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Getting Started

Thanks for choosing Voltage Modular! We're sure you'll have a blast creating amazing sounds with what we feel is the finest virtual modular synthesis system available.

If you have some experience with hardware modular synthesizers, you'll likely jump right in and get cookin', but if you're new or need information about specific functions, this is where you'll find it. This guide won't cover the functions of specific modules, but it will explain all of Voltage Modular's basic underlying functionality: preset loading and saving, adding and moving modules, the Voltage Module store, and more - essentially everything except how individual modules work.

COMPATIBILITY

Mac OS X: Voltage can run as a standalone application or an AU, VST2, VST3, or Pro Tools AAX virtual instrument. It can also run as an effects plug-in in the aforementioned formats.

Windows: Voltage can run as a standalone application or as a VST2, VST3, or Pro Tools AAX virtual instrument. It can also run as an effects plug-in in the aforementioned formats.

USER ACCOUNT/LOGGING IN

To use Voltage Modular, you'll need a user account. If you haven't yet created one, click the *Create Account* button which automatically opens the Cherry Audio website where you'll be walked through the easy-peasy process. Once a user account is set up, simply enter your email and password in the appropriate fields to start using Voltage Modular.

Voltage Modular Install and Copyright Protection

Voltage Modular's copyright protection uses an advanced encryption scheme that customizes the primary app and modules for use on *your* computer only. You'll need an active internet connection during initial installation of the primary app, modules, and sound presets, but once installed, you're free to go off the grid, eat organic spelt in a field, and power your music computer with a generator hooked to your stationary recumbent bike. (Voltage Modular is licensed for up to four computers. Users can log into their accounts to control which computers are licensed.)

Configuring Standalone Version MIDI and Audio I/O

Voltage can be used as a standalone application with or without a hardware keyboard or pad control. With its multiple note and trigger sequencers, you can make a heck of a lot of music without even plugging in a keyboard. To use a hardware keyboard or pad controller, click the gear icon to open *Settings*:

Click the *Audio* tab:

... then check the box for the appropriate USB controller in the *Active MIDI Inputs* area.

Audio inputs and outputs can also be set in this tab. Voltage will typically default to built-in system audio outputs, but clicking the pop-up window will display any other available audio hardware. The audio input can also be set here, but it's not necessary unless you intend to use Voltage's audio in jacks to process external audio (more on this in the *I/O Panel* section).

GETTING UP AND RUNNING

If you're brand new (or semi-new) to modular synthesis and just want to start making sounds, have a look at the following video. If gives a quick overview of loading presets, adding, moving, and patching modules, and more.

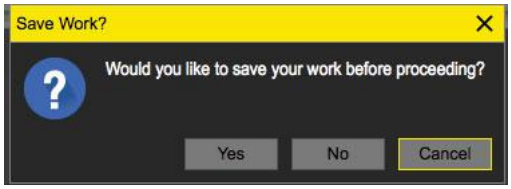
[Show Me The Way To The Section About The Toolbar]

Oh... don't ask why.

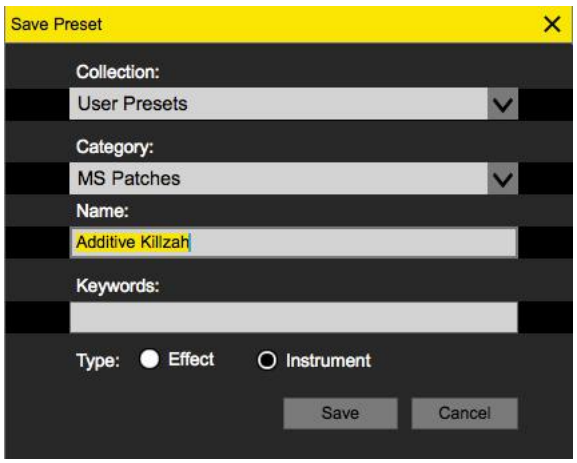
TOOLBAR

This strip at the top of Voltage's interface is where you'll load, save, and create sound presets. It also contains basic utility functions such as undo, redo, zoom level, and more. Let's go over them:

New- Opens a new blank patch preset. If an unsaved patch is currently open or you've modified an existing saved patch, a dialog will ask if you'd like to save the patch in its current state. This greatly reduces the possibility of losing a patch that you may have spent a lot of time creating.

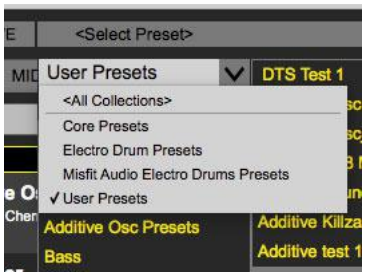


Save- Use this to save patches. There are a couple of levels of hierarchy:



- *Collection*- This is the top level of organization, and contains entire "sets" of presets. The *Core* presets are the main collection of factory presets included with Voltage. New preset collections are included with additionally purchased module sets (such as *Misfit Audio Electro Drums*), and we also include a *User Presets Collection*. However, you're free to create your own collections. To create a new collections, click in the *Collection* text field (where it says *User Presets* above) and type a name. User-created sounds can be freely saved to any collection; we like to keep 'em separated for organizational purposes.
- *Categories*- Within each *Collection* are a number of sound categories. As with collections, you're free to create as many categories as you like. To create a category, click in the *Category* text field of the *Save* dialog window (where it says *MS Patches* above) and type a new category name.
- *Patch*- A patch is an individual sound. To save a patch, simply type the name in the *Name* field and click *Save*.
- *Keywords*- You can add descriptive words such as "huge," "noisey," "poly," etc. to patches to make them appear when terms are typed in the *Search* field. Use commas to separate multiple keywords entries.
- *Type: Effect/Instrument*- Select one when saving patches. This tells Voltage Modular whether the patch is intended for use as a virtual instrument, or as an insert effect.

Browsing Patches- Patches can be browsed by clicking the <*Select Preset*> field. To select a preset collection, click in the area that says <*All Collections*> or on the downward-facing arrow next to it.



Clicking on the left-side categories will narrow down which patches are displayed.

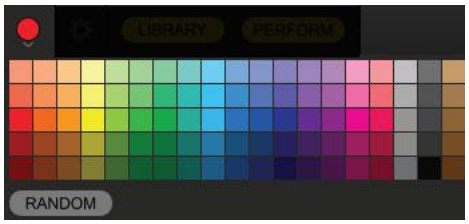
- <*All Presets*> will show presets from all collections and categories.
- <*Recent*> displays recently used presets. (surprising, right?)

Preset Step Back/Forward Arrows- These step to the previous or next preset.

Undo/Redo- Use these to undo or redo your last action. Patch a cable to the wrong place? Undo button. It remembers many steps, so if you really loused something up, keep on clickin'...

Zoom- Clicking this allows resizing of the I/O Panel, Performance Controls, and main module cabinets to accommodate various screen and window sizes. These settings will never change Voltage Modular's overall window size; this can be done by clicking and dragging any edge or corner.

Cable Transparency- Clicking the checkerboard icon displays cable transparency horizontal slider. Slide this to the left for more transparent cables, or to the right for more opaque cables.



Cable Color Select- Click this to select the global cable color, i.e. the color of any newly patched cable. Clicking *Random* will randomly choose a color for each new cable.

Special Cool Cable Color Select Feature!- The color of any existing cable can be changed by right-clicking in jack area. Right-clicking on a jack that doesn't have a cable plugged in will change the global cable color (i.e. the same as changing the color with the toolbar button).

Settings- This is where user preferences for cables, audio interfaces, user account, and more are configured. See the **Settings** section for full information.

Library- The "library" refers to the column on the left of the screen (or right depending upon the preference setting) containing the *Modules*, *Cabinets*, *MIDI*, and *Store* tabs. The *Library* button simply hides or displays the column. This is useful for maximizing the available display space for modules in a patch. Click here for more information on the Library column (or check the card catalog in the 786's at your local library).

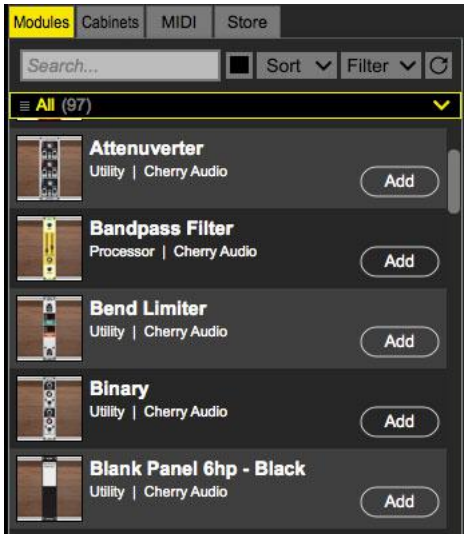
Perform- The Perform control panel contains nine knobs and four buttons; each control can be assigned to control one or more module controls. Like the Library button above, the Perform button simply hides or shows the panel to maximize the viewable cabinet workspace. **Click here** for the full lowdown on the *Perform* control panel.

Voltage Logo- Though it appears to be in-app advertising, clicking this displays "about" information, and shows the version number and current registered user ID.

Continue to Library section

LIBRARY

The “library” refers to the large column on the left of the screen (or right depending upon the preference setting) containing the *Modules*, *Cabinets*, *MIDI*, and *Store* tabs. You can hide or show the library tab by clicking the *Library* button (or using the key shortcut SHIFT+1). Let’s go over each tab:



Modules Tab

The library *Modules* tab displays all modules currently owned by the logged-in user (that’s you, bub). This is where you'll go to add new modules to patch, either by clicking *Add*, or by dragging-and-dropping to a cabinet.

For more information about the *Modules* library tab, see **Working With Modules**.

Cabinets Tab

A “cabinet” refers to a single horizontal row of modules. In contrast to presets, which save and load *all* modules and cabinets as a single entity, saving and loading cabinets allows mixing and matching of rows of modules, aka cabinets. This allows subsections of larger presets to be moved freely between patches. Cabinets also offer a time-saving way to load and save templates for sound creation. When the *Cabinets* tab is selected, all saved cabinets are displayed in the library column.

For more information about the *Cabinets* library tab, see **Working With Cabinets**.

MIDI Tab

This tab displays information about how hardware slider/knob, button, and pad MIDI controllers are assigned to on-screen controls. It's also where you can see and configure DAW automation and Performance Controls Panel assignments.

For more information about the *MIDI* library tab, see **MIDI Continuous Controller Assignment**.

Store Tab

The *Store* library tab lets you purchase modules and sounds from directly within Voltage Modular. Purchased modules and sounds are automatically downloaded and installed for use in Voltage Modular. For information about using the *Store* library tab, see **The Voltage Modular Store**.

Continue to I/O Panel section

I/O PANEL

The input/output, aka I/O Panel, is Voltage's "mission control." Here you'll route audio signals, virtual control voltages, and MIDI to and from your computer, audio hardware, and DAW software. Let's go over its jacks and controls:

CV Outs

All output jacks in this area output a virtual control voltage or "CV" just like a hardware modular synthesizer. These conform to the 1V/octave standard used in most analog synthesizers and can only transmit a single signal at any time.

Oct- Transposes the pitch of the outgoing pitch control voltage in octaves.The LEDs to the right display transposition interval.

Pitch- This is the pitch control voltage output. This usually is patched to an oscillator keyboard CV input, allowing oscillator pitch to track the keyboard in chromatic half-steps.

Gate- Outputs a constant 5V gate signal for as long as a key is pressed. This typically is patched to an envelope generator or voltage-controlled amplifier to control amplitude.

Trig- A trigger signal is much like a gate signal, but instead of staying high while a key is held, it briefly outputs 5V then returns to 0V (roughly 0.02 milliseconds). It's often used to turn something on or off, or trigger a "one-shot" drum sound.

Single/Multi- Defines how the *Gate* and *Trigger* voltages behave when a key is struck while another key is held. In *Single* mode, a new gate and trigger voltage will not be sent until all previously held keys are released. In *Multi* mode, new gate and trigger voltages are sent any time a new key is played. (Because the gate voltage is already "high," it will very briefly dip to zero volts when a new key is struck in order to let the module know to retrigger.)

Vel- Outputs a control voltage between 0V and 5V, proportionate to how hard the key (or pad) is struck when using a velocity-sensitive controller.

Aftertouch- Outputs a control voltage between 0V and 5V, proportionate to ongoing key pressure when using a controller that transmits aftertouch.

Sus- Outputs a 5V control voltage when a MIDI sustain pedal message greater than 64 is received.

Bend- Outputs a control voltage between -5V and 5V, proportionate to pitch wheel movements. No voltage is transmitted at nominal position.

Mod Wheel- Outputs a control voltage between 0V and 5V, proportionate to mod wheel position.

Poly CV Outs

These are special type of jack that can transmit up to sixteen separate "lanes" of CV's, for use with special poly modules from Cherry Audio, PSP, and others. They make creating and playing poly patches a cinch!

They make use of a special "poly" cable, identifiable by its slight larger "D-shaped" connector; **poly cables can only be patched to an appropriate poly jack**. In addition to poly oscillators, filters, amps, mixers, etc., Voltage Modular includes a number of utility modules for splitting and converting poly cable signals to standard "mono" CV's for tremendous flexibility (type "poly" in the Library search field to see them).

Poly Pitch- Pitch control voltage outputs.

Poly Gate- Outputs 5V gate signals for as long as keys are pressed.

Poly Vel- Outputs control voltages between 0V and 5V, proportionate to how hard the key (or pad) is struck when using a velocity-sensitive controller.

Number of Voices- Globally sets the maximum number of poly voices, up to 16 voices. This can be helpful if you're using a computer with limited CPU.

MIDI Jack

Unlike most analog modular synthesizers, Voltage's virtual MIDI jack transmits polyphonic pitch, note on-off, and MIDI CC data from external keyboard controllers and other devices. When used with various MIDI-compatible modules, this allows for polyphonic patches, arpeggios and more. Voltage MIDI cables are a little fatter than "standard" patch cables and can only be routed to modules with MIDI jacks, including the Poly Oscillator, Arpeggiator, Poly CV Converter, and a number of MIDI utility modules. The LED beside the jack indicates when MIDI data is being received from a controller.

Transport

Sorry, this isn't some nifty Star Trek doodad, but it's still pretty cool. The transport section carries 5V trigger CVs from your DAW host software that simplify incorporating Voltage into projects (especially where timing is concerned).

Play- Transmits a 5V trigger when play mode is initiated in DAW host software.

Stop- Transmits a 5V trigger when stop mode is initiated in DAW host software.

Sync Out- Transmits a constant 96-pulse-per-quarter-note (PPQN) signal used to synchronize sequencers and other modules to DAW host tempo. These are intended for use with Voltage's *Sync Divider* module, which essentially "slow down" the super-fast sync signal to musically relevant note-values. (Look out for more sync signal-compatible modules in the future.)

There are a couple of important points to understand about sync signals:

- **Sync signals are dumb:** It's important to understand that sync signals have no idea where the "one" is, or whether your DAW is playing or stopped. If a sync signal is routed to the *Sync Divider* module and its clock is sent to a sequencer, the sequencer will play at the same tempo as the host DAW project, but "shifted" in time by some random (and usually undesirable) amount.

- **Use the *Reset* jack for perfect timing:** You'll notice that the Sync Divider, all sequencer modules, Eight To One Switch, and One To Eight Switch all have *Reset* input jacks. Routing the *Transport* section *Play* CV out to these resets these modules to "one" the instant the DAW play button is pressed, forcing everything to play in time. (Make sure the DAW play marker is starting on an even beat when you hit play.

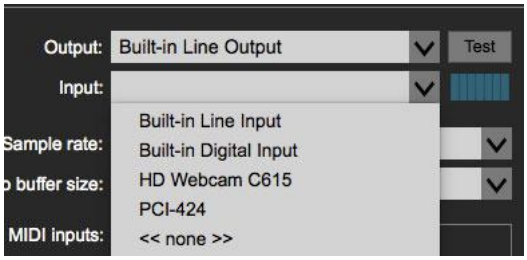
Play Gate- Outputs a constant 5V signal any time the DAW host is in play mode. This isn't necessary to play sequenced patches in sync, but it can be handy for more esoteric applications, such as gating voltage-controlled amplifiers during playback.

Audio In From Host

These allow audio to be routed in from either a host DAW when using the Voltage plug-in version (via the plug-in's sidechain inputs) or via the computer's onboard audio inputs when using the Voltage standalone edition. The *Audio In* sources can be set in *Settings* (gear icon at the top of the window) when using the standalone version.

... then clicking the *Audio* tab

and selecting the *Input* pop-up window. Input level can be set using the horizontal meter next to the pop-up, or with the input meters by the jacks in the I/O Panel.



The *Audio Ins From Host* are useful when using Voltage as an insert effect in a DAW (check out the *Insert & Bus Effects* category in the presets). They can also be used as carrier and modulator sources with Voltages wickedly cool Vocoder module.

Main Outs To Host

This is Voltage's master output section.

Volume Knob- This is Voltage Modular's master volume. Note that like the *CV Octave* and *Single/Multi* settings, its setting is stored with patches.

Limiter- Clicking this engages a transparent-sounding audio level limiter across the final output bus. Its intention is to prevent blowing your head off with loud or obnoxious patches. Safety first at Cherry Audio!

Main Outs To Host Jacks- The main out jacks that the final module of a patch is plugged into- the final module **must** be plugged into these (or the neighboring *Aux Outs*) in order to hear sound ("Hello, tech support? It doesn't make any noise...").

- **Are They Inputs or Outputs?** The concept can be a little confusing: these jacks are routed to your computer's audio hardware. Technically, they're inputs, because you're plugging an output of a module into them, but since they're internally attached to your computer's audio hardware, we call them "outputs." (Incidentally, we had some "spirited discourses" on this topic and how to name them in I/O Panel. Just plug the final module in here and everything will be fine, we promise.)

Aux Outs To Host Jacks- These work exactly like the *Main Outs To Host* jacks explained in the preceding paragraph, but they're routed to your audio hardware's "extra" outputs. Depending on the audio interface used, they can potentially be custom routed within a DAW's virtual mixer or set up to output to additional physical outputs.

Continue to MIDI Tab section

MIDI TAB

This is command central for external MIDI controller, DAW automation, and Voltage Modular's *Perform* control panel assignments. Here you'll be able to see information about all currently assigned controllers and adjust control ranges. Let's go over the *MIDI* tab functions and displays.

MIDI Learn- This is almost exactly the same as enabling MIDI learn mode by right-clicking a control. Click the *MIDI Learn* button to enter learn mode (all controls turn purple). Unlike right-clicking on specific knobs where Voltage Modular automatically exits controller assignment mode, clicking the *MIDI Learn* knob "stays on" to enable assignment of multiple hardware controls.

To assign multiple controls, click *MIDI Learn*, click an on-screen control, move the desired hardware knob or slider, then continue clicking and assigning on-screen controllers until all desired controls are assigned.

When you're done assigning controllers, click *Stop Learning*. (Just remember that when we stop learning, we stop growing... oh, forget it...)

MIDI Tab Columns

Name- Displays the name of the module parameter being controller.

Type- There are three possible types of controller automation in Voltage Modular:

- *MIDI Continuous Controller (CC)*- The standard 128 MIDI controller numbers as defined in the MIDI spec. More specifically, these are the controllers transmitted by hardware knob, slider, or pad controllers. MIDI CC's can be used to control parameters in real-time or recorded and played back within DAW software.
- *Parameter*- Up to 128 slots used with DAW parameter automation. Compared to MIDI CC controllers, DAW automation typically has finer control resolution, easy on-screen drawing and editing of controller movements, and allows controller movements to be directly written by moving Voltage Modular's on-screen module controls.
- *Perform Controls Panel*- This refers to the panel directly beneath the I/O Panel containing nine knobs and four buttons, which are assignable to any module controls in a patch. Each knob or switch can control can control an unlimited number of module parameters over different ranges (via the *Min* and *Max* controls), and external hardware controllers can be assigned to the *Perform* knobs and buttons. (See the **Perform Controls Panel** section for the full lowdown.)

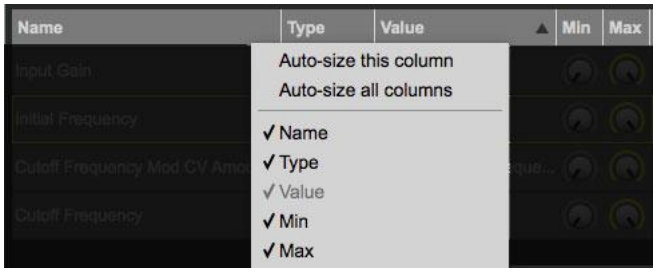
Value- Displays the specific automation controller. In the case of a MIDI CC, this would be the MIDI CC controller number. For DAW automation, this is the automation slot # (1-128) and associated module control parameter. For the *Perform* controls panel, this displays the knob or button number.

Min- Sets a limit on the lowest value any automation control can set a mapped controller to. This actually recalibrates the range of the automation controller to the remaining parameter range.

Max- Sets a limit on the highest value any automation control can set a mapped controller to. This actually recalibrates the range of the automation controller to the remaining parameter range.

- ***Super Tricky Min-Max Inversion***- Not only can parameter ranges be limited via the the *Min* and *Max* knobs, mapped control destinations can be completely inverted by setting the *Min* knob all the way up and the *Max* knob all the way down (or anywhere in between).

MIDI Tab Column Configuration Right-Click Menus



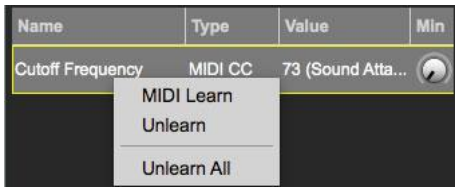
Right-clicking anywhere in the top row displays the column configuration menu.

Auto-size This Column- Automatically resizes so that all text in this column is visible.

Auto-size This Column- Automatically resizes all columns simultaneously so that all text visible.

Column View Filters- Clicking any of these will hide or show the respective columns.

MIDI Tab Parameters Right-Click



Right-Clicking on an assigned parameter opens the menu above.

MIDI Learn- This is used to change the controller assigned to a particular parameter. This only works if you're changing to a MIDI CC controller.

Unlearn- Deletes the selected automation parameter.

Unlearn All- Deletes all controller assignments for the patch. Voltage Modular will display a warning dialog prior to deletion in order to thwart potential disasters

Continue to Creating A Basic Patch

CREATING A BASIC PATCH

Phew, now that we have all that menu and settings stuff out of the way, let's get to the part everyone's been waiting for: creating wicked modular synth sounds with a mess o' patch cables! Here we'll walk through creating a basic two-oscillator subtractive synthesizer patch:

Cabinets operate in Voltage Modular much as they do in the hardware world, except that you'll never need to worry about power routing or requirements, and that the size and number of cabinets is only limited by computer screen real estate (or how much you're willing to scroll).

Upon launch, Voltage Modular will display an "empty" screen. To create an empty cabinet, right-click anywhere in the empty gray area and choose *Add Cabinet*, or add a module by dragging it to the gray area or clicking the module's *Add* button.

Here we've added an empty cabinet. Note that the cabinet's edge and "back panel" appearance will change dependent upon the *Cabinet Theme* selected in *Settings Gear icon>Interface>Cabinet Theme*. In this screenshot we've chosen the roadworthy-yet-understated *Vinyl* theme.

Here we've dragged in an Oscillator module. You could choose the *All* category and scroll to locate the Oscillator module, but it's much faster to type the first few letters of the desired module in the *Search* text field. Here we've typed "osc" which filters the display to only show modules with "osc" in their name. Just like finding stuff on Netflix, only noisier.

To patch a cable, click on a jack, drag it to the desired destination jack, and release the mouse button.

Inputs vs. Outputs

An important concept to understand is that all jacks are exclusively an input or an output (unlike a hardware modular synth, where some jacks can be used as inputs *or* outputs). When a jack is clicked to patch a cable in Voltage Modular, jacks not available as destinations are grayed out. For example, if you're patching a cable from an output jack, all other output jacks are temporarily grayed out. The same applies if you're patching a cable from an input jack; all other input jacks are grayed out. Now back to our previously scheduled programming…

In the screenshot above, the *Pitch CV* output is being patched, causing all of the oscillator output jacks to become grayed out, while all of the oscillator inputs are potential destinations.

Here we've added two cables for a super basic patch. The green cable routes the keyboard pitch control voltage out (we'll refer to control voltages as "CVs" from here on out) to the oscillator's keyboard CV in to allow keyboard control of pitch. The red cable routes the oscillator's sawtooth wave output to the main audio outputs. You'll notice that the sound plays continuously, but we'll fix that soon.

Here we've fleshed out our basic patch with the addition of a Filter, and Amplifier, and two Envelope Generators (one to control the filter cutoff, and another to control amplitude).

Now that we've covered how to set up a basic patch, we'll go over some (slightly) more advanced things you should know about cabinets, modules, and cables.

Continue to Working With Cables and Jacks

WORKING WITH CABLES AND JACKS

Patching Cables

Patching a cable is simple- click on a jack, drag it to the desired destination jack and release the mouse button, **but there's one very important thing to be aware of:**

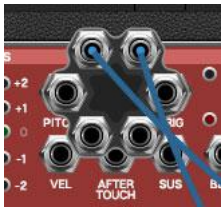
Unlike a hardware modular synth, where some jacks can be used as inputs *or* outputs, **all Voltage Modular jacks are exclusively an input or an output.** To help clarify this, when a jack is clicked and held to patch a cable, jacks *not* available as destinations are grayed out. For example, if you're patching a cable from an output jack, all other *output* jacks are temporarily grayed out. The same applies if you're patching a cable from an input jack- all other *input* jacks are grayed out.

In the screenshot above, the *Pitch CV* output is being patched, causing all of the oscillator output jacks to become grayed out, while all of the oscillator inputs are potential destinations.

Disconnecting Cables

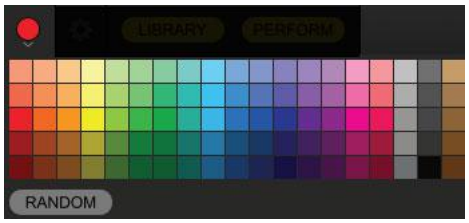
Cables can be disconnected by grabbing one end of a jack and dragging it to any area that isn't a jack, or by right-clicking on a jack and selecting *Disconnect Cables*.

The Built-In Six-Way Mult (Hiding Beneath Every Jack)



If you look closely at the I/O Panel *Gate* CV out, you can see we've routed two cables from this jack to control both envelope generators. Single-clicking on any Voltage Modular input or output jack reveals a six-way multiple jack (aka, a "mult"), which is super convenient for routing (or mixing) multiple sources. The mult will stay visible until a cable is routed, at which point it disappears. If you need more than six jacks for any connection, you can always use a dedicated Multiple module (or link together as many Multiple modules as you like), but using the built-in six-way mults will save a whole lot of patching hassle.

Choosing Cable Colors



There are a couple of ways to select cable colors. The most obvious way is to click the colored dot in the top menu bar to reveal the color picker palette and select a global color. By "global," this means all newly patched cables will be the chosen color (or a random color, if *Random* is selected). Existing cables are not affected.

To change the color of an existing patched cable, right-click on one of the jacks it's connected to, then click a new color. This changes *only* that cable, and won't affect the global cable color in the top menu bar.

- **Super Handy "Pre-Patching" Cable Color Selection**- Right-clicking a jack that doesn't have a cable plugged in opens the color palette and changes the global color; the same as clicking the color selector in the top menu bar. This is convenient for specifying a cable color right before patching a new cable.

Rapidly Routing A Cable To Multiple Destinations

This one's not so obvious, but it's really handy. To patch cables from a single jack to multiple destinations, press and hold the [SHIFT] key, click the source jack, then click up to six destination jacks as desired and release the [SHIFT] key when you're done. This works with input or output jacks, and is particularly useful for patching pitch and gate CV's from the I/O panel to multiple oscillators or envelope generators.

Virtual MIDI Cables

Voltage Modular's virtual MIDI cables behave much like standard cables, but instead of carrying a single audio or control voltage signal, they carry all the same note and control as a traditional MIDI cable. This lets Voltage Modular transmit and receive polyphonic note and controller data, and in conjunction with the Poly Oscillator and other poly-oriented modules, greatly simplifies creating polyphonic patches.

You'll notice that virtual MIDI cables are a bit fatter than standard cables; this is done to make them easy to recognize on-screen (and to fit all that extra data). Virtual MIDI jacks also contain the previously discussed built-in six-way mult, and if that's not enough, there's a MIDI Multiple module as well. There are also MIDI input, output, drum trigger modules and more for transmitting and receiving MIDI data with external instruments and other useful functions.

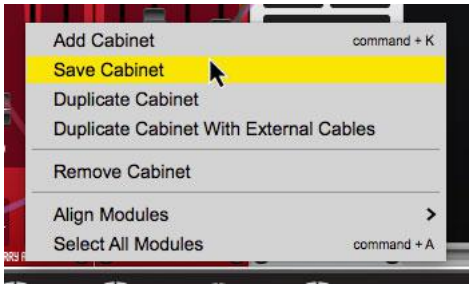
Continue to Working With Cabinets

WORKING WITH CABINETS

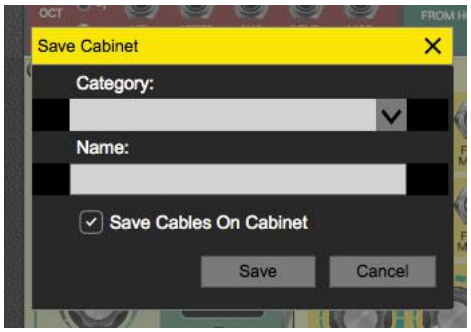
A "cabinet" refers to a horizontal row of modules. Cabinets have no width limitations; you're free to add as many modules as you like. If the number of viewable modules exceeds the width of the Voltage Modular window, a scroll bar appears at the bottom of the window. Optimally, you'll want to see as much of a patch on-screen as possible, so it makes sense to organize modules into two more cabinets, stacked vertically. (It also makes sense to "borrow" your rich brother's 120" flat-panel TV and use that as a computer display, but you didn't hear that from us.)

The Cabinets Library Tab

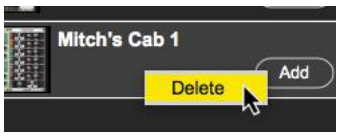
Loading Cabinets- Cabinets can be added to the current preset by clicking the *Add* button, dragging to the module area, or by double-clicking. Newly added cabinets always appear beneath existing cabinets, but once a cabinet is added, modules can be freely dragged between cabinets.



Saving Cabinets- To save a cab, right-click either on the left-edge of a cabinet, in open area of the cab (i.e., an open space without a module), or on one of the "aluminum" rails and select *Save Cabinet*.



Choose an existing category by clicking the downward arrow, or type in the text field to create a custom category, then type a name in the *Name* field. The *Save With Cables* box is on by default and will save all cable routings. Disabling it will save the module layout only, without cables.



Deleting Cabinets- To permanently delete a cabinet from the library, right-click it in the library tab and click *Delete*. Be careful with this (though you can hit the *Undo* button).

Like the *Modules* tab, cabinets can be saved in user-named categories, but unlike modules, which are "pre-assigned" to one of Voltage Modular's five module categories, there are no limitations on the naming convention or number of cabinet categories.

Search- This super-handy field lets you search for modules by typing a few letters of the module name. For example, typing "LFO" would display the LFO and MiniLFO modules. The search field can be initialized by clicking the *X* icon.

Graphic/List View Select- This little guy is easy to miss, but clicking it toggles between graphic+name or name-only in the module list.

Sort- This drop-down menu allows sorting of the module list by name, category (more on this below), date acquired (as in, "show me my new stuff!"), or the company that made the module.

Filter- Allows filtering of which modules are displayed using descriptive headings.

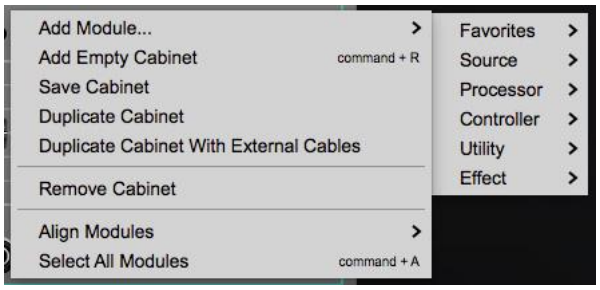
- *None*- Shows all currently owned modules with no separate headings.
- *Categories*- Divides up modules by "stock" and user-created categories.
- *Name*- Sorts categories alphabetically.

Creating Cabinets

The easiest way to create cabinet is to drag a module from the library or an existing cabinet onto the gray area next to the library. Cabinets can also be added by right-clicking anywhere in the empty gray area and clicking *Add Cabinet*.

Cabinet Right-Click Menu

The contextual menus that appear when you right-click in a "blank" (i.e., no modules) area of the cabinet.



Add Module...- Allows modules to be added quickly without using the *Library* tab. The submenu displays Favorites, then the five module type categories.

Add Empty Cabinet- Adds a new blank cabinet. The new cabinet will appear beneath if there are any existing cabinets.

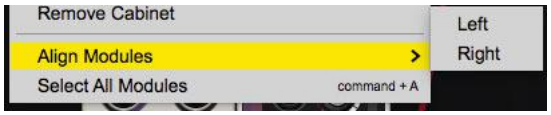
Save Cabinet- Saves the cabinet that's being right-clicked to the library *Cabinet* tab.

Duplicate Cabinet- Creates a copy of the cabinet with all modules directly beneath. All cables *within the cabinet only* remain intact.

Duplicate Cabinet With External Cables- Creates a copy of the cabinet with all modules directly beneath. All cables will be intact, *including cables patched to destinations not within the cabinet*. (e.g., I/O panel connections).

- ***Helpful Hint***- The *Duplicate Cabinet* commands are particularly useful when creating polyphonic patches using the Poly CV Converter module - patch up a one "voice" of synth, use *Duplicate Cabinet* to copy the single synth voice multiple times, then patch the appropriate pitch and gate CV's from the Poly CV Converter.

Remove Cabinet- Clears the entire cabinet and its cables. Be careful with this one, as it's easy to mess up patches (you can always hit the *Undo* button).



Align Modules- This is a quick shortcut for "pulling together" modules and eliminating gaps between them. *Align Modules>Left* pulls all modules in the cabinet to the left. If there are no modules "hidden" beyond the right border of the Voltage Modular window, *Align Modules>Right* pulls all modules in the cabinet to the right window border. If there are modules beyond the right window border, *Align Modules>Right* aligns all modules in the cabinet to edge of the right-most module.

Select All Modules- Highlights all modules in the cabinet. You'd typically use this to move or delete all modules in a cabinet simultaneously.

Moving Cabinets

Cabinets can be vertically relocated. You can swap positions of multiple cabinets, or move cabinets above or below the I/O Panel or Performance Controls panel. To move a cabinet, click and drag on the left edge of the cabinet frame. It can be little hard to tell where you're supposed to grab, so we've highlighted the "grab" area in red In the screenshot below (it isn't actually red in Voltage Modular). This works exactly the same for moving the I/O Panel and Performance Controls pane.

Continue to Working With Modules

WORKING WITH MODULES

Here we'll cover the nuts and bolts of working with modules (but unlike a hardware modular synth, no actual nuts or bolts are involved). Before we discuss the big library tab you see on-screen, we'll take a short detour to discuss module categories.

Module Type Categories

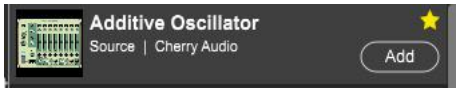
All modules are assigned to one of the following categories when programmed:

- ***Source***- oscillators, noise generators, anything that makes a sound.
- ***Processors***- filters, waveshapers, EQ's, things that alter sound.
- ***Controller***- envelope generators, sequencers, keyboards.
- ***Utility***- mixers, gates, multipliers, amplifiers, etc.
- ***Effect***- traditional audio effects such as reverb, delay, chorus, distortion.

These categories affect how Voltage Modular handles processing internally. Modules may be sorted according to their category (see all the sort criteria below).

The Modules Library Tab

The library *Modules* tab displays displays all modules currently owned by the logged-in user (aka, you). **This is where you'll go to add new modules to patch, either by clicking *Add*, or by dragging-and-dropping to a cabinet.**



Each module in the library displays the following:

- Module Name
- Thumbnail Image
- Category
- Manufacturer
- Add button
- Favorite Star- The star above the *Add* button turns yellow when a module is favorited. The *Favorites* tag can be enabled or disabled by clicking on the star and can be used as a sort criteria (see following section for more info).

Search, Sort, and Filtering

These are the fields and buttons above the module list.

Search- This super-handy field lets you search for modules by typing a few letters of the module name. For example, typing "LFO" would display the LFO and MiniLFO modules. The search field can be initialized by clicking the *X* icon.

Graphic/List View Select- This little guy is easy to miss, but clicking it toggles between graphic+name or name-only in the module list.

Sort- This drop-down menu allows sorting of the module list by name, category (more on this below), date acquired (as in, "show me my new stuff!"), or the company that made the module.

- *Name*- Sorts all modules alphabetically from A-Z or Z-A.
- *Category*- Sorts categories alphabetically.
- *Date Acquired*- Signal modules according to date of purchase.
- *Manufacturer*- Sorts alphabetically by the company that made the module.

Filter- Allows filtering of which modules are displayed using descriptive headings.

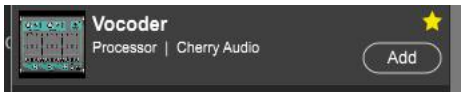
- *None*- Shows all currently owned modules with no separate headings.
- *Category*- Divides up modules by their categories. This is the default filter setting.
- *Manufacturer*- Sorts alphabetically by the company that made the module.
- *Name*- Sorts modules alphabetically.

Module view filters can also be selected by clicking on individual categories.

Refresh- Voltage Modular automatically downloads new modules or presets each time it's launched. The *Refresh* button checks for new content while Voltage Modular is running; this is particularly useful for developers who are frequently revising modules.

Module Library Right-Click Functions

Add To Cabinet- This adds a module to a cabinet (though it's usually easier to drag and drop the module).



Favorite- Adds a module to the *Favorites* category.

Info- Contains general information, reviews, etc. For some modules, this also contains operational information.

Working With Modules In Cabinets

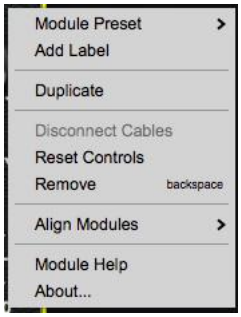
Clicking any non-control area (i.e., jack, knob, switch, etc.) of a module will select it. Selected modules will be outlined in yellow. Modules can also be selected by clicking and dragging a square over them. Depending upon cable behavior preferences, cables may show differently from unselected modules. Selected modules are affected by move, delete, and other commands.

