Ornament & Crime
Polymorphic CV Generator

The Workshop

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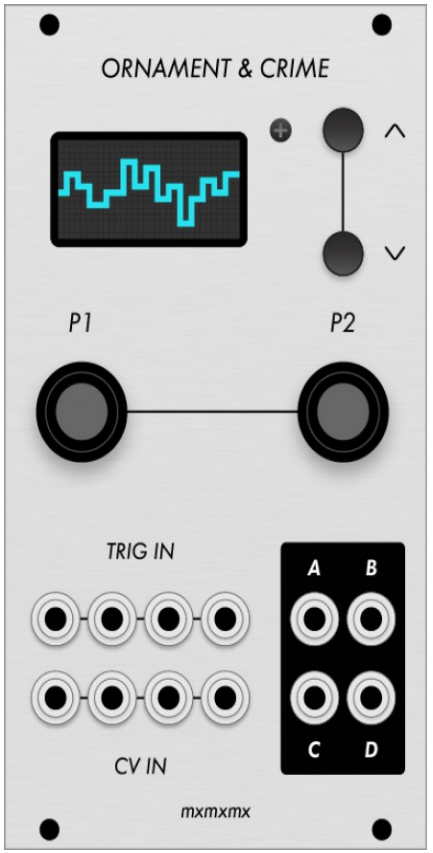
O&C – The Workshop

* Introduction
* Brief History and Background
* Hardware Design, DIY kits, etc.
* Open Source Design & Files
* O&C Modes (Apps)
* Questions
* Hand's On Workshop
* Next Meeting



http://ornament-and-cri.me

Halcyon Modular

* Justin Patrizi – many years of audio design and production. Currently teaching at PNCA.

* Tom Moxon – many years of engineering experience, designing integrated circuits and electronics for companies like : Cray Research, Adobe Systems, Hewlett Packard, Silicon Graphics, Hyundai, Rohm, Emu Systems (Emulator/Drumulator)

HALCYON

Halcyon Modular

* Eurorack Modular Synthesizers
* Local - Portland Based
* Developing new, pure Analog and Mixed Signal Designs
* Miasma – Dual CEM3340 VCO

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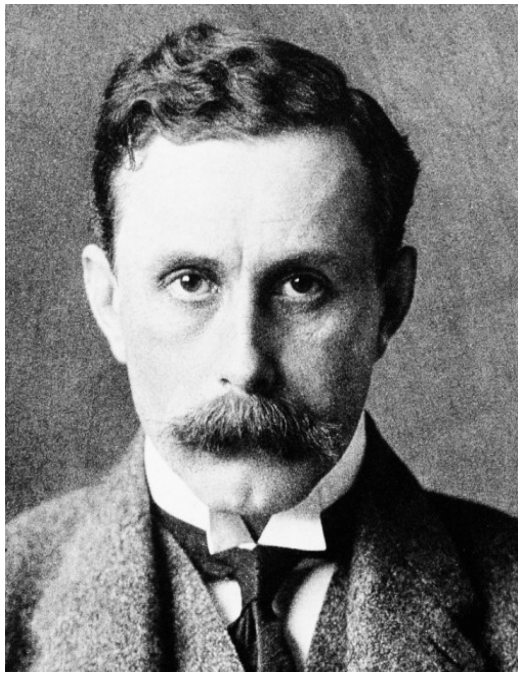
O & C History

* Ornament and Crime is an essay and lecture by modernist architect Adolf Loos that criticizes over ornamentation in useful objects -

  “The evolution of culture marches with the elimination of ornament from useful objects"

* O & C Modules tend to have a “plain” front panel, the usefulness is on the inside...



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Who did O&C (Hardware)?

* Max Stadler (mxmxmx) primary hardware designer
* (JakPlugg) micro-Ornament and Crime layout
* Many other custom versions (commercial and non)

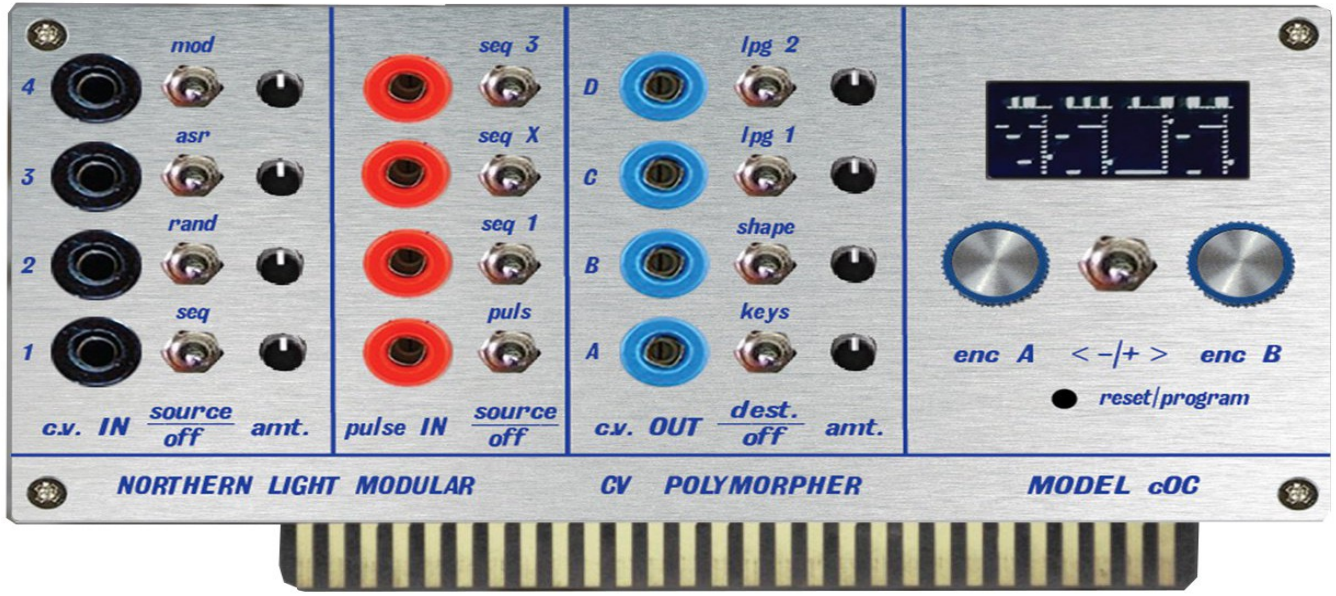
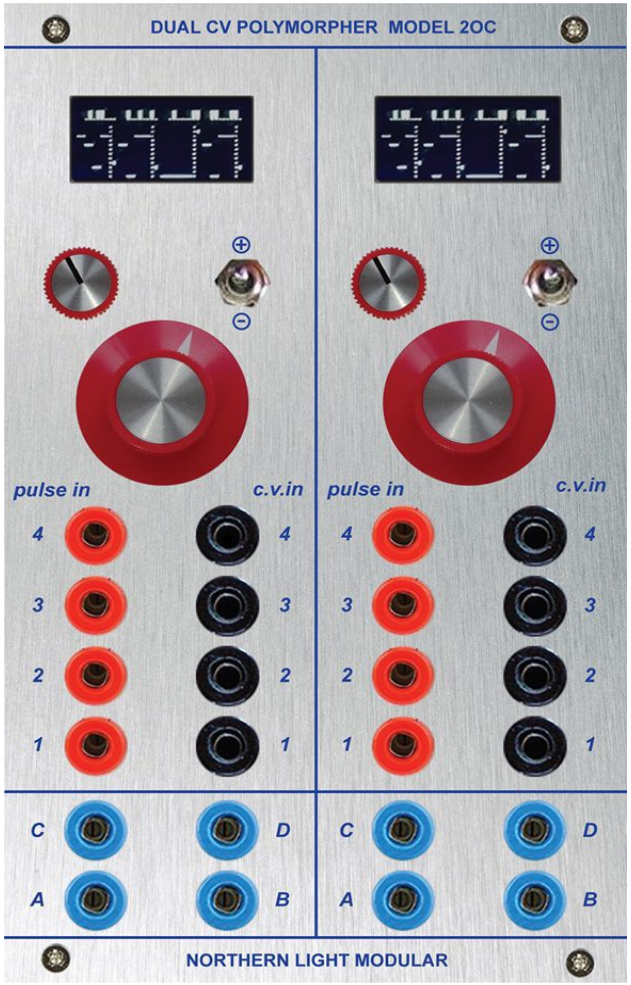


Image Courtesy of : Northern Light Modular

Who did O&C(Software)?

* The Ornament and Crime Polymorphic CV Module is the based on the work of a whole community
* Max Stadler (mxmxmx) is the primary designer, with major software design by Patrick Dowling (pld), and Tim Churches (bennelong.bicyclist)
* The software for several functions is based on work by Olivier Gillet (Mutable Instruments)
* Paul Stroffregen (PJRC) Teensy and Arduino libraries
* Ville-Matias Heikkilä (viznut) ByteBeat function
* Many others...

Why O&C?



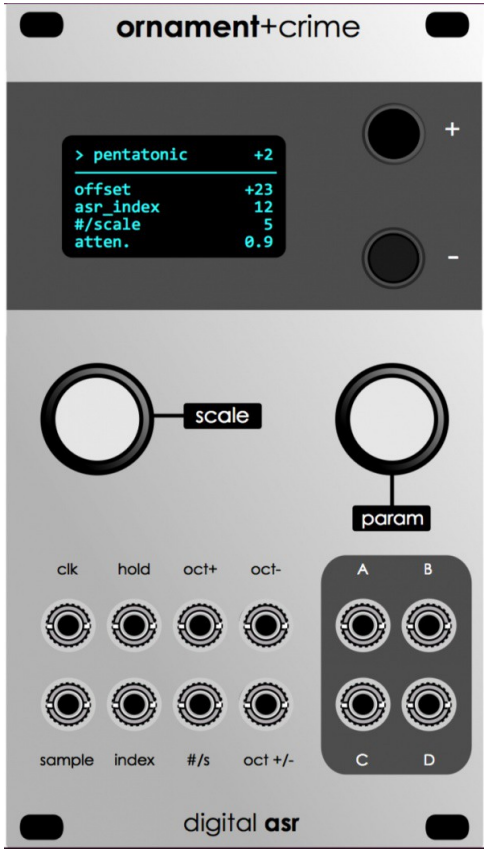
* Amazing synthesizer utility module
* We wanted to build some of our own - so we're here to tell you about this DIY module, why you might want it, how to build or obtain one, and what we have learned so far...
* The O&C software is open, you can change it to do what you want!

Image Courtesy of : Northern Light Modular

How to get O&C?

