# KRON CV Toolbox

## Alien Seed Tech

### 1.2.0

## Table of Contents

# Updates

## 1. Version 1.2 (requires Reason 9.2+)

**Popup menus improved:**
Many menus have been upgraded and now have more organization and/or submenus: the mods, source menus, the curve shapes, and a couple others. (More menus would be in this version but it was causing major problems, so they're on hold till that can be solved.)

**Mod sections are combined into displays:**
Instead of individual displays for each menu, they're combined for performance reasons.

**Mod amount knobs are now Thor-like number displays:**
They have zero-snap and go by 1% increments when holding shift.

**Menus to clear mods are on the bottom row with the scale mods.**

**Random waveform generation tools:**
6 new tools are available via the waveform tool name display (which is now a menu). They can generate random waves from scratch or randomize the existing wave (for both x and y, just x, or just y). The latter uses the smooth tool knob as an amount.

**Modifier keys can be used with the waveform editor:**
Shift grabs a point, control adds a point, and alt deletes a point.

**Sample and hold sources:**
The gate inputs, note velocity, and CV inputs all have new sample and hold versions in the source menus.

**More grid sources:**
9 new entries in these menus include more of what's available in the regular sources.

**Scope source menu now turns on the scope when used.**

**Changed resolution of the main displays and thickened lines to compensate for the loss of blur.**

**Custom waveform step/smooth display is now a clickable toggle.**

**Reversed copy-from-to waveform tool up/down cursor buttons.**

**Minor GUI bug fixes.**

# Introduction


Here's a quick introduction to the KRON (well, 14 pages, with pictures). The rest of the manual actually goes into the details of each control, and the main sections are generally ordered from their positions on the KRON: top to bottom , left to right.

There are also a bunch of help menus on the KRON itself (showing a "**?**"). The main green ones on the front (plus one on the back) list each component with a quick description. The yellow ones on the top of the back panel are mostly introductions and overviews of the components but do not detail every property (the note quantizer intro is an exception). They might be a better place to start. Just click on them if you need help! (Also, please keep in mind that the screenshots are not exactly what the KRON looks like, largely because the colors aren't reproducing as crisply as they should be in this editor. And I tweaked some things after making this. And many of then were taken before version 1.2. :))

The KRON was designed to do just about anything CV-related, though it focuses on generating and combining LFOs. There are a ton of options on here, with many parts capable of serving multiple purposes.

If you're intimidated by the density of controls, keep in mind that a lot of the special stuff lights up when it's in use and blends into the background when it's not. The idea was to make it obvious what was being used on an LFO and to be able to see the entire LFO at once. Plus, on the LFOs, there's an up/down meter, a 2d plot above, and an oscilloscope available that will mostly show you what each control is doing as you change things.

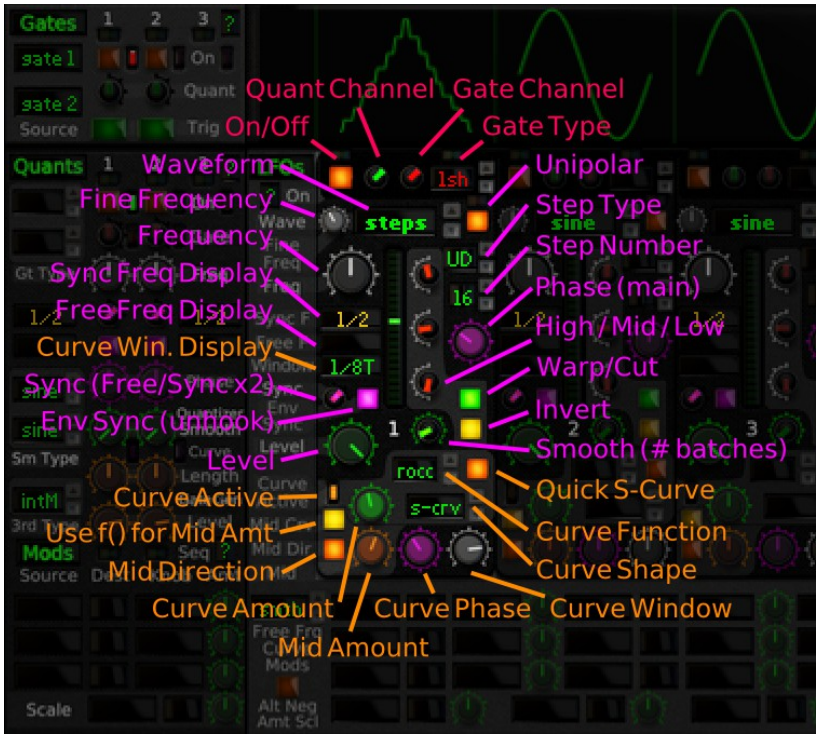
The color options are there to please your eye! :) And to make it easier to distinguish KRONs in your rack. When you come up with some favorite color settings, let me know! I plan on adding a bunch of user-generated presets in the future, though I can't promise to add them all.

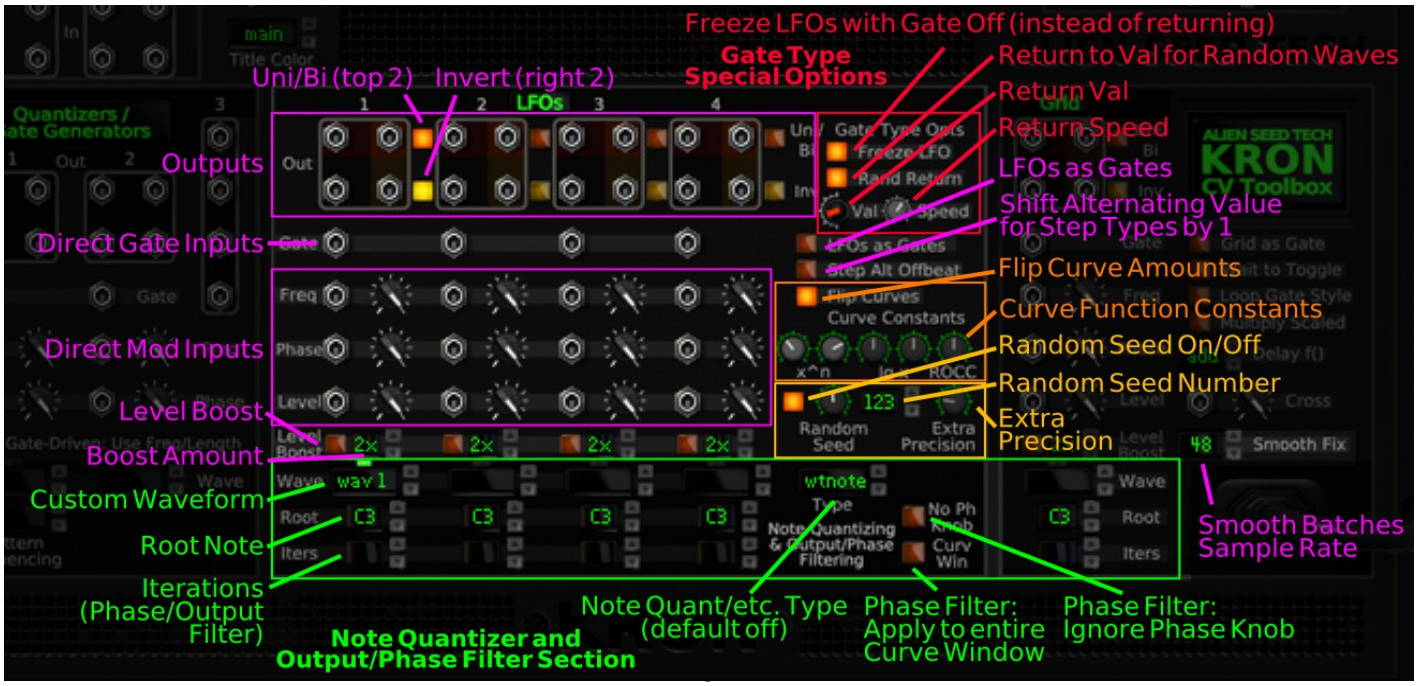
Before the rest of the introduction gets started, here's a shot of the back using the gold meter color:

# 1. LFOs

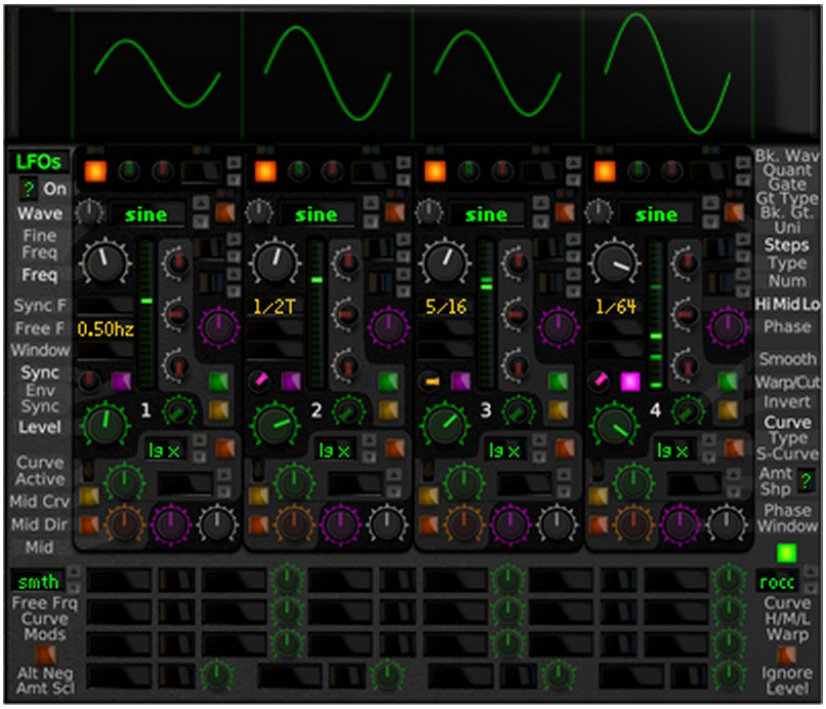
The KRON actually has 7 LFOs, 4 of which are full-featured (and labeled LFOs) and 3 of which are square wave only: 2 for the quantizers/gate generators and 1 for grid selection functions.

For reference, here are 2 color-coded pictures labeling all of the LFO controls, front and back. All of these labeled pictures are also in the first appendix at the end of the manual. Also note that most pictures in this manual haven't been updated with version 1.2.



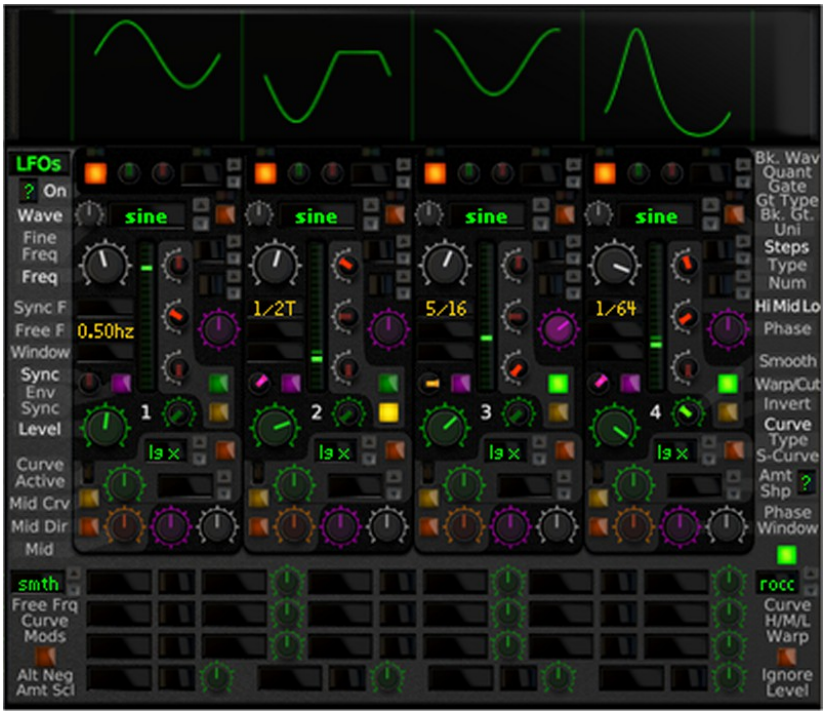
The main LFOs start with basic waveforms and alter them via a bunch of controls: basic ones like frequency, free/sync selection, level, invert, etc. and advanced ones like the curve section, high/mid/low shapers, quantizer and gate channels, and stepped wave-specific menus. They also have a full-featured mod section that can wire up just about anything to just about anything else, including combos of sources and destinations. The waveform menu itself is somewhat limited but it includes custom drawn waveforms (via the top wide display) and random waves (which also have a number of options on the back panel, such as the ability to use a random seed). Basically by using the curve section and the mods (and the grid, etc.), just about any kind of waveform can be generated.




The picture above shows the main controls in action. All LFOs are using the default sine **waveform**. LFO 1 is using **free** frequencies and about a halfway **level**. LFO 2 is using the **first sync** set of frequencies (its **sync** knob is purple). LFO 3 is using the **second sync** set (its **sync** knob is orange). And LFO 4 is using the **first sync** set, plus its **env sync** button is on, making the frequencies behave like free frequencies when the freq knob changes. It won't be "synced" to the play position.

The **frequency displays** in yellow (plus the **curve window display** in green, not shown here) can be directly dragged on too. They're less responsive than the knobs, taking longer to switch between values, so it might be easier to dial in particular frequencies with them.


There is a small **fine frequency** knob, above the main **frequency** knob, that can multiply the main **frequency** by 25% to 400%. The **level** knobs can also be **boosted** by different amounts via the back panel (shown to the right). This is useful when doing heavy multiply mods or averaging and/or multiplying a lot of signals on the grid, for example.



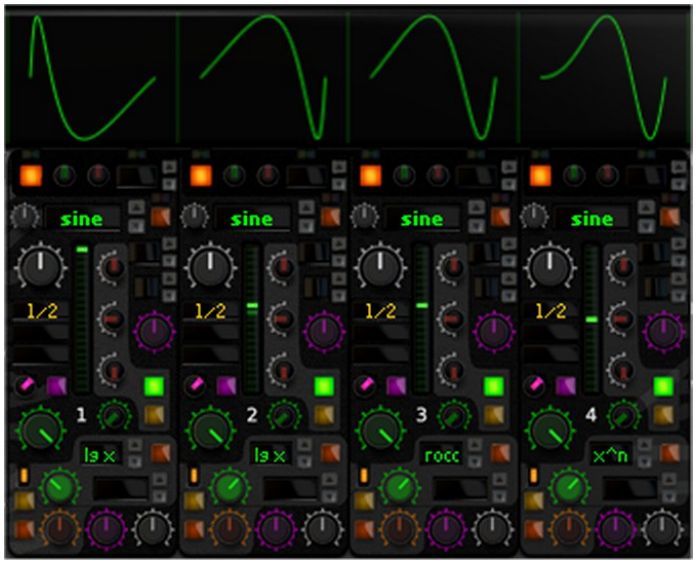

The lighting-up-orange **high/mid/low** shapers are to the immediate right of the displays. **Mid** shifts the midpoint. When the green **warp** button is off, the **high** and **low** shapers are conceptually similar to low and high-pass filters. They cut off the output at a given position. If the **warp** buttons are on, they can warp and skew the signal instead. But it's also recommended that you use curve functions to do this by having the **curve high/mid/low warp** toggle on, to the right of the LFO mods. The warping will be linear without it.

Below that green **warp** button is the yellow **invert** toggle which just inverts the signal. To the left of the **invert** is the green lighting-up **smooth** knob which averages the signal over a number of batches. (Use the back panel option, **fix smooth**, in the grid section, to make this somewhat sample rate independent.) Above those buttons is a purple **phase** knob to rotate the entire waveform.

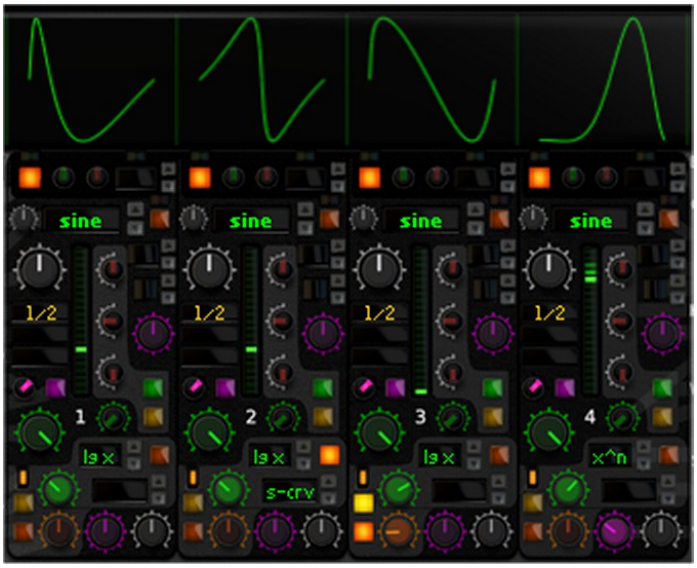

In the picture above, LFO 1 uses the **mid** knob to shift the LFO up (with half volume, it fits); LFO 2 is cutting off the top part of the LFO and also inverting it beforehand; LFOs 3 and 4 are being **warped**, and that **special curve** toggle is also on, using the rocc function. LFO 3 has its **phase** knob set to a positive offset, and the **low** knob just moves the entire LFO up. But LFO 4 is using both **mid** and **high** to visibly **warp** the LFO. It also has its **smooth** knob set to a moderate value, though I'm not certain it's very useful in this circumstance. If the waveform were jagged, not a sine wave, it would be.

Above that **phase** knob are two menus that are used for stepped waveforms (and some of the random waveforms too): a **number-of-steps** chooser and a **steps type** (forward, reverse, up/down, and these three alternating with -1, 0, or 1). In the picture to the right, the up/down, alternating with zero **step type** is chosen, with 32 **steps**.

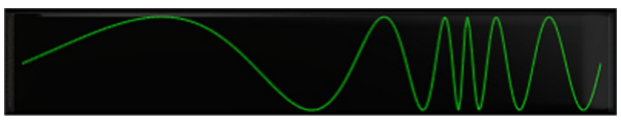
The **curve section** at the bottom of each LFO is designed to alter the LFO's phase. (They can also be used by the quants instead by choosing these curve sections in the quant **smooth type** menus.) The phase normally advances at a certain rate (at the chosen **frequency**), and this curve section will turn that line (a diagonal when plotted versus time) into something more complicated and/or curvy. Basically there's a function (**curve type**) and variable (**curve amount**) that can be applied to the phase, once or several times in different permutations by using the **shape** menu. In the picture to the right, the first 2 LFOs use opposite **curve amounts** with the same **function**, and the last 2 use different **functions** for comparison. (All of these are using the back panel **flip curve amounts** toggle.)

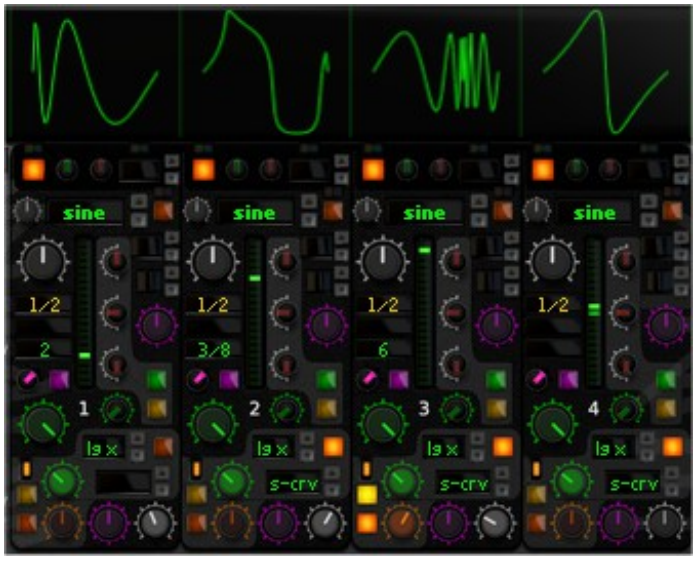



Below those controls is a simple linear **midpoint** shift (plus a **direction** toggle and option to **use the curve function** instead of a linear function), a **phase** knob for rotating the LFO phase within the curve section (or rotating the function over the original waveform), and a **curve window** knob that also displays underneath the main frequency. To the right, the only difference between the first 2 LFOs is that the 2nd is using the **s-curve shape**. The 3rd LFO uses the **mid** knob set to around the opposite of the **curve amount** knob, plus those 2 toggles, to create a sort of s-curve. The 4th LFO is using the **curve phase** knob to rotate the LFO before it's curved.




The **curve window** will apply the curve section to multiple phases of an LFO or a fraction of one, using multipliers that are modeled after the first set of sync frequencies. In this picture, the first 3 LFOs have **curve windows** set, and the last 3 LFOs are using the **s-curve shape**. LFO 1 is curving 2 iterations of a sine wave. LFO 2 is applying an s-curve to fractions of the original sine wave. Here is what 6 phases of it look like, and LFO 3 below that:





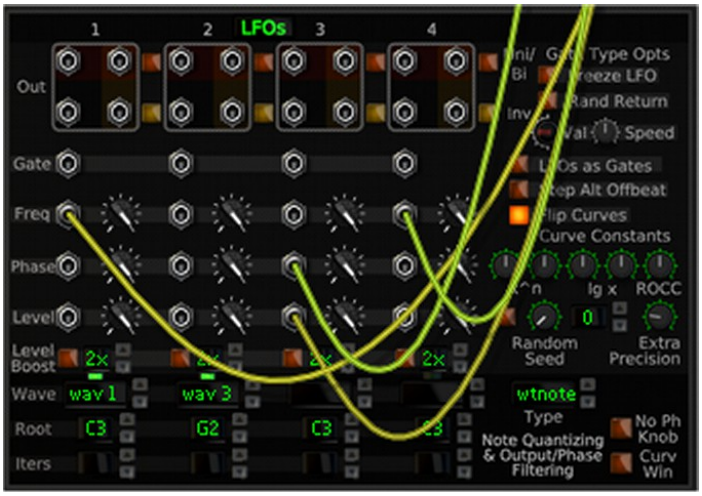


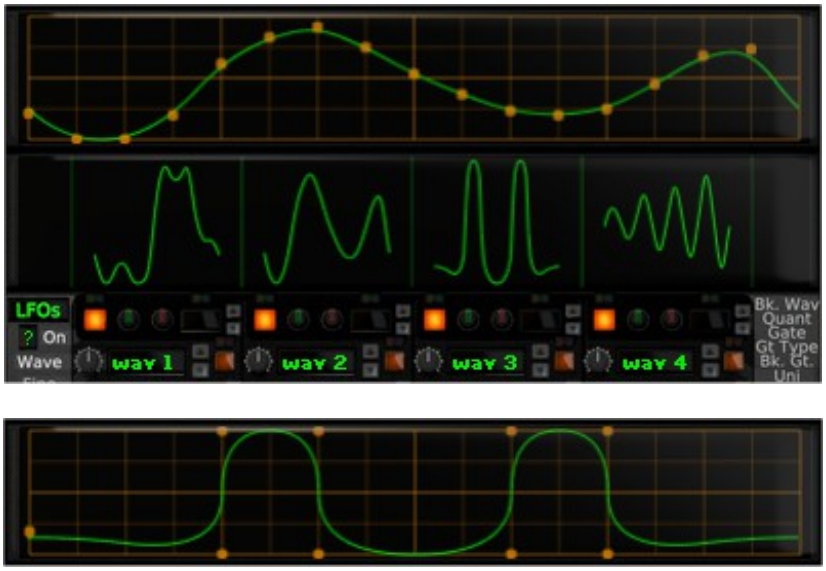

At the top of each LFO there is a small row of controls that hides in the background somewhat when not in use. The **on/off** button is on the left, followed by a greenish **quant channel**, a reddish **gate channel**, and a **gate type** menu (with red text if it's not on the default blank choice). The **quant channel** points to the quants on the left side of the device, using those gate generators as quantizers/smoothers. The **gate channel** points to the gate channels above those quants. When in use, the **gate channel** will trigger the LFO according to the **gate type**, which by default just retriggers it. (The gate channels can be driven via the quants and/or by any source, including note/gate inputs and internal outputs.)