To select multiple modules, [CTRL]-click modules in Windows or [CMD] (Apple key)-click on Macs, or simply drag a rectangle (starting in an area with no modules) over multiple modules. Multiple modules in different cabinets can be simultaneously selected.

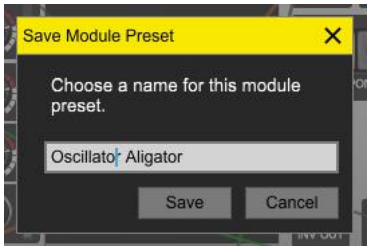
Moving Modules

To move a module (or modules), click and drag at the very top of the module. The cursor will change to a hand, and a shaded gray rectangle appears in the top area. Neighboring modules will magically scoot out of the way, and all cable connections stay intact. Groups of modules can also be highlighted and moved "en masse.

Module Right-Click Commands



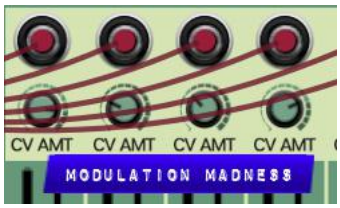
Module Preset- This allows loading and saving all parameter settings *for a single module.* This allows recall of module settings for future use in any patch.



To save the module settings, choose *Module Preset* from the right-clock menu, then click *Save As...,* enter a name and click *Save* (or click *Cancel* if you're gonna chicken out, you big chicken).

Modules with at least one saved preset also have a *Manage Settings* right-click command. Selecting this opens the folder containing the presets for the module. This is useful for deleting or renaming module presets.

Saved module presets will appear in the menu beneath the *Save As* and *Manage* commands.



Add Label- Creates an editable text label that can be freely positioned within the boundaries of the module. The label will be in edit mode upon creation; in this way you'll be able to immediately type the desired text. The text can be edited at any time either by right-clicking and choosing *Edit*, or by double-clicking on the text.

The label can be moved by simply dragging with the mouse. Right-click on the label to change the font or background color, or delete the label. The *Remove All* command will delete all labels for that module (but not for other modules).

Duplicate- Creates a copy of the module in the next position to the right wide enough to accommodate the module. No cables will be attached to the copy. Modules can also be duplicated by ALT-dragging (Windows) or OPTION-dragging (on Mac).

Disconnect Cables- Disconnects all cables currently connected to the module.

Reset Controls- Initializes all of the selected module's control settings.

Remove- Deletes the module. Modules can also be deleted by highlighting them and hitting the DELETE key in Windows or the backspace key on Mac (the little DEL key in Windows and the big one above the backslash key on Mac).

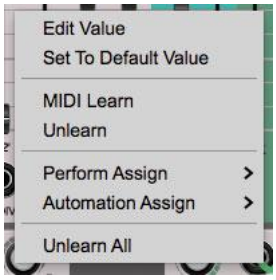
Align Modules- This is a quick shortcut for "pulling together" modules and eliminating gaps between them. *Align Modules>Left* pulls all modules in the cabinet to the left. If there are no modules “hidden” beyond the right border of the Voltage Modular window, *Align Modules>Right* pulls all modules in the cabinet to the right window border. If there are modules beyond the right window border, *Align Modules>Right* aligns all modules in the cabinet to edge of the right-most module.

Module Help- Links to information and module documentation on the Cherry Audio website.

About- Displays revision and general information about the module. For third-party modules, this box often contains important information about how controls work, so have a look in here if you remember!

Module Control Right-Click Commands

Right-clicking any knob, slider, switch, or button reveals a standard right-click menu. Here’s what they do.



Edit Value- Opens a field where exact values can be entered.

Set To Default Value- Returns any control (i.e. knobs, sliders, buttons, switches, etc.) to their default value. It will be grayed out if the control is already at its default setting.

MIDI Learn/Unlearn- These are used for assigning external MIDI hardware controls. Check out the Hardware MIDI Controller Assignment for more information.

Automation Assign- Assigns controllers to DAW automation. Please see the **DAW Automation** section for more information.

Unlearn All- Cancels all MIDI CC, DAW, and *Perform* control assignments.

Continue to MIDI Continuous Controller Setup

MIDI CONTINUOUS CONTROLLER SETUP

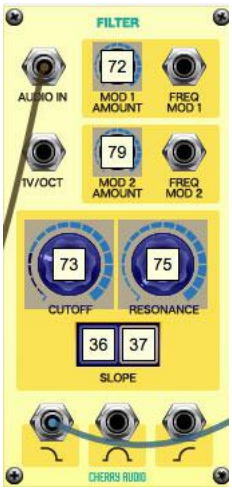
Voltage Modular really comes to life when hardware MIDI knob, slider, or pad controllers are assigned to controls. Learning controller assignments is fast and easy, so let's delve in.

Assigning An External Hardware Control

In this example, we'll assign a hardware slider control to a filter module's cutoff frequency.

Start by right-clicking the *Cutoff* knob, and select *MIDI Learn*.

All of Voltage Modular's controls turn purple, indicating that MIDI learn mode is enabled. Now move the hardware control you'd like to assign. You should see the cutoff knob move as the external knob or slider is moved, and assign mode will automatically be disabled. This is the basic procedure for assigning hardware controllers.



When assigning controllers, you'll see numbers inside squares on the module controls. These indicate the MIDI continuous controller number of the assigned hardware control (these are also displayed in the *MIDI* library tab).

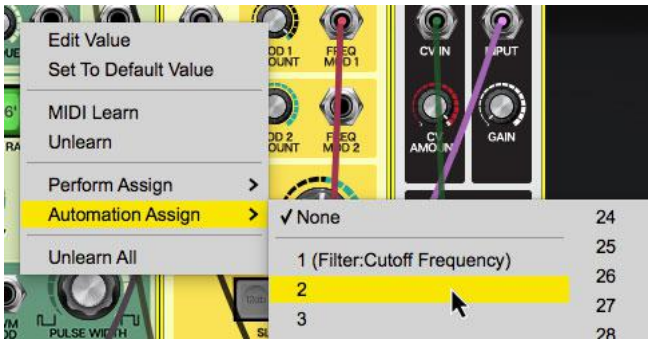
Once a MIDI CC controller has been assigned, in addition to real-time control of a Voltage Module parameter, you'll also be able to record and play back controller data from a DAW.

Continue to DAW Automation

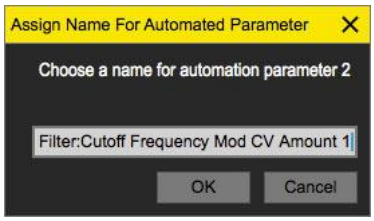
DAW AUTOMATION

Module controls can also be automated using DAW software automation. Voltage Modular allows a maximum of 128 parameters to be automated.

Assigning Parameters To DAW Automation



To assign a parameter, right-click on the module control, select *Automation Assign*, and choose any automation "slot." It's not important which number you choose, as long as it doesn't already have a parameter assigned. In the screenshot above, slot #1 already has an assigned parameter, so we'll choose slot #2.



The default automation parameter name (shown in your DAW) will be the module name followed by the name of the automated parameter, but custom names can be typed in this field if desired.

The automation parameter can now be seen in the *MIDI* tab, and it will also appear as an available instrument automation parameter in your DAW software.

Continue to Perform Controls Panel

PERFORM CONTROLS PANEL

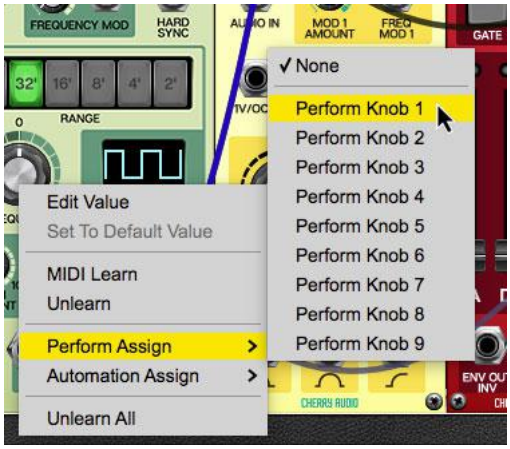
The *Perform* controls panel contains nine knobs and four buttons that are freely assignable to control almost any controls within a module. What makes them special is that each one can be matrixed to simultaneously control an unlimited number of module parameters. In conjunction with the *MIDI* tab's individual *Min* and *Max* controls, a single knob or button can be configured to dramatically alter a patch, with great accuracy. If you're wondering why we choose nine knobs (as opposed to an even number), this was done to match the sliders on many hardware MIDI controllers (which, in turn, often feature nine sliders to mirror the nine drawbars of a Hammond-style tonewheel organ).

Besides being really powerful, the *Perform* controls panel is super simple to set up and use, so let's delve in:

Hide/Show Perform Controls Panel

Not its most exciting feature, but the *Perform* controls panel can hidden from view or displayed by clicking the big yellow *Perform* button at the top of the Voltage Modular window. We included this option in case you need more room for modules and aren't currently making use of the fabulous *Perform* controls panel.

Assigning Control Knobs To The Perform Controls Panel



To assign a module control to a *Perform* controls panel knob, right-click on the module control, select *Perform Assign*, and choose a *Perform Knob*. Once the control is assigned, the parameter will appear beneath the appropriate knob.

The perform knob or button can be renamed by double-clicking the name, typing a new name, and hitting ENTER or clicking the mouse- this is especially if the knob is configured to control more than one parameter concurrently.

To control more than one module parameter with a single *Perform* control, right-click on additional module controls and simply assign the same perform panel knob or button. The parameter shown next to the knob will update to show the most recent assignment, but all the module controls it's assigned to can be easily seen in the *MIDI* library tab.

As mentioned, the *Min* and *Max* controls can be used to fine tune the control range for each module parameter- be sure to take some time and experiment with this, it's really fun and powerful.

- ***Using Perform Control Knobs and Automation With Stepped Module Controls***- Note that modules with stepped knob "switch" controls (such as the Sync Divider, Random Task, and the Additive Oscillator) work great with automation and/or Perform Control knobs.

Assigning Control Buttons To The Perform Controls Panel

These work much the same as the Perform Control knobs, but are (obviously) intended for assignment to module button controls. They are momentary in nature (i.e. they send a brief on or off message when clicked). In the screenshot above, two Perform buttons are configured to control the two *Slope* toggle buttons of the Filter module.

Perform Controls Right-Click Menu

Edit Value- Opens a field where exact values can be entered.

Set To Default Value- Returns knobs controls to their default value. It will be grayed out if the control is already at its default setting.

MIDI Learn/Unlearn- MIDI CC controls can be assigned to *Perform* controls, allowing (amongst other things) real-time manipulation of multiple module parameters.

Automation Assign- Assigns DAW automation slots to Perform controls. Please see the DAW Automation section for more information.

Unlearn All- Cancels all MIDI CC, DAW, and *Perform* control assignments.

Move It All Around

Don't forget that, like the I/O Panel and cabinets, the *Perform* controls panel can be moved vertically by grabbing and dragging at the left side of its cabinet (highlighted in red above.. it doesn't actually turn red, we just did that in Photoshop because we're your pals).

Continue to Settings

SETTINGS

Here's where you'll configure all the under-the-hood stuff such as cable behavior (oh behave!), user-interface preferences, account settings, and audio and MIDI settings.

GENERAL

Undo, user log file settings, and more. Wee!

- *Add Undo For Module Control Changes With The Mouse*- Enabling this allows undo of knob/slider/button adjustments to modules. You'll probably want to leave this on if you want the ability to undo all aspects of patch editing and programming.
- *Load Last Preset On Startup (Standalone Only)*- Automatically loads the last preset used when Voltage Modular standalone version is started.
- *Create A Log File For Usage*- This creates a text doc of all of Voltage Modular's internal and routines during use. It is mainly intended for those developing custom modulars using our *Module Designer* app. Clicking *Show Log Folder* opens the folder containing Voltage Modular log file docs. It does not display a photo of a wooden log.
- *Preset Folder*- Displays the current location of Voltage Modular's sound presets. This can be changed by clicking and typing in the field.
  - *Browse*... - Displays the current location of preset folder in the file manager.
  - *Set Default*- Sets the current displayed *Preset Folder* path as the default location
- *Clear Cache Files*- Deletes all log files, temporary sounds, and the image cache.
- *Delete Module Files*- Deletes all modules. This is here in case a module becomes corrupt; you won't permanently lose anything, because Voltage Modular will "know" your modules have been deleted and automatically re-download all purchased modules. That said, it might take a bit, so don't delete module files five minutes before you're gonna hit the stage.

CPU

These settings define how Voltage Modular utilizes your computer's processor hardware.

- *Use Multiple Threads For Mixing*- On a fast computer with multiple cores, this feature can improve mixing performance considerably, but it will also use more CPU. On a slow computer, this feature can potentially slow down mixing and cause degraded performance. The number of mix threads used can be set in the dialog. This option is off by default, so definitely enable it if you have a honkin' fast multi-processor computer.
- *Use OpenGL Hardware Acceleration*- This allows improved graphics performance if your graphics card supports it. If you're not sure, we recommend doing some research on your graphics card (or just try both ways to see what performs better).

INTERFACE

Here's where you can customize Voltage Modular's user interface settings.

- *Reset To Default Window Size*- Resets the Voltage Modular workspace to 1280x720 pixels. Use this to reset the window size if Voltage Modular's workspace somehow becomes too large for your display and can't be resized.
- *Minimum Cabinet Width*- This sets the narrowest you'll be able to size Voltage Modular when resizing by dragging the edges of the window.
- *Cabinet Theme*- These are various "skins" for the outside and inside of the Voltage Modular's cabinets. Try this with a hardware modular!
- *Tooltip Delay*- In case you hadn't noticed, Tooltips are those handy little bits of text that pop up when hovering over a control or jack (go ahead and try it, we'll wait...). The *Tooltip Delay* setting defines how long you must hover over a control before the tooltip pops up.
- *Monitor Pixel Density*- If you're using a monitor with high pixel density choose this - typically this would be a PC with a 4K+ display. Macs with Retina displays fall into this category, but that wiley OS X will automatically adjust for this, so you shouldn't need to change this.
- *Library Location*- This determines whether the library containing the *Modules*, *Cabinets*, *MIDI*, and *Store* tabs will appear on the left (default) or right side of the workspace.
- *On Control Double-Click*- Defines what happens when the mouse is double-clicked on a control. If *Edit Value* is selected, an exact number can be entered by typing the number and hitting ENTER or RETURN. If *Sets Default Value* is selected, double-clicking a control resets it to its default value.
- *Mouse Wheel Adjusts Control Value*- Enabling this lets you adjust knob, slider, and switch values by moving the mouse wheel (or sliding your finger if you're using an Apple Magic Mouse).
- *Do Not Show Tooltips Unless From Mouse Down*- With this checked, tooltips won't display when hovering over controls; they'll only display if the mouse button is down. This typically occurs when moving a rotary knob or slider control.
- *Hide Store On Library View During Searches*- If this box is unchecked, Voltage Modular will show modules don't own in a special *Store* category. Clicking this option disables display of the Store category and only shows modules you own.
- *MIDI Program Changes Should Change Current Preset*- Allows MIDI program change messages to change Voltage Modular patches.

CABLES

This where you'll set how Voltage Modular's virtual patch cables behave.

- *Animate Cables*- When checked, Voltage Modular cables will bend and dangle like real cables. This makes everything sound better (not really, but it looks cool).
- *Move Cables Away*- When checked, hovering over a cable (or multiple cable spaghetti) will temporarily shift them out of the way to make it easier to see modules beneath.

- *3D Cables*- Checking this shades cables to appear more well, three-dimensional. Best of all, you won't need those silly red and green glasses to see this.
- *Draw Shadow*- Causes cables to cast a shadow upon modules.
- *Cable Thickness*- Adjusts the thickness of all cables.
- *Transparent Cables*- This works in conjunction with the *Cable Transparency* button discussed previously. Selecting *All Cables* will make the *Cable Transparency* slider affect all cables. *With All But Current Module* selected, hovering over a module will make its cables opaque. If the *Cable Transparency* control is set to its maximum setting, *Transparent Cables* will have no effect.
- *Show Signal Animation*- Enabling this superimposes a stream of "marching ants" over cables displaying signal flow and direction. (They're easier to see at wider cable width settings.) The Speed slider adjusts the speed of display, but has no effect on signals.
- *Enable Animations For Jacks*- Selecting this shows a nifty little animation when a jack is clicked to use its built-in six-way mult. If you're a super impatient Type A personality (like the guy typing this), unchecking this box disables the animation, causing the six-way mult to pop up immediately.
- *Hide Cables When Dragging Modules*- This one's pretty self-explanatory; having the cables disappear when moving modules around can simplify arranging modules.

ACCOUNT

Settings for your personal login information and account.

- *Email*- This displays the email address of the current login.
- *Update Login Info*- No, this isn't a place for news and tour dates for yacht rock superstar, Kenny Loggins. Clicking this opens the same email and password login screen you'll see when initially launching Voltage Modular.
- *Ask Before Downloading Updated Modules*- We often fix bugs and improve modules. By default, Voltage Modular automatically downloads new versions of modules when available. Checking this box defeats automatic updates and will ask if you'd like to update modules. We'll never make changes to existing modules that can potentially "break" existing patches, but nonetheless, we recommend enabling *Ask Before Downloading Updated Modules* if you're using Voltage Modular for live performances or other "mission critical" situations.
- *Use One-Click Purchasing*- Enabling this skips over all that login/credit card nonsense and speeds up buying modules. Don't leave this on if you have an irresponsible kid who's crazy for modular synthesis (or if YOU are an irresponsible kid who's crazy for modular synthesis).
- *View Account Settings*- This opens your personal account page on the Cherry Audio Store website containing information about modules purchased and more.

AUDIO/MIDI

Settings for audio and MIDI hardware input and output. **This tab is only visible in the standalone version of Voltage Modular.**

- *Output*- Use this drop-down menu to choose a physical audio output source. This defaults to *Built-In Line Output*, i.e. your computer's onboard system audio, but you'll get better fidelity with an external professional audio interface. The biggest audible difference is usually reduced background noise or hum, but external audio hardware also offers greater flexibility in terms of number of inputs and outputs and built-in mic or low-level instruments pres (i.e. electric guitars). These are especially useful if you're using Voltage Modular's external inputs to process sound. The *Test* button will produce a sine wave when clicked; this will help with troubleshooting, aka, "WHY THE HECK ISN'T THIS MAKING ANY NOISE?!?"
- *Input*- Clicking the drop-down menu lets you select which physical input(s) feed the *Audio In from host jacks* in the I/O Panel. The small horizontal input meter to the right illuminates when the selected input is receiving an audio signal.
- *Sample Rate*- This sets Voltage Modular's global sample rate. We generally suggest using the 48 kHz default rate for best overall performance, but if you have the processor horsepower, feel free to try 96 kHz mode.
- *Audio Buffer Size*- As with any digital audio app, this defines performance vs. note latency, and will largely depend upon computer CPU speed. A professional external audio interface will almost always exhibit better performance than "built-in" system audio. Lower settings will result in less latency (in the form of faster response to notes played), but will increase the chances of audio gapping or crackling noise.
- *Active MIDI Inputs*- Displays all available MIDI input sources, i.e. keyboards, pad controls, MIDI knob/fader control surfaces, etc. Checking the boxes will enable them.

Continue to Keyboard Shortcuts and Mouse Control

KEYBOARD SHORTCUTS AND MOUSE CONTROL

Following is a list of Voltage Modular's keyboard shortcuts (or "hot keys," if you prefer). We'll also talk about some not-so-obvious handy mouse functions.

KEYBOARD SHORTCUTS

Please note that shortcut key functionality can be affected by "focus" and existing key shortcuts in the the host app when running Voltage Modular as a virtual instrument.

New Patch - OS X [COMMAND+N], Windows [CTRL+N]

Creates a blank new patch. If an unsaved patch is currently open, Voltage Modular asks if you'd like to first save the existing patch.

Save Patch - OS X [COMMAND+S], Windows [CTRL+S]

Saves the current patch.

Previous Preset - OS X [COMMAND+left arrow key], Windows [CTRL+left arrow key]

Loads the previous preset in the current bank.

Next Preset - OS X [COMMAND+right arrow key], Windows [CTRL+right arrow key]

Loads the next preset in the current bank.

Undo - OS X [COMMAND+Z], Windows [CTRL+Z]

Cancels the last edit action. Voltage Modular remembers all edits back to the last save, so *Undo* can be repeatedly clicked if you really make a mess of things!

Redo - OS X [SHIFT+COMMAND+Z], Windows [SHIFT+CTRL+Z]

Returns controls to their state prior to the last undo. Voltage Modular remembers all edits back to the last save, so you can also step forward through edits.

Zoom View In/Out - OS X [COMMAND+PLUS KEY/MINUS KEY], Windows [CTRL+PLUS KEY/MINUS KEY]

This zooms the view of the IO Panel, Perform controls and module cabinets. Use the + and - keys above the QWERTY keyboard.

Reset Zoom To 100% - OS X [COMMAND+0], Windows [COMMAND+0]

Resets the zoom of the IO Panel, Perform controls and module cabinets to 100%. Use the zero key above the QWERTY keyboard.

Show/Hide Library Tab - OS X [COMMAND+1], Windows [CTRL+1]

Toggles the visibility of the *Library* tab. This is useful for making room for large patches.

Show/Hide Performance Controls - OS X [COMMAND+2], Windows [CTRL+2]

Toggles the visibility of the *Perform* controls tab. This is also useful for making room for large patches.

Delete Module - [DELETE] key

In OS X version, use the backspace key in the main keyboard area (above the back slash key); in Windows, use the DEL key (above the arrow keys). Note that a module (or multiple modules) must be selected.

MOUSE CONTROL

Though most of the mouse functions are obvious, there are a couple of mouse-related-things that aren't so obvious, so in no particular order...

Zooming With Mouse Wheel, Track Pad, or Magic Mouse -
OS X desktop Magic Mouse [COMMAND+slide finger]
OS X desktop mouse w/wheel [COMMAND+mouse wheel]
OS X Macbook/Macbook Pro [COMMAND+two-finger trackpad up/down]
Windows desktop mouse w/wheel [CTRL+mouse wheel]
Windows laptop mouse [CTRL+trackpad up/down]

The view of the IO Panel, Perform controls and module cabinets can be zoomed in or out. The cursor must be within the boundaries of the IO Panel, Perform controls, or a cabinet.

Rapidly Routing A Cable To Multiple Destinations

We discussed this trick back in the **Working With Cables and Jacks** section, but we like it so much (and it's real easy to miss), we thought we'd mention it again:

To patch cables from a single jack to multiple destinations, press and hold the [SHIFT] key, click the source jack, then click up to six destination jacks as desired and release the [SHIFT] key when you're done. This works with input or output jacks, and is particularly useful for patching pitch and gate CV's from the I/O panel to multiple oscillators or envelope generators.

Mouse Behavior Settings

We also cover these in the **Settings** section, but hey, you're already here, amiright?

- *On Control Double-Click*- Defines what happens when the mouse is double-clicked on a control. If *Edit Value* is selected, an exact number can be entered by typing the number and hitting [ENTER] or [RETURN]. If *Sets Default Value* is selected, double-clicking a control resets it to its default value

- *Mouse Wheel Adjusts Control Value*- Enabling this lets you adjust knob, slider, and switch values by moving the mouse wheel (or sliding your finger if you're using an Apple Magic Mouse).
- *Do Not Show Tooltips Unless From Mouse Down*- With this checked, tooltips won't display when hovering over controls; they'll only display if the mouse button is down. This typically occurs when moving a rotary knob or slider control.

The Selecting Multiple Buttons Trick

Click and drag on a toggle button, then drag across adjacent same-function buttons to engage or disengage multiple buttons.

As of this writing, this is only supported in the fabulous Misfit Audio **Drum Trigger Sequencer** module, but you'll likely see this feature in other modules containing rows of similar button controls.

Uninstalling Voltage Modular

UNINSTALLING VOLTAGE MODULAR

We don't know why the heck you'd want to do that, but hey, different strokes, right? In this section we'll explain the removal procedure for OS X and Windows.

UNINSTALLING IN OS X

There isn't a dedicated "uninstaller" app for Mac, so you'll need to manually delete the following files from a few folders:

UNINSTALLING IN WINDOWS

The procedure for uninstalling Voltage Modular is the same as for any other Windows app:

- Click on the Windows search bar and type *Add or remove programs*.
- Search the list of installed applications for *Voltage Modular*.
- Select *Voltage Modular* and click *Uninstall*.

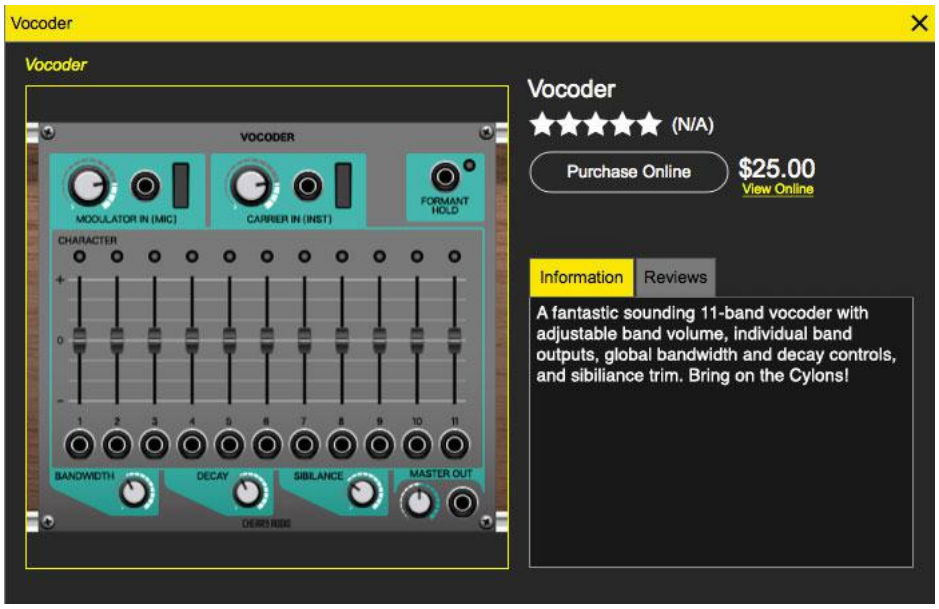
Continue to The Voltage Modular Store

THE VOLTAGE MODULAR STORE

The *Store* library tab lets you purchase modules and sounds from directly within Voltage Modular. Purchased modules and sounds are automatically downloaded and installed for use in Voltage Modular.

Categories in the store only display modules *not* installed on your computer except for the *Purchased* category, which displays previously purchased modules and sounds.

Purchasing Modules and Sounds- To purchase a module, module collections, or sounds package, click on the price button, or double-click anywhere in the listing.



Purchase Online- This takes you to the Cherry Audio website where you'll be able to complete purchases. Upon completion of the transaction, the new module(s) is automatically downloaded to your hard drive and installed for immediate use. Yay!

The *Information* tab displays information about the item you're purchasing (bet you didn't see that coming), and the *Reviews* tab contains puffy five-star reviews that we wrote ourselves user reviews to help you make decisions on purchases.

If *Use One-Click Purchasing* is enabled (*Settings Gear icon>Account>Use One-Click Purchasing*), modules will be instantly purchased- you will **not** be taken to the Cherry Audio website.

WORKING WITH POLY MODULES

The "Poly" modules in Voltage Modular make use of a special "Poly" cable, identifiable by its slight larger "D-shaped" connector. Each poly jack and cable can transmit up to sixteen separate channels, or "lanes," of CV or audio to drastically simplify creating polyphonic patches.

A basic polyphonic patch typically needs an oscillator, envelope and amplifier for each voice. To create eight-voice polyphony, that's already 24 modules! Once additional envelopes, filters, modulations etc. are added, it's easy for a patch to become a huge mess! Poly modules make it easy!

Each poly module can be thought of as a "stack" of regular modules. The number of modules in the stack is defined by the *Number Of Voices* setting in the I/O Panel. When set to eight, for example, every poly module is actually a stack of eight standard modules, and every poly jack can send or receive eight individual channels, or "lanes" of CV or audio. This means that only three poly modules are needed to create a patch that would take 24 "mono" modules!

Let's look at an example to see how it all works

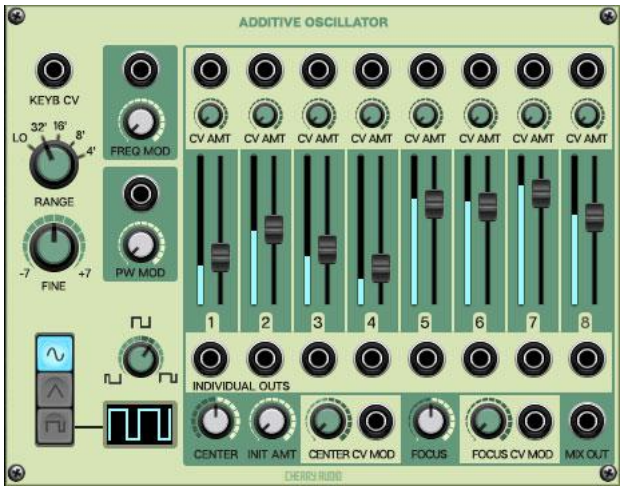
In the patch above, the polyphonic note data received from a MIDI controller is sent from the *Poly Pitch* jack on the I/O Panel to the *Poly Keyb CV* jack of the Poly Oscillator module. This one cable can send up to eight pitch CVs simultaneously to individual oscillators in the stack. The *Poly Gate* output jack in the I/O Panel is patched to the *Gate In* jack of the Poly Envelope Generator which triggers a stack of envelopes which control the amplitude of each oscillator using the Poly Amplifier module.

To patch the output from the Poly Amplifier to the *Main Outs*, we need to mix the eight lanes of audio back down to a regular "mono" signal. In the patch above, this is done using a Mini Poly To Mono module. Alternatively, a stereo mix of the eight signals can be made using a Poly Spread module which mixes a poly signal to a stereo output with width control.

In addition to poly oscillators, filters, amps, mixers, etc., Voltage Modular includes a number of utility modules for splitting and converting poly cables to standard "mono" signals and vice-versa, creating a tremendous amount of flexibility!

- Note that in order to save CPU, when the *Poly Pitch* jack in the Poly CV Outs section of the I/O Panel isn't patched to anything, the *Poly Gate* and *Poly Vel* jacks won't output CVs. If these jacks need to be used by themselves, the *Poly Pitch* jack can be patched to the input of a "dummy" module like the Poly Multiple, for example, to activate the *Poly Gate* and *Poly Vel* outputs.

ADDITIVE OSCILLATOR



The Additive Oscillator lets users combine the first eight partials in the harmonic series to create composite tones with a choice of sine, triangle, or variable-width pulse waves. Inspired by 70's "West Coast" synthesizer modules, it includes separate outputs for each partial, and allows the partial levels to be modulated in a number of creative and intuitive ways. First we'll explain the function of each control, then we'll explore the Additive Oscillator in use.

Keyboard CV - Standard 1V/octave CV input for pitch control.

Range - Sets the octave range in standard footage increments. The Lo setting is intended for modulation purposes and will generally be below audible range. (unless you're a whale and can hear 1Hz)

Wave Select Buttons - These select sine, triangle, or variable-width pulse wave. Only one can be selected at a time.

Pulse Width Control and Display - This knob allows manual control of pulse width. Center position will generate a 50% square wave; rotating left or right results in narrower pulse-widths. The waveform display shows the current width of the pulse wave.

Freq Mod - Applying CV's here modulates the base pitch of the oscillator; in other words, all partials are affected equally. This can be used for basic vibrato or siren effects with sub-audio modulation speeds, or wilder FM cross-mod when using audio-range signals.

PW Mod - Short for pulse-width, this mod input allows real-time modulation of the pulse wave. It won't have any audible effect if the sine or triangle wave is selected.

Top Row CV Jacks and Attenuator Knobs - These CV inputs allow level modulation of each partial. The small CV Amt knobs are CV attenuators. Incoming CV's are combined with slider settings.

Partial Level Meters - These give a visual display of partial volume levels.

Partial Level Sliders - Sets the levels of each partial in the harmonic series. 1 is the the fundamental frequency, 2 is the second harmonic, etc.

Partial Individual Out Jacks - Separate audio outs for separate processing of individual partials. Note that these are affected by the partial slider volume settings.

Center - Defines the center frequency of the slider "peak."

Init Amt - Sets the initial amplitude of the the slider "peak."

Center CV Jack and Attenuator Knob - CV input for external modulation of Center frequency.

Focus - Sets the width of the slider "peak."

Focus CV Jack and Attenuator Knob - CV input for external modulation of "peak" width.

Please see the "Modulation Time C'mon" section below for more information about Center, Focus, and slider peak.

Mix Out - Audio output of the mix of all partials.

Basic Use

Let's start by setting up a basic patch consisting of an Additive Oscillator and a voltage-controlled amplifier, as shown below:

Pitch from the IO Panel goes to *Keyb CV* input, *Mix Out* is routed to amplifier *Input*, and gate from the IO Panel goes to the amplifier's *CV In*. Amplifier audio out is routed to IO Panel *Main Outs to host*.

If you ignore the modulation options, the Additive Oscillator is super easy to use, and operation is just like using a standard analog oscillator - in fact, it's effectively the same as opening eight individual oscillators and tuning each to partials one through eight of the harmonic series (for example, 100Hz, 200Hz, 300Hz, 400Hz, 500Hz, 600Hz, 700Hz, and 800Hz).

With the above patch set up, go ahead and play the Additive Oscillator. Adjusting the fader levels affects the volume of each harmonic, sort of like a vintage tonewheel organ on steroids. Notice the blue level meter to the left of each slider - this may seem superfluous now because the meter is displaying the static level of the adjacent fader, but their usefulness will become clear once we begin exploring the Additive Oscillator's modulation possibilities.

Modulation Time, C'mon

If you're a seasoned synthesist, all of the controls at the left of the panel should be familiar. Things start getting nutty when the Additive Oscillator's modulation controls are used. Let's begin with the CV level mod jacks and wee knobs at the top of the panel:

Partial Level Mod Controls and CV Attenuators

The CV input jacks above each partial slider allow CV control of each individual partial level. The small knob beneath each CV jack is an attenuator for setting the amount of CV voltage. Note that partial level CV mod works *additively* with the current fader level setting. Of course this easy to see by looking at the blue level meter, which always shows the actual output level.

Center and Focus Mod Controls and CV Attenuators

Things get pretty awesome here! The Center and Focus controls essentially let you create a "peak" of faders and move the "peak" up and down across the faders either manually or via CV. It's much easier to demonstrate than it is to explain, so let's set the controls as shown below:

Notice that all sliders are set at zero, but the meters show a peak - partials three and six are quiet, while four and five are louder. Adjusting the Center *Init Amt* knob adjusts the level of the peak. Turning the *Center* knob sweeps the peak up or down across the partials. Remember that, like the partial level CV mod at the top of the panel, Center and Init Amt control settings combine with the existing fader settings and level CV mod. (This is why we zeroed the slider settings for this demo, but of course these can set any way you like.)

You may have noticed that sweeping the *Center* control sounds really cool, which is why there's a *Center CV Mod* in jack and attenuator knob. This can be modulated by anything that outputs a voltage, but an LFO at a slow rate is a good place to start.

The *Focus* knob adjusts the peak width, from one partial wide to all partials at full blast. To its right is a *Focus CV Mod* in jack and attenuator knob, allowing CV modulation of *Focus* width.

Advanced Additive Oscillator Madness

- Try routing the two sections of a Mini LFO to *Center CV Mod* and *Focus CV Mod*. This simple setup will go a long way, especially if you use the triangle wave on one of the CV ins and the square on the other.
- Embellish the above routing by routing another LFO to the *PW Mod CV* in and selecting the pulse wave on the Additive Oscillator.
- If you've purchased the Misfit Audio Drum Modules package, the Drum Trigger Sequencer is a wickedly fun modulation companion - it's eight individual channels enable each harmonic partial to have its own complex rhythmic sequence. BTW, after experimenting with this, we added a couple of milliseconds of lag into the level CV ins to prevent clicking with hard on/off gate voltages.
- We've saved the wackiest for last. The Additive Oscillator's partial separate outputs can be routed *back into any of its mod inputs* for all manner of audio-range frequency modulation madness. Try routing these to the *Freq Mod* and *PW Mod* inputs as well as individual partial CV ins.

AMPLIFIER

The Cherry Audio Amplifier module is a voltage-controlled amplifier, usable with audio or control signals. It's operation is relatively simple, but it remains one of the most important modules in the synthesis "tool box."

The idea of a voltage-controlled amplifier (VCA) is that an audio or control signal is patched to its input, then its amplitude can be externally controlled via the *CV In* jack. This is useful for turning audio or control signals on or off, applying envelope volume curves to sounds, regulating the amount of modulation signals applied to audio signals, and more. Think of it as a voltage-controlled gate, with a variable amount of gate opening.

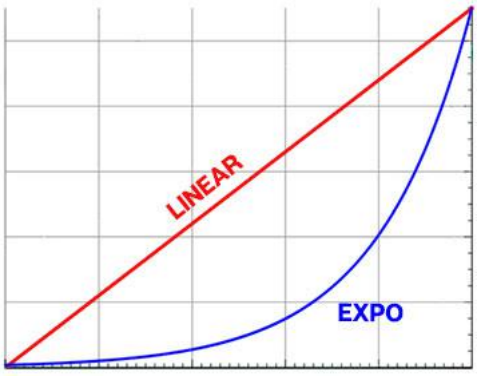
Inputs, Outputs, and Controls

CV In jack- Control signal inputs such as gates, envelope generators, and mod sources (such as low-frequency oscillators) are patched in here. The most common control signal would be an envelope generator (for shaping the amplitude curve of notes), but any control signal can be patched here, including gates, LFO's, sequencers, noise generators, sample and holds, etc.\ The voltage level applied corresponds to the input signal's amplitude, with 0V = no signal passed and 5V = full amplitude passed.

CV Amount- Sets the amplitude of the control signal received at the *CV In* jack.

Input jack- Use this jack to patch in audio or control signals to be affected by the *CV In* jack.

