



# HEXEN

## VIRTUAL SYNTH

### User Manual

©2024 Silicon Droid Inc.

Multi platform Eurorack  
Modular synthesis system.

Explore soundscapes no  
beings have heard before

Formatted in 3 columns  
for reading on phones.

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# What is modular synthesis?

Modular synthesizers are synthesizers which are built from modules. Each module has a different function.

The concept is similar to regular HiFi equipment where you could think of an amplifier as one module and say a radio tuner as another module. Just like in HiFi equipment the modules need connecting together to work as a whole. Connecting these modules together is known as “patching”.

In HiFi equipment you are usually only patching audio signals, for example you patch a radio tuner's audio output channels into an amplifier's audio input channels.

In modular synthesis you will be patching audio signals and also CV signals. CV stands for “Control Voltage”, these CV signals are simply other signals, just like regular audio signals, their value (signal voltage) moving up and down over

time. However using CV signals you can control module functions, for example:

Say you want to make the music go from full volume to zero volume on a regular HiFi system, what would you do?... You would place your hand on the volume control and slowly turn it down. Now imagine if that volume control had a jack socket next to it and you could put a voltage into that socket that would control the volume, well that's exactly what a CV input is, it allows you to automate some function using a control voltage signal.

One thing to note: because CV signals are just another type of signal: you are allowed to route audio signals into CV inputs, and CV signals may be routed into audio inputs, there are no rules. On a modular synthesizer you can plug a cable from anywhere to anywhere without breaking it, you make the rules as you design your own system. In fact if you wish to experiment with FM synthesis then you need to route audio into CV inputs.

In modular synthesis all of your modules are placed

inside “Racks”, similar to the racks one might find in a network server center. The particular format of these racks in Hexen is known as “EuroRack”.

The great thing about modular synthesis is that you are in command of building your own synth system and you have more instant control than other more high level systems. Modular synthesis has a relatively gratifying workflow; while searching for sounds it feels quite free and playful when compared to other more high level systems like DAWs (Digital Audio Workstations).

The more organic/chaotic nature of patching means that modular synthesis does not give the same kind of “on rails” control that some folk like for final mix down. For that you can always export samples/loops from modular and make some final composition using a DAW. Of course with a little practice and patience some great final mix downs and live sets can be performed from purely modular space.

# Introducing Hexen

Hexen is a virtual modular synthesizer designed to run on most platforms.

Get it for Android here:  
<https://play.google.com/store/apps/details?id=com.silicondroid.hexen>

It was developed using the Unity game engine and Microsoft Visual Studio. The synth engine and rendering engine run on separate processor threads to give good performance. Both engines are optimized such that they should run pretty well even on modest mobile phones or tablets. All of the internal signal paths in Hexen have 32 bit resolution and are clocked at 48KHz. The final rendered audio is 16 bit 48KHz.

We (Silicon Droid) chose to use a 3D rendering engine because our ultimate goal is to make a perfect virtual modular synthesizer for AR/VR, in the future we envision being able to walk around your living space wearing AR shades... through these you will see your real walls, tables etc

adorned with virtual modular racks that you'll be able to patch using your hands. You can patch alone or with other people in your living space or even collaborate with people in remote locations as they "transport" their avatar into your space to jam with you.

Back to the present... We are striving to make Hexen as intuitive and fun to use as a real modular synthesizer, of course if you're using a small phone screen then the user experience will be lesser than that of a real modular synth, for that we need to wait for the VR version which will take us a step closer to the real thing.

How might Hexen fit into your life?... Many modular synth users tend to build nice sounding loops and evolving soundscapes that they then export to incorporate into a larger composition using a desktop computer and a DAW. Of course it's quite possible to just stay in modular space and do your final mix down right there, but due to the constrained user interface when working with Hexen on a mobile phone we like to spend 10 minutes here

and there exploring sounds and formulating ideas, kind of like a sonic sketch pad which can then be incorporated into larger tracks. It's a good tool to help you be more creative in your idle time if you wish.

Hexen is currently released as a free evaluation version with all modules available to play with but no save capability. Upgrading with a one time payment will give you full save capability for all versions of Hexen now and into the future.

We're really excited to have the whole world be able to play with Hexen and we hope you enjoy it!

# Navigating Around

## Mobile Phones and Tablets

### Zooming In and Out

When using Hexen on your mobile device you can zoom in and zoom out of your rack space, this can be done in a couple of ways:

1. You can use two fingers to pinch and un-pinch your screen.
2. You can use one finger to double click the screen. Note: if you are fully zoomed in and double click a control like a knob or a button then you will interact with that control, however if you are zoomed out some then you can double click anywhere to zoom into the module you double clicked.

### Two modes

There are two distinct modes of operation:

Zoomed **in** and Zoomed **out**.

The threshold between zoomed **in** and **out** is about halfway.

You can:

Change controls and patch cables when zoomed **in**,

Move modules around in the rack or delete them when zoomed out.

### Scrolling Around

You can scroll around to make your screen a window into various parts of your rack like this:

1. Using two fingers, keep them approximately the same distance apart and slide them around to drag your entire rack space around.
2. When zoomed out some: using one finger you can tap and drag anywhere to drag your racks around.
3. When zoomed in if you tap and drag a control you will interact with that

control, however if you tap and drag a modules body (not a control) then you can also scroll around.

# Menu System

## Mobile Phones and Tablets

### Open Main Menu

You will notice a small button in the bottom left of your screen. A button with three horizontal bars on it, this is your one and only main menu button:



Tap it to open up your main menu.

You will be presented with multiple menu item buttons.

Click a button to explore that menu item.

### Closing Menus

When you have a menu open you can close it in two ways:

1. Tap anywhere on the screen that is not a button.
2. Or tap the exit button:



# Cable Patching

Patching refers to the act of connecting output jacks to input jacks using signal cables.

## Patching a Cable

To place a patch cable follow these steps:

1. Zoom into the module whose input jack you want to patch to, you can zoom in by double clicking on the module.
2. Push the input jack that you want to connect to and slide your finger, you will see a new cable appear, connected to the input jack you pushed on
3. Drag the new cable plug to the output jack socket that you want.

NOTE: If the desired output socket is off screen

then you can drag the cable to the edge of the screen to cause the screen to scroll.

## Stacking Outputs

You can patch multiple input jacks to the same output jack:

Simply drag a new cable to an already patched output.

Once an output is stacked then dragging the stacked output will move or delete the whole stack as one.

If you want to move or delete just one cable in a staked group then you must drag the input end of the stacked cable.

## Stacking Inputs

You can't stack inputs.

Hexen could have been made to calculate the average of stacked input signals, however that would require changes that would significantly slow down Hexens DSP engine. If you want to mix multiple outputs into a

single input then use some mixer module.

## Importing Audio

To import stereo .WAV files as audio data you can use the [TAPE](#) module.

## Exporting Audio

To export audio as a stereo .WAV file you can use the [TAPE](#) module.

# Modules

## Input/Output

### BTNS

This module gives you six momentary action push buttons.

Each button outputs a CV voltage.

At the top of the module you will see a three way mode switch.

Each mode operates as follows:

#### POS

If a button is pushed it's output is full positive.

If a button is not pushed it's output is zero.

#### DUAL

If a button is pushed it's output is full positive.

If a button is not pushed it's output is full negative.

#### NEG

If a button is pushed it's output is full negative.

If a button is not pushed it's output is zero.





## KEYBOARD 1

A single octave monophonic keyboard.

### OCTAVE

The octave numeric allows you to select which octave the keyboard will produce a note for.

### CV

This output will generate a control voltage corresponding to the desired note, this output voltage is latched meaning that if you pressed say key C in octave 4 then the CV voltage will output that note until you press another key.

### GATE

This output will be high if a key is pressed otherwise it will be low.

You might want to use the gate output to trigger an [ENV](#) module to generate an envelope.



## KEYBOARD 2

A four octave monophonic keyboard.

### OCTAVE

The octave numeric allows you to select which octave the bottom keyboard will produce a note for. The keyboards above it go up one octave each.

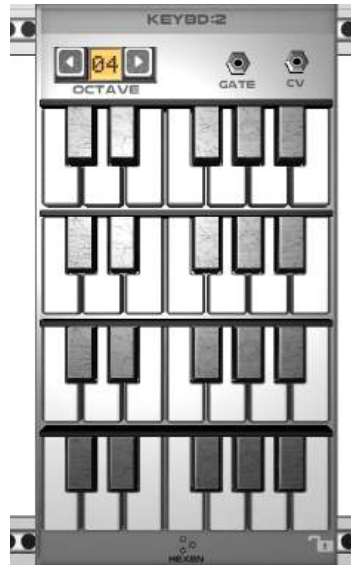
### CV

This output will generate a control voltage corresponding to the desired note, this output voltage is latched meaning that if you pressed say key C in octave 4 then the CV voltage will output that note until you press another key.

### GATE

This output will be high if a key is pressed otherwise it will be low.

You might want to use the gate output to trigger an [ENV](#) module to generate an envelope.



## KNOBS

This super simple input module gives you four channels of knob controlled CV outputs.

The knobs are mapped in a linear fashion:

Full anti clockwise causes minimum CV output value.

Full clockwise causes maximum CV output value.

As with all other knobs in all other modules: You can double tap a knob to toggle to its default value.

In this module's case the default value is zero CV (knob in the middle).



## MIDI

Hexen has Midi in and out support. You should be able to connect to available midi devices over USB or Bluetooth. For USB you may need to purchase a “USB OTG” (On The Go) cable to connect your mobile device to some other Midi enabled device.

### Input section

Select your desired input device using the upper selector.

Select the desired Midi channel.

All going well you should see the Midi data live as hex data in the “DATA” window.

You might want to use the CV and GATE and PITCH outputs to control some modules, this way you can play those modules using an external controller keyboard.



