synthesizer should be without one:

ModFX panel, Chorus mode, equalizer On

Mode

Chorus: chorus / flanger using short delay lines
Phorus: chorus / flanger using allpass filters
Phaser: classic phaser unit

Center

Nominal delay time / allpass cutoff, i.e. before modulation.

Speed

The rate of the ModFX module’s own LFO (from 0.1Hz to 1Hz).

Depth

Amount of LFO modulation.

Feedbk

Bipolar feedback control for ‘flanger’ type resonances – especially at extreme values.

Mix

Balance between dry and wet signal.

Stereo

LFO phase offset between the two stereo channels.
Note that 50% is often more ‘stereo’ than 100%.

Quad

The volume of an **additional** chorus effect, with independant LFO.

Q-Phase

Modulation LFO phase offset (see *Stereo* above) for the Quad effect.

Equalizer

This unique feature can e.g. preserve the stereo image of bass frequencies via low cut, while at the same time making the chorus effect sound less harsh via high cut.

EQ: switches ModFX equalization on/off
LowFreq: low crossover frequency
HiFreq: high crossover frequency
Boost: cut/boost controls for the two frequencie ranges

Delay

The delay module in Zebra2 is (as you should already have begun to suspect) rather flexible. It has four delay lines, each with time scaling and pan controls. Two flavours of feedback with inserted low and highpass filters can run at the same time, feeding each other...

Delay module in stereo 2 mode (ping-pong regeneration via x-back)

Mix

Cross-fades between the dry and wet signal

Mode

stereo 2.....stereo delay, uses delay 1 and 2 only
multitap 4..... all four delays in parallel
dubby 2+2..... like two instances of stereo 2 in series
serial 2..... ping-pong delay, uses delay 1 and 2 only

Feedback & X-back

Normal regeneration, cross-regeneration.
In multitap mode, X-back is 1>2, 2>3, 3>4, 4>1.

Lowpass & Hipass

Simple filters in the feeback paths for changing the tonal quality of successive repeats.

Timing, Ratio & Pan

The button above each Ratio and Pan knob sets either a synchronized value (1/64th to 1/1 triplet) or absolute time (1 second). The Ratio knob scales this from 0% (4 samples long) to 200%. Pan is of course the stereo position of each delay line.

Tip: Try using small amounts of random GLFO to modulate one or two of the delay Ratios!

Rev

Place your Zebra2 sounds in wide open spaces or long dark tunnels... with Reverb:

Reverb panel, 'Reverb' mode

The reverb panel has 3 rows of controls: The top row is for mixing dry and wet signals. The middle row features the usual set of reverb parameters. The bottom row has a similar set for the so-called **Diffusor** – diffusion adds more reflections, increasing the reverb density.

Mode

Reverb is Zebra's standard digital reverb model
Metalverb sounds more artificial, but is also wider

Dry / Wet

Two separate controls for the dry and wet signal levels. Why? Firstly, there's room in the panel, and secondly, modulating individual levels instead of cross-fading dry/wet is more flexible.

PreDelay

A delay before the reverb. Especially good for retaining the 'closeness' of the dry signal.

Range, D-Range

Reverb/Diffusion length i.e. delay times, from 'extremely short' to 'rather long'! Together, the *Range* and *Feedback* parameters shape the impression of room size.

Feedback, D-Feedb

How much of the reverb signal is fed back into the reverb input. If *Range* and *Feedback* are set to maximum and *Damp* is at zero, the reverb will carry on almost indefinitely.

Damp

Simple low pass filter in the feedback loop. Emulates the damping effects of carpets, curtains, wood etc.. Makes a space warmer, more real.

D-Mix

The amount of diffusion in the reverb signal.

Speed, D-Speed

The rates of the LFOs modulating Range and Feedback / D-Range and D-Feedb.

Modulation, D-Mod

The levels of the LFOs modulating Range and Feedback / D-Range and D-Feedb.

Comp

This is Zebra's updated compressor module, which now features two high-quality modes. If you're much more familiar with synthesizers than with compressors, think of it as an inverted envelope follower modulating the volume i.e. an automatic volume attenuator. Audio engineers use compressors for a wide variety of tasks – google "compressor" .

compressor, smooth mode

Mode

eco: original lo-fi version, with low CPU-hit.
smooth: smooth compression, the best choice for most sounds.
strong: very powerful compression, best for bold percussive sounds.

Attack

The time it takes the compressor to fully work after the threshold has been reached. Attack can affect brightness – very fast values cause the compressor to reduce gain immediately, which can dull the attack of the original sound. When set to zero, Attack is only one sample in length.

Release

Recovery time i.e. the time the compressor takes to return to unity gain after the input signal has fallen below the threshold. Very short Release can distort low-frequency input, overly long Release can 'clamp' the sound down and not release enough before the next 'attack' arrives. When set to zero, Release is only one sample in length.

Thresh

Threshold sets the level above which compression will be applied, and below which compression will be released – so lower values will result in more compression than higher values.

Comp

Sets the amount of compression. Think of this as a dry/wet crossfade.

Input

Adjusts the input level before the signal reaches the compressor.

Output

Adjusts the output level to compensate for any loss/gain during compression.

EQ

This module is a 4-band parametric equalizer. Drag the handles to set frequency and gain. Right-click on a handle and drag vertically to adjust the Q (width/slope) of the band. Right-click in the background for basic editing functions: copy, paste, clear (flatten).

Equalizer module, bass+treble boost, dip around 1.5 kHz

Apart from compression, equalization is the audio engineer's "Swiss-army knife" used to ensure that tracks work well together in the context of the song.

In Zebra2, they are very useful for tweaking the final timbral character of a patch – make it generally brighter or duller, boost or cut certain frequencies...