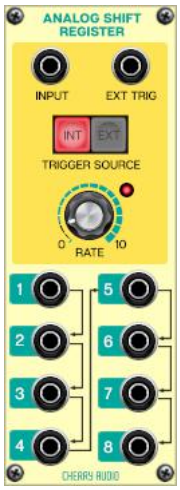
Gain- Adds up to 5 volts of gain. This works *in addition* to incoming *CV In* jack voltages. It's also useful for manually "opening" the amplifier.



Response - Lin/Expo- These select the "curve" of the amplifier's response as the input CV rises from 0 to 5V. *Lin* or linear response curve is equally proportional across the voltage input range, where as an *Expo* or exponential curve is closer to how the human ear perceives volume. With that in mind, you'll likely want to use the *Lin* setting for modulation or control voltage situations, and use the *Expo* setting when an envelope generator is used to control an audio signal with the amplifier. Or just use whatever sounds best, we won't tell.

Output jacks- The *Output* jack carries the CV-modified version of the input signal. The *Inv Out* jack is an inverted version of the output signal. Be careful not to use both at the same level, because they can cancel the output entirely.

ANALOG SHIFT REGISTER



The Cherry Audio Analog Shift Register is an eight-stage analog-style shift register that can be triggered via an internal or external clock source.

The concept behind an analog shift register (ASR) is similar to a sample and hold module which repetitively "samples" an input signal and outputs its voltage until triggered again. In fact the first output of the Analog Shift Register is **exactly** the same as the Sample and Hold module. What makes the ASR different is that every time a new sample is taken, the previous sample is "shifted" sequentially to the next output.

Typically the outputs are used to control the pitch of individual oscillators to create a canonic melody or pattern where the leading oscillator voice is "followed" by multiple subsequent voices.

Inputs, Outputs and Controls

Input jack- This is the input jack for the audio or control signal that will be sampled.

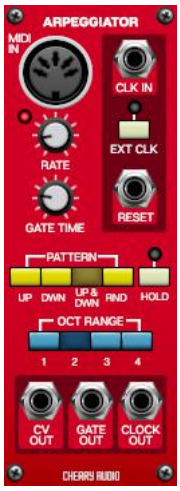
Ext Trigger jack- A 5V pulse or gate received at this jack will externally trigger the module.

Trigger Source- The buttons *Int* and *Ext* select between the internal and external trigger source.

Rate- Controls the rate of the internal trigger source from 0.02 Hz - 50 Hz.

1-8 output jacks- These are the jacks where the sampled voltages will be output. Each sampled CV will initially be available at the first output and shifted sequentially to the next output with each following trigger. Note that voltages from the eighth output are not shifted back to the first output.

ARPEGGIATOR



The Cherry Audio Arpeggiator is a classic "vintage-style" arpeggiator. In case you're wondering, an arpeggiator is basically a step sequencer that takes a chord as its input, and plays each note of the chord individually in an ascending or descending pattern over one or more octaves.

This module uses its polyphonic MIDI input jack to receive chords from a keyboard or DAW and convert them into a monophonic series of notes which are output as CV/gate signals. The rate at which the pattern is played can be set on the module or synced to an external clock source.

Inputs, Outputs and Controls

MIDI In jack- This MIDI input jack receives polyphonic pitch and note on/off messages from a MIDI controller or host DAW. Typically this will be connected to the *MIDI From Host* output on the I/O panel.

Rate- Sets the rate of the arpeggiator when it is not synced to an external clock source.

Gate Time- Sets the length of the 5V gate signal from 1 - 500ms for each step of the arpeggio pattern. The gate signal will be output at the *Gate Out* jack.

Clk In jack- This input jack can be used to sync the arpeggiator to an external clock source such as a sequencer or your DAW host. Typically the clock output from a module such as the Sync Divider is sent to this input jack but any signal can be used. The pattern will advance any time the input signal transitions from below 2.5V to 2.5V or higher.

To sync the Arpeggiator to your DAW host, connect the *Sync Out* and *Play* jacks from the Transport section of the I/O panel to a Sync Divider module's *Sync In* and *Reset* jacks respectively. Then connect the *Clock Out* jack from the Sync Divider to the *Clk In* jack of the Arpeggiator and engage its *Ext Clk* button.

- **Pro Tip**: To create a "swing" or "shuffle" feel, set the Sync Divider to 8th notes and send its clock output into a Delay module. Set the delay to 100% wet and 0% feedback and patch its output into the same *Clk In* jack of the Arpeggiator. The timing of the delayed signal can be adjusted to create a swung 16th note between the 8th notes.

Ext Clk- Engaging this button overrides the module's internal clock and allows the signal sent to the *Clk In* jack to externally control the rate of the arpeggiator.

Reset- This jack is used to force the module's internal clock to restart immediately when a signal of 2.5V or higher is received. Note that this will restart the clock, but not the arpeggiator pattern. The pattern is only reset once all keys in the chord are released and a new MIDI note or chord is played.

Pattern- These buttons select the order in which the notes of the chord will be played. *Up* plays the notes in order from lowest to highest, *Dwn* from highest to lowest, *Up&Dwn* will play the notes from lowest to highest then back to lowest again (the highest and lowest note will be played twice in a row) and *Rnd* will randomly cycle through the notes.

Hold- While engaged the arpeggiator will continue to run without having to continuously hold down keys. This allows you to play a series of chords without the arpeggiator stopping as you release keys between chords. Be aware that it will not stop until you disengage the button again. Mapping this to a sustain pedal or button on a MIDI controller could be useful for conveniently toggling this on and off.

Oct Range- Selects how many octaves the pattern will be played at before repeating.

CV Out jack- This is the output for the arpeggiated pitch CV. Typically this will be patched to the *Keyb CV* input of an oscillator to make the oscillator's pitch step through the notes of the chord being played but can also be used to control a filter's cutoff frequency or anything else with a CV input.

Gate Out jack- Outputs 5V gate signals for each step of the arpeggio pattern. Usually this will be patched to the gate input of an envelope generator whose output is patched to the CV input of an amplifier (VCA).

Clock Out jack- Outputs the clock signal of the arpeggiator. This is particularly useful for syncing other modules to the arpeggiator when using its internal clock.

ATTENUVERTER

The Cherry Audio Attenuverter features three independent modules for attenuating and/or inverting audio or control signals. Attenuators are used to reduce the level of signals while inverters “flip” the polarity of a signal making positive voltage negative and negative voltage positive. While that doesn’t sound like too much fun, it is an extremely useful and invaluable tool within any modular system.

Signals within Voltage Modular start out as full-amplitude signals that often need to be turned down. An LFO, for example, can be used to create vibrato by subtly modulating an oscillator’s frequency. But if the LFO signal is not attenuated first, the result will sound more like a sci-fi laser than vibrato!

The Attenuverter also comes in handy when you have multiple CVs patched to a single input. Reducing their levels individually before the CV input is an effective way to "dial in" the perfect amount of modulation from each signal. The CV or mod amount knob on the module can then be used as a master modulation amount that attenuates all of the CVs at once while keeping their relative levels in tact.

Inputs, Outputs and Controls

-∞ to Unity- This knob scales the amplitude of the incoming audio or control signal from 0% to 100%.

In jack- Input jack for the signal that will be attenuated and/or inverted.

Inv (invert) - Engaging this button will invert the polarity of the signal. All positive voltages from the input signal will be negative in the output signal and all negative voltages will be positive. Be careful not to mix a signal and its inverted signal together at the same amplitude or they will completely cancel each other out!

Out jack- Output jack for the attenuated and/or inverted signal.

BANDPASS FILTER

The Cherry Audio Bandpass Filter is a simple audio filter which allows frequency content at and around a specified frequency to pass through the filter while attenuating the signal above and below it. The width of the frequency band can be adjusted from quite wide to extremely narrow making this a tremendously versatile bandpass filter.

Inputs, Outputs and Controls

Input jack- Patch audio signals here.

Freq (Frequency)- Audio content at and around this frequency will be allowed to pass through the filter.

Width- Adjusts the width of the frequency band that is allowed to pass through the filter.

Gain- This is a post-filter gain control for adjusting the output volume of the filter.

Output jack- Outputs the filtered audio signal.

BEND LIMITER

The Bend Limiter module is designed to easily configure incoming pitchbend messages received from a MIDI keyboard or DAW to “bend” the pitch of an oscillator up and down in different amounts from zero to 60 semitones (five octaves).

To set up the typical pitchbend behavior, connect the *Bend* output from the CV Outs section on the I/O panel to the *Bend CV In* jack, and connect the *Out* jack to an oscillator’s *Keyb CV* input (usually this will be in addition to a CV input from a keyboard or sequencer).

Although intended to scale the positive and negative voltages received from a pitchbend wheel, any signal can be altered. Try running an LFO through it. The amplitude of the positive and negative portions of its waveform can be scaled allowing the depth of modulation to be adjusted in each direction independently!

Inputs, Outputs and Controls

Bend CV In jack- For typical pitchbend wheel behavior, connect this input to the *Bend* output in the CV Outs section of the I/O Panel.

Bend Up Steps- Sets the number of semitones a pitchbend wheel will raise the pitch of an oscillator when patched to its *Keyb CV* input.

Bend Down Steps- Sets the number of semitones a pitchbend wheel will lower the pitch of an oscillator when patched to its *Keyb CV* input.

Out jack and LEDs- For typical pitchbend wheel behavior, connect this output to the *Keyb CV* input of an oscillator. The green and red LEDs give visual feedback of when the output voltage is positive and negative respectively.

BINARY

The Binary module is a dual module that continuously tests an incoming audio or control signal to determine if its voltage is greater than zero (> 0) or less than zero (< 0) and outputs a selected voltage whenever the condition is true. The output will always be a binary signal, meaning it is either on (outputting the selected voltage) or off. It basically creates a series of gate signals which can be used to turn things on and off, trigger envelopes, step through sequencers etc.

One of the coolest things about modular synthesis and Voltage Modular is the ability to create unique relationships between modules so that they "react" to one another. The Binary module can "automatically" trigger an event or action based on other signals already present within a patch. It could be used, for example, to send only higher notes of an arpeggiator to a reverb send or change a drum sequencer's pattern every time an LFO passes zero.

Inputs, Outputs and Controls

> 0 and < 0 In jacks- Input jack for the audio or control signal whose voltage will be tested. The top module tests whether or not the signal is above zero and the bottom module tests whether or not it is below zero.

- **Pro Tip**: A DC Source module can be used to offset the input signal's voltage making it possible to test if a signal is above or below voltages other than zero.

-5V to +5V and LEDs- This knob selects the voltage that will be output any time the tested condition is true. The green LED shows that the condition is true while the red LED indicates that it is false.

Out jack- Output jack for the binary signal created. If both modules are testing the same input signal, the outputs will alternate outputting voltage and can be combined to create a square wave made up of both selected voltages.

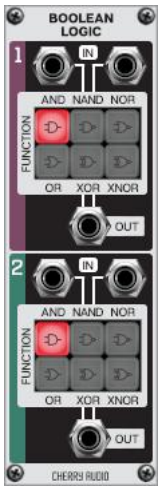
BLANK PANEL 6HP BLACK/WHITE

The Blank Panel 6HP black and white modules are handy blank panels with "scribble strips" for patch notes. Simply double click anywhere within the module and begin typing. If more text is entered than there is space for, a scroll bar will appear on the right side of the module.

HP is short for "Horizontal Pitch" which is the standardized unit of measurement for the width of Eurorack modules.

Finally, Voltage Modular's Blank Panels are the most accurately modeled, warmest and best sounding blank panels ever created.

BOOLEAN LOGIC



The Boolean Logic module is a dual module that combines two incoming gate signals using the common boolean functions AND, NAND, NOR, OR, XOR, and XNOR.

Each function creates a different gate-signal output based on the state of the two input signals. Using only one input will give the same result as combining it with a second input that is always "off." A signal is considered to be "on" when its voltage is 2.5V or higher and "off" when lower than 2.5V. The result of each function is based on the rules that define it:

- AND only outputs a gate signal when both inputs are "on."
- OR outputs a gate signal whenever either one of the two inputs is "on."
- XOR (exclusive OR) outputs a gate when only one, but not both, of the inputs is "on."

The N (not) version of each function will create the same gate signal only inverted.

Let's look at a couple examples of how this might be used:

In the example below, the AND function is used to combine the gate out signal from a running sequencer and the gate signal from a keyboard so that the sequencer's gate pattern will only be output while a key is held down.

In this example, a gate signal from the CV Outs section of the I/O Panel is patched to one of the inputs of both modules. The top module function is set to OR and the bottom module is set to XNOR. This setup will trigger the sequencer to start when a key is pressed and stop as soon as all keys are released.

Inputs, Outputs, and Controls

In jacks- These are input jacks for the two gate signals that will be combined.

Functions- There are six possible boolean functions that can be used to combine the two inputs:

- **AND (and)**- While both input signals are "on" a gate signal will be sent to the output.
- **NAND (not and)**- While both input signals are "off" a gate signal will be sent to the output.
- **NOR (not or)**- While neither input signal is "on" a gate signal will be sent to the output.
- **OR (or)**- While either or both input signals are "on" a gate signal will be sent to the output.
- **XOR (exclusive or)**- While either, but not both, input signals are "on" a gate signal will be sent to the output.
- **NXOR (not exclusive or)**- While neither or both input signals are "on" a gate signal will be sent to the output.

Out jack- Outputs a 5V gate signal whenever the selected function tests true.

CHORUS

The Cherry Audio Chorus module is a great sounding and flexible stereo chorus effect featuring CV control of delay time, feedback level, and wet/dry mix. Chorus is created by mixing an audio signal with one or more slightly delayed and pitch-modulated “copies” of itself and is often used to make a sound seem bigger, richer, and wider.

Inputs, Outputs and Controls

L(M) and R Input jacks- These are the mono or stereo audio input jacks. When using a mono input signal, patching it to the L(Mono) jack will feed the signal to both sides of the stereo effect.

Speed- Sets the speed of the pitch modulation from 0.01Hz to 8.0Hz.

Depth- Adjusts the depth of the pitch modulation.

Delay Time- Sets the amount of time, from 4ms to 50ms, that the “copies” are delayed.

Delay Time CV Amt jack and attenuator- CV input for externally controlling the delay time.

Feedback- Increases the number of “copies,” or layers, of the input signal by “feeding” the effected signal “back” to the effect input. This is the same principle as a delay pedal with repeating echoes only with shorter delay times.

Feedback CV Amt jack and attenuator- CV input for externally controlling the feedback amount.

Mix (Dry/Wet)- This knob adjusts the mix between the input signal (Dry) and the effected signal (Wet) that will be sent to the outputs.

Mix CV Amt jack and attenuator- CV input for externally controlling the dry/wet mix.

L and R Output jacks- These are the module's stereo output jacks.

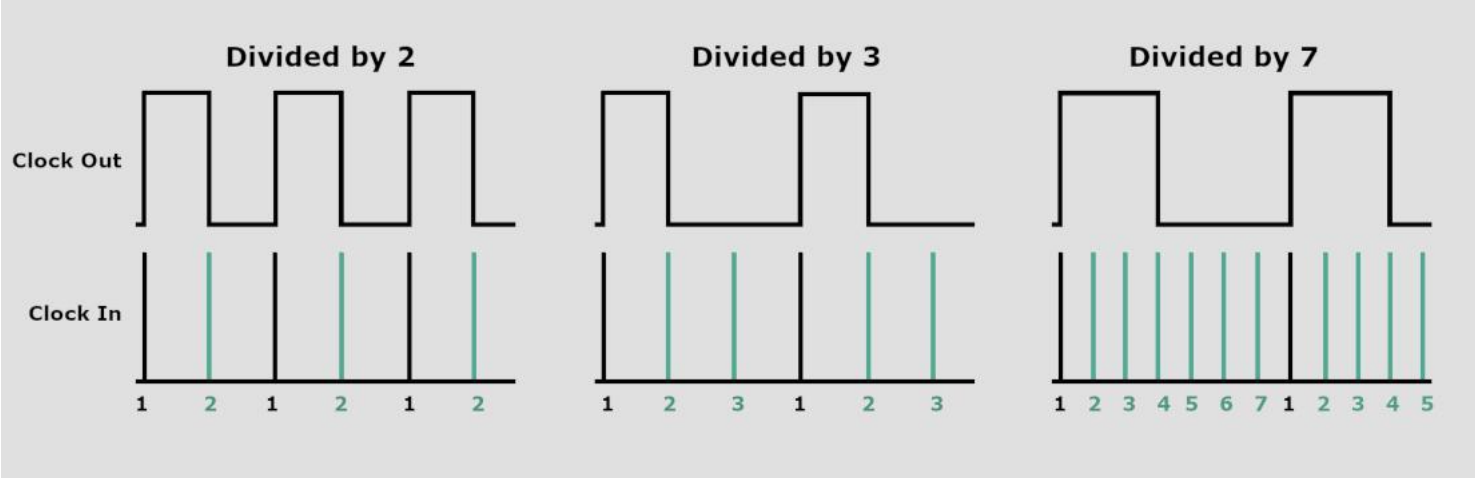
CLOCK DIVIDER

The Clock Divider is a dual module that slows incoming clock pulses by a factor of two to sixteen. The modules can run independently from one another or be linked so that the clock input and reset jacks from the first module are shared by both.

So what does it mean to divide a clock signal?

When a clock signal is divided, the timing of its pulses are not changed. Instead, the Clock Divider creates a new pulse-wave signal that represents only a fraction of the pulses received at the input.

Let's look at a sixteenth-note clock signal as an example. Dividing by a factor of two means that one pulse is output for every two pulses received resulting in an eighth note clock signal. Dividing by a factor of three means that one pulse is output for every three received which is the equivalent of dotted-eighth notes. Dividing by a factor of seven doesn't result in a common note duration, but the same principle is used. The divider only outputs one pulse for every seven pulses which by the way can create some really cool poly-rhythms!



It is worth noting that the input signal doesn't need to be a designated clock signal. Any voltage transition from below 2.5V to 2.5V or higher will be interpreted as a pulse meaning you can use an LFO, the gate signal from a MIDI controller, or even an audio signal!

Inputs, Outputs and Controls

In jack- Input jack for the clock signal that will be divided. When the modules are linked the input signal from module one is internally routed to module two.

Reset jack- A 5V pulse or gate signal received at this jack will force the divided clock signal to restart on the next pulse received at the input jack. When the modules are linked the reset jack from module one will reset module two as well.

Divide By- This is the factor by which the clock signal will be divided. It can be set from one to sixteen by clicking on the up and down arrows to the left of the number display. A *Divide By* factor of one means the clock input will be unchanged (because duh, anything divided by one is itself!) but is a convenient way to temporarily bypass any clock division. A factor of two means one pulse is output for every two pulses received at the input. A factor of nine means one pulse is output for every nine pulses. You get the idea.

Out jack- Outputs the divided clock signal.

Input Link- When engaged, the input and reset jacks from module one are sent internally to module two. If a cable is patched to either of module two's inputs, the signal from the cable will "override" the link.

The Cherry Audio Compress module is a simple compressor effect with gain and reduction metering for controlling and/or shaping the dynamics of an audio signal. Compressors come in many styles and are used for various applications. This module has static attack and release times that are good for general dynamic control and/or creating punchier percussive sounds.

For anyone unfamiliar, compressors lower the output level of a signal once its input level passes a threshold. This helps reduce the dynamic range of an audio signal. This module uses a simple approach to compression with only two controls. First set the amount of compression using the *Peak Reduction* control, then use the *Gain* knob to compensate for any decrease in perceivable volume.

Inputs, Outputs, and Controls

Input jack- Patch audio signals here.

Peak Reduction- As this knob is turned up from 0% to 100%, the amount of compression, or gain reduction, is increased. This is the equivalent of reducing the threshold on many compressors. The inverted VU meter shows the amount of gain reduction.

Gain- This is a post-compression output-level control (often labeled "Make-Up Gain") that can be turned up to compensate for the decrease in volume caused by the compressor. The VU meter shows the level of the output signal.

CONSOLE MIXER

The Cherry Audio Console Mixer module is a powerhouse 12-input audio mixer featuring two effects sends with stereo returns and a three-band EQ (with semi-parametric mids), solo, and mute on each channel. This is the perfect “mission command” module for any live performance setting as well as a great utility for getting all of your sounds to gel just right.

Input Channel Section

Each of the twelve channels has identical controls, so let’s just look at channel one from top to bottom.

Input jack- This is the input jack for the audio signal which will be controlled by this channel of the mixer.

Send 1 and 2- These are post-eq and post-fader effect sends. Turning a knob up will send the audio signal to its respective *Aux Send* jack which can be patched to the input of an effects device such as a reverb or delay.

High Shelf Cut/Boost- This is a typical high-shelf EQ control and is used to darken or brighten the tone of the signal.

Parametric Mid Frequency- Selects the target frequency for the *Parametric Mid Cut/Boost*.

Parametric Mid Cut/Boost- This is a "bell-shaped" mids EQ control that decreases or increases the amplitude of mid-range frequencies targeted by the *Parametric Mid Frequency* knob.

Low Shelf Cut/Boost- This a typical low-shelf EQ control for decreasing or increasing the amount of low end in the audio signal.

Pan- Typical pan control for routing the channel’s audio signal between the left and right master outputs of the mixer.

Level Fader- Controls the amplitude of the channel’s audio signal from -infinity to +6.0 dB.

Solo- Typical solo button for isolating the channel’s audio signal. This is a non-exclusive solo button meaning that more than one channel can be soloed at the same time.

Mute- Typical mute button for silencing the channel’s audio signal.

Aux Sends and Effect Returns Section

Aux 1 and Aux 2 Send jacks- These outputs can be used to send audio from each channel of the mixer (via the *Send 1* and *Send 2* knobs) to two separate effects units.

Return L and R jacks- Patch the outputs of your effects units to these input jacks to "return" the effects to the mixer. The returned effects will be added to the mixer's master output. When using a mono effect, the *L Return* jack can be used as a mono return.

Pan- Pan control for adjusting the stereo placement of the returned signal.

Level- Adjusts the amplitude of the return signal.

Master Output Section

Master Pan- Pan control for adjusting the balance between the left and right master outputs.

Master Fader- Master level fader for adjusting the amplitude of the master outputs.

Mono/Stereo- These buttons select between monitoring the mixer's output in mono or stereo. When *Mono* is selected, the sum of the left and right channels are sent to both outputs. This can be a good way to check the phase correlation between the left and right channels. When two similar audio signals are out of phase, they can partially or completely cancel each other out. If a signal suddenly looses body or disappears when switched to mono, you may want to try inverting the polarity of one of the channels.

L Channel Inv- Inverts the polarity of the left output signal.

R Channel Inv- Inverts the polarity of the right output signal.

L and R Output jacks- Main stereo output of the mixer. Typically patched to the *Main Outs L* and *R* jacks in the I/O panel.

CROSSFADE

The Cherry Audio Crossfade module is a CV controllable two channel mixer, usable with both audio and control signals. This module smoothly mixes between two input signals with a single knob and/or the *CV Mod* input.

Remember that **any** two signals can be mixed. You could, for instance, mix two LFOs together to create a more complex shape, combine two different CV sequences, or even modulate between a sync signal and an oscillator if you were so inclined! Or maybe you'd rather use it like a DJ crossfader and mix between two drum beats.

Inputs, Outputs, and Controls

Input jacks 1 and 2- These are the input jacks for the two signals that will be mixed together.

CV Mod input jack- CV input for externally modulating the balance between the two input signals.

CV Mod Amount- Scales the amplitude of the CV signal received at the *CV Mod* input jack.

Initial Balance- Sets the initial balance of the two input signals before any CV modulation. It can also be used to manually mix between the two signals. Assign this knob to a midi controller's slider to create a DJ-style crossfader.

CV To MIDI

The CV To MIDI module converts incoming CVs for pitch, gate, velocity, pitch bend, mod wheel and aftertouch into MIDI data that can be used to control external hardware such as synthesizers or drum machines. Incoming pitch CVs can be transposed as much as three octaves up or down in semitone increments and the MIDI channel on which the data will be transmitted is assignable.

To send pitch and gate CVs from an Eight-Step Sequencer module to an external MIDI synthesizer, connect the sequencer's *Output* and *Gate Out* jacks to the CV To MIDI module's *Pitch* and *Gate* input jacks respectively. Then connect the *MIDI Out* jack of the CV To MIDI module to the *MIDI In* jack of a MIDI Out module and click its *Select MIDI Device* button to choose which external output to use. Make sure your synth is set to receive MIDI on the same channel as the CV To MIDI module and you should be all set! (Note that if the MIDI Out module is set to a MIDI channel other than "All", the data will be output on that channel overriding the CV To MIDI module's channel setting.)

Inputs, Outputs and Controls

Pitch- Input jack for receiving pitch CVs that will be converted to MIDI note number messages.

Gate- Input jack for receiving gate CVs that will be converted to MIDI note on/off messages.

Vel- Input jack for receiving CVs that will be converted to MIDI velocity messages. The CV that is present at this input jack when a gate signal is received will be assigned as the velocity value of the MIDI note.

Bend- Input jack for receiving CVs that will be converted to MIDI pitch bend messages. Voltage from -5V to 5V will be mapped across to the pitch bend range.

Mod Whl- Input jack for receiving CVs that will be converted to MIDI mod wheel messages. Voltage from 0V to 5V will be converted to MIDI CC #1 values 0 - 127.

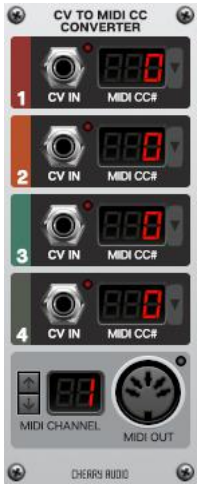
After Touch- Input jack for receiving CVs that will be converted to MIDI aftertouch (channel pressure) messages. Voltage from 0V to 5V will be converted to MIDI channel pressure values 0 - 127.

Transpose- Shifts the pitch of the MIDI notes up or down in semitone increments. The MIDI can be transposed as much as three octaves in either direction.

MIDI Channel- Selects the MIDI channel on which the converted MIDI messages will be output.

MIDI Out- Connect this MIDI jack to the input of a MIDI Out module to send MIDI to external software or hardware.

CV TO MIDI CC CONVERTER



The CV To MIDI CC Converter module converts up to four incoming CV signals to assignable MIDI CC (continuous controller) messages that can be used to control external hardware such as a synthesizer or drum machine. The four MIDI CCs are output on the selected MIDI channel and can be sent to external hardware using a MIDI Out module.

Inputs, Outputs and Controls

CV In jacks- Input jacks for the CV signals that will be converted to MIDI CC messages. Voltage from 0V to 5V will be converted to CC values 0 - 127.

MIDI CC#- selects which MIDI CC (continuous controller) number the CV signals will be converted to. MIDI CCs are used to control parameters on hardware equipment. A synthesizer, for example, may have a filter cutoff knob which can be externally controlled via MIDI CC# 102. Any CV signal from within Voltage Modular, be it an LFO, envelope, or sequence, can be converted to MIDI CC# 102 and used to control the synth's filter cutoff frequency. Refer to your hardware's user manual or MIDI implementation chart to determine which CC#s control its parameters.

MIDI Channel- Selects which MIDI channel (1- 16) the CC messages will be output on. Make sure your external hardware is set up to receive MIDI on the same channel as you designate here.

MIDI Out- Outputs all four CC messages on a single MIDI channel for controlling external hardware. Connect this to the input of a MIDI Out module and click its *Select MIDI Device* button to choose which external MIDI output to use.

DC SOURCE

The Cherry Audio DC Source module is a two-channel DC voltage source. It outputs a constant voltage between -5V and 5V specified by the *DC Amount* knob.

This simple module can be especially useful for offsetting control voltages. The DC source can be mixed with any other signal to add or subtract voltage depending on its polarity. When mixed with a +/-5V LFO, for example, a 3V DC signal will shift the center of modulation from 0V to 3V resulting in an LFO ranging from -2V to 8V.

Outputs and Controls

DC Amount- Sets the DC voltage that will be output.

Output jack- Outputs the DC voltage.

DELAY

The Cherry Audio Delay module is a mono delay effect with up to two seconds of delay time, a high cut control, and normal and inverted outputs. While this module is primary used as an audio effect, it can also be used on controls signals.

Inputs, Outputs, and Controls

Input jack- Patch audio or CV signals here.

Milliseconds- LED display for the delay time set using the *Time* knob.

Time- This sets the delay time from 0 to 2048ms.

Feedback- Controls the amount that the delayed signal is "fed back" to the input. Turning this up creates more repeats, or echoes, of the delayed signal. Be aware though, that at very high settings, the feedback loop will repeat indefinitely and continue to get louder and louder!

High Cut- This controls how much high-frequency content, or treble, is present in the delayed signal. When turned all the way to the right to *Bright*, the delayed signal will sound almost identical to the input signal, much like a digital delay pedal. As the knob is turned to the left towards *Dark*, the high frequencies of the delayed signal are reduced, or "rolled off," creating a darker tone more similar to old tape-echo machines.

Mix (Dry/Wet)- This knob adjusts the mix between the input signal (*Dry*) and the delayed signal (*Wet*) that will be sent to the outputs.

Output Inv jack- Outputs the Dry/Wet mix with its polarity inverted. This is most useful when using short delay times and can sometimes result in a more "hollow" or flanger-like sound when mixed with the original non-inverted signal. Note that this jack inverts the mix of both the dry and wet signals. If both outputs of this module are combined, they will completely cancel each other out resulting in silence! Therefore, it is usually a good idea to use the delay as a parallel effect or aux send with the *Mix* set to 100% when using the inverted output.

Output jack- Outputs the Dry/Wet mix.

DIGITAL REVERB

The Cherry Audio Digital Reverb module is a deep-toned reverb audio effect with variable room size, damping, and mono, mono-to-stereo or true-stereo operation. This module is capable of replicating the sound of a large range of room styles from small ambiences to long dark caverns.

Inputs, Outputs and Controls

L(M) and R Input jacks- These are the mono or stereo audio input jacks. When using a mono input signal, patching it to the L(Mono) jack will feed the signal to both sides of the stereo effect.

Room Size- Adjusts the reverb's decay length and character to simulate the size and frequency response of small and large rooms.

Damping- Adjusts the rate at which high frequencies in the reverb signal dissipate. This is used to simulate the characteristics of different rooms. A room that is full of people and/or has soft walls, for example, will soak up high frequencies quicker than an empty room with cement walls. Turning this knob to the left allows the high frequencies to last longer simulating brighter rooms, while turning the knob to the right will dampen the high frequencies more quickly to simulate a darker room.

Mix (Dry/Wet)- This knob adjusts the mix between the input signal (Dry) and the effected signal (Wet) that will be sent to the outputs.

L(M) and R Output jacks- These are the module's stereo output jacks. When using a mono input signal and wish to keep the reverb mono as well, use only the *L(Mono) Output* jack.

DIODE

The Cherry Audio Diode module is a two-channel audio or CV polarity splitter. It takes any input signal and outputs its positive and negative voltages individually.

Inputs and Outputs

Input jack- Input the signal that you want to split here.

Positive Output jack- Outputs only the positive voltage received at the input jack. Any negative voltage is "clipped" off and outputs 0V.

Negative Output jack- Outputs only the negative voltage received at the input jack. Any positive voltage is "clipped" off and outputs 0V.

DISTORTION

The Cherry Audio Distortion module is an aggressive distortion effect unit with voltage control of distortion amount and audio level compensation. This is a great all-purpose distortion unit for adding some bite to a drum loop, attitude to a bass line, harmonics to a sub etc.

Note that although distortion is typically used as an audio effect, it can also be used to alter the shape or curve of LFOs and envelopes.

Inputs, Outputs, and Controls

Input jack- Patch audio signals here.

CV Mod jack- CV input for externally controlling the *Dist Amount.*

Dist (Distortion) CV Amount- This knob attenuates the CV signal received at the *CV Mod* jack.

Dist (Distortion) Amount- Adjusts the amount of distortion imparted on the input signal. Low values can add subtle harmonics or saturation while high values can become quite aggressive.

Output Level- Adjusts the output level of the distorted signal. This is typically used to compensate for the raise in volume caused by adding distortion.

Output jack- Outputs the distorted audio signal.

DRUM HIGHPASS LOWPASS

The Drum Highpass Lowpass module is a simple combination filter with steep slopes and convenient sliders for carving low and high frequencies from drum sounds or any other audio signal.

Inputs, Outputs and Controls

Input jack- Input jack for the audio signal that will be filtered.

Highpass- This slider is used to remove low-end frequencies from the input signal by "rolling off" audio content lower than the slider's frequency. This value can be edited manually by double clicking on the slider.

Lowpass- This slider is used to remove high-end frequencies from the input signal by "rolling off" audio content higher than the slider's frequency. This value can be edited manually by double clicking on the slider.

Output jack- Outputs the filtered input signal.

DRUM OSCILLATOR

The Cherry Audio Drum Oscillator module is a simple three-waveform oscillator made especially for creating vintage analog-style drum sounds. The pitch of the oscillator can be tuned from 30 Hz - 1200 Hz and can be modulated via its *CV Mod* input.

Analog drum sounds are often made by modulating the pitch of an oscillator with a short envelope to mimic the "smack" of a drum. To create a simple kick sound, first set the pitch knob to a frequency around 60 Hz. Then patch the sine-wave output to an Amplifier module's *Input* jack. Next, add a Percussion EG (envelope generator) module and patch its *Env Out* jack to the *CV In* jack of the amplifier. Now connect the *Trig* jack from the CV Outs section of the I/O panel to the *Trig In* jack of the Perc EG module. You should now hear a short tone when a key is pressed. Adjust the decay settings until you like the length of the drum. Now add a second Perc EG module that will be used to create a pitch envelope. Patch the *Env Out* jack to the *CV Mod* input of the Drum Oscillator and set the CV mod amount to about 75%. Finally, connect the *Trig In* jack to the same *Trig* output on the I/O panel.

Although the title seems pretty specific, the applications for this oscillator go far beyond creating drum sounds! Try using one of the waveform outputs as a ring modulation input or use several instances as “operators” in an FM synthesis patch.

Inputs, Outputs and Controls

CV Mod jack and attenuator- CV Input for externally controlling the pitch of the oscillator. When the CV Mod amount is at 100% the oscillator’s pitch will be mapped across a keyboard at 1V/Oct like a typical Keyb CV input.

Pitch- Sets the frequency of the oscillator from 30 Hz - 1200 Hz.

In order to play this oscillator in tune with a traditional oscillator, the pitch needs to be set to a frequency that is equal to one of the octaves of the note C.

C1 = 32.70 Hz
C2 = 65.41 Hz
C3 = 130.81 Hz
C4 = 261.63 Hz
C5 = 523.25 Hz

Waveform Outputs- Three individual outputs for sine, triangle, and square waveform oscillators. These can be used simultaneously in any combination and are all effected by the *Pitch* knob and *CV Mod* input.

DUAL VU METER

The Cherry Audio Dual VU Meter is an analog-style stereo VU meter for monitoring audio and CV levels. Analog VU Meters don't respond quickly enough to show every peak and transient of a signal and are therefore show the average volume, or "loudness," of a signal.

Inputs, Outputs, and Controls

Peak LED- This LED lights up to indicate when the signal is at or above 0VU.

VU Meter- The needle moves to show the current VU level of the signal. The louder the signal is, the further right the needle moves.

Text Label- Double-click to create a text label for each meter.

In jack- Patch audio or CV signals here to meter their loudness.

Meter Color- Pick between *Amb* (Amber) or Blk (Black) meters.

8 Step Sequencer

The Cherry Audio 8 Step Sequencer is a fast and easy-to-use sequencer that can used not only for playing melodic sequences, but also as a modulation source for filters, amps, and more.

If you're not familiar with using step sequencers, the step sequencer concept is the forerunner of modern MIDI DAW software; the basic idea is that each step outputs a pitch and gate CV, making it act as a sort of "player piano" for melodies or CV control signals. Eight steps (i.e. notes) may not seem like much, but step sequencers can be used for a variety of applications and are highly useful for pattern-based music and modulation.

Inputs, Outputs, and Controls

Transport Section

The top area of the module is analogous to standard tape deck-style transport controls.

Stop button and CV jack- Stops sequencer from running. The *Stop* button can be activated via CV using the jack below the button with any trigger or gate CV greater than +2.5 volts.

Start and CV jack- Starts sequencer running. The *Start* button can be activated via CV using the jack below the button with any trigger or gate CV greater than +2.5 volts.

Step- Advances current position to the next step. This is useful for setting pitches for each stage when the sequencer is stopped. The advance button also works when the sequencer is in play mode. Note that we didn't include a CV jack for step advance- the *Ext Clk* jack does exactly this.

Play Trig- The *Play Trigger* jack outputs a 5V trigger spike any time play mode is initiated (from the *Start* button or via CV control). This can be useful for starting ganged multiple sequencers and other functions.

Reset- This input jack is **really** important for locking sequencer timing to a DAW project or other sequencers. It force-resets the sequencer to the very beginning of step 1 the instant it receives a gate or trigger voltage.

If you're syncing to a DAW, route the IO Panel *Play* jack to the *Reset* input; if you're slaving to another sequencer, route the master sequencer's *Play Trig* out to the slave's *Reset* input.

And since we're getting hot 'n' heavy with all this clock talk, a quick primer on clock and sync signals would be er, timely:

- **Clocks: Not just a sappy song by Coldplay**- It's very important to clearly understand how clock signals work with step sequencers, so don't skim this section! One clock tick (i.e., a single voltage spike) equates to one sequencer step. If the clock signal was 120 clicks-per-minute, the sequencer would step 120 times a minute.
- **Can I just use the *Sync Out* jack on the IO Panel to sync the sequencer to a DAW? It says *Sync* right on it!**- You can, but not directly, so don't plug the IO Panel *Sync Out* jack into the sequencer *Ext Clock* (unless you like **really** fast music) . *Sync* and *Clock* signals are different - keep on reading...
- **What's the difference between *Clock* and *Sync* signals?**- Clock signals are explained above. To summarize, clock signals are the what-you-hear-is-what-you-get of timing signals: one click = one sequencer step advance. Sync signals are also a series of clicks, but they run MUCH faster and are intended to be subdivided down to musical note values via a Sync Divider module. They're typically expressed in pulses per-quarter-note, usually abbreviated to the catchy acronym, "PPQN." Voltage Modular's IO Panel *Sync Out* jack uses the common rate of 96 PPQN, with the actual speed of the pulses varying dependent upon the DAW host project tempo. The IO Panel *Sync Out* jack, along with a Sync Divider module, is the key to precisely syncing Voltage Modular sequencers to a DAW project. (If you're running Voltage Modular in standalone mode, the Sync Generator module can be used in place of the IO Panel *Sync Out* jack.)
- **I'm just reading, why are you making up all these fictional questions, weirdo?**- Hey, we're just trying to help. No need to get snippy.