### 16 control channels

The 4x4 array of lit buttons and jacks gives you 16 midi control input channels.

To map a control simply do this:

- Press one of the 16 buttons.
- Move a knob on your external midi hardware.
- Or push a button on your external midi hardware.

As soon as you use a control: Hexen will hear it and map the channel accordingly.

### Output section

Select your desired output device using the lower selector.

Select the desired Midi channel.

Feed CV and Gate signals into the output section and they will get translated into midi note on/off commands that can be routed to external Midi equipment. You can control an external synth using one of Hexens [sequencers](#).

### Pitch Bend

Push the BEND button to enable pitch bend. This will adjust the pitch of the incoming CV signal such that its frequency is bent in accordance with the external controllers pitch wheel.

### TIP:

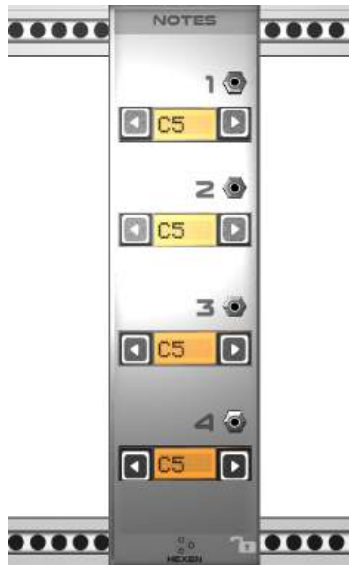
The pitch signal is always available on the pitch jack. You can turn BEND off and still use that signal to modulate any module's CV input such as a [filter's](#) cutoff frequency etc.

## NOTES

This simple module gives you four channels of constant note CV voltages.

Simply set each channel to the note you require.

The output jacks will have CV voltages on them that correspond to the selected note.



### Example Usage

You could add four [VCO](#) modules to your rack and patch NOTES channels into each [VCO](#) FM input.

Then use a [MIX:4](#) module to combine all four [VCO](#) SIN audio outputs into one.

This would give you a polyphonic four note chord sound on the output of the mixer. Great for the starting point of some ambient drone sound.

## OUT

This is the master out module.

Your rack will always contain one master out module.

The master out module routes the inputted audio signals to the stereo audio output bus of your device.

If you want to hear something you need to route it to this module.

## GAIN

The GAIN knob ranges from -10db to +10db. Double click it to set a default value of 0db.

The gain is applied at the very end of the DSP pipeline, after the EQ.

NOTE: Use caution, the VU meters will not show output signals overdriven by applying too much final gain. We recommend keeping 0db default, unless you really need that extra volume to drive tiny speakers etc.

## EQ

Tap the EQ LED button to enable/disable the three channel equalizer.

Adjust the LOW, MID and HIGH knobs.



## L/R METERS

The VU meters show you the level of the signals entering the OUT module.

If the meters ever show any red then reduce the gain of the incoming signals by adjusting the necessary module that is feeding the OUT module. In fact it's better to keep them all green as this will give the EQ stage more headroom.

## L/R SOCKETS

Patch your audio signals into the left and right sockets from any other module's audio out socket/s.

## DSP

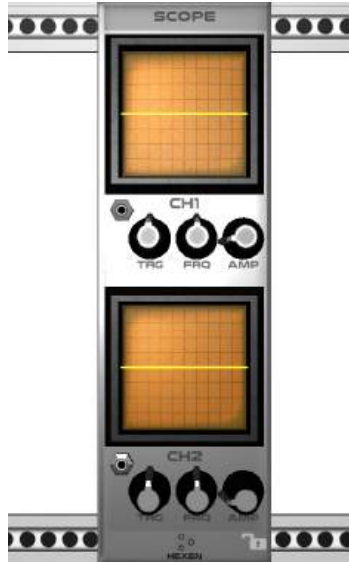
The DSP meter shows you how much of your CPU is currently being used by Hexens DSP engine. The more modules you add to your rack the more CPU is used.

## SCOPE

A handy little two channel oscilloscope.

An oscilloscope is simply a way of visualizing a time varying signal, it's a graph where time is on the horizontal axis and the input signal's value is plotted on the vertical axis.

Patch any other module's output signal into the scopes CH1 or CH2 input in order to visualize that output signal.



## TOUCH

A simple input touchpad.

### GATE

The gate output is high while your finger is touching the touchpad.

### X

The X output channel is mapped to the horizontal dimension of the touchpad. Slide your finger left and right to change the X output signal.

### Y

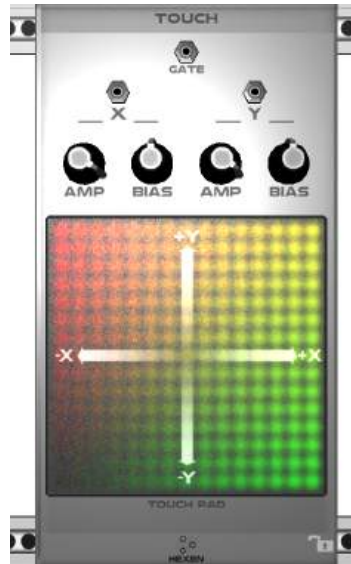
The Y output channel is mapped to the vertical dimension of the touchpad. Slide your finger up and down to change the Y output signal.

### AMP

Each channel has an AMP control. This specifies a multiplication factor that gets applied to your fingers' vertical position. *AKA Gain.*

### BIAS

Each channel has a BIAS control. This specifies a +/- offset factor that gets applied to your fingers' vertical position. *AKA DC Offset.*





# Signal Sources

## DTMF

This module is not strictly musical in that it is not possible to form notes of the standard scale using it.

It might find a place in some soundscape though, who's to know?

DTMF stands for dual tone multi frequency.

DTMF is a standard for encoding 16 values into 2 mixed frequencies.

The mapping is as follows:

HZ	1209	1336	1477	1633
697	1	2	3	A
770	4	5	6	B
852	7	8	9	C
941	*	0	#	D

## KEYS

Press any one of the 16 keys to generate the corresponding DTMF code.

## GATE

While the gate input receives a high signal the OUT signal will sound.

## CV

The CV input voltage dictates which DTMF code will sound when the GATE is high.



## LFO

Low Frequency Oscillator.

So, you want to twiddle a knob to make something sound cool? well you can stand there and twiddle it by hand or you can employ an LFO to do the twiddling for you.

An LFO generates a relatively low frequency output waveform.

The frequency range is:

0.01Hz ... 65.406Hz  
( 130.812Hz using CV )

TIP: Hook an LFO output into a [VCOs](#) FM input to hear how the [VCOs](#) frequency gets auto twiddled by the LFO. Or hook it into a [SCOPE](#) to watch it.

The LFO can produce 6 different waveform types:

1. SIN: Sine wave
2. TRI: Triangle
3. SQR: Square wave
4. SWUP: Ramp up
5. SWDN: Ramp dn
6. RAND: Random



When the reset input signal goes from low to high the LFO gets instantly reset to the beginning of its waveform. You might want to hook up the reset input to a [CLOCK](#) output if tight timing is your thing.

### RATE

How fast do you want your LFO to oscillate? You can also apply CV control to the rate using the jack beneath the rate knob.

### GAIN

Sets the amplitude of the output waveform.

### BIAS

This knob sets the DC offset of the waveform, doubleclick it to set a default bias of zero.

### RESET

Say you wanted a filter to slowly open up over time, well you could use the SAWUP output with the LFO tuned to a really low rate. But say you wanted the filter opening to keep in time with your music, this is where the reset input comes in:

## MIC

This module enables you to patch stereo audio signals from real world microphones into Hexen.

### MIC

Select any mic available on your system.

### RUN

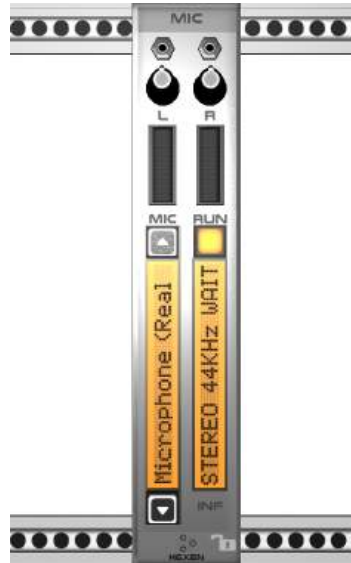
After selecting your MIC press RUN to make the MIC go live.

### L & R

Stereo output sockets are available as L & R channels.

Each channel has its own VU meter and gain control knob.

Adjust the gain control knobs so that the loudest noise you expect does not cause red in the VU meter.



### INF

The INF text shows you the current status of the selected MIC.

### MONO MICS

If you are using a mono mic, the INF will show "mono". Both L & R channels will produce the same signal.

## NOISE

This module contains four channels of different noise types.

You can use these noise generators as audio sources or CV sources.

### KNOBS

The knobs set the level of the output signals.

### WHITE

White noise is mathematically perfect noise:

It's frequency content is distributed in a flat spectrum, it contains equal levels of all frequencies high and low, as such it is a good candidate for subtractive synthesis using [filters](#).

### PINK

Pink noise has less high frequency content than white.

### BROWN

Brown noise has less high frequency content than pink.

### WATER

A seamless long sample loop of real water flowing over pebbles and rocks in a small river. Great for ambient stuff.



## PAD

The PAD module gives you 109 seamless synth pad textures.

The selected sample will loop continuously, its sound being available on the OUT jack.

The sample frequency is tuned to note C at zero CV input.

Patch any CV source like a [sequencer](#) or [keyboard](#) into the CV socket to control the output frequency.

### TIPS

You can shape the output sound using an [ENV](#) module.

You can change the flavor of the sound using a [VCF2](#) module.

The sample output is mono, to give some stereo spread, use a [MIX:HEX](#) mixer module and automate the PAN using an [LFO](#).