Note that all twelve parameters (frequency, gain, slope) of the EQ are available in the Matrix as modulation targets. The highlighted entry in the list here is actually the green handle (2):

Handle 1 = LowShelf
Handle 2 = Mid1
Handle 3 = Mid2
Handle 4 = HiShelf

Example: To use the EQ arrangement in the above image as a swept band reject filter (which sounds a bit like phasing), you need to modulate handle number 3 – so the target is *Freq Mid2*.

Performance

Arpeggiator / Sequencer Programming

Arpeggiator settings used in the patch 'How Money More Times'

If you would like to experiment with an existing arpeggio, load e.g. *How Money More Times* from the 'Two Point Five' folder and play with all the settings – including the Swing value (Global/FX).

On the other hand, why not follow this little tutorial instead... all will become clear in time:

Quick insight tutorial

1. Click on *Patches* in the upper bar and load the Initialize patch from the Local folder.
2. Click below the OSC1 cell and add VCF1. The Synthesis window automatically opens.
3. Take VCF1 Cutoff down to minimum, click on a (...) knob in the VCF and select Env1
4. Set 'Env1' in the VCF to about 110, the Sustain (in Envelope 1) to minimum and Release to 50
5. Click on the Global/FX tab in the lower bar. Set Voice Mode parameter to *arpeggiator*.
6. Play a low note. Click on 'Tune' in the Global/FX panel and select '< 12'.
7. Change OSC1 mode to 'dual', and Detune it to taste.
8. Play a low note and adjust VCF1 Resonance to about 10 (or higher if you prefer).
9. We should now have a simple bass arpeggio, so click on the Arp/Seq tab in the lower bar to open the arpeggiator...
10. Change Steps to 4. Change Transp of the 3rd step to 1, 4th step to 7. Play a note...
11. Change the leftmost triangle to a different icon... why is this an 8-note sequence now? Experiment – see what happens if you change one or two of the other 'triangles'.
12. Play a chord... Change the first four 'Voices' to 6 (use your mouse wheel to do this)
13. Play a high chord. If it distorts, turn down the volume in Lane 1.
14. Click on the remaining (...) knob in the VCF and select 'ArpMod'. Set it to +20. In the right half of the arpeggiator panel, set the leftmost four sliders to different values.

Now try adjusting all Lengths, Gates etc.. Then add reverb and SB3, perhaps?

Selectors

The block of buttons on the left...

Arp Sync

1/64 – 1/1 trip: The duration of the default 'semiquaver' step. See *Length* below.

Arp Order

Incoming notes are ordered within a **note buffer** in one of two ways. Note: The buffer is then played back in the direction set by the *Arp Loop* parameter (see below).

by note..... notes are reordered according to MIDI note number
as played..... the original order in which notes were played is retained

Arp Loop

Determines the direction in which the note buffer is played back. See *Arp Order*.

f ==> forwards
b <== backwards
fb <=> forwards / backwards
bf >=< backwards / forwards

Note: *Arp Loop* does not affect the direction in which the arpeggiator runs (which is always forwards!) or the transposition of notes (see *Transp* on the next page).

Oct

0, 1 or 2 times: This switch sets how often the octave is shifted up after all notes in the buffer have been played back.

Steps

The number of steps used for the arpeggio. Note that a 3-step arpeggio (for instance) can create a 15-note sequence (or even 24 in *fb* or *bf* loop mode!) if you set Oct to 2 and play a 5 note chord.

Slide

When the Slide switch is on, any Glide set in the Global/FX panel will only be applied to connected notes (see Gate below).

Step parameters

Step

Sets which note in the buffer is played at this step.

next: play the next note
same: repeat the same note
first: play the first note (see Arp Order above)
last: play the last note (see Arp Order above)

Tip: Set all used Steps to 'last' for typical monophonic arpeggios.

Length

Step lengths are defined as multiples of the *Arp Sync* value:

 1 x

 2 x

 3 x

 4 x

Gate

Arpeggiators autiomate playing / releasing notes, so gate times need to be defined:

0, 1 ,2, 3, 4.....from very short to almost the length of *ArpSync*
5 (arrow)..... connected to the next step (see also *Slide* above)

The step following a '5' will not be retriggered unless it uses more than one Voice.

Voices

The maximum number of notes that can be played at once per step.

Transp

Pitches may already be jumping about, but on top of this movement, the individual steps can be transposed +/- 12 semitones using the small 'keyboard' buttons. Unpredictability is therefore to be expected!

Arp Mod, Arp Md2

The entire right half of the Arp/Seq panel comprises two rows of bipolar sliders that can be used to modulate any targets (e.g. VCF cutoff and Glide rate) in step with the arpeggiator. The corresponding sources are 'ArpMod1' and 'ArpMod2'

XY Pad Programming

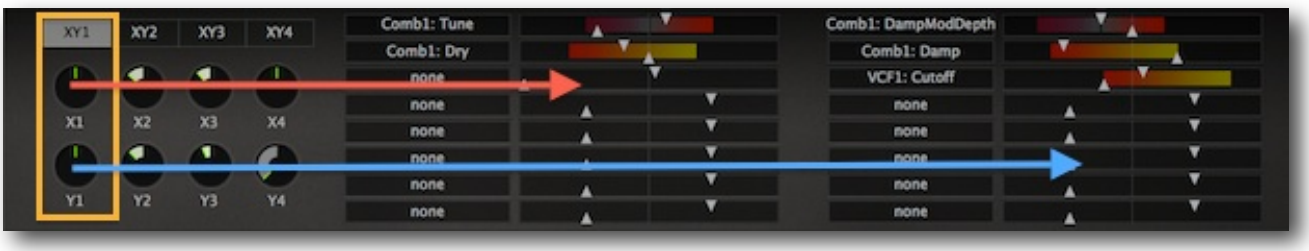
Click on the XY tab in the lower bar...