Ext Clk button and CV jack- Clicking the *Ext* toggle button disconnects the 8 Step Sequencer's internal clock and accepts clock signals from *Ext Clk* jack. Note that the 8 Step Sequencer isn't too fussy about external clock sources; pretty much anything that creates rapid (or not-so-rapid) pulses can be used, including LFO's, oscillators, or even the gate or trigger output of another sequencer. Along these lines, note that external clock pulses don't have to consistently repeat either; any pattern of pulses can drive the sequencer *Ext Clk* input.

Num Of Steps and numeral display- These up/down buttons set the total number of sequencer steps from 2 - 8 steps. This defaults to 8 steps and can be altered with the sequencer in stop or play mode.

Rate and LED indicator- Sets the speed of the 8 Step Sequencer's internal clock from around 4 - 450 bpm. The LED indicator flashes with each "click" or step advance. The 8 Step Sequencer's *Rate* pop-up tooltip is calibrated to display tempos based on sixteenth-notes. For example, setting the *Rate* knob to 120 bpm plays 480 notes a minute (we did this because you'll likely want to play fast tempos such as this, and it's sort of kooky to set the knob to "480 bpm" just to get sixteenth-notes). External clock signals can used if faster or slower speeds are needed.

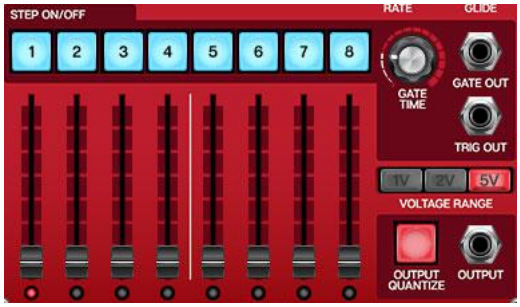
CV Offset- This input jacks lets you add or subtract overall voltage from the sequencer's output. Most commonly this would be used to transpose the key of a sequence during

playback (from a keyboard CV, or another synced sequencer running at a slower rate), but it can also be used for more esoteric applications, such as routing an LFO to continuously vary the pitch of the entire sequence.

Glide- The *Glide* control causes notes to slide from one pitch to the next, as opposed to discretely jumping from one pitch to the next. Higher settings create a slower glides. Glide speed is **not** affected by the overall sequence rate; in other words, glide times between notes remain constant regardless of tempo.

Step and CV Slider Section

The bottom area sliders and buttons define how each sequencer step behaves. This is where the magic happens!



Stop On/Off buttons 1-8- Clicking these toggles the gate and trig output for each step. Keep in mind that disabling a step doesn't skip over it, it just creates a "rest" at this step, which is useful for creating rhythmic musical lines (as opposed to the ever popular never-ending-barrage-of-sixteenth-notes so popular in the modular synth community).

CV Slider- These sliders set the voltage sent to the *Output* jack for each step. The slider tooltip displays express their values either in MIDI note-style (e.g., "C3", "F#2", etc.) or in decimal value, dependent on the *Output Quantize* button setting (see *Output Quantize* button section below). Their range is defined by the *Voltage Range* switches (also explained below; reading is fun, right?).

Step Indicator LED- These guys light to display the current sequencer step. They're especially useful for setting pitches (in conjunction with the *Step* button) when the sequencer is stopped. Most importantly, they look really cool whizzing by at 100 mph when sequences are running.

Gate Time- Sets the length of the 5V gate signal from 1 - 500ms for enabled steps at the *Gate Out* jack. The *Gate Time* setting is not affected by the overall sequencer rate. It also has no effect on the *Trig Out* jack signals (because a trigger signal is always a rapid pulse).

Gate Out jack- This jack outputs 5V gate signals for active steps.

Trigger Out jack- This jack outputs 5V trigger signals for active steps.

Voltage Range- Selects the ranges of voltage for sliders.

1V = 0 to +1V (one-octave range)
2V = 0 to +2V (two-octave range)
5V = 0 to +5V (five-octave range)

Since Voltage Modular's pitch conforms to the 1V /octave standard, this means a 1V range equates to a range of one octave, a 2V range equates to two octaves, and a 5V range equates to five octaves. The 8 Step Sequencer's pop-up tooltip displays will change to reflect range button selection.

Output Quantize- Enabling *Output Quantize* forces fader values to snap to 1/2 step note increments. Without this, it would be difficult to set note values to play in tune (check out any 70s Kraftwerk record to hear the sound of wonkily tuned step sequencers). Disabling *Output Quantize* turns off pitch "snap" and allows any value to be set - this is useful when the sequencer is being used to modulate non-pitched destinations, such as filter cutoff or amplitude. The pop-up tooltip displays will show note or decimal values dependent on *Output Quantize* button position.

Output jack- Outputs the slider CV for the current step.

EIGHT TO ONE SWITCH

The Cherry Audio Eight To One Switch module routes eight audio or control input signals to a single output jack. An input signal is only passed to the output when its respective “step” is active. The inputs can be stepped through sequentially with a manual or CV trigger, or targeted individually via discrete control voltages.

Switches are used to re-route signals without having to unplug or re-patch any cables. As an example, the Eight To One Switch could be used to send different modulation sources to a single destination or switch between different oscillator waveforms. The fun starts when you begin experimenting with different ways to step through the inputs!

Inputs, Outputs, and Controls

1-8 input jacks and LEDs- Input jacks for up to eight signals that will be routed to the output jack whenever their respective step is active. The small red LEDs give visual feedback of the active step.

Steps- Sets the number of steps that can be activated. When stepping through the inputs sequentially with either the manual or *Step Trigger* CV input, this sets the number of the last step before it will cycle back to step one.

Step Trigger jack- A 5V pulse or gate received at this jack will trigger the steps sequentially.

Step CV jack- CV input jack for switching between steps in any order. The control voltage range of 0V - 5V is evenly divided between the number of steps making it possible to target specific steps with discrete voltages.

Here are a couple examples of how the voltage is divided:

- If *Steps* is set to two, the 5V range is divided between the two steps. Step one is selected with voltage from 0V - 2.49V and step two is selected with 2.5V - 5V.
- If *Steps* is set to eight, the 5V range will be divided equally between the eight steps. Five divided by eight is 0.625 so, step one = 0V - 0.62V, step two = 0.63V - 1.24V, step three = 1.25V - 1.87V and so on.

If you don’t happen to make music with a calculator next to you, we recommend just playing around until you find the step you’re looking for!

Reset jack- A 5V pulse or gate received at this jack will immediately force the module back to step one. Note that resetting the module will be unnoticeable when using the *Step CV* input because the voltage received at its jack is constantly updating the active step.

Manual Step- Click this button to manually advance to the next sequential step.

Out jack- Outputs the active step’s input signal.

ENVELOPE FOLLOWER

The Cherry Audio Envelope Follower converts the amplitude of an incoming audio signal into a control voltage (CV) output. The module has VU meters to monitor the input and output signals as well as an adjustable input gain and envelope release time.

This is a great tool for creating dynamic CV signals that can be used to modulate just about anything in Voltage Modular. A drum loop, for example, could be used to modulate the cutoff frequency of a filter, the pitch or pulse-width of an oscillator, or the rate of a Super LFO!

Input, Output, and Controls

In jack- Input jack for the audio signal that will be converted to a CV output.

Gain- Scales the amplitude of the input signal from 0% to 200%.

Input Level- This VU meter displays the amplitude of the incoming audio signal after being scaled by the *Gain* knob.

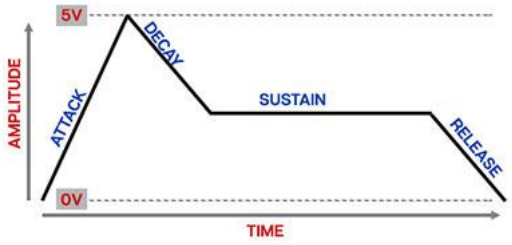
Env Out- This VU meter displays the CV output signal.

Release- Adjusts the amount of time it takes for the CV output to decrease in voltage as the input signal's amplitude decreases. When tracking percussive audio signals this will be very similar to a traditional envelope's release stage. However when tracking less dynamic input sources, the release time acts more as a smoothing value for the CV output.

ENVELOPE GENERATOR

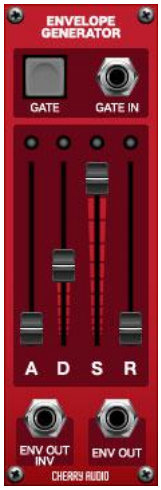
The Cherry Audio Envelope Generator module is a standard "ADSR"-style envelope generator most often used to shape amplitude or filter curves. If you're not familiar with the operation of envelope generators, here's an overview:

When a gate voltage is sent to the *Gate In* jack (or the *Gate* button is held), the envelope generator outputs a voltage that changes dynamically according to the settings of its four stages.



The *Attack* stage defines how long it takes for the output voltage to rise from 0 to 5 volts. Once the attack stage reaches 5V, it moves to the *Decay* phase, which defines how long it takes to fall from 5V to the setting of the *Sustain* phase. Unlike the *Attack*, *Decay*, and *Release* phases, each of which define a time, *Sustain* simply sets the held voltage level following the *Attack* and *Decay* phases - this usually equates to the envelope output level while holding down a key on a keyboard controller. Finally, the *Release* knob defines the the length of time it takes for the voltage to fall back to 0V when the gate input voltage is removed (typically when you let go of a key on a keyboard controller).

Now that you're an ADSR envelope expert, let's go over the Cherry Audio Envelope Generator module.



Inputs, Outputs, and Controls

Gate Button- Manually initiates the envelope generator cycle for as long as it's held. The same as sending a gate voltage to the *Gate In* jack.

Gate In jack- This is where you'll patch gate voltages to initiate the envelope generator cycle. Most often this will come from the IO Panel *Gate* output. The standard gate voltage for Voltage Modular (and most hardware analog synths) is +5V, but the Envelope Generator module will function with gate voltages as low as +2.5V.

- **Can I use a "trigger" to trigger an envelope generator?**It would seem logical, but the answer is, "sometimes, but generally, no." First let's clarify the difference between a gate signal and a trigger signal:
  - A **gate** is a *constant* voltage. If you're playing a keyboard, it remains high (i.e. +5V) as long as the key is held down.
  - A **trigger** is a *rapid spike* of +5V. It's useful for a number of things (like turning stuff on and off, or triggering "one-shot" drum sounds or modules).

Getting back to the Cherry Audio Envelope Generator module, like most standard envelope generators, it needs to see a constant gate voltage to move through the *Attack* and *Decay* phases and hold during the *Sustain* phase. Removing the gate voltage following the *Sustain* phase tells it to move to the *Release* stage. With all that in mind, using a trigger signal will cause the envelope generator to *immediately* jump to the *Release* phase (which might be useful in certain situations).

Some envelope generator modules can be used with a trigger signal if they have a "free-run" mode (for example, the Cherry Audio Perc EG module is *always* is in free-run mode and accepts gate or trigger signals). However, the standard Cherry Audio Envelope Generator module is designed to generally use gate signals.

"A" (Attack) slider- Defines the length of time for voltage to rise from 0V to 5V when the gate voltage is applied.

"D" (Decay) slider- Defines the length of time for voltage to fall from the *Attack* stage 5V peak to *Sustain* stage setting.

"S" (Sustain) slider- Sets the held voltage level following *Attack* and *Decay* phases.

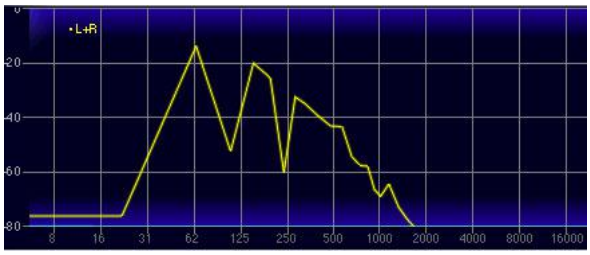
"R" (Release) slider- Defines the length of time for voltage to fall from *Sustain* level to 0V when gate is released.

LED stage indicators- In case it wasn't obvious, these guys illuminate to show the currently active envelope stage, and besides, the more blinking lights, the better!

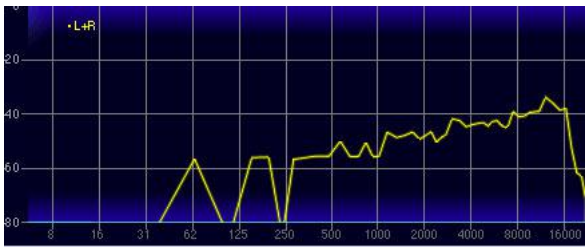
Env Out and Env Out Inv- These are the envelope voltage outputs. The *Env Out* voltage ranges from 0V to +5V, whereas the *Env Out Inv* jack is an inverted version, with output ranging from 0V to -5V.

FILTER

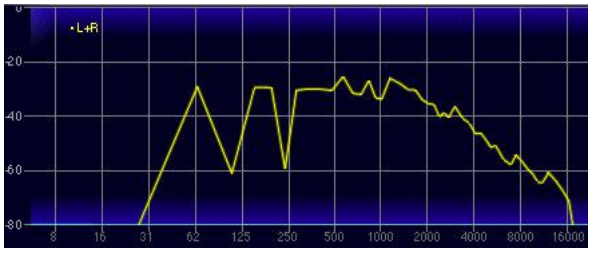
The Cherry Audio Filter module is a full-featured classic analog synthesis filter featuring lowpass, bandpass, and highpass outputs, 12- and 24-db per octave slopes, and two modulation inputs.



If you're not familiar with how filters work, a lowpass filter allows frequencies *below* the cutoff frequency setting to pass through, but blocks frequencies *above* the cutoff frequency. The frequency plot above shows the effect of a lowpass filter with its cutoff set at 412 Hz on a sawtooth wave. (The vertical axis represents amplitude and the horizontal axis represents frequency. "Axis: Bold As Love" represents a sweet Jimi Hendrix record from '67.) You can see how the high-frequency content trails off as it gets higher.



This plot shows the same oscillator signal and cutoff frequency setting using the highpass mode. This is the opposite of lowpass mode: high-frequency content remains, but low frequencies are removed as the cutoff frequency increases.



The plot above shows the same oscillator signal and cutoff frequency setting using the bandpass mode. Bandpass mode combines *both* lowpass and highpass modes, leaving sound only in "in the middle." The cutoff frequency lies roughly halfway between the falloff on each side. By the way, this is pretty much how the tone controls on your stereo work!

Now that you know how filters work, let's look into Voltage Modular's "standard" filter:

Inputs, Outputs, and Controls

Audio In jack- Patch audio signals in here.

1V/Oct- This is a cutoff frequency modulation input intended to be used with keyboard CV inputs. It allows the cutoff frequency to follow or "track" notes played so that the relative brightness of notes follows note pitch.

Mod 1 Amount/Freq Mod 1 and **Mod 2 Amount/Freq Mod 2**- CV mod inputs affecting cutoff frequency. Each includes an attenuator knob.

Cutoff- Sets the frequency where attenuation begins. Attenuation will be above or below this frequency (or both) depending on which output is currently used. Also something I frequently hear at the bar, as in "you're cut off, pal!"

Resonance- Emphasizes sound energy at and around the current cutoff frequency by adding feedback from the filter's output back to its input. At lower settings, this can be used to create mild resonances such as those heard in acoustic instruments. At more extreme settings, resonance can create a pure sine wave at its own frequency (variable via the *Cutoff* knob). Be careful with this knob as it can get loud at extreme settings.

Slope- The nature of how a filter works is such that its affect on frequencies "falls off" above or below the cutoff frequency. Slope adjusts the "steepness" of this slope. A 12db per/octave filter has a shallower slope, giving it a clearer and brighter character, whereas a 24db per/octave filter's steeper slope gives it a tighter and darker tone (as well as more pronounced character with the resonance knob turned up).

Lowpass, Bandpass, and Highpass Output Jacks- These are output jacks for lowpass, bandpass, and highpass modes, respectively. The icons visually represent the effect each has on incoming signals if the signal were to be viewed in a spectrum analyzer (check out the fancy diagrams in the intro). These can be used simultaneously, in any combination. Combining the outputs with a mixer can result in interesting curves.

FORMULA

This module uses the MXParser library written by Mariusz Gromada:

GLIDE

The Glide module is used to slide smoothly from one input control voltage to another. This is typically used to slide between pitch CVs creating portamento as one note glides to the next. The module features an adjustable speed, linear or constant curve, and a CV jack for enabling and disabling the glide in real time.

Inputs, Outputs and Controls

Input jack- Input jack for the control voltages you wish to glide between. Typically this will receive pitch CVs from a keyboard or sequencer.

Amount- Adjusts the speed of the glide from 0ms to 5000ms (5 seconds). When the curve is set to *Con*, this is the amount of time it will take to slide from one CV to the next. When the curve is set to *Lin*, the slide time will be different depending on the distance between CVs so this is actually adjusting the speed of the glide rather than the time it will take to complete each transition.

Curve- Selects between two options for transitioning from one CV to the next. When *Lin* (linear) is selected, the rate of the glide will remain the same regardless of how far apart the CVs are. Therefore gliding between voltages near one another will take less time than voltages that are farther apart. When *Con* (constant) is selected, the amount of time it takes to glide between voltages will be the same regardless of how far apart the voltages are.

External Engage jack- Allows the glide module to be enabled and disabled in real time using control voltages. Voltages 2.5V or higher will enable the glide while voltages less than 2.5V will disable it.

Output jack- Outputs a CV signal that slides from one voltage to the next. Typically this will be connected to the Keyb CV input of an oscillator to create portamento.

MIDI OUTPUT

The Cherry Audio MIDI Output module allows modules with MIDI out jacks, such as the CV To MIDI and CV To MIDI CC Converter, to control external MIDI hardware devices. This means that any MIDI capable sound module, synthesizer, drum machine or effects unit can be part of your modular setup! Create sequences, arpeggios and complex modulations inside of Voltage Modular and send them via MIDI to all of your favorite hardware.

The MIDI Output module can be used to merge up to six MIDI inputs. If more than six inputs are needed, multiple instances can be set to the same external device and their MIDI data will be merged.

In the image below, four channels of MIDI are being sent to the *MIDI In* jack. The MIDI Output module will merge the data so they can be simultaneously output by one MIDI cable. This allows four external devices to be individually controlled while "daisy-chained" together.

Inputs, Outputs and Controls

MIDI In jack- Modules with MIDI out jacks can be patched to this input to send their MIDI data to external MIDI devices. This jack can accept up to six MIDI inputs at once which will be merged and sent to the selected external MIDI device. The small LED next to the jack lights up when MIDI is being received.

MIDI Channel- Selects the MIDI channel on which the data received at the *MIDI In* jack will be output. When set from one to sixteen, MIDI data from all channels will be merged and output on the selected channel. When set to *All,* each channel of MIDI will be output on the same channel that it was received.

Transpose- Shifts the pitch of the output MIDI notes up or down as much as three octaves in semitone increments.

Select MIDI Device- Click this button to select which external interface or port will be used to output MIDI data.

Device Status- These two LEDs give visual feedback of the state of the selected external MIDI device. The *Active* LED will light up when the selected MIDI device is connected and working properly. The *Error* LED will light up if there is a problem with the MIDI device such as its connection being lost.

INVERT

The Invert module is a dual utility module that flips the polarity of an audio or control signal. All positive voltages from the input signal will be negative in the output signal and all negative voltages will be positive.

Be careful not to mix a signal and its inverted signal together at the same amplitude or they will completely cancel each other out!

LADDER FILTER

The Cherry Audio Ladder Filter is a CV-controllable, 24dB/oct, low-pass filter based off the famous transistor ladder filter patented by Bob Moog in 1966, and made famous in the Moog Modular and Minimoog synthesizers in the 1960s and 1970s. In addition to the classic Cutoff and Resonance (or "Emphasis") controls, we've added a Saturation knob as well for overdriving the tone even further! This filter is the definition of raw, raunchy, and powerful!

Inputs, Outputs and Controls

Input jack- Patch audio signals in here.

Freq Mod jacks and attenuators (1 and 2)- These are CV input jacks and attenuators for externally controlling the filter's *Cutoff Frequency.* Both jacks can be used simultaneously. The sum of both jack's voltage will control the cutoff.

Cutoff Frequency- Sets the cutoff frequency of the filter from 0Hz to 24,000Hz. Since this is a low-pass filter, all frequencies lower than this value will be allowed to pass through the filter while frequencies higher than the cutoff will be attenuated at a rate of 24db per/octave.

Emph (Emphasis) Mod jack and attenuator- CV input jack and attenuator for externally controlling the emphasis (resonance) of the filter.

Emphasis- Turning this knob up emphasizes sound energy at and around the cutoff frequency by adding feedback from the filter's output back to its input. On other filters this is often called Resonance. With higher settings, any modulations or knob twisting of the cutoff frequency becomes more pronounced.

Sat Mod jack and attenuator- CV input jack and attenuator for externally controlling the saturation amount.

Saturation- Adds distortion to the signal. This is where things begin to get raw and raunchy!

Output jack- Outputs the filtered audio signal.

LFO

The Cherry Audio "standard" LFO, or low-frequency oscillator, is a multi waveform, analog-style LFO. It generates six different control voltage (CV) waveforms and is capable of audio-rate modulation.

If you are unfamiliar with using LFO's, a simple application would be to slightly modulate an oscillator's frequency to create vibrato (pitch modulation), or to modulate a VCA's amplitude to create a tremolo effect (amplitude modulation). Modulating the cutoff frequency of a filter can create a dubstep-style wobble, or if modulated very slowly, long sweeping tonal shifts.

Many of the Voltage Module modules have dedicated CV inputs, sometimes labeled as "mod" inputs, all of which can be modulated with the LFO. But remember, just because an input isn't labeled as CV or mod, that doesn't mean you can't route an LFO to it! Patch away and see what happens- unexpected results are what makes modular synthesis so much fun.

Inputs, Outputs, and Controls

Reset jack- Any trigger or gate CV greater than +2.5 volts received at this input jack will force-reset the LFO's cycle. Connect the *Trig* or *Gate* jack in the IO Panel *CV Out* section to this input jack to reset the LFO each time a new note is played, or connect the *Trig Out* from a sequencer to keep the LFO in sync with the sequence.

Range- The *L* (low) and *H* (high) buttons alter the frequency range of the LFO. When *L* is selected, the LFO is a typical low frequency, or sub-audio rate, oscillator ranging from 0.02 Hz - 10 Hz. When *H* is selected, the LFO's frequency range is from 5 Hz - 400 Hz, making audio rate modulation possible.

Frequency- Sets the frequency, or rate, of the LFO. Frequency values are represented in Hz, or cycles per second. In other words, 1 Hz means it takes one second to complete a full cycle of the waveform. Therefore, 2 Hz = 0.5s, 4 Hz = 0.25s etc. Don't worry though, you don't need to know the math because the LED beside the knob flashes to display the LFO's current frequency.

Polarity- Sets the polarity of the LFO output waveforms. In the *Bi* position ("bipolar," meaning above and below 0V), the LFO will output signals ranging from -5V to 5V. In the + position, the output signals will range from 0V to 5V, and in the - position, the signals will range from -5V to 0V. Note that in the + and - positions, the amplitude of the LFO has been halved, and the center point of modulation has been shifted to 2.5V or -2.5V, respectively. This can be desirable in many situations, but be cautious of using these modes with pitch modulation; if you were to create vibrato using the + mode, for example, your patch may sound great on its own, but the oscillators will actually be slightly sharp, and out of tune with the rest of the world!

Pulse Width- This knob adjusts the width, or "duty-cycle," of the pulse wave output. At 50%, a symmetrical square wave is produced, meaning the positive and negative portions of the cycle are equal lengths. As the knob is turned clockwise, the positive portion of the LFO cycle is increased; as it is turned counter-clockwise, the positive portion of the cycle is decreased. Be aware that the knob goes all the way to 0% and 100%- at either of these extremes, the modulation will be static.

Waveform Output jacks- These are the output jacks for the LFO signals. Each jack outputs a different waveform and can be used simultaneously in any combination. Shape options are square, random (i.e. sample and hold), sine, ramp up, ramp down and triangle.

LIMITER

The Cherry Audio Limiter module is an extreme "brickwall" style limiter for audio signals. Limiters can be used subtly to "catch" the loudest peaks of a signal to keep it from clipping or quite aggressively to "smash" a signal's dynamics. They are famously known for their use in the mastering process to increase the overall level of a song while also making it sound punchier and "larger than life."

Inputs, Outputs, and Controls

Input jack- Patch audio signals here.

Reduction- Increases the amount of gain reduction. On many limiters, this knob is referred to as "Gain" or "Input Gain." Turning the knob up increases the level of the input signal being sent to the limiter's level detector. The louder the signal is, the more "Reduction" is needed to keep the signal from exceeding 0dB.

VU Meter (Red./Out)- This VU meter can be set to display the limiter's amount of gain reduction (*Red.*) or its output level (*Out*). When *Red.* is selected, the meter's needle will remain still at 0VU until the input signal exceeds 0db at which point it moves left to display how much the signal is being reduced to keep it from crossing 0dB. When *Out* is selected, the meter behaves as a typical VU meter displaying the level of the output signal.

Makeup Gain- This increases the volume of the output signal to "make up" for the amount of gain reduction imparted by the limiter.

Output jack- Outputs the limited audio signal.

MEGA SAW

Mega Saw delivers the immense "hoover" sound of multiple detuned sawtooth waves with up to 32 simultaneous saws plus CV-controllable detune amount. It's perfect for massive EDM lead lines, dramatic trailers, and more. We'll go over its functions, section by section.

Keyboard CV

Keyb CV jack- Accepts a CV input for pitch. Typically this would come from the PITCH jack in the IO Panel CV OUT section, or from a sequencer pitch CV out.

Saws

Number Of Saws and number display- This sets the total number of sawtooth waves you'll hear. The display shows the current number of saws (in case you don't feel like counting all those little lines around the knob).

Detune- Sets the average pitch detune amount for all sawtooth waves - higher values "spread" the detuning between the saws for a larger sound.

Detune Mod

Detune Mod attenuator and input jack- CV input for modulating the amount of detuning. Center setting is zero, and negative or positive modulation can be applied by turning the knob left or right.

Keyb CV jack- Accepts a CV input for pitch. Typically this would come from the IO Panel PITCH jack in the CV OUT section, or from a sequencer pitch CV out.

Freq

Range- Sets the basic pitch of the oscillator, displayed in traditional organ footage.

Fine- Fine-tune control for pitch.

Freq Mod

Freq Mod attenuator and input jack- CV input for modulating overall pitch. Center setting is zero, and negative or positive modulation can be applied by turning the knob left or right. Useful for adding vibrato with an LFO, siren noises, envelope-controlled pitch sweeps, etc.

Output

Output Jack- Where all those saw waves come out!

MICRO BURST

The Cherry Audio Micro Burst module generates a “burst” of up to 32 CV triggers for each individual trigger it receives. Both the number of triggers per burst and burst rate are CV controllable.

This module can be used to replicate a number of acoustic sounds such as snare flams, hi-hat rolls and guitar strumming but is just as comfortable creating a cacophony of bleeps and bloops from another world! Try running a clock signal or LFO through the Micro Burst and use its output as the external trigger source for a Sample and Hold module. Modulating a resonant filter’s cutoff or an oscillator’s frequency can create some pretty crazy results!

Inputs, Outputs and Controls

Trigger jack- A 5V pulse or gate received at this jack will trigger a “burst” of triggers.

Num of Bursts- Sets the number of triggers, from 1 to 32, that will be output in each burst. The number can be externally controlled via its *Mod* CV input jack and attenuator.

Rate- Adjusts the speed at which the burst triggers are output. The time between triggers in the burst can be adjusted from 10ms to 100ms and can be externally controlled via its *Mod* CV input jack and attenuator.

Output jack- A burst of 5V pulses are output from this jack each time a single pulse is received at the *Trigger* input.

MIDI CC CONVERTER

The MIDI CC Converter module converts eight selectable MIDI CC (continuous controller) messages from external MIDI devices to individual CV signals for use within Voltage Modular. This allows a hardware device's knobs and buttons to be used as CV sources.

Inputs, Outputs and Controls

MIDI Channel- Selects which MIDI channel the module will receive MIDI CC messages on. Set this to the same channel that your external device or devices are transmitting MIDI on. When set to *All,* CC messages from all 16 MIDI channels will be received allowing the module to convert CCs from multiple devices on different channels.

MIDI In jack- Receives MIDI messages from external MIDI devices. Typically this will be connected to the *From Host* MIDI output on the I/O panel or the *MIDI Out* jack of a MIDI In module.

MIDI CC#- Selects which MIDI CC (0 - 127) will be converted to a CV signal. Clicking on the small arrow to the right of the number display opens a pop-up menu of the standardized CC message assignments to pick from. Keep in mind that every piece of hardware will transmit different CC messages so it is usually easiest to refer to the MIDI implementation chart of your device or use the MIDI Learn function to find the number you are looking for.

- To find the CC# using the MIDI Learn function, right-click on any knob and select *MIDI Learn*, turn the knob you want to use, then look in the MIDI tab to see which CC# it transmitted. Once you know the number, you can remove the MIDI assignment by right-clicking on it in the MIDI menu and selecting *Unlearn*.

Many MIDI controllers allow you to assign any CC# to any knob or button so don't worry too much about what the list says. If a knob on your controller transmits CC# 5, it doesn't mean you have to use it to control portamento time.

CV Out jacks- Each jack outputs a CV signal for its respective MIDI CC#. MIDI CC values from 0 - 127 are converted to voltage between 0V and 5V. If no messages are received by the selected MIDI CC, no voltage will be output.

MIDI CHANNEL FILTER

The MIDI Channel Filter module allows easy selective filtering of any combination of channelized MIDI data and includes "All On" and "All Off" buttons to quickly enable or disable all MIDI channels. This module can be used in various ways including muting/unmuting MIDI channels on the fly, splitting data to multiple MIDI destinations, or rerouting MIDI channels. You could, for example, use the MIDI Channel Filter to isolate a single channel of MIDI from a signal and reroute its data to a different channel and/or destination using a MIDI Output module.

Inputs, Outputs, and Controls

MIDI In jack- Patch MIDI signals here to selectively filter which channels are passed to the output jack. The small LED lights red when MIDI is being received.

Active Channels (1-16)- Click on these buttons to select which MIDI channels are passed to the output jack. Channels are active when their corresponding button is lit green. MIDI data received on active channels will be passed to the output while data received on unselected channels will be filtered out.

All Chnls (Off/On)- These *Off* and *On* buttons can be used to quickly select or deselect all 16 MIDI channels with a single click.

Midi Out jack- Outputs all MIDI data received on active channels. The small LED lights red when MIDI is being output.

MIDI CLOCK DIVIDER

The MIDI Clock Divider allows Voltage Modular to be synced to external devices such as drum machines, synths, and sequencers which are capable of sending MIDI clock. This module divides a 24-pulse-per-quarter-note MIDI clock signal into slower, musically relevant note-values, and outputs a voltage-based clock signal that can be used to advance sequencers, switches, etc. inside of Voltage Modular. Clock divisions can be set from 1/32-notes to 4 bars including triplet and dotted values.

Inputs, Outputs, and Controls

MIDI Clk In jack- This is the MIDI input jack that will receive MIDI clock from an external device. Typically this will be patched to the *From Host* MIDI jack on the I/O Panel or the *MIDI Out* jack of a MIDI In module.

Reset jack- A 5V pulse received at this jack will immediately reset the clock divider. Note that most devices that send MIDI clock also send "Start" messages when the external device's Play button is pressed which will automatically reset the MIDI Clock Divider. Remember to reset any sequencers, switches, etc. that are being triggered by the clock divider as well so that everything starts at the same time.

Note Value- Selects the note-value of the clock output pulses from 1/32-notes to 4 bars. Any of the selected note-values can be changed to a triplet or dotted note-value by clicking the corresponding buttons which light up green when engaged.

- For anyone unfamiliar with rhythmic note-values, a triplet clock will pulse three times for every two regular pulses of the same note-value, while a dotted-note clock will pulse twice for every three regular note-value pulses.

Clock Out jack- Outputs 5V clock pulses for syncing other modules in Voltage Modular. Often this will be patched to the external clock input of a sequencer but can be used for any number of things including advancing switches, resetting LFOs, and triggering sample and hold modules.

MIDI DRUM TRIGGER

The Cherry Audio MIDI Drum Trigger module converts incoming MIDI notes to eight individual gate outputs and features easy-to-use *Learn* buttons for quickly mapping external devices. MIDI notes sent from the pads or keys of an external controller or drum machine can be mapped to individual drum modules, samplers etc. inside of Voltage Modular to create the modular drum-machine of your dreams!

Inputs, Outputs and Controls

MIDI Channel- Selects which MIDI channel the module will respond to. Set this to the same channel as your controller or external MIDI device. When set to "All," MIDI notes from all sixteen channels will be received allowing devices on different channels to trigger the module simultaneously.

MIDI In jack- Input jack for receiving MIDI notes from an external controller or MIDI device. This is typically patched to the *From Host* MIDI jack in the I/O panel or the *MIDI Out* jack of a MIDI Input module.

Triggers 1 - 8

Learn / MIDI Note- Displays the MIDI note-number assigned to each gate output. This can be reassigned by clicking the *Learn* button (the button will turn red), and playing the desired note on the device patched to the *MIDI In* jack.

Gate Out jack- Outputs a 5V gate signal while the respective MIDI note is being played. This will typically be used to play a drum sound via the trigger input of a drum module or gate input of a sampler but can also be used, for example, to start and stop sequencers or step through switch modules.

MIDI INPUT

The Cherry Audio MIDI Input module receives MIDI messages sent from an external MIDI device and converts them to CV signals for use within Voltage Modular. Using this module in addition to the CV Outs section of the I/O panel makes it possible to route MIDI data from multiple external MIDI devices to different parts of a patch. An external sequencer could be used to play notes in one part of your patch while a midi keyboard controller is simultaneously used to play a different part of the patch.

Inputs, Outputs and Controls

Select MIDI Device- Click this button to select which external interface or port will be used for MIDI input.

Device Status- These two LEDs give visual feedback of the state of the selected external MIDI device. The *Active* LED will light up when the MIDI device is connected and working properly. The *Error* LED will light up if there is a problem with the MIDI device such as its connection being lost.

MIDI Out jack- MIDI output for passing the MIDI data received by the selected input device to other MIDI modules within Voltage Modular such as the Arpeggiator or Poly Octave Oscillator. The small LED next to this jack lights up when MIDI is being sent from the output.

Transpose- Shifts the pitch of the CV signals that are output from the *Pitch* jack up or down as much as three octaves in semitone increments.

Trig (Single/Multi)- Defines how gate and trigger voltages behave when a key is struck while another key is held. In *Single* mode, a new gate and trigger voltage will not be sent until all previously held keys are released. In *Multi* mode, new gate and trigger voltages are sent any time a new key is played. (Because the gate voltage is already "high," it will very briefly dip to zero volts when a new key is struck in order to let the module know to retrigger.)

Pitch- MIDI note number data is converted to a pitch CV signal and output from this jack. Typically this will be patched to the Keyb CV jack of an oscillator.

Gate- MIDI note on/off messages are converted to gate CV signals and output from this jack. This is often patched to the Gate In jack of an envelope generator to control a sound's amplitude and/or filter settings.

Vel- MIDI note velocity (how hard a key is pressed) values 0 - 127 are converted to CVs between 0V and 5V and output at this jack.

Bend- MIDI pitch bend messages are converted to CVs ranging from -5V (all the way down) to 5V (all the way up) and output at this jack.

Mod Whl- Mod wheel (MIDI CC# 1) values 0 - 127 are converted to CVs from 0V - 5V and output at this jack.

After Touch- MIDI After touch (channel pressure) values 0 - 127 are converted to CVs from 0V - 5V and output at this jack.

Sus- Sustain (MIDI CC# 64) on/off messages are converted to a CV gate signal and output from this jack.

MIDI OUT

The Cherry Audio MIDI Out module allows modules with MIDI out jacks, such as the CV To MIDI and CV To MIDI CC Converter, to control external MIDI hardware devices. This means that any MIDI capable sound module, synthesizer, drum machine or effects unit can be part of your modular setup! Create sequences, arpeggios and complex modulations inside of Voltage Modular and send them via MIDI to all of your favorite hardware gear.

The MIDI Out module can be used to merge up to six channels of MIDI. The MIDI protocol allows up to 16 channels of MIDI data to be transmitted over one cable. If more than six channels are needed, multiple instances can be set to the same external device and their MIDI data will be merged.

In the image below, four channels of MIDI are being sent to the *MIDI In* jack. The MIDI Out module will merge the data so they can be simultaneously output by one MIDI cable. This allows four devices to be individually controlled while "daisy-chained" together.

Inputs, Outputs and Controls

MIDI In jack- Modules with MIDI out jacks can be patched to this input to send their MIDI data to external MIDI devices. This input can accept up to six MIDI cables at once. The inputs will be merged and sent to the selected external MIDI device.

MIDI Channel- Selects the MIDI channel on which the data received at the *MIDI In* jack will be output. When set from one to sixteen, MIDI data from all channels will be merged and output on the selected channel. When set to *All,* each channel of MIDI will be output on the same channel that it was received.

Transpose- Shifts the pitch of the output MIDI notes as much as three octaves up or down in semitone increments.

Select MIDI Device- Click this button to select which external interface or port will be used to output MIDI data.

Device Status- These two LEDs give visual feedback of the state of the selected external MIDI device. The *Active* LED will light up when the selected MIDI device is connected and working properly. The *Error* LED will light up if there is a problem with the MIDI device such as its connection being lost.

MIDI MULTIPLE

The MIDI Multiple module takes one MIDI input and "copies" it to four additional MIDI outputs so that one MIDI cable can be routed to multiple destinations. Since every jack in Voltage Modular can have up to six cables connected to it, it's possible to merge up to six MIDI inputs and send the data to as many as 24 destinations!

The MIDI Multiple module can also be used to help organize or quickly re-route signals. The *From Host* MIDI jack, for example, could be patched to a MIDI Multiple which sends data to all of the MIDI modules in a patch. That way if you decide to change the MIDI input source, only one cable needs to be moved to re-route all of the MIDI in the patch.

Inputs and Outputs

Input jack- This is the MIDI input jack. All signals received at this jack will be "copied" to the four MIDI output jacks. Up to six cables can be connected to merge MIDI data.

Output jacks- Each of these four MIDI jacks will output the same MIDI data that is received at the MIDI input jack.