## SAMPLES

All textures are sampled from various real life instruments:

- E-mu PROTEUS (3)
- Ensoniq ESQ1 (2)
- Ensoniq SD1 (2)
- Ensoniq SQ1 (1)
- Ensoniq SQ2 (1)
- Ensoniq SQ80 (1)
- Kawai K1R (2)
- Kawai K3 (2)
- Kawai K11 (2)
- Kawai K5000W (7)
- Korg O1W (5)
- Korg M1 (5)
- Korg M3R (3)
- Korg MS2000 (1)
- Korg NS5R (3)
- Korg TR-RACK (2)
- M-Audio VENOM (4)
- Roland JD990 (2)
- Roland JV2080 (6)
- Roland SC88 (7)
- Yamaha A1NX (3)
- Yamaha DX7 (3)
- Yamaha FS1R (6)
- Yamaha MU90R (2)
- Yamaha SY22 (9)
- Yamaha TG77 (3)
- Yamaha TG100 (10)
- Yamaha TG500 (2)
- Yamaha TX81Z (2)
- MISC OTHER (3)

## RADIO

This module enables you to get live audio from thousands of online radio stations.

The directory of stations available is provided by [Shoutcast](#).

The network stream decoder is provided by [FMod](#).

To tune into a station simply follow these steps:

1. Select a MAIN GENRE.
2. Select a SUB GENRE.
3. Select a STATION.
4. Press the play button.

Press the stop button at any time to stop the radio playing.



### **BUFFER**

When the radio is playing the BUFFER meter shows the stream buffer state.

The buffer is cyclic in nature. So a healthy buffer is half full: this is when the buffer read and write pointers are furthest apart.

### **MODE & RATE**

When the radio is playing you will be shown MODE and RATE info.

### **TRACK INFO**

Scrolls info about the currently playing track.

## SAMPLER

The sampler module allows you to record audio as a stereo sample which can then be played back as an instrument in your rack.

### INPL & INPR

This is where the audio signal/s you want to sample enter the module.

### OUTL & OUTR

The left and right audio outputs from the module.

### MONO

The mono audio output, which is simply the sum of the left and right outputs.

### GAIN

This knob sets the final gain of the audio outputs.

### MODE

This button allows you to set the sampler module into one of its three modes of operation.

When starting with a new sampler module your workflow should be in this order: RECO then EDIT then PLAY.



### MODE: RECO

Record mode allows you to record the audio entering the input jacks.

When in RECO mode the input audio passes through to the output jacks, allowing you to monitor the audio that you are sampling.

Recorded audio is written to one rolling master sample. You can record forever but only the last 30 seconds get stored.

RECO mode is the only mode in which you can change the master sample data. So rest assured: nothing you can do in any other modes will change your master sample data.

### REC

To start the recording process simply press the red circle REC button once.

To stop the recording process the REC button again.

### LOAD

Press this button (in RECO mode only) to load an external .wav file into the sampler. Loaded samples will be resampled to stereo 48KHz.

Loaded samples get added to the end of the rolling master sample. This way you can load multiple .wav files into the same master sample and separate them in EDIT mode later.

### SAVE

Press this button (in RECO mode only) to save the current sample data as a stereo 48KHz .wav file.

### MODE: EDIT

After you have recorded some audio you should press the MODE button to enter EDIT mode.

EDIT mode allows you to change parameters for each of the 12 subsamples available.

Each subsample is some selection of the recorded master sample track.

Each subsample can have its own tuning, loop type and envelope.

Use the SUB SAM number selector to choose 1 of the 12 subsamples to edit.

Each subsample can then be edited by:

- Dragging main selection.
- Setting loop type.
- Setting TUNE knob.
- Setting envelope knobs.

### **AUTO**

If you press the AUTO button when in EDIT or PLAY mode then all 12 subsamples will be made into random selections.

### **ZER**

Pressing this button will make the currently selected subsample be as seamless as possible.

The selection window is adjusted such that the subsample end points form a zero crossing. If a stereo samples left and right channels have different zero crossing positions then the average of the two positions is used.

NOTE: The master sample data remains unchanged

when you press the ZER button.

### **GATE LED BUTTON**

This small LED button only works in EDIT mode. It overrides the gate signal allowing you to continuously hear the subsample you are currently editing. It is simply a convenience feature to help you find a good loop.

### **MODE: PLAY**

After you have set up your subsamples you should press the MODE button to enter PLAY mode.

In PLAY mode the module operates like any other signal source module: The start/stop of played notes is controlled by the GATE input signal. The tuning of played notes is controlled by the CV input signal.

When in play mode you can change the current subsample by tapping the SUB SAM number selector control.

### **SUB SAM JACK**

This jack input is only active in PLAY mode. It allows you to automate subsample selection. A subsample will be selected according to the

note value of the incoming CV signal.

This enables you to make multi bar percussive loops by having the sub sample selection controlled by some [sequencer](#) module.

### **HAND PLAYING**

When in PLAY mode the module can also be triggered by hand: simply tap/hold any one of the 12 sample thumbnails in the main screen. Similar to how you would play finger drum pads.

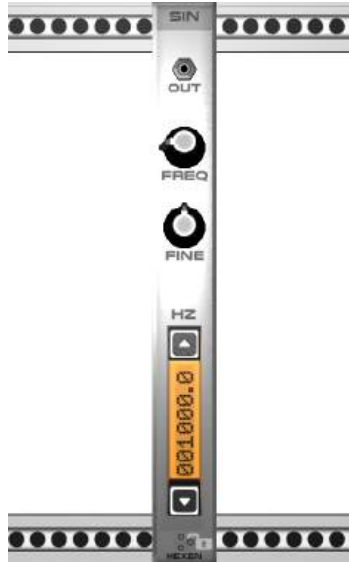


## SIN

This module enables you to generate a sine wave of any set frequency.

The module is more of a piece of lab equipment than a modular module. It generates a perfect sine wave of any frequency with relatively good accuracy and spectral purity.

There is no CV input to control the frequency, if you want a CV controlled sine wave then use the [VCO](#) module.



## SPEECH

This module captures the sounds of the classic SP0256 chip.

### What is it?

From Wikipedia:

*"SP0256 refers to a family of closely related NMOS LSI chips manufactured by General Instrument in the early 1980s, able to model the human vocal tract by a software programmable digital filter."*

### MODE SELECT SWITCH

There are four modes of operation as follows:

#### MODE: ONE WORD

In this mode the currently selected word will be spoken whenever a TRIG signal is received.

The **WORD SELECT** jack input can be utilised in ONE WORD mode only: CV signal on this input allows you to select the current word to be spoken.

The selection is mapped per CV note so you could for example use a [keyboards](#) CV output to select words.



#### MODE: SEQ WORD

In this mode your words will play in sequence whenever a TRIG signal is received. For example with four words it will play: 1,2,3,4,1,2,3...etc.

#### MODE: RND WORD

In this mode a random word from all of your words will be spoken when a TRIG signal is received.

If you have not entered any words then a random word from the entire dictionary will be spoken.

#### MODE: RND PHON

In this mode a random allophone (speech sound quanta) will be uttered whenever a TRIG signal is received.

### OUT

The main audio output.

### WORD SELECTOR

This numeric selector allows you to navigate around your list of words.

### WORD DISPLAY

This vertical text displays your currently selected word.

### ADD

Press this button to add a word to your word list. The word will be added after the currently selected word.

TIP: You can add a sentence as a word if you like.

### DEL

Press to delete the currently selected sample.

### FRQ

Sets the pitch of the speech playback. This can be modulated by the CV input below it.

### TRIG

When a trig signal is received or the button is pushed the module will speak a word.

## TAPE

This module allows you to record and playback stereo audio up to 30 minutes in length as well as import and export audio WAV files.

### **.WAV Export format:**

Stereo, 44.1KHz, 16 bit PCM

### **.WAV Import format:**

Mono or stereo , PCM, any sample rate.

### **How to use**

The module operates like a vintage personal cassette recorder from yesteryear.

To record: patch signals into the inputs and press the red record button.

To play a tape back simply patch the tape outputs into your master OUT or a mixer etc.

### **SPEED**

Sets the record/play tape speed from 50% to 200%.

Note: saved/loaded WAVS will only have the correct pitch when tape speed is set to 100%.

Double click the knob to set it to the default speed of 100%.

### **DUB Lit:**

Newly recorded audio will be mixed over existing audio on the tape. Also, playing audio back will be mixed over the input.

### **DUB Unlit:**

Newly recorded audio will replace existing audio. Also, playing audio will mute the input signals preventing them from propagating the outputs.



### **NUDGE**

The left/right keys on the SECS control allow you to nudge the transport back and forth by 0.1 second increments.

### **TRIGGER**

This allows you to have a recording start at the exact same time that the trigger input signal goes high. For example you could patch a [CLOCK](#)

output into the trigger socket to ensure that your recording starts exactly on the beat.

Once you've patched in an external trigger signal you need to press ARM in order to have the tape module act on it. So keep your cable plugged in and arm unlit. Then press play or record,

then press ARM to light it right before the beat you want to hit.

Said a different way:

Press play/record: As soon as the trigger input goes high AND arm is lit then the play/record operation will start.

## VCO

Considered by many as the foundational building block of modular synthesis, the Voltage Controlled Oscillator, it makes a simple noise which you can sculpt using other modules.

You can adjust the frequency of the oscillator using the two knobs:

### Oscillator Types

Hexens VCO can produce four different waveforms with good stability and spectral purity; the outputs for these waves are at the top of the module.

#### SIN

A pure sine wave contains only one frequency and no others, a pure sine wave contains no harmonics, it is just one pure tone. Due to its spectral purity and lack of harmonic content a sine wave is quite reluctant to be sculpted into more complex sounds.

#### TRI

It goes up and down in a straight line, a zig-zag.

Contains harmonics that are odd multiples of the fundamental frequency.