* Download from http://ornament-and-cri.me
* Kits are available from several sources (details later on)
* Kits require surface mount soldering skill (not for the casual builder)
* A few outlets sell assembled modules, sending a royalty back to the designers

* We build our own – there are different models to choose from :



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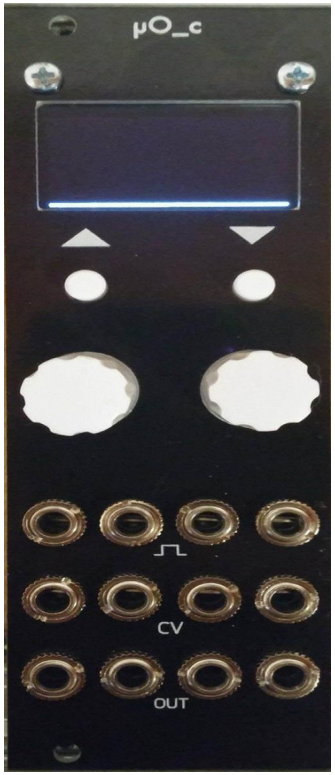
Original vs micro O&C



* 12 HP vs more compact 8 HP
* More intuitive arrangement of jacks

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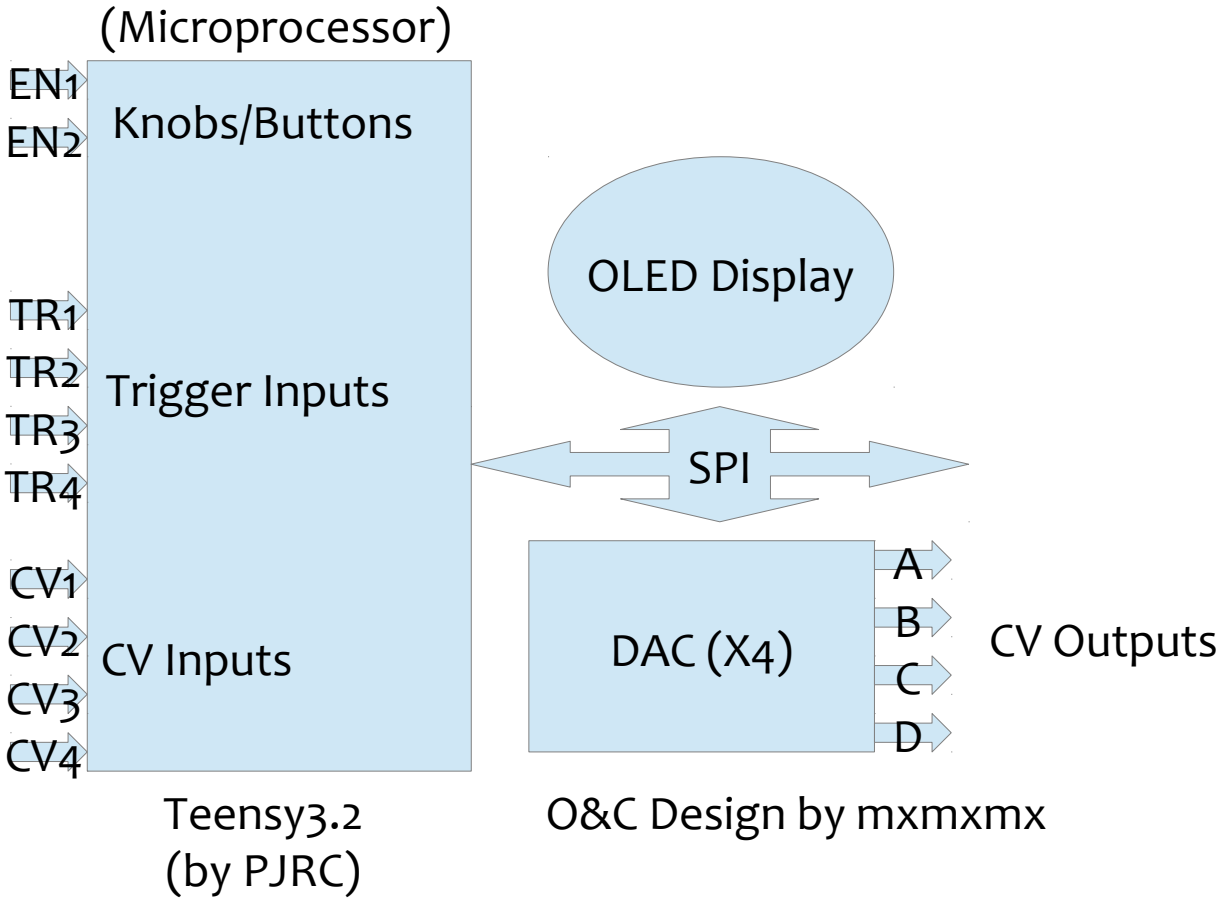
O&C Basic Design



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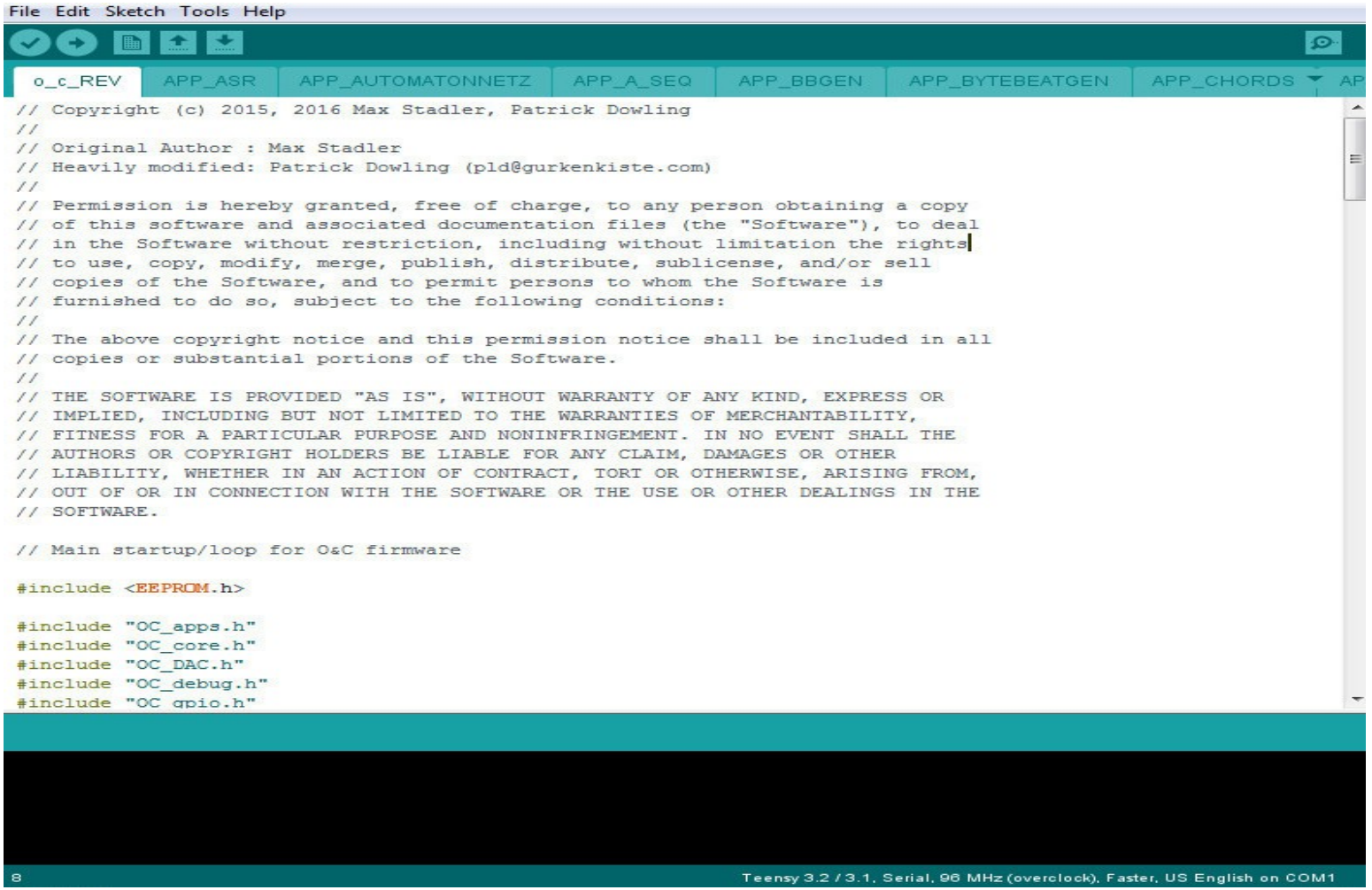
Open Source Firmware



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O&C Modes

* The original o_C module was designed to perform a single function: a digital, quantizing version of the classic analogue shift register (ASR)

* Now named CopierMaschine, it is an enhanced version of the original quantizing digital emulation of a four stage analogue shift register (ASR)

* Many other modes have been added, like quantizers, sequencers, LFOs, random/chaotic CV generators, and more. These modes are selectable on-the-fly, without having to reboot the module or toggle the power.

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O&C General Operation:

* Right Encoder Knob scrolls the list of settings
  push/click the right encoder knob
  to modify the selected setting
* Left Encoder Knob changes the channel
  in multiple channel modes
* Buttons: Operation varies with mode, but they
  usually halve/double/transpose the current frequency

* Screen Saver: Long press on the Up button

Saving Settings

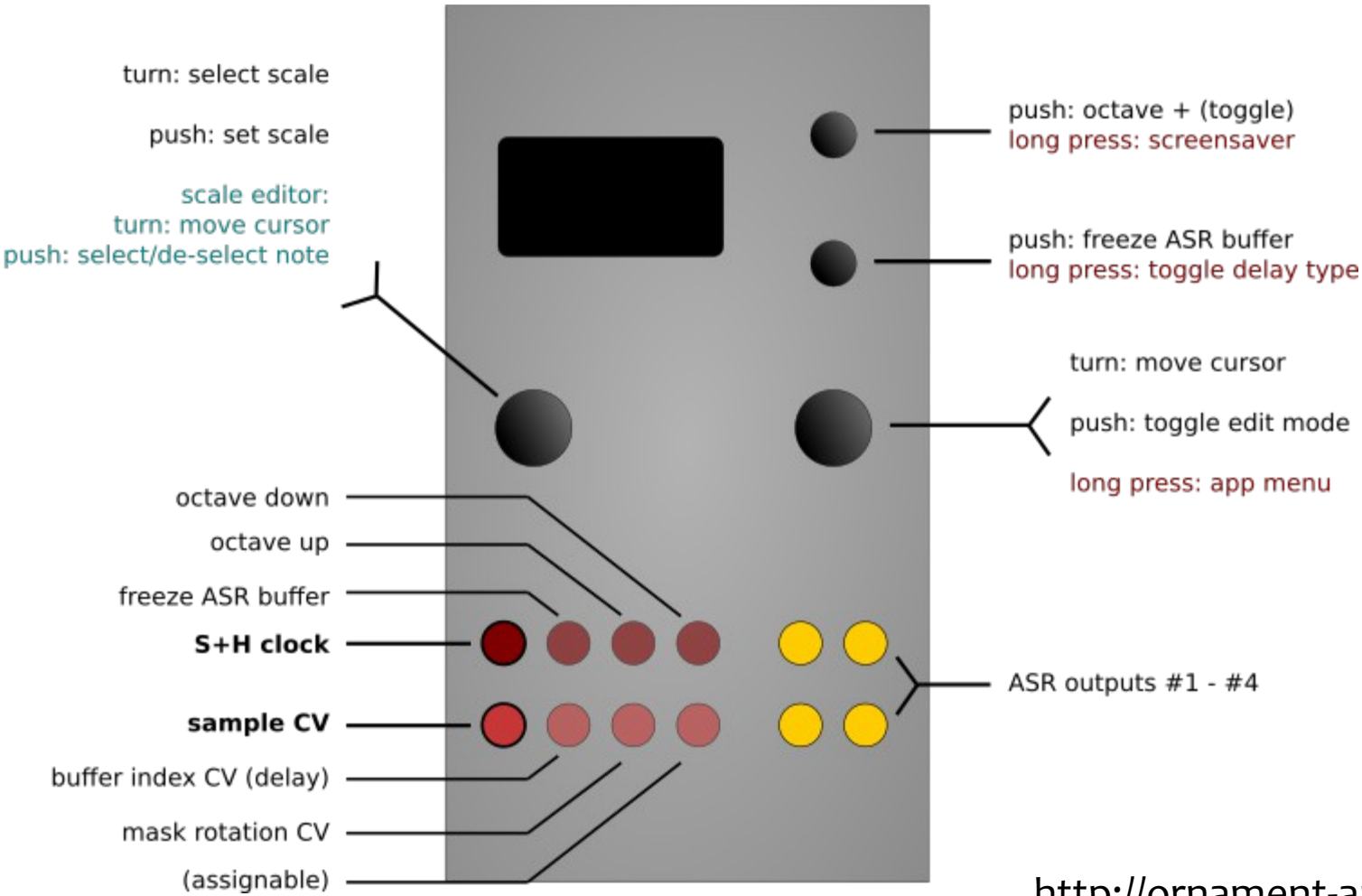
* Long press right encoder, goes to mode menu
* Long press right encoder again :
  until dot appears next to the mode
* This saves the settings for all the modes,
  not just the one currently selected
* Settings saved in the EEPROM (permanent)