MIDI TRIGGER 3

The MIDI Trigger 3 module converts MIDI notes C3, D3, and E3 to trigger outputs for basic drum module setups. If you want a quick and simple way to convert three MIDI notes to trigger outputs this it! If three notes isn't enough, or you want to use different MIDI notes, check out the MIDI Drum Trigger module.

Inputs and Outputs

MIDI In jack- Input jack for receiving MIDI notes from an external controller or MIDI device. This is typically patched to the *From Host* MIDI jack in the I/O panel or the *MIDI Out* jack of a MIDI Input module. Remember that this module ONLY responds to MIDI notes C3, D3, and E3.

Trig Out jacks- Outputs a 5V pulse, or trigger, each time its respective MIDI note is received at the *MIDI In* jack. These will typically be used to trigger drum modules via their *Trig In* jacks but can also be used to trigger "one-shot" samples, envelopes or LFOs.

MINI LFO

The Cherry Audio Mini LFO module features two independent, low-frequency oscillators. Each LFO has an adjustable rate and simultaneously outputs a triangle and square wave.

If you are unfamiliar with LFOs it may be helpful to read the documentation for the "standard" LFO module.

Outputs and Controls

Rate- Sets the frequency, or rate, of the LFO. Frequency values are represented in Hz (cycles per second). A frequency setting of 1 Hz means it takes one second to complete a full cycle of the waveform. The Mini LFOs frequency range is 0.02 Hz - 20 Hz.

Output jacks- These are the output jacks for the LFO signals. Each LFO has a triangle and square wave output which can be used simultaneously.

MINI MONO TO POLY

The Mini Mono to Poly module converts a standard "mono" CV or audio input signal to a multi-channel "poly" output. The input is copied to each channel, or "lane," of the poly output making it possible to send the signal to other poly module's input jacks.

Inputs and Outputs

CV In jack- Patch standard "mono" CV or audio signals here to convert them to poly signals. The small LED glows red when voltage is present.

Poly Out jack- This "poly" output carries the signal received at the *CV In* jack on each of its channels, or "lanes."

MINI PLUG-IN HOST

The Mini Plug-In Host module lets you use almost any virtual instrument or effect plug-in "inside" of Voltage Modular and allows CV control of four plug-in parameters. It includes four audio ins and outs as well as MIDI I/O.

It's functionally identical to the larger "double-wide" Plug-In Host module, but has four parameter control slots instead of twelve. We provided this to save space when many control slots aren't needed.

Please see the full-size Plug-In Host user guide for information on how to use Mini Plug-In Host.

MINI POLY TO MONO

The Mini Poly to Mono module mixes, or sums, the individual signals carried by a "poly" CV or audio cable to a standard "mono" output jack. This module can be used, for example, to mix the individual audio signals, or voices, of a poly synth to a standard mono output so that it can be sent to the *Main Outs*.

Inputs, Outputs, and Controls

Poly In jack- Patch "poly" CV or audio cables here to convert the signals to standard "mono" cables.

Mix Level- Adjusts the level of the combined signals. It is often necessary to attenuate the output to compensate for the increase in amplitude caused by summing multiple signals.

Mix Out jack- Outputs a standard "mono" signal carrying the sum of all signals received by the *Poly In* jack.

MOD WHEEL ASSISTANT

The Mod Wheel Assistant is a handy "helper" module designed to make configuring mod-wheel controlled LFO routings quick and easy. The module has a full-featured internal LFO whose amplitude is scaled by the voltage received at the *Mod Wheel In* jack. An attenuator is also included at the output to scale the overall depth of modulation.

Typically the *Mod Wheel* output jack from the CV Outs section of the I/O panel will be connected to the module's *Mod Wheel In* jack. Mod wheel messages sent from your MIDI keyboard or DAW will then control the amplitude of the internal LFO which in turn increases or decreases the amount of modulation it imparts on its destination.

A typical application would be to use the mod wheel to adjust the amount of vibrato (pitch modulation) in a patch. To set this up, patch the *Mod Wheel* jack from the CV Outs section of the I/O panel to the Mod Wheel Assistant's *Mod Wheel In* jack and patch the *Output* jack to the Keyb CV or Freq Mod input of an oscillator.

Remember that any type of control signal can be patched to the *Mod Wheel In* jack. An envelope, sequencer, or LFO could be used to modulate the depth of the internal LFO in the same way that a mod wheel allows you to control it manually.

Inputs, Outputs and Controls

Mod Wheel In jack- Patch the *Mod Wheel* jack from the CV Outs section of the I/O panel to this input to control the internal LFO's amplitude manually with the mod wheel of a MIDI keyboard controller.

Frequency- Sets the frequency, or rate, of the internal LFO.

Pol- Sets the polarity of the LFO. With the mod wheel and the *Amount* knob all the way up, *Bi* will output a bipolar LFO ranging from -5V to 5V, + will output an LFO ranging from 0V to 5V and - will range from -5V to 0V.

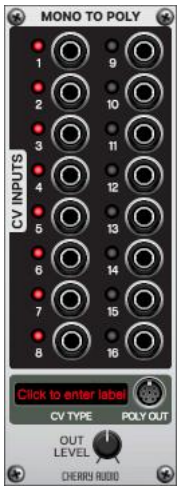
Pulse Width- Adjusts the width, or "duty-cycle," of the LFO when the pulse wave is selected. At 50%, a symmetrical square wave is produced, meaning the positive and negative portions of the cycle are equal lengths. As the knob is turned clockwise, the positive portion of the LFO cycle is increased; as it is turned counter-clockwise, the positive portion of the cycle is decreased.

Waveforms- These six buttons select the waveform of the LFO. Shape options are pulse, random (i.e. sample and hold), sine, ramp up, ramp down and triangle.

Amount- This is a second stage of attenuation that limits the maximum amount of modulation imparted by the LFO.

Output- Outputs the scaled internal LFO signal. Connect this jack to the CV input of the parameter whose modulation depth will be controlled via the mod wheel.

MONO TO POLY



The Mono To Poly module accepts up to 16 individual CV or audio inputs and converts them to a single multi-channel "poly" output. The module can be used with CVs to send different envelopes, LFOs, pitch CVs etc. to each individual voice of a polyphonic patch or to convert multiple mono audio signals, such as oscillators, to a "poly" audio signal.

Let's look at an example.

In the patch below, four LFOs are patched to a Mono To Poly module's inputs to create a "poly" CV signal that is modulating the cutoff frequency of a Poly Filter module. This results in a patch where each of its four active voices have a different LFO rate modulating its filter.

Inputs, Outputs, and Controls

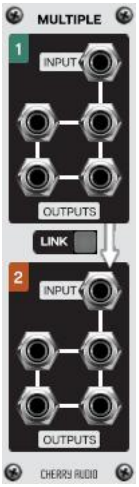
Input jacks- Each input jack can receive a unique CV or audio signal that will be "packaged" together and output as individual channels, or "lanes," of the poly output signal. The number of active inputs depends on the *Number of Voices* setting in the I/O Panel. When the patch is set to eight voices, for example, the LEDs for *Inputs 1 - 8* will glow red to indicate that they are active. Signals received by inputs that are not active will not be passed to the output.

CV Type- This is a handy little text box that can be used to label the module. To change the text, click in the box labeled "Click to enter label" and begin typing.

Poly Out jack- Outputs the CV or audio signals received by the active input jacks as a multi-channel "poly" signal.

Out Level- Simultaneously adjusts the output level of all channels of the poly signal.

MULTIPLE



The Cherry Audio Multiple is a dual module that "copies" the CV or audio signal received at its input to four output jacks so that the signal can be sent to multiple destinations. When the *Link* button is engaged, the input from module one is sent to the outputs of module two as well, creating a total of eight copies. Since every jack in Voltage Modular can have up to six cables connected to it, it's possible to send a mix of six input signals to as many as 48 output jacks when linked!

The Multiple module can also be used to help organize or quickly re-route signals. Copying the *Pitch* and *Gate* jacks from the I/O panel, for example, is a common practice for keeping things tidy and versatile. By using the outputs of a Multiple to send pitch and gate CVs to all of the oscillators and envelopes in a patch, the input source can easily be changed, to an arpeggiator or sequencer for example, without having to re-patch every pitch and gate CV.

Inputs, Outputs and Controls

Input jack- This is the input jack for the CV or audio signal that will be copied to the output jacks. As many as six signals can be patched to this input.

Output jacks- These four jacks will output a copy of the signal received at the input jack. Each jack can have up to six cables patched to it for a total of 24 possible copies.

Link- When this button is engaged, the input from module one will be copied to the outputs of module two as well, and the input of module two will be ignored. When linked there is a total of 48 possible copies.

NOISE GENERATOR

The Cherry Audio Noise Generator simultaneously outputs white and pink noise which can be attenuated by its built-in amplifier.

Noise signals are random-voltage signals that can be used as audio or control signals. As an audio signal, noise is often used to emulate the percussive hit of a drum or the breathiness of a voice. As a control signal, it can be a great source for creating randomness in a patch. Noise signals are often used as the input signal of a Sample and Hold module which can adjust the rate at which random voltages are output.

Outputs and Controls

Amount- Attenuates the amplitude of the noise signals.

White Noise- Outputs a random signal in which all frequencies across the frequency spectrum are represented equally.

Pink Noise- Outputs a random signal in which each octave across the frequency spectrum is represented equally. Pink noise will sound duller to the ear than white noise, and as a control signal, will be less likely to output higher frequencies.

NOTCH FILTER

The Cherry Audio Notch Filter is a variable-bandwidth audio filter for removing frequencies in a CV-controllable notch. This module can be used "surgically" to target and remove unwanted frequencies from an audio signal or can be used more creatively to create phaser-type effects by modulating the filter's frequency.

Inputs, Outputs, and Controls

Input jack- Patch audio signals here.

CV Mod jack and attenuator- CV input jack and attenuator for externally controlling the *Frequency.*

Frequency- Sets the frequency where the filter's notch will be. Audio content at and around this frequency will be removed from the input signal.

Bypass button- When lit red, the notch filter is active. When gray, the filter is bypassed. Notch filters are often used to make subtle adjustments. Toggling this button on and off can help identify which frequencies are being removed by the filter.

Bandwidth- Adjusts the width of the notch. Low values create a narrow notch while higher values create a wider notch.

Output jack- Outputs the filtered audio signal.

OCTAGON

Octagon is a mondo powerhouse sequencer. At first glance, it appears to have just 8 steps, but it actually can be set from 1 up to 32 steps, and each step can have up to 8 individual clock "pulses." Add this to myriad step play order options, per-step 303-style slide, and it's easy to see what a beast Octagon is!

We'll begin by explaining Octagon's top section for global controls, including transport, number of steps, and more.

Global Controls

Steps and Banks

A "step" refers to one set of sequence step controls. Eight steps are visible at all times, but Octagon can actually be set between 1 and 32 steps. Each step, in turn, can consist of between 1 and 8 gate or trigger "pulses." The important thing to remember is that ***each step has its own CV value (typically a musical note), but pulses within a step will all be the same CV value (note).***

As a result, ***individual clock pulses from Octagon's internal clock or external clock pulses correspond to the pulses within each sequencer step*** (not the entire step, like most typical sequencers). This may sound a little confusing, but we promise, it's easy to wrap your head around once you start using it.

Octagon can have up to 32 sequence steps with 8 steps viewable at any given time.

Shift Bank Left/Right buttons- Shifts which sequence step sliders are currently visible in banks of 8. For example, if the *Sequence Length* is set at 16 steps, and steps 1-8 were currently visible, clicking the *Shift Bank Right* button would change the view to steps 9-16. The gold numbers beneath each step change to reflect this.

Shift Step Left/Right buttons- Shifts which sequence step sliders are currently visible by one step. For example, if the Sequence Length is set at 16 steps, and steps 1-8 were currently visible, clicking the *Shift Bank Right* button would change the view to steps 2-9. The gold numbers beneath each step change to reflect this.

Step Play Order button and display- Clicking the button or display opens a pop-up where step playback order can be changed. The step play order modes are as follows:

- *Forward*- Starts at first enabled step and continues to last enabled step then loops. This is the default setting.
- *Reverse*- Starts at last enabled step and continues to first enabled step then loops.
- *For-Rev*- Moves forward until it reaches the last step number thenreverses. When it reaches step 1, it plays forward.
- *For-Rev Repeat*- Same as *For-Rev* but plays the first and thelast stage twice. This can help to keep sequences playingcorrectly in 4/4 time, for example.
- *Even Only*- Plays even steps only, in forward direction.
- *Odd Only*- Plays odd steps numbers only, in forward direction.
- *Funnel*- First, last and inward, e.g., if the sequence length is 8 steps, the order would be1,8,2,7,3,6,4,5, etc.
- *Hourglass*- Same as *Funnel* above, but once it reaches the "center," it works its way backout in reverse, ex: 1,8,2,7,3,6,4,5,5,4,6,3,7,2,8,1.
- *Random*- Starts at a random step and chooses steps randomly within the # of steps setting.
- *Brownian*- Advances in a pseudo-random pattern known as “drunken walk.” Starting at stage 1 it has a 50% chance of movingforward, 25% chance of staying at the same stage, and 25%chance of moving backwards. This results in a sequence thatmostly moves forward with some degree of repetition. (Not to be confused with *James Brownian*, which only plays on step one, and fines you if you make a mistake.)

Order CV jack and associated Step Play Order modes
The *Order CV* jack allows CV control of which steps are played when using the *Step Play Order* modes below. Since the *Order CV* jack only affects these modes, it appears "grayed out" for all other modes.

- *CV Cont - Distributed*- The 0-5V CV "spread" is equally divided by the current *Sequence Length* setting. For example, If the sequence length was 8 steps, voltages from 0-0.625 would correspond to step 1, 0.626-1.25 would correspond to step 2, 1.26-1.875 would correspond to step 3, etc. Math is fun, eh?

- *CV Cont - 1V/oct*- Each stage corresponds to 1/12V divisions, allowing akeyboard or secondary sequencer CV to "play" the steps in a consistent fashion. Unlike *CV Cont - Distributed* mode, stage voltages are the same regardless of the *Sequence Length* setting.

Transport Section

The top area of the module uses standard tape deck-style transport controls.

Stop button and CV jack- Stops sequencer from running. The *Stop* button can be activated via CV using the jack below the button with any trigger or gate CV greater than +2.5 volts.

Start and CV jack- Starts sequencer running. The *Start* button can be activated via CV using the jack below the button with any trigger or gate CV greater than +2.5 volts.

Step- Advances current position to the next step. This is useful for setting pitches for each stage when stopped. The advance button also works when the sequencer is in play mode. Note that we didn't include a CV jack for step advance- the *Ext Clk* jack does exactly this, hence the fanciful arrow.

Rate, Gate, and More Top Controls

Ext Clk button and CV in- Clicking the *Ext* button disconnects Octagon's internal clock and accepts clock signals from *Ext Clk* jack. Octagon isn't too fussy about external clock sources; pretty much anything that creates rapid (or not-so-rapid) pulses can be used, including LFO's, oscillators, or even the gate or trigger output of another sequencer. Along these lines, note that external clock pulses don't have to consistently repeat either; any pattern of pulses can drive the sequencer *Ext Clk* input.

Reset- This input jack is **really** important for locking sequencer timing to a DAW project or other sequencers. It force-resets the sequencer to the very beginning of step 1 the instant it receives a gate or trigger voltage.

Offset CV- This input jack lets you add or subtract overall voltage from the sequencer's output. Most commonly this would be used to transpose the key of a sequence during playback (from a keyboard CV, or another synced sequencer running at a slower rate), but it can also be used for more esoteric applications, such as routing an LFO to continuously vary the pitch of the entire sequence.

Rate knob+LED/CV jack and attenuator- The rate knob sets the internal clock speed from around 4 - 240 bpm. The LED indicator flashes with each "click" or step advance. The *Rate* pop-up tooltip is calibrated to display tempos based on sixteenth-notes. For example, setting the *Rate* knob to 120 bpm plays 480 notes a minute (We did this because you'll likely want to play fast tempos such as this, and it's sort of kooky to set the knob to 480 bpm to get sixteenth-notes). External clock signals can used if faster or slower speeds are needed - we won't judge! The CV In jack and attenuator allow CV control of tempo.

Gate Time- Sets the length of the 5V gate signal from 1-1000ms for each pulse in a sequence step. The *Gate Time* setting is not affected by the overall sequencer rate. It also has no effect on the *Trig Out* jack signals (because a trigger signal is always a rapid pulse). The CV In jack and attenuator allow CV control of the gate length.

Sequence Length and display- These up/down buttons set the total number of sequencer steps from 1-32 steps. This defaults to 8 steps and can be altered with the sequencer in stop or play mode. The *CV In* jack and attenuator allow CV control of the gate length.

Pro tip: Holding down the buttons continuously changes the setting, so you won't have to click the button a zillion times.

Slide knob- The *Slide* control causes notes to slide from one pitch to the next, as opposed to discretely jumping from one pitch to the next. It works in conjunction with the individual *Slide* buttons in each step's controls - **slide only occurs if the *Slide* button is enabled for that step.**

Octagon's slide implementation is unique in that it features two types of slide; normal and "303" style.

- **Standard slide-** Technically, this would be referred to as "constant time" slide, where the speed of the glide is fixed and higher settings = longer glide time. This is how the portamento or glide operates in most classic monophonic synthesizers. Depending on the overall *Rate* setting, note interval distance, and *Slide* knob setting, pitches may or may not fully "make it" up or down to the next note in the time between steps.
- **Constant Rate/303-Style slide-** "Constant rate" slide emulates the famous little silver box o' techno heard around the world. It has a few unique idiosyncracies.

  - Pitch changes from one step to the next *always* occurs within the time between the two steps, regardless of pitch interval or bpm setting. In other words, the pitch change will always "arrive" at the following pitch in the time between the steps regardless of whether it's a half-step or five octaves.
  - When the *Slide/Constant Rate* button is enabled, the last pulse of a slide enabled step is automatically set to legato- i.e. the gate is high from last pulse of the step until the beginning of the next sequence step, and the pitch slide happens during the last 16% of the step. (To frame that in little-silver-Japanese-technobox terms, each of its steps lasts 24 pulses, and the slide occurs during the last 4 pulses.)

Sequencer Step Controls

Each step consists of a big fader for setting the step CV, along with a gaggle of buttons many featuring fun cryptic abbreviations! (Hey, we could've made this thing bigger, but it would've taken up your whole dang screen, ok?) Here we'll dissect one sequence step and run down what all the buttons do.

CV Slider and LED- Sets the voltage sent to the main CV out for the step. The LED beneath indicates to show the current step is active.

Pulses buttons- Each sequence step can have up to eight gate/trigger pulses. The sequence step counts vertically through the number of pulses for that step; the pulse buttons flash red at each pulse count.

The gate signals behave differently depending upon the current *Gate* mode selection. The *Pulses* buttons will illuminate differently dependent onthe current *Gate* mode, and the gate pulse steps may or may not send a voltage depending on their setting, but Octagon will also count up to the highest selected pulse number before advancing to the next step.

Gate mode- These buttons define the behavior of the gate voltages for the pulse steps.

- **Off**- Doesn't output any gate CV's, but lingers on the step for theduration of the current *Pulses* setting. All buttons up to theselected # of "rest" pulses are lit and flash as it counts up. When itreaches the last selected pulse #, it advances to the next step.The # of counts is selected by clicking the top button only. This is essentially a rest with definable length.
- **Single (Sngl)**- Outputs a single gate on pulse #1 then counts up towhatever the # of pulses setting is. In this mode, pulse #1 isalways on (hence always green); you only need to click the top button to select the # of pulse counts (how long it rests after thepulse on 1). When it reaches the last selected pulse #, itadvances to the next step.
- **Legato (Leg)**- Outputs a continuous gate lasting as long as the # ofpulses setting then advances to the next step. The # of counts is chosen by clicking the top button only.
- **Repeat (Rept)**- Outputs a separate gate on each active pulse #. When itreaches the last selected pulse #, it advances to the next step. The # of counts is chosen by clicking the top button only. If you're not hearing individual notes sound, make sure the *Gate Time* knob setting is short enough. If the gate output is patched to an envelope generator, make sure the decay and release times are short enough to hear individual notes.
- **Defined (Def)**- The overall pulse count AND which steps send gates can both be set in any combination. Consecutively selected steps send separate gates (i.e., no legato).

  When the *Defined* button is clicked, a pop-up menu opens where you'll select the number of active pulses and the corresponding number of pulse buttons will illuminate in amber. Any combination of the active pulses can be clicked to turn on gates. Active gate steps will illuminate in green, and gray pulse buttons don't do anything. The number of active pulses can be changed at any time by clicking on the *Defined* button and changing the number of pulses.

  In the image below, the step will count up to six and gates will be sent for steps 1, 2, and 5.

Skip- When a step's skip button is on, Octagon jumps over it as it if wasn't there (in contrast to the *Off* gate mode, where the selected number of pulses will count but no gate voltages are output).

Slide- Adds a CV slide for the step - see *Slide knob* section for more info.

Division- Sometimes referred to as "ratcheting," this adjusts the pulse rate for the step. By default, this is set to the standard /1 rate, but can also be set to /2, /3, or /4 to play pulses more quickly. The *Division* button acts globally for all pulses of a step. Note: The Division function is disabled when using an external clock source (because external clock pulses happen once per sequence pulse or step and can't be "multiplied."

Output Jacks and Other Right-Side Controls

Play Trig Out- The *Play Trigger Out* jack outputs a 5V trigger spike any time play mode is initiated (from the *Start* button or via CV control). This can be useful for starting ganged multiple sequencers and other functions.

Clock Out- This outputs Octagon's internal clock signal for syncing other modules. If *External Clock* mode is selected, it echoes the incoming clock, thus turning Octagon into the world's most complex mult module.

Trigger Out jack- Outputs 5V trigger signals for active pulses.

Gate Out jack- Outputs 5V gate signals for active pulses.

CV Range buttons- Selects the ranges of voltage for sliders.

- **1V = 0 to +1V** (one-octave range)
- **2V = 0 to +2V** (two-octave range)
- **5V = 0 to +5V** (five-octave range)

Since Voltage Modular's pitch conforms to the 1V/octave standard, this means a 1V range equates to a range of one octave, a 2V range equates to two octaves, and a 5V range equates to five octaves. Octagon's pop-up tooltip displays will change to reflect *CV Range* selection.

Quantize- Enabling *Quantize* forces fader values to snap to 1/2 step note increments (i.e. 1/12 volt). Without this, it would be difficult to set note values to play in tune. Disabling *Output Quantize* turns off pitch "snap" and allows any value to be set - this is useful when the sequencer is being used to modulate non-pitched destinations, such as filter cutoff or amplitude. The pop-up tooltip displays will show note or decimal values dependent on the *Quantize* button setting.

CV Out jack- Outputs the slider CV for the current step.

ONE TO EIGHT SWITCH

The Cherry Audio One To Eight Switch module routes an audio or control input signal to eight individual output jacks. Signal is only passed from an output when its respective “step” is active. The outputs can be stepped through sequentially with a manual or CV trigger, or targeted individually via discrete control voltages.

Switches are used to re-route signals without having to unplug or re-patch any cables. As an example, the One To Eight Switch could be used to pass a clean audio signal from one output while sending another output to a distortion module and another to a delay unit. The fun starts when you begin experimenting with different ways to step through the outputs!

Inputs, Outputs and Controls

In jack- Input jack for the signal that will be routed to the eight outputs.

1-8 output jacks and LEDs- These eight jacks output the signal received at the input jack whenever their respective step is active. The small red LEDs give visual feedback of the active step.

Steps- Sets the number of steps that can be activated. When stepping through the outputs sequentially with either the manual or *Step Trigger* CV input, this sets the number of the last step before it will cycle back to step one.

Step Trigger jack- A 5V pulse or gate received at this jack will trigger the steps sequentially.

Step CV jack- CV input jack for switching between steps in any order. The control voltage range of 0V - 5V is evenly divided between the number of steps making it possible to target specific steps with discrete voltages.

Here are a couple examples of how the voltage is divided:

- If *Steps* is set to two, the 5V range is divided between the two steps. Step one is selected with voltage from 0V - 2.49V and step two is selected with 2.5V - 5V.
- If *Steps* is set to eight, the 5V range will be divided equally between the eight steps. Five divided by eight is 0.625 so, step one = 0V - 0.62V, step two = 0.63V - 1.24V, step three = 1.25V - 1.87V and so on.

If you don’t happen to make music with a calculator next to you, we recommend just playing around until you find the step you’re looking for!

Reset jack- A 5V pulse or gate received at this jack will immediately force the module back to step one. Note that resetting the module will be unnoticeable when using the *Step CV* input because the voltage received at its jack is constantly updating the active step.

Manual Step- Click this button to manually advance to the next sequential step.

OSCILLATOR

The Cherry Audio "standard" oscillator is a full-featured classic analog-synthesis oscillator. It generates all standard synthesis waveforms and can be used as an audio source, or as a control voltage (CV) modulation source. Its waveform outputs are always “on”; you’ll need to use a mixer or amplifier (VCA) of some sort to start and stop its sound.

Inputs, Outputs, and Controls

Keyb CV jack- Accepts a CV input for pitch. Typically this would come from the PITCH jack in the IO Panel CV OUT section, or from a sequencer pitch CV out.

Frequency Mod attenuator and input jack- This is used for externally modulating the oscillator frequency. It's useful for adding vibrato with an LFO, siren noises, envelope-controlled pitch sweeps, etc.

Hard Sync- Force resets the start of the waveform to the beginning of its cycle. Most often used to create the "sync sweep" oscillator sounds made famous in The Cars' "Let's Go" (or Kraftwerk's "Neon Lights" and No Doubt's "Just A Girl"), by routing the output of a second oscillator to the *Hard Sync* input and sweeping the pitch of the first oscillator.

Hard Sync is also useful when creating drum and percussion sounds to ensure that the wave starts at the beginning of its cycle.

Range- Sets the basic pitch of the oscillator, displayed in traditional organ footage. *LO* will be beneath the audible range and allows the oscillator to be used as a mod source.

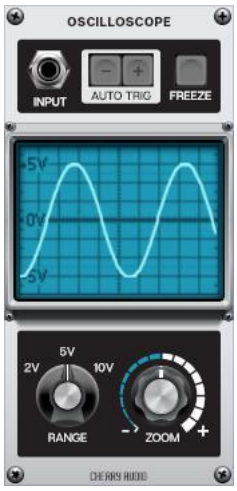
Frequency- Fine-tune control for pitch. This can be used to fatten up multi-oscillator patches by detuning a small amount, or for "building-in" a set interval. Its range is a smidge over a fifth, up or down.

Pulse Width- This sets the width or "duty-cycle" of the pulse wave. It has no effect on any other waveform. Its default setting of 50% outputs a perfect square wave, rich in delicious odd-order harmonics. Moving the knob left or right narrows its width as well as the thickness of sound until it almost disappears at its extremes, and we’ve included a nifty “faux-OLED” display to indicate the current pulse width.

PWM Amount attenuator and PWM Mod input jack- You may have noticed that moving the *Pulse Width* knob back and forth creates a nifty sound; instead of wearing our your mouse hand, the *PWM Mod* input can be used in conjunction with an LFO, envelope generator, or other mod source to continuously vary the pulse width. Best of all, the OLED display looks real cool swooping back and forth.

Waveform Output Jacks- These are output jacks for ramp, sawtooth, pulse, sine, and triangle waves. These can be used simultaneously, in any combination.

OSCILLOSCOPE



The Cherry Audio Oscilloscope is a handy utility module and slick visual component featuring range, zoom, and a freeze button for monitoring audio and CV signals. Besides looking cool (who doesn't love looking at waveforms in realtime!), this is an extremely helpful tool for learning about modular synthesis or troubleshooting a complicated patch.

Inputs, Outputs, and Controls

Input jack- Patch CV and audio signals here to visually monitor their voltage.

Auto Trig- These buttons are used to "stabalize" the visualization of the signal. When neither of these buttons are engaged, the voltage received is displayed without a consistent trigger or "starting point" within the display window which can sometimes appear jumpy and unstable. By engaging the - button, the oscilloscope will always show voltage starting from 0V at the left hand side and decreasing, while the + button will show voltage increasing from 0V. Having a consistent trigger point for where the voltages are displayed on the oscilloscope creates a stable waveform when monitoring cyclical signals such as oscillators. Try patching a sine-wave oscillator to the input and switching between - , +, and neither to see the difference.

Freeze- Instantly freezes the display. The signal that was present at the moment the button was clicked will be displayed until the button is turned off again.

Display window- A classic analog-style oscilloscope display showing the signal received at the *Input* jack. The horizontal line in the center represents 0V. Positive voltage is displayed above the 0V line while negative voltage is displayed below.

Range- Adjusts the range of voltage shown within the display. Think of this as a vertical zoom.

Zoom- Adjusts the sample length of the display window. Think of this as a horizontal zoom.

PANNER

The Cherry Audio Panner module is a static or voltage-controllable utility for panning an audio or CV signal between two outputs. Typically the outputs will be connected to a stereo mixer or the *Main Outs* in the I/O panel to pan an audio signal between the left and right speaker but the module is also useful for sending signals to two unrelated destinations. You could, for example, route the CV output from a sequencer to the mod inputs of a filter's cutoff and oscillator's pulse-width. The *Pan Position* can then be used to gradually route the CV sequence to either or both destinations.

Inputs, Outputs and Controls

Input jack- Receives the audio or CV signal that will be routed to the two outputs.

CV Mod jack- CV input for externally controlling the pan position.

CV Mod Amount- Scales the amplitude of the CV signal received at the *CV Mod* input jack. The + and - LEDs indicate when positive and negative voltage respectively is modulating the pan position.

Pan Position- Controls how much of the input signal is sent to each output. With the knob in it's center position, the input signal is sent at full amplitude to both outputs. Moving the knob to either side gradually decreases the amplitude of the opposite output.

Left and Right Outputs- Patch these to the left and right jacks of a stereo input for traditional panning. When used to route signals to destinations other than the left and right speaker, you can think of these as outputs "one" and "two" if it makes you feel better.

PERCUSSION EG

The Percussion EG (Envelope Generator) module is an envelope generator with controls optimized for percussive sounds. It features a continuously variable exponential to logarithmic decay curve, click enable switch, attack peak hold knob, and accent and choke inputs making this the perfect go-to envelope for sculpting a percussion sound from scratch.

Inputs, Outputs, and Controls

Trig In jack- A 5V gate or trigger received at this jack will trigger the envelope. If a gate signal is used, the length is ignored as this is a "one shot" envelope and has no sustain stage.

Accent In jack- A 5V gate or trigger received at this jack triggers the same envelope shape only with a greater amplitude (set by the *Accent Leve*l knob). This can be used to create a second, "louder" version of the envelope that can be used to create accented drum patterns. The Drum Trigger Sequencer has dedicated *Acc (Accent)* output jacks that are perfect for triggering this. Note that if the envelope is modulating something other than an amplifier, the sound will not necessarily be louder. Instead, the accent will increase the modulation amount.

Click- Adds a distinct "click" at the beginning of the envelope to add presence to the beginning of a drum sound.

Choke- A 5V gate or trigger received at this jack will immediately force the envelope to 0V. This can be used to stop the ringing of a long drum or to "close" an open hi-hat sound.

Attack Hold- Adjusts how long the the envelope will stay at 5V before starting the *Decay* stage.

Accent Level- This knob scales the amplitude of the accent envelope by as much as 400%. The accent envelope is triggered via the *Accent In* jack.

Decay- Defines the length of time it takes for the envelope's voltage to drop from 5V back to 0V. This can be set extremely short (making it perfect for adding a little "smack" to a sound), or as long as 2.5 seconds.

Decay Curve- Adjusts the shape, or curve, of the envelope's *Decay* stage from logarithmic when turned to the left, to linear at its center position, to exponential when turned to the right.

Env Out jack- This is the output jack for the envelope.

PHASER

The Cherry Audio Phaser module is a four-stage phaser audio effect featuring voltage-controlled rate and individual on/off switching for each stage. The stages of this module are made from four notch filters instead of typical all-pass filters creating a unique type of phaser effect.

Inputs, Outputs, and Controls

L(M) and R Input jacks- These are the mono or stereo audio input jacks. When using a mono input signal, patching it to the *L(Mono)* jack will feed the signal to both sides of the stereo effect. This is a true stereo effect unit with each side having its own phaser effect. The internal LFOs that modulate the frequency of the left and right notch filters are 180° out of phase with each other to create a sweeping motion from left to right.

Stages- These buttons engage each of the independent notch filters that make up the phaser effect. Each of the four notch filters modulates through a different range of frequencies with stage one being the lowest and stage four the highest.

Rate Mod jack and attenuator- CV input jack and attenuator for externally controlling the *Rate.*

Rate- Adjusts the rate, from .02Hz to 10Hz, at which the notch filters frequencies are modulated by the internal LFO.

Feedback- Adjusts how much of the filtered signal is sent back to the input of the effect.

L and R Output jacks- These are the module's stereo output jacks.

PLUG-IN HOST

The Plug-In Host module lets you use almost any virtual instrument or effect plug-in "inside" of Voltage Modular and allows CV control of up to 12 plug-in parameters. It includes four audio ins and outs as well as MIDI I/O.

In this guide, we'll interchangeably refer to virtual instruments and effects plug-ins simply as "plug-ins" to save me some typing and you some reading.

The Big Disclaimer

We've tested Plug-In Host with many plug-ins, and in most cases, it performs fabulously well, but be aware that not all plug-ins will play nice with it.

- If individual plug-ins use a shell host, you may not be able to load them.
- Controls for some plug-ins won't appear in the *Parameter Select* menu.
- Because some developers use non-standard preset browsers, presets may not appear in the *Preset Select* window.
- Some plug-ins may crash our system, but we're continually working to improve third-party plug-in support.

Top Buttons

Active- This is the "on/off" switch. Green is on, gray is off. In off mode, virtual instruments won't make any sound, and plug-ins will pass signals unaffected.

Select Plug-In- Use this to choose an instrument or effect. When clicked, you'll see a sub-menu with instrument and effects types *(Audio Units, VST, VST3* - depending on whether you're using Windows or OS X). Choosing the desired type will automatically navigate to the appropriate folder where plug-ins can be selected.

View Editor- Opens the editor window for the selected instrument or plug-in. Edit windows can be closed by clicking the *View Editor* button again or by clicking the *X* in the top-left corner of the plug.

Latency- Just like the audio latency setting in DAWs, lower settings result in quicker processing and snappier performance, but require more computer processing power. As with audio hardware, the general rule is to set this as low as possible until you start hearing crackling noises, but the default setting of 128 samples should work well for most applications.

Preset Select- The left/right arrow buttons can be used to cycle through a plug-in's presets. Clicking in the black area to the right of the selection arrows also opens a pop-up menu displaying all presets for the plug-in.

Please keep in mind that presets won't be visible if the plug-in developer uses a proprietary preset browser implementation; presets will only be displayed if the plug-in uses the standard Windows or OS X plug-in preset browser.

Inputs

MIDI- You'll typically play virtual instruments by patching the I/O Panel *MIDI From Host* MIDI output to the Plug-In Host *MIDI* input jack.

If you'd like to play a virtual instrument using CV's from a sequencer or other source within Voltage, use the **CV To MIDI** module (or the **CV To MIDI CC Converter** for transmitting MIDI CC data).

Audio Inputs- Use these for routing audio into an effects plug-in. Usually the *1L* and *1R* inputs are all you'll need, but we've provided a second set of inputs as well.

Outputs

MIDI- A MIDI out for plug-ins that use it, typically arpeggiators and some virtual instruments with on-screen keyboards.

Audio Outputs- The plug-in's audio outs. A second set of outputs is included for multi-out instruments and plug-ins.

Parameter Control Slots

We've arrived at the fun part! Not only do these allow 12 plug-in parameters to be "remote-controlled," but each slot includes a CV in jack and bipolar attenuator. This allows CV control of any parameter of any plug-in, which is kind of awesome.

CV Amount knob - Attenuates and/or inverts incoming control voltages. Center position is zero. Turning the knob right applies positive voltage, turning the knob to the left applies negative voltage.

CV In jack - Patch incoming CV's to this jack.

Parameter Amount - Sets the initial amount for mapped plug-in parameters. Once mapped, it acts as a "remote control" for the selected parameter, but keep in mind that that it only communicates one way, i.e. moving the control in the plug-in's interface will **not** move the *Parameter Amount* knob, but moving the *Parameter Amount* knob **will** move the control in the plug-in interface.

Parameter Select button - Click this to assign plug-in parameters to control slots. A single mouse click displays all of the plug-in's parameters; clicking on one assigns it. Parameters can also be assigned using Plug-In Host's *Learn* function.

To learn a control, select *Learn* from the pop-up menu (if the plug-in editor window is currently hidden, the menu will say *View Editor and Learn*; this initiates learn mode and opens the plug-in editor window). The *Parameter Select* button will say *LEARNING* in red; simply move the control you'd like to assign in the plug-in interface to instantly assign it to the current control slot. Learn mode will automatically disengage.

Learning vs. direct assignment*: Generally speaking, for plug-ins with a just a few parameters, it's fastest to assign controls by simply clicking the Parameter Select button and clicking the desired parameter, but for plug-ins with dozens of parameters, Learn mode greatly simplifies parameter assignment.*

To clear control assignments and intialize a parameter control slot, click the *Parameter Select* and choose *None*.

POLY AMPLIFIER

The Cherry Audio Poly Amplifier is a voltage-controlled amplifier (VCA) for polyphonic audio or CV signals. If you need a refresher on how VCAs work, check out the documentation for the standard Amplifier module.

Below is a simple polyphonic patch where the Poly Amplifier is modulated by a Poly Envelope Generator to control the volume of a Poly Oscillator.

Inputs, Outputs, and Controls

Input jack- Use this jack to patch in "poly" audio or control signals to be affected by the *Poly* and/or *Mono CV Mod* jacks.

Gain- Adds up to 5 volts of gain. This works *in addition* to incoming *CV Mod* jack voltages. It's also useful for manually "opening" the amplifier.

Poly CV Mod jack and attenuator- This is a "poly" CV input and bipolar attenuator for individually controlling the amplitude of the signals received at the *Input* jack.

Mono CV Mod jack and attenuator- Standard "mono" CV input and bipolar attenuator for simultaneously controlling the amplitude of all signals received at the *Input* jack.