#### RMP

Goes up in a straight line and then drops back down instantly. Contains integer harmonics (both odd and even).

The best waveform to use for subtractive synthesis with [filters](#) like LPF and HPF.

#### PLS

A pulse wave, it's a square wave with a variable on/off ratio.

#### FREQ

Use this to lower or raise the frequency, the knob spans exactly four octaves, -2 turning anticlockwise and +2 going clockwise. Double click it any time to return to 0.

#### FINE

Turn this to lower or

increase the frequency, the knob spans exactly 1 semitone, -50 cents turning anticlockwise and +50 cents going clockwise. Double click it any time to return to 0.

#### PWM

Use this to set the on/off ratio of the PLS wave. Double click to set it to a perfect 50/50 square wave.

#### FM

The FM input will modulate the VCO frequency. This input is volt per octave mapped.

#### CV

This is a one volt per octave CV input, use it to make your VCO play musical notes by feeding it a CV signal from a keyboard, sequencer etc.

# Clocks

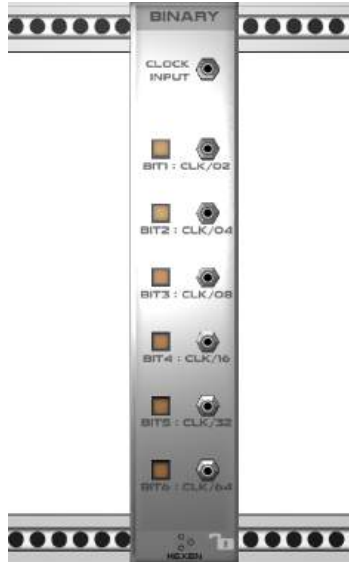
## BINARY

This is a binary clock divider.

### CLOCK

Patch a [CLOCK](#) signal into the CLOCK input jack.

You now have six output clocks that are divided versions of the input clocks:



### BIT 1

Input clock divided by 2.

### BIT 2

Input clock divided by 4.

### BIT 3

Input clock divided by 8.

### BIT 4

Input clock divided by 16.

### BIT 5

Input clock divided by 32.

### BIT 6

Input clock divided by 64.

## CHANCE

This module allows you to route periodic CV signals to different target modules depending on chance.

It contains 4 identical and isolated channels that operate thus:

### IN

Route any periodic CV signal (like a CLOCK) into the main input.

### OP-A & OP-B

These are the outputs that the IN gets routed to depending on chance.

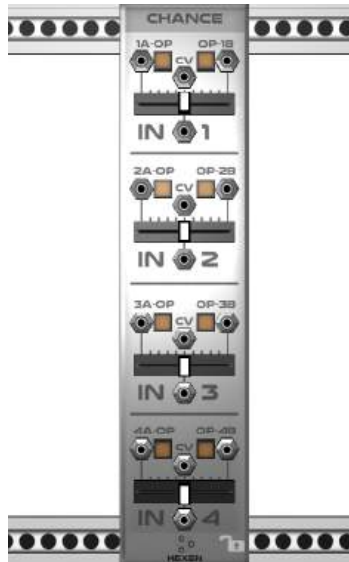
### SLIDER

The slider sets the chance of the output routing:

In the middle (default position) there is a 50/50 chance that the signal will go to either output A or B.

On the left the chance of output A is 100%.

On the right the chance of output B is 100%.



### CV

Chance can also be controlled by an external CV signal. The final chance setting is the sum of the slider position and the input CV signal.

### LEDS

Each output has an associated LED.

The LED is lit when the corresponding output goes high.

The LED remains half lit until the opposite output goes high.

### TIP

You can cascade 1 chance channel into a further 2.

This would give 4 random routing possibilities.

Using another CHANCE module you could even cascade deeper like 1:2:4:8 giving 8 random routing possibilities.

## CLOCK

The clock module gives you 6 high precision phase locked clock generators.

Use the CLOCK module to drive sequencer modules that require a clock input.

### BPM

This allows you to set the beats per minute of the whole module.

Unless you have an EXT CLK connected, in which case it will show the BPM of the external clock.

### EXT CLK

You can feed the module with an external clock. If you do not plug anything into this then the module generates its own master clock.

### SYNCH

When the CV input goes from low to high or the button is pressed:

All clocks will immediately fire and then run at their individual rates.

All other clock modules in your rack will be synched.

Any [sequencer](#) module/s connected to the clock/s will be synched: the sequencers will be reset and start playing their

sequences from the beginning.



### RUN

When the CV input goes from low to high or the LED button is pressed:

The run state will be toggled between all clocks running and all clocks stopped.

### CLOCK ADJUSTERS

Each of the clocks can be set to individual speeds.

The speeds are fractions and multiples of the set BPM.

## LOGIC

A digital logic module.

Performs binary logic operations on any input signals present on the left hand column of jack sockets.

Useful for making complex clock signals from other [CLOCK](#) signals.

### NOT

The module contains two not gates (aka logic inverters).

Signals present on the left hand input jack/s will be inverted and present on the output jack/s.

An input signal above zero level will cause a low output signal.

An input signal below zero level will cause a high output signal.



### MULTI INPUT LOGIC

Above the NOT gates are two multi input logic gates. You can plug signals into any or all the input jacks (1, 2 & 3).

Logic gates will ignore any disconnected inputs.

Each logic output jack operates as follows:

### AND

If all of the connected inputs are above zero level then the AND output will be high.

### OR

If any of the connected inputs are above zero level then the OR output will be high.

### XOR

If one of the connected inputs is above zero level and the rest of the connected inputs are below zero level then the XOR output will be high.



# Sequencers

## SEQ:CHORD

This is an auto arpeggiator sequencer; the notes of a chord are played quickly one after the other instead of all the notes sounding at the same time.

### CLOCK

Patch an output from a [CLOCK](#) module to the sequencers clock input.

### SEED

This CV input sets the random seed number used when in RAND mode with reset enabled.

### GATE

Output gate CV pulse length.

### COLUMNS

This specifies how many left hand columns your sequence will occupy. NOTE: Values greater than eight will wrap, so a value of 10 would repeat this sequence:

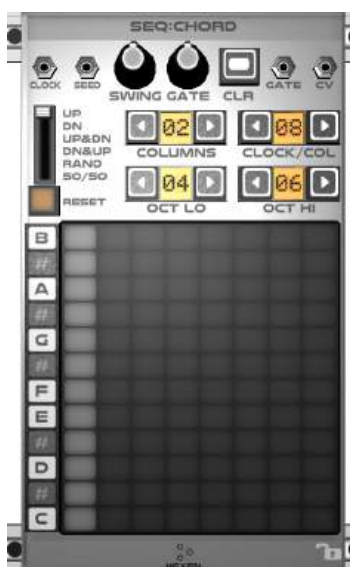
1, 2, 3, 4, 5, 6, 7, 8, 1, 2...

### CLOCK/COL

This specifies how many clock inputs are played by each column until progressing to the next column.

### OCT LO & HI

These controls allow you to set the range of octaves that your sequence will occupy.



### THE PATTERN MATRIX

Simply tap the matrix to add and remove notes. An orange cell places a note, a green cell places a note at +1 octave. Pressing **CLR** will clear the pattern matrix.

### MODE: UP

A column's notes are played in sequence up through all of the specified octaves, when the top note is reached the sequence reverses and plays down to the bottom note, this repeats.

### MODE: DN

The opposite of UP.

### MODE: RAND

The sequence is composed of random notes, chosen from all specified notes in the currently playing column.

### MODE: 50/50

The sequence progresses depending on a coin toss: heads means the next note is the note above, tails the note below. NOTE: Reset has no effect on this mode.

### RESET

Push to change the reset mode:

Unlit: the sequence progression will never reset.

Orange: the sequence progression will be reset when a new column starts.

Green: the sequence progression will be reset when the first column starts.

## SEQ:DRUM

A simple grid based drum sequencer. Based on samples from the Roland TR-808 drum synthesizer.

The sequencer has 4 rows and 16 columns, each row can play a different sample type, chosen using the bottom set of selector controls.

### CLOCK

Patch an output from a [CLOCK](#) module to the sequencers clock input.

### VOLUME KNOBS

The 4 volume knobs allow you to set the global volume of each row.

### SEQ LEN

This specifies how many left hand columns your sequence will occupy. NOTE: Values greater than 16 will wrap.

### THE PATTERN MATRIX

Simply tap the matrix to add and remove drum samples. The cell color dictates the sample volume.



### CLR ALL

Press it to clear the pattern matrix.

### RND VOL

Randomizes the volume of each pattern sample.

### RND PAT

Randomizes the pattern placement.

### RND TYP

Randomizes the types of instruments used.

### RND IND

Randomizes the subtypes of instruments used.

### RND ALL

Randomizes everything.

### SHFT LEFT

This will shift the entire pattern one step to the left. The pattern gets wrapped from one end to the other as you shift it.

### SHFT RIGHT

This will shift the entire pattern one step to the right. The pattern gets wrapped from one end to the other as you shift it.

### CV CONTROL

Each of the four rows can be CV controlled:

The left column of jacks allows you to control the sub sample type.

The right column of jacks allows you to control the volume.

## SEQ:FISH

This random sequencer uses the movement of fish to derive gate and note CV.

Each fish represents a certain musical note.

To add a fish to the tank simply select the octave you want and press a keyboard note.

When a fish crosses the line of bubbles the CV signal changes to represent the note of the fish and the gate goes momentarily high.

### GATE

You can set the output gate length using this knob.

### FEED

If you push the FEED button, or the FEED jack signal goes from low to high the one food pellet is dropped into the tank. This causes one fish to break out of its sequence and feed on the pellet.

### SPD

This slider sets the average speed of the fish in the tank.



### RND

This slider sets how randomly the fish will swim.

Setting the slider to zero will give you a sequence that repeats with little variation.