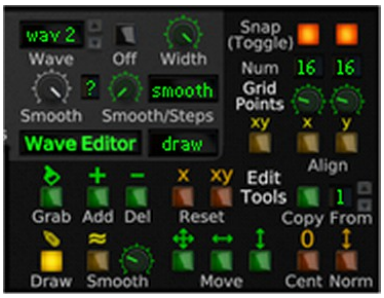


There is also a **direct CV gate-in** for each LFO on the back panel. When it's in use, a lamp lights up below the **gate type** (shown on 3 and 4 above). Below these controls is the basic **waveform** selector, already discussed, and the **unipolar/bipolar** toggle to the right. The default is off, bipolar (1 and 2 are unipolar in the picture above).


There are 9 mods (plus 4 scale mods to scale these) below the LFOs, each of which can use any of the on-board or back panel sources (including bank-of-4 combinations), target more than one LFO at a time if desired, and affect any of the LFO controls by a chosen positive or negative amount. There are also back panel direct mods and a number of other options, including a note quantizer / filter section that can use a custom waveform to snap the output to note CV scales/intervals or filter the output or phase of the LFO.



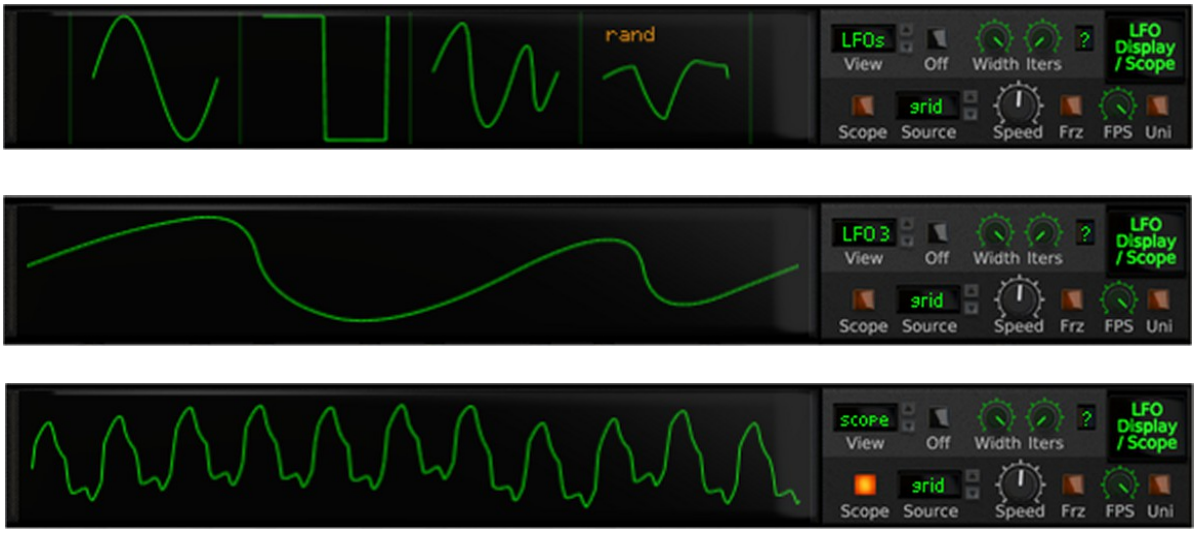



The waveform editor has a number of radio tools with which to edit and draw waveforms. There are 4 basic waveforms with up to 32 points each, plus combos of these which share the same data but allow access to more points (X=1+2, Y=3+4, Z=all 4). They can function in either **smooth** or **stepped** mode. You can draw in a waveform and manually change the **number of points**. You can also freely **add** and **delete** points (within the limits of the waveform), **move** them around individually or all at once, **snap points to a grid**, **randomize**, etc. (Version 1.2 adds the ability to **grab**, **add**, and **delete** the points with the modifier keys.) The above picture is showing a simple drawn waveform (on LFO 2) and a wave with dragged points that were snapped to a grid (on LFO 3).

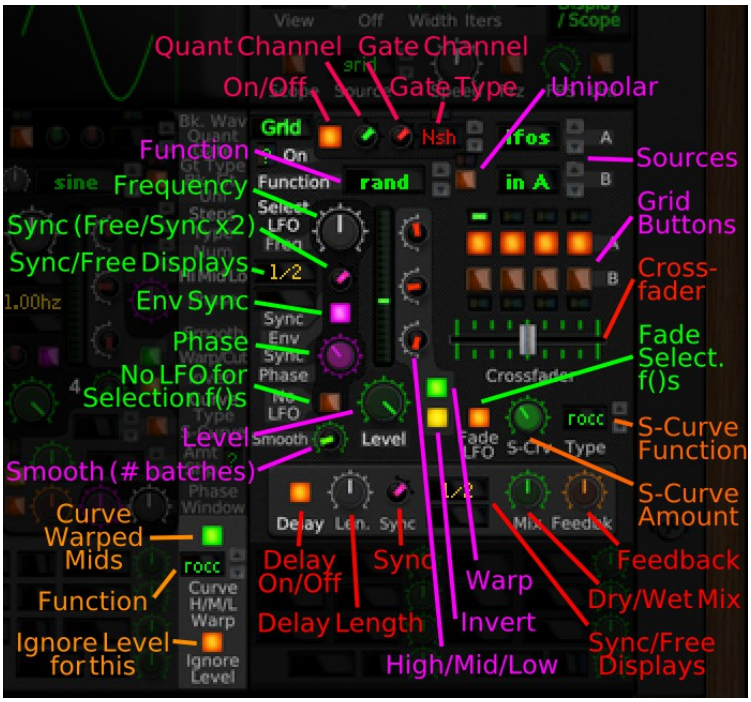
The LFOs can use these as their basic **waveforms**, and they can also be used as **note/filter quantizers** (for the LFOs and grid) and **pattern sequences** (for the quants) using the back panel note quantizer / etc. sections at the very bottom of each component's back panel area, pictured below.


When a **wave** is used this way, the editor display changes. Shown below is a 12-step note quantizer with C and G on. Because of some limitations, the display will always start with C, but you can move this scale around via the root menu on the back or with the mod section, etc.




The **LFO display** shows all 4 LFOs or one at a time, and it can also display an oscilloscope, set to the grid output by default. Click on an LFO to zoom in on it, and click again to go back to the main display. Click to the left or right of the LFOs when it's showing all four to go to the scope, and click to go back to the main display. The **width** and **iterations** knobs may come in handy when zooming in on one LFO. And there are several controls for use with the oscilloscope: the **source** menu, **speed**, a **freeze/pause** button, an **fps** knob (which will be a fraction of the main fps knob), and a **unipolar** toggle.

# 2. Grid



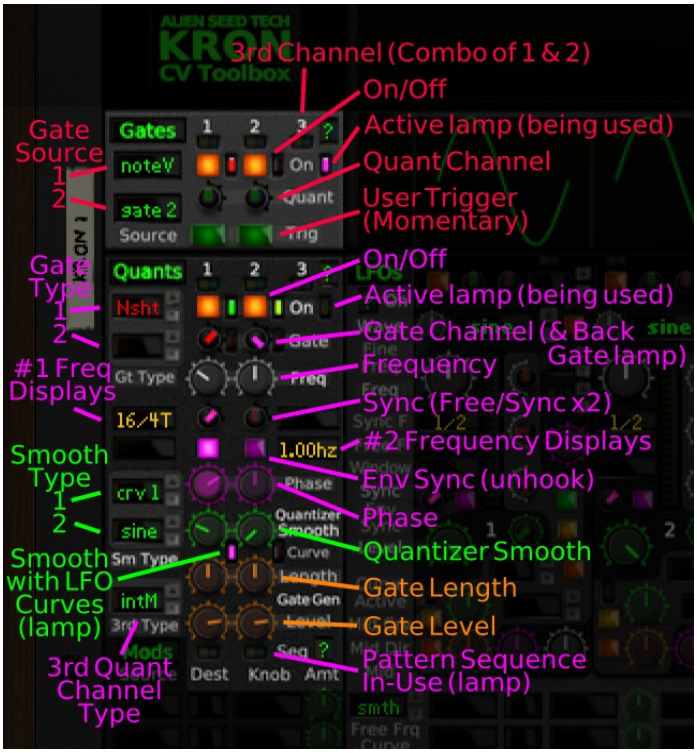


The grid combines various signals. It has a 4x2 grid of buttons which point to two separate banks of 4 sources, selectable above the grid via the **source** menus. It has a similar LFO setup for the **selection functions** (like max or loop). It uses this LFO, along with gates, to select signals at a certain rate. The **no frequency** toggle will bypass this LFO, re-selecting every processing batch (as fast as it can go). The **fade LFO toggle** will use the **crossfader s-curve** controls to smoothly change signals.


The grid also has basic **sum/multiply/average functions** that ignore this LFO, along with a set of **crossfader functions** that use a **crossfader** to select and combine signals. This **crossfader** can be **s-curved**. There's an optional **delay** that occurs before the **high/mid/low** shaper and an **average-smoother** knob (like the LFOs, the option to "fix" these to a sample rate is in the grid's back panel section). It has the same **gate** and **quant** controls as the LFOs, with a slightly different set of **gate types**. Six mods (plus 2 scale mods) are available, along with back panel direct mods and some options.

# 3. Gates and Quants

The two gate channels on the left of the device use **source** menus, **momentary triggers**, and the quants themselves via the **quant channel** knobs to generate gates internally. This is where the red-purple **gate channel** knobs point to, and when a channel is on and in use, a correspondingly-colored lamp will light up to the right of the **enable** button.



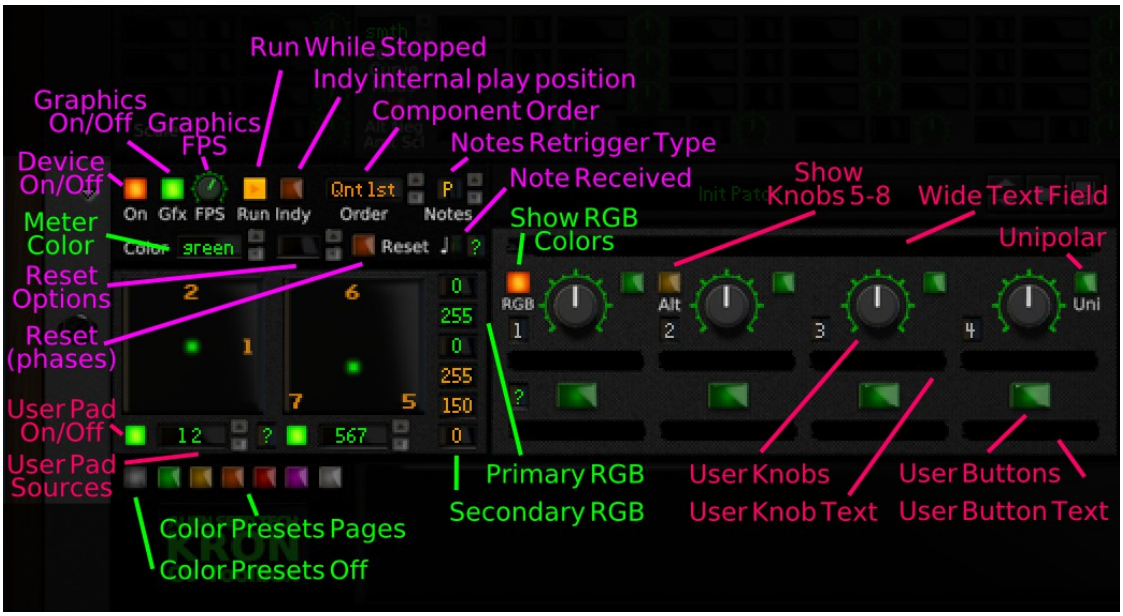

The two quants are used for quantizing and/or gate generation. The LFO and grid have **quant channel** selector knobs for quantizing, and the gate channels have these knobs for generating internal gates. These quants can also be used to drive other devices via their back panel gate outputs. They have the same basic LFO controls that the other LFOs have (including **gate channels** and **type** menus for triggering these quants), along with extra **smoothing** and **gate generation** knobs and menus. And there's a **third channel** that is a combo of the first two, with a menu to select how to combine the first two.

In the picture to the right, the first gate channel is triggering via the first quant, the second gate is wired up to back panel gate inputs, and the second quant is being used to quantize an LFO (not pictured), while having its **frequency** modded by another LFO.

These quants can be sequenced using the **custom waveforms** and the back panel **pattern sequencer** section, similar to how the LFOs and grid's **note quantization/etc.** works. They can also be curved via the LFO **curve sections** by choosing those sections in the **smooth type** menus. This can be used for both quantizer smoothing (custom smooth functions basically) and gate generation (by using a **curve window** setting greater than 1 to generate a cluster of beats that can be curved).

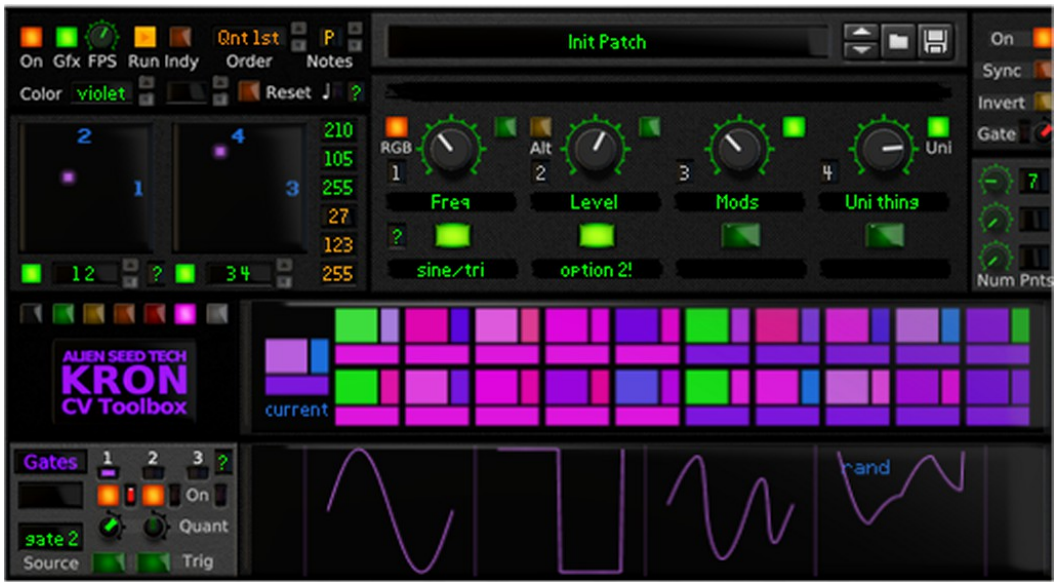
# 4. General and User Controls, Envelope, Etc.

At the top right of the device, there's a simple **ADSR** envelope with a **sync** toggle (free/sync lengths), **invert**, **gate channel**, **level** knob, **loop**, **bipolar**, and a couple of mods. It's mainly meant to be used as a source for modding (and if you scale those mods by the envelope itself, you can get a nonlinear mod).

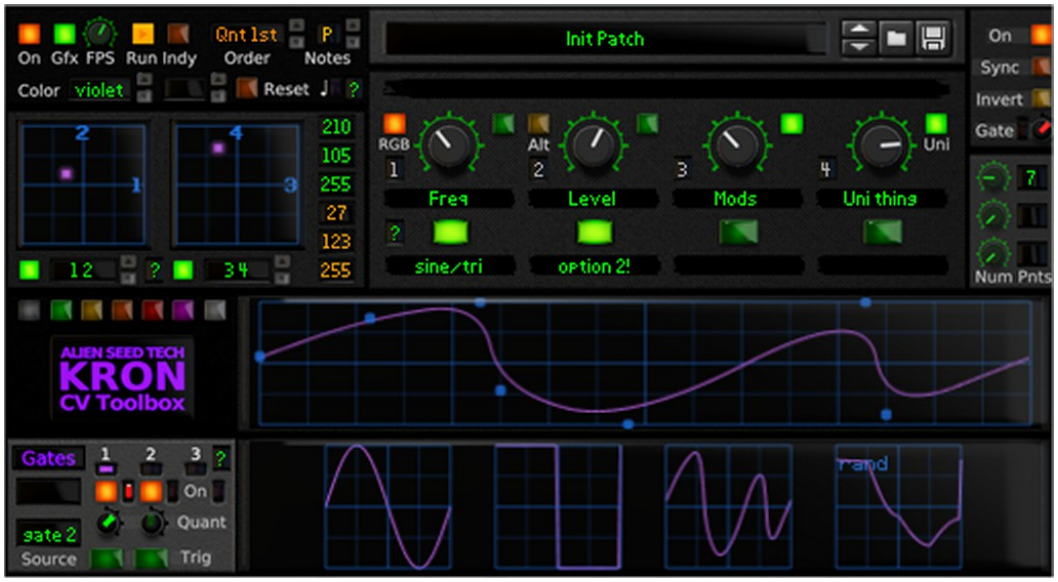

In the top middle there are four **user knobs** (with four more available via the **alt** toggle) and four **user buttons** with labels, giving you more combinator control and internal modding ability. There are also two **user pads** on the left that can be used to control various combos of the user knobs.

General controls on the upper left of the device allow you to turn the **device on and off**, toggle running modes (**run while stopped**), turn the **graphics on and off**, change the **frames per second**, change the **order of components**, and do **phase resets** of the device (optionally synced via the menu).

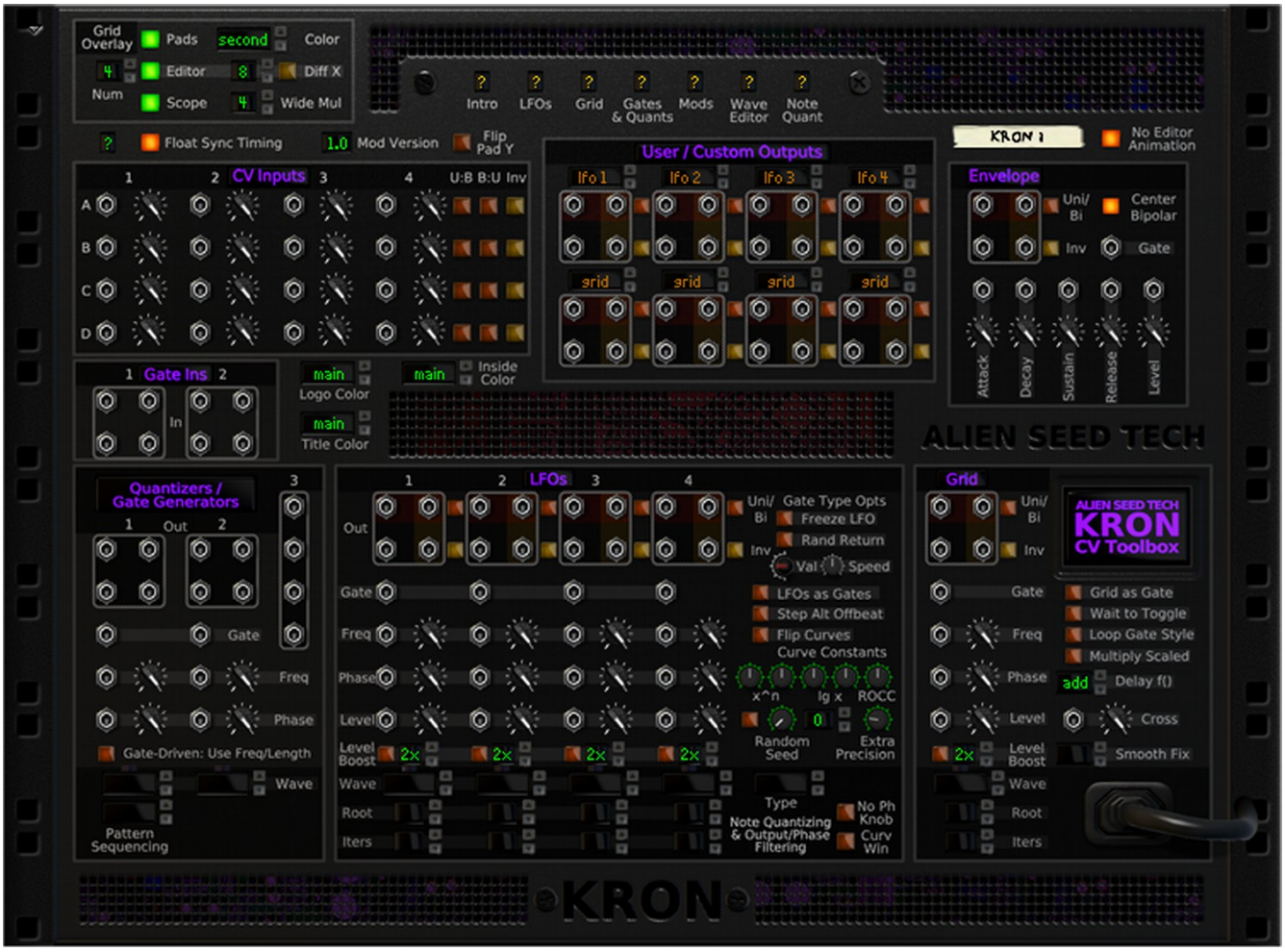



Maybe most importantly, you can change the colors of the device via a **meter color** menu (3 properties are set in here), 2 sets of **RGB values** for the big displays (shown by toggling the **RGB** button in the upper left of the user section), and a set of **color presets** of these that show in the waveform editor display by clicking on the colored buttons above the KRON logo. Click on the presets to set the colors and click on the current color or the dark radio button on the left of the radio presets to get rid of that display.

There are also optional **grid overlays** for all of the 2d screens via controls on the top left of the back panel.