Response - Lin/Expo- These select the "curve" of the amplifier's response as the input CV rises from 0 to 5V. *Lin* or linear response curve is equally proportional across the voltage input range, where as an *Expo* or exponential curve is closer to how the human ear perceives volume. With that in mind, you'll likely want to use the *Lin* setting for modulation or control voltage situations, and use the *Expo* setting when an envelope generator is used to control an audio signal with the amplifier.

Output jacks- The *Output* jack carries the CV-modified version of the polyphonic input signal. The *Inv Out* jack outputs an inverted version of the same "poly" signal. Be careful not to use both at the same level as they can cancel the output entirely.

POLY CV CONVERTER

The Poly CV Converter converts polyphonic MIDI input to four individual CV/gate/velocity outs for creating versatile polyphonic patches. Featuring selectable number of voices, MIDI channel, and outputs for converting MIDI pitch bend, mod wheel, aftertouch and volume messages to CV signals. If more than four voices are needed, multiple instances can be chained together using the *Overflow* MIDI jack to expand the polyphony of a patch.

Voltage Modular has a number of "Poly" modules that can simplify making polyphonic patches, but doing it the "old-school" way can give you more versatility by being able to customize each voice individually. It's possible, for example, to use a different filter envelope on each voice so that every note in a chord sounds a little different from one another.

MIDI Section

MIDI Channel- Selects which MIDI channel the module will respond to. Set this to the same channel as your controller or external MIDI device. When set to "All," MIDI notes from all sixteen channels will be received.

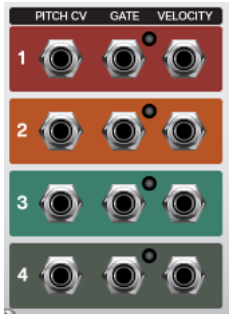
MIDI In jack- Input jack for receiving MIDI notes from an external controller or MIDI device. This is typically patched to the *From Host* MIDI jack in the I/O panel or the *MIDI Out* jack of a MIDI Input module.

Over Flow jack- Once the module is using all of its allocated voices, additional MIDI notes received at the *MIDI In* jack will be passed thru to this jack. Connecting this to the *MIDI In* jack of a second instance of this module makes it possible to increase the number voices to more than four.

Polyphony

Number of Voices- These buttons select how many voices will be used in the polyphonic patch. Set this to the maximum number of notes you wish to play at the same time. If only three voices of polyphony are needed, setting this to three eliminates the need to set up an oscillator, envelope, amplifier, etc. for the fourth voice which can save space and CPU.

Pitch, Gate, and Velocity CVs



Each time a MIDI note is received, the module evaluates which voices are already being used and allocates the note to one of the four available voices. Each voice has the same three output jacks.

Pitch CV jack- MIDI note-number messages are converted to CVs for controlling the pitch of an oscillator via their *Keyb CV* or *Pitch CV* jacks.

Gate jack- MIDI note-on/off messages are converted to gate CVs which are typically patched to the *Gate In* jack of an envelope. The red LED illuminates to show when each voice is in use.

Velocity jack- MIDI note-velocity messages are converted to CVs which can be used for a number of things, but often will be patched to the *CV In* jack of an Amplifier module to scale an envelope that is controlling the volume of a sound.

Mod/Performance Controls

Pitch Bend jack- MIDI pitch-bend messages are converted to CVs ranging from -5V to +5V. 0V is output when the pitch wheel is in its center, or neutral, position. This will often be patched to the *Bend CV In* jack of a Bend Limiter module who's output is patched to the *Keyb CV* or *Pitch CV* jack of an oscillator.

Mod Whl jack- MIDI mod wheel (CC#1) messages are converted to CVs ranging from 0V when down to +5V when up.

Aftertouch jack- MIDI channel-pressure messages (how hard the key is pressed while sustaining) are converted to CVs ranging from 0V to +5V. Note that not all MIDI controllers send aftertouch messages.

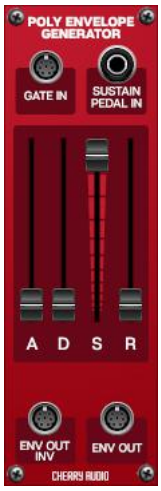
Volume jack- MIDI volume (CC#7) messages are converted to CVs ranging from 0V to +5V.

Let's look at an example

This is a velocity-sensitive patch with four voices of polyphony. You can see that MIDI is received from the *From Host* MIDI output in the I/O Panel. The Poly CV Converter converts the note messages to four separate pitch, gate, and velocity CV outputs. The *Pitch CV* jack for each voice is patched to the *Keyb CV* inputs of the four oscillators. The *Gate* jacks are patched to the *Gate In* jack of four envelopes which are patched to the *CV In* jack of the Amplifier next to them to control the volume of the oscillators. The *Velocity* jacks from the Poly CV Converter are patched to the *CV In* jack of a second Amplifier which scales the overall level of each voice. Then finally the output of each secondary Amplifier is fed to a Stereo Mixer which is patched to the Main Outs.


CV OUTS
POLY CV OUTS
MIDI
TRANSPORT
AUDIO IN from host
MAIN OUTS to host
AUX OUTS to host
POLY CV CONVERTER
OSCILLATOR
ENVELOPE GENERATOR
AMPLIFIER
CHERRY AUDIO

POLY ENVELOPE GENERATOR



Cherry Audio's Poly Envelope Generator is a polyphonic ADSR with sustain control that drastically simplifies creating polyphonic patches. It takes a polyphonic gate signal as its input and generates control voltage envelopes for each individual note, or voice. If you are unfamiliar with envelopes in general, or need a quick refresher, check out the documentation for the "standard" Envelope Generator which goes over ADSR envelopes in detail.

Below is an example of a simple polyphonic patch with sustain control that uses the Poly Envelope Generator to control the amplitude of a Poly Oscillator module.

Inputs, Outputs, and Controls

Gate In jack- Patch polyphonic gate signals here to trigger the envelope. Typically this will be connected to the *Poly Gate* jack in the I/O Panel.

Sustain Pedal In jack- A +5V gate signal received at this jack holds the envelope at its sustain level. Typically this is patched to the *Sus* (sustain) jack in the CV Outs section of the I/O Panel which converts MIDI sustain pedal messages (CC#64) from a keyboard controller to a +5V gate signal.

"A" (Attack) slider- Defines the length of time for voltage to rise from 0V to 5V when the gate voltage is applied.

"D" (Decay) slider- Defines the length of time for voltage to fall from the *Attack* stage 5V peak to *Sustain* stage setting.

"S" (Sustain) slider- Sets the held voltage level following *Attack* and *Decay* phases.

"R" (Release) slider- Defines the length of time for voltage to fall from *Sustain* level to 0V when gate is released.

Env Out and Env Out Inv- These are the envelope voltage outputs. The *Env Out* voltage ranges from 0V to +5V, whereas the *Env Out Inv* jack is an inverted version, with output ranging from 0V to -5V.

POLY FILTER

The Cherry Audio Poly Filter is a full-featured polyphonic synthesis filter featuring lowpass, bandpass, and highpass outputs, 12- and 24-db per octave slopes, with "poly" and "mono" CV modulation inputs. If you are unfamiliar with filters, check out the documentation for the "standard" Filter module.

The image below shows a simple polyphonic patch using several poly modules. The Poly Filter is modulated by a Poly Envelope Generator which results in each individual note, or voice, having its own dedicated filter envelope.

Inputs, Outputs, and Controls

Audio In jack- Patch "poly" audio signals in here.

1V/Oct jack- This is a cutoff frequency modulation input intended to be used with polyphonic keyboard CV inputs. It allows the cutoff frequency to follow or "track" notes played so that the relative brightness of notes follows note pitch. This will typically be patched to the *Poly Pitch* jack in I/O Panel.

Keyb Tracking- This is an attenuation control for the signal received at the *1V/Oct* jack. At 100%, keyboard CVs are tracked at 1V per octave.

Poly CV Mod jack and attenuator- Polyphonic modulation input and bipolar attenuator for controlling the cutoff frequency of each individual note played. This is useful with the Poly Envelope Generator, for example, to create individual filter envelopes for each voice as shown in the image above.

Mono CV Mod jack and attenuator- Standard "mono" CV input and bipolar attenuator for simultaneously controlling the filter cutoff of all voices with one CV signal.

Cutoff- Sets the frequency where attenuation begins. Attenuation will be above or below this frequency (or both) depending on which output is currently used. Also something I frequently hear at the bar, as in "you're cut off, pal!"

Resonance- Emphasizes sound energy at and around the current cutoff frequency by adding feedback from the filter's output back to its input. At lower settings, this can be used to create mild resonances such as those heard in acoustic instruments. At more extreme settings, resonance can create a pure sine wave at its own frequency (variable via the *Cutoff* knob). Be careful with this knob as it can get loud at extreme settings.

Slope- The nature of how a filter works is such that its affect on frequencies "falls off" above or below the cutoff frequency. Slope adjusts the "steepness" of this slope. A 12db per/octave filter has a shallower slope, giving it a clearer and brighter character, whereas a 24db per/octave filter's steeper slope gives it a tighter and darker tone (as well as more pronounced character with the resonance knob turned up).

Lowpass, Bandpass, and Highpass Output Jacks- These are the poly output jacks for lowpass, bandpass, and highpass modes, respectively. The icons visually represent the effect each has on incoming signals if the signal were to be viewed in a spectrum analyzer. These can be used simultaneously, in any combination. Combining the outputs with a poly mixer can result in interesting curves.

POLY GLIDE

The Poly Glide module is used to smoothly transition between polyphonic CVs. This is typically used to slide between pitch CVs allowing chords to be played with portamento.

This module can be thought of as a stack of standard Glide modules. Each module in the stack slides between the CVs received by one of the active voices in the patch. The number of voices used in a patch is set using the *Number of Voices* control in the Poly CV Outs section of the I/O Panel. This setting effects all poly modules in the patch.

The image below shows a simple polyphonic patch using the Poly Glide module to create portamento.

Inputs, Outputs, and Controls

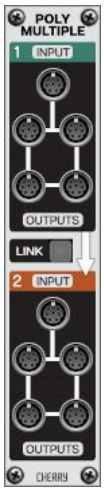
Input jack- Polyphonic input jack for the control voltages you wish to glide between. Typically this will be patched to the *Poly Pitch* jack in the Poly CV Outs section of the I/O Panel to create polyphonic portamento.

Amount- Adjusts the speed of the glide from 0ms to 5000ms (5 seconds). When the curve is set to *Con*, this is the amount of time it will take to slide from one CV to the next. When the curve is set to *Lin*, the slide time will be different depending on the distance between CVs so this is actually adjusting the speed of the glide rather than the time it will take to complete each transition.

Curve- Selects between two options for transitioning from one CV to the next. When *Lin* (linear) is selected, the rate of the glide will remain the same regardless of how far apart the CVs are. Therefore gliding between voltages near one another will take less time than voltages that are farther apart. When *Con* (constant) is selected, the amount of time it takes to glide between voltages will be the same regardless of how far apart the voltages are.

External Engage jack- “Mono” CV input that allows the glide module to be enabled and disabled in real time using control voltages. Voltages 2.5V or higher will enable the glide while voltages less than 2.5V will disable it.

Output jack- Polyphonic output jack which outputs multiple "lanes" of CVs that slide from one voltage to the next. Typically this will be connected to the *Poly Keyb CV* input of a Poly Oscillator to create polyphonic portamento.



The Cherry Audio Poly Multiple is a dual module that "copies" the CV or audio signals received at its "poly" input to four poly output jacks so the signals can be sent to multiple destinations. When the *Link* button is engaged, the input from module one is sent to the outputs of module two as well, creating a total of eight copies. Since every jack in Voltage Modular can have up to six cables connected to it, it's possible to send a mix of six polyphonic input signals to as many as 48 poly outputs when linked!

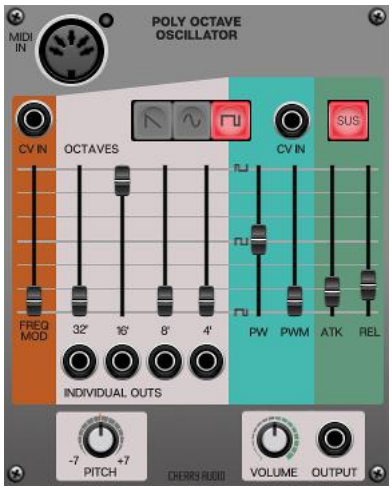
Inputs, Outputs and Controls

Input jack- This is the input jack for the poly CV or audio signal that will be copied to the output jacks. As many as six poly cables can be patched to this input.

Output jacks- These four jacks output a copy of the poly signal received at the input jack. Each jack can have up to six cables patched to it for a total of 24 possible copies.

Link- When this button is engaged, the input from module one will be copied to the outputs of module two as well, and the input of module two will be ignored. When linked there is a total of 48 possible copies.

POLY OCTAVE OSCILLATOR



The Cherry Audio Poly Octave Oscillator is a polyphonic oscillator with four mixable octaves per voice. The MIDI input receives pitch and note on/off messages and internally routes them to the oscillator's frequency and internal amplitude envelope respectively. This module is the perfect starting point for an organ or lush pad! Waveform options are saw, sine and a voltage-controllable variable-width pulse wave.

Inputs, Outputs, and Controls

MIDI In- This MIDI input jack receives polyphonic pitch and note on/off messages from a MIDI controller or host DAW. Typically this will be connected to the *MIDI From Host* output on the I/O panel.

Freq Mod CV In jack- Control voltage input for externally modulating the oscillator frequency. Useful for adding vibrato with an LFO, siren noises, envelope-controlled pitch sweeps, etc.

Freq Mod- Attenuates the signal received at the Freq Mod *CV In* jack. At 0% no modulation occurs; at 100% a +/-5V signal will modulate the pitch up and down one octave.

Octaves and Individual Out jacks- The sliders act as a mixer for the four octaves of the oscillator. Each octave, labeled in traditional organ footage, is output simultaneously to the main output and its individual output jack at the amplitude specified by the attenuation slider.

Waveform Selector- Selects the waveform of the oscillator. Options are saw, sine and a voltage-controllable variable-width pulse wave.

PW (pulse width)- Sets the width or "duty-cycle" of the pulse wave. This slider has no effect on the other two waveforms. Its default setting of 50% outputs a perfect square wave, rich in odd-order harmonics. Moving the slider up or down will shorten or lengthen the duty-cycle resulting in a thinner sound at either extreme.

PWM CV In jack- Connect an LFO, envelope generator or other mod source here to continuously vary the width of the pulse wave. This is a time-tested analog synthesis trick for adding some serious flavor to a patch!

PWM- Sets the amount of pulse-width modulation by attenuating the signal received at the PWM *CV In* jack.

Attack- Adjusts the amount of time it takes for the internal amplitude envelope to raise from zero to its maximum level.

Sustain- This button activates or deactivates the sustain stage of the internal amplitude envelope. After the designated attack time, the envelope will either sustain at full volume until a key is released or jump immediately to the envelope's release stage.

Release- Adjusts the amount of time it takes for the internal amplitude envelope to fall from its maximum volume back to zero once the release stage is activated.

Pitch- This is a fine tune control for the oscillator. The frequency of the oscillator can be shifted up or down by as little as 0.01 semitones (1 cent) or as much as 7 semitones.

Output jack and Volume attenuator- The main output and volume control for the four mixed octaves.

POLY OSCILLATOR

The Cherry Audio Poly Oscillator is a polyphonic version of the "standard" Oscillator module with up to 16-voices of polyphony. This module can be thought of as a "stack" of oscillators that each receive individual pitch CVs so that multiple notes can be played simultaneously.

The number of voices that are used is defined by the *Number of Voices* setting in the Poly CV Outs section of the I/O Panel. This setting is used for all poly modules in the patch.

Below is a simple polyphonic patch created using the Poly Oscillator and other poly modules.

Inputs, Outputs, and Controls

Poly Keyb CV jack- Accepts a polyphonic CV input for independently controlling the pitch of each oscillator in the "stack." Typically this would come from the *Poly Pitch* jack in the Poly CV Outs section of the I/O Panel.

Poly CV Mod jack and attenuator- Accepts a poly CV input for individually modulating the frequency of the oscillators. A polyphonic envelope, for example, could be patched here so that each individual note in a chord has its own pitch envelope. The bipolar attenuator adjusts the amount of modulation for all voices.

Mono CV Mod jack and attenuator- This is a standard "mono" CV input and bipolar attenuator for modulating the frequency of all of the oscillators in the stack simultaneously.

Hard Sync- This is a polyphonic input jack for force resetting the oscillators. This can be used, for example, to make each oscillator start from the beginning of its waveform every time it is triggered or to create "sync sweep" oscillator sounds by routing the output of a second Poly Oscillator to the *Hard Sync* input and sweeping the pitch of the first oscillator.

Range- Sets the basic pitch of the oscillators, displayed in traditional organ footage. *LO* will be beneath the audible range and allows the Poly Oscillator to be used as a polyphonic modulation source.

Fine- Fine-tune pitch control for all oscillators in the stack.

Pulse Width- Sets the width or "duty-cycle" of the pulse wave. It has no effect on any other waveform. Its default setting of 50% outputs a perfect square wave, rich in delicious odd-order harmonics. Moving the knob left or right narrows its width as well as the thickness of sound until it almost disappears at its extremes, and we've included a nifty "faux-OLED" display to indicate the current pulse width. All oscillators in the stack are controlled simultaneously by this knob.

PWM CV In jack and attenuator- Standard "mono" CV input jack and bipolar attenuator for controlling the pulse width of all of the oscillators. This only effects the pulse waveform.

Waveform Output Jacks- These are polyphonic output jacks for the ramp, sawtooth, pulse, sine, and triangle waves. These can be used simultaneously, in any combination. Each jack outputs all oscillator voices via a single poly cable. This will typically be patched to a Poly Amplifier, Poly Filter, Poly Six-Input Mixer, etc.

Once the signal is ready to be patched to the *Main Outs*, the "poly" signals will need to be converted back to standard "mono" cables. There are multiple modules that can be used for this including the Poly to Mono CV, Mini Poly to Mono CV, and Poly Spread modules.

POLY QUANTIZER

The Cherry Audio Poly Quantizer is a polyphonic version of the standard Quantizer module. This module receives polyphonic pitch CVs via its "poly" input and conforms them to a specific key and scale, or a user-defined set of notes. There are 29 preset scales available and custom scales can easily be created by manually toggling individual notes on or off using the virtual "keyboard." Pitches are tracked and quantized according to the standard 1V/octave scaling.

Inputs, Outputs, and Controls

Input jack- "Poly" input jack for the CVs to be scale quantized. Typically this will originate from the *Poly Pitch* jack in the Poly CV Outs section of the I/O Panel.

Scale Select- Opens a menu to select one of the 29 preset scales.

Key- Sets the root note or tonic of the scale.

Keyboard Octave- These 12 black and white keys represent each note of an octave in a standard piano keyboard arrangement. The notes included in the selected scale are illuminated in red and can be toggled on and off to create custom scales by clicking on the buttons.

In Offset- Offsets all input voltages up or down in semitone increments by up to two octaves.

In Offset CV Mod jack- Input jack for externally controlling the voltage offset of the input signal. Patching the *Pitch CV Out* from the I/O panel allows pitch transposition of the input signals in semitones via a keyboard or other CV source.

Output jack- Outputs the input signals after being forced to the specified key and scale.

POLY SIX-INPUT MIXER

The Poly Six-Input Mixer module is a six-channel mixer for polyphonic CV or audio signals. Each poly input jack accepts up to 16 "lanes" of audio or CVs which are mixed to a single poly output jack. This can be used, for example, to mix the audio outputs of Poly Oscillators or to combine multiple polyphonic CV signals sent from Poly Envelope Generators, Mono to Poly CV modules etc.

Inputs, Outputs and Controls

Input jacks (1 - 6)- Poly input jacks for polyphonic audio or CV signals.

Level (1 - 6)- This knob adjusts the level at which each channel's audio or CV signals are sent to the mixer’s master output.

LED- Lights when signal is being sent to the mixer’s master output.

Master Volume- This knob controls the volume of the mixer’s master output.

Master Output jack- Poly output jack which outputs a mix of all six poly signals.

POLY STEREO SPREAD

The Poly Stereo Spread module converts Voltage Modular's "poly" audio signals to a standard left/right stereo output with CV control of width and balance.

When using poly modules, it's necessary to convert the poly signals to standard "mono" signals before sending them to the Main Outs. This module takes care of the conversion while also allowing all of the active voices to be evenly spread between the left and right outputs to create width.

For example, if the *Number of Voices* in the Poly CV Outs section of the I/O Panel is set to three and the *Width* control is set to 100%, one voice will be panned hard left, one will be centered, and one will be panned hard right. The number of active voices will always be spread equally between the two outputs and the overall width can be narrowed by decreasing the *Width* setting.

Keep in mind that if all of the active voices are not being played, the panning positions may seem random or unbalanced because there will be "gaps" between voices. If you are playing four note chords with four active voices on the other hand, each chord will remain evenly balanced between the two outputs.

Inputs, Outputs, and Controls

Poly In jack- Patch "poly" audio signals here.

Width CV jack and attenuator- This is a standard "mono" CV jack and attenuator for externally controlling the width of the stereo output.

Width- Adjusts the overall width of the stereo output. When set to 100%, the voices will be spread across the entire stereo field from 100% left to 100% right. This range can be narrowed by turning this knob down.

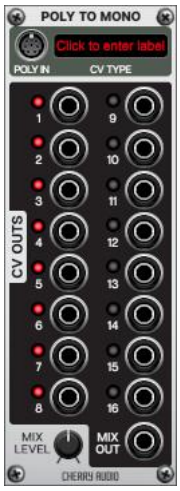
Bal (Balance) CV jack and attenuator- This is a standard "mono" CV jack and attenuator for externally controlling the balance of the stereo output.

Balance- Adjusts the overall pan position of the voices as a group. In other words it offsets the "center position" which the voices are spread evenly around.

Out Level- Handy little volume knob for controlling the level of the stereo output. When converting poly signals back to standard "mono" signals, the summed amplitude of all the voices can become quite loud and often needs to be attenuated.

L and R Outputs- Outputs a stereo mix (using standard "mono" cables) of all the voices received at the *Poly In* jack.

POLY TO MONO

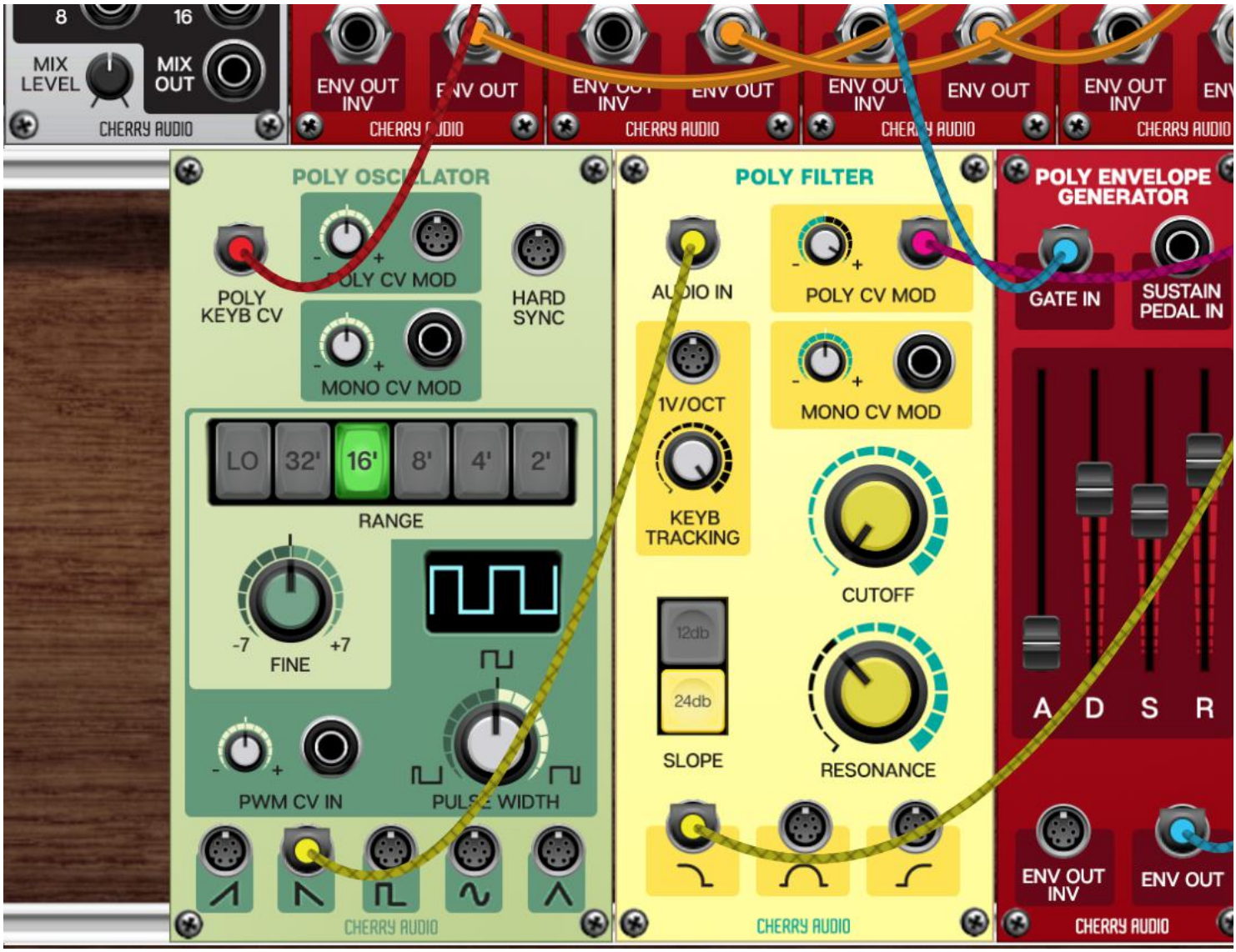


The Cherry Audio Poly To Mono module receives a "poly" audio or CV signal, and outputs its channels, or "lanes," individually and as a summed mono output with level control.

Let’s look at an example.

In the image below, the Poly To Mono module is used to create a polyphonic patch that has a different filter envelope for each voice.

The *Poly Gate* jack in the I/O Panel is patched to a Poly To Mono module to separate the gate signals for each of the four active voices. The gate signals are then patched to four envelopes with different settings and converted back to a poly signal using the Mono To Poly module which is patched to the *Poly CV Mod* jack of the Poly Filter. By using four standard envelopes instead of a Poly Envelope Generator, the filter envelope of each voice can be shaped differently which can create interesting variations as the patch is played.



Inputs, Outputs, and Controls

Poly In jack- Patch "poly" audio or CV signals here.

CV Type- This is a handy little text box that can be used to label the module. To change the text, click in the box labeled "Click to enter label" and begin typing.

Output jacks- Each of these jacks outputs one channel, or "lane," of the signal received at the *Poly In* jack. The number of active outputs depends on the *Number of Voices* setting in the I/O Panel. When the patch is set to have eight voices, for example, the LEDs for *Outputs 1 - 8* will glow red to indicate that they are active. Jacks that are not active will not output signal.

Mix Level- Adjusts the level of the summed signals. When converting signals from "poly" to "mono," it's often necessary to attenuate the output to compensate for the increase in amplitude caused by summing multiple signals.

Mix Out jack- Outputs a standard "mono" signal carrying the sum of all signals received by the *Poly In* jack.

POLY UNISON

The Poly Unison module allows monophonic pitch and gate CVs from a keyboard or sequencer to control a "stack" of up to 16 detuned voices playing in unison. The amount of detune can be adjusted manually or controlled externally via the CV input and bipolar attenuator.

Playing a stack of detuned oscillators is a classic trick for creating massively thick sounds! To create the infamous super-saw waveform heard in so many EDM hits, connect the *Pitch* output to the *Poly Keyb CV* input of a Poly Oscillator module and add a healthy dose of detune. The Poly Oscillator's saw-wave output will now be a nice fat super-saw!

Inputs, Outputs and Controls

Keyb CV In jack- Receives pitch CV signals from a keyboard or sequencer. Typically this will be connected to the *Pitch* jack in the CV Outs section of the I/O panel or the CV output of a sequencer.

Gate In jack- Receives gate CV signals from a keyboard or sequencer. This is usually connected to the *Gate* jack in the CV Outs section of the I/O panel or the gate output of a sequencer.

Detune CV jack and attenuator- CV input jack for externally controlling the amount of detune. The attenuator for this input is a bipolar knob. When at its center position, the detune amount will not be affected by voltage received at this input. When turned to the right, positive voltage received will increase the amount of detune while negative voltage will decrease it. When turned to the left, the CV signal is inverted so that positive voltage will decrease the detune amount and negative voltage will increase it.

Detune- Spreads the tuning of the voices equally above and below the input pitch while keeping the perceived note constant. If the *Number of Voices* is set to one, the detune knob will have no effect. When set to two, increasing the detune amount will lower the pitch of the first voice while equally raising the pitch of the second voice. If set to three voices, the first will be detuned lower, the second will be in tune, and the third will be tuned higher. As more voices are added, their pitches are evenly spread between the lowest and highest voices.

Number of Voices- Shows the number of voices that will be "stacked" in unison and output from the Poly Out jacks. This can be adjusted with the *Number of Voices* setting in the Poly CV Outs section of the I/O panel and will affect all poly modules in Voltage Modular.

Pitch Poly Out jack- "Poly" CV output to control the pitch of a Poly Oscillator module. This jack will output pitch CVs for multiple voices playing the same note in unison. The pitch of the voices can be detuned from one another using the *Detune* knob.

Gate Poly Out jack- This "poly" jack outputs a gate CV signal for each stacked voice. This will typically be patched to the *Gate In* jack of a Poly Envelope Generator to control a Poly Amplifier or Poly Filter module.

QUANTIZER

The Cherry Audio Quantizer module is designed to conform a control voltage input signal to a specific key and scale, or a user-defined set of notes. There are 29 preset scales available and custom scales can easily be created by manually toggling individual notes on or off using the virtual "keyboard." Pitches are tracked and quantized according to the standard 1V/octave scaling.

Inputs, Outputs, and Controls

Input jack- Input for the CV to be scale quantized. Typically this will originate from the CV output of a module such as the Arpeggiator, Eight Step Sequencer, or I/O Panel *Pitch CV Out*.

Scale Select- Opens a menu to select one of the 29 preset scales.

Key- Sets the root note or tonic of the scale.

Keyboard Octave- These 12 black and white keys represent each note of an octave in a standard piano keyboard arrangement. The notes included in the selected scale are illuminated in red and can be toggled on and off to create custom scales by clicking on the buttons.

In Offset- Offsets the input signal's voltage up or down in semitone increments by up to two octaves.

In Offset CV Mod jack- Input jack for externally controlling the voltage offset of the input signal. Patching *Pitch CV Out* from the I/O panel allows pitch transposition of the input signal in semitones via a keyboard or other CV source.

Output jack- Outputs the input signal after being forced to the specified key and scale.

RANDOM TASK

The Cherry Audio Random Task module is a “Turing machine” CV module for generating semi-random voltages with CV control of probability, step shuffling, and pattern length.

This module generates random voltages that are stored at 16 individual steps. Once the steps are initially filled with random voltages, the *Probability* knob controls the chance that the current step will be overwritten with a new random voltage while the *Shuffle* knob controls the chance that all of the stored voltages will be “shuffled” like a deck of cards.

Inputs, Outputs and Controls

Clock In jack- A 5V pulse or gate received at this jack will advance the module to the next step.

Direction- These three buttons change the order in which the steps are cycled through. Options are *Backward*, *Back* and *Forth*, and *Forward*.

Probability- This sets the probability that the voltages stored at the current step will be overwritten by a new random voltage. At 0% there is no chance that the stored voltage will be changed. At 50%, there is a 50/50 chance that each step will output its stored voltage or be changed to a new random voltage. At 100%, every step will be overwritten with a new random voltage.

Prob CV In jack- CV input for externally controlling the *Probability* setting.

Shuffle- Adjusts the chance that the stored voltages will be “shuffled” like a deck of cards. All of the voltages stay the same but the step number that they are stored at are randomly changed. At 0% there is no chance that the steps will be shuffled. At 50%, there is a 50/50 chance at each step of the pattern that all of the values will be shuffled. At 100%, the voltages are shuffled every step creating a random pattern of the same stored voltages.

Shuffle CV In jack- CV input for externally controlling the *Shuffle* setting.

Steps- Sets the number of steps that are being cycled through as well as potentially changed due to the *Probability* and *Shuffle* settings. With the *Probability* and *Shuffle* knobs both set to 0%, the number of steps can be adjusted and all of the voltages will remain unchanged. If *Steps* is set to three, and the *Probability* and/or *Shuffle* knobs are above 0%, there is a chance that the first three steps may be randomly changed or shuffled, but steps four through sixteen will remain unchanged. Therefore, if the *Probability* and *Shuffle* knobs are set back to 0% and the number of steps is increased again, the voltages previously stored at steps four through sixteen will be the same as they were before.

Steps CV In jack- CV input for externally controlling the number of steps in the pattern.

CV Offset- Offsets the output voltage by adding or subtracting up to 2V.

CV Range- Attenuates the output signal so that its voltage can be limited to a specific range.

CV Out jack- Outputs a control voltage each time the module advances to a new step.

SPRING REVERB

The Cherry Audio Spring Reverb module is a realistically modeled spring-style reverb with adjustable decay length and true-stereo operation. Spring reverbs can be used in many situations. Short decaying spring reverbs are great for adding a little energy or life into a sound without drastically changing it, while long decaying spring reverbs can take a sound into an entirely new dimension! And let's not forget how cool a classic surf guitar riff sounds drenched in spring reverb!

Inputs, Outputs, and Controls

L(M) and R Input jacks- These are the mono or stereo audio input jacks. When using a mono input signal, patching it to the *L(Mono)* jack will feed the signal to both sides of the stereo effect.

Input- This knob adjusts the level at which the input signal is sent to the spring reverb effect.

Decay (Short/Long)- Adjusts the length of the reverb.

Mix (Dry/Wet)- This knob adjusts the mix between the input signal (*Dry*) and the effected signal (*Wet*) that will be sent to the outputs.

L(M) and R Output jacks- These are the module's stereo output jacks. When using a mono input signal and wish to keep the reverb mono as well, use the *L(Mono) Output* jack.

RING MODULATOR

The Cherry Audio Ring Modulator multiplies two input signals together, typically resulting in a metallic tone with inharmonic overtones often used to recreate pitched percussion instruments such as bells and chimes.

When two signals are multiplied by one another, the resulting signal contains only the sum and difference of the two signals and not the original signals themselves. This often results in tones with unrelated harmonics which can sound harsh or out of tune, but when dialed in carefully can create sounds and timbres hard to create with other methods.

It's worth mentioning that any two signals can be multiplied by the Ring Modulator. Try multiplying two LFOs to create a more complex LFO shape or multiplying a drum beat and a synth lead!

Inputs, Outputs and Controls

X and Y Input Level- Attenuators for reducing the level of the input signals. Changing the level of the input signals can help "dial in" the tone or timbre of the output.

X and Y Audio In jacks- Input jacks for the signals that will be multiplied. Although labeled as audio inputs, CVs can also be multiplied to create more complex control signals and audio signals can even be multiplied by CVs.

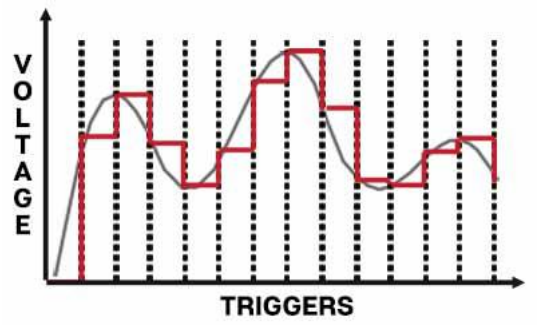
X and Y CV Mod jacks- CV inputs for externally controlling the level of their respective input signals.

Out jack- Outputs the result of multiplying the X and Y input signals.

SAMPLE AND HOLD

The Cherry Audio Sample and Hold module is an analog-style synthesis tool that repetitively "samples" an input signal and outputs its voltage until triggered again. This module has an adjustable rate internal trigger source or can be triggered externally with a CV or audio signal.

In the image below, the smooth gray line shows a continuous input signal. Each time the module is triggered the current voltage is "sampled" and "held" until the next trigger. The red line shows the stepped output signal.



White noise is often used as an input source to generate a random stepped-CV signal. Modulating the pitch of an oscillator with this will create the classic sample and hold sound often heard in sci-fi movies. Play with the rate and amount of modulation to create all sorts of bleepy-bloopy goodness! "What was that R2-D2?"

Inputs, Outputs, and Controls

Input jack- This is the input jack for the audio or control signal that will be sampled.

Ext Trigger jack- This jack can be used to externally trigger the module with a CV or audio signal. Any voltage transition from below 2.5V to 2.5V or higher will trigger the module.

Trigger Source- The buttons *Int* and *Ext* select between the internal and external trigger source.

Rate- Controls the rate of the internal trigger source from 0.02 Hz - 50 Hz.

Output jack- Outputs the stepped sample and hold signal.

SAMPLER I

The Cherry Audio Sampler I is a unique, retro-inspired digital sampler module, designed with creativity at the fore. It's useful for musical tones, drum loops, droning effects and more, and allows instant user sampling, import, and storage of sounds.

We usually try to explain panel controls from top to bottom, or left to right, but here we'll go over things in a way that'll make the most sense for learning how to use Sampler I.

Concept

Though it bears a resemblance to a classic 80s sampling keyboard, Sampler I works a little differently. It can hold one sample at a time, and can play back one note at a time. And because it has no onboard amplifiers or envelope generators, it's best to think of it more as a sophisticated digital oscillator (as opposed to a self-contained sampling instrument). Since samples don't necessarily play continuously as a standard oscillator would, we've included a few different trigger modes to accommodate different ways you might to use it.

Audio and CV Inputs and Outputs

Keyb CV- Standard 1V/octave CV input for pitch control.

Gate- Standard 5V gate input for initiating sample playback. This operates a little differently depending on the currently selected *Trigger Mode*.

Master Volume- This is an output volume control. Center position is unity, and turning it adds up to 12db of additional gain, which is useful if a sample is really quiet.

Left / Right Stereo Outputs- These are the audio outputs, but you knew that.

File Section

This is where existing audio samples can be loaded, and currently loaded samples can be saved and exported. Sampler I can load and play samples in AIF, WAV, MP3, and OGG formats. User samples are in WAV format at 32-bit/48kHz resolution.