### AIR

Set the horizontal position of the air bubble line.

### UNDO

Press undo to remove the last fish that was added to the tank.

### CLR

Press clr to remove all fish from the tank.

## USAGE TIP

A great way to make an ambient sequence that slowly evolves:

1. Set SPD to a lowish level.
2. Set RND to zero.
3. Place AIR in the middle.
4. Add a number of fish to represent some chord in various octaves.
5. Patch a very slow [CLOCK](#) signal into the FEED jack.

This will give you a sequence that repeats with a pattern until the clock causes a feed and then one fish will change its position in the sequence.

## SEQ:GRID

A very simple monophonic grid based sequencer.

### CLOCK

As with any other sequencer: Patch an output from a [CLOCK](#) module to the sequencers clock input.

### GATE

Output gate CV pulse length.

### STEPS

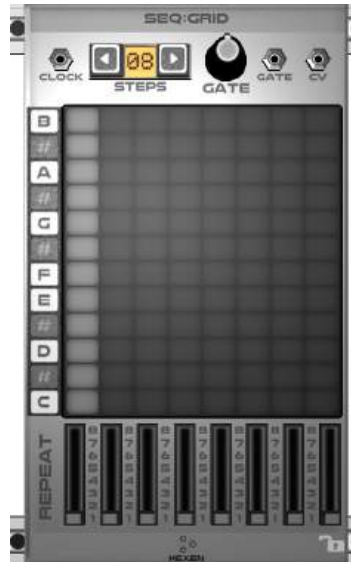
This specifies how many clock counts your sequence will occupy.

### THE PATTERN MATRIX

Simply tap the matrix to add and remove notes. Each of the five colors represents the octave for the note. To remove a note keep tapping it until the cell goes dark.

### REPEAT

The repeat switches simply specify how many times each column repeats until progressing to the next column.



## SEQ:LOTTO

LOTTO is an intuitive and fun electro mechanical random sequencer.

Consisting of balls in a rotating wheel.

The wheel has seven buckets.

When a ball enters a bucket the GATE output goes high and the CV voltage is set to represent the note of the ball.

To add a ball to the wheel simply press a note on the bottom keyboard.

The maximum number of balls allowed in the wheel is 32.

### GATE

This knob allows you to set the output gate length.

### RPM

This slider allows you to set the revs per minute of the wheel. You can make the wheel spin clockwise or anticlockwise.

### GRAV

This slider sets the gravity exerted on the balls.

### BNCE

This slider sets how bouncy the balls are.



### OCTAVE

When adding balls using the bottom keyboard, the balls octave is set here.

### UNDO

Pressing this button will remove the last ball that you added to the wheel.

### CLR

Pressing this button will remove all balls from the wheel.

## SEQ:RAND

A versatile random sequencer that is very similar to the CHORD sequencer, but with the ability of random timing.

### CLOCK

Patch an output from a [CLOCK](#) module to the sequencers clock input.

### COLUMNS

This specifies how many left hand columns your sequence will occupy. NOTE: Values greater than eight will wrap, so a value of 10 would play columns in this sequence repeated:

1, 2, 3, 4, 5, 6, 7, 8, 1, 2

### CLOCK/COL

This specifies how many clock inputs are played by each column until progressing to the next column.

### OCT LO & HI

These controls allow you to set the range of octaves that your sequence will occupy.

### CLR

Press it to clear the pattern matrix.



### GATE MODE

In FIXED mode the gate pulse width is directly specified by the gate knob.

In RAND mode the gate pulse width will be a random value around the value specified by the knob.

### CHAOS

This knob allows you to the randomness of the sequence in time. With CHAOS set to zero (fully anticlockwise) the sequence will be played back with no randomness and the notes will happen exactly in time with the input clock signal.

With the CHAOS set to full the playback will be random in time with the shortest interval in notes being just a few more samples than the notes gate length and the maximum interval being twice the input clock period.

The average number of notes played in time (if you were to count the number of notes that happen in 1 minute) is similar regardless of the CHAOS level.

### THE PATTERN MATRIX

Simply tap the matrix to add and remove drum samples. The cell color specifies the chance of that note being played:

- Red: 1 chance.
- Green: 2 chances.
- Blue: 3 chances.

## SEQ:ROLL

The roll sequencer is the most powerful sequencer in Hexen.

It allows you to create a sequence of any length.

You can enter notes using a graphical matrix.

It also allows you to record sequences captured from other modules like [KEYBOARD](#), [MIDI](#), etc.

### CLK (INPUT)

Patch an output from a [CLOCK](#) module to the sequencers clock input.

### GATE (INPUT)

Patch a [KEYBOARD](#) gate signal in for recording.

### CV (INPUT)

Patch a [KEYBOARD](#) note CV signal in for recording.

### CLR

Allows you to clear all sequence data, with a user confirmation prompt.

### GATE (OUTPUT)

The sequencer's output gate signal, with a knob to adjust gate length.

### CV (OUTPUT)

The sequencers CV note signal output.

### VAL (OUTPUT)

This is a general CV value out.



### THE PATTERN MATRIX

Simply tap the matrix to add and remove notes. Each of the five colors represents the octave for the note. To remove a note, keep tapping it until the cell goes dark.

### JOIN

These 8 LED push buttons allow you to set the gate type of each note. When lit the gate stays on and the note gets joined to the next.

### VAL

The knob sets the amplitude of all the switches.

Use the VAL switches to program expressions into

your sequence. For example you might use the VAL output to modulate a VCF module's filter frequency.

### MODE

Push to toggle the mode:

#### MODE: RALL

“Record All”, The cursor is advanced through all pages of the sequence. Gate and CV inputs will be recorded live into the sequence.

#### MODE: RPAG

“Record Page”, The cursor is looped over the current page of the sequence. Gate and CV inputs will be recorded live into the sequence.

#### MODE: PLAY

The cursor is advanced through all pages of the sequence. The user is not able to change any sequence data.

### PAGE

Selects the current page of the sequence.

### STEP

Selects the current step of the sequence.

### PAGE: INS

Inserts an empty page into the current page position, the current page is pushed forward by one.

**PAGE: DEL**

Deletes the page at the current page position, pages in front get pushed backward by one.

**PAGE: CPY**

Copies the current page into temporary memory, for pasting later.

**PAGE: PST**

Pastes a copied page into the current page position, the current page is pushed forward by one.

**STEP: INS**

Inserts an empty step into the sequence, if in RALL mode then all steps to the right (in all pages) will be shifted, if in RPAG mode then only steps on the current page will be shifted.

**COL: DEL**

Deletes the currently selected step from the sequence, if in RALL mode then all steps to the right (in all pages) will be shifted, if in RPAG mode then only steps on the current page will be shifted.



## SEQ:STEP

The step sequencer allows you to create a sequence of any length.

You enter notes (or rests) one at a time in a stepwise fashion.

### CLOCK

Patch an output from a [CLOCK](#) module to the sequencers clock input.

### MODE: EDIT

You need to be in EDIT mode to actually create your sequence.

Once in edit mode you can simply play your sequence using the three octave keyboard. Set the base octave of the keyboard using the OCTAVE selector.

To add a note simply press a keyboard key. To add a rest press the REST button.

You can move around your sequence using the step selector. If you move back into your sequence and press a note (or REST) then a note (or REST) will be inserted after the selected note (not replaced).



### To Replace a Bad Note

1. Step backward to select the bad note.
2. Press the correct note on keyboard
3. Go one step back.
4. Press DEL.

### To Insert a note

1. Move to the note step that you wish to insert after.
2. Press the keyboard note (or REST) that you wish to insert.

### CLR

Clear all notes from the sequence.

### DEL

Deletes the currently selected note from the sequence.

### JOIN

Pressing join will cause the currently selected note to join the next, this means that the selected note and the next note will share the same gate: the gate will be high for the duration of all consecutively joined notes

### REST

Pressing REST will add a rest into the sequence: No gate signal will be generated while a rest is being played.

### MODE: FWD

Standard playback mode: Your sequence will be played normally: advancing one step per input clock rising edge.

### MODE: RND

Random playback mode: Your sequence will be played randomly: one step chosen randomly from all available steps per input clock rising edge.

## SEQ:TECH

This is a techno sequencer, inspired by the Roland 100m 185 analogue sequencer, as is the Intellijel Metropolis sequencer.

### CLKIN

Patch an output from a [CLOCK](#) module to the sequencers clock input.

When the clock signal goes from low to high the sequencer will advance one step.

### STEPS

This specifies how many clock counts your sequence will play before resetting to column 1 and starting again.

NOTE: Steps are specified in input clock counts, NOT columns.

### SHIFT

Pressing a shift button will shift the whole sequence 1 column to the left or right.

### 8 Way Switches

This top row of 8 way switches specify how many input clock cycles each column will repeat for.

### 4 Way Switches

The second row of 4 way switches specify the

mode that each column will play in:

**Mode 1:** No notes will be played by this column.

**Mode 2:** One note will be played, regardless of repeat count.

**Mode 3:** Multiple notes will be played depending on repeat count.



**Mode 4:** Join, repeated notes in a column will be played as one long note. All sharing the same long output gate on signal.

### The Sliders

Drag these up and down to set each column's note, you will be aided by a small popup display showing the currently set note value.

### The LED buttons

When a button is lit it indicates that the corresponding column will be manipulated by the slide control.

### GATE

Specifies output gate length.

### SLIDE

Sets the amount of time it takes to slide to any note whose slide LED button is on.

### ROOT

The root control enables you to transpose the whole sequence up to +11 semitones.

The ROOT CV input allows you to transpose the sequence using any input signal.

### SCALE

Sequence notes will be quantized to occupy notes of the displayed scale in the displayed root.

### MODE: FWD

The sequence plays forward until the total step count is reached then it starts again.