CopierMaschine

* ASR mode is a four-stage sample-and-hold module. Feed a pulse into the left-most Trigger input (TR1), along with a CV signal (from a LFO, ADSR, etc.) into the left-most CV input (CV1)
* When triggered (TR1) by the clock, the four outputs will be updated; the current sample (CV1) will be present at output A, the previous samples shifted down the remaining outputs :

  (S(0)->A, S(-1) > B, S(-2) > C, S(-3) > D)

CopierMaschine



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CopierMaschine

I/O	Function
TR1	Clock input
TR2	Hold (= freeze ring buffer)
TR3	Transpose: Octave up, when high
TR4	Transpose: Octave down, when high (overridden by TR3)
CV1	Sample in
CV2	Index: ring buffer index (= “delay”)
CV3	Mask: rotate scale mask
CV4	assignable: octave, root, transpose (by scale-degrees), buffer-length, or CV input scaling

A, B, C, D Analog Shift Register Outputs 1-4

CopierMaschine

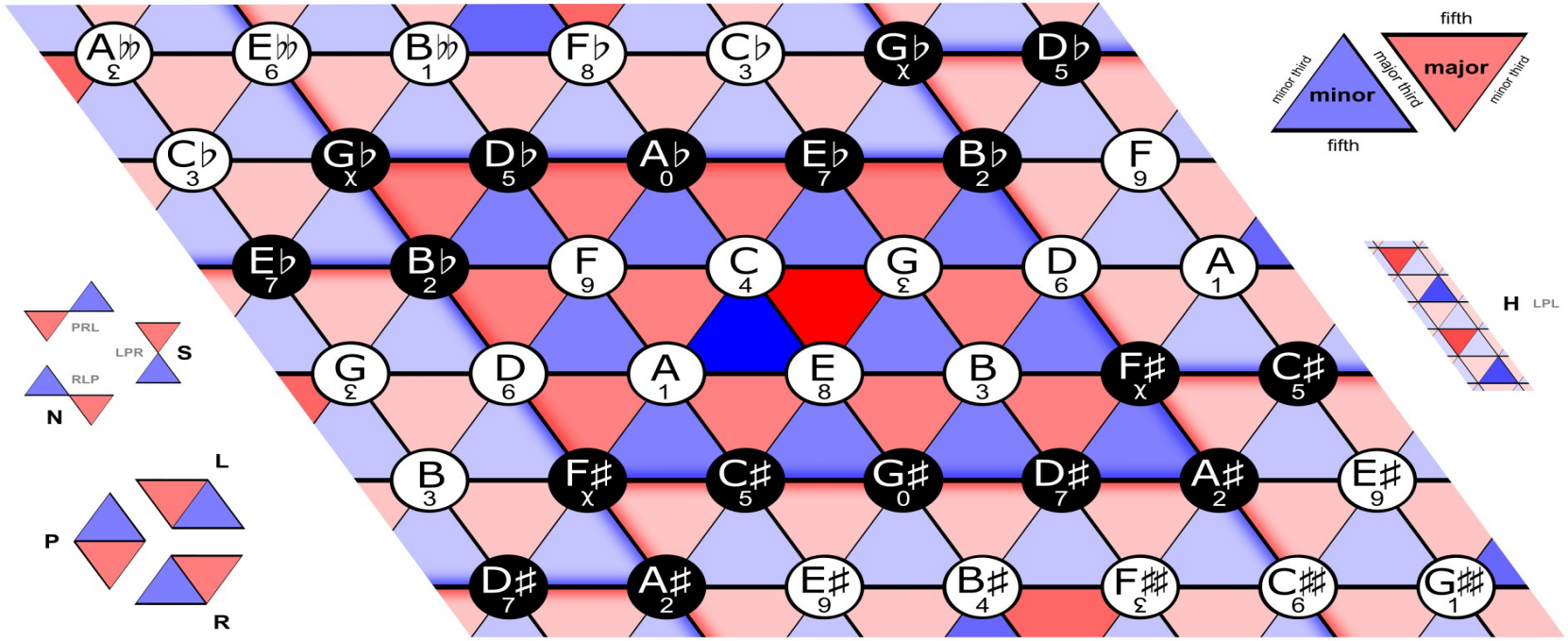
* In addition to acting as a sampling shift register, CopierMaschine can also Quantize those samples, enforcing a traditional (or custom) scale, and masking some of those notes if desired.
* CopierMaschine allow CV control of those note masks for more flexibility

* The triggers can also come from other modes, such as the internal sequencers, for even more fun!

Harrington 1200

* Neo-Riemannian transformation mode for generating triad (three note chord) progressions with the following basic (atomic) tranformations :
* P (Parallel): Moves the third up or down a semitone, thus P(Cmaj) = Cmin, P(Cmin) = Cmaj.
* L (Leittonwechsel): Converts a major triad to a minor by shifting the root down a semitone and making the third the root, or from minor to major by moving the fifth up a semitone to become the root.
* R (Relative): Converts a major triad to its relative minor, or a minor triad to its relative major.

Pitches in the Tonnetz



The Riemannian Tonnetz is a planar array of pitches along three axes, corresponding to the three consonant intervals.
Major and minor triads are represented by triangles which tile the plane of the Tonnetz.

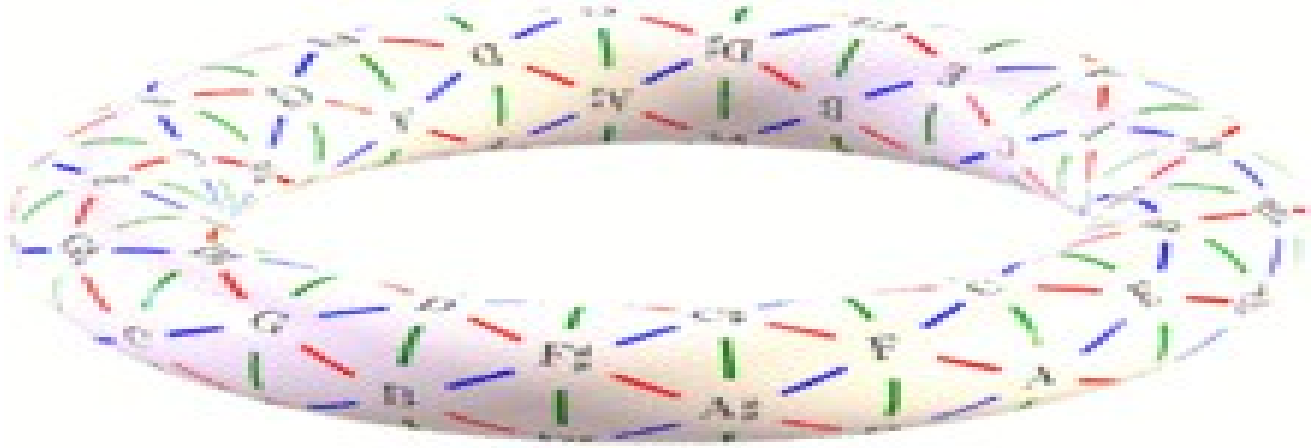
http://wikipedia.com

Harrington 1200

* Or Secondary Transformations :
* N (Nebenverwandt): Exchanges a major triad for its minor subdominant, and a minor triad for its major dominant (e.g. C major and F minor). The “N” transformation is the same as applying R, L, and P successively.
* S (Slide): Exchanges two triads that share a third (e.g. C major and C♯ minor); it is the same as applying L, P, and R successively, in that order.
* H (Hexatonic): Exchanges a triad for its hexatonic pole (e.g. C major and A□ minor); it is the same as applying L, P and L transformations successively.

Harrington 1200

* Neo-Riemannian theory typically assumes enharmonic equivalence [G(sharp)= A(flat)] which wraps the planar graph into a torus



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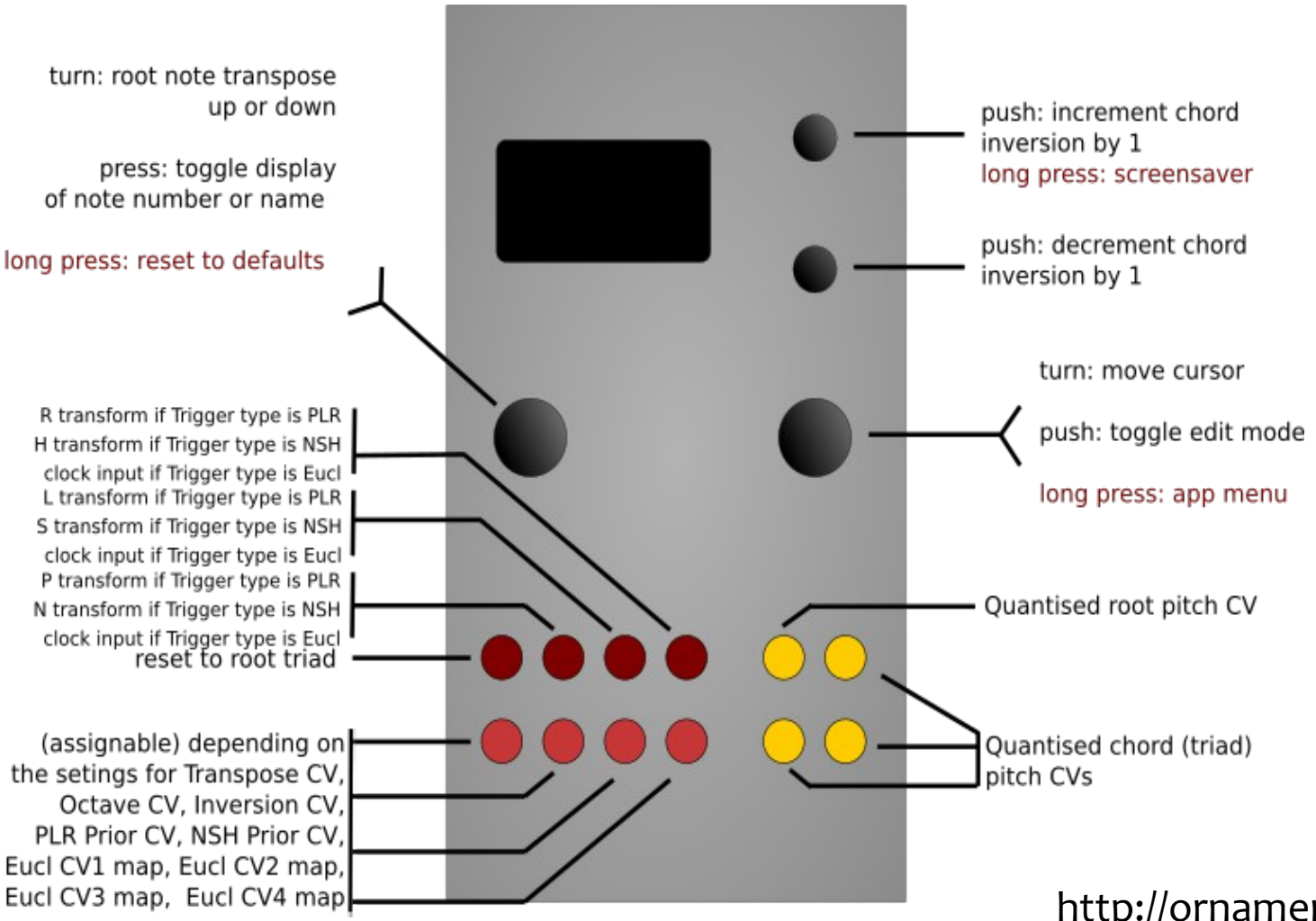
Harrington 1200