Almost everything is available as a **mod source**, and almost everything can be modded. Many single options are also turned into virtual properties via the mods (e.g. so you can set an option for only one LFO instead of all four). There are also plenty of back panel connections for modding, gate inputs, four outputs for each component, and the ability to output any source from the 8 **user/custom** outputs (in the picture below, each of them is pointing to a custom source: the LFOs and the grid).




That's it for this section! The rest of the manual goes into detail about every component, along with some extra notes. So good luck! :) And let me know what you think, especially if you find bugs or you want to suggest new waveforms, functions, options, etc. Thanks!!

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# Components

# 1. General Controls

**Summary**
These control the entire device. The main **on/off** is self-explanatory. The green **display enable** will toggle the various displays on/off, and the **fps** (frames per second) knob sets the target framerate and changes the look of the displays. **Run** toggles between running and not running when the song is stopped (useful for gate generation or holding free freq LFOs when the song stops). **Indy** makes toggling **run** start from the play position (by default it's off, syncing up multiple KRONs when the song is stopped). The **order** menu chooses the order of execution of the components. The **phase reset** menu and button (below the order menu) are used to reset the device. And the **notes** menu determines how notes are used to trigger the gate channels. The colors of the displays and meters can be changed via the **meter color** menu and the two sets of **RGB** values (next to the user pads). There also **color presets** available via the colored buttons above the KRON logo. There are also a bunch of back panel general controls, such as a **grid overlay** section.


**On/Off**
Turns the entire device on and off, similar to the bypass/on/off switch on audio effects. (CV Utilities do not, by default, have a bypass/on/off switch, which means a combinator would not affect one if I used it, and this device doesn't have just one obvious way for CV to pass through.)

**Graphics On/Off**
Turns the displays on and off, doing nothing to the actual functioning of the device. Use it if you're tired of seeing flashing lights or you want to lower the CPU usage.

**Frames per Second (FPS)**
The display frequency. Defaults to 40 fps, but the actual fps is determined more by Reason and the audio settings. It's variable and only very powerful computers will probably be able to actually display 60 fps. This knob can affect both what the displays look like and the CPU usage. I had to choose a default for this, and since 60 is probably not happening anyway and is mildly more CPU intensive (for large numbers of KRONs at least), and 30 is probably reasonable, but I personally think 40 looks neater than 30. So I chose that. Otherwise, there's no great reason why the default is 40 fps.

**Run (Run When Stopped)**
If on, the device will run when the song is stopped. It works similarly to the run buttons on the Matrix and Redrum, except it does not get toggled off when the song is stopped. So having it on, the KRON behaves like most other LFO generators and continues to run when stopped. Turning it off while the

song is stopped will pause or silence it. This is very useful if you are using the gate generators to drive drums or other instruments. Turning it off while the song is playing has no effect until the song stops.

The next button, **indy**, controls the behavior of this when toggled on. If **indy** is off and the song is stopped, toggling **run** on will not result in starting from the play position. Rather, it will continue with an internal play position that started when the song stopped. Thus, other KRONs will be synced up when their run buttons get toggled off and on and the song is stopped. Toggling **indy** on will allow this button to act as a reset to the play position every time it's triggered. None of these options however will sync up to Matrixes and Redrums while the song is stopped. This functionality of Matrixes and Redrums isn't exposed to REs. You could however use a Matrix as a gate trigger on a KRON and sync up that way. Note that moving the play position manually in either mode will sync up KRONs' internal play position to the song's play position. Also note that creating a new KRON while the song is stopped will result in that KRON's play position being different than others until the play position is moved or the song is started. From that point on, it will be synced up. (This also goes for pasting devices and deleting/undo, etc. Just start the song to sync them up.)

**Indy Run (Independent Run)**
Defaulting to off, all KRONs will have the same internal play position when the song is stopped. Then toggling any KRON's **run** button (or being already on) will sync it up to other KRONs that are running, so that all sync frequencies will be in sync while the song is stopped. Turning this option on will allow the **run** button to start the KRON from the current play position every time the button is turned off and on, though it will be out of sync with other KRONs. Basically these two modes allow the KRONs to behave sort of like Matrixes or Redrums, behavior which is not possible to do all at once with REs.

**Order (Run/Execution Order)**
This menu controls the order of execution of the various components and mods. For certain configurations, this can allow a patch to have zero latency between various components when used as grid, gate, or mod sources. Each setting is useful for different scenarios, but they all work in general for any situation, so long as you don't mind the extra 1 batch latency (which is at least what you'll have anyway when you use multiple devices and wire them up via the back panel). You will most likely not be able to tell that the latency is there in most cases. It's mainly meant for optimizing away latency and edge cases that end up sounding like bugs because of very subtle timing issues. This knob cannot help resolve latency for modding configurations that use a component to mod itself (e.g. LFOs modding LFOs). The options are taken from a large set of possibilities, so there are presently 8 and I may add more (and let me know if you can think of something useful that isn't in here.

| | |
|---|---|
| **Mods first:** | Mods, Gates/Quants, LFOs, Env, Grid. |
| **LFOs as Mods:** | LFOs, Mods, Gates/Quants, Env, Grid. |
| **Grid as Mods:** | Grid, Mods, Gates/Quants, Env, LFOs. |
| **Quants as Mods:** | Gates/Quants, Mods, LFOs, Env, Grid. |
| **Modding LFOs:** | Gates/Quants, Env, Grid, Mods, LFOs. |
| **Modding Grid:** | Gates/Quants, Env, LFOs, Mods, Grid. |
| **Modding Quants:** | LFOs, Env, Grid, Mods, Gates/Quants. |
| **LFOs as Mods and Gates:** | LFOs, Gates/Quants, Env, Mods, Grid. |

**Notes (Note Retrigger)**
This menu controls the holding and retriggering of note-based gates. *Hold* keeps a gate on as long as there is at least one note on. *Mono* retriggers if a note is released and another note is still on. *Poly* will retrigger with each distinct note hit.

**Note On Lamp**
Note that this only indicates that the device is receiving notes, not that the device is using them. The typical way to use them would probably be to send them to a gate channel and use that gate to trigger various things (such as the envelope). It's also possible to route these signals into the various components and modify and output them (especially with the **note quantizer**), turning the KRON into a MIDI arpeggiator of sorts.

**Phase Reset Button**
Resets the phase of the LFOs, the grid LFO (and the loop function if selected), and the quantizers/gate generators. This is essentially a gate trigger for the entire device. This is useful for choosing where free frequencies start, for synchronizing sync frequencies away from the normal play position, for using sync frequencies with weird time signatures (e.g. a 7/8 break in the middle of a 4/4 song), for working on loops, and just for messing around with the device and getting the LFOs to line up.

If you are drawing the phase reset in a sequencer lane, it's easiest to use *instant*. It won't matter for how long the phase reset is drawn; only the initial hit matters. However, if you are looping onto a phase reset (so that the left marker is on a phase reset), you will need to release it before the end of the loop. Also, looping onto a phase reset will only work properly with the *instant* selection. Manually dragging the play position to the middle of a phase reset automation will reset the phase to wherever it was dropped, not to where the phase reset was first drawn, as the KRON has no way of knowing where it was first drawn without encountering it while playing. And if you move it to a drawn phase reset from another drawn phase reset while playing, the KRON won't know that a new phase reset was hit.

Note that moving the play position to the left of a phase reset will clear the phase reset, while moving it to the right will not (either through manually moving it or looping). To clear it, stop twice or use the phase reset knob selection, *clear*, and hit the phase reset. Also, a phase reset zeroes out free frequencies while setting a gate trigger for sync frequencies. The KRON deals with free frequencies by just continually incrementing, while sync frequencies are actually synced to the play position. So moving the play position to the right of a phase reset will keep the sync frequencies where they would be while playing normally but the free frequencies will carry on from where they were before the play cursor was dropped.

**Phase Reset Sync (Menu)**
A sync'd value that the **phase reset** is applied to. The options are: *instant*, *4/4*, *1/2*, *1/4*, *1/8*, and *clear*. *Instant* will make the phase reset happen when the button is pressed. The sync values will snap the phase reset to the next division of the song's play position (or internal position if not playing). They are mostly meant for triggering while recording or in live situations. *Clear* will reset the phase reset back to the beginning of the song (effectively clearing it). It is probably best to use *instant* when

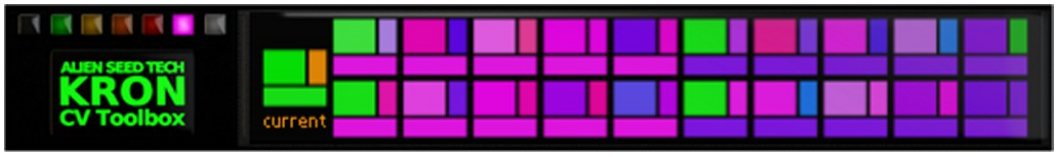
drawing in automation of the phase reset.

**Meter Color**
This menu controls the color of the up/down output meters for the LFOs, Grid, Envelope, the Gate/Quantizer/Note/LFO selection lamps, and the logo and section titles. Currently there are 10 choices, starting at green and moving through yellow and red to purple. The back panel has 3 menus, **logo**, **title**, and **inside color**, that can be used to individually change those colors. All of the color options have song persistence, not patch persistence. So only copying and pasting (or duplicating) a device will copy the color settings. Browsing device patches will not affect the color settings.

**Menu Colors**
There are two options inside the **meter color** menu that choose what colors to use for most of the menus. There are four basic choices for the two options: a specific meter color, the main meter color, the primary RGB color, or the secondary RGB color.

**Display Color Enable (RGB)**
This is just to the left of the first **user knob**, to the right of the RGB menus. The 2 sets of **RGB** values are normally hidden (to cut down on the distraction). Toggle this on to view and edit them.


**Display Color RGB**
These are crammed in to the right of the **user pads**. There are 2 sets of RGB menus, starting from the top with: primary red, green, and blue; then secondary red, green, and blue. They control the colors of the 2d displays (the waveform editor, LFO view/scope, and 2 user pads).




**Color Presets**
The row of colored toggles above the KRON logo are pages of **color presets**, organized by meter color first (they currently have 2 meter colors per page). Clicking on one of these radio toggles will display a set of presets in the waveform editor display. Each shows the primary color to the upper left (the largest rectangle), the secondary color to the right, and the meter color below. Clicking on them will set all color controls. To get rid of this display, either click on the blackish radio toggle (furthest to the left) or the current color (the single left-most option in the display).

**Patch Browser**
Load and save patches. Remember that not all of the included patches use the same outputs (but generally they are organized in this way in the patches folder). This device has many outputs (and inputs) and can be used in many configurations. Also note that you will easily want to tweak e.g. the high/mid/low and level knobs, depending on what you're targeting and what patches you're loading.

**Back Panel Options:**


**Grid Overlay Controls**
These turn on and change the optional grid overlays on the main 2d displays. They're located on the upper left of the back panel.

**Number (of Parts)**
This is the number of equal parts to divide the displays into. By default, all displays use this as their Y value. All square displays use this as their X value, and all wide displays, if they use X (the oscilloscope doesn't), will multiply this value with the **wide multiplier**.

**Enables**
One each for the user pads, the wave editor, and the LFO display/scope.

**Color**
You can choose from: the color preset's primary, secondary, and meter color, and each of the 10 meter colors specifically.

**Wide Multiplier**
The editor and wide single LFO display on the lower screen multiply the base number by this to get the number of parts for X.

**Special Editor X Number and Enable**
Turn this on to set a different X value for the editor (e.g. to match the specific waveforms, note quantization, etc.)


**Float Sync Timing**
When this back panel toggle is enabled, the KRON uses an internal floating point song position, rather than the integer reported to REs by Reason. On rare occasions, with certain tempos and usages of sync frequencies, components that should trigger on the same batch end up triggering on adjacent batches at regular intervals (with or without this toggle, depending). This is essentially due to rounding errors. So far I've only seen this happen with a certain usage of quants used as mods and triggers to create a ping pong loop, along with something else I've forgotten the details of. Most usages of the KRON should not have this problem. But if a patch seems like it should work and is also very precise, and you hear errors rarely but at regular intervals, this is most likely what is happening. I figured I'd just try to avoid those errors by enabling it by default.. If you're having problems with timing issues or lining up exactly with other CV devices that are making independent sync value calculations, try untoggling this.

**Mod Version**
I may add more waveforms, functions, and types to existing menus in future releases (from suggestions plus anything I think of after releasing this). This menu ensures that any patches and songs that mod these values will not break when more options are added.

The default for the first release will be 1.0. Every future KRON release that adds options to any of the menus will also add and set the default of this menu to the latest version. This way, new KRONs made after later releases will use the new full range by default, and existing KRONs will use whatever range was the default at the time of their creation, though they can easily be changed to use the latest via this menu.

**Flip Pad Y**
This just flips the vertical coordinates for the **user pads**.

**No Editor Animations**
This turns off the scrolling display that shows roughly where an LFO is on the **waveform editor**. It's a reverse toggle because I ran out of custom properties and had to use an existing but unused, already-false property.


**Logo, Title, and Inside Color**
These control the colors individually, overriding the main **meter color**.


**Smooth Batches Fix**
This helps make the **smooth batches** knobs on the LFOs and grid be sample rate independent. See the LFO section for details. It's located in the grid options, underneath the **crossfader** direct mod input, above the power cord.

# 2. User Controls


**Summary**
This section has knobs, buttons, and pads that are linked to user properties. There are 8 **user knobs**, 4 of which are displayed at a time (switched out via the **alt** toggle). The first 4 have **unipolar** toggles. The second 4 are available as bi or uni sources in the source menus. 4 **user buttons** are also available.

All of the **user knobs** can be used in combos via the 2 **user pads**. Each knob and button has a user text label, plus there's a single wide label above the user knobs.

There are 8 groups of 4 outputs on the back panel that have **source** menus pointing to the main user knobs and buttons, but they can be freely changed to any other source. They have **bi** and **invert** toggles that function like the other main component outs.


These may come in handy if you need extra knobs for controlling a combinator (attach the four knobs or buttons to the "Programmer CV In" with "Show Programmer" toggled on the back panel) or when being driven by a combinator (a combinator only allows 10 mods per device, so you can control a user knob or button via the programmer and then use that for internal modding). They also just plain come in handy in general when making patches. :) I often find myself controlling a few things on a device patch via the user controls.

Most of the moddable single properties that control multiple components have virtual properties for each component so that they can be set individually via the mod sections. The 4 extra user knobs can help with this. They're also useful when you want to have both pads and all 4 user knobs controlling separate things.

**User Pads**
These are 2d surfaces that can be clicked and dragged on to control 2, 3, or 4 user variables at once. Turn them on by clicking on them or toggling their enable buttons, and choose the configuration of variables via their menus. The back panel has a **grid overlay** option that applies to both pads.

**Knobs**
There are 8 total user knobs but only 4 "physical" knobs to display them. The second set of 4 user knobs (5-8) can be displayed instead by using the **alt** toggle.

**Unipolar**
Switches a knob to unipolar mode, between 0 and 1. (Note that if you switch to unipolar, the value reported by the reason interface will still be between -1 and 1.) This only affects the main 4 user knobs. The other 4 user knobs have both bipolar and unipolar choices in the source menus.

**Alt / Extra User Knobs**
This toggles between the two sets of user knobs (including the 4 knob and 1 wide label). The numbers next to the knobs will update and a new set of text labels are shown.


**Buttons**
Four buttons, generating 0 when off, 1 when on (duh).

**Labels**
Each of the user knobs and buttons has a user label, and there is also a large user label above the user knobs. The user and large labels get switched out too when the **alt** toggle is on.

# 3. Envelope


**Summary**
The envelope can be used as a mod and grid source, and also as an output for other devices. It is a basic ADSR envelope with both free and sync modes, along with **invert** and **bi** toggles and **level** control. It's triggered by a **gate** channel and/or the back panel **gate-in**. It also has two front panel mods and ADSR plus level back panel mods.

**On/Off**
Turns the envelope on and off.

**Gate Channel**
Drives the envelope, along with a back panel gate.

**Sync**
Toggles between free and sync modes for the attack, decay, and release faders.

**Invert**
Inverts the envelope. The resting state is set by the **level** knob.

**Attack**
The ramp-up time. At gate hit, the envelope starts climbing and will take this long to reach its maximum, so long as the gate is still held.

**Decay**
As long as the gate is holding, this is the time that it will take for the envelope to drop and reach the sustain level.

**Sustain**
The level at which the gate settles after the attack and decay. 100% will keep it all the way up at 1. 0% will drop to 0.

**Release**
When the gate is released, this controls the amount of time it takes to fall back to 0 (or 1 if inverted). Note that whenever the gate is released, regardless of what stage the envelope is in (attack, decay, or sustain), the release will start. If the sustain level is 0 and it finished the decay while the gate was holding, it will already have reached 0 and there will be nothing to release from.

**Level**
Controls the level of the envelope, defaulting to 1. As with the LFOs and grid, this can go above 1, but all values coming out of the device will be clamped to be between 0 and 1. If inverted, this is the resting state (corresponding to 0 when not inverted).

**Loop**
This loops the envelope. Upon reaching the sustain stage, the attack stage is restarted, beginning at the **sustain** percentage of the **level** and peaking at the **level** before decaying back to the **sustain**.

**Bi(polar)**
The envelope is unipolar by default, and this makes it bipolar. Both use the full envelope output display (unlike the LFOs and grid which will only use half for unipolar signals).

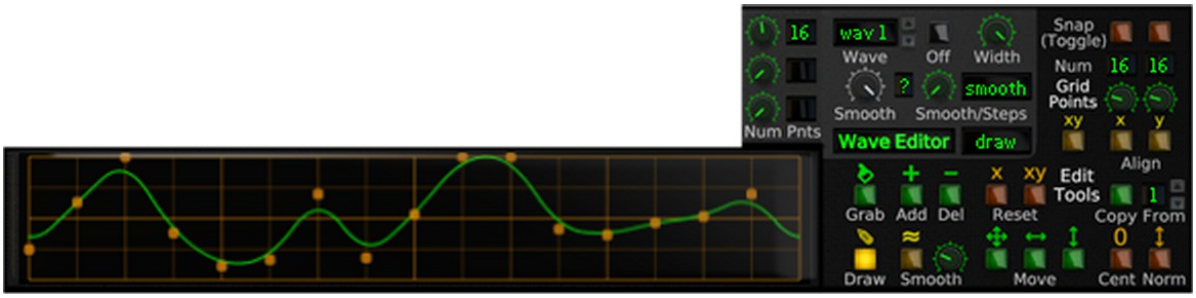
**Mod Section**
Two mods are available, along with a back panel mod for each of the ADSR faders and the level. Modding the ADSR faders while the envelope is active will only affect the current run of the envelope if it is in the same stage as the fader being modified. For example, changing the attack fader while the envelope is in the attack phase will speed up or slow down the attack but will not instantly affect the position of the envelope. Wherever the envelope is at the moment, it will pick up from there, similar to how the frequency knob with free or sync and env sync will not alter the present position of the LFO as it's changed.

**Back Panel:**


**Uni/Bipolar** for the top two outputs, and a relative **invert** for the right two outputs.

**Center Bipolar** will center a bipolar envelope on 0 so that the extremes are equally distant from 0.

# 4. Waveform Editor




**Summary**
The waveform editor is used to edit 4 basic waveforms (waves 1-4 with up to 32 points each) and 3 extended waveforms (X and Y use up to 64; Z can use all 128). The main editor controls are at the top left of the controls area: waveform **selection**, display **width**, **smooth amount**, **smooth vs. stepped**, and the **number of points** to the left of these.

Below that section are the main radio tools, such as **draw**, **grab**, **add**, **delete**, etc. These are used to edit the waveform. At the top right are the **snapping to grid** controls.

The points can be freely drawn, moved, deleted, added, etc. You can change the **number of points** directly and you can also change the number of points via **adding** and **deleting** them. For the smooth type of waveform, these curves are something like bezier curves. The **smooth** knob will change the abruptness/smoothness of these curves, and you can move and add points to shape these curves. You can also stack points to make sharp edges.

Since version 1.2, the text-display of the edit tools is now a drop-down menu. There are new tools for **random generation** of the wave in that menu. This version also adds the ability to use the modifier keys to **grab** (shift), **add** (control), or **delete** (alt) points.

Waves X, Y, and Z use the same data as waves 1-4. X uses 1 and 2, Y uses 3 and 4, and Z uses all 4. So there are a total of 128 points that can be accessed in different ways, depending on how many points you want in a waveform. For most purposes, just using the first 4 waves will probably work and give you the most flexibility (up to 4 different waveforms, one for each LFO).

These are typically used by the LFOs as their waveform, but they can also be used as note quantizers and output/phase filters for the LFOs and grid, and pattern sequences for the quants via the back panel.

The back panel has options to put a **grid overlay** on this and the other 2d displays. This display is also used for color preset selection (via the radio toggles above the logo).


**Wave (menu)**
Selects which waveform to edit.

**Off**
A radio button that is the first entry of the above menu. It just turns off the display until it is clicked on again or selected by clicking on an LFO below.

**Width**
Controls the width of the display.

**Smooth**
Each waveform has its own smooth knob, switched out on one physical knob as they're selected in the display. All the way to 0 just connects each point with a line. All the way to 1 uses a smooth algorithm to round off these lines. The end result passes through the midpoints between each of the actual drawn points and only approaches the drawn points. Both the smooth knobs and the number of points entries can be modded with the LFO mods.

**Smooth Type**
This defaults to a smooth/linear method but it can also select a stepped method that looks a lot like the Matrix CV curves.

**Number of Points**
This controls the number of points to use in each waveform. It is also switched out by choosing different waveforms, just like the smooth knob. It has no up/down cursors because they won't work with the switching.


**Drawing Tools**

These are radio buttons allowing the user to manipulate the waveforms via the display. The currently selected one is also displayed to the right of the section title lamp in a drop-down menu (new with version 1.2). You can also use modifier keys when clicking: shift is grab, control is add, and alt is delete.

Bottom row:

**Draw** The default tool. Clicking and dragging on the waveform will move the points up and down.

**Smooth** This will adjust points to more match their neighbors as the cursor is drawn across them. It has a smooth amount knob too for fine-tuning.

**Move** This moves the waveform up and down, left and right, wrapping around.

**Move L/R** This only moves the waveform left and right.

**Move U/D** This only moves the waveform up and down.

**Center** Centers the waveform.

**Normalize** Normalizes the whole waveform, stretching the highest point to 1 and the lowest point to -1.

2nd Row:

**Grab (shift)** This will move a point around.

**Add (ctrl)** This adds/inserts a point (and will not work if the size is the max size).

**Delete (alt)** This deletes a point (and will not work if the size is the minimum).

**Reset X** This gets rid of custom X info, snapping all points to an evenly spaced grid.

**Reset X Y** This does the above and zeroes all Y values.

**Copy** Copies the waveform selected by the menu into the currently displayed waveform.

Above those two rows is the **Grid** (snap/align) section. It has both radio buttons and normal toggles. The radio buttons at the bottom, which are "drawing" tools, like the above:

**Align X & Y** Aligns the waveform to the X & Y grid specified.
**Align X** Just for X.
**Align Y** Just for Y.


The number of points selectors, which can be different for each waveform:

**X Num** The number of divisions on the X axis.
**Y Num** The number of divisions on the Y axis.

And two on/off toggles that work for all waveforms and are used to snap points to a grid as they are manipulated.