Load- Opens a standard dialog for loading raw samples or *.voltagesample* files, which contain samples as well as the following settings:

- Trigger Mode
- Sample Start, End, and Loop Point settings and CV modulation attenuator settings
- Snap To Transient, Crossfade Length, and Loop Enable button settings
- Tune section Octave, Fine, and CV modulation attenuator settings
- Sample Rate/Bit Depth section Rate, Bit Depth and CV modulation attenuator settings

Save- Saves *.voltagesample* files detailed in above.

Export- Exports the entire current sample in WAV format. The exported sample is not affected by *Sample Start*, *End*, or *Loop Enable* control settings (or any other Sampler I settings). The exception is that if a sample has been cropped or normalized, it will export that way.

Trigger Mode

This affects how samples play back when a gate voltage is received. **It's important to understand how the trigger modes work to best use Sampler I**, so now's the time to turn off Celebrity Big Brother and hunker down.

As mentioned earlier, it's best to think of Sampler I as a sort of big bad sampling oscillator (as opposed to a self-contained instrument), because it doesn't have its own envelope generators or amplifiers. Though it can be used on its own, it's best to create a standard subtractive synth patch where Sampler I's output is patched to filter and amplifier modules, with the amplifier module controlled by an envelope generator, like this:

The way the Trigger Modes function may initially seem counterintuitive, but as you use Sampler I, they'll make more sense, we promise!

Normal- In *Normal* mode with *Loop Enable* off, a sample plays from start to finish when 5V is present at the *Gate* input. The sample plays until the end point regardless of the voltage at the gate input. This is often referred to as "one-shot" playback.

If *Loop Enable* is on, when 5V is present at the *Gate* input, the sample plays from start to finish, then jumps to the loop point and continues loop playback (from loop to end) indefinitely.

In conjunction with the Sampler>Filter>Env>Amp patch shown above, *Normal* mode is useful for playing standard pitched sounds, particularly with looping enabled. The idea is that Sampler I outputs sound continuously while the envelope generator/amplifier combo articulates the amplitude curves of each note. Each time a key is played, the pitch changes to the incoming pitch CV and the new gate voltage restarts playback from the sample start point while retriggering the envelope generator(s).

Gate- Gate mode works much like *Normal* mode, but instead of playing continuously when a voltage is applied to the gate input, sample playback **only** occurs when a gate voltage is present. With *Loop Enable* off, the sample plays from the sample start point until the end as long as a gate voltage is present. If *Loop Enable* is on, playback jumps to the loop point, and the sample plays continuously from the loop point to the end as long as a gate voltage is present.

Gate mode is useful when Sampler I is used by itself, as the on/off nature of the gate effectively functions as a basic on/off organ-style envelope. It's also useful for drum loops when a complex volume envelope isn't needed.

Drone- The sample plays back continuously and the *Gate* CV jack is effectively disabled. This is useful for sound effects beds, background noises, etc. *Loop Enable* is automatically engaged and cannot be disabled in *Drone* mode.

Tune Section

Octave- Allows transposition of sample playback up or down up to two octaves.

Fine- Allows fine tuning by just over a fifth interval, up or down.

Tune CV jack and attenuator- Allows bipolar CV control of pitch, up to five octaves up or down. You can get pretty crazy with this.

Sample Rate/Bit Depth Section

Rate- Allows adjustment of sample rate from 48 kHz down to 100Hz. This is a playback parameter, so it won't permanently alter sample data (but it'll temporarily make a real mess). There is no anti-aliasing filtering applied; at lower sample rate settings, you'll hear delicious digital aliasing noise above the playback rate frequency, just like a vintage sampler. The *Rate* setting can be modulated with the *Rate CV* mod jack and bipolar attenuator.

Bit Depth- Sets the bit rate of sample playback from 32 bits down to a grunky 2 bits. As with *Rate*, *Bit Depth* is a playback parameter that won't alter stored sample data. Its setting can be modulated with the *Bits CV* mod jack and bipolar attenuator.

Sample Edit Section

Here's where the action happens. This where sample start, end, loop points, and other parameters affecting sample playback are set. We'll jump around this section a bit to best explain its operation.

Sample Root- As its name implies, this sets the root position for the current sample. Click on the down arrow button to choose a note value. C2 corresponds to a 2V keyboard CV input, and plays the sample at its native pitch at MIDI note C2.

Sample Start- Sets the sample playback start point. The sample number appears in the tooltip as the slider is moved. As with any control in Voltage, it will move in finer increments by holding down the *Command* key in OS X, or the *Option* key in Windows. *Sample Start* may also be adjusted by grabbing the red start marker in the *Wave View* display. *Sample Start* position can be modulated in real time using the *Start CV* mod jack and bipolar attenuator.

Sample End- Sets the sample playback end point. *Sample End* may also be adjusted by grabbing the red end marker in the *Wave View* display. *Sample End* position can be modulated in real time using the *End CV* mod jack and bipolar attenuator.

Loop Point- With the *Loop Enable* button on, this sets the point at which sample playback loops. Looping always plays from the loop point to the end point, regardless of whether the loop point is set before or after the end point. This potentially translates to all kinds of forward/backward playback shenanigans - see "*Pushin' Forward Back*" section below. *Loop Point* can be modulated in real time using the *Loop CV* mod jack and bipolar attenuator.

Setting Sample Start, End, and Loop points: Note that the *Sample Start* slider's movement resolution stays constant regardless of the *Wave View Zoom* setting, but the resolution of the *Wave View* start marker increases as the *Zoom* size is increased. As a result, it's best to use the *Sample Start*, *End*, and *Loop Point* sliders for big adjustments, and to directly move the *Wave View Start*, *End*, and *Loop* markers for finer adjustments.

Wave View display and controls- Sampler I's *Wave View* screen makes it easy to see and edit samples. The view select buttons have no effect on sound, they only affect the current display.

- *ST*- displays both left and right channels
- *L/M*- displays the left channel, or the entire wave if a mono sample is loaded
- *R*- displays the right channel of a stereo wave
- *Zoom*- rotating clockwise magnifies the wave view. Use the *Zoom* knob in conjunction with the scroll bar thumb beneath the wave display for precise sample editing.

Normalize- This is a fancy term for "increase the overall volume of the sample so that the loudest peak is at 0 db." It's generally a good idea to hit the *Normalize* button if samples aren't very loud. Keep in mind that unlike compression or limiting, normalizing doesn't change the dynamics of a sample, it just proportionally raises the overall gain, and won't affect noise floor. Normalizing does not permanently edit samples loaded from your hard drive, but any exported or saved versions will retain normalization.

Crop- Deletes sample data before the start point and after the end point. This is particularly useful for extracting a region of audio (a drum loop, for example) from a much larger sound file, and will make editing much easier. As with normalization, cropping will not permanently alter samples loaded from your hard drive, but any exported or saved versions will retain cropping.

Snap To Transient- Toggling *Snap To Transient* on makes the start, end, and loop markers snap to detected transient "hits" in the waveform. This is very helpful when editing drum loops, because the markers will instantly snap to drum hits. It's also handy for setting the start point when there's silence at the beginning of a sample. We like it so much that we set

to "on" by default.

Crossfade Length- Adds an equal-power crossfade of up to 300ms from the end point to the loop point when looping is enabled. It's very helpful for creating smooth loop transition points with sustained sounds.

Loop Enable- Turns looping on and off. When disabled, the yellow loop marker disappears from the *Wave View* display.

Force LP To Start- Clicking this button instantly sets the loop point to the same location as the start point for situations where you want the sample to repeatedly play from start to end.

Pushin' Forward Back: *The inspiration for Sampler I's horizontal Start, End, and Loop sliders came from a crude 80s hardware sampler. Not only did the sliders make real-time sample editing super easy, its niftiest trick was that samples could instantly be played in reverse by swapping the start and end points. Sampler I lets you do the same- if the end point is set before the start point, the sample will play backwards. As mentioned, when Loop Enable is on, the loop always plays from the loop point to the end point. If the loop point position is modulated using its CV in, it's possible to move the loop point past the end point. Not only does this allow changing from a forward loop to a backward one, it makes very nifty noise as you cross over the end point. To try this, patch the I/O panel Mod Wheel out to the Loop CV mod input (you may need to experiment with positive or negative mod amount settings depending on the loop point location).*

SAMPLER II

The Cherry Audio Sampler II is a unique, retro-inspired digital sampler module, designed with creativity at the fore. It's useful for musical tones, drum loops, droning effects and more, and allows instant user sampling, import, and storage of sounds.

We usually try explain panel controls from top to bottom, or left to right, but here we'll go over things in a way that'll make the most sense for learning how to use Sampler II.

Concept

Though it bears a resemblance to a classic 80s sampling keyboard, Sampler II works a little differently. It can hold one sample at a time, and can play back one note at a time. And because it has no onboard amplifiers or envelope generators, it's best to think of it more as a sophisticated digital oscillator (as opposed to a self-contained sampling instrument). Since samples don't necessarily play continuously as a standard oscillator would, we've included a few different trigger modes to accommodate different ways you might to use it.

Audio and CV Inputs and Outputs

Keyb CV- Standard 1V/octave CV input for pitch control.

Gate- Standard 5V gate input for initiating sample playback. This operates a little differently depending on the currently selected *Trigger Mode*.

Master Volume- This is an output volume control. Center position is unity, and turning it adds up to 12db of additional gain, which is useful if a sample is really quiet.

Left / Right Stereo Outputs- These are the audio outputs, but you knew that.

File Section

This is where existing audio samples can be loaded, and currently loaded samples can be saved and exported. Sampler II can load and play samples in AIF, WAV, MP3, and OGG formats. User samples are in WAV format at 32-bit/48kHz resolution.

Load- Opens a standard dialog for loading raw samples or *.voltagesample* files, which contain samples as well as the following settings:

- Trigger Mode
- Sample Start, End, and Loop Point settings and CV modulation attenuator settings
- Snap To Transient, Crossfade Length, and Loop Enable button settings
- Tune section Octave, Fine, and CV modulation attenuator settings
- Sample Rate/Bit Depth section Rate, Bit Depth and CV modulation attenuator settings

Save- Saves *.voltagesample* files detailed in above.

Export- Exports the entire current sample in WAV format. The exported sample is not affected by *Sample Start*, *End*, or *Loop Enable* control settings (or any other Sampler II settings). The exception is that if a sample has been cropped or normalized, it will export that way.

Trigger Mode

This affects how samples play back when a gate voltage is received. **It's important to understand how the trigger modes work to best use Sampler II**, so now's the time to turn off Celebrity Big Brother and hunker down.

As mentioned earlier, it's best to think of Sampler II as a sort of big bad sampling oscillator (as opposed to a self-contained instrument), because it doesn't have its own envelope generators or amplifiers. Though it can be used on its own, it's best to create a standard subtractive synth patch where Sampler II's output is patched to filter and amplifier modules, with the amplifier module controlled by an envelope generator, like this:

The way the Trigger Modes function may initially seem counterintuitive, but as you use Sampler II, they'll make more sense, we promise!

Normal- In *Normal* mode with *Loop Enable* off, a sample plays from start to finish when 5V is present at the *Gate* input. The sample plays until the end point regardless of the voltage at the gate input. This is often referred to as "one-shot" playback.

If *Loop Enable* is on, when 5V is present at the *Gate* input, the sample plays from start to finish, then jumps to the loop point and continues loop playback (from loop to end) indefinitely.

In conjunction with the Sampler>Filter>Env>Amp patch shown above, *Normal* mode is useful for playing standard pitched sounds, particularly with looping enabled. The idea is that Sampler II outputs sound continuously while the envelope generator/amplifier combo articulates the amplitude curves of each note. Each time a key is played, the pitch changes to the incoming pitch CV and the new gate voltage restarts playback from the sample start point while retriggering the envelope generator(s).

Gate- Gate mode works much like *Normal* mode, but instead of playing continuously when a voltage is applied to the gate input, sample playback **only** occurs when a gate voltage is present. With *Loop Enable* off, the sample plays from the sample start point until the end as long as a gate voltage is present. If *Loop Enable* is on, playback jumps to the loop point, and the sample plays continuously from the loop point to the end as long as a gate voltage is present.

Gate mode is useful when Sampler II is used by itself, as the on/off nature of the gate effectively functions as a basic on/off organ-style envelope. It's also useful for drum loops when a complex volume envelope isn't needed.

Drone- The sample plays back continuously and the *Gate* CV jack is effectively disabled. This is useful for sound effects beds, background noises, etc. *Loop Enable* is automatically engaged and cannot be disabled in *Drone* mode.

Tune Section

Octave- Allows transposition of sample playback up or down up to two octaves.

Fine- Allows fine tuning by just over a fifth interval, up or down.

Tune CV jack and attenuator- Allows bipolar CV control of pitch, up to five octaves up or down. You can get pretty crazy with this.

Sample Rate/Bit Depth Section

Rate- Allows adjustment of sample rate from 48 kHz down to 100Hz. This is a playback parameter, so it won't permanently alter sample data (but it'll temporarily make a real mess). There is no anti-aliasing filtering applied; at lower sample rate settings, you'll hear delicious digital aliasing noise above the playback rate frequency, just like a vintage sampler. The *Rate* setting can be modulated with the *Rate CV* mod jack and bipolar attenuator.

Bit Depth- Sets the bit rate of sample playback from 32 bits down to a grunky 2 bits. As with *Rate*, *Bit Depth* is a playback parameter that won't alter stored sample data. Its setting can be modulated with the *Bits CV* mod jack and bipolar attenuator.

Sample Edit Section

Here's where the action happens. This where sample start, end, loop points, and other parameters affecting sample playback are set. We'll jump around this section a bit to best explain its operation.

Sample Root- As its name implies, this sets the root position for the current sample. Click on the down arrow button to choose a note value. C2 corresponds to a 2V keyboard CV input, and plays the sample at its native pitch at MIDI note C2.

Sample Start- Sets the sample playback start point. The sample number appears in the tooltip as the slider is moved. As with any control in Voltage, it will move in finer increments by holding down the *Command* key in OS X, or the *Option* key in Windows. *Sample Start* may also be adjusted by grabbing the red start marker in the *Wave View* display. *Sample Start* position can be modulated in real time using the *Start CV* mod jack and bipolar attenuator.

Sample End- Sets the sample playback end point. *Sample End* may also be adjusted by grabbing the red end marker in the *Wave View* display. *Sample End* position can be modulated in real time using the *End CV* mod jack and bipolar attenuator.

Loop Point- With the *Loop Enable* button on, this sets the point at which sample playback loops. Looping always plays from the loop point to the end point, regardless of whether the loop point is set before or after the end point. This potentially translates to all kinds of forward/backward playback shenanigans - see "*Pushin' Forward Back*" section below. *Loop Point* can be modulated in real time using the *Loop CV* mod jack and bipolar attenuator.

Setting Sample Start, End, and Loop points: Note that the *Sample Start* slider's movement resolution stays constant regardless of the *Wave View Zoom* setting, but the resolution of the *Wave View* start marker increases as the *Zoom* size is increased. As a result, it's best to use the *Sample Start*, *End*, and *Loop Point* sliders for big adjustments, and to directly move the *Wave View Start*, *End*, and *Loop* markers for finer adjustments.

Wave View display and controls- Sampler II's *Wave View* screen makes it easy to see and edit samples. The view select buttons have no effect on sound, they only affect the current display.

- *ST*- displays both left and right channels
- *L/M*- displays the left channel, or the entire wave if a mono sample is loaded
- *R*- displays the right channel of a stereo wave
- *Zoom*- rotating clockwise magnifies the wave view. Use the *Zoom* knob in conjunction with the scroll bar thumb beneath the wave display for precise sample editing.

Normalize- This is a fancy term for "increase the overall volume of the sample so that the loudest peak is at 0 db." It's generally a good idea to hit the *Normalize* button if samples aren't very loud. Keep in mind that unlike compression or limiting, normalizing doesn't change the dynamics of a sample, it just proportionally raises the overall gain, and won't affect noise floor. Normalizing does not permanently edit samples loaded from your hard drive, but any exported or saved versions will retain normalization.

Crop- Deletes sample data before the start point and after the end point. This is particularly useful for extracting a region of audio (a drum loop, for example) from a much larger sound file, and will make editing much easier. As with normalization, cropping will not permanently alter samples loaded from your hard drive, but any exported or saved versions will retain cropping.

Snap To Transient- Toggling *Snap To Transient* on makes the start, end, and loop markers snap to detected transient "hits" in the waveform. This is very helpful when editing drum loops, because the markers will instantly snap to drum hits. It's also handy for setting the start point when there's silence at the beginning of a sample. We like it so much that we set to "on" by default.

Crossfade Length- Adds an equal-power crossfade of up to 300ms from the end point to the loop point when looping is enabled. It's very helpful for creating smooth loop transition points with sustained sounds.

Loop Enable- Turns looping on and off. When disabled, the yellow loop marker disappears from the *Wave View* display.

Force LP To Start- Clicking this button instantly sets the loop point to the same location as the start point for situations where you want the sample to repeatedly play from start to end.

Pushin' Forward Back: *The inspiration for Sampler II's horizontal Start, End, and Loop sliders came from a crude 80s hardware sampler. Not only did the sliders make real-time sample editing super easy, its niftiest trick was that samples could instantly be played in reverse by swapping the start and end points. Sampler II lets you do the same- if the end point is set before the start point, the sample will play backwards. As mentioned, when Loop Enable is on, the loop always plays from the loop point to the end point. If the loop point position is modulated using its CV in, it's possible to move the loop point past the end point. Not only does this allow changing from a forward loop to a backward one, it makes very nifty noise as you cross over the end point. To try this, patch the I/O panel Mod Wheel out to the Loop CV mod input (you may need to experiment with positive or negative mod amount settings depending on the loop point location).*

Sample Record Section

The *Sample Record* section allows real-time user sampling.

Left/Mono and Right inputs- Patch audio to be sampled to these inputs.

Rec Level and Stereo Input Meters- Sets the input level of audio to be sampled. If you've made it this far, you probably know how to set input levels - just into the yellow region for optimum signal-to-noise ratio and overall volume.

Record Button and indicator LED- The *Record* button initiates sample recording. The red LED next to it flashes to indicate "arm" mode, and glows solid to indicate "record" mode. Its operation is closely tied to the *Rec Threshold* control setting. Keep on readin'!

Record Threshold and indicator LED- The sets the level at which Sampler II begins recording. The green LED next to it lights when the recording threshold level has been reached.

If the *Rec Threshold* knob is at zero, the green light is always on, regardless of input level. This means that when the *Record* button is clicked, sample recording begins instantaneously. If the *Record* button is pressed and the *Rec Threshold* LED is not lit, the *Record* button flashes, indicating that it's in "arm" mode - i.e., it's waiting for a signal louder than the *Rec Threshold* setting before it commences recording.

Record Threshold is useful for sampling sources that are quiet and then get loud, such as a drum. In this situation, you'd first set the *Rec Level*, then set *Rec Threshold* so that the green light flashes when the drum sound is played. Now click the *Record* button - its LED flashes to show that it's waiting in arm mode (not recording) until the drum sound is played. When this happens, the threshold has been reached, and recording begins (*Record* LED glows solid). Recording continues until the *Record* button is clicked a second time.

Record Gate- Applying a gate voltage of greater than 2.5V initiates sample recording **for the duration of the gate voltage only**. This is useful for "triggered" on-the-fly recording. Be careful with this, as gate recording will overwrite the currently loaded sample.

SIX-INPUT MIXER

The Six-Input Mixer module is a six-input, mono-out mixer for audio or CV signals featuring solos and mutes on each channel. Mixing audio signals is something most of you are probably familiar with but don't forget that this is a CV mixer as well. LFOs, envelopes, pitch CVs, even clock and gate signals can all be mixed together to create unique and interesting control signals.

Inputs, Outputs and Controls

Input Channels 1 - 6

Input jack- Audio or CV input jack.

Level- This knob adjusts the level at which the input signal is sent to the master output.

S- Solo button for isolating the channel's signal. When engaged, all channels that are not also soloed will be removed from the master output.

M- Mute button for removing the channel's signal from the master output.

Level Meter- Visually shows the level at which the input signal is being sent to the master output.

Master

Volume- This knob controls the volume of the master output.

Output jack- This is the mixer's master output jack.

M- Mute button for muting the master output.

SIX-INPUT STEREO MIXER

The Six-Input Stereo Mixer module is a six-channel mixer for audio or CV signals featuring stereo inputs, pan controls, solos and mutes on each channel. This is typically used as a straight-forward stereo mixer for audio signals but don't forget that it can be used as a CV mixer as well. If you think of the *Left* and *Right* output jacks as outputs "One" and "Two," the module can then be used as a routing device to mix CV signals in various ways between the two outputs.

Inputs, Outputs and Controls

Input Channels 1 - 6

L(M) and R Input jacks- Stereo audio or dual CV input jacks. Use the *L(Mono)* jack to send mono signals to both outputs.

Level- This knob adjusts the level at which the input signals are sent to the master outputs.

S- Solo button for isolating the channel's signals. When engaged, all channels that are not also soloed will be removed from the master outputs.

M- Mute button for removing a channel's signals from the master outputs.

Level Meter- Visually shows the level at which the input signals are being sent to the master outputs.

Master

Volume- This knob controls the volume of the master outputs.

L and R output jacks- These are the mixer's stereo audio or dual CV output jacks.

M- Mute button for muting the master outputs.

SPRING REVERB

The Cherry Audio Spring Reverb module is a realistically modeled spring-style reverb with adjustable decay length and true-stereo operation. Spring reverbs can be used in many situations. Short decaying spring reverbs are great for adding a little energy or life into a sound without drastically changing it, while long decaying spring reverbs can take a sound into an entirely new dimension! And let's not forget how cool a classic surf guitar riff sounds drenched in spring reverb!

Inputs, Outputs, and Controls

L(M) and R Input jacks- These are the mono or stereo audio input jacks. When using a mono input signal, patching it to the *L(Mono)* jack will feed the signal to both sides of the stereo effect.

Input- This knob adjusts the level at which the input signal is sent to the spring reverb effect.

Decay (Short/Long)- Adjusts the length of the reverb.

Mix (Dry/Wet)- This knob adjusts the mix between the input signal (*Dry*) and the effected signal (*Wet*) that will be sent to the outputs.

L(M) and R Output jacks- These are the module's stereo output jacks. When using a mono input signal and wish to keep the reverb mono as well, use the *L(Mono) Output* jack.

16 Step Sequencer

The Cherry Audio 16 Step Sequencer is identical to the Eight Step Sequencer in feature set and functionality, the only difference is in the number of steps and placement of controls. With that in mind, here's a link to the documentation for the 8 Step Sequencer. Every time you see the number 8, just pretend it's a 16!

SPLITTER

The Splitter module is a MIDI utility module for easily creating “split patches” where the upper and lower portions of a MIDI keyboard-controller send pitch, gate, and velocity MIDI and/or CVs to separate destinations. This can be used, for example, to play a bass sound with the lower keys while playing a lead sound with the upper keys. The split point can be set at any MIDI note and multiple instances of the module can be used to split the keyboard into any number of "zones."

Inputs, Outputs and Controls

MIDI In jack- This is the MIDI input jack for the splitter. Typically this will be connected to the output of a MIDI keyboard via the *From Host* MIDI jack in the I/O panel or the *MIDI Out* jack of a *MIDI In* module.

Learn / Split Point- The *Split Point* displays the MIDI note which separates the lower and upper portions of the keyboard and can be changed by clicking the *Learn* button (the button will turn red) and playing the desired note on the MIDI device patched to the *MIDI In* jack.

Lower section

MIDI Out jack- All notes lower than the *Split Point* will be output from this MIDI jack.

Pitch jack- All MIDI note-number messages lower than the split point are converted to pitch CVs and output from this jack.

Gate jack- All MIDI note-on/off messages lower than the split point are converted to gate CVs and output from this jack.

Velocity jack- All MIDI note-velocity messages lower than the split point are converted to CVs and output from this jack.

Upper Section

MIDI Out jack- The *Split Point* note itself, and all notes higher, will be output from this MIDI jack. To create more than two “zones,” patch this output to another Splitter module’s *MIDI In* jack. The second module can then be used to split the first module’s upper half for a total of three zones. This can be repeated as many times as necessary to create additional zones.

Pitch jack- All MIDI note-number messages at or above the split point are converted to pitch CVs and output from this jack.

Gate jack- All MIDI note-on/off messages at or above the split point are converted to gate CVs and output from this jack.

Velocity jack- All MIDI note-velocity messages at or above the split point are converted to CVs and output from this jack.

STRING CHORUS

The Cherry Audio String Chorus module is a quad-chorus, stereo effect modeled after chorus units featured in classic vintage string synthesizers. It can be used in mono, true-stereo, or mono-to-stereo and features *Dry/Wet Mix* and *Stereo Width* controls.

This module uses four chorus effects with varying rates and depths to replicate the sound of a string section where each player performs with slightly different rates and amounts of vibrato.

Inputs, Outputs and Controls

L(M) and R Input jacks- These are the mono or stereo audio input jacks. When using a mono input signal, patching it to the L(Mono) jack will feed the signal to both sides of the stereo effect.

Stereo Width- While using both the *Left* and *Right Output* jacks, this knob adjusts the width of the chorus effect. With the knob in its fully left position, the left and right sides of the effect are summed to mono while in the fully right position, the four chorus effects are panned apart from one another to create a wider stereo image.

Mix (Dry/Wet)- This knob adjusts the mix between the input signal (Dry) and the effected signal (Wet) that will be sent to the outputs.

In/Out- This button toggles the effect on and off.

L and R Output jacks- These are the module's stereo output jacks.

SUB OCTAVE

The Cherry Audio Sub Octave module is a sub-octave generator that tracks the pitch of an input signal and generates square waves one and two octaves below it. There are individual attenuators for each sub-octave as well as the direct input allowing you to create the perfect mix between the three signals. This module will instantly fatten up an oscillator and is a quick way to add some weight to your sounds!

Although this module is usually used to create lower octaves of oscillators or audio signals, it is worth noting that it will also work on LFOs and can create some interesting patterns when mixing the two sub-octave square waves with the original.

Inputs, Outputs, and Controls

Input jack- This is the input jack for the signal whose pitch will be tracked.

Direct Out jack and attenuator- Output and level control for the signal received at the Input jack.

-1 Oct Out jack and attenuator- Output and level control for the square wave generated one octave below the input signal.

-2 Oct Out jack and attenuator- Output and level control for the square wave generated two octaves below the input signal.

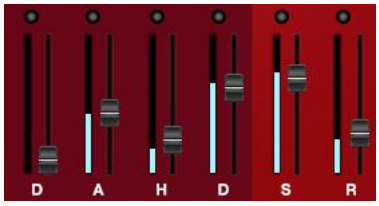
Mix Out jack- Outputs a mix of all three attenuated signals.

SUPER ENVELOPE GENERATOR

Cherry Audio's Super Envelope Generator is the dream-come-true envelope for modular synthesists. It starts with a complex DAHDSR envelope (Delay-Attack-Hold-Decay-Sustain-Release). The shapes of the *Attack*, *Decay*, and *Release* stages are individually controllable, morphing from logarithmic to linear to exponential, and these shapes can all be modulated via control voltage. On top of that, the length of each stage (and the sustain level) is CV-controllable as well! Powerful visual feedback is provided every step of the way, so you can see at a glance what's happening with your envelope generator in real-time.

We are going to assume that you understand how a standard ADSR envelope works. If you are unfamiliar with envelopes in general or need a recap, please check out the documentation for the standard Envelope Generator which goes over the basics in detail.

DAHDSR Sliders



"D" (Delay) slider- This is the first stage of the envelope and defines the length of time (after receiving a gate signal) the envelope will remain at 0V before starting the *Attack* phase.

"A" (Attack) slider- Defines the length of time it takes for voltage to rise from 0V to 5V.

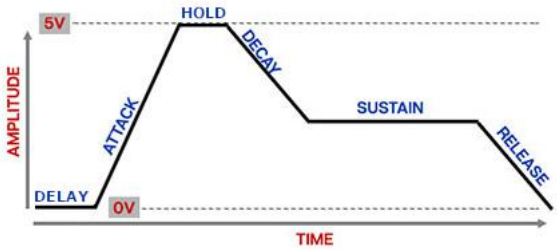
"H" (Hold) slider- Defines how long the envelope will remain at 5V before starting the envelope's *Decay* phase.

"S" (Sustain) slider- Sets the held voltage level (sustain level) following the *Decay* phase.

"R" (Release) slider- Defines the length of time for voltage to fall from *Sustain* level to 0V when the gate is released.

LED stage indicators- These illuminate to show the currently active envelope stage.

Below is a diagram of a DAHDSR envelope to help clarify the individual stages.



DAHDSR CV Control

Each of the DAHDSR sliders can be CV-controlled using their respective CV input jack and bipolar attenuator. When controlling a slider's value externally, the light blue LED meter to the left of each slider shows the modulation in real time.

It is important to understand that the sliders themselves only show the initial value before any modulation. The blue LED meter displays the actual current setting being used for each stage of the envelope.

Attack, Decay, and Release Curves

The shape, or curve, of the *Attack*, *Decay*, and *Release* stages of the envelope can be adjusted individually. Each stage has its own curve control which can morph smoothly from logarithmic, to linear, to exponential.

- A logarithmic curve will move quickly at first, then slower as it approaches its destination (as shown in the *Decay* and *Release Curve* displays above).
- A linear curve moves towards the destination voltage at a constant pace.
- An exponential curve will move slowly at first, then quickly "ramp up" as it approaches its destination (as shown in the *Attack Curve* display above).

The shape of each curve can be CV-controlled using its respective *Curve CV* jack and bipolar attenuator and all modulations will be visually displayed in real time.

Input

Gate In jack- A gate signal received at this jack triggers the envelope to start when in *Normal* or *One Shot* mode.

Multiplier

These buttons multiply all of the slider's timed values by one, five, or ten making it possible to have seriously long envelope shapes! As an example, if the *Decay* slider is set to 1000ms (1 second) with the *x1* button selected, the decay length will be 5 seconds or 10 seconds with the *x5* or *x10* buttons selected respectively.

- Note that these buttons have no effect on the Sustain slider as it is not a time based stage.

Segment Mode

The Super Envelope Generator can be used in three different modes.

Norm- This is the normal envelope behavior where when a gate signal is received, the envelope starts at the *Delay* stage, moves to the *Attack*, *Hold* and *Decay* stages, sustains at the *Sustain* level, then starts the *Release* stage when the gate stops.

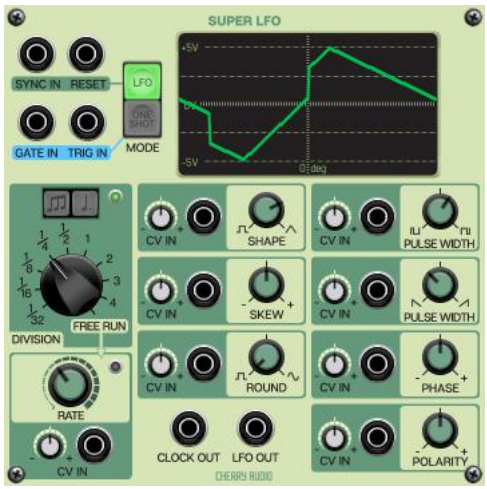
Loop- Pressing this button loops the first four stages (DAHD) continuously making the envelope behave more like an LFO. As soon as the button is pressed, the envelope starts at the *Delay* stage, moves to the *Attack*, *Hold* and *Decay* stages, then loops back to the *Delay* stage to start over again. The *Sustain* and *Release* stages are not used at all in this mode, therefore the *Decay* stage will always return to 0V before looping back to the beginning.

One Shot- This mode also only uses the first four stages (DAHD) of the envelope. Each time a gate signal is received at the *Gate In* jack, the envelope starts at the *Delay* stage, moves to the *Attack*, *Hold* and *Decay* stages and then stops. All four stages will be completed regardless of how long the gate signal is held. Note that since the *Sustain* stage is inactive, the *Decay* stage returns all the way back to 0V.

Outputs

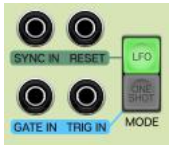
Env Out and Env Out Inv- These are the envelope voltage outputs. The *Env Out* voltage ranges from 0V to +5V, whereas the *Env Out Inv* jack is an inverted version, with output ranging from 0V to -5V.

SUPER LFO



We named it "super" for a reason! The Cherry Audio Super LFO (low-frequency oscillator) module is jam-packed with killer features. It can be used as a standard cycling LFO or switched to "one-shot" mode for use as an envelope generator. It includes a built-in sync divider and reset input for easily syncing the LFO to a host DAW, or can be used in free-run mode with CV-controllable rate. But the real showstopper is its mindblowing custom waveshaping flexibility... with seven waveshaping parameters, a huge real-time display, and bipolar CV control for real-time manipulation, the possibilities are endless. The final word in LFO modulation!

Sync and Trigger Inputs



Sync In jack- Accepts a 96-pulse-per-quarter-note (PPQN) sync signal for syncing the LFO to a Sync Generator or DAW. To sync the Super LFO to your host DAW, patch the *Sync Out* jack in the Transport section of the I/O Panel to this jack. When *Division* is set to *Free Run*, the sync signal is ignored.

Reset jack- A 5V pulse or gate received at this jack resets the LFO waveform to the beginning of its cycle. When syncing the Super LFO to a DAW, patch the *Play* jack in the Transport section of the I/O Panel to this jack to reset the LFO's cycle each time the play button in your DAW is pressed.

Gate In jack- When in *One Shot Mode*, a 5V gate signal from a keyboard or sequencer can be used to "play" the LFO like an envelope generator. The LFO will only output while a gate signal is being sent to this jack. Therefore, if a gate signal is shorter than the LFO cycle, only a portion of the LFO waveform will be output. Typically this will be patched to the *Gate* jack in the CV Outs section of the I/O Panel or the *Gate Out* jack of a sequencer.

Trig In jack- When in *One Shot Mode*, a 5V trigger, gate or pulse received at this jack will cause one full cycle of the LFO to output. Typically this will be patched to the *Trig* jack in the CV Outs section of the I/O Panel or the *Trig Out* jack of a sequencer.

Mode- The Super LFO can be used in two different modes.

- When *LFO* is selected, the Super LFO behaves like a standard cycling LFO that is continuously outputting signal. The *Sync In* and *Reset* jacks are used in this mode and the *Gate In* and *Trig In* jacks are ignored.
- When *One Shot* is selected, the LFO can be used as an envelope generator outputting one cycle of the LFO each time a gate or trigger is received at the *Gate In* and *Trig In* jacks.

Rate

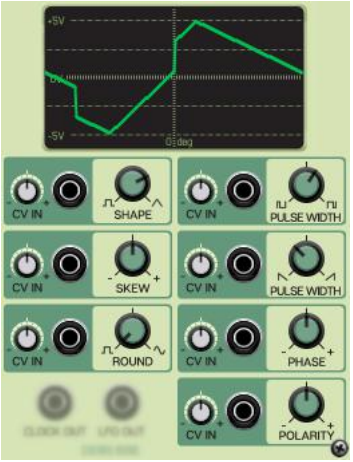
Division- Sets the rate of the LFO to a BPM-specific note-division when synced to an external sync signal via the *Sync In* jack. Triplet and dotted note-values can be selected by engaging their respective buttons above the dial. When set to *Free Run*, the sync signal is ignored and the *Rate* knob is used to set the LFO's frequency.

Rate- When *Division* is set to *Free Run* this knob controls the frequency, or speed, of the LFO.

Rate CV In jack and attenuator- CV input and bipolar attenuator for externally controlling the rate of the LFO when *Division* is set to *Free Run*.

Waveshaping

The following seven parameters dictate the shape of the LFO waveform and can all be CV controlled with their respective CV input and bipolar attenuator. The waveshape, and any modulations of it, are displayed in real time by the waveform display.



Shape- The LFO's wave shape can morph between a pulse wave, when turned fully to the left, and a triangle wave when turned fully to the right. At any position between, the waveform is a combination of the pulse and triangle waves, both of which can be edited independently of one another by some of the following controls.

Skew- Changes the phase of the triangle waveform independently of the pulse wave.

Round- Gradually "softens" or "rounds" the shape of the LFO.

Pulse Width- Adjusts the width, or "duty-cycle," of the pulse wave independently of the triangle wave.

Triangle Pulse Width- Adjusts the width of the increasing and decreasing portions of the triangle wave allowing it to morph between "ramp down" and "ramp up" waveforms.

Phase- Adjusts the phase of the combined LFO waveform. Changing the phase doesn't change the shape itself, but instead changes the "starting point." This is especially useful when syncing the LFO to a DAW or when in *One Shot* mode.

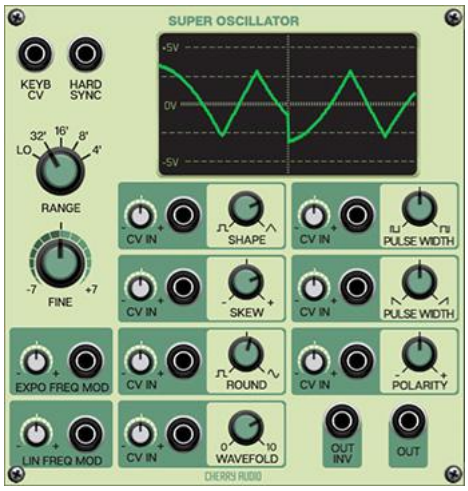
Polarity- This knob changes the polarity range of the LFO's waveform from only negative voltages (-5V to 0V) when turned fully to the left, to bipolar (-5V to 5V) at its center position, to only positive voltages (0V to 5V) when turned fully to the right.

Outputs

Clock Out jack- Outputs a clock signal for syncing sequencers, switches, other LFOs etc. to the Super LFO.

LFO Out jack- This is the main output jack for the LFO signal.

SUPER OSCILLATOR



The Cherry Audio Super Oscillator is our mondo-powerhouse, pull-out-all-the-stops oscillator module. It's capable of creating an endless variety of waves, many of which you wouldn't expect from a traditional analog-style oscillator. It's surprisingly easy to use, and all of its fabulous waveshaping parameters are voltage controllable. On top of all that, it features a large, real-time animated waveform display for visual representation of the current waveform (plus it looks really neat).

We'll start with the basic controls, then move into the more advanced waveshaping controls.

Inputs, Outputs, and Controls

Keyb CV jack- Accepts a CV input for pitch. Typically this would come from the PITCH jack in the IO Panel CV OUT section, or from a sequencer pitch CV out.

Hard Sync- Force resets the start of the waveform to the beginning of its cycle. Most often used to create the "sync sweep" oscillator sounds made famous in The Cars' "Let's Go" (or Kraftwerk's "Neon Lights" and No Doubt's "Just A Girl"), by routing the output of a second oscillator to the *Hard Sync* input and sweeping the pitch of the first oscillator.