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Harrington 1200

I/O	Function
TR1	Reset to root triad
TR2	P transform , or N transform, or clock input
TR3	L transform, or S transform, or clock input
TR4	R transform , or H transform , or clock input
CV1	Mapped according to Transpose CV, Octave CV, Inversion CV, etc. each CV input can be used for multiple internal destinations.
CV2	Ditto
CV3	Ditto
CV4	Ditto
A	Quantized root
B, C, D	Transformed & inverted triad (also quantized)

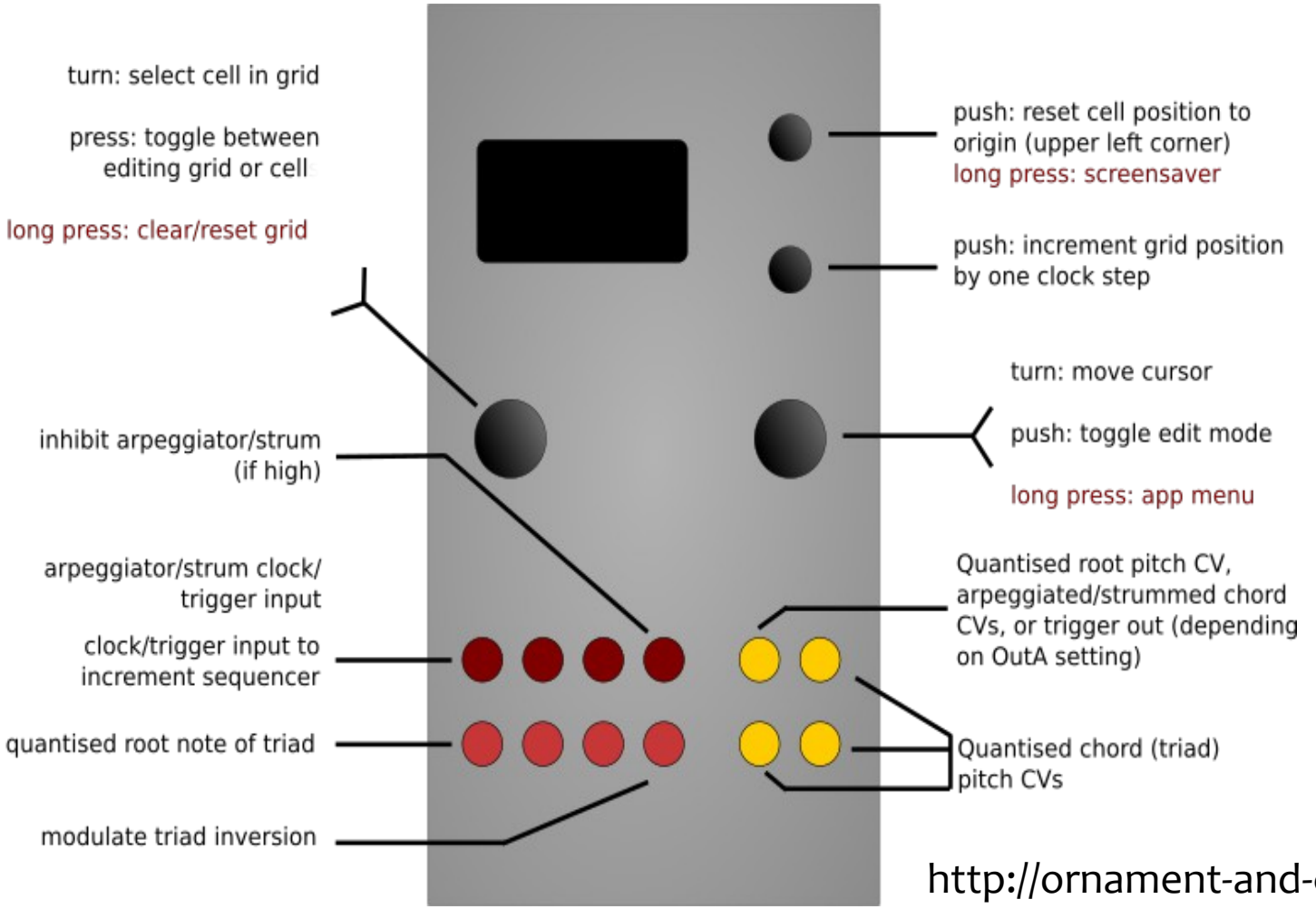
Automatonnetz

* This mode also uses the neo-Riemannian transformations (Harrington 1200), but with the sequence of transformations determined by navigating a 5x5 “vector sequencer” grid

* On each clock input the dx (delta x) and dy (delta y) values are added to the current position on the grid to determine the next active cell. The position simply wraps around when it reaches the edge of the grid, allowing“backwards” motion

* The position and movement can also be fractional, allowing for clock divisions and many different patterns

Automatonnetz



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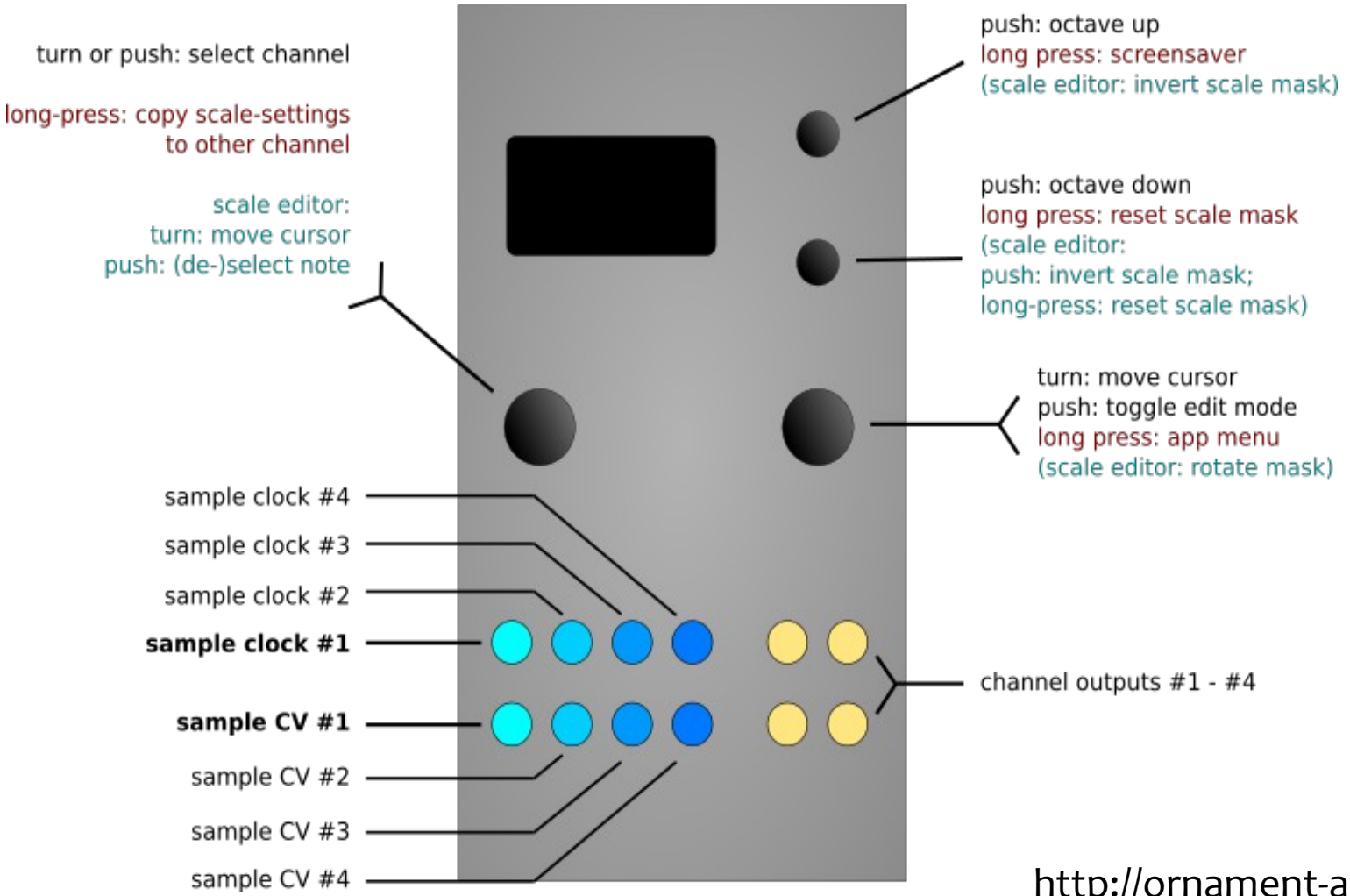
Quantermain

* A four channel quantizer, **Quantermain** integrates the quantizer from the Mutable Instruments **Braids** module
* **Quantermain** expands it with interactive scale-edit functionalities, supporting 99 different pre-defined scales" and four fully user-definable scales
* Each scale with a maximum of 16 notes per octave and additional finetune and microtonal editing options
* The four channels are fully independent, but can be slaved to the same clock and/or track the same CV sources,