**Snap X** All drawing, grabbing, and adding of points snap to the X grid.
**Snap Y** For Y.

Note that this **grid snap/align** section has nothing to do with the **grid overlay** on displays. Apologies, but I ran into severe constraints at this point and couldn't link the two easily.

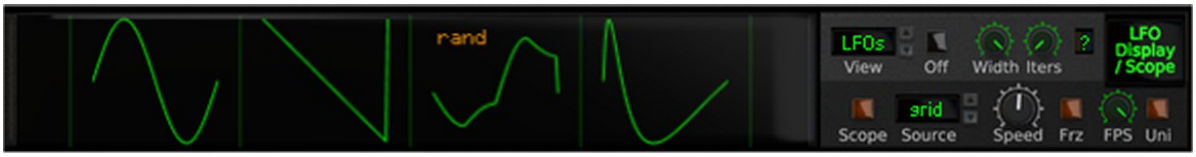
Six new **random** waveform tools were added in version 1.2. The first three completely randomize the values:

**Rand XY** Generates an entirely new waveform.
**Rand X** Just the X values, keeping Y values intact.
**Rand Y** Just the Y values, keeping X values intact.

The next three add random amounts to the existing values. The **smooth amount** knob for the **smooth tool** is used as an amount of randomness for these:

**Rand XY2** Randomly alters the XY values
**Rand X2** Just the X values
**Rand Y2** Just the Y values

# 5. LFO Display / Oscilloscope




**Summary**
This display has several modes. The main mode shows all 4 LFOs (one phase of each). Clicking on one of the displayed LFOs switches to that LFO only. The **iterations** knob controls how many phase iterations to display in that mode (which helps to show curved and windowed LFOs). Clicking on that display will return to the 4-LFO display. The oscilloscope can display any of the sources (like the grid/LFO outputs, CV inputs, etc.) and has several controls (such as **speed**). It can be seen by clicking on the sides of the 4-LFO display or by clicking on the scope radio button. Clicking on it returns the display to the 4-LFO mode.

These pictures are generated using samples of each LFO. They are rough approximations and there are certain waveforms that may not display well because they coincide with the number of samples (such as curve windows of size 32 and 64 or large step numbers). But the single-LFO display mode does a better job.

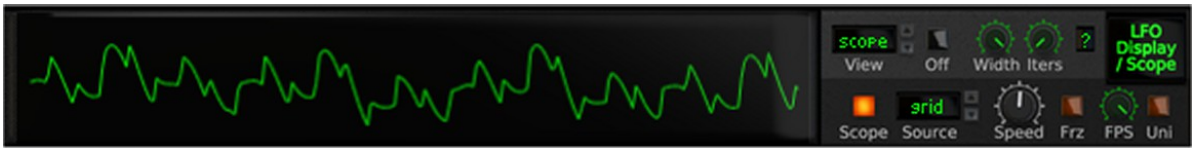
The back panel has options to put a **grid overlay** on this and the other 2d displays.

**View**
This menu selects the various modes of the display. It's largely just there to show, in text, which mode is selected, but it can also be used to select the modes. Clicking on the display is an easier method to change this.

**Off**
This radio button links to the display mode, turning off the display.

**Width**
Controls the width of the display for the single LFO modes.

**Iterations**
The number of times the LFO will be repeated for the single LFO modes. This is especially useful when using **curve window** values greater than 1.




**Scope**
Another radio button for the display mode showing when the oscilloscope is selected.

**Source**
This is the source for the oscilloscope.

**Speed**
The speed of the oscilloscope (it's actually a reversed number of batches to sample into a single data point on the rolling graph--the faster, the less batches).

**Freeze (Pause)**
This just pauses the display while the button is enabled.

**FPS**
This controls the relative FPS of this display and the editor's display. It is a fraction of the main **FPS** knob's rate in the general controls section.

**Uni(polar)**
Use when the source is unipolar. This only displays 0 to 1, rather than the normal -1 to 1.

# 6. Gate Channels


**Summary**
The gate channels are driven by quants (via the **quant** channels) and/or **sources** (defaulting to nothing or the back panel **gate-ins**). There's also a momentary **trigger** button for the user to trigger the gate channels directly (this can be automated). The lighting-up red->purple **gate** channels on the rest of the components refer to these channels and will turn corresponding lamps on when in use. The third channel is a simple combo of the first two, only turning a gate off when the combined gate input is 0. It is only displayed when in use.

**On/Off**
Turns the gate on/off.

**Trigger**
A momentary button that triggers the gate. These are also available in any **source** menu if you want to use them to mod something (basically giving you 2 momentary user buttons).

**Quantizer Channel**
Drives the gate via a quant.

**Source**
This can be any source. The default is the back panel gate inputs for each channel with the default patch, or blank/nothing with a device reset or init patch.


**Example: Driving LFOs and Quants via Notes**
Here, the first gate channel is being triggered by incoming notes (using their velocities). If this is in a combi patch, you'd have to make sure to set this KRON to receive notes in the programmer.

Both quants and the 2 LFOs are all set to trigger via the first gate channel. The red indicator lamp is on, next to the first gate's enable, showing that it's in use, matching the color of the first setting on the gate channels. All components set to n-shot gate types will sit still until the gate is triggered by a note and then play while the note is held, and the 2nd LFO will simply reset to phase=0 with a note.

**Example: Driving the Gates via the Quants**
Here, the first two LFOs are being driven by the two gates. As before, the first channel is being driven by notes, but the second channel is now triggered by the first quant. Both gates are simply resetting the LFO.


**Notes**
Note that the KRON can deal with basic wiring that uses the gates and quants to trigger each other, making this section have zero latency. (Also see the **order** menu description in the General Controls section for details on moving the gates/quants before and after other components.).

Partially because I didn't implement it early on, there is no third gate source available in the sources menu. I also boil down the gate channels into on/hold/off and don't keep track of a combined floating-point signal, unlike the quants and other components. So basically, the gate sources available are the two separate combinations of four back panel gate inputs, and they are there mostly to be sources in the gate source menus. But they can still be used for mod sources as two extra sets of CV inputs that sum.

# 7. Quants (Quantizer Channels / Gate Generators)


**Summary**

The two quants are multipurpose LFOs used as quantizers and/or gate and square wave generators. They're set up similarly to the LFOs and grid LFO, with a **gate** channel, **frequency** knob, **sync** and **env sync**, and **phase**. **Smooth** controls quantizer smoothing, while **length** and **level** are for gate and square wave generation. The **type** menus are on the left, with two **gate types** and two **smooth types**, plus the **third type**, used for choosing the algorithm to use to combine quants 1 and 2 into the 3rd. As with the gates, indicator lamps light up when the quants are being used (including back panel output connections), and the third quant will only run and display when it's being used. Finally, three mods (plus one scale mod) are available. Direct mods, a gate in, and four outs each (plus four more for the third quant) are on the back panel. There is also a back panel **pattern sequencer** section that can use the custom waveforms to launch the quants.


**On/Off**

Turns the quantizer on/off.

**Gate Channel**

Triggers the quantizer via the gate channel, similar to the grid. There is also a back panel gate.

**Gate Type**

There are currently 5 gate types: *Retrigger*, *Mix with LFO*, *Gates Only, N Shot*, and *N Hold*. A gate hit for *Retrigger* will simply reset the LFO (offset according to the **phase** knob). A gate hit for *Mix with LFO* will mix into the LFO's natural frequency (and ignoring the phase knob—that will just be for the main LFO). *Gates Only* works just like it sounds, presently ignoring the phase knob and just hitting when the gate hits. And finally, *N Shot* and *N Hold* will stay silent while a gate is off and trigger regularly while the gate is on (offset by the phase knob). *N Shot* will hold the last hit until it finishes, possibly past the gate off. So it behaves a lot like the LFO's *N Shot* gate type.


**Frequency, Sync, and Env Sync**
Same as the LFOs and grid.

**Phase**
Same as the LFOs and grid. This is only used for gate hits with **gate types** of *Retrigger* and *N Shot/Hold*. It is ignored for *Mix with LFO* and *Gates Only* gate hits.


**Smooth Amount**
This controls the smoothing of the quantizer. It is a percentage of the entire period, so smaller settings are faster. At a default of 0, no smoothing occurs. At any other setting, the LFO or grid that is quantizing will approach the sample (taken when the quantizer hit) according to the **smooth type** function. At the maximum setting of 1, it will constantly be smoothing, reaching the previous sample just when it takes the next sample. It has no effect on gates generated with the quant.

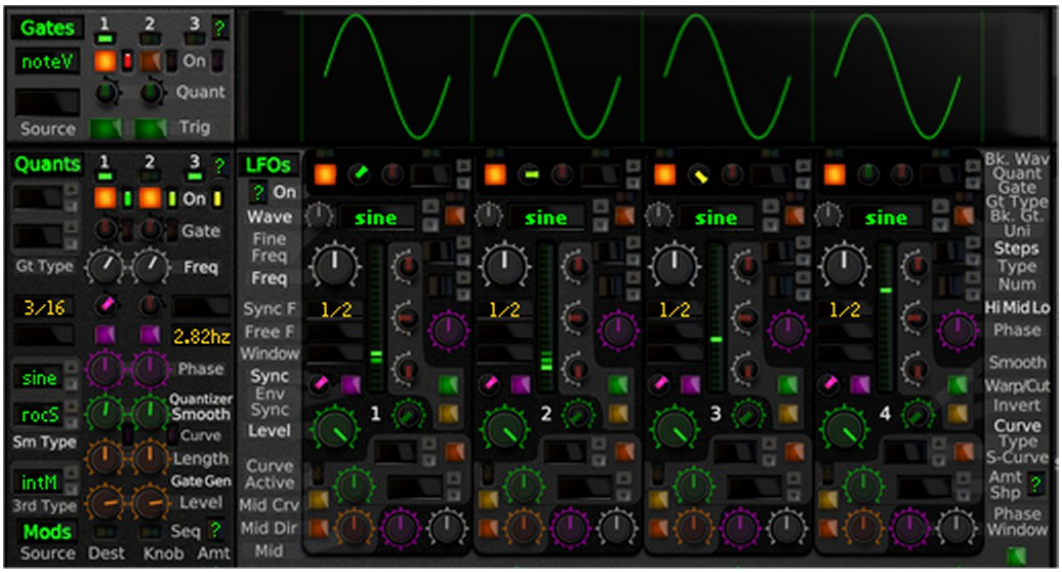
All but the ROCC smooth types will smooth while the phase is below the **smooth amount** and then hold. The ROCC smooth types will smooth for the entire phase, but lower **smooth amounts** spend much of their time around either the next or current quantized amount. The ROCC smooth types are equivalent to the linear smooth type at 100% smoothing.

The gate types of *Mix with LFO* and *Gates Only* will use the frequency and smooth settings of the normal quantizer LFO on gate hits. The third quantizer channel will use the smoothing knobs, frequency settings, and the **3rd type** choice to smooth the combo of the first two quants.

**Smooth Type**
This selects the function used for quantizer smoothing, defaulting to a sine wave. The first options are simple, just using the **smooth amount** knob.

The last options use the LFO curve sections to do much more complex smoothing (and triggering via **curve windows**), treating the **smooth amount** knob as the percentage of time spent smoothing. This works equally well for quantizing and gate generation.

| | |
|---|---|
| **Linear** | A constant speed. |
| **Sine Wave** | A half sine wave approach, starting and ending fast, slow in the middle. |
| **Sine fast->slow** | Just a quarter sine wave, starting fast and ending slow. |
| **Sine slow->fast** | The reverse: starting slow and ending fast. |
| **ROCC fast->slow** | Receiver Operating Characteristic Curve (see appendix). |
| **ROCC slow->fast** | Reversed. |
| **LFO 1-4 Curve** | Uses the LFO curve sections. A purple lamp also lights up next to the **smooth** knob and replaces the orange **curve-active** lamp on the LFOs. |




**Example: Quantizer Smoothing**

The first 3 LFOs are being quantized: #1 is using the first quant (set to a sync frequency), #2 is using the second (set to a free frequency), and #3 is using a combo of both. Like with the gate channels, the indicator lamps next to the enables are on, showing that all 3 channels are being used.

Both quants are set to about halfway smoothing. The first uses a sine smooth type and the second uses an ROCC one. For this particular setup, each of the LFOs is now unique. Note that the two bottom knobs on the quants only matter if they are set to 0 or 100% (which will turn off or keep on the quant) in this situation (assuming that they aren't connected on the back panel to something). The 3rd type menu in this case just means that each hit of the quants will generate a new smoothing signal. If it was set to one of the first 3 types, it would combine overlapping signals, generating less hits.

**Gate Length**


This controls the length of the gate coming out of the back panel or when used as a gate trigger or source. It defaults to 50%, which is the default length of Matrix-generated gates. This has no effect on the gate length if the quant is triggered via a gate channel or back panel gate for gate types of *Mix with LFOs* or *Gates Only*. Then that triggering gate's length determines the gate length.

The range goes from 0% to 100%. At 0%, the gate is not triggered. At 100%, the gate is held indefinitely. Thus, this knob can be used to pause and hold gates. However, for fast gates coming out of the back panel, values very close to 100% may result in held gates, depending on the audio settings. Basically there will not be a gap between the gate ending and the gate starting as far as other devices are concerned. This does not apply to internal wiring on the KRON.

**Level (Gate Velocity)**
Defaulting to 80%, the Matrix's default gate velocity, this controls the velocity of the gate generator. When set to 0%, no gate is generated. Thus, it can also be used to pause or skip a gate.

**3rd Type**
This controls how the third quant gate generator is calculated using the first two. Note that the third quant channel will only run and display when it is somehow being used, whether via a quant channel, as a source, or with a back panel output connection.

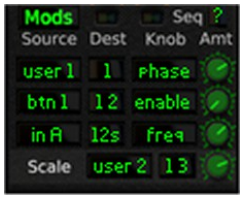
There are five possibilities: *sum*, *max*, *last*, *interrupt (sum)*, and i*nterrupt (max)*. The first three hold so long as one of the quants is holding. The last two interrupt a holding gate, retriggering when either quant triggers. This is done by looking at the next frame without added latency, outputting a 0 if the other quant is going to hit. (Gates triggering the quants via a gate knob or back panel connection are not seen by this, so this is not a perfect method.)

*Sum*, *max*, and *last* refer to how the gate velocities combine or are selected when both are hitting/holding: the sum of the two, the max of the two, or the last (most recent) to hit. For the *interrupt* types, all quant hits become 3rd quant hits, and *sum*/*max* refer to what the velocity is when the two hit simultaneously.

This also affects the quantizer channel in the same fashion—*sum*, *max*, and *last* types will hold gates that overlap, only quantizing once per held hit (and using the smooth settings of the first to hit). There's no difference between the three when it comes to quantizing. *Interrupt* types will re-quantize with every hit, regardless if the other quant is holding, and use the smooth settings of the latest to hit. They're also identical when quantizing.

**Mod Section**
Three mods are available (plus a scaled mod), with a **destination** menu that allows a **source** to target one or both of the quantizers with a positive/negative **amount**. There are four destination options that are similar to the LFOs' bank mods. And there are back panel mods for frequency and phase.

**Example Mod Wiring**
In this example, all front mods are being used. The first connects the first user knob to the first quant's phase knob. The second mod wires up the first user button to turn off both quants. The third mod uses a special destination type, connecting the first two CV inputs to each quant's frequency knob, in parallel but swapped (A1 to quant 2, A2 to quant 1). Finally, the scale mod will scale the first and last mod entry according to the second user knob.



**Back Panel Options**

**Gate-Driven Quants: Use Frequency/Length**


This causes the quant to use its own settings to generate hits rather than relying on the gate (it is only used for non-default gate types). This is especially useful with very fast gates such as the REX's gate outputs.

**Pattern Sequencing**

Like the note quantizer / filter section for the LFOs and grid, this uses custom waveforms as sequence patterns for the quants. These sequence patterns work for every **gate type** except **gates only**. The quant will crawl through the pattern at its set **frequency**. For the weighted **type**, it will scale the waveform height data with the **level** knob. For both types, it will use the **gate length** knob settings.

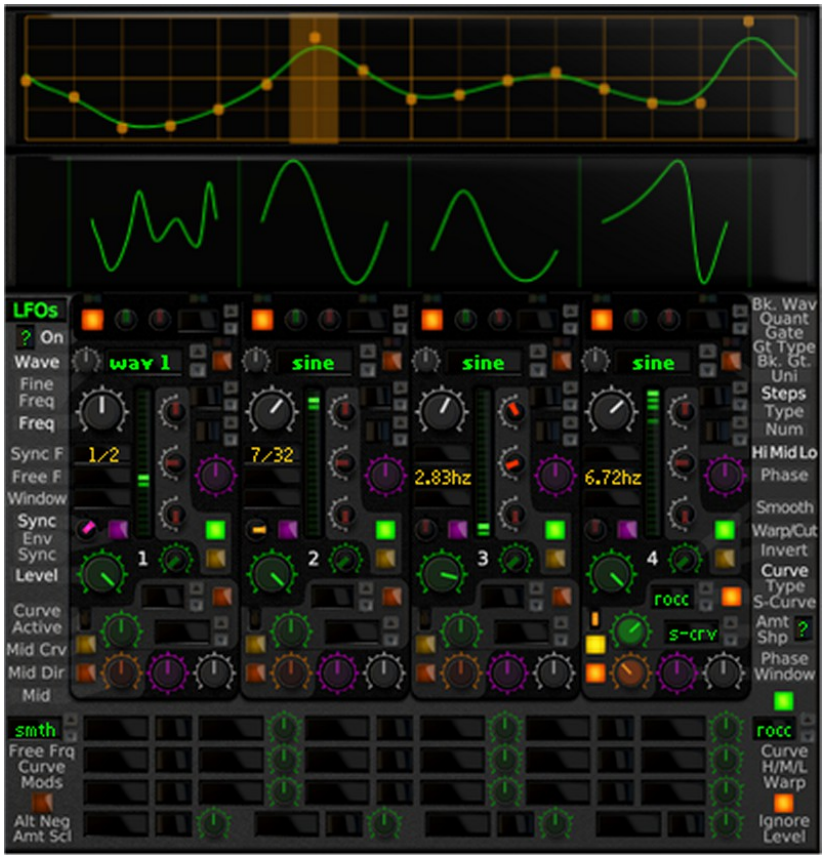
**Waveform**

This chooses the waveform to be used as a pattern for a quant. When this waveform is displayed via the wave editor, it looks something like this:


**Type**

This turns the section on and has only 2 types: unweighted and weighted sequencing. The weighted version scales the velocity by the height of each wave's point, up to the max set by the normal quant **level** knob. Like the LFOs' and Grid's special type menu, there is only one for both quants (but both menus can be individually set using the mod section).

# 8. LFOs (Low Frequency Oscillators)




**Summary**

The KRON has four identical main LFOs. They use a somewhat minimal set of waveforms (including user-created ones) designed to be extensively altered via various options, curve functions, high/mid/low shapers, gate and quantizer channels, note quantizers, etc.


The top row of controls are **on/off**, **quant channel**, **gate channel**, and **gate type**. The **quant channel** is used to quantize the signal with one of the quants located on the left side of the device. The **gate channel** triggers the LFO according to the **gate type** (shown in red text if not on the default of *retrigger*). Both knobs "light up" when in use, with a different color for each channel. The actual **gate** and **quant** channels on the left side of the device also have lamps that light up when they're in use via a **gate/quant** knob (or a back panel output connection on the quants). There is also a lamp below the **gate type** that indicates when the back panel gate is connected (seen on #4, above), and one above the **gate type** that indicates the LFO is using a **note quantizer** / **filter** (not shown in the picture).

Underneath that is the **waveform** menu, where the basic waveforms are chosen, the **uni/bi** toggle (unipolar/bipolar signal) to the right, and the **fine freq** to the left of the menu (both shown on in the picture to the right).


Below that and to the left of the main display is the **frequency** knob and its two frequency displays underneath (one for sync freqs, one for free freqs, plus a third display for the **curve window**). Under those displays is the **sync** knob (toggling between free and 2 sync modes--the 2nd sync mode is chosen in the picture to the right), **env sync** (which decouples synced frequencies from the play position), and the **level** knob (or gain/depth).


To the right of the main meter display are three shaper knobs: **high**, **mid**, and **low**, with a green **warp** toggle below and to the right of **low**. These act as a midpoint and cutoffs or warps (with the **warp** toggle on) for the top and bottom of the CV range. They also light up when off of their default value. (I highly recommend you turn these **warps** on unless you actually want to use the **high** and **low** knobs as cutoffs. I also recommend that you turn on the **curve high/mid/low warp** toggle/function to curve this high/mid/low warping, and optionally the **ignore level toggle** too. Both are to the right of the LFO mods.)


To the right of those are the two **steps** menus (controlling the **type** of stepped waveform and the **number** of steps). In the picture above, up/down and 16 steps are chosen. Below those menus is the main purple **phase** offset, which lights up off of 0 and has a range of -360 to +360 degrees. Underneath the green **warp** button is the yellow **invert** button. To the left of those toggles is the green **smooth** knob that averages a signal over the number of chosen batches.

Below all of that is the curve section, which is used to drastically alter the phase of the LFO. The **curve function** menu has various functions that are applied to the phase (the rocc function is chosen in the picture to the right), and the **curve amount** knob is a positive/negative variable for this function. The **curve shape** menu has combinations of normal curve (+), inverted curve (-), and no curve (0). This subdivides the normal phase into 2, 3, or 4 pieces and applies those combos of curves to these pieces. (In this picture, the s-curve shape is chosen (-+). The s-curve can be selected via a special **s-curve** radio toggle to the right of the **function**, shown on in the picture.)


The **curve midpoint** sets the midpoint of the curve, and it functions in horizontal or vertical mode, selected via the **midpoint direction** toggle. (Horizontal/vertical is not the greatest name for these two modes--I usually prefer using this toggle, for what it's worth.) The yellow **use mid as curve** toggle will use the **curve function** with the **mid** knob. (Without it, the mid knob is a simple linear adjustment. I recommend using it! All of these are turned on in the picture above.)

The **curve phase** knob rotates the phase inside the curve section, effectively rotating the function over the original waveform. The **curve window** knob selects how large or small of a window to apply the curve to. It also displays as a number under the frequency display (those 2 knobs have been changed in the picture to the right). With it, multiple copies or a fraction of the main LFO can occur within one sweep of a curve

function. The **curve active** lamp (in the upper left of the section, below the **level** knob) lights up orange if the curve section is active on the LFO, and it lights up purple if the curve section is being used by a quant.