XY programming panel

Programming the XY pads may seem daunting at first, but it really is quite easy – especially if you follow this little hands-on tutorial... then experiment:

Quick insight tutorial

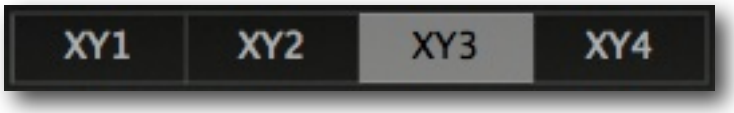
1. Click on *Patches* in the upper bar and load the *Initialize* patch
2. Click on *Synthesis* and add a VCF below OSC1. Note that Cutoff knob is at maximum. Right-click on the Cutoff knob and select 'assign to / X3'.
3. Click on XY in the lower bar, then on the XY3 tab to the left of the panel
4. Click on Perform, move the handle around the XY3 pad while playing a note. Watch what's happening below.
5. Click on the upper right '**none**' and select **Filter1** / **Cutoff** from the menu
6. Play a note and move around the XY3 pad again. Only the lower half affects cutoff...
7. ...so grab the righthand multicolored bar and move it to the center.
8. Hold down a note and try out the XY3 pad again. Positive Y values also affect cutoff now because **you have just turned down the filter's cutoff knob.** Open the Synthesis window and see for yourself... then go back to the Perform window.
9. Double-click **twice** on that multicolored bar to set minimum/maximum to the extremes.
10. Double-click on ***XY3*** above the pad, and change the text to "PITCH + CUTOFF". Double-click where it says ***xy3 not assigned*** below the pad, and change the text to "X = Pitch (new line) Y = Cutoff".
11. Try assigning XY4 to other targets e.g. filter resonance and oscillator vibrato. This time, drag the little triangles around instead of double-clicking on the colored bar. You can assign up to 8 targets per axis of each pad, but you will only see targets for existing modules – of course you could add a few more modules to the patch...



XY1 programming panel, X (left) and Y (right) programming areas

Controls

XY1–XY4 Selectors



The four buttons at the top lefthand corner of the panel select the XY pad to be edited.

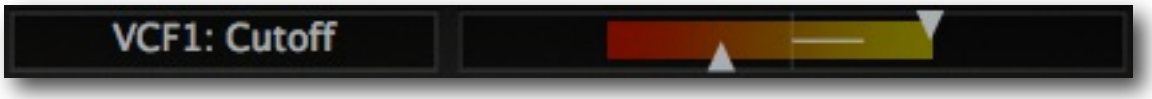
X and Y knobs

These knobs are directly linked to the X/Y pads in the Perform window: moving a knob will also move (X=horizontally, Y=vertically) the handle in the corresponding pad. And vice versa.

The individual X and Y knobs come in very handy as single-axis 'pads' while the Synthesis window is open. Also best for "MIDI-learning" XY pads (for remote control / automation).

Target Selectors and Range Controls

The main area of the XY programming panel is divided into two blocks – the left half is for the X-axis (of the selected pad – see *XY1–XY4 Selectors* above), while the right half is for the Y-axis.



target selector *range bar and range markers*

The 16 *Target Selectors* (set to 'none' by default) open a nested menu containing everything that can be modulated in the current patch – more targets appear as modules are added to the grids.

Targets in the Matrix can also be selected fom the Synthesis window or effect panels by right-clicking on a knob and choosing 'assign to / (X1...Y4)' from the context menu.

To the right of each Target Selector is another field. As soon as a target is selected, a brightly-colored *Range Bar* appears, representing the full range of the target parameter.

Important: The current value is always in the center of the area (you will see a faint vertical line there), so sliding the Range Bar to the left or right actually adjusts that value. Go to the Synthesis window and watch the corresponding knob move as you slide the Range Bar (and vice versa – adjust that knob and watch the Range Bar move).

The two triangular *Range Markers* set the minimum and maximum values. Note that you can invert the range by setting the upper marker to the left and the lower one to the right. Double-clicking on a Range Bar switches between three preset ranges: normal full range, inverted full range and zero range (at the current value). A handy little function!

MIDI Control

MidiLearn and MidiUnLearn

Zebra can be remote-controlled / automated via MIDI messages from a hardware controller unit or from your sequencer program. Right-click any knob to open a menu containing *MidiLearn* and *MidiUnLearn*. Currently undergoing a major redesign, the extra functionality described below should be considered 'beta'.

MIDI controllers

Zebra's expanded *MidiLearn* function lets you define how parameters will react to MIDI continuous controller (CC) messages. Before you use *MidiLearn*, right-click on the data display and select the *MIDI Controllers* entry from the top of the list. The options are...

- **none** – practically "MidiLearn Off", prevents accidental MIDI learns
- **normal** – full range (standard)
- **integer** – whole numbers only
- **fine** – between nearest integers, in 0.01 steps
- **octaves** – 32' to 2' without changing fine tune
- **semitone** – semitones/cents between octaves
- **fineSelected** – like fine, but controls the most recently selected element. Switch the mode to *fineSelected* and *MidiLearn* the knob/slider you would like to use as a general-purpose fine controller. It doesn't matter which knob you right-click to do this.

The seven **page** options are not implemented yet, and should be ignored for now.

- **Encoder 127** – unipolar encoders
- **Encoder 64** – bipolar encoders
- **Continuous 7bit** – 7-bit MIDI CC (standard)
- **Continuous 14bit** – 14-bit MIDI CC

Note: MIDI remote control is **channel sensitive**: Map up to 16 channels of any CC except *ModWheel*, *BankSelect*, *Hold* or *AllNotesOff* – over 1,900 mappable controllers!