Quantermain



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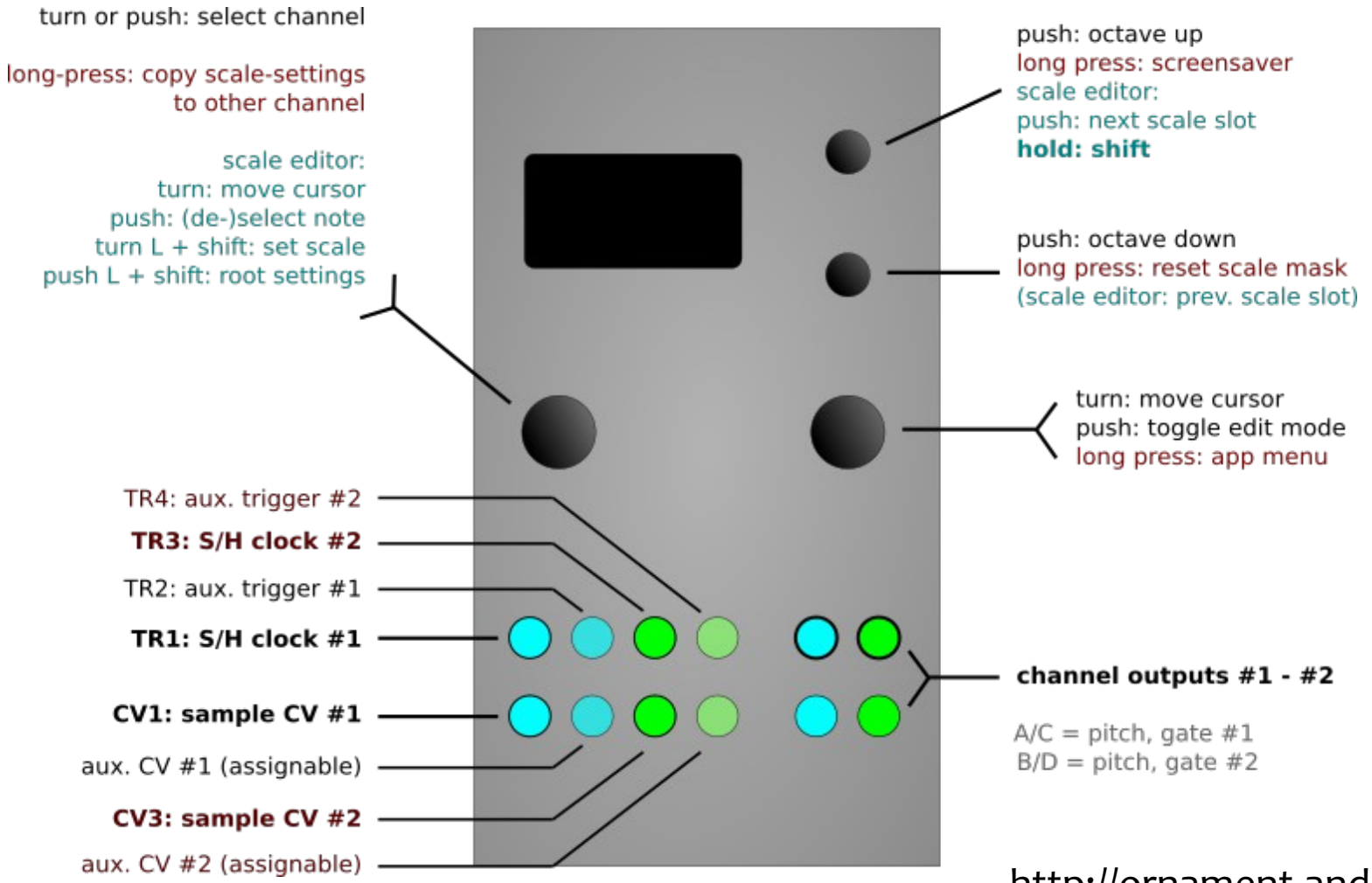
MetaQ

* Meta-Q is a dual-channel quantizer that's similar to Quantermain, but two channels with more scale options

* It has fewer internal CV sources (currently, only LFSR) but comes with four 'scale slots' per channel, which is a package of scale, mask, root and transpose values

* 'scale slots' can be sequenced to provide a lot of additional, structured variation to the input CV sequences (or the LFSR internal CV source)

MetaQ



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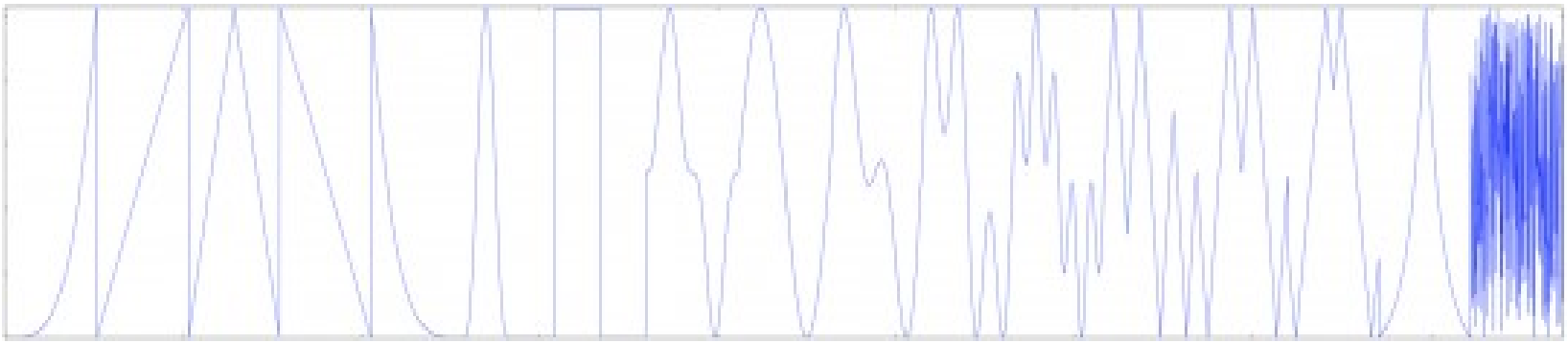
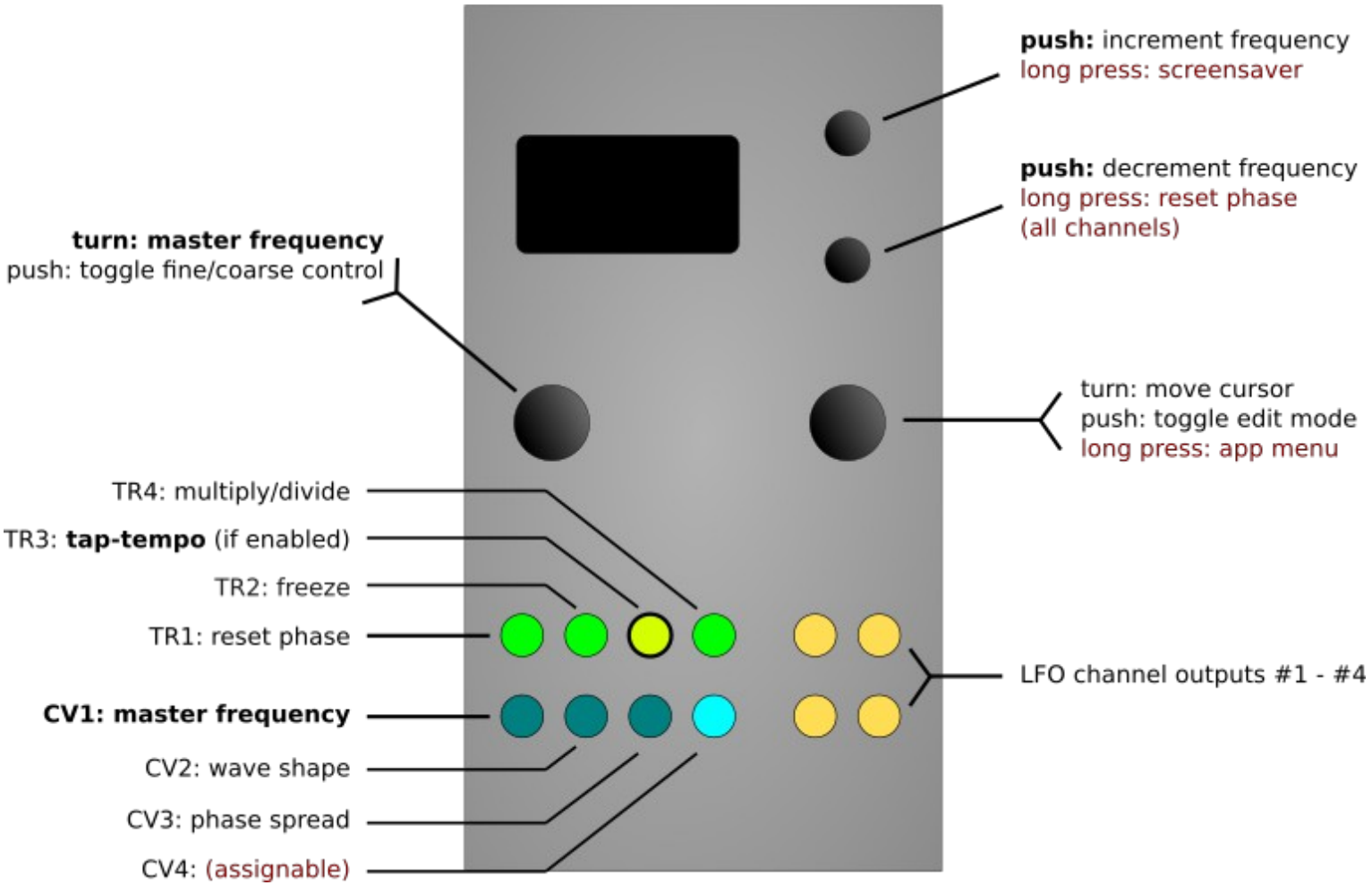
Quadraturia

* Quadraturia is Quadrature Low Frequency Oscillator (QLFO) previously available as the “Easter egg” in the Mutable Instruments **Frames** module



* Quadraturia supports CV control of QLFO frequency
* Quadraturia adds CV control over additional LFO parameters like Wavetable Waveshape, Phase Spread, and Level

Quadraturia



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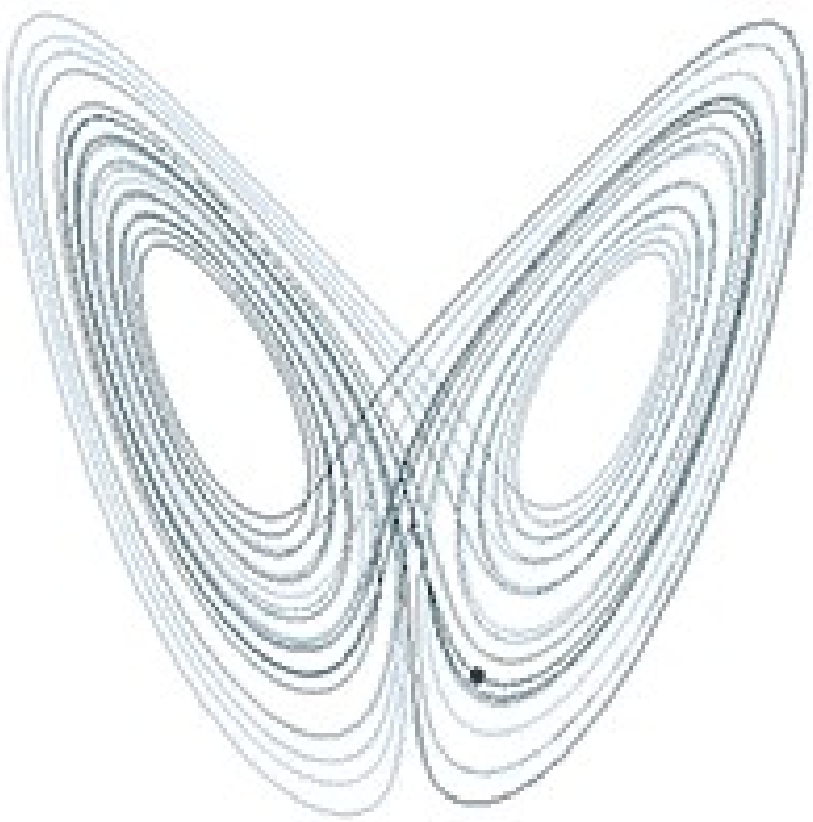
Quadraturia