Finally, below the LFOs, there are 9 mods that can connect any source to any LFO parameter. **Source** is the mod source, **dest** is the destination LFO (with all combos of LFOs listed), **knob** is the destination parameter, and **amount** controls the positive/negative amount to apply. There are also 4 **scale mods** to wire up sources to combos of the mods above, scaling them. And there are additional direct mods on the back panel, along with four outputs, a gate-in for each LFO, and a large number of other options, including note quantizing and more random wave controls, described below.

**On/Off**


Turns the LFO on/off. Note that all components will output a 0 when off (if used as an internal source or via the back panel).

**Waveform**

The basic LFO waveform. The basic LFO waves, random waves, and a more extensive stepped wave set are available. The curve options and phase knob allow one to radically alter these waveforms, hence the barebones set of basic waveforms. There will probably be more in this list in future updates. (If you can think of ones that cannot be easily produced with the KRON already, please me let me know!)

| | |
|---|---|
| **Sine** | sine wave. |
| **Tri** | triangle wave, starting and ending at 0, similar to the sine wave. |
| **Square** | square wave. |
| **Saw** | down sawtooth wave. |
| **Sine 2** | the first half of a sine wave, scaled to start and end at -1. |
| **Rand H** | Random with no smoothing. |
| **Rand L** | Random with linear smoothing. |
| **Rand S** | Random with sine wave smoothing (the direction of this sine wave is controlled via the **steps type** menu). |
| **Steps** | Steps going up. |
| **Stp X** | Steps expanding from the middle, alternating up and down. |
| **Stp R** | Steps random, much like **Rand H** with the ability to use the **steps type** menu. |
| **Wave 1, 2, 3, 4, X, Y, and Z** | Custom waveforms that can be drawn with the **waveform editor**. |

For all of the stepped waveforms, the number of steps is set by the **steps** knob, and the **steps type** menu controls two things: direction (or up/down) and alternating with -1/0/1.

**Frequency**
This sets the frequency, either in free or one of 2 sync modes. Frequencies range from 0.004 Hz to 256 Hz for the free frequencies, 32 bars to 1/128 notes for the first sync set, and 12 bars to 6/256 for the second sync set. Both free and sync frequencies are displayed below the knob in separate displays for greater clarity (and finer-grained control!).


[Below these displays is another for the **curve window** knob (the corresponding knob is actually at the bottom right of the LFO, in the **curve section**). It applies the curve across multiple copies of the base LFO or a fraction of the base LFO. The overall average frequency of the LFO will be the set **frequency** value, but it can speed up and slow down across the number of waveforms indicated by the **curve window** value.]

**Fine Frequency**
This scales the chosen frequency, allowing finer control. It multiples the frequency by a value between 25% and 400% (allowing a range of .001 Hz to 1kHz for free frequencies). This is a zero-snap knob with a default of 100%, tucked into the corner above the main **frequency** knob. Note that it works for both sync and free values, and thus this knob will be used on both if they are switched back and forth. This is a way to get a precise synced-to-the-song LFO that is not at a regular sync frequency.

**Sync**
This selects among one free (Hz) and two sync modes. The first position, not lit up, is the free mode, and the next two, purple and orange, are the sync modes.

**Env Sync**
This enables sync frequencies to change smoothly. The default is off, so that frequency knob movements will be jumpy but always produce the same LFO output for a given song position. With this button on, moving the frequency knob will do a similar thing as moving the frequency knob in free mode, changing the waveform on the fly without resetting its position. This currently has no effect if the sync button is off. However, if it's on and you toggle the sync button (between sync and free frequencies), the LFO will carry on from its last position smoothly. So it's a neat way to switch frequencies with one button (sync) without a jump in position. Note that you can use gates to reset the LFOs at regular intervals or via notes in Reason's sequencer and have env sync'd but reproducible LFOs.

**Level**
The amplitude or depth of the LFO, with a default of 1. This is basically the spread, up and down, of the LFO. Larger values than 1 are permitted internally, giving you some wiggle room when adjusting things, but all output from the device is clamped between -1 and 1.

**High**


This controls either the cut or warp at the top of the LFO. The green **warp** button (or **shaper type**) will toggle between the two. In the default cut mode, it behaves much like a low-pass filter does with frequencies. Any values above the **high** knob value are turned into the **high** knob value. In warp mode, everything is squashed or warped to be between the midpoint and the **high** value, instead of 0 and 1 (for a bipolar signal with a level of 1). The **high**, **mid**, and **low** knobs light up when moved off of their default positions.

**Mid**

Sets the midpoint of the LFO with a default of 0. This is a snap-to-zero-knob.

**Low**

Much like the **high** knob, this controls the low-end of the LFO, defaulting to -1.

**Warp**

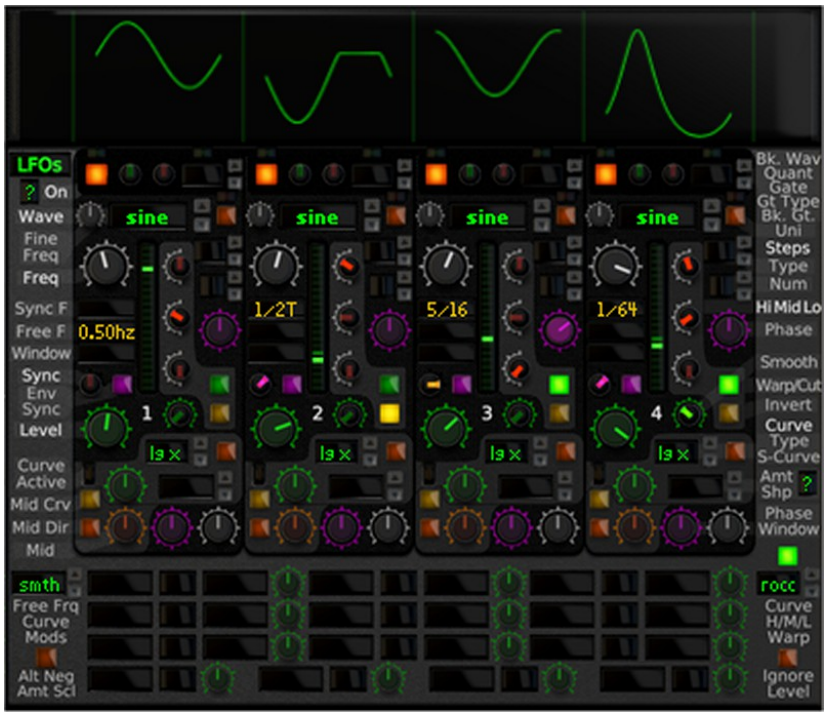
Enabling this makes the **high** and **low** knobs behave as new boundaries, warping the output to be between **low** and **mid**, and between **mid** and **high**. In the default (off/cut) position, the **high** and **low** knobs just cut off the signal. Use the general **Curve HI/Mid/Low Warp** toggle and **type** menu to curve all mid knobs when warped (found to the right of the mods).

**Invert**

Inverts the waveform.

**Example (from the Intro)**

The first LFO is using an un-warped **mid** to shift a low level sine wave up. The second LFO is cutting off the top of an inverted sine wave via its **high** knob, again un-warped. The third LFO shifts the sine wave with its main **phase** knob and uses the warped **low** knob to push the entire thing up. The fourth LFO is actually warping the sine wave by using a warped **mid** and **high** knob. Both of these LFOs are using functions to do this warping by having the toggle to the right of the mods on (and in this case, they're using the rocc function to do so).



**Unipolar**


This toggles between bipolar (the default) and unipolar modes. Bipolar is positive and negative (-1 to 1); unipolar is only positive (0 to 1). Note that a unipolar signal will just occupy the top half of the display presently and that the high/mid/low knobs will be within 0 and 1 although they will still read between -1 and 1. This is mostly to make it more apparent that the signal is unipolar, rather than displaying the same signal as a bipolar signal.

**Step Type**

This menu does two things for stepped waveforms. It controls the direction (forward, reverse, or both which is up/down), and it can create steps alternating with -1, 0, or 1 using forward, reversed, and up/down versions.

It also controls the direction and type of smoothing for the **Rand S** waveform: normal is a 1/4 sine, fast to slow; reversed is a 1/4 sine, slow to fast; and up/down is a 1/2 sine, fast to slow to fast.

**Steps**

The number of steps for a stepped waveform: 2 to 64.

**Phase (Offset)**


Running from -360 to 360 degrees (one full phase in either direction), this controls the starting point of the LFO. The knob snaps to 0, and +/- 180 is the middle of the waveform. This knob goes all the way to 360 in both directions to allow a smooth movement of the phase knob in either direction, for a full cycle. The knob itself has the widest possible range of motion, so that 360 degrees in either direction is directly pointing down. This way, 180 degrees phase is left or right, 90 is exactly 45 from the top, etc. It's two full cycles, one forward and one backward, mapped onto one cycle. (In the picture to the right, a negative phase is chosen using a basic sine wave).

There are actually two **phase** knobs. This one is applied after any curve settings, affecting the overall phase of the LFO. The other, in the curve section, is applied before the curve (only if the curve is active), and will affect what the curve function does to the basic waveform. So e.g. a curve function can compress various parts of the original waveform as the **curve phase** knob is moved around, but the regular **phase** knob will still move the entire curved waveform around in time.

**Quantizer (Quant) Channel**

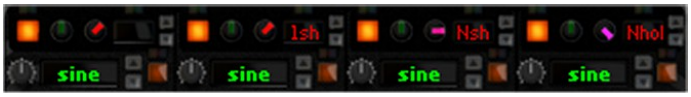

This quantizes the waveform using the chosen quantizer. There are two quantizers on this device, and the third channel is a combination of both. The knob lights up (green to yellow) when active and has a unique color for each choice, along with lighting up a corresponding lamp in the **quant** section. If a **quant channel** is selected that corresponds to a quant that's off, the LFO behaves normally, not quantizing. See the quantizer section for more details on how the quantizers work.

**Gate Channel**


Similar to the **quant channel** (it lights up red to purple). Two gates and the combination of the two can be selected to drive the LFO, along with direct back panel connections. If any of the non-default **gate types** are selected, the LFO will only move if either this **gate channel** is active and points to an enabled and active gate, or if a back panel gate-in connection is active. See the **gate type** for more details.

If you're using the on-board quantizers to drive the gates, and if the right **order** menu option is selected (the default works well), there will be no latency between the quant triggering and the LFO triggering.

**Gate Type**




Five modes are currently implemented: *retrigger*, *one-shot*, *n-shot*, *one-shot hold*, and *n-shot hold*. *Retrigger* (default and blank) retriggers the LFO with a gate hit and then behaves normally. *One-shot* causes the LFO to run through one period of the waveform and then return to the beginning (if you want it to stay at the end, there's an option for that on the back panel). *N-shot* is similar to *one-shot* except the waveform keeps running so long as the gate is held, and finishes a waveform when the gate turns off. *One-shot hold* will only run the LFO so long as the gate is held. If it finishes the waveform and the gate is still held, it will hold at the end of the waveform until the gate turns off. *N-shot hold* will keep the LFO running so long as a gate is held, then return to the beginning of the waveform (returning immediately versus *N-shot* which finishes the waveform).

Only the first **gate type**, *retrigger,* will allow the LFO to do its thing with or without a gate (the same holds true for other components). The other types specifically are active when a gate is hit and held, so without any kind of connected gate, the LFO will just sit there at 0.

Back panel gate-ins will light up a red lamp below the **gate type**. This way you have visual feedback that some kind of gate is connected to the component if you are going to use a **gate type**.

**Smooth (Batches)**


This knob controls a special smoother that averages the current signal with the signals from the previous *n* batches, smoothing abrupt changes. (You can also use a **quant channel** to do something similar, sampling at fast intervals and smoothing between them, but this allows a bit more precision and an alternate method for doing this, while also freeing up the quantizers.) It defaults to off and presently can go up to 256 batches. The smoothing is the very last thing done to the output (except for a new mod entry that adds to the signal after everything else.)

This essentially adds some latency to the signal, depending on the setting. It's smoothing the signal, so a large and abrupt change in the signal will initially register somewhat in the output, taking its time to fully reach the new value. It will spread out hits over time rather than just delaying them. It will also easily smooth and cancel out rapid changes, such as with an LFO with a very fast frequency. So the use

and effect of this knob is very dependent on what kinds of LFOs and other signals are being used. Also note that this shows up near the end of the mod list because it was added to the LFOs late in the development of the device.

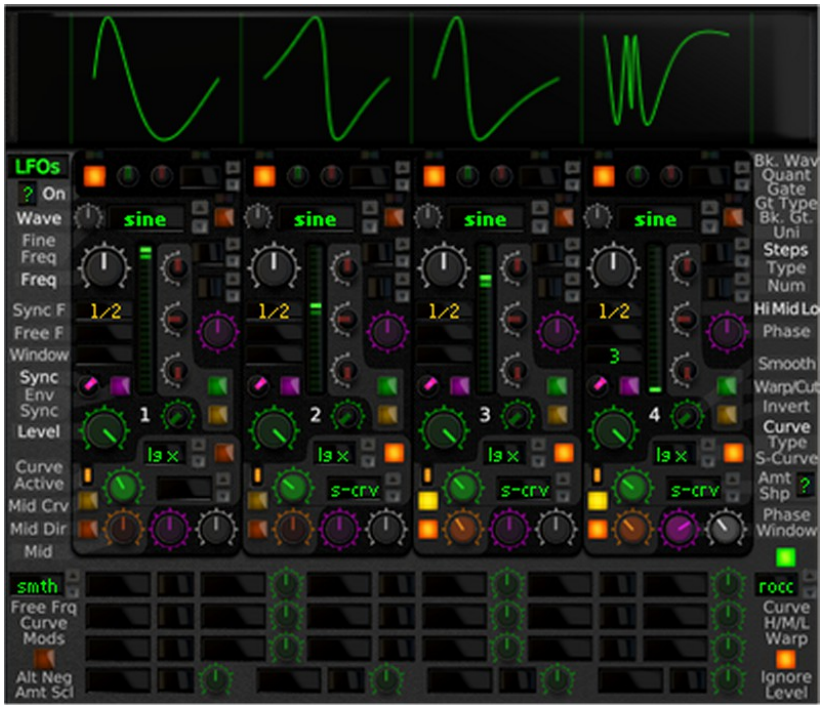
**Smooth Batches Fix / Correction**


The back panel has an option menu in the **grid** section called **smooth batches fix**. This has entries for each of the Reason-supported sample rates. If you want your smooth knobs to work basically the same no matter what sample rate you choose, use this menu to set the base sample rate that it should convert from (the sample rate you typically use or were using when you set the smooth knobs). Without this, since the actual number of batches being used in Reason will change when the sample rate changes, the averaging smoothers will appear to do more or less.

Note that the conversion may not be perfect and e.g. won't work for 1 batch moving to a lower rate. There is also a max conversion rate of 4x (e.g. 22k to 88k or 48k to 192k). Going the other direction means dividing that number, so the only limits are how low the knobs are set to and whether or not the results are integers (they will snap to integers). E.g. if a knob is set to 5 and your current sample rate is half what this back panel option is set to, it will use the value of 2, which is basically what an original 4 would look like. So the bigger the smooth knob value, the better this feature will work, I think. Again, this is not perfect, but it'll work better than leaving this option unset.

## Curve Section

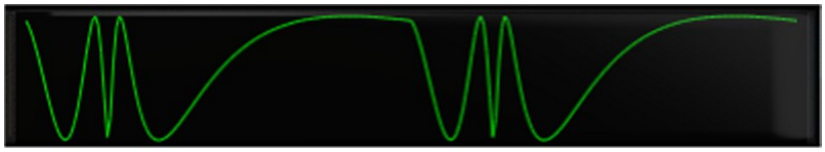
This section is dense but very powerful in terms of what it can do to a basic waveform. By default, it is used on the LFOs, but it can also be used for quantizing and gate generation by selecting it via a **quant smooth type** menu. It can only work on its LFO or one or both quants at the same time. When used on the LFO, its **curve active** lamp is orange; as a quantizer smoother or gate curver, its **curve active** lamp is purple. The curve section is active only if both the **curve type** and **amount** are non-default or if the **curve midpoint** is non-default (or just the **curve window** which can be used to generate a number of hits). The rest of the parameters are not sufficient by themselves to make any kind of difference. Thus, you know for sure that a curve is being applied if that light is on. Note that you can move all of these controls when using free frequencies or env sync'd sync frequencies and the internal phase will be auto-adjusted to smoothly transition, just like when you move the frequency knobs. There is a special menu for this algorithm that you can safely leave alone (to the left of the mods).

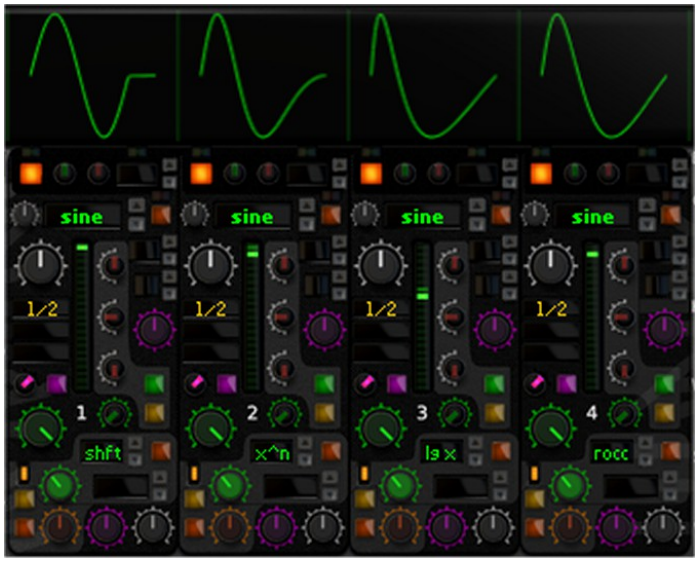



**Example Curve Section**

The example pictured above shows stages in turning on features in the curve section. (The back panel **flip curves** toggle is on, otherwise the LFOs would look different.) The first LFO just uses the **curve function** and **amount**. The second adds the s-curve **shape** which makes a symmetrical but lopsided sine wave. The third uses the **midpoint** knob to move the midpoint of the s-curve left, using the **function** to do this too via the yellow **use-curve-function** toggle. The fourth uses a **curve window** of 3, which will apply this **function** to 3 full sine waves. It also rotates the entire thing with the **curve phase** knob.

If you were to click on the fourth LFO's display and choose an **iterations** knob setting of 2, this is what you would see:



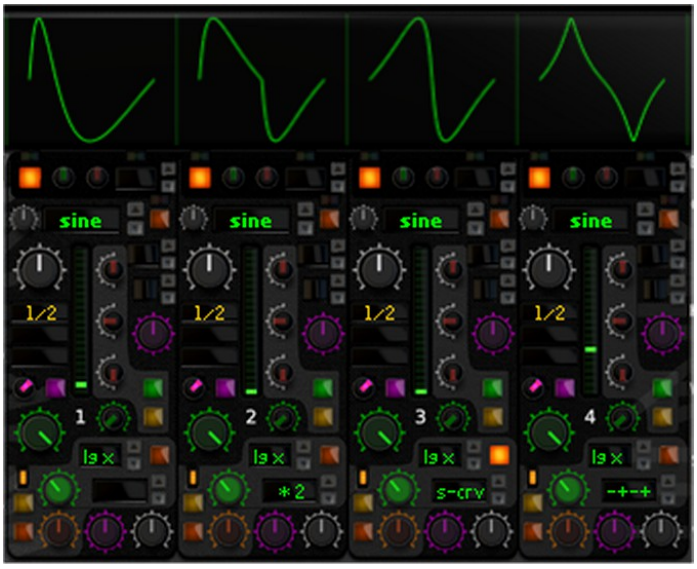



**Curve Type/Function**
This is a function that is applied to the phase of the waveform. The **curve amount** knob is a variable for this function and it must be non-zero for this function to have any effect. These mathematical functions are:

| | |
|---|---|
| **Blank** | No function. |
| **Shift** | Shift the whole wave. This essentially squashes the whole wave on one side. |
| **Linear** | This moves the midpoint of the phase and scales each side linearly. |
| **Linear 2** | Same as the above except horizontally or over time. |
| **X^N** | X^N (roughly—it's actually more complicated). |
| **X^N 2** | Essentially a backwards version of the above function. |
| **Log N** | Log(N) (again, it's actually more complicated). |
| **Log N 2** | Backwards version. |
| **ROCC** | A receiver operating characteristic curve. This one is symmetric (see the appendix). |

**Curve Amount**
Defaulting to 0, this lights up a bit off of 0 and is a positive/negative variable for the **curve type** function.

**Curve Shape**



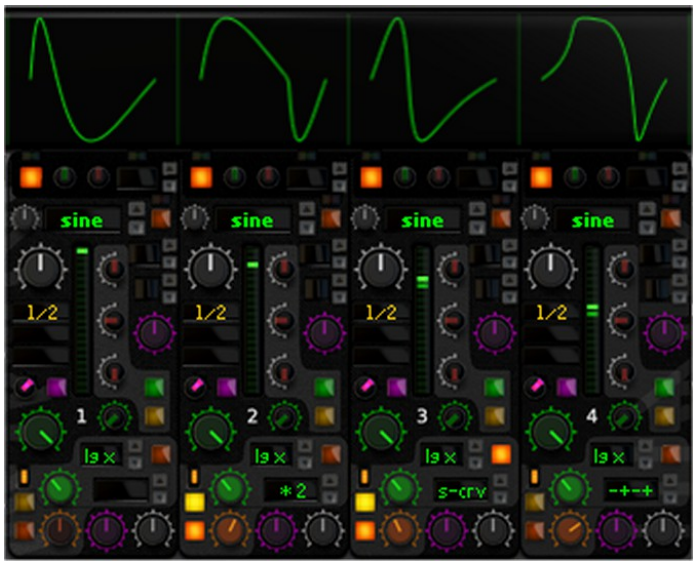

This menu subdivides the waveform into 2, 3, or 4 parts and applies the **curve amount**, its inverse, or nothing to each part. It is a large menu full of permutations. Basically, it shows combinations of the symbols **+**, **-**, and **0**, starting with a default of no shape (which would just be a single **+**) and progressing through the permutations of 2, 3, and 4 of these subdivisions. Some of these entries are labeled (probably the most useful ones are) and most are not.

This shape is applied to the overall waveform. So if the **curve window** is being used, this shape will apply to that overall size, whether it's larger or smaller than 1. For example, if the **curve shape** is a 4-part subdivision and the **curve window** is also 4, each normal one-phase waveform will have its own **+**, **-**, or **0** applied to it. The **curve midpoint** will take the middle of this shape and move it around.

**S-Curve (Shape radio toggle)**

This is just an easy radio toggle that chooses the basic s-curve **shape** type.