### MODE: PONG

The sequence plays forward then backward. NOTE: the sequence will only play backwards if the

specified number of steps  
is greater than the total  
steps in all columns.

**MODE: RAND**

Sequence is played  
randomly.

**MODE: 50:50**

The sequence goes up or  
down one column per  
step randomly.

## SEQ:TWEAK

This powerful sequencer module gives you six channels of endless CV or audio gain control.

It enables you to create patches that evolve in a controlled manner over many minutes or even hours.

It kind of turns Hexen into a lightweight DAW.

### CLK

Patch an output from a [CLOCK](#) module to the sequencers clock input.

When the clock signal goes from low to high the sequencer will advance one step, (unless in EDT mode).

**Note1:** You can feed this module with relatively slow clocks and the output will not be stepped. The output is interpolated perfectly on a per sample basis. Put another way: The signal outputs will always be smooth ramps even if they look stepped in the data screen.

**Note2:** Use faster clocks to record faster movement like live [VCF](#) filter tweaking etc.



### Bottom Jacks 1 to 6

Each channel can operate in two modes:

#### [1] Audio Mode

If a jack is fed with an audio signal that channel will operate in audio mode using internal VCA/s: The output signal will be a copy of the input signal with a gain (0 to 1) applied to it.

#### [2] CV Mode

If a jack is left unplugged, that channel will operate in CV mode: The output signal will be a bipolar (+ and -) CV signal.

You could for example auto control the cutoff frequency of a [VCF](#) using one CV channel.

### SLIDERS 1 to 6

The sliders can be moved

by the user in EDT or REC mode.

In EDT mode a slider can only be moved if there is active channel data at the selected step.

Double click a slider to default it to zero CV.

### STEP

The step selector allows you to navigate to any step in the sequence.

Single arrow buttons navigate one step at a time. You can hold them to move quicker.

Double arrow buttons allow you to move to the nearest step that contains actual data, handy when in MODE:EDT.

### MODE

A small but very important button. Press it to select one of the three modes of operation:

#### MODE:EDT

This mode allows you to create or change channel data.

Use the step selector to move to the step you want to change. Then press a square channel button until it turns green. Then move the

channel slider to the position you want.

### **MODE:REC**

In this mode the sequencer plays back all channel data.

It also records any slider movements made by the user and replaces any existing data with the user's new movement data.

It's possible to mix down a whole 6 channel track in one take.

If you want to tweak it after recording then drop into MODE:EDT.

### **MODE:PLY**

In this mode the sequencer plays back all channel data.

### **ZOOM**

Sets the zoom level of the channel data screen.

### **LOOP**

Only relevant in MODE:PLY.

Press it to enable or disable looping.

With looping enabled the sequence data will jump back to step 0 after the last recorded step (on any channel) is played.

### **RST**

Press it to jump to step 0.

### **CLR**

Allows you to clear all data from any channel (or all).

Press it and you will be shown popup dialogs to help you understand more.

# Utilities

## ATT

This is a 2 channel attenuverter.

An attenuverter allows you to scale and offset any input signal.

### GAIN

The gain knob sets a value that your input signal gets multiplied by.

The gain knob has a range of -2 to +2.

Using negative values allows you to invert the applied input signal.

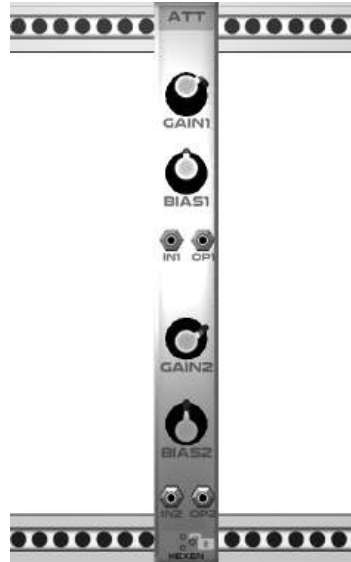
Double tap the gain knob to default it to a value of 1.

### BIAS

The bias knob sets a value that gets added to your input signal.

The bias knob has a range -1 to +1.

Double tap the bias knob to default it to a value of 0.



## ENV

An envelope generator.

Applies an ADSR amplitude envelope to the input signal.

It allows you to “shape” sound by applying a volume envelope to it.

When the gate input signal goes high the envelope plays: ATT, DEC, SUS.

While the gate input stays high the envelope plays SUS.

When the gate input goes low the envelope plays DEC.

### ATT

This sets the attack time of the envelope, for hard plucked sounds set it to zero, for softer sounds turn it up.

The attack envelope starts as soon as the input gate signal goes high.

### DEC

Sets the decay time, this is the time it takes to go from the end of the attack envelope to the sustain level. note: the decay will start even while the input gate signal is high. The decay starts as soon as

the attack envelope has finished.

### SUS

This specifies the sustain level of the envelope.

### REL

This sets the time it takes the envelope to release to zero once the input gate signal goes low.

### CV input jacks

CV signal applied to the jacks under the knobs will be added to the knobs current value.



### EXAMPLE USE

To build a simple flute like sound:

Add 3 modules:

1. [KEYBOARD 2](#)
2. [VCO](#)
3. ENV.

Patch the [KEYBOARD 2](#) CV output into the [VCO](#) FM input.

Patch the [KEYBOARD 2](#) GATE output into the ENV GATE.

Patch the [VCO](#) SIN output into the ENV INP.

Patch the ENV OUT into your master [OUT](#) module so you can hear it.

Set the ATT knob to about the 9 o'clock position.

Set DEC knob to zero

Set SUS knob full.

Set REL knob to about the 9 o'clock position.

Now try playing your new sound by pressing keys on [KEYBOARD 2](#)

## FLW

An envelope follower. This module listens to the incoming input signal and produces an output envelope that tracks the amplitude of the incoming signal.

### INP

Route any signal source into the INP jack.

### GAIN

Sets the overall amplitude of the resulting output envelope.

### RISE

Sets how fast the envelope follows the amplitude of the incoming signal as its amplitude is rising.

### FALL

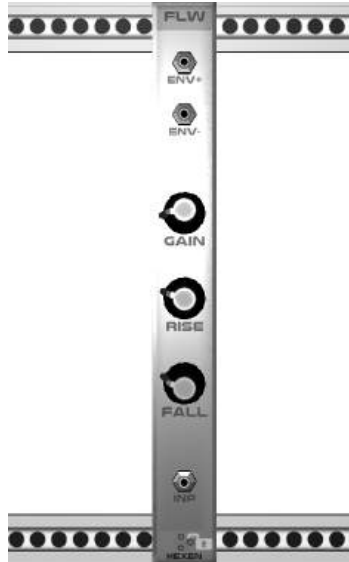
Sets how fast the envelope follows the amplitude of the incoming signal as its amplitude is falling.

### ENV+

Outputs a positive version of the follower envelope.

### ENV-

Outputs a negative version of the follower envelope.





## HOLD

A 2 channel sample and hold module

### IN 1&2

Connect the inputs to any time varying signals.

### OP 1&2

The outputs are latched versions of the inputs.

### ONE SHOT

If you press the ONE SHOT button then you update the latched signals, that is: the module samples the inputs at that instant and the values are then held on the outputs. Hence the term “sample and hold”.

### CLOCKIN

If you connect a signal into the clock input then a sample hold will happen every time the incoming signal goes high. I.e. every time the input signal goes from below zero to above zero.

### RATE COARSE

The module also contains an internal clock generator that triggers new sample holds. This internal clock becomes active as soon as any rate knob is turned above zero.

## RATE FINE

Use it along with RATE COARSE to dial in the exact rate you want.



## MUX

A 3 to 4 switched multiplexer module.

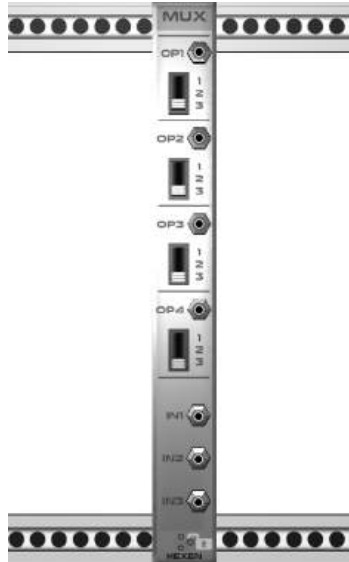
### **BOTTOM JACKS IN 1,2,3**

Input any 3 signals into these inputs. You may leave some unplugged that will simply set that input to zero level.

### **TOP JACKS OUT 1,2,3,4**

Copies of the input signals appear on these outputs.

The input signal that gets copied to each output is specified by the switch position.



## LIM

A 2 channel limiter module.

The output signals are limited versions of the input signals.

The limiter does not simply clip the signals, it applies a soft knee so that minimal spectral damage is done to the signals (minimal distortion).

### LIMIT

This knob sets the amplitude level that you wish to limit the signal to.



## QUANT

A 2 channel Note quantizer. This module quantizes input CV levels such that the output signals lie exactly on note values.

### NOTE LED BUTTONS

Simply tap the notes that you want to quantize to until they turn green.

### HI OCTAVE

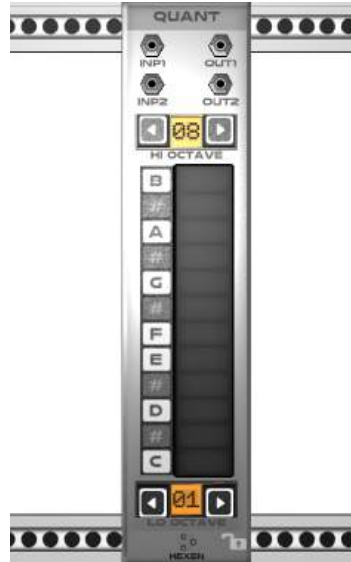
Specifies the highest octave of the quantized notes.

### LO OCTAVE

Specifies the lowest octave of the quantized notes.