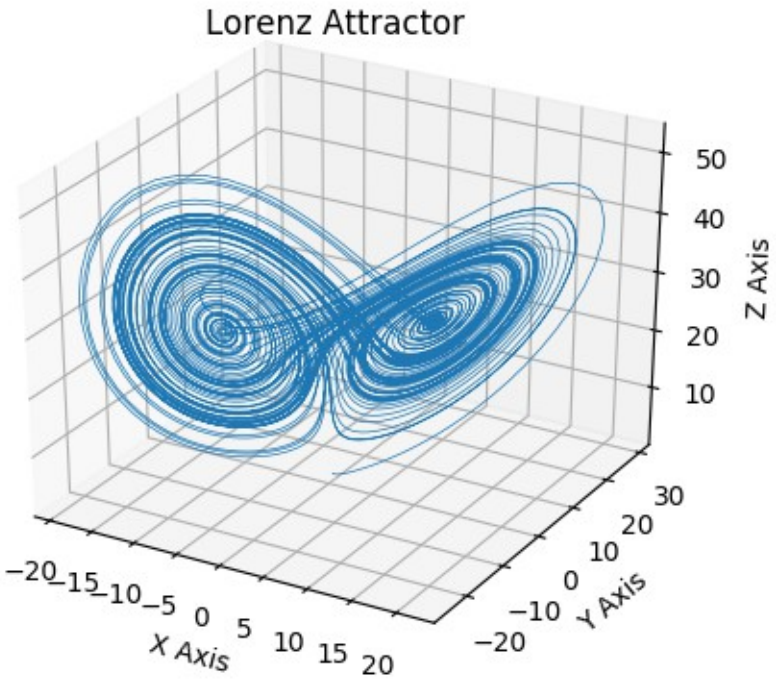
* Quadraturia adds “predictive” tap-tempo capability from the Tap LFO mode in the Mutable **Peaks** module. This allows the period of the LFO waveform output on channel A to be locked to the period of “taps” or pulses input on TR3. This will synchronize to both regular clock inputs as well as regular rhythms with unequal spacing of the taps.
* The frequency/period of the output on channels B, C and D will be the same as channel A if the frequency ratio setting for those channels is 1.0 (unity). Otherwise, it will be some multiple or division of the channel A frequency. In other words, the frequency ratio settings for channels B, C and D are honoured in tap tempo mode as well as in normal mode.

Low-Rents

* Low-rents is a port of the Lorenz attractor modulation generator from the "Easter egg" in the Mutable Instruments **Streams** module, to which Rössler attractors have been added.
* Two independent function generators are provided, with each generator calculating both the Lorenz and Rössler functions simultaneously, using the same phase accumulator, but with the rate/speed of each generator independently settable.
* Both the Lorenz and the Rössler functions output three values (x, y & z), and various combinations of these can be mapped to the four output channels. The chaotic strange attractors work best as slow modulation functions.

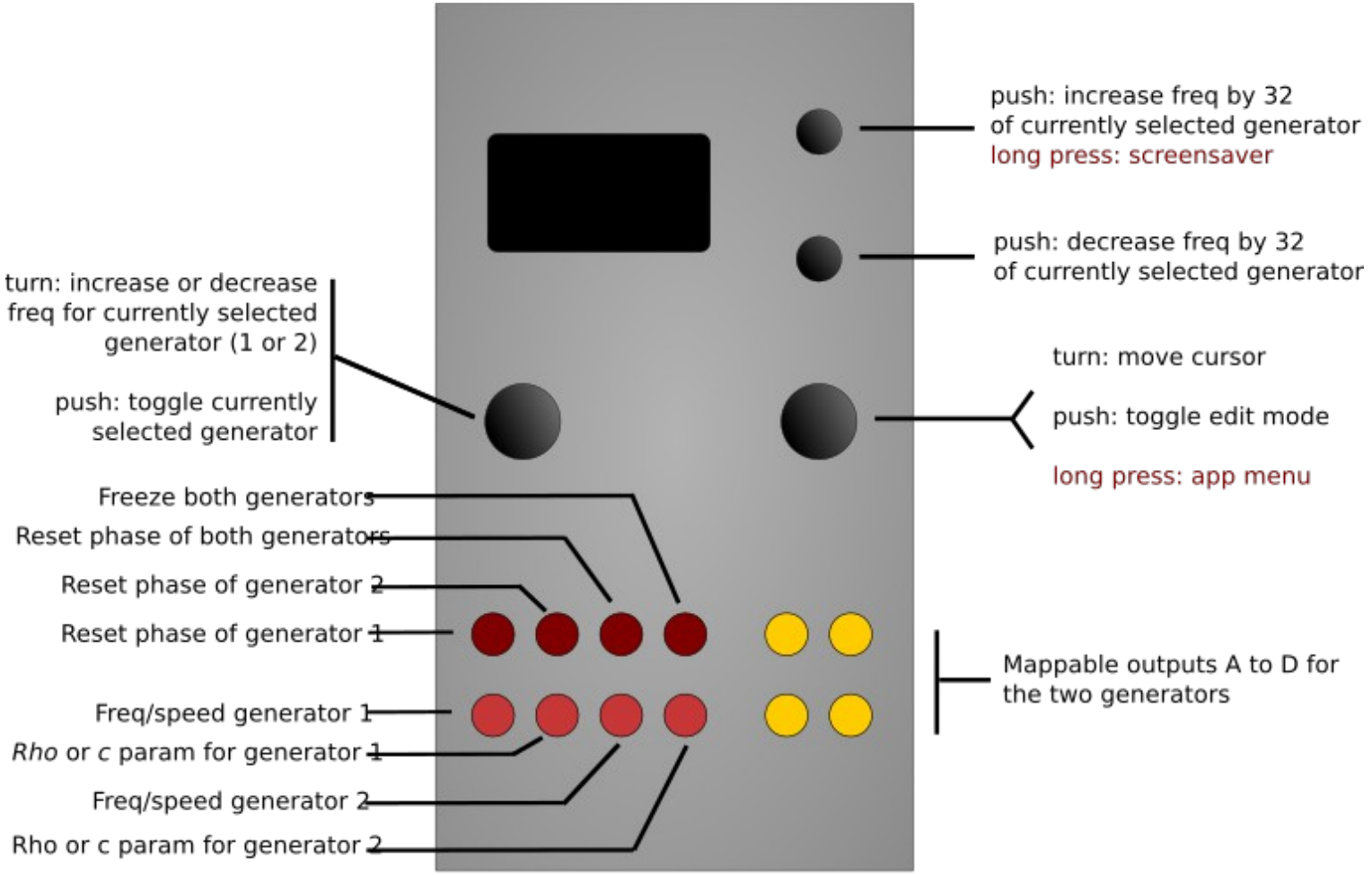
Low-Rents





http://wikipedia.com

Low-Rents



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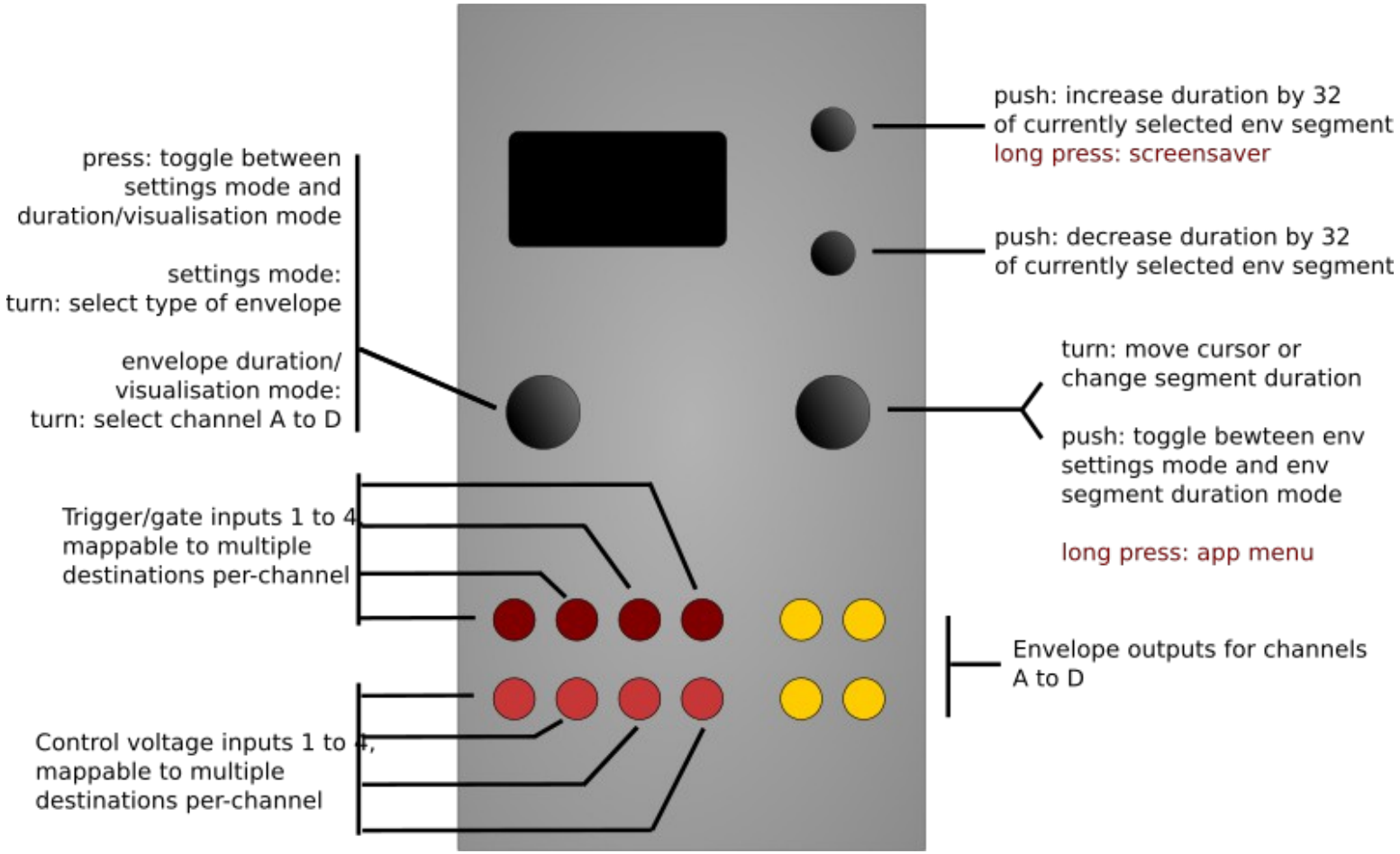
Piqued

* Piqued is a a port of the envelope generator function from the open-source Mutable Instruments **Peaks** module
* Piqued provides four independently triggered envelopes on output channels A,B,C,and D; with independently mappable voltage-control inputs CV1 to CV4
* Piqued provides CV control over envelope duration and/or other parameters for each segment of each envelope.
* Segment shape (curves) can be set for each segment of each of the four envelopes
* “Euclidean trigger filter” mode turns Piqued into a quad-channel Euclidean poly-rhythm generator, that can output envelopes