Some Interesting Tricks

This section only includes tricks that need more than a little ‘thinking outside the box’. I’m sure a few more will be discovered in time, Zebra2 certainly has enough fire-power...

A motion viewer for modulators

Thanks to Brian Rzycki for this interesting tip...

Load the *initialize* patch, then assign a ModMapper as modulation source for something. The target doesn’t matter for this experiment, because the amount will be left at zero. I chose oscillator Pan:

A ModMapper will appear in the modulators pane:

Click on Alternate and change it to Map Smooth. Select LFO1 as the Modulator (it’s unfortunate that we can’t select MMix here!)

Click on ‘+’ to expand the map, set the leftmost and rightmost values to maximum, right-click and select straighten. The map should now look like this:

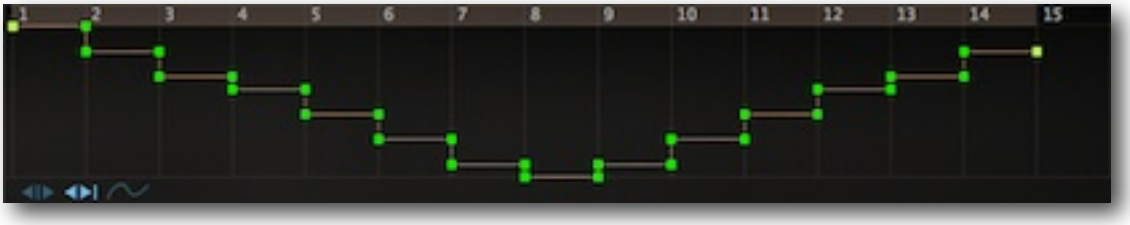
Play a note and slow down the LFO a bit (this trick only works well if the modulator is relatively slow). Works fine with envelopes or MIDI input such as aftertouch.

A 64-stage MSEG

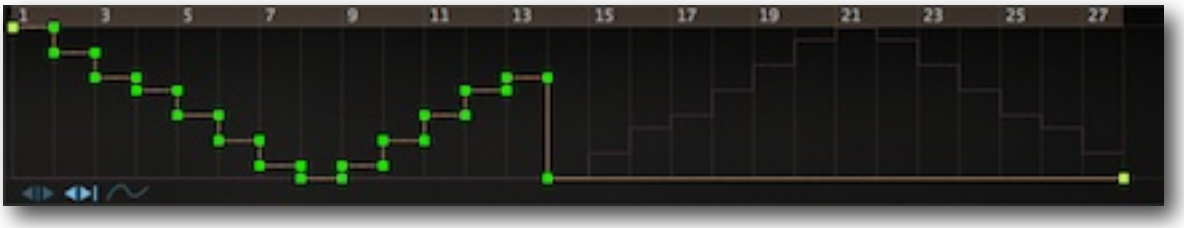
If you really need more handles that the 33 available in each MSEG, you can use two or more of them in series...

MSEG1 (modulating oscillator pitch) already uses up 28 handles:

Just for fun, let's invert that same pattern and copy/paste it into MSEG2:



Take the last two handles down to zero, extend the first (zero) step of MSEG1 to the zeroed bit of MSEG2, extend the last handle of MSEG2 to the end of MSEG1... you should end up with something like this (it's the principle that counts):



We're looking at MSEG2 here, but you can see a faint MSEG1 in the right half of the image. All you need to do then is use a mod mixer (MMix) e.g. to modulate OSC1 *Tune*, put both the MSEGs into that mod mixer and crank up *Const* to maximum...

I can't find any example patches that make use of this trick – perhaps 33 really is enough!

Modulation inverter

Now and again it can be useful to be able to invert unipolar modulation sources, e.g. to cross-fade between two lanes of the main grid:

Alternatively, a Mix module can cross-fade between two signals, and the individual oscillator volumes could simply be cross-faded in this particular example, but the solution here is interesting because it also converts unipolar to bipolar and allows for non-linear curves.

Absolute value

A minus times a minus is a plus! This example always outputs positive pitchwheel values.

Vibrato under control

When the mod-wheel is at minimum, output is all ATouch, and when at maximum, output is all ModWhl. It always adds up to 100%.

Especially ‘Prog-Rock’ keyboard wizards will understand the reason for this one. It lets you add vibrato using either mod-wheel or aftertouch (or any mixture of the two) in the same patch, without letting vibrato get too deep. So you can take a solo using the mod-wheel, then get back to playing two keyboards at once – using aftertouch instead.

Zebrify

Introduction

The ‘effects’ version of Zebra2. Zebrify includes several features that transcend what you normally expect from an insert effect, for instance audio oscillators – with carefully programmed pitch-detection, Zebrify can be used as a powerful guitar synthesizer. Like the effects section in Zebra2, Zebrify is strictly monophonic i.e. single-voice.

Zebrify’s Synthesis window, showing generator and effect modules in a single grid

Zebrify uses the main patching grid for all modules. It has fewer generators than Zebra2...

VCF (4)	Shape (2)	XMF (2)	Delay (2)	EQ (2)
FMO (2)	Mix (2)	SB (2)	Rev (1)	OSC (2)
Comb (2)	Ring (1)	ModFX (2)	Comp (2)	Noise (2)

...but has four additional modulation sources:

EnvFol1	**Pitchness**	**Essness**	**Transient**

MIDI

Click on the ‘Midi’ tab in Zebrify’s lower bar to open this panel:

Zebrify’s MIDI panel, with KeySource menu

Together with the Pitch Detector (see a few pages down), this panel is mainly concerned with Zebrify’s own monophonic version of **KeyFol**, the key-follow modulation source.

Note: Many DAWs (e.g. Cubase and Reaper) directly route MIDI from source plugins into insert effects. Some use more complicated methods – in Logic, load Zebrify as "AU midi-controlled effect", then read up about signal routing and MIDI in the manuals!