### TIP:

Patch the CV-X from a [TOUCH](#) module into this quantizer and you will tame the wild touchpad allowing you to play melodies in perfect pitch.



# SOL

A solfeggio frequency quantizer module.

## How it Works

Any CV signal that you input will be quantized to lie on one of the frequencies of the solfeggio scale that you select.

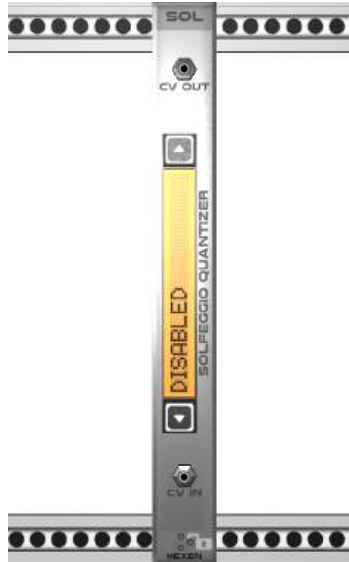
## What is a Solfeggio Scale?

*“The ancient Solfeggio scale, known as “Just Intonation”, is best known for its use in the soothing Gregorian chants, but its history can be traced back to Biblical times”*

[Ancient Solfeggio Scale - Explained In Detail](#)

The above quote refers to the “Earthly” scale. But you have 9 scales types to experiment with.

You can see frequency details for the 9 different scales below in the table diagram on this page.



1. Angelic Scale
2. Second Scale
3. Third Scale
4. Fourth Scale
5. Universal Scale
6. Sixth Scale
7. Earthly Scale
8. Divine Scale
9. Natural Scale (432 Hz)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Karmic Freqs	111	123	135	147	159	162	174	186	198
Remembering	222	234	246	258	261	273	285	297	219
Opening	333	345	357	369	372	384	396	318	321
Change	444	456	468	471	483	495	417	429	432
DNA related	555	567	579	582	594	516	528	531	543
Connection	666	678	681	693	615	627	639	642	654
Awareness	777	789	792	714	726	738	741	753	765
Spiritual Journey	888	891	813	825	837	849	852	864	876
Unity	999	912	924	936	948	951	963	975	987

## SLW

A 2 Channel Signal slew limiter.

The output signal follows the input signal.

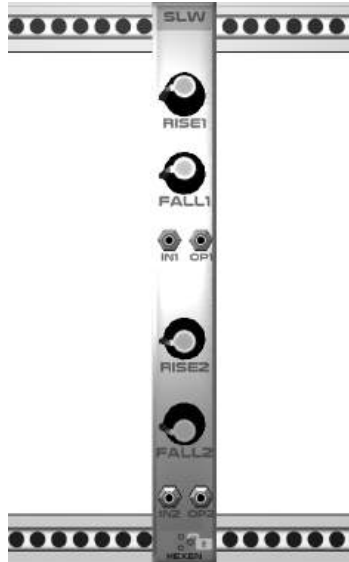
### RISE

Sets how quickly the output signal follows the input signal when it is rising.

### FALL

Sets how quickly the output signal follows the input signal when it is falling.

NOTE: If both rise and fall knobs are set to zero then the output signals will be exact copies of the input signals.



## SPL

Signal splitter.

This module produces 4 copies of the input signal.

Use the knobs to set the gain of each output signal copy.



## TRANS

A four channel CV transposer.

Each of the four channels, 1 to 4, works like so:

### CVIN

An input CV signal is plugged into the CVIN socket.

### CVOP

The CVOP output socket will be a transposed version of the input CV signal.

### SEMIS

The signal is transposed up or down by some number of semitones.

You may plug a control signal into the SEMIS socket, this allows you to automate the semitone transposition.

The total number of semitones transposed is the sum of the user set value on the SEMIS screen and the SEMIS CV value.

TIP1: To transpose by one octave set SEMIS to 12.





## VCA

A Voltage Controlled Amplifier.

Use CV inputs to apply variable amplification to the audio input signal.

### EXP +/-

These outputs are exponentially mapped versions of the linear outputs.

### LIN +/-

The linear output signals of the VCA.

### LEAK

This sets how much input signal will leak through to the outputs regardless of what the input CV signals may be doing.

### CV1&2

These knobs set how much the input CV signals applied to the jacks will drive the amplifier.

### INPUT

The input knob applies a user set gain to the input signal before the VCA operates on it.

Apply any input signal to the input jack that you want to be modified by the VCA.



## VCF

An advanced voltage controlled filter.

### TYPE

Select the filter algorithm type you want to use.

### DSP

This shows approximately how many nanoseconds it takes your CPU to process one sample using the selected filter algorithm type.

### FREQ

Sets the frequency cutoff threshold used by the filter.

### RESO

Sets the filter resonance.

### CV

Both FREQ and RESO parameters can be controlled by external CV signals.

Adjusting the small CV knobs sets how much the external CV signal will control the parameters.



# Effects

## **FX:BIT**

A 2 channel bit crusher effect.

The output jacks produce signals that are down sampled versions of the input signals.

### **FREQ**

Sets the resampling frequency.

This control has a CV input jack for automation if you want.

### **BITS**

Sets the resampling bit depth.

This control has a CV input jack for automation if you want.



## FX:DIST

A multi mode distortion effect module.

### TYPE

Select the distortion algorithm type you want to use.

### DSP

This shows approximately how many nanoseconds it takes your CPU to process one sample using the selected distortion algorithm type.

### MIX

Set the dry/wet ratio of your output signal.

### AMP

Sets the gain of the module's internal pre amplifier. It applies amplification to the input signal before applying the distortion.

### LEV

Sets the distortion effects level threshold.

### CV

All 3 controls can be modulated using external CV signals. Set the gain of the CV signals using the small CV knobs.



## FX:DLY1

A beat timed digital delay line.

### FBACK

Specifies the gain of the signal that gets fed back into the delay line.

Sets how much echo is applied to the delay.

### DRY/WET

How much delay effect gets applied to the input signal before it appears at the output.

### BPM

Set this to be the same or some multiple of your melodies clock BPM.

### PERCENT

If set to 100% then the delay period will match the specified BPM.

If set to 75% then you will get a delay period that plays  $\frac{3}{4}$  time of the specified BPM.



## FX:DLY2

An open path digital delay line.

### DRY/WET

How much delay effect gets applied to the input signal before it appears at the output.

### DELAY

Sets the delay line length.

### FBACK

Specifies the gain of the signal that gets fed back into the delay line.

Sets how much echo is applied to the delay.

### PATH

This delay line allows you to inject any signal processing you want into the delay line's feedback path, great for experimenting with making your own custom sounding delay effects.

TIP:

Try putting a [VCF2](#) in the PATH.



## FX:GRAIN

A granular delay effect.

### INP

The audio input signal enters a cyclic sample buffer. Think of the cyclic buffer being like a tape loop.

Grains are small sample packets with individual attack/decay envelopes.

Each grain is a random selection from the whole tape loop.

### OUT

Many grains are mixed together and mixed with the input signal to appear on the output jack.

### MIX

Sets how dry or wet the output signal is. Can be CV controlled.

### LEN

Sets the length of the cyclic sample buffer. Can be CV controlled (only responds to CV changes at a rate of 60Hz).

### FRQ

Sets the individual grains frequency, aka playback speed, like a timestretch effect. Can be CV controlled. Double tap to reset frequency.



### NUM

Sets how many grains may play in unison. AKA the density of the effect.

### SIZE

Sets the grain size. Larger grains take longer to play.

### RND FRQ

Sets the randomness of each grain's frequency, at zero level each grain has the same playback frequency.

### RND AMP

Sets the randomness of each grain's amplitude, at zero level each grain has the same amplitude.

## FX:PHASE

A phaser module.

### MIX

This sets the mix level.

Fully anticlockwise causes the output to be 100% dry input signal.

Fully clockwise causes the output to be 100% the phase shifted version of the input signal.

NOTE1: If you want to hear maximum effect at the output then set this to 50%. This causes the dry signal and the wet signal to mix fully for maximum hearing effect at the output.

NOTE2: When fully clockwise you can use the pure phase shifted output signal in some other module such that it gets mixed somehow with the original signal (or some derivation of the original signal).

### RATE

Sets the frequency of the phase modulation, ranging from 0.025Hz to 10Hz.

### DEPTH

Sets the amplitude of the phase modulation.

### CENTER

Sets the center point of the phase modulation.



### STAGES

Sets how many bandpass filter stage pairs are cascaded together to give the phase effect. Higher settings will use slightly more CPU, but they do sound nicer.



## FX:RVB1

A reverberation effect module with a simple DSP algorithm.

### MIX

Set the DRY:WET mix ratio. Turn it up to have more reverb mixed into the output jack.

### SIZE

Sets the average time it takes for a reverb echo to come back.

Low values approximate smaller spaces like bathrooms.

High values approximate larger spaces like halls.

### RVB

Sets how reflective (echoey) the room's walls are.

### RESO

Sets the resonance of the room walls.



## FX:RVB2

A reverberation effect module with an advanced DSP algorithm. It sounds much nicer than [FX:RVB1](#) but it has a higher DSP cost.

### MIX

Set the DRY:WET mix ratio. Turn it up to have more reverb mixed into the output jack.

### INP

Sets how much of the input jacks signal gets routed into the effect.

NOTE: This is different to mix, If you turn it to zero the reverb effect is still running: the reverb tail will still sound and decay naturally.

### SIZE

Sets the average time it takes for a reverb echo to come back.

Low values approximate smaller spaces like bathrooms.

High values approximate larger spaces like halls.

### RVB

Sets how reflective (echoey) the room's walls are.



### CV Inputs

All of the knobs have associated CV input jacks. This allows you to modulate all parameters using any other CV signals.

## FX:VINYL

This module adds a vinyl record effect to incoming audio signals.