**Curve Midpoint: Use Mid as Curve**



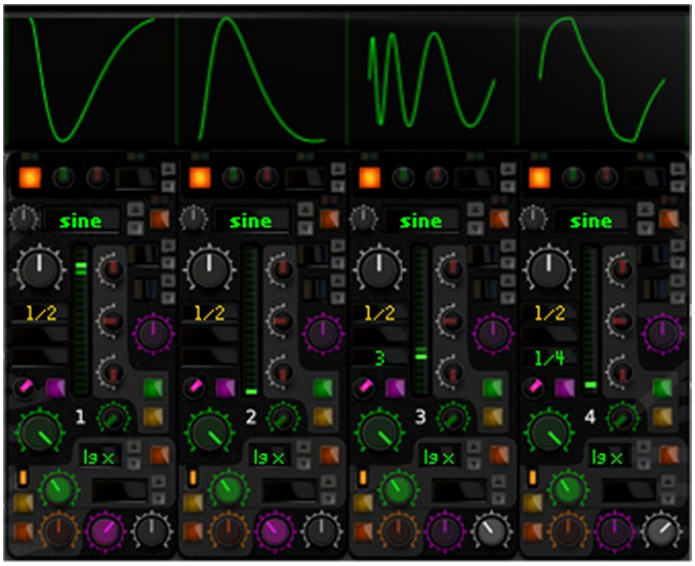

This yellow button is especially useful when using the **curve shapes**. It will treat the **curve midpoint** as a curve amount knob, using the LFO's **curve type** function. When this is off, by default, the **curve midpoint** behaves linearly.

**Curve Midpoint Direction**

Horizontal (by default) or vertical (when toggled), this alters the **curve midpoint**. LFOs with horizontal midpoints will spend an equal amount of time on both sides of the midpoint, while LFOS with vertical midpoints will not. This toggle is literally which direction the midpoint is applied to on a 2d graph.

**Curve Midpoint**

This controls the midpoint of the phase. It can function in two different modes via the **curve midpoint direction** toggle. It is especially useful in conjunction with the **curve shape** menu and the **curve window** knob. When the **use mid as curve** toggle is off, it is essentially the same thing as using the **curve amount** with a linear **curve type**.





**Curve Phase**
This basically rotates the LFO within or before the curve section. The regular **phase** knob will then rotate the final result.

**Curve Window**
This knob selects a window of the original waveform to apply the curve to. It is much like the sync **frequency** knobs except it is shifted slightly and labeled differently. This is the number of waveforms that will be completed in one overall curve section pass. For values less than 1, the curve section will be applied multiple times within one iteration of a waveform. For values greater than 1, the curve section will be applied to multiple waveforms. When this is the case, the **frequency** knobs are then roughly the average rate for the LFO. (Just multiply this **curve window** value by the **frequency** knob value to get the actual period of the overall curved multi-phase LFO.) If the **curve shape** is used, it will subdivide the overall **curve window** number of waveforms (shown in the smaller picture above).

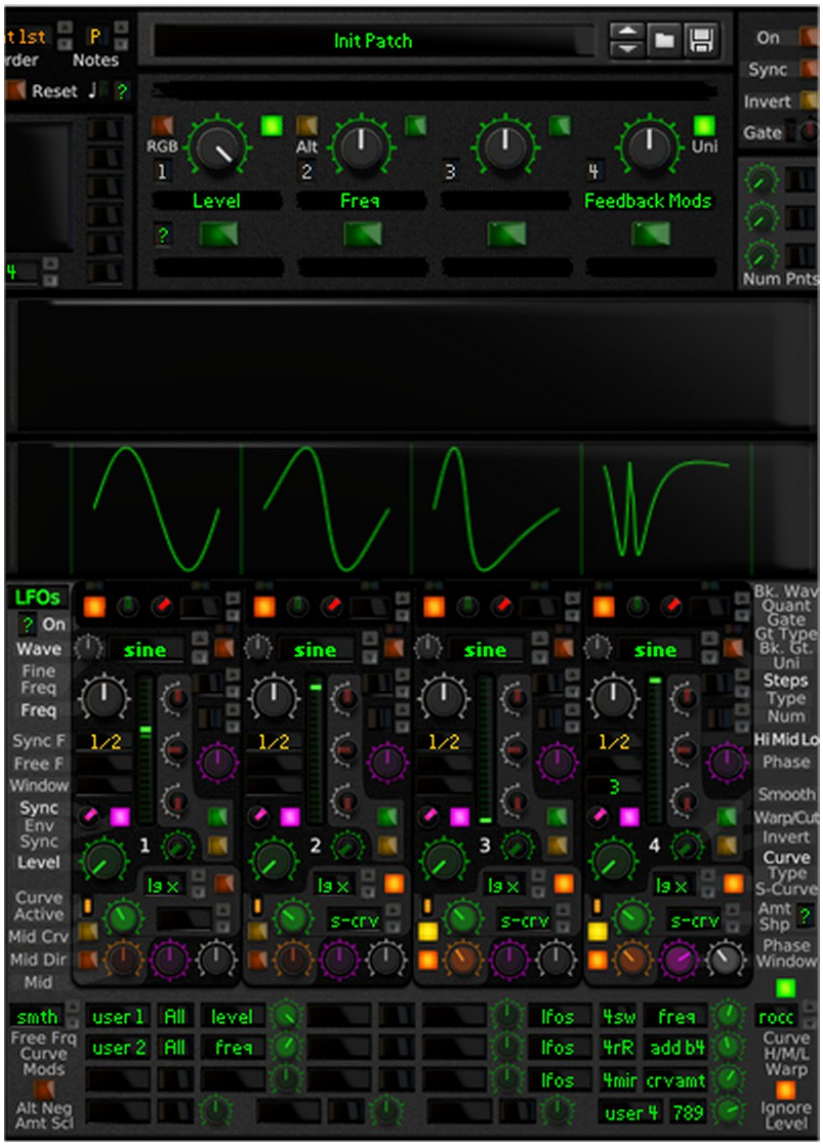
**Mod Section**

The KRON comes with 9 front panel mods for the LFOs, each of which is capable of modifying between 1 and 4 of the LFOs. (Plus there are 4 scaled mods at the bottom.) All parameters can be modded using all on-board sources and CV inputs. The order of these in the knob/property list is roughly the same as in the grid's and quantizers' lists. It's more or less in order from top to bottom, left to right, with similar properties grouped together, and dual properties (frequency free and sync) combined at first and separated at the end of the list. Some of the properties are out of order from where they appear on the board in order to stay consistent with the other components' mod sections. Towards the end, it's just the history of added features.

The destination menu starts off simple and then gets complicated. The top is just simple one-to-one mod wiring. The rest of it is used with banks in the source menu to wire up multiple connections at once. Nearly every permutation is listed in there. The first part of that section is a bit out of order because of backwards compatibility issues, but it starts with a simple 4->4 parallel wiring. This can be used to e.g. wire up 4 CV inputs to 4 LFO controls. See the Mod section of this manual for more details.

**Example Mod Wiring**

This adds **mods** and **user knobs** to the previous example (the curve section example). On the left side of the mods, the first user knob now controls the level of all LFOs; the second, the frequency. On the right side, there are 3 bank-to-bank entries. Each wires up all LFOs to all LFOs but with different pairings. The first mods frequency, the second adds the output of one LFO to another (in this case, subtracting it), and the third mods the curve amount. These three are scaled by the fourth user knob.




The LFOs have their **env sync** buttons turned on and a **gate channel** set too so that they can be aligned via a gate signal. Now the apparent speed and movement of these LFOs will get really weird because of the feedback, but it will still be smooth. Without the **env syncs** on, it would skip around constantly.


**Free Frequency Curve Mods**
By default, this will smooth the phase of an LFO using a curve section that is being modded. It's to the left of the mods. See the main Mod section for more details.

**Curve Hi/Mid/Low Warp**
Turn the toggle on to have all of the mid shapers (the knobs along the side of the displays) curve the midpoint of the LFO when **warp** is on, and choose which function to use with the menu. This and the next control are to the right of the mods.

**Ignore Level**
This ignores the **level** knob when calculating this curve, pretending it's 1. It's useful for the special **add/mul-before** mods and for generating interesting waveforms.


**Back Panel Options:**

**Freeze LFO**
For non-default **gate types** only, this will not return the LFO to its starting position but keep it at its end. For **1/N-shot** types, this means at the very end of the waveform, and for **1/N-hold** types this will just freeze the LFO as soon as the gate driving it is turned off.

**Rand Return (on/off, value, speed)**
Also for non-default **gate types** only and only for **random waves**, this causes the wave to return to the chosen **value** (which is a zero-snap knob defaulting to 0) upon completion. Its speed of return can be increased or decreased by the **speed** knob (10% to 1,000%).

**Level Boost**
This will multiply the level knobs by the selected constant. Several constant multipliers are available in the menu next to this toggle.

**Use as Gates**
This basically zeroes each of the LFOs' outputs when the device stops in order to facilitate using them as gate generators. This will often be used in conjunction with turning the **run** toggle off, so that stopping the song will stop the gates. Primarily this device was meant for modulating other devices, but since it can also be used as a gate generator and the fact that these two modes require different behaviors, both the **run** toggle and this toggle allow it to do both.

**Step Alt(ernating) Offbeat**
This only affects stepped waveforms that use the *alternating with a constant* selection in the **steps type** menu. This makes the constant hit on even steps instead of odd (counting the first step as 1).

**Bi/Unipolar and Invert on the Outputs**
The **bi/uni** toggle operates relative to the front panel and affects the top two outputs. So if the front is bi (default), this makes them uni and vice versa. The **invert** button works the same way relative to the front **invert**, affecting the right two outputs.


**More General Options for the LFOs and the Grid**
These options apply to both the LFOs and the grid. Similarly, the grid section has a **smooth batches fix** menu that applies to the LFOs also. Use it when you want to change sample rates in Reason but keep those knobs working basically the same. See the earlier LFO section on **smooth batches** for more details.

**Flip Curves**
This will reverse the values of **curve amount** and **curve mid** knobs so that they tend to move left and right along with the knob movement, rather than the reverse. I implemented them before the 2d displays and I only realized too late that it made more sense when flipped. If I could make the knobs just work in the opposite direction, I would, but I can't, so this toggle can fix that.

**Curve Constants**
One for each of the **curve function types**, these affect their max ranges, ie. their depth or how extreme they can get with large positive and negative values. Each group has a different scaling range but they roughly correspond to each other. (In the picture, 3 functions have non-default constants).

**Random Seed**
Normally, random numbers are generated using a simple and unpredictable random number generator. This option makes all LFOs and the grid generate random numbers by hashing a **seed** (0..255) and the play position. This way, the output sequence will be repeated with each song playthrough. (In the picture above, it is turned on and 70 is chosen as the seed, with no change in precision.)

Both synced and free frequency LFOs will have the same sequence for a given frequency, but free frequencies need to be triggered by a gate in order to align them and be truly repeatable.

**Precision**
Mainly meant for use with **curve windows**, as the KRON makes calculations for the random seeds based on the frequencies of each LFO. With **curve windows**, the actual hits can be squashed together and thus need more precision, but this will adversely affect the ability to change tempos and keep the same output sequence.


**Note Quantizing and Output/Phase Filtering**
Custom waveforms can be used to shape the output of the LFOs (and grid). Anything above the lowest point on the wave is considered on. (There is an example of the wiring-up of this on the next page.)

**Type**
This turns the section on (for all LFOs and the grid). It has four options:

| | |
|---|---|
| Note quantizing: | snaps output to note CV; the number of points is the size of the scale |
| Weighted version: | uses the height of each point when calculating which note to snap to |
| Output filtering: | similar but without snapping to notes and by default applying once |
| Phase filtering: | applied to the phase of the LFO rather than its output |

**Root Note**
For note quantizing, this sets the root note to calculate intervals from (the default is middle C). This is hidden when the **type** isn't set to note quantizing. This does not affect the editor display however and can't because of SDK limitations (and the fact that I maxed them out).

**Iterations**
By default 1, this can make the output/phase filtering be applied multiple times, similar to note quantizing (which is automatic and based off of the size of the wave). This is hidden when the **type** isn't set to filtering.

**No Phase Knob**
Only for phase filtering, this allows the **phase** knob to rotate the LFO independently of the filter.

**Curve Window**
Also only for phase filtering, this will apply the filter to the entire **curve window**, not just 1 phase at a time.





**Example Note Quantizing**

Here, the first LFO is being note-quantized by the first waveform. The **number of points** is set to 12 so that it's a complete scale, and in this picture, C, E, and G have different weights, emphasizing the root and fifth. The **unipolar** toggle is on, which is very important as note quantizing will discard any negative CV anyway. And the note-quantizing lamp indicator is green, above the **gate type**, below the display, showing that it is wired up on the back panel.

This turns a smooth sine wave into note CV that snaps to C, E, and G. You can see how the display of the sine wave is rougher than in the next LFO. If I had chosen just one note to snap to and/or raised the number of points (e.g. 2 octaves), it would look more stepped.

Note that in general, you do not want to use the same waveforms as both note quantizer scales and LFO waveforms, etc. The editor display will have text showing what each waveform is being used for, but it's not necessarily recommended to use these for more than one thing at a time unless you really want to. It may get confusing otherwise.

# 9. Grid (CV Combination and Selection)


**Summary**
The grid combines and selects signals. Most of the knobs and buttons on the left half, surrounding the display, work the same as their LFO counterparts, with a few knobs in different places. The **function** menu has simple combinations (like sum, average), selection functions that use the grid LFO and/or gates to trigger (like loop, max), and crossfaders that use the **crossfader** slider. The **source** menus choose a bank of signals for each row of **grid buttons**, which are then toggled on and off to choose signals. Above the mods is the **delay**, which is mixed in before the **high**/**mid**/**low** shapers. A **smooth** knob averages signals over time. It has four general purpose front panel mods, plus specific back panel mods, a gate input, option toggles, and four outputs.

The **crossfader** has an **s-curve smooth amount** and **type**, and the **fade LFO** toggle will use this crossfader when switching between sources using a **selection function**. The grid's output can also be **note quantized** or **output filtered** via a custom waveform (see the LFO help section).

**On/Off**
Turns the grid on/off.

**Frequency**
Only in play for the selection functions, this behaves like the LFO frequency knob, controlling the rate at which selections are made. The **No Frequency** button will disable this, making a new selection with every batch or frame.

**Sync and Env Sync**
Same as the LFOs and only used for the selection functions.

**Phase**
Same as the LFOs but on the left, below the sync and env sync. This is just the phase of the grid's LFO, controlling when it triggers for the selection functions only, and only applying to gate hits for the **gate types** of *Retrigger* and *N Shot*.


**No Frequency / Fast**
Turn this on to make the grid ignore the frequency knob, updating any selection functions every single batch of calculation, rather than at a certain rate. This is typically about 700 times a second at a sample rate of 44khz (I think). Use this to essentially instantly update selection functions. It will have no effect on the other functions.

**Level**
Same as the LFOs (in a slightly different position).

**High, Mid, Low, and Warp**
Same as the LFOs. Note that it is applied last, after the delay if enabled and that it isn't labeled on the grid.

**Invert**
Same as the LFOs and applied last.

**Smooth (Batches)**
Same as the LFOs.

**Quantizer and Gate Channels**
Same as the LFOs, and the grid also has a back panel gate. The gate channel controls the grid's LFO, so it only applies to the selection functions.

**Gate Type**
Similar to LFOs. *Retrigger* is essentially the same thing, starting the grid's LFO over with a gate hit. *Mix with LFO* leaves the grid's LFO untouched, mixing in gate hits. *Gates Only* disables the grid LFO and only uses gates. *N-Shot* runs the grid LFO for as long as the gate is held. These also apply to the back panel gate. Also note that there is a toggle on the back panel that will change the *Retrigger* and *N-Shot* gate types for the loop function. The normal behavior is for a gate to reset the loop back to the first selection along with resetting the LFO. With the back panel toggle on, the LFO is reset but the loop selection moves to the next position.

**Unipolar**
Same as the LFOs.

**Function**
A bunch of functions to apply to the CV signals, listed below according to type:

**Combining Functions:**

| | |
|---|---|
| **Sum** | Sums the selected sources. |
| **Multiply** | Multiplies the sources. Toggle the *Scale Multiply* button on the back panel to have this function multiply this result by the number of sources - 1 (if > 1), which may come in handy with more than 2 sources. |
| **Average** | Averages the sources (sums and divides by the number of sources). |

**Selection Functions:**

These will be updated at the frequency set by the frequency knob (and by gate hits), unless the **no frequency** button is enabled, in which case they will be updated every batch (roughly 700 times a second with a sample rate of 44khz). The lamps above and below the grid buttons will show what is currently selected.

| | |
|---|---|
| **Minimum** | Selects the lowest or most negative source. |
| **Maximum** | Selects the highest or most positive source. |
| **Narrow** | Selects the source closest to 0. |
| **Wide** | Selects the source furthest from 0. |
| **Random** | Randomly selects a source. The back panel **random seed** controls will also affect this. |

**Looping:**

| | |
|---|---|
| **Loop** | Starts with the most upper-left selected button, moving right. If all buttons are selected, it moves across A1, A2, A3, A4, B1, B2, B3, B4. |
| **Loop Backwards** | The reverse of the above, starting at B4. |

**Fade LFO**

This is only for use with the selection functions. Instead of instantly changing selections, it will fade the selections, using the **s-curve amount** and **type** controls and the **crossfader** as a midpoint of the fade.


**Selection Function Notes:**

The grid LFO is only used for selection functions and works like the other LFOs. It selects the current source at a given frequency according to the function. As with the other LFOs, when using the sync frequencies without **env sync**, moving the **frequency** knob will cause the LFO to jump to where it would normally be at that song position (or internal version of this if the song is not playing). Using the **env sync** button or the free frequencies, moving the **frequency** knob will just change the frequency, and the LFO carries on from where it last was.

By default, toggling the source buttons happens immediately. Turn on the back panel option, **Wait to Toggle**, to have this toggling occur at the LFO/gate hits only (and only for selection functions).

Changing from loop to loop backwards and vice versa will simply switch direction for the free and env

sync frequencies (even if the gate type is gate only). Doing this with a sync frequency will cause the loop position to switch to what it will always be at that song position with those sources selected. In other words, use the sync frequencies without **env sync** to have a reliable and repeatable loop given the selected sources. You can skip ahead to any part of the song, loop it, etc. and know that the grid loop position will be the same when you load the song and start playing, export audio, etc. Use the free or env sync frequencies to facilitate toggling between forwards and backwards loops, selecting/deselecting sources with a smooth looping movement, possibly modulating the grid LFO's frequency, etc.

You can use these features together, syncing the LFO at various points and then **env sync**'ing and flipping directions, selecting, unselecting sources, etc., and have all of this be repeatable on every song playthrough. Note that a phase reset or a retrigger gate can accomplish a similar thing, starting the loop over at any given point reliably.

Another option on the back panel, **Loop Gate Style**, controls how looping behaves with gate hits with the gate types of *Retrigger* and *N Shot*. Without this option set, a gate hit retriggers the LFO and sets the loop back to its first position. With the option set, a gate hit instead advances the loop position while retriggering the LFO.

**Crossfading:**
These use the **crossfader** below the source selecting buttons.

| | |
|---|---|
| **Crossfader Up/Down** | Crossfading between the top and bottom sources. All the way right selects the sum of the selected sources in the top bank; all the way left selects the bottom bank. |
| **Crossfader Up/Down Hardcut** | Same as the above except with an immediate transition. |
| **Crossfader Left/Right** | Up to a four-way crossfade, choosing amongst the sums of each column. The fader areas are split up evenly according to the number of columns currently on. |
| **Crossfader Left/Right Hardcut** | Same as the above except with an immediate transition. The crossover regions are where the regular version outputs an even mix between neighboring sources. |
| **Crossfader Left/Right Hard Even** | Same as hardcut except it splits the zones evenly across the entire range, so that a sweep from -1 to 1 spends an equal amount of time on each source (for 3 or 4 vertical groups of sources). |

**Sources A and B**


Use this to select the bank source for each group of 4 toggles. The default is for the top four buttons to correspond to the LFOs and the bottom four buttons to correspond to the first four CV inputs.

| | |
|---|---|
| **LFOs** | The onboard LFOs. |
| **Quantizers** | The quantizer channels, with the fourth button = 0. |
| **Envelope** | All four of the buttons point to the single envelope. |
| **User Knobs** | The first four user knobs. |
| **User Buttons** | The four user buttons. |
| **Notes** | Two copies of note number and velocity, alternating. See the Tips and Tricks section for more detail on using MIDI/sequencer/Matrix notes. |
| **CV in A** | The first bank of CV-in on the back panel. |
| **CV in B** | The second. |
| **CV in C** | Third. |
| **CV in D** | Fourth. |
| | |
| (new with version 1.2): | |
| **Gate Inputs** | Two copies of the inputs to the gate channels. |
| | |
| **User Knobs 5-8 (Bi)** | The second set of user knobs (bipolar). |
| **User Knobs 5-8 (Uni)** | Unipolar. |
| | |
| **Notes Sample and Hold** | Notes sample and hold. |
| | |
| **CV in A S&H** | The first bank of CV-in, sample and hold. |
| **CV in B S&H** | Second. |
| **CV in C S&H** | Third. |
| **CV in D S&H** | Fourth. |
| | |
| **Gate Inputs S&H** | Gate inputs ample and hold. |

**Source Buttons**

Eight buttons: Four buttons for each of the two sources selected via the source menus.

**Crossfader**


Used only for the crossfader functions (and the selection functions if the **fade LFO** toggle is on), this controls the fade from top to bottom or left to right.

**S-Curve Amount and Type**

This allows nonlinear fading for all of the smooth crossfader function types (and selection functions with **fade LFO** on).

**Delay Section**


This is a delay that can be added to any of the functions, occurring before the hi/mid/low shapers. It has five parameters, listed below.

**Delay On**

Turns the delay on or off.

**Delay Length**

Controls the length of the delay via free or sync modes, ranging from 0 to 31.5 seconds or a 1/128 note to 32 bars.

**Delay Sync**

Toggles between free and sync modes.

**Delay Feedback**

This controls the feedback. All the way to 0 will repeat the incoming signal exactly once. All the way to 100% will keep the delay repeating indefinitely.

**Delay Mix**

The dry/wet of the delay. At 0%, only the sources come through. At 100%, only the delayed signal comes through.

**Mod Section**

There are six front panel mods for the grid and two scaled mods. No destination field is present on normal mods because there is only one grid. The order of the knob list is roughly the same as the LFOs and quantizers where they overlap. There are also four back panel mods for frequency, phase, level, and the crossfader. See the mod section for more details, but the source buttons can be modded via bank sources, allowing one mod entry to independently control four buttons. So for example, with two mod entries, two banks of CV input can toggle all 8 of the source buttons, or one mod entry can allow the four LFOs to control the toggling of the source buttons.

**Example Mod Wiring**


In this example, the first user knob is wired up to both the smooth knob (with a negative amount) and the level (with a positive amount). It is scaled by the third user knob, about halfway in the negative direction. (This is kind of an arbitrary setup!) In the second column, the entire bank of LFOs is also being added to the grid (no matter what kind of grid function and input is being used). That amount is scaled by the fourth user knob. The second mod in that column uses the entire second bank of CV inputs, B, wiring them up to turn on the second set of grid buttons. So they would introduce extra signals into the grid.