Piqued



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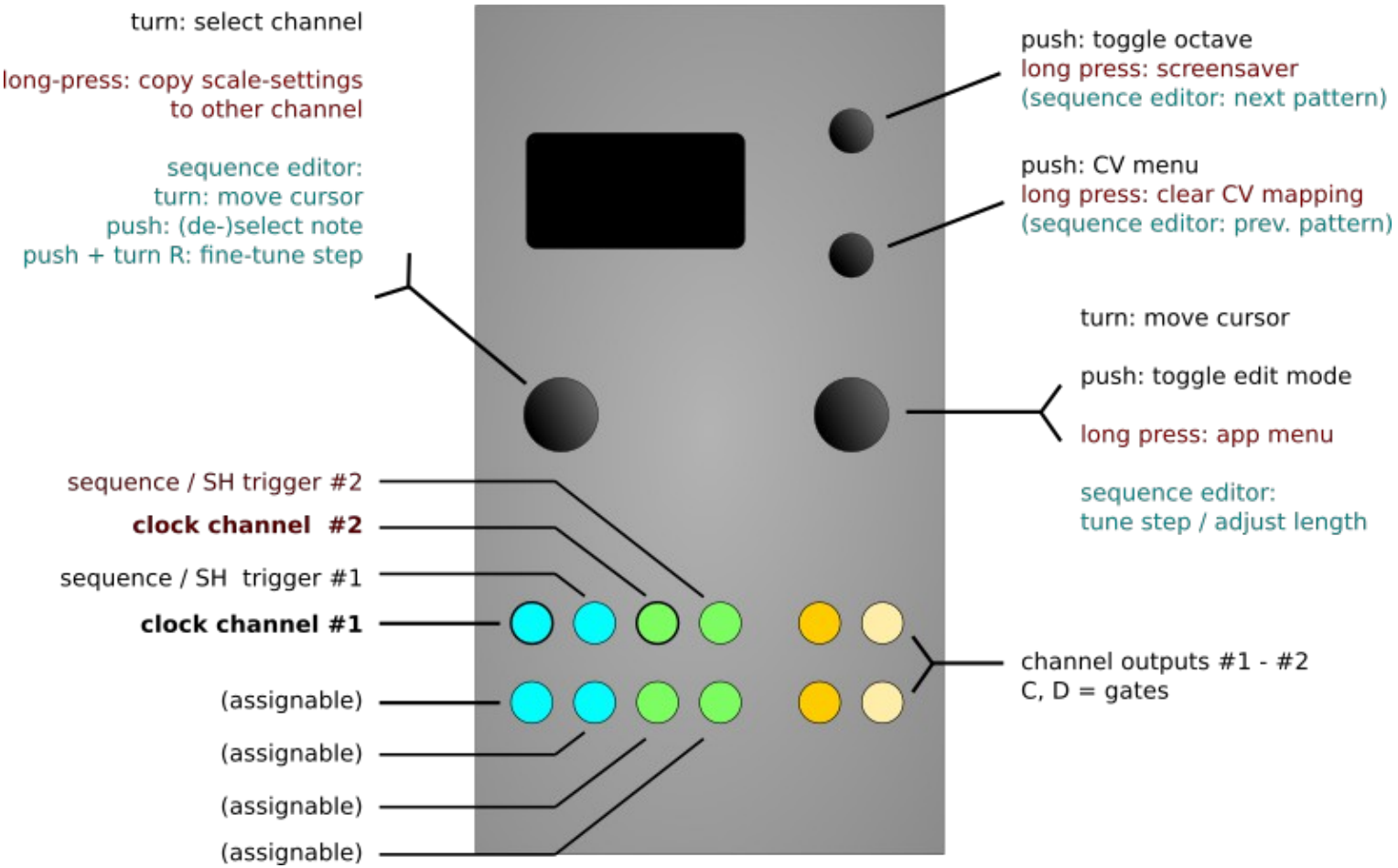
Sequins

* Sequins is a basic, dual-channel sequencer
* Sequins provides four 16-step sequences per channel, and CV-control over various channel parameters, including scale mask, octave, pulse width, and clock multiplication
* Sequins allows four sequences to be chained in various ways, providing sequences from 4 to up to 64 notes
* Sequins data is stored along with the other settings (whenever settings are saved in EEPROM)

Sequins



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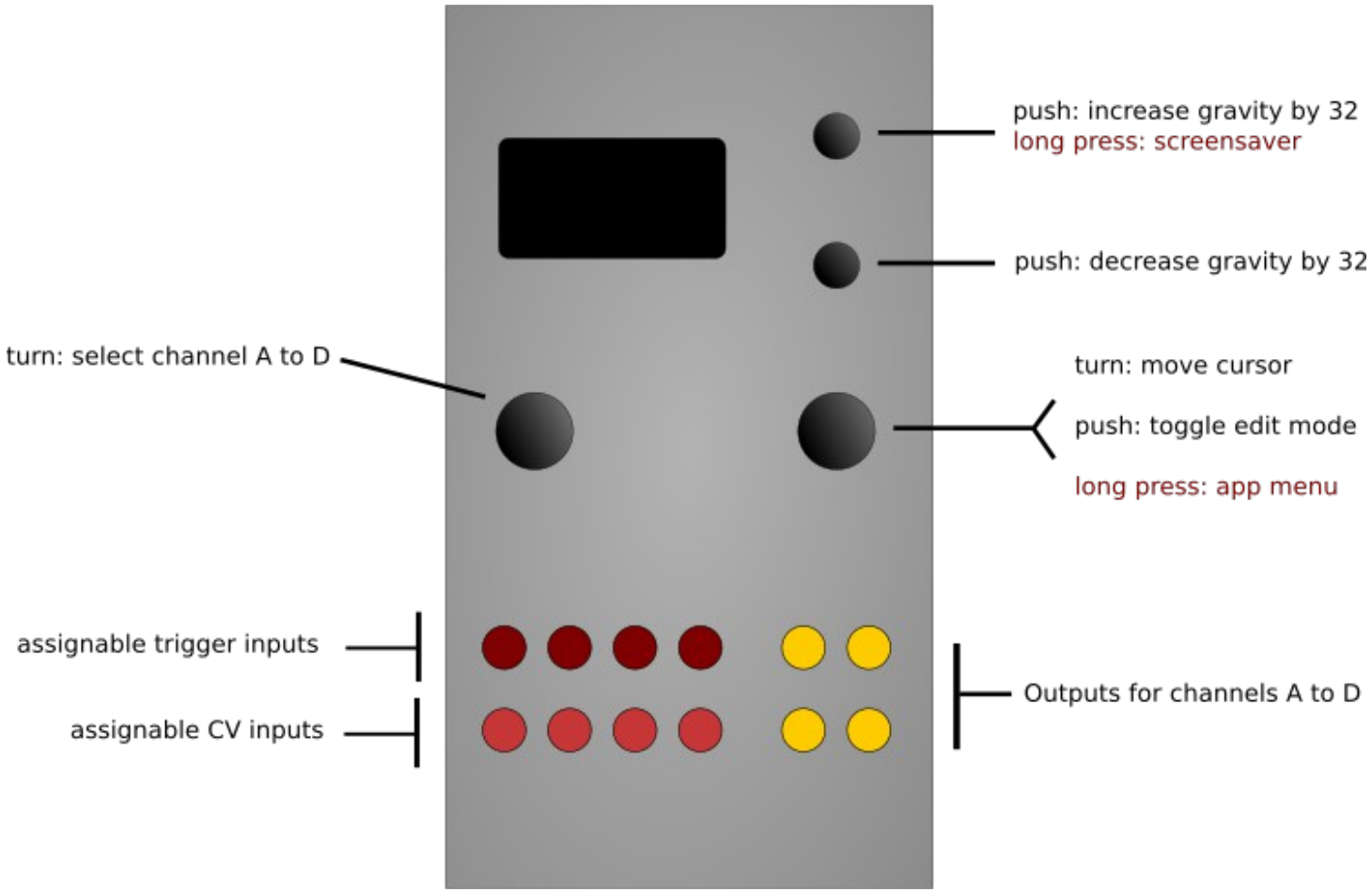
Sequins

* When identical sequences are set up on both sequencer channels, and the same clock input is used to drive both channels, then Steve Reich “Piano Phase” type effects can be acheived by setting the mult/div setting for one channel to, say, /32 (divide by 32), and to /31 on the other channel, and then using a fast clock
* The two sequences will slowly move out of phase. By varying the division up and done in one channel, the two sequences can be moved in and out of phase as required.

Dialectic Ping Pong

* Dialectic Ping Pong is a port of the bouncing ball envelope generators from the Dead Man's Catch alternative firmware for the Mutable Instruments Peaks module
* These generators implement a simple but effective simulation of the physics of a ball that is thrown into the air with a certain velocity, from a certain height, and which then returns to Earth (or a planet of your choice) under the influence of (configurable) gravity, and then bounces (with a settable "bounce loss" simulating how hard the ball is pumped up, if it is a basketball), before being pulled back to Earth and bouncing again, and so on.

Dialectic Ping Pong



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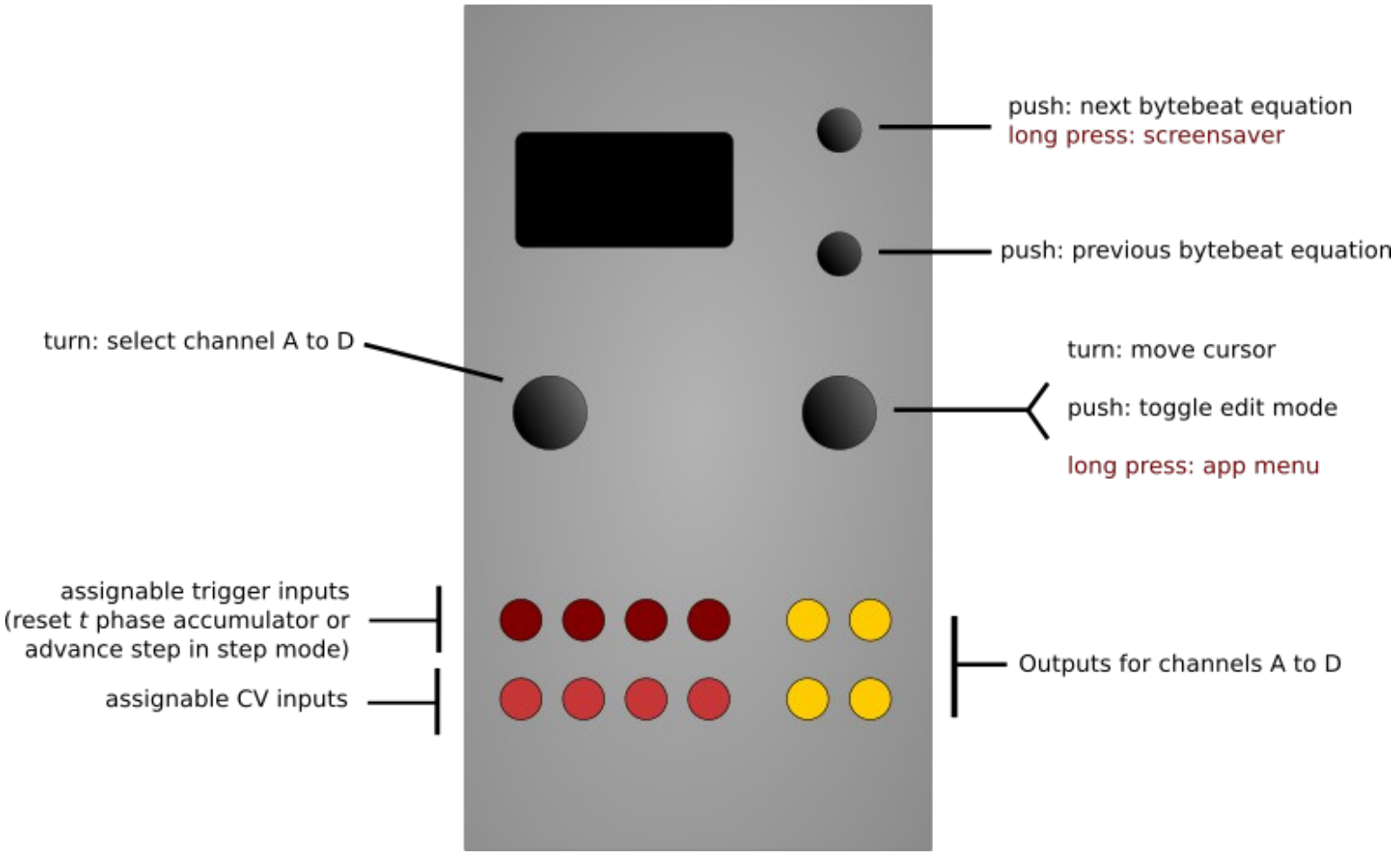
Viznutcracker, sweet!