Glide

Smooths KeyFol when *KeySource* is set to ‘MIDI’.

KeySource

Determines how Zebrify derives its note data i.e. KeyFol and envelope gate.

MIDI: KeyFol uses incoming MIDI notes with last note priority, like in Zebra2’s effects section. Note: Envelopes and MSEGs can only be triggered in this mode.

Input: Detects the fundamental pitch, KeyFol is a continuous variable.

In Qtz: Detects the fundamental pitch, KeyFol is quantized to the nearest semitone.

Output

Zebrify’s main output level control.

Keyboard

Displays derived notes or MIDI notes (see *KeySource* above). Notes derived from input signals with ambiguous pitch content (e.g. chords) can cause key to jump around.

The keyboard can also be used to trigger/gate envelopes and MSEGs, in case your sequencer is incapable of routing MIDI data to effect plugins.

Input

Click on the ‘Input’ tab in the lower bar. The input pane contains three panels: Input Mixer, Envelope Detector and Pitch Detector...

Input Mixer

Zebrify’s grid has four lanes, and each has its own input...

Zebrify’s Input Mixer panel

Input1 ... Input4

Input levels. Input1 goes to the lefthand lane of the grid, Input2 to the next lane etc..

Input selectors

Stereo, *left*, *right* or *mono*-sum for each input. For instance, setting Input1 to ‘left’ and Input2 to ‘right’ lets you split the two channels of a stereo signal between lanes 1 and 2.

Envelope Detector

The Envelope Detector continuously analyses the input signal level and outputs the modulation source **EnvFol1** (envelope follow). EnvFol1 can then be used to control targets that would typically be modulated by a standard envelope e.g. the output level of a lane in the grid. Note that envelope detection is independent of the Input Mixer settings.

Zebrify’s Envelope Detector panel

Mode

Follow: EnvFol1 is an envelope follower i.e. it is proportional to input signal level
AR Env: EnvFol1 is a simple Attack-Release envelope triggered at the Threshold

Curve

linear: EnvFol1 is linear – best option for modulating levels e.g. lane volumes
exponential: EnvFol1 is exponential – for modulating frequencies e.g. filter cutoff

FilterType

Zebrify's envelope detector includes an input filter so it can be set up to react to certain frequencies only. See *Filter* below.

signal: No filter
bandpass: Isolate a particular frequency
lowpass: Isolate low frequencies e.g. bass drum
highpass: Isolate high frequencies e.g. hi-hat

***Attn** (attenuation)*

Gain control for the envelope detector only, independent of Input Mixer levels. See also *Thresh* below.

Attack

Rise time after the signal level has reached the threshold (see *Thresh* below).

Release

Fall time after the signal level drops below the threshold.

Smooth

Smooths both Attack and Release.

Filter

Cutoff frequency of the envelope detector's input filter – see *FilterType* above.

VU

Input level display.

***Thresh** (threshold)*

This **slider** (!) adjusts the level at which the envelope follower is 'on'. Use together with the *Attn* parameter (see above).

Level

Realtime display of EnvFol1 output.

Pitch Detector

Input signals with a strong fundamental frequency can be used to control the pitch of Zebrify's oscillators. Patch up your own guitar synthesizer or voice-controlled 'Theremin'. The pitch detector can output four different modulation sources at the same time:
Transient, **Essness**, **Pitchness** and **KeyFol**.

Zebrify's Pitch Detector panel

Mode

percussive: for strong attack signals: acoustic guitar, tuned percussion etc.
voiced: for breathy / noisy signals: vocals, flutes etc.
clear: for mostly pure signals: monophonic synth lines etc.

Source

Input selector for pitch detection – *stereo*, *left*, *right* or *monosum*.

Sense (Input)

The main input gain for all parts of the Pitch Detector, with an indicator that lights up whenever the signal is strong enough for pitch detection.

Sense (Transient)

This threshold determines the level at which transients (short-lived jumps in volume) will be recognized as such. The output of this section is the **Transient** modulation source...

Decay

Controls how quickly **Transient** decays to zero.

Sense (Ess)

Ess frequency cutoff, from 4 to 8 kHz ('esses' are sibilants, high-frequency noises with little or no pitch content). The output of this section is the **Essness** modulation source.

Transient > Ess

Adds detected transients to the **Ess** modulation source.

Sense (Pitchness)

Pitchness is effectively the opposite of Ess(ness) i.e. it reacts to pitched signals. Set low values for meticulous but relatively slow pitch detection, and higher values for signals with clear pitch content. The output of this section is the **Pitchness** modulation source, practically a smooth gate that opens as long as pitch is detected.

HiNote, LowNote

Limits pitch detection to a range of notes (standard MIDI note numbers).

ZRev

Despite its austere appearance, ZRev is the mother of non-convolution reverb units. It is a tool for hand-tuning delay coefficients in feedback delay and allpass networks. Exactly how it works is a well-kept secret – to quote Urs Heckmann:

“Before tweaking any knob on Zrev one should use google on the following terms: *comb allpass filter*, *feedback delay network*, *jot householder matrix*, and finally *schroeder moorer reverb*.”

Assuming you didn’t just spend hours searching those words, the following might help: The left section is a feedback delay network with damping, the right section is two cascades of nested allpass filters with adjustable feedback for each set.

ZRev is a challenge. If enough people try enough different coefficients for a long enough time, somebody might just stumble upon a great-sounding set. The ZRev challenge should not be seen as a “chimps on typewriters” scenario – in theory, ZRev is capable of emulating any artificial reverb, and it’s up to you to work out the best strategy! However...

The relative values affect the room quality – the more irregular, the better. Some claim that prime numbers or other special ratios are necessary, but so far the best tactic still appears to be simple trial-and-error. If you believe you have a set of values that produces **almost no metallic ringing**, please contact anybody@u-he.com.