**Back Panel Options:**
Three toggles on the back alter basic functionality of individual functions. These are also available in the mod section. Another toggle is meant to be used when connecting the grid out to another device's gate-in (and probably in conjunction with using the **run** toggle). There is also a **level boost**, like the LFOs', and a **delay function**.

**Level Boost**
This will multiply the level knobs by the selected constant. Several constant multipliers are available in the menu next to this toggle.

**Use as Gate**
This basically zeroes the output when the device stops, in order to facilitate using the grid as a gate generator (e.g. by using the grid with quants or MIDI sources). It's not available via the front panel mod system just because it really isn't meant to and doesn't need to be automated.

**Wait to Toggle**
For selection functions, untoggling a grid source while it is selected will normally immediately select another grid source. With this enabled, it will untoggle with the next grid LFO or gate hit. Note that this only applies to the selection functions, not the simple (sum, average, multiply) or crossfading functions.

**Loop Gate Style**
This only applies to the loop functions with a gate type of *Retrigger* or *N Shot*. Normally when a gate hits, the loop will reset to the beginning for these gate types. With this enabled, it will just advance to the next position.

**Multiply Scaled**
For the multiply function, multiply the result by the number of selected sources - 1 (if greater than 1, so it does nothing for 1 or 2 sources). This can help scale up the multiply with a few rapidly changing sources that cross 0 a lot. Otherwise, it is easy to end up with mostly 0.

**Delay Function**
There are currently 3 choices here: add (which is typical delay behavior), subtract, and average.

**Bi/Unipolar and Invert on the Outputs**
A relative **bi/uni** for the top two outputs, and a relative **invert** for the right two outputs.

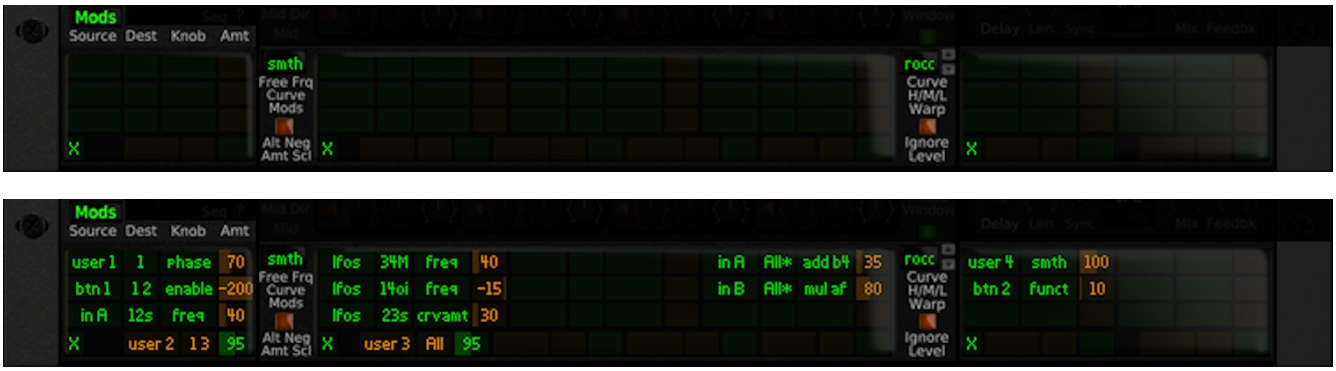
**Note Quantizing and Output Filtering**


**Waveform** , **root note**, and **iterations** menus: these work the same as their LFO counterparts and are turned on via the same **type** menu. See the LFO section for more details.

**Smooth Batch Fix/Correction**


This affects all **smooth batches** knobs (the grid's and the LFOs'). It can more-or-less keep these knobs operating the same when the sample rate is changed (via the Reason preferences). See the LFO section for more details, but basically you choose the sample rate you were using when you set the **smooth** knobs, and then when you change the sample rate, those knobs will do their best to change automatically, though there are some limits.

# 10. Mod Sections




**Summary**
There are front panel mods for the LFOs, grid, quantizers, and envelope. Each has a **source** menu, a **parameter-to-be-affected (knob)** menu, and a negative/positive **amount** display. The LFOs and quantizers also have a **destination** menu. For the quantizers, this is simply choosing 1, 2, or both (plus a few bank to bank selections). For the LFOs, you can choose any combination of the four (plus a ton of additional bank to bank selections). Each section also has its own **clear mods** menu ('X').

For the LFOs, grid, and quantizers, there are also **scale mods** (the bottom row of mods) that can be used to scale combos of mods by sources. They have a source menu, a destination menu (pointing to the above mods), and an amount knob.

Note that the **source**, **destination**, and **property** choices are blank by default, and the **amount** knob is 0 by default. In order for a mod to have any affect, all of these values must be non-default. This also provides an easy method for disabling a mod temporarily without losing most of its settings.

Most of the single controls that affect multiple components (like back panel options for the LFOs or the **high/mid/low curve warp** controls for the LFOs and grid) have virtual properties that can be set individually for each component via the mod section. The user section should come in handy for this (and it's partially why there are 4 extra **user knobs** available, available via the **alt user knobs** toggle).

**Source**
Every component on the board (with the exception of the internal gate channels) is available in here, along with the back panel gate and CV ins. There are also whole banks of components--either treated as the sum/combination of four components or inputs, e.g. CV A1-4; or used to wire up multiple things with a single mod entry, e.g. CV A1-4 wired up to the frequency of LFOs 1-4. Version 1.2 adds **sample and hold** versions of the gate inputs, note velocity, and CV inputs.

**Destination**
For LFOs, quantizers, and the scale mods, this selects which component will be modded. You can select just one or a combination. The first entries are simple: 1 source to 1 or more destinations. The last entries in the LFOs' and quants' menus are bank to bank destinations, allowing multiple sources to

connect to multiple destinations. They only work with banks as sources. Otherwise, they work like the normal multiple destination choices. The grid buttons can be modded in a similar way by choosing *All Buttons A* or *B* in the knob section and a bank source.

There are tons of these for the LFOs, grouped into categories by the number of connections. I think every possibility is listed though I could be wrong. Basically by choosing a bank source, such as all 4 LFOs, and a bank destination, which could be from 2 to 4 destinations, perhaps rotated or flipped, you can do complex wiring with a single mod entry. I use this stuff a lot.

For **scale mods**, the destination points to the normal mods, which are numbered from top to bottom, left to right (so for the LFOs, the left column is 1, 2, 3; middle is 4, 5, 6; and the right is 7, 8, 9).

**Knob / Button / Menu / Property (labeled Knob)**
This selects the actual property to be modded. All properties for a component are available. The dual free/sync knobs and faders (**frequency**, **delay length**, **attack**, **decay**, and **release**) are listed both as a combined property first and as individual properties at the end of the list. This is to make it easier to mod these if you switch between sync and free frequencies, etc.

**Amount**
This goes from -200% to 200%.

**Clear Mods Menu**
The Quants, LFOs, and Grid mod sections have menus that can clear mods, in the bottom row with the scale mods, labeled with an 'X'.

**Free Frequency Curve Mods**
This is the method used to smoothly change the signal when something is using a curve section and that curve section is being modded. This mainly applies to the LFOs but can also apply to the quants if they use a curve section (via their **smooth type**). The default option, *smooth*, alters the phase of the LFO (or quant) in order to match up the output. There is also a backwards-compatible and buggy option that does a pretty bad job at this (mainly for my beta testers and myself, so I wouldn't break anyone's songs), and a do-nothing option that will make the output jump around.

This is analogous to modding the frequency of an LFO that is using a free frequency or a sync frequency with **env sync** on. That will simply speed up or slow down the LFO without radically altering its output. Doing that to an un-env-sync'd sync frequency LFO will result in lots of jumping around. In terms of code, this is really simple, but modding curve parameters is not. A reverse curve section is applied in order to figure out what the phase needs to be to match the output.

However, the default option is not perfect. There will be a noticeable overall speedup or slowdown of the LFO if it's being modded by a faster or slower LFO, proportional to the speed difference. If I ever figure out how to solve this, I'll create a new option for this menu.

**Alternative Negative Amount Scale**
This toggle will make the **scale mods** behave more like the Thor's scale mods when using a negative **amount**. Instead of applying a negative amount, they invert the direction of the signal.

**Mod Version (back panel option)**
This keeps old patches working as they should when new options are added to integer properties.

Version **1.1** changes the way integer mods are calculated so that they line up better with each other. Basically when modding multiple integer properties that are set to different values (e.g. sync frequencies), they will now all change at the same time. Previous to 1.1, they did not (oops!).

The default for a new device is the latest version, and this is the recommended version, but old songs and patches will keep their entry for this menu, behaving the same as they did before. Feel free to change them to the new version, but it may affect integer mods (this can usually be fixed by adjusting the **mod amount** knobs for integer mods a little bit).

**Notes:**
The mod section differs from a combinator in that the lower and higher bounds can't be selected directly. So you will have to fine-tune the amount and/or source level and/or the destination knob's setting to get the exact range that you need. A mod amount of 200% corresponds to a back panel mod with trim all the way up. Note that you can select a positive or negative amount.

Basically all knobs and parameters go from -1 to 1 when modding. So if you're modding a knob that is set all the way to the bottom or the top of its range, it has to move 2 to reach the other end. So a unipolar source operating on a knob at its lowest setting with a mod amount of 200% will span the entire range of the knob. Similarly, if you set a frequency knob halfway, modding it with a normal bipolar LFO source that goes from -1 to 1 will cover its entire range when the mod amount is set to 100%. (Also, obviously, all mods will stack up, combining front and back panel mods if they apply to the same knob.)

Note that integer and boolean values are both treated as if they are equally split up across the range of -1 to 1, just like other floating point knobs. This means that modding anything on here works essentially the same, no matter how it's represented internally.

All mods for parameters that have a free and sync version are first listed for both: e.g. frequency or envelope attack. Near the end of the list, they have the free and sync versions. This is to make it slightly easier to mod things via the front panel. The back panel mods do this also, which is typical for reason devices. So note that you will be modding both free and sync versions if you end up switching between the two. Thus, it's also possible to mod the free and sync versions differently (using different sources and amounts) and switch between the two.

# 11. Back Panel


**General Options**

At the top middle of the device, there is a row of **intro** help sections that mostly give a broader overview of various components, rather than focusing on explaining every property like the other **help** sections do.


The **grid overlay** section on the upper left has controls to put a grid overlay on each display (the pads, the wave editor, and the LFO display/scope), change the number of parts (X/Y divisions), the color, etc. See the general section in this manual for more details.


**Float sync timing** uses floating point values to calculate the sync/play position timing rather than the default integers. **Mod version** can be used for backwards compatibility with patches and songs should I ever release versions of the KRON with more menu options (or fix something in the mods, as I did

with "1.1." **Flip pad Y** just flips the vertical direction of the **user pads**. **No editor animation** just turns off the moving cursor in the editor display. **Logo**, **title**, and i**nside color** can be used to individually change the logo and title colors, rather than link them to the **meter color**. These are also all covered in more detail in the general help section.


**CV Inputs**
4 banks of 4, each with a trim knob. These can be used individually or by banks of 4 in the front panel mods. Each bank has 3 toggles that alter the entire bank's CV signals: **unipolar to bipolar**, **bipolar to unipolar**, and **invert**.


**User / Custom Outputs**
These 8x4 outputs have source menus above each group of 4 outputs. By default, the basic **user knobs and buttons** are selected, but they can be repurposed. They also have **bi/uni** and **invert** toggles that work like the ones on the other outputs.


**Envelope**
There are 4 outputs: the top 2 can be made uni/bi relative to the front, and the right 2 can be inverted relative to the front. The **center bipolar** toggle will center bipolar envelope output so that the extremes of the envelope are equally distant from 0. It's on by default. One gate input will trigger the envelope (and note that the front panel has gate channels used for this purpose also). Finally, there are direct mods for the 4 stages (**ADSR**) and the **level**.


**LFOs**
Each LFO has 4 outputs, along with **uni/bi** (top 2) and **invert** (right 2) toggles. They each have a **gate trigger** and 3 direct mods: **frequency**, **phase**, and **level**. They also each have a **level boost** with **amount** menu.

The options on the upper right of the LFO section affect all LFOs but can be set individually via the mod section. **Use as gates** zeroes the LFOs when the song stops. **Step alt even** makes alternating step types start on the step, not the alternating value.

The options above those are for non-default **gate types** (1/n-shot and 1/n-hold). **Freeze LFO** causes the LFO to hold its position at the end of a gate-triggered movement. **Random return** causes a random-wave movement to return to a position set by **return value** with a **return speed** modifier.

Below the above options are a toggle and knobs for the **curve section**. **Flip curves** just flips the left/right movement of all curve amount knobs (**curve amount** and **mid** for the LFOs, **s-curve amount** for the grid). Below this, each **curve function** has a **constant** modifier knob that can adjust their relative curviness and intensity (this could be useful when modding the **curve amount** knobs or trying to better align different functions).

Below that are the random seed controls. There's an **enable** to turn it on, a **seed** chooser, (each LFO and the grid has its own seed which is combined with this to produce repeatable chaos, unique for each component). and an **extra precision** knob (just in case). See the main LFO section for more info.

At the very bottom of the LFO (and grid) section is the **Note Quantizer / Output Filtering** section. This can be used to snap output to Note CV scales, chords, and intervals. It can also "filter" the output or phase (of the LFOs only), skipping regions of the output or phase (essentially silencing portions). The type menu turns this on and selects the basic function of this section (unweighted and weighted note quantizing and output/phase filtering). The **waveform** menus select which custom waveform to use. There's a root note menu for note types and an iterations menu for filtering. Phase filtering also has 2 options: **ignore phase knob** (allowing the LFO to be rotated relative to the phase filter) and **apply to entire curve window** (normally it still applies to one iteration/phase of the LFO, even when it has a curve window). See the main LFO section for more info.


**Grid**

Mostly this is set up like the LFOs plus a **crossfader** mod. It has 3 special options: **wait to toggle**, which holds the grid selection until the grid LFO triggers, rather than changing upon user clicks; **loop gate style**, which will allow gates to advance the loop in the default gate type, rather than resetting the loop; and **multiply scaled**, which boosts the multiply function output with a multiplier the tracks the number of selected inputs. There is a **delay function** menu that defaults to add. And below the crossfader mod, there is an option, **smooth batches fix**, to make the **smooth batches** settings sample rate independent.

The LFOs and Grid share these options: **flip curves**, **curve constants**, the **random seed** controls, **smooth batches fix**, and the **note quantizer/etc. type** and **show notes** toggle. See the LFO section for more info.


**Quants**

These are gate outputs, 4 for each of the 2 main quants plus another 4 for the 3rd, which is a combo of the 2 (use the **3rd type menu** on the front to select how they combine). The main 2 quants each have a gate input plus direct **frequency** and **phase** mods. There is also an option for use with gates and a pattern sequencing section that uses the custom waveforms as patterns (see the Quant section).

# Notes and Tips

**Color Options**
All of the color settings have song level persistence, so device patches do not store this info but combinator patches and songs do. This means you can browse device patches without affecting colors. To copy your color settings, use combinator patches, duplicate or copy and paste the device, or just copy a patch from one device to another using the mouse (this last one surprised me and IMO makes this much easier!).

**Patches**
The combinator patches are a combo of my own (Alien Seed Tech) and some of my beta testers'. Mine have a "#K" at the end where # is the number of KRONs. The device patches were all done by me and some of them are taken from my combinator patches. I have just barely scratched the surface with these device patches.

**Loading Time**
The KRON has a long loading time, unfortunately. I haven't been able to figure out any way to improve this. It seems to be more dependent on the total number of properties and such that I have, not on the code, the graphics and animations, etc. So it appears to be beyond my control and more a product of what the Reason engine is doing to set up REs when they load. Perhaps it'll be fixable in the future. Sorry about this!

**Keyboard Sources**
The KRON can accept notes (via MIDI, a note lane, Matrix, combinator, etc.) but it is not automatically set up to do so because it is not an instrument type device. These notes can be used as mod, grid, and gate sources, and then the KRON can trigger instruments and function as a fancy arpeggiator. Note that this device only outputs monophonic information.

If a KRON is inside a combinator, you can make it receive notes by showing the programmer, clicking on the KRON, and then clicking on the box to the left of "Receive Notes." Now the KRON will receive the same MIDI and/or sequencer and/or Matrix input, just like instruments normally do by default when inside a combinator.

You can also have a KRON receive note information directly by creating a sequencer track for the KRON and then creating a new note lane for the KRON. Neither are automatically created (though a sequencer track will be created if any properties are automated). To create a new sequencer track, right-click and select "Create Track for KRON ..." (or select this from the "Edit" menu). Then right-click on that track and select "New Note Lane" (or select this from this "Edit" menu).

**Order of Execution and Latency**
The order of execution of the major components can be switched around using the **run order** menu in the general section. Generally with the KRON, the internal latency between components can be reduced to nothing or 1 batch (the smallest unit of device to device latency), depending on what this

menu is set to and the wiring of the patch. So for most basic uses and even more advanced uses with the correct **order** setting, a patch can have no internal latency. With more complicated wiring, it can probably still be 1 batch if it has the right **order** setting, but with the wrong setting or a seriously complex set of mods, it could be 2 batches of latency.

**Back Panel versus Front Panel Wiring**
Most of what you can do via the back panel, as far as CV connections goes, can be done on the front panel. The **gate channels** are specifically on this device for zero-latency gate triggering via the Quants or any other component if the proper **order** setting is chosen. So while you can wire up say the gate output of a quant to the gate input of another component on the KRON, you're adding an extra batch of latency by doing so.

The back panel mods are similar but it also depends on the **order** menu setting. If a component is modding itself, no matter what, back panel or front, it can't all be done in one batch. But if a component is modding a different component, it can be done with the right **order** choice via the front panel mods.

**Dealing with High CPU Usage via Graphics Options**
Basically start turning off graphics options. The main **fps** knob controls both the 2d displays and the 1d meters, so moving that down is a good idea and a great place to start if you still want to see everything. Honestly, the default setting may be a little excessive. The scope has an **fps** knob (it's a fraction of the main **fps** knob) that can help when the LFOs' curve sections and levels, etc. are modded. You could also just turn this display off.

If an LFO is using a custom wave and animating movement in the editor, you can turn off that animation via the **no editor animation** back toggle, or just turn off the editor display with the **off** radio toggle. The **grid overlays** aren't terribly efficient. You can tone down their number of parts or turn them off for displays that are being animated, such as the LFO displays with modded LFOs.

Or just turn off the entire graphics via the main **graphics enable** toggle. Especially if you're using a lot of combinators and don't need to see what the LFOs and such are up to most of the time, just toggle that green "gfx" button off. I'm not sure how much this saves, and it probably depends on your setup, but it's something.

On my previous computer, I routinely did this with songs that maxed out the CPU, and it always helped.

Note that you also may want to choose fixed color settings for the menus inside the **meter color** menu (use one of the basic meter color choices).

You can also toggle the **run** buttons off in order to have the KRONs freeze in place, not doing anything, so long as the song is stopped. This option is mainly meant for other purposes, but it should make a KRON use far fewer CPU cycles when the song isn't playing.

**The Gate Channels and Reset Button are your Frequency-Modding Friends**
You can wire up **gate channels** to LFOs that are being smoothly frequency-modded (with **env sync** enabled or with the free frequency set) and trigger them with a Matrix or the Quants. But you can also just record or draw the **reset** button at the beginning of the song, at various points, etc. This will line up all LFOs, quants, and the grid and envelope.

**Smoothing a Choppy Signal**
Some ways of using the grid (or using square waves, steps, etc.) can make, for example, a filter sound choppy with its sudden knob movement. There are three basic ways to fix this with the KRON: use the LFOs' or grid's **smooth** knobs, which will average the current signal with the previous signals (from 1 to 256 batches back); use a **quantizer channel** with some smoothing and a rapid frequency (the fastest free frequency works out to roughly a sample every 3 batches); or, for **grid selection functions**, use the **fade LFO** toggle and set the **s-curve amount** to give a smooth transition between selections.

**Driving basic Reason devices with a Combinator**
When using the combinator to drive something versus a direct back panel mod input, many signals will be smoothed and less responsive. This may be a desired effect or it may interfere with fast LFOs. For full control over this smoothing, rather than letting the combinator do it, wire it up directly if possible and use one of the above techniques.

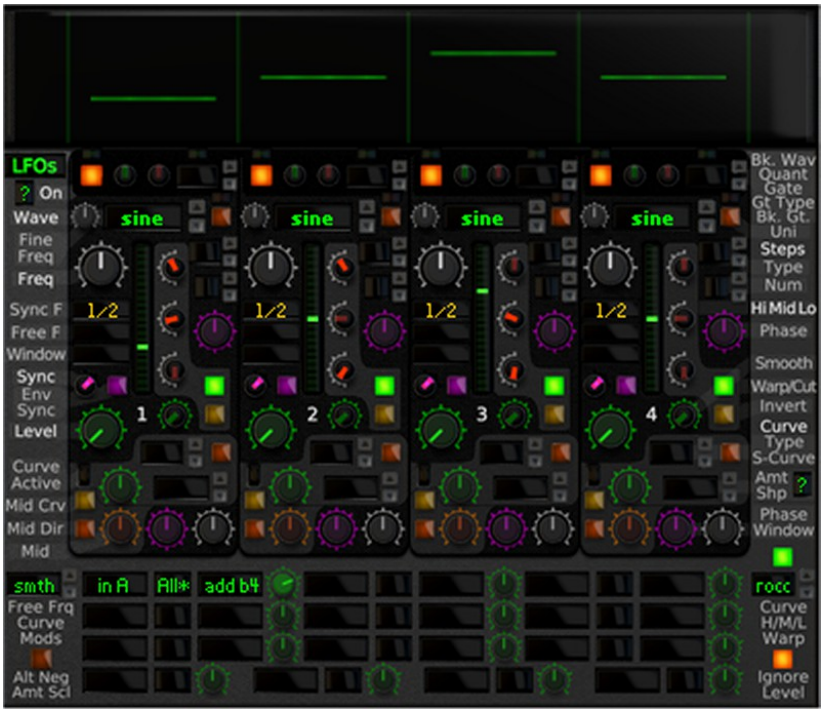
**Extra User Knobs / Constant Generators**
There are a total of 8 user knobs, 4 of which are hidden but can be swapped into view. If you need even more, you can use LFOs and the grid as user knobs or constant generators. For the LFOs, set the **level** to 0; for the grid, do the same or select no **grid sources**. Then use the **midpoint** knob. This works great for constants or automated sweeps. You can also use the crossfader for this (it's available as a bi or uni **source**) if you're not already using it on the grid.

**Extra Outs**
If you run out of outputs on a component, there are **source** menus above the **user/custom outputs** that can select any of the other components, inputs, etc.

Using the menus above the **user** outs on the back panel, you can rewire any of them to output anything, including regular components and inputs. This gives you up to 32 additional outputs. These also have **uni/bi** and **invert** toggles set up like the rest of the outputs.