### GAIN

This sets the overall effect gain.

### RPM

Sets the record speed the knob ranges from 33 RPM to 78 RPM.

Doubleclick the RPM knob to set the default speed of 45 RPM.

### DAMAGE

Sets the number of scratches on the record surface.

### SCRATCH

Sets the average volume of the scratches.

### NOISE

Sets the volume of the turntables preamp noise.



Only the scratch effect is added to the incoming signals.

If you want to approximate how a blunt stylus and preamp changes the audio quality then you might consider adding a low pass filter ([VCF2](#) module) before each input signal. Set the filter to allow through all but the highest frequencies and turn the resonance way down.

### ABOUT THE EFFECT

This effect is not simply a looped sample of a scratched record.

The module has a scratch management system that models physical scratches and dust as found on a real record.

In this model, scratches are assumed to run generally radially and have variable cut depth with the shallowest depths at the scratches ends and the deepest cut depth around the middle of the scratch.

The scratch sequence generated is complex and never repeating.

### NOTE:

No filtering is applied to the incoming signals.

# Mixers

## ADD

A four channel additive mixer.

All four channels operate identically:

The IN signals are passed directly through to the OP jacks.

The ADD jack gets added (mixed) to the output jack depending on the knob position.

Put another way:

The ADD signal is added to the input signal depending on the knob position.



## FADE

A 2 channel crossfader module.

Drag the slider to fade between the 1 and 2 input channels:

### **With the slider fully down:**

The top L/R output signals are copies of only the L2/R2 input signals.

### **With the slider fully up:**

The top L/R output signals are copies of only the L1/R1 input signals.

With the slider half way:

The top L/R output signals are a mix of both the L1/R1 + L2/R2 input signals.

Note: The fader is amplitude balanced correctly. The crossfade is non linear such that constant loudness is maintained.



## LABEL

This module helps you organize your rack.

### TXT

You can apply any label text that you want by pressing the TXT button.

### IN & OP

These are simply pass through jacks. The signal present on IN is internally wired directly to OP.

You may want to use these jacks to route audio signals through before they go to a mixer.

Think of it like a big label that you can attach to a patch cable.



## MIX:4

A simple 4 to 1 channel mixer.

Each of the four input stages work as follows:

Each input signal gets multiplied by the stage gain.

The stage gain is the CV input level summed with the knob position.

The stage gain is clamped between the values of 0 and 1.

All stages are then summed to the OUT jack to yield the final mix output.



## MIX:HEX

A very capable 6 channel stereo mixer module with 2 FX sends and a sidechain compressor.

We will explore the module from the bottom to the top:

### BOTTOM JACKS

6 channels of audio inputs are along the bottom.

Above these are 6 channels of CV inputs.

Each channels mix gain is calculated like so:

CV input is added to the slider position to give a gain that is limited between values 0 ... 1.

### LEVEL SLIDERS

Allow you to set the mix level of each channel.

### MU

Single click an unlit button to mute the channel.

Single click a lit button to return the channel to normal.

Double click a button (lit or unlit) to solo the channel.

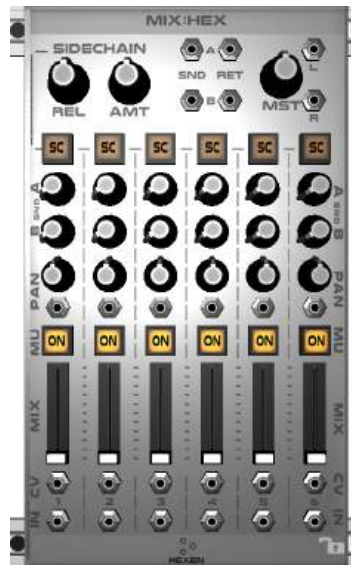
### PAN

Sets the stereo position of

each channel. These pans can all be CV controlled.

### SND A & B

These knobs set what fractions of each channel signal gets sent through the external effects busses.



### SND & RET JACKS

The mixer has two mono effects busses.

Say you want a reverb module as bus A effect:

- Connect SNDA jack to a RVB input.
- Connect RETA jack to that reverb's output.

### MST

The master gain knob specifies the amplitude of the resulting stereo mix

that appears on output jacks L/R.

### SIDECHAIN

Push SC button/s to select the channel/s you want to drive the sidechain.

### REL

Sets the sidechain compressor's release envelope time.

### AMT

Sets how much compression the sidechain will apply to the overall mix.

### WHAT IS SIDECHAIN COMPRESSION?

Say you have a busy mix of sounds and you want one sound to punch through all others (maybe a [kick drum](#)) then you make that channel have its SC button lit.

All channels without SC lit will duck out of the way to make room for channels with SC lit.

It's an easy way to dial punch into a mix.



# Tutorials

## Start Here

This is the simplest of patches, a single [VCO](#) module connected to the [OUT](#) module.

In this first tutorial we will describe the exact steps to complete it.

The tutorials that come after this will assume you have read this tutorial.

### Step 1

Open the main menu and press “Clear Rack” to clear the rack.

### Step 2

Now add a single VCO module:

- Open the main menu and press “Add Module”.
- Press “Signal Sources”.
- Press “VCO”
- Press the small X exit button to exit the menu.

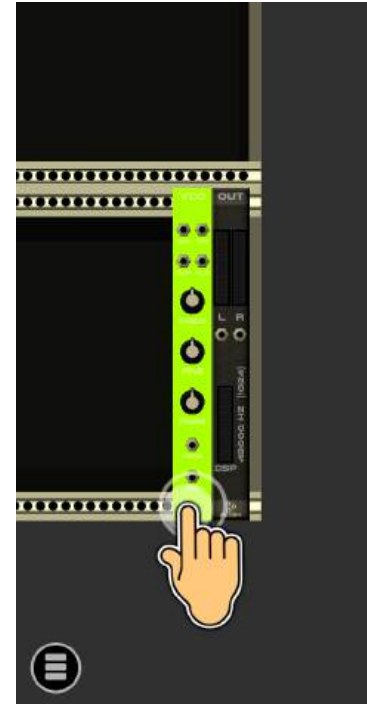
You should now be presented with your newly added VCO module:



### Step 3

Now we will move the new VCO module so that it is next to the existing OUT module:

- Use the zoom slider to zoom out so you can see both the VCO and the OUT module on your screen.
- Now tap and hold the VCO module and drag it close to or next to the OUT module.
- While dragging you can see valid positions of the module when it is lit green like so:



Note: you don't need to move modules next to each other to connect them together. We are just doing it to practice moving a module in this first tutorial.

#### Step 4

Now zoom into the VCO module:

- Double tap anywhere on the body of the VCO module.
- You should be presented with the VCO full screen like so:



#### Step 5

Now we will patch the VCO modules SIN output jack to the OUT modules L input jack:

- Tap and hold the SIN output jack.
- A new plug will appear near your finger.
- Drag the plug to the L input jack until it turns green:



Now lift your finger to connect the cable:



Congratulations, you just built your first patch!

In this super simple patch we have routed the SIN audio output signal of a VCO module to play on the master OUT modules left channel.

A SIN wave audio signal flows down the patch cable and into the OUT module.

You should now hear a sine wave tone playing through your device's left speaker.

#### Extra Steps

Try changing the

frequency of the tone by dragging up or down on the FREQ knob.

Try dragging the cable from the SIN output to hear the other output waveform types that your VCO can generate: TRI, RMP & PLS.

# A Simple Playable Instrument

In this tutorial we will build a touchpad playable monophonic synth.

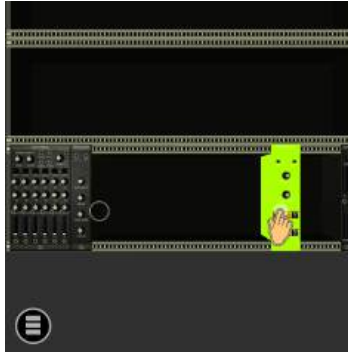
Clear the rack using the menu option.

Let's get started building the output mixer stage first...

[1] Add these modules to your empty rack: MIX:HEX, FX:RVB, FX:DLY1:



[2] Zoom out and drag these three modules to the right like so:



[3] You should now have all modules on the right:



[4] Patch your mixer into your master out:



[5] Patch the reverb into the mixers effect bus A:



[6] Patch the delay into effect bus B.



[7] Turn channel 1 volume up to max.



**[8]** Add modules: TOUCH, QUANT, SLW, ENV, VCO, VCF2:



**[9]** Patch VCF2 output into mixer channel 1:



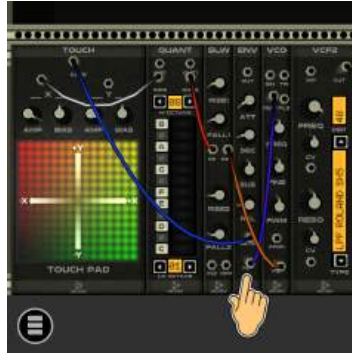
**[10]** Patch the TOUCH X axis through QUANT & SLW and into the VCO CV input:



**[11]** Patch the TOUCH gate output into the ENV gate input:



**[12]** Patch VCO RMP out into the ENV input:



**[13]** Patch ENV output into VCF2 input:



**[14]** Select some notes on the quantizer:



**[15]** Patch the TOUCH Y output into the VCF2 FREQ CV input:



**[16]** Turn up the RISE and FALL knobs a little on the SLW module:



[17] Turn up the RESO a little on VCF2:



[18] Now try playing your new instrument by dragging your finger around on the touchpad:



[18] Try turning up your A&B effect sends for channel 1 in your mixer:



### Extra Steps

Try tweaking everything and seeing what it does.

Try adding a LFO module and have its SIN output control the PAN input on mixer channel 1.

Try swapping out the TOUCH module for some sequencer module like [LOTTO](#).

Try anything you can imagine...

Enjoy! :)