Although ZRev itself has no Save button, you can save your settings in the native format of the host application – there should be a Save button somewhere at the top of the window.

Modulation Target Lists

Generators

Modules and target names are in alphabetical order, knob names are in **bold**, “modulation amount” means the degree to which another modulator affects its target.

Comb	
Damp	**Damp**
DampModDepth	(...) Damp modulation amount
Detune	**Detune**
Distortion	**Distortion**
Dry	**Dry**
FBModDepth	(...) Feedback modulation amount
Feedback	**Feedbk**
Flavour	**Flavour**
FlavourMod	(...) Flavour modulation amount
Input	**Input**
InputMod	(...) Input modulation amount
key scale	**KeyScale**
Pan	**Pan**
PanModDepth	(...) Pan modulation amount
PreFill	**PreFill**
Tone	**Tone**
ToneMod	(...) Tone modulation amount
Tune	**Tune** in semitones
TuneModDepth	(...) Tune modulation amount
Vibrato	**Vibrato**
Volume	**Volume**
VolumeModDepth	(...) Volume modulation amount
Width	**Width**

FMO	
Detune	**Detune**
FM Depth	**FM** input
FM ModDepth	(...) FM modulation amount
key scale	**KeyScale** (lower panel)
Pan	**Pan**
PanModDepth	(...) Pan modulation amount
Tune	**Tune** in semitones
TuneModDepth	(...) Tune modulation amount
Vibrato	**Vibrato**
Volume	**Volume**
VolumeModDepth	(...) Volume modulation amount
Width	**Width**

Mix (ChannelMix)	
Mix	**Mix**
Pan	**Pan**
PanMod Depth	(...) Pan modulation amount

Noise	
F1 ModDepth	(..) Lowpass modulation amount
F2 ModDepth	(..) Highpass modulation amount
Filter1	**Filter1 (**Lowpass)
Filter2	**Filter2** (Highpass)
Pan	**Pan**
PanModDepth	(...) Pan modulation amount
Volume	**Volume**
VolumeModDepth	(...) Volume modulation amount
Width	**Width**

OSC	
Detune	**Detune**
key scale	**key scale** (lower panel)
Normalize	**Normalize** (lower panel)
Pan	**Pan**
PanModDepth	(...) Pan modulation amount
Phase	**Phase**
PhaseModDepth	(...) Phase modulation amount
Poly Width	**Width**
Resolution	**Resolution** (lower panel)
SFX(n)ModDepth	(...) spectral effect modulation amount
SpectraFX(n) Val	selected spectral effect
SyncModDepth	(...) Sync modulation amount
SyncTune	**Sync**
Tune	**Tune** in semitones
TuneModDepth	(...) Tune modulation amount
Vibrato	**Vibrato**
Volume	**Volume**
VolumeModDepth	(...) Volume modulation amount
WarpModDepth	(...) Wave modulation amount
WaveWarp	**Wave** index

Shape	
D_modDepth	(...) Depth modulation amount
Depth	**Depth**
Edge	**Edge**
Edge ModDepth	(...) Edge modulation amount
HiOut	**HiOut**
Input	**Input**
Output	**Output**

VCF	
Cutoff	**Cutoff**
Drive	**Drive / Vowel / Split**
Gain	**Gain**
KeyFollow	**KeyFol**
ModDepth(1,2)	(...) Cutoff modulation amount 1, 2
Resonance	**Res**

XMF	
Bias	(visible but not implemented)
Click	**Click**
Cutoff	**Cutoff**
FilterFM	**FilterFM**
Freq mod(1,2)	(...) Cutoff modulation amount 1, 2
FreqOffMod	(...) Offset modulation amount
FreqOffset	**Offset**
KeyFollow	**KeyFol**
Overload	**Overload**
Resonance	**Res**
XFMmod	(...) FilterFM modulation amount

Voice

Voice Circuit	
Arp Step Mod nn	(visible but not implemented)
FineTuneCents	(visible but not implemented)
Portamento	**Glide**
Portamento2	**Glide2**
PortaRange	**Range**

Voice Mix	
Mod Depth(1-4)	(...) 'Mod' modulation depth (Vol) – main grid
Pan Mod Dpt(1-4)	(...) 'Mod' modulation depth (Pan) – main grid
Pan(1-4)	**Pan(1-4)** – main grid
Send1	**Send1** – FX grid
Send2	**Send2** – FX grid
SendDepth1	(...) Send1 modulation amount – FX grid
SendDepth2	(...) Send2 modulation amount – FX grid
Volume(1-4)	**Vol(1-4)** – main grid

Modulators

Envelopes	
Init	(...) Initial level before the Attack stage
Attack	**Attack**
Decay	**Decay**
Sustain	**Sustain** level
Fall/Rise	**F/R**
Sustain2	(...) Sust2 level (if Sust2 is active)
Release	**Release**
Velocity	**Vel**
Vel2I	**Velocity Scale** initial level amount (if Init is active)
Vel2A	**Velocity Scale** to Attack amount
Vel2D	**Velocity Scale** to Decay amount
Vel2S	**Velocity Scale** to Sustain amount
Vel2FR	**Velocity Scale** to F/R amount
Vel2S2	**Velocity Scale** to Sust2 amount (if Sust2 is active)
Vel2R	**Velocity Scale** to Release amount
Key2I	**Key Scale** to initial level amount (if Init is active)
Key2A	**Key Scale** to Attack amount
Key2D	**Key Scale** to Decay amount
Key2S	**Key Scale** to Sustain amount
Key2FR	**Key Scale** to F/R amount
KeyS2	**Key Scale** to Sust2 amount (if Sust2 is active)
Key2R	**Key Scale** to release amount
Slope	Slope (if the envelope is in v-slope mode)