So if you run out of outputs on a component, you can easily create more. They also come in handy for CV splitting, such as triggering a chain of KRONs' **gate channels** with one Matrix gate signal: Wire up the Matrix to one of the KRON's **main gate inputs**. Select that gate input via one of the custom out **sources**, and then connect that to the other KRONs' **gate inputs**.

**Using LFOs and the Grid as CV-in Shapers**




You can use an LFO or grid as a CV meter, shaper, quantizer, or just plain splitter. Set the level to 0 (or choose no sources for the grid), and use the mod section to wire up an input to the virtual knob called "Add b4 Hi/Mid/Low/Invert." This just adds the signal to the LFO/grid's signal, after the **level** knob and before the **invert**, shapers, and quantizers. The **level** knob happens before this mainly to allow an independent volume control over both the main signal and any added signal. But the rest of the features are done afterward so that they can be applied to this kind of added signal. You can also mod the **mid** knob in the same way, and it will take place after the **level** and **invert**, before the shapers and quantizers. In the picture to the right, a bank-to-bank mod destination is used. It is connecting the first 4 CV inputs to the 4 LFOs (A1 to LFO 1, A2 to LFO 2, etc.).

**Mods and Timing Issues**

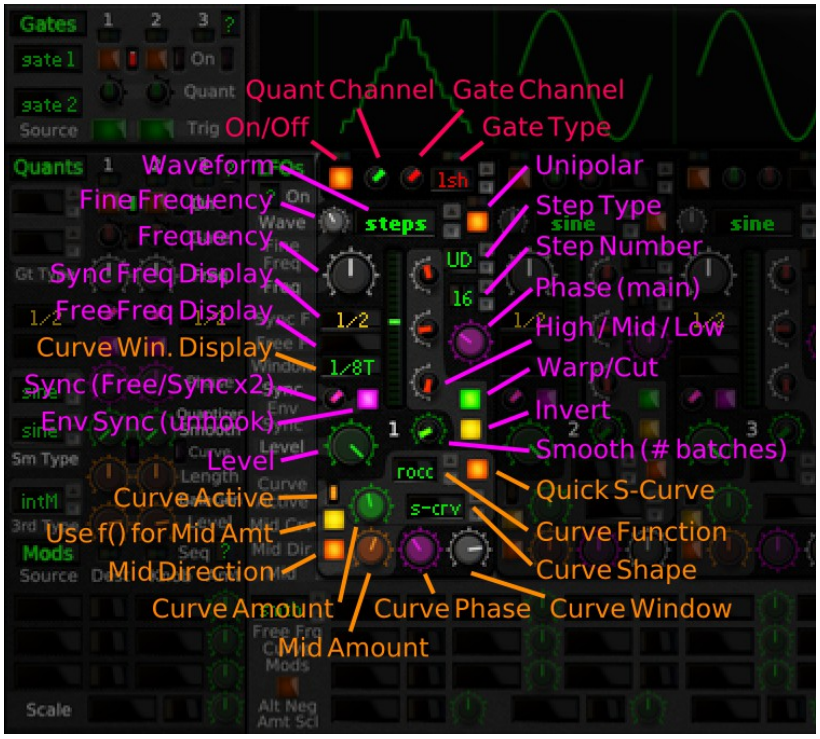
If your patch relies on precise timing, e.g. using a sync frequency mod to change functions or to trigger something, you may run into subtle timing errors. First off, choose the most appropriate **order** of execution in the general controls so that triggering and modding sources are calculated, followed by the mods and then the primary modded component.

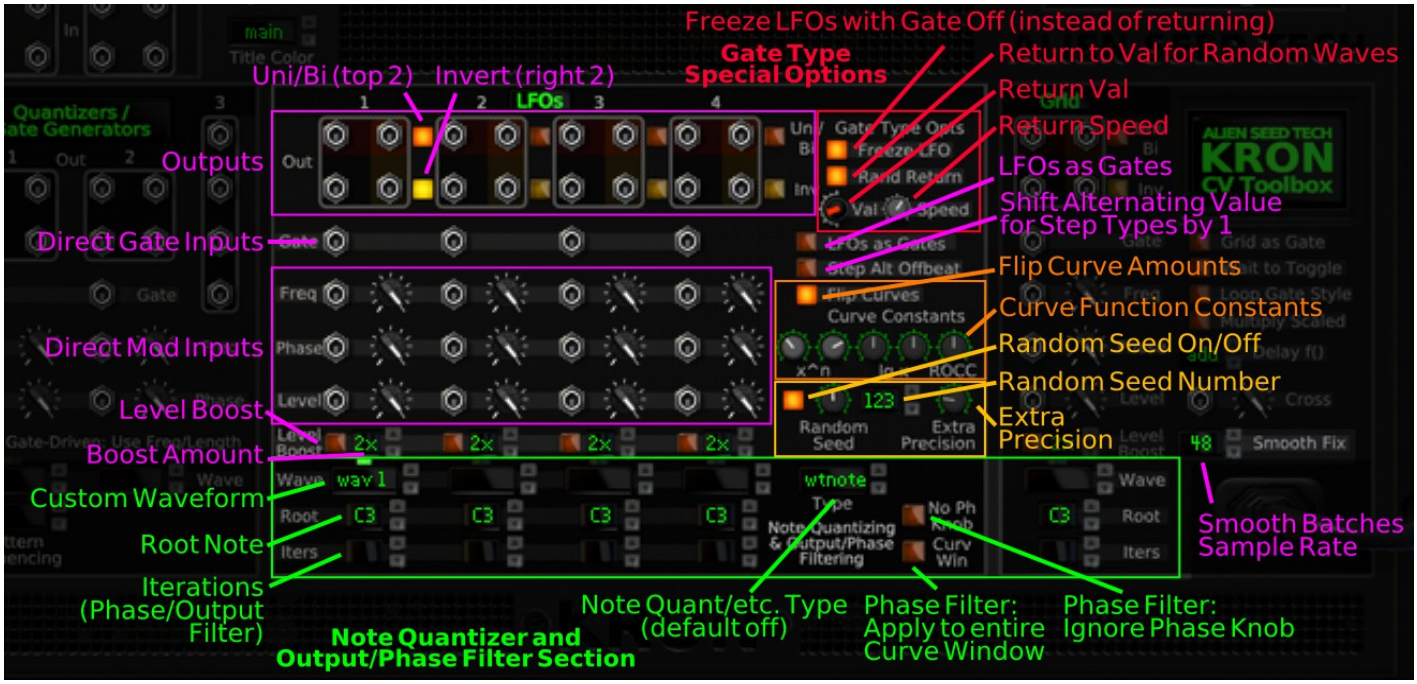
Secondly, try toggling the **float sync timing** option on the back panel. With certain tempos and uses of sync frequencies, the integer song position that Reason reports to REs can result in two different components' waveform changes falling on adjacent batches instead of the same batch due to rounding errors. It's rare, but it can happen. Enabling **float sync timing** causes the KRON to use an internal floating point song position that is more accurate than the Reason integer song position. It is on by default. However, it can cause other problems with looping and moving the play position, also infrequently, and this comes down to the same basic tempo/sync problem pushed into a different place. I can't figure out a way to avoid it completely, so this way you can choose if you need to.

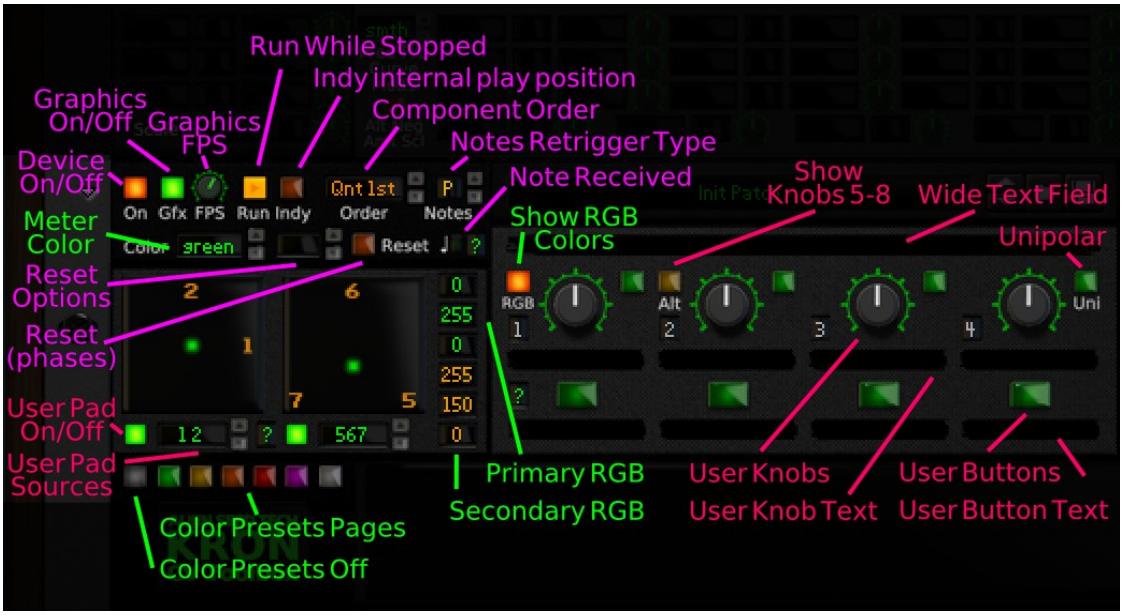
For probably the vast majority of use cases of the KRON, this is not going to be an issue. But if you're having timing issues with a patch, make sure the **order** menu option makes the most sense and try toggling **alt sync timing**.

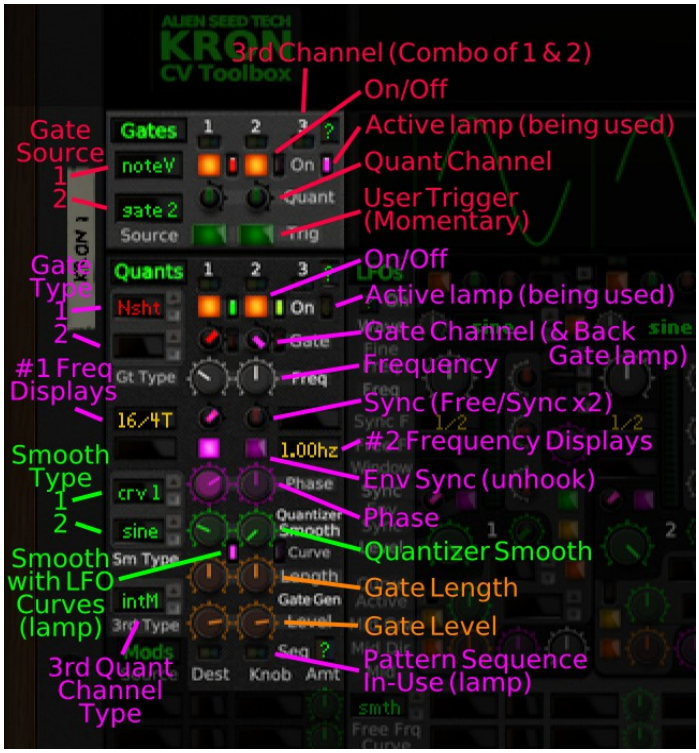
# Appendix

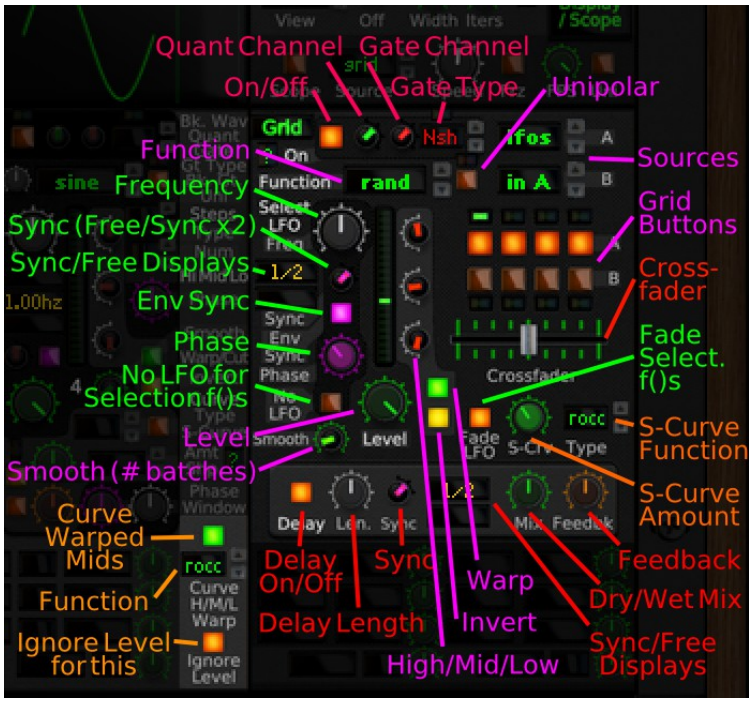
## 1. Labeled Controls



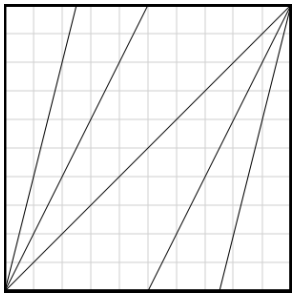

Run While Stopped
Indy internal play position
Graphics On/Off
Graphics FPS
Component Order
Notes Retrigger Type
Device On/Off
Note Received
Show Knobs 5-8
Wide Text Field
Meter Color
Show RGB Colors
Unipolar
Reset Options
Reset (phases)
User Pad On/Off
User Pad Sources
Primary RGB
Secondary RGB
User Knobs
User Knob Text
User Buttons
User Button Text
Color Presets Pages
Color Presets Off
On Gfx FPS Run Indy Order Notes
Qnt 1st
Reset
RGB
Alt
Uni


3rd Channel (Combo of 1 & 2)
On/Off
Active lamp (being used)
Gate Source 1 2
Quant Channel
User Trigger (Momentary)
On/Off
Gate Type 1 2
Active lamp (being used)
Gate Channel (& Back Gate lamp)
#1 Freq Displays
Frequency
Sync (Free/Sync x2)
#2 Frequency Displays
Smooth Type 1 2
Env Sync (unhook)
Phase
Quantizer Smooth
Smooth with LFO Curves (lamp)
Gate Length
Gate Level
3rd Quant Channel Type
Pattern Sequence In-Use (lamp)
KRON
CV Toolbox
Gates
Quants
noteV
gate 2
Source
Nsht
16/4T
crv 1
sine
intM
1.00hz


Quant Channel
Gate Channel
On/Off
Gate Type
Unipolar
Function
Sources
Frequency
Grid Buttons
Sync (Free/Sync x2)
Cross-fader
Sync/Free Displays
Env Sync
Fade Select. f()s
Phase
No LFO for Selection f()s
S-Curve Function
Level
Smooth (# batches)
S-Curve Amount
Curve Warped Mids
Feedback
Function
Delay On/Off
Sync
Warp
Dry/Wet Mix
Delay Length
Invert
Ignore Level for this
High/Mid/Low
Sync/Free Displays
Grid
Nsh
rand
in A
1/2
Crossfader
Level
Delay

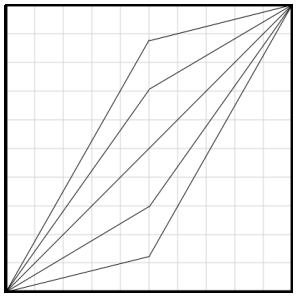
# 2. Curve Functions

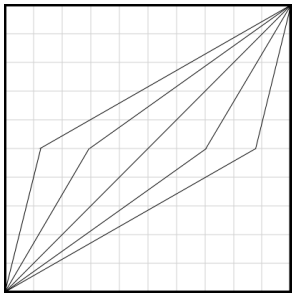
Here are some graphs to help explain what the LFO, HML shaper, and crossfader **curve types** are doing to the phase and/or output. This is roughly what they look like with the default **curve constants**, showing positive and negative **curve amount** values. All of the graphs shown here are transforming a saw wave. The LFO curve section directly affects the phase of the wave, which is then used to determine where the LFO is. Without a curve, the phase advances linearly, like a saw wave. But the HML shaper with its function enabled will be doing this to the output of the LFO. So these functions are used in various ways, but they always essentially change a saw wave into something curvier that still goes from (0,0) to (1,1).



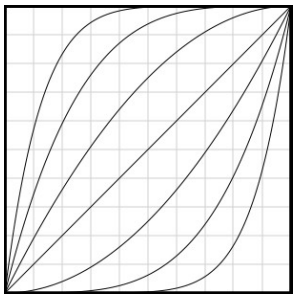
**Shift Whole**
This scales and moves the waveform. It will hold at one end or the other. This is sort of equivalent to pulse width.

**Linear**
This moves the midpoint of the waveform, linearly scaling either side. The vertical version is on the left, and the horizontal version is on the right. (Each of the following functions also has 2 versions that work similarly but aren't pictured here.)

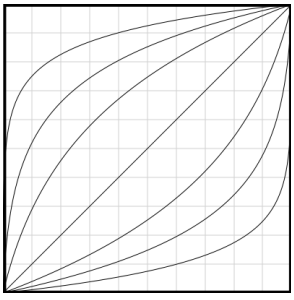




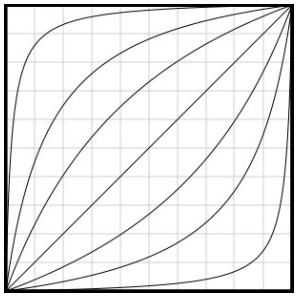
**X^N**
There are two versions of this. The second version is basically a reversed but unique function. The function itself is adjusted to work within this window-- this isn't strictly x^n.



**Log N**
Similar to X^N, it has two versions, the second being the reverse of the first. Again, it's not strictly log N but that's the bulk of the function.



**Receiver Operating Characteristic Curve**
This balanced and smooth curve function affects the waveform the same on both ends and is symmetric for positive and negative curve values. This particular function is one of many possible ROCCs.



$$\frac{e^{\ln\left(\frac{x}{1-x}\right)+C}}{1+e^{\ln\left(\frac{x}{1-x}\right)+C}}$$

# 3. Sync A Frequencies

The first set of sync frequencies used for all LFOs and the delay and envelope lengths (listed in reverse) are all the same (the envelope has an additional *instant* option). They are grouped in threes, and each group of three is twice or half the length of the previous (depending on the direction). For example: 4/4, 3/4, 4/4T; 1/2, 3/8, 1/2T. 1/2 is twice as fast as 4/4 (a half note versus a whole note). 3/4 is three quarter notes and 3/8 is three eighth notes; the 4/4T and 1/2T are triplets, fitting three notes into two whole notes and one whole note, respectively.

The entries marked with a T are actually 1/3 of the entry 5 levels above. E.g. three 1/2Ts fit into one 4/4. One 1/2T is actually two-thirds as long as a 1/2. So each group of three frequencies is basically one unit, 3/4 of a unit, and 2/3 of a unit, with the next group of three being half of (or twice) that.

| | |
|---|---|
| 128/4 | 32 bars |
| 96/4 | 24 bars |
| 128/4T | 3 notes to 64 bars |
| 64/4 | 16 bars |
| 48/4 | 12 bars |
| 64/4T | 3 notes to 32 bars |
| 32/4 | 8 bars |
| 24/4 | 6 bars |
| 32/4T | 3 notes to 16 bars |
| 16/4 | 4 bars |
| 12/4 | 3 bars |
| 16/4T | 3 notes to 8 bars |
| 8/4 | 2 bars |
| 6/4 | 1 1/2 bars |
| 8/4T | 3 notes to 4 bars |
| 4/4 | 1 bar |
| 3/4 | 3/4 bar |
| 4/4T | 3 notes to 2 bars |
| 1/2 | half note |
| 3/8 | three eighths |
| 1/2T | 3 notes to 1 bar |
| 1/4 | quarter note |
| 3/16 | three sixteenths |
| 1/4T | 3 notes to 1/2 note |
| 1/8 | eighth note |
| 3/32 | 3 1/32 |
| 1/8T | 3 notes to 1/4 note |
| 1/16 | sixteenth note |
| 3/64 | 3 sixteenth notes |
| 1/16T | 3 to 1/8 |
| 1/32 | 1/32 |
| 3/128 | 3 1/128 |
| 1/32T | 3 to 1/16 |
| 1/64 | 1/64 |
| 3/256 | 3 1/256 |
| 1/64T | 3 to 1/32 |
| 1/128 | 1/128 |

# 4. Sync B Frequencies

The second set of sync frequencies has a narrower range. It is 1/2 in the middle, like the first set. But at the slowest, it only gets to 48/4, which is the first sync set's 5th entry. At the fastest, it gets to 3/128, which is the sixth-to-last entry for the first sync set.

It's grouped into 4s: 8 units, 7 units, 6 units, and 5 units; repeating at twice or half of that depending on the direction one is going in. For example,  4/4 (which is 8/8), 7/8, 6/8, and 5/8.

The total number of these is the same as the first set of frequencies, but because there are groups of 4 instead of 3 that double and halve and the SDK wants these 2 sync sets to have the same number of entries (because of how I switch them out), the range has to be narrower. Note that you can use the fine frequency knobs to change sync frequencies to be up to 4 times as slow or fast as normal. That potentially adds 8 entries to both ends of this list (6 to both ends for the first set).

| | |
|---|---|
| 48/4 | 12 bars |
| 40/4 | 10 bars |
| 32/4 | 8 bars |
| 28/4 | 7 bars |
| 24/4 | 6 bars |
| 20/4 | 5 bars |
| 16/4 | 4 bars |
| 14/4 | 3 1/2 bars |
| 12/4 | 3 bars |
| 10/4 | 2 1/2 bars |
| 8/4 | 2 bars |
| 7/4 | |
| 6/4 | 3 half notes |
| 5/4 | |
| 4/4 | 1 bar |
| 7/8 | |
| 6/8 | 3/4 |
| 5/8 | |
| 1/2 | half note |
| 7/16 | |
| 6/16 | 3/8 |
| 5/16 | |
| 1/4 | quarter note |
| 7/32 | |
| 6/32 | 3/16 |
| 5/32 | |
| 1/8 | eighth note |
| 7/64 | |
| 6/64 | 3/32 |
| 5/64 | |
| 1/16 | sixteenth note |
| 7/128 | |
| 6/128 | 3/64 |
| 5/128 | |
| 1/32 | 1/32 |
| 7/256 | |
| 6/256 | 3/128 |

# Etc.

**Ideas and suggestions welcome!**
If you have suggestions for more curve/grid functions, waveforms, gate types, color presets, additional features and a big etc., let me know! I'm especially open to the color presets--those are easy enough to add and I was counting on trying to get some more user-requested ones in here. Function-wise, I'm also very open to suggestions. The same thing goes for most of the menus.

However, adding additional options is not going to be as easy as it should be. I ran out of custom properties but still have a few I think I can re-purpose into bitfields. :) Keep that in mind if you have suggestions for more knobs and buttons and such. I can add to existing menus easily, and I can add more on/off toggles, especially on the back panel, but adding entirely new knobs or CV in/outs, etc. is pretty much impossible unless a future SDK version raises this limit.

I'll make more devices though!

Thanks, and have fun! :)

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