Most traditional hard sync sounds are created using square or saw waves, but there's no reason hard sync can't be used with the Super Oscillator's more esoteric waveshapes.

Range- Sets the basic pitch of the oscillator, displayed in traditional organ footage.

LO outputs frequencies beneath the audible range and allows the oscillator to be used as a mod source. There's no reason you *can't* use the Super Oscillator for modulation purposes, but we suggest using the Super LFO module instead, as its controls and capabilities are similar, but optimized for modulation purposes.

Fine- Fine-tune control for pitch. This can be used to fatten up multi-oscillator patches by detuning a small amount, or for "building-in" a set interval. Its range is a smidge over a fifth, up or down.

Expo Frequency Mod attenuator and input jack- This is used for externally modulating the oscillator frequency. *Expo* refers to the amount curve across the knob travel - values are finer at the bottom and grow larger exponentially as the setting is increased.

Lin Frequency Mod attenuator and input jack- This is used for externally modulating the oscillator frequency. *Lin* refers to the amount curve across the knob travel - unlike Expo mod, the amount curve is constant or "linear" across the knob travel.

Waveform Display The waveform display window is a real-time animated display showing the current waveform, and any modulation being applied. The center horizontal line represents the 0V point, i.e. zero crossing of the waveform; the center vertical line represents the start/loop point of the waveform. The -5V and +5V lines indicate the 10V peak-to-peak maximum output of the Super Oscillator. The peak-to-peak differential of the waveform is a good general indicator of overall output level.

Waveshaping Parameters, aka, The Fun Part

Unlike a typical analog oscillator where fixed waveforms are selected using a switch or multiple outputs, the Super Oscillator outputs a single wave, dialed in using its seven continuously variable controls. Each of these controls includes a CV in jack and bipolar attenuator.

Note: If you get really out there, the waveshaping parameter knobs (or any other knobs in Voltage Modular) can be reset to their initial values by double-clicking or option-clicking them (depending on your preference settings in *Gear Settings Icon>Interface>On Control Double-Click*).

Shape- This defines the basic character of the waveform. By default, its position is far right, which creates a pure triangle wave. Dialing the knob to the left audibly and visibly morphs the wave to a pure square by adding a vertical section in its middle. Interestingly, triangle, square, and all points in-between create a wave rich in odd-order harmonics (real-world examples include clarinets and Wurlitzer electric pianos).

Skew- This slides the waveform start/loop point left or right. Its affect on sound will vary depending on Shape and other settings. If Shape is set full right to a pure triangle wave, it won't have much affect; essentially it will just alter wave phase. It will affect the sound more noticeably when the Shape knob is set to create the aforementioned "vertical line" in the center of a wave. As you'll see, experimentation is key.

Round- Gradually rounds off any sharp edges in the wave. Set to its far right, this will change a triangle OR square wave into a sine wave. Its affects are similar to that of a lowpass filter.

Wavefold- The Wavefold control is one of the Super Oscillator's most powerful sound shaping parameters. It sets a threshold at some point in the wave, and "flips" that portion of the wave for dramatic changes in tonality and harmonics. The best way to illustrate the effects of wavefolding is to set up a sine wave by initializing all waveshaping controls and setting the *Round* control at full right position.

Now slowly bring up the Wavefold control amount. You'll see the top curves of the wave "fold" over increasingly and hear its harmonic content grow more intense. Wavefolding's effect is look to see if the wave goes above (or below) a specific threshold. When it does, instead of clipping off the top and bottom of the wave, they create a mirror image of it and

reflect that portion of the wave back upon itself, creating more high harmonics and interesting spectra in the process.

To help drive the incoming waveshape into this behavior, they may have amplifiers on their input, or offsets to cause the wave to clip & fold on one excursion such as positive but not the other (this is sometimes referred to as symmetry). They are often adjustable to allow several folds to occur on a single positive or negative excursion beyond the folding threshold, which causes increasingly bright and noisy sounds on the output.

Pulse Width- This sets the width or "duty-cycle" of the pulse wave. It has no effect on any other waveform. Its default setting of 50% outputs a perfect square wave, rich in delicious odd-order harmonics. Moving the knob left or right narrows its width as well as the thickness of sound until it almost disappears at its extremes, and we've included a nifty "faux-OLED" display to indicate the current pulse width.

PWM Amount attenuator and PWM Mod input jack- You may have noticed that moving the *Pulse Width* knob back and forth creates a nifty sound; instead of wearing our your mouse hand, the *PWM Mod* input can be used in conjunction with an LFO, envelope generator, or other mod source to continuously vary the pulse width. Best of all, the OLED display looks real cool swooping back and forth.

Waveform Output Jacks- These are output jacks for ramp, sawtooth, pulse, sine, and triangle waves. These can be used simultaneously, in any combination.

SYNC DIVIDER

The Cherry Audio Sync Divider can be used to synchronize sequencers and other modules within Voltage Modular to a host DAW. The *Sync Out* jack in the Transport section of the I/O Panel transmits a constant 96-pulse-per-quarter-note (PPQN) signal based on the tempo of the DAWs session. The Sync Divider is used to “slow down” the super-fast sync signal to musically relevant note-values from 1/32-notes to 4 bars, including dotted and triplet values.

Inputs, Outputs and Controls

Sync In jack- Patch the *Sync Out* jack from the Transport section of the I/O Panel to this jack to receive a sync signal from your DAW that can be used to synchronize sequencers and other modules in Voltage Modular.

Reset jack- A 5V pulse or gate received at this jack will immediately force-reset the clock.

- It’s important to understand that sync signals have no idea where the "one" is, or whether your DAW is playing or stopped. If a sync signal is routed to the Sync Divider module and its clock is sent to a sequencer, the sequencer will play at the same tempo as the host DAW project, but “shifted” in time by some random (and usually undesirable) amount. To avoid this the Sync Divider, all sequencers, and many other modules have *Reset* input jacks. Patching the *Play* output jack from the Transport section of the I/O Panel to these resets the modules to “one” the instant the DAW play button is pressed, forcing everything to play in time.

Note Value- Selects the note-value of the clock output pulses from 1/32-notes to 4 bars. Any of the selected note-values can be changed to a triplet or dotted note-value by clicking the corresponding buttons which light up green when engaged.

- For anyone unfamiliar with rhythmic note-values, a triplet clock will pulse three times for every two regular pulses of the same note-value, while a dotted-note clock will pulse twice for every three regular note-value pulses.

Clock Out jack- Outputs 5V clock pulses for syncing other modules in Voltage Modular. Often this will be patched to the external clock input of a sequencer but can be used for any number of things including advancing switches, resetting LFOs, and triggering sample and hold modules.

SYNC GENERATOR

The Sync Generator module generates 96-pulse-per-quarter-note (PPQN) sync signals with adjustable rate, tap tempo, and CV control of tempo. When using Voltage Modular as a stand-alone instrument, this module can be used to create a master sync-signal at a specified BPM. The *Sync Out* jack will typically be patched to the *Sync In* jack of a Sync Divider module which “slows” the super-fast sync signal down to a note-value clock signal that can be used to advance sequencers and switches, reset LFOs, trigger sample-and-hold modules etc.

While this module can be used as a rock-solid sync generator to keep everything perfectly in time, the *Tap Tempo* button allows the BPM to be changed “on the fly” and the *Rate CV* jack can be used in creative ways to introduce variation into the sync signal if desirable.

Inputs, Outputs and Controls

Reset jack- A 5V pulse or gate received at this jack will immediately force-reset the sync signal. It's important to reset the Sync Generator at the same time as other modules so that everything starts at the same instant. Typically this will be connected to the *Play Trig* jack of the "master" sequencer whose play and stop buttons are being used.

Rate CV jack and attenuator- CV input and attenuator for externally controlling the rate of the sync signal.

Rate- Sets the tempo of the sync signal from 1 to 450 BPM (beats-per-minute).

Tap Tempo- Allows the rate to be set by “tapping” the tempo manually. The tempo is set based on the time between two consecutive clicks of the button.

Sync Out jack- Outputs a 96-pulse-per-quarter-note (PPQN) sync signal. Typically this is patched to the *Sync In* jack of one or more Sync Dividers to create clock signals for advancing sequencers, switches etc.

SYNC TO MIDI CLOCK

The Sync To MIDI Clock module converts a Sync signal to MIDI Clock messages for syncing external MIDI devices such as drum machines, synths, and sequencers to your host DAW's tempo when using Voltage Modular as a plug-in instrument. The Transport In section's *Stop* and *Play* jacks can be patched to the Transport output jacks in the I/O Panel to send MIDI Stop and MIDI Start messages to external devices each time your DAW is stopped and started.

Inputs and Outputs

Sync In- Patch this to the *Sync Out* jack in the Transport section of the I/O Panel to receive a sync signal at the tempo of your host DAW.

Transport In Stop jack- Patch this to the *Stop* jack in the Transport section of the I/O Panel to send a MIDI Stop message to external devices each time the Stop button in your DAW is pressed.

Transport In Play jack- Patch this to the *Play* jack in the Transport section of the I/O Panel to send a MIDI Start message to external devices each time the Play button in your DAW is pressed.

MIDI Clk Out- Patch this to the *MIDI In* jack of a MIDI Out module to send MIDI Clock (including MIDI Start and Stop messages) to an external device.

TB FILTER

The TB Filter is a super-accurate modular recreation of the diode-style filter of the world's most iconic acid techno bass synth. It perfectly captures the aggressive and "screamy" character of the original, and its *Saturation* control adds even more distortion and emphasis.

Inputs, Outputs, and Controls

Input jack- Patch audio signals here.

Cut Off- Sets the frequency where low frequency attenuation begins. And yes, we split the word "cutoff" intentionally, just like the original.

Resonance- Emphasizes sound energy at and around the current cutoff frequency by adding feedback from the filter's output back to its input. At lower settings, this can be used to create mild resonances such as those heard in acoustic instruments. At more extreme settings, you'll hear the trademark TB squelch and scream. Be careful with this knob as it can get loud at extreme settings.

Saturation- Adds distortion to the signal. Higher settings will produce the screamy character that the original is famous for. Again, this can get loud, so be careful.

Freq CV mod input- Allows modulation of cutoff frequency. Note that the attenuator knob is bipolar, i.e. "zero" position is center. Turning right adds a positive modulation, turning left inverts the incoming CV.

Res CV mod input- Allows modulation of resonance amount.

Sat CV mod input- Allows modulation of saturation amount.

Output jack- Outputs the filtered audio signal.

TB OSCILLATOR

TB Oscillator is a super-accurate modular recreation of the oscillator section of the simple-but-beefy oscillator of the world's most iconic acid techno bass synth. Like many vintage oscillators, its waveforms aren't totally accurate on an oscilloscope, which gives them a unique character. In addition to its standard controls, the TB Oscillator's W*ave Mix* control adds new tone colors.

Inputs, Outputs, and Controls

Keyb CV jack- Accepts a CV input for pitch. Typically this would come from the *Pitch* jack in the IO Panel *CV Out* section, or from a sequencer pitch CV out.

Range- Sets the basic pitch of the oscillator, displayed in traditional organ footage, i.e. larger number equals lower pitch.

Tuning- Fine tune control for pitch, up or down about a fourth.

Freq CV mod input- Allows modulation of oscillator pitch. Note that the attenuator knob is bipolar, i.e. "zero" position is center. Turning right adds a positive modulation, turning left inverts the incoming CV.

Wave Mix and Mix Out jack- Allows blending of the saw and square waves when using the *Mix Out* jack.

Mix CV mod input- CV control input for the *Wave Mix* control.

Waveform out jacks- Output jacks for sawtooth and square waves.

THREE-BAND EQ

The Cherry Audio Three-Band EQ is a straightforward equalizer with 15dB of cut or boost at 150 Hz, 2.5 kHz, and 8 kHz. This is a simple Low/Mid/High EQ useful for changing the tonal balance of an audio signal.

Inputs, Outputs, and Controls

Input jack- Patch audio signals here.

8 kHz (Highs)- This is a 6dB/Oct high-shelf filter band at 8 kHz with up to 15dB of cut or boost. Turning the knob to the left cuts the "highs" while moving it to the right will boost them.

2.5 kHz (Mids)- This is a 6dB/Oct mid-band peaking filter at 2.5 kHz with up to 15dB of cut or boost. Turning the knob to the left cuts the "mids" while moving it to the right will boost them.

150 Hz (Lows)- This is a 6dB/Oct low-shelf filter band at 150 Hz with up to 15dB of cut or boost. Turning the knob to the left cuts the "lows" while moving it to the right will boost them.

Output jack- Outputs the equalized audio signal.

THRESHOLD

The Cherry Audio Threshold module passes voltages received at its input jack to one of two outputs based on whether or not the signal is above or below a specified voltage level. Each output jack also has an affiliated *Gate Out* jack which generates a +5V signal any time it's respective output is passing voltage.

There are many ways to use this module but let's look at a few fun examples.

- You could patch the output of an Eight-Step Sequencer to the input of a Threshold module to send the low and high notes of a sequence to two different oscillator/envelope/amp setups. The Threshold knob could then be "played" to somewhat randomly change which notes go to which oscillator setup.
- The two *Gate Out* jacks could be patched to the *Stop* and *Start* jacks of a sequencer to have a sequence play only during a portion of a slow envelope or LFO. This could be a fun experiment for a generative patch!
- You can even get really cool results from running audio signals through the Threshold module. Try using a drum loop as the input signal and using the *Over Out* jack to modulate the pitch of an oscillator!

Inputs, Outputs and Controls

Input jack- This is the input jack for the audio or CV signal that will be tested.

Threshold- Sets the voltage level, between -5V and +5V, that the input signal will be determined to be above or below. This is the setting that defines the "split point" between the two outputs.

Under Out jack- Outputs any voltage received at the input jack that is below the *Threshold*.

Under Gate Out jack- Outputs a +5V gate signal anytime the input voltage is below the *Threshold*.

Over Out jack- Outputs any voltage received at the input jack that is above the *Threshold*.

Over Gate Out jack- Outputs a +5V gate signal anytime the input voltage is above the *Threshold*.

TRIGGER TO GATE CONVERTER

The Trigger to Gate Converter module converts short momentary trigger signals to longer gate signals. The gate length can be set between 5 and 5000 milliseconds and is CV controllable.

This could be used, for example, to trigger an Envelope Generator (which only has a gate input) with the trig outs of a sequencer such as the Euclidean Duel or to convert the trig out signal from an Eight-Step Sequencer to a CV-controllable variable-length gate signal.

Inputs, Outputs, and Controls

Trigger In jack- Patch trigger signals here to create longer gate signals. The small red LED flashes when a trigger is received.

Gate Length- Adjusts the length (from 5 to 5000 ms) of the gate signals created from each trigger.

Length CV jack and attenuator- CV input and bipolar attenuator for externally controlling the *Gate Length*.

Gate Out jack- Outputs a 5V gate signal for each trigger received at the *Trigger In* jack. The small red LED glows when voltage is being output.

VCF-20 FILTER

The Cherry Audio VCF-20 Filter is an analog-style, voltage-controllable, dual highpass/lowpass filter that recreates the aggressive tones of a classic 70s Japanese monosynth. Its uniquely raunchy sound totally transforms the overall tonality of Voltage Modular! The two resonant filters can be used individually, in series, or manually patched in various configurations and are both capable of screaming self-oscillation. We carefully A/B'd the VCF-20 Filter with the coveted "version 35" filter of the original instrument and we think you'll be delighted with its authenticity.

Inputs, Outputs and Controls

Highpass/Lowpass In jacks and Level control- These are the input jacks for the highpass and lowpass filters. Signals input here can be attenuated before being sent to the filter via their respective *Level* knobs. Be sure to try using these to “dial in” the filter. Changing the input level of a signal can drastically change the way the filter sounds especially when using high peak settings.

Series- Engaging this button internally routes the output of the highpass filter to the input of the lowpass filter. This is a quick way to use both filters in series with only one input patched. Note though that this bypasses the input stage level control of the lowpass filter. It is possible however to manually patch the filter in series and use both input stages.

HP Cutoff Freq- Sets the cutoff frequency of the 6db highpass filter. All frequencies higher than this will be allowed to pass through the filter while frequencies lower than the cutoff will be attenuated at a rate of 6db per/octave.

LP Cutoff Freq- Sets the cutoff frequency of the 12db lowpass filter. All frequencies lower than this will be allowed to pass through the filter while frequencies higher than the cutoff will be attenuated at a rate of 12db per/octave.

HP Freq CV and LP Freq CV inputs and attenuators- CV mod inputs and attenuators for externally controlling each filter’s cutoff frequency.

Peak (resonance)- Emphasizes sound energy at and around the cutoff frequency by adding feedback from the filter’s output back to its input. As the peak is increased, any modulations or knob twisting of the cutoff frequency becomes more pronounced and can create the classic “vowel-sound” this filter is known for. When turned up past seven or so, the filter begins to feed back enough to self-oscillate. (Note that unlike the original, a cable must be patched to the filter’s input to hear it self-oscillate. This is designed to save CPU when the filter is not in use.)

Peak CV inputs and attenuators- CV mod inputs and attenuators for externally controlling the peak (resonance) of each filter. This is a feature the original monosynth did not have. The resonance of this filter can get out of hand pretty quickly, so it’s quite nice to have a little extra control via the CV inputs.

Saturation- Adds distortion to the signal. Used subtly it can add extra harmonics to a smooth bass sound or some tasteful grit to a vocal sample. Higher settings will produce the aggressive character that the original is famous for. Be careful though... when used in conjunction with a high peak setting, this filter will literally scream!

About MS-style Oscillator Distortion: *You may notice that VCF-20 doesn't necessarily distort in the expected way when using the standard green Voltage Modular Oscillator (especially with square waves). This is because the wacky, characteristic MS-style filter distortion is partially the result of the not-exactly-correct-on-an-oscilloscope waveforms output from the original MS synth oscillators. These "incorrect" waveshapes are accurately recreated in the VCO-20 Dual Oscillator module, so try it in conjunction with VCF-20.*

Saturation CV inputs and attenuators- CV mod inputs and attenuators for externally controlling the saturation of each filter.

Highpass Out jack- Outputs the processed signal from the highpass filter.

Mix Out jack- Outputs the sum of both filters.

Lowpass/Series Out jack- Outputs the processed signal from the lowpass filter. When the *Series* button is engaged, this will output the signal sent to the highpass filter’s input which is then sent to the lowpass filter.

VCO-20 DUAL OSCILLATOR

VCO-20 accurately replicates the tone and functionality of a classic 70s Japanese monosynth, including all waveforms and a white noise source. It also adds CV-controllable pulse width on VCO 1, and hard sync inputs for both oscillators. Because of its unique waveforms (i.e. not-exactly correct), it's the perfect companion for the VCF-20 Filter module.

Since VCO-20 contains two independent oscillators, we'll go over the repeated controls and I/O one time, because you're smart, and we don't like typing!

Inputs, Outputs, and Controls

Keyb CV jack- Accepts a CV input for pitch. Typically this would come from the *Pitch* jack in the IO Panel *CV Out* section, or from a sequencer pitch CV out. Patching a cable to the *Keyb CV* input on the VCO 1 side automatically connects to the VCO 2 *Keyb CV* input if nothing is plugged into VCO 2's *Keyb CV* input (hence the dotted arrow). Patching a cable into VCO 2 *Keyb CV* "breaks" the normalization and lets the *Keyb CV* inputs function independently.

Hard Sync jack- Force resets the start of the waveform to the beginning of its cycle. Most often used to create the "sync sweep" oscillator sounds made famous in The Cars' "Let's Go" (or Kraftwerk's "Neon Lights" and No Doubt's "Just A Girl"), by routing the output of one oscillator to the other's *Hard Sync* input and sweeping the pitch of the first oscillator.

Wave Form- Yes, we incorrectly split the word in half, just like the real synth. This selects the waveform for each oscillator.

VCO 1 pulse position has a variable duty-cycle (i.e. width), adjusted by the *PW* knob. The jaggedy wave in the last position of VCO 1 indicates white noise.

VCO 2 has two fixed pulse waves - square and narrow. The *Ring* position enables ring modulation between the two oscillators. It won't affect the *VCO 1 Out*, but you'll hear it in both the *Mix Out* and VCO 2 Out. It's actually not a true, technically correct ring modulator - the engineers of the original synth used a common-for-the-era method of achieving a very similar effect, and it sounds pretty wicked! It's most audible when using wide pitch spreads between the oscillators and mucking with VCO 2's *Pitch* knob (or modulating via VCO 2's *Freq CV* mod input if you're one of them fancy types).

PW (VCO 1 only)- Sets the width of VCO 1's pulse wave, from a perfect square to a very narrow pulse. It has no effect on other waveforms.

Master Tune (VCO 1 only)- This is situated on the VCO 1 side, but it affects tuning for both oscillators, up or down about a fourth.

Scale- Sets the basic pitch of the oscillator, displayed in traditional organ footage, i.e. larger number equals lower pitch.

Pitch (VCO 2 only)- Detunes VCO 2 independently of VCO 1, up or down about a fourth. This can be used for subtle "fattening," or setting note intervals between the two oscillators for hideous prog rock soloing (or other less offensive uses).

PW CV Mod jack- You may have noticed that moving the *PW* knob back and forth creates a nifty sound; instead of wearing out your mouse hand, the *PW CV* input can be used in conjunction with an LFO, envelope generator, or other mod source to continuously vary the pulse width. Note that the attenuator knob is bipolar, i.e. "zero" position is center. Turning right adds a positive modulation, turning left inverts the incoming CV.

Freq CV Mod jack- Allows modulation of oscillator pitch.

VCO 1 Out / VCO 2 Out- Independent outputs for each oscillator.

Mix Out- Outputs an equal, 50/50 mix of both oscillators. For finer control of oscillator mix level, patch the individual outputs to a mixer module.

VINTAGE OSCILLATOR

The Vintage Oscillator is a fat and warm sounding oscillator that flawlessly replicates the unique waveform discrepancies and minute drift characteristics of coveted classic analog oscillators. It generates all standard synthesis waveforms and features both exponential and linear frequency-modulation inputs.

Inputs, Outputs, and Controls

Pitch CV jack- Accepts a CV input for pitch. Typically this would come from the *Pitch* jack in the IO Panel *CV Out* section, or from a sequencer pitch CV out.

Hard Sync jack- Force resets the start of the waveform to the beginning of its cycle. Most often used to create the "sync sweep" oscillator sounds made famous in The Cars' "Let's Go" (or Kraftwerk's "Neon Lights" and No Doubt's "Just A Girl"), by routing the output of a second oscillator to the *Hard Sync* input and sweeping the pitch of the first oscillator.

Hard Sync is also useful when creating drum and percussion sounds to ensure that the wave starts at the beginning of its cycle.

Range- Sets the basic pitch of the oscillator, displayed in traditional organ footage. *LO* will be beneath the audible range and allows the oscillator to be used as a mod source.

Expo Freq Mod attenuator and input jack- This jack is used for exponential frequency modulation. This is the "normal" 1V/Oct method used for mapping the pitch of an oscillator across the keys of a keyboard. Positive and negative voltages will raise and lower the pitch of the oscillator in equal musical amounts making this a good choice for creating vibrato or any other low-frequency modulations.

Frequency- Fine-tune control for pitch. This can be used to fatten up multi-oscillator patches by detuning a small amount, or for "building-in" a set interval. Its range is a smidge over a fifth, up or down.

Lin Freq Mod attenuator and input jack- This jack is used for linear frequency-modulation. Linear FM is used for classic FM synthesis where the frequency of an oscillator (referred to as the "carrier") is modulated by another audio-range oscillator called the "modulator." To set this up, patch one of the waveform outputs (typically a sine wave) of another oscillator module to this jack. Patch the *Pitch* jack from the CV Outs section of the I/O panel to the *Keyb CV* or *Pitch CV* input of each oscillator. Now patch one of the waveform outputs of the Vintage Oscillator to the *Main Out* jacks. Changing the modulator oscillator's frequency and the modulation amount using the Vintage Oscillator's *Lin Freq Mod* attenuator will give you a wide range of tones from subtle harmonics to harsh buzzy goodness!

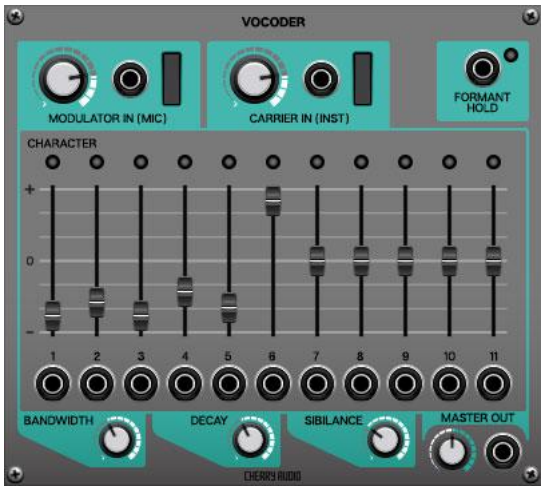
- To see the difference, try using *Exp Freq Mod* jack instead of the *Lin Freq Mod* input. You'll notice that the perceived pitch changes as the modulation amount is increased. In addition to this, the pitch relation between the modulator and carrier oscillators changes as different notes are played on the keyboard making it impossible to tune the oscillator to a traditional chromatic scale. This is exactly why Linear FM is used! Linear FM keeps the pitch relation between the modulator and carrier oscillators intact at different modulation amounts across the whole keyboard.

Pulse Width- This sets the width or "duty-cycle" of the pulse wave. It has no effect on any other waveform. Its default setting of 50% outputs a perfect square wave, rich in delicious odd-order harmonics. Moving the knob left or right narrows its width as well as the thickness of sound until it almost disappears at its extremes, and we've included a nifty "faux-OLED" display to indicate the current pulse width.

PWM Amount attenuator and PWM Mod input jack- You may have noticed that moving the *Pulse Width* knob back and forth creates a nifty sound; instead of wearing out your mouse hand, the *PWM Mod* input can be used in conjunction with an LFO, envelope generator, or other mod source to continuously vary the pulse width. Best of all, the OLED display looks real cool swooping back and forth.

Waveform Output Jacks- These are output jacks for ramp, sawtooth, pulse, sine, and triangle waves. These can be used simultaneously, in any combination.

VOCODER



A vocoder is a specialized type of multi-filter bank that imparts the tonal characteristics of one sound upon another. Vocoders are commonly used to create “robot” voice or choir effects by imparting the spectral character of a spoken or sung source (aka, the “modulator”) to a full-spectrum constant tone, typically a bright sawtooth synth pad (aka, the “carrier”). Unlike most other Voltage modules, getting sound from the Vocoder module isn’t immediately obvious, so we’ll explain how to configure it for real-time (i.e. with a mic input) or pre-recorded audio control (i.e. playing back an audio track).

Quick Start

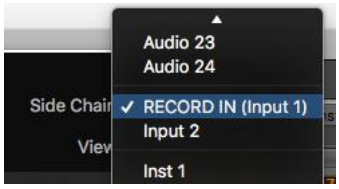
If you’re not interested in what’s going on under the hood and just want to get your electro *rock-it-baby* on, you and your pal The Egyptian Lover can read this section to get the party started.

The basic idea is that the modulator input imparts its character upon the carrier input. A crude analogy would be humming a pitch while cupping your hand over your mouth to change the sound - the constant hum would be the carrier signal, and modulator would be your hand on your mouth.

In the context of a Voltage Modular patch, the *Carrier In* jack would typically be a constant audio source, such as an oscillator wave or white noise, preferably with rich harmonic content; sawtooth waves and noise work particularly well. The *Modulator* In jack would be the tone “shaper” - live or prerecorded vocals work well, as do drum beats or rhythmic guitar tracks.

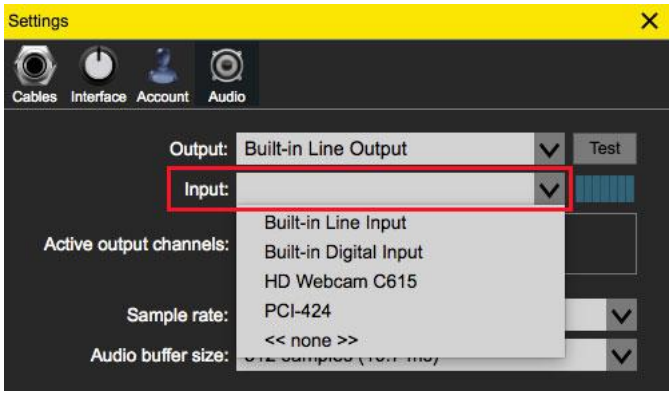
Configuring Configuring Modulator Input and Modulator Audio Source

If you’re using the VST or AU plug-in version of Voltage, you’ll use its sidechain input to route audio to the *Audio In* from host jacks in Voltage’s I/O Panel. The image below shows Logic Pro’s *Side Chain* input pop-up menu (located in the upper-right corner of the plug-in window):



The specific location of the sidechain dialog may vary depending on your DAW software, but you’ll want to select the audio source being used to modulate the static (carrier) audio. In this example we're using Logic’s first audio input, with a live microphone plugged into an audio interface. (You may need to enable software monitoring in your DAW to use live audio sources.) Alternatively, the sidechain source could be an audio track containing pre-recorded audio.

If you’re using the standalone version, you’ll need to choose the audio input source in Voltage’s preferences menu. Clear the gear icon to the left of the *Library* button at the top, then click *Audio*. Click in the *Input* section to choose an audio source.



The sidechain audio is now routed to jacks *1L/1R* in the *Audio In from host* section of the I/O Panel at the top of the Voltage window. When sidechain audio is playing, the *Audio In from host* meters will blink. Depending on which input is routed, click on the *1L* or *2L* jacks to route a cable to the *Modulator In (Mic)* jack. Set the signal level so that the nominal level sits in the full green/occasionally yellow region.

Configuring The Carrier In

This one's easy - route the output of a continuous audio source such as an oscillator, or noise source to *Carrier In (Inst)* and set the level appropriately. A patch with an amp/envelope generator that gates on and off with a keyboard is fine, just avoid percussive sounds that die away quickly, otherwise you'll be trying to vocode "nothing." Remember that vocoding controls not only the carrier audio's frequency spectrum, but its amplitude as well.

Voltage's Poly Oscillator module set to saw waves makes an ideal vocoder carrier signal source. Its built-in voltage-controlled amp and envelope generator means you won't need to use separate modules for amplitude control. A basic patch would look something like this:

Once you've got the Vocoder up and rockin', try manipulating the Poly Oscillator's octave sliders as well as the Vocoder's Bandwidth, Decay, and Sibilance controls for different effects.

How Does It Work?

The Voltage Vocoder module consists of two matching sets of ten bandpass filters (plus two highpass filters): one set for the modulator signal, and the other set for the carrier signal. These bandpass filters each cover a small "slice" of the audible audio spectrum - the eleven bands you see on the panel logically go from low frequencies to high frequencies. The number 11 slider is a highpass filter that handles the top end of the audio spectrum from 8k-20k.

The modulator signal is split and runs through all eleven filters. Each filter only allows a small "slice" of the audio frequency range through. Immediately following each filter is an Envelope Follower, which is a special type of amplifier that converts incoming audio levels to a corresponding control voltage. So far, we have the incoming modulator signal being split into eleven separate control voltages, all changing independently and in real-time dependent upon the modulator audio's energy across the frequency spectrum. Heavy stuff, right?

Let's slide on over to the carrier signal side and talk about what's going on with its filters. The carrier signal also gets split, and runs through the second set of eleven bandpass and highpass filters. These filters each route to the audio input of a standard voltage-controlled amplifier (or "VCA" for short). Remember all those control voltages from the modulator's envelope followers? Those are connected to the carrier's individual corresponding VCA control voltage inputs.

If there is no signal at the modular input, the carrier's VCA's are all closed. If the modulator signal contains audio energy in the 400Hz area, the carrier filter/amp combos will "open up" in the same area of the audio spectrum, thus letting carrier audio in the 400Hz area through. In reality though, this is much more complex and nuanced, because different audio signals contain different energy levels across their frequency spectrum. This complexity is why vocoders can create such unique sounds (and also why a relatively simple set of filters can produce recognizable speech).

Though this covers the basic operation of a vocoder, there are few other things going on under the hood that help the speech intelligibility and general fidelity of a vocoder, including adding highpassed noise to help with S sounds, weird EQ curves, and some other tricks we'll never divulge! Suffice to say, making a great-sounding vocoder is tricky business, and we hope you'll enjoy the fruits of our efforts.

Now That I (Sort Of) Understand How This Mess Works, What Do The Knobs Do?

Modulator In (Mic)

This sets the input level of the modulator signal input. Use the meter to set it so that nominal sits in the full green/occasionally yellow region.

By the way, this input is labeled Mic for clarity, but any audio signal can be used, such as a pre-recorded vocal track, a drum loop, rhythm guitar, or even an entire song. Signals with constantly changing frequency and/or amplitude tend to work best - in other words, don't use an organ.

Carrier In (Inst)

This sets the input level of the carrier input signal. Use the meter to set it so that nominal sits in the full green/occasionally yellow region. If you've made it this far, we're sure you know how to set an input level, but do keep in mind that vocoders are fairly sensitive to levels (too low and too high), so it's a good idea to make sure levels are in their happy spot for best sound.

Because the constantly changing filter bank is effectively removing different areas of harmonics, the best choices for carrier audio are sources with a full-frequency spectrum and constant sustain.

Formant Hold

If you read the *How Does It Work?* section (of course you did, everyone loves a rambling technical explanation), we talked about how the carrier's eleven VCAs dynamically mirror the modulator's frequency "profile" as it changes in real-time. Applying five-volts to the *Formant Hold* jack freezes the current state of the carrier VCA's. The most common use for this would be if you were singing into a mic to shape a continuous sound, and you wanted to sustain the sound (imagine a vocoded choral "ahh"), but were going to run out of breath. A sustain pedal patched via Voltage's IO Panel to the *Formant Hold* jack allows the sound to infinitely sustain the current carrier filter curve. The LED indicates when *Formant Hold* is active, i.e. when five volts is being received.

Character LEDs, Sliders, and Individual Output Jacks

These controls correspond to the Vocoder module's individual filter bands. The individual Character LEDs display the activity of each filter band's envelope follower voltage output. This can be seen by making low-to-high pitched noises with a microphone (make S noises for the highest bands). In use, these give a good general idea of frequency spectrum activity.

The Character sliders control the volume of each of the carrier side VCA's, and effectively act as a graphic EQ of sorts. Unlike most other vocoders, bands can be turned down to zero, effectively turning them off completely for unique effects. The Character individual out jacks correspond to each individual carrier VCA's output; note that individual out volumes are affected by the sliders. Separately routing specific bands or groups of bands within Voltage allows all kinds of interesting noises.

Bandwidth

Sets the width or "Q" of all bandpass filters. Narrow bandwidths let less audio through, whereas wider bandwidths let more audio through for a denser sound. A good analogy would be to imagine water running through a comb with wider or narrower tooth spacing.

Decay

This sets how quickly the carriers signal envelope followers recover to zero amplitude. Lower settings have a snappier, tighter sound (good when using drums or percussion as a modulator); higher settings are looser (a good choice when using vocals as a modulator).

(Not to toot our own horns too much, but Bandwidth and Decay are both parameters that you'd never see on an analog hardware vocoder, as they would be difficult to implement in analog electronics - these features are comparatively easy in computer world.)

Sibilance

This adds highpassed white noise into the final signal when S sounds are detected. This helps speech intelligibility, because vocoders aren't inherently good at detecting S sounds, and many carrier sources don't have much energy in the S sound spectrum.

Master Out

This is the mix of all the of the bands, with a volume knob and out jack.

VOLTAGE-CONTROLLED MIXER

The Cherry Audio Voltage-Controlled Mixer is a four-channel mixer for audio and control signals featuring solos and mutes, individual stereo outs, and CV control of level and pan on each channel. This module essentially consists of four Panner modules, each with a dedicated VCA (voltage-controlled amplifier), that can be used individually and/or mixed to the master output (which by the way also has a dedicated VCA!).

Inputs, Outputs, and Controls

Channels 1 - 4

Each of the four individual channels feature all of the same jacks and controls, so we will just look at channel 1.

Input jack- Audio or CV input jack.

Pan- Typical pan control for routing the signal between the left and right outputs of both the channel and master outs.

Pan CV- CV input and attenuator for externally controlling the pan position. The *-CV* and *+CV* LEDs will light up to indicate the polarity of the voltage currently controlling the pan position.

S- Solo button for isolating the channel's signal. When engaged, all channels that are not also soloed will be muted.

M- Mute button for muting the channel.

VU Meter- Visually shows the level at which the input signal is being sent to the channel and master outputs.

Level- This fader adjusts the channel's output level (to both the channel and master outputs) from -infinity to +6.0dB.

Level CV jack and attenuator- CV input and attenuator for externally controlling the channel's output level.

L and R Ch Out jacks- Individual stereo outputs for the channel.

Master Output

Stereo VU Meter- Visually shows the master output level of the mixer.

Master Output Level- This fader adjusts the amplitude of the master outputs from -infinity to +6.0dB.

Level CV jack and attenuator- CV input and attenuator for externally controlling the master output level.

L and R Mast Out jacks- This is the mixer's master output. All four channels are mixed in stereo and output from these jacks.

TB FILTER

The TB Filter is a super-accurate modular recreation of the diode-style filter of the world's most iconic acid techno bass synth. It perfectly captures the aggressive and "screamy" character of the original, and its *Saturation* control adds even more distortion and emphasis.

Input jack- Patch audio signals here.

Cut Off- Sets the frequency where low frequency attenuation begins. And yes, we split the word "cutoff" intentionally, just like the original unit.

Resonance- Emphasizes sound energy at and around the current cutoff frequency by adding feedback from the filter's output back to its input. At lower settings, this can be used to create mild resonances such as those heard in acoustic instruments. At more extreme settings, you'll the trademark TB squelch and scream. Be careful with this knob as it can get loud at extreme settings.

CV Mod jack and attenuator- CV input jack and attenuator for externally controlling the *Frequency.*

Frequency- Sets the frequency where the filter’s notch will be. Audio content at and around this frequency will be removed from the input signal.

Bypass button- When lit red, the notch filter is active. When gray, the filter is bypassed. Notch filters are often used to make subtle adjustments. Toggling this button on and off can help identify which frequencies are being removed by the filter.

Bandwidth- Adjusts the width of the notch. Low values create a narrow notch while higher values create a wider notch.

Output jack- Outputs the filtered audio signal.