GLFO (LfoG)	
Amplitude	**Amp**
Phase	**Phase**
Rate	**Rate**

LFO	
Amplitude	**Amp**
Delay	**Delay**
DepthMod Dpt1	(...) Amp modulation amount
FreqMod Dpt	(...) Rate modulation amount
Phase	**Phase**
Rate	**Rate**

MMix	
Constant	**Constant**

MSEGs	
Velocity	**Velocity** amount
Attack	**Attack** time
Loop	**Loop** time
Release	**Release** time

Effects

Comp	
Attack	**Attack**
Compression	**Comp**
Input	**Input**
Output	**Output**
Release	**Release**
Threshold	**Thresh**

EQ	
Freq HiShelf	**(4)** horizontal position
Freq LowShelf	**(1)** horizontal position
Freq Mid1	**(2)** horizontal position
Freq Mid2	**(3)** horizontal position
Gain HiShelf	**(4)** vertical position
Gain LowShelf	**(1)** vertical position
Gain Mid1	**(2)** vertical position
Gain Mid2	**(3)** vertical position
Q HiShelf	**(4)** slope
Q LowShelf	**(1)** slope
Q Mid1	**(2)** slope
Q Mid2	**(3)** slope

Delay	
Drive	(unused)
Feedback	**Feedback**
Hipass	**Hipass**
Lowpass	**Lowpass**
Mix	**Mix**
Pan1 ... Pan4	**Pan1** ... **Pan4**
Ratio1 ... Ratio4	**Ratio1** ... **Ratio 4**
X-Back	**X-back**

Mix (ChannelMix)	
Mix	**Mix**
Pan	**Pan**
PanMod Depth	(...) Pan modulation amount

ModFX	
Center	**Center**
Depth	**Depth**
Feedback	**Feedbk**
HiCut Freq	**HiFreq**
High Boost dB	**Boost** (high)
Low Boost dB	**Boost** (low)
LowCut Freq	**LowFreq**
Mix	**Mix**
Q1, Q2	(unused)
Quad	**Quad**
QuadPhase	**Q-Phase**
Speed	**Speed**
Stereo	**Stereo**

Reverb	
Damp	**Damp**
Diff Feedback	**D-Feedb**
Diff Mix	**D-Mix**
Diff Mod	**D-Mod**
Diff Range	**D-Range**
Diff Speed	**D-Speed**
Dry	**Dry**
Feedback	**Feedback**
Modulation	**Modulation**
PreDelay	**PreDelay**
Range	**Range**
Speed	**Speed**
Wet	**Wet**

SB	
FModDepth	(...) Freq modulation amount
Frequency	**Freq**
Mix	**Mix**
MModDepth	(...) Mix modulation amount
Offset	**Offset**
OModDepth	(...) Offset modulation amount

Shape	
D_modDepth	(...) Depth modulation amount
Depth	**Depth**
Edge	**Edge**
Edge ModDepth	(...) Edge modulation amount
HiOut	**HiOut**
Input	**Input**
Output	**Output**

VCF	
Cutoff	**Cutoff**
Drive	**Drive / Vowel / Split**
Gain	**Gain**
KeyFollow	**KeyFol**
ModDepth1	(...) Cutoff modulation amount 1
ModDepth2	(...) Cutoff modulation amount 2
Resonance	**Res**

Troubleshooting

If you are having problems with Zebra2, you might find the solution here:

Random Notes

Problem
Zebra goes “out of tune” after about 15 minutes.

Solution
That’s our demo-mode restriction. Please read the ReadMe file included in the installer!

Parameter Reset

Problem
“I'm on [computer platform and OS version] using [DAW]. I load Zebra2 into a project, and whenever I play the song or try to record, it resets [parameter] to [value]”.

Solution
That sounds very much like an accidental MIDI learn. A controller has somehow been assigned to that parameter, and restarting the song resets all controllers. Simply right click on the knob and select "MIDI Unlearn".

Note: MIDI Learn assignments are global for all patches in all instances of Zebra2, and are stored at the following locations (you might like to put an alias on your desktop!):

Win *...\VstPlugins\u-he\Zebra2.data\Support\com.u-he.Zebra2.midimap.txt*
Mac *~/Library/Application Support/u-he/com.u-he.Zebra2.midimap.txt*

VST Mac: File permissions

Problem
Some Mac OSX users have observed problems (including crashes) if u-he VST plugins are placed in the root *Library* folder.

Solution
After installation, move **Zebra2.vst** from */MacHD/Library/Audio/Plug-Ins/VST/u-he* to */MacHD/Users/[you]/Library/Audio/Plug-Ins/VST/u-he*

VST Win: Protected directories

Problem
Zebra2 doesn’t appear in the plug-in list, or installation causes error messages.

Solution
Move the file **Zebra2.data** to *C:\Users\[you]\Documents* and put a shortcut to that file into your standard *VstPlugins* directory under the name **Zebra2.data.lnk** (you may not be able to see the suffix in Windows Explorer).

Glossary

A

ACE (u-he product) "Any Cable Everywhere" wireless modular synthesizer

ADSR Traditional envelope generator with 4 stages: Attack, Decay, Sustain, Release

aftertouch The most common term for either channel pressure or key pressure from a MIDI keyboard. The latter is polyphonic, but rarely transmitted by the hardware

allpass (filter) Only affects the phase of the input signal, not the frequency content

amplitude The level of a signal

analogue (of a synthesizer) Popular term for non-digital

antiphase Upside-down signal (i.e. phase-shift of 180° / 50.00%)

attack (**A**DSR) Usually the first stage of an envelope, where the level rises from zero to maximum. In Zebra2's envelopes, the attack stage can be preceded by a delay, or a non-zero initial level can be set

attenuate To reduce the level of a signal

B

bandpass (BP filter) Allows frequencies close to the cutoff point to pass through while attenuating higher and lower frequencies

bandreject (BR filter) Allows all frequencies to pass through except those which are close to the cutoff point. Often called a 'notch' filter

bazille PD-based modular synth currently in development (alpha) as member of...

berlin modular future u-he synth trio, expected to include an expanded version of ACE, Bazille and a third model yet to be decided upon

bipolar (modulator) Can output both positive and negative values, for instance pitch-bend or LFO. See *unipolar*

blend (as opposed to *morph*) In Zebra: The levels of harmonics are crossfaded

BPM Beats Per Minute = standard representation of song tempo

C

channel pressure see *aftertouch*

cell In Zebra: a single position within one of the *grids*, can be assigned a module

cent One-hundredth of a semitone

comb (filter) Resonant delay based filter/oscillator

cutoff (of a filter) The frequency that defines where (within the audio spectrum) the input signal will start to be attenuated or boosted. See *resonance*

D

daft eric rigby Infamous 19th-century Welsh cellist

decay (A**D**SR)

default Setting or value assigned as a sensible starting point. Double-clicking on Zebra2 knobs will set appropriate defaults

delay Two meanings in Zebra2: 1) an effect module 2) an envelope phase

DIVA (u-he product) virtual analogue synth with choice of oscillator and filter models

duophonic (synthesizer) Can play only two notes at the same time, defined by the lowest and highest notes received

E

envelope generator (modulator) Contour for levels, tone etc.

F

filter-FM Audio rate frequency modulation of filter cutoff

Filterscape (u-he product) Popular dual-filter plugin suite, with complex modulation

FM Frequency modulation

FMO Frequency modulation oscillator

frequency Speed of a cyclic system (in cycles per second = Hertz). Can be translated into e.g. the absolute pitch of an oscillator or the *BPM* of a song.

FX Abbreviation for “effects”

G

glide Smooth pitch transition between consecutive notes

global (parameter) In Zebra2: patch-wide parameter, not per-voice

grid In Zebra: Matrix of 'cells' used for patching / routing signals

H

highpass (filter) Allows frequencies above the cutoff point to pass through while attenuating low frequencies

handle (Zebra2 GUI object) Any small object used for editing e.g. the pips in EQs

I

index Position within a 1-dimensional array (e.g. a waveset)

initialize In Zebra: A very simple patch suitable as a template for new creations

instantiate To create an object (e.g. an LFO) from its class (e.g. the LFO parameters)

J

junk In Zebra: A patch marked as unwanted but not yet deleted

K

key follow (modulator) In Zebra: MIDI note with Glide

key pressure see *aftertouch*

L

legato No space between consecutive notes, not retriggered

LFO Low Frequency Oscillator (usually remains below the audible range)

lowpass (filter) Allows frequencies below the cutoff point to pass through while attenuating higher frequencies.

M

microtuning Fine-tuning per note, usually to break away from equal temperament

mode (of a system) A particular way of working, selected from multiple options

MIDI-learn Assigning MIDI controllers to parameters by sending controller data

mod-wheel Modulation wheel. Multi-purpose left-hand controller on a MIDI keyboard

modulation Controlling a parameter (from a modulator)

modulation matrix Panel used for connecting modulation sources to targets

modulator Any control source used for modulation

module Patchable unit within a modular synthesizer

monophonic Able to deliver only one voice / signal at a time

More Feedback Machine (u-he product) A complex 4-way delay plugin

morph Smooth interpolation between defined states

MSEG Multi-Stage Envelope Generator. Complex envelope with up to 32 curves

N

normalize To make consistent. In Zebra: to balance levels of waves within a waveset

O

oscillator Pitched tone generator

overload (of a filter) Distortion effect produced when the input level is “too high”

PQ

parameter Variable factor within a system

pane In Zebra: subdivision of a window

panel In Zebra: block of controls for an individual module / section

paraphonic Polyphonic oscillators but monophonic filters / envelopes

patch Zebra’s preferred term for preset, program, sound etc.. The word ‘preset’ goes against Zebra’s DIY philosophy, ‘program’ and ‘sound’ are too nondescript

per-voice Non-global, instantiated for each note

phase A particular position within a cycle (OSC or LFO). Often expressed as angles, *Phase* values in Zebra are percentages of a complete cycle

polarity (of a signal) ”normal” or inverted state

polyphonic Able to deliver more than one voice / signal at the same time

portamento Glide

R

release (ADS**R**)

resolution In Zebra oscillators: interval between successive waveform calculations

rolloff filter slope

Rumblence:Zoyd (u-he product) ‘Legacy’ semimodular synthesizer, freeware

S

scale ("to scale") multiply, as opposed to add/subtract

signal A time-variant value, usually audio-rate

slew Smoothing of control signals (e.g. portamento / glide is slewed pitch)

sub-panel switchable area of a panel (different controls appear)

sustain (ADSR)

T

threshold A value above or below which an action commences

Triple Cheese (u-he product) Free comb-filter based freeware synthesizer

TyrellN6 (u-he product) Free virtual analogue synthesizer

U

Uhbik (u-he product) A collection of high-quality effect plugins

unipolar (of a modulator) Can only output positive values

V

VA virtual analogue – digital emulation of classic subtractive synthesis

velocity (modulator) How fast a key is struck

W

wave In Zebra: a single waveform within a waveset...

waveset In Zebra: the set of all 16 waves in an oscillator

XYZ

ZebraCM (u-he product) Non-modular 'magware' synthesizer related to Zebra2

Zoyd see *Rumblence:Zoyd*

The End

Many thanks to u-he forum members for ideas and proof-reading
Howard Scarr 2010