* An experimental implementation of several **bytebeats** signal generators. **bytebeats** are equations (I.e. recursive functions), expressed usually as a single line of program code, typically involving various bit-level operators, which when evaluated with an incrementing phase value at audio rates produce all manner of harsh digital noises, some of which sound musical, or perhaps, interesting.
* **bytebeats** were first described in 2011 by Ville-Matias Heikkiläviznut (viznut)

Viznutcracker



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Viznutcracker

* Perhaps uniquely amongst byte beat generator modules, the Viznutcracker, sweet! apps permits the byte beat generators to be run at very slow rates, and because the o_C module outputs are DC-coupled, they can therefore be used as sources of stepped control voltages. For example, the outputs can be fed into a quantiser (such as another o_C module) to create potentially interesting pitch sequences (possibly even melodies…). Furthermore, the app allows each byte beat equation to be incremented by an external clock/trigger input, so that these stepped voltages can be generated in synchrony with other external processes.

Acid Curds

* Acid Curds is a basic chord sequencer

* Acid Curds provides four 8-step chord progressions and CV-control over various parameters, including chord type, progression length, direction, voicing, inversion, and more
* Acid Curds four chord progressions can be chained in various ways, providing progressions from 1 to up to 32 chords
* Acid Curds chords/sequence data is stored along with the other settings (whenever settings are saved in EEPROM)

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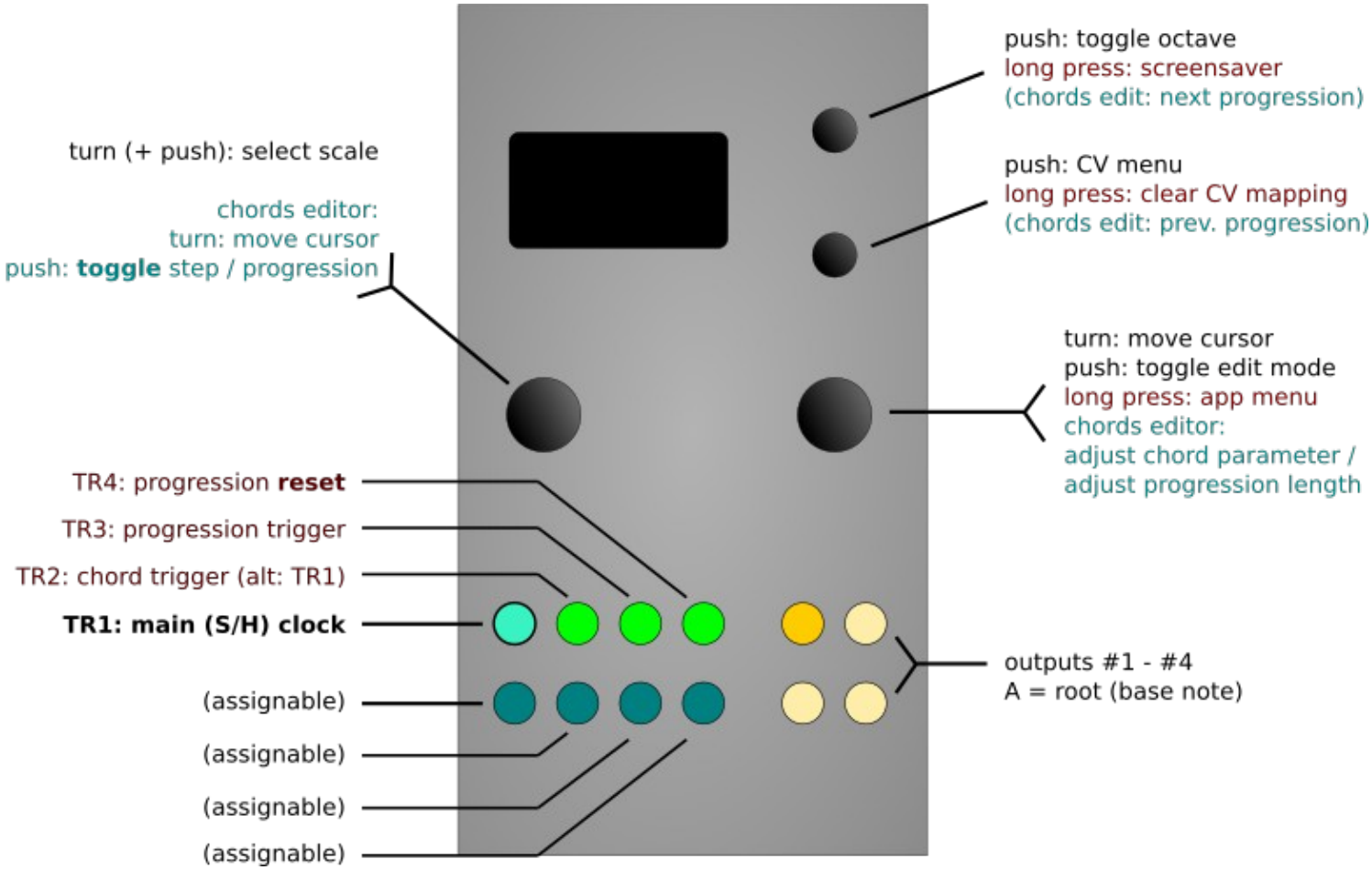
Acid Curds



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Acid Curds

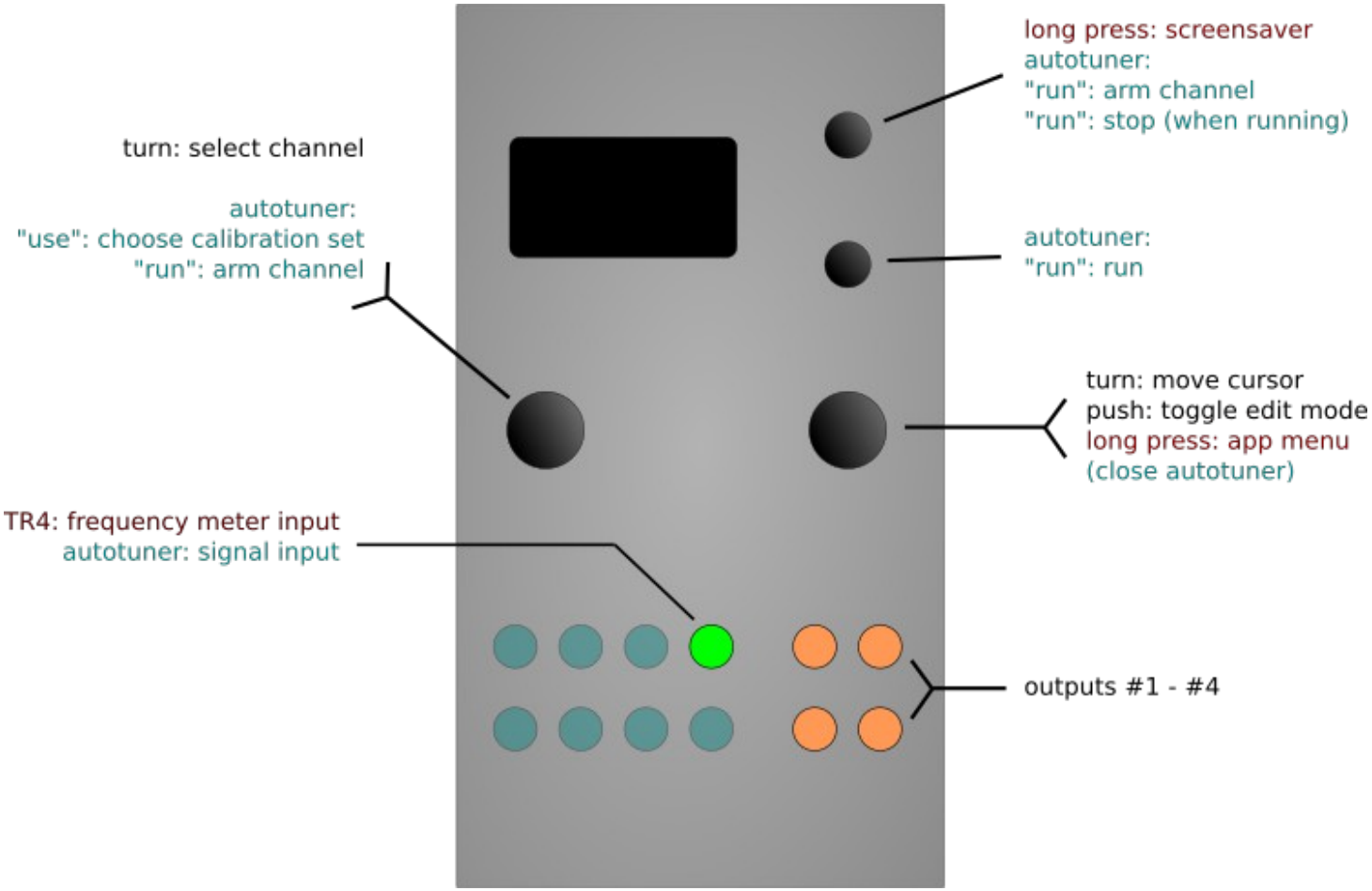
* Acid Curds can be used as either a basic quantizer / sample-and-hold type thing, in which case the chords will be formed on the basis of the incoming root CV, or it can be used as a step-sequencer, in which case the chord base-notes and chord properties will be fixed notes (chosen from a given scale) respectively features (inversion, voicing, etc); it's also possible to combine sequencer and S+H type behaviors.

References

* References mode is a tuning-utility

* References comes with a frequency/BPM meter (via the TR4 input, or TR1 in upside-down mode)
* References supports a closed-loop calibration mode
* References supports fixed reference output voltages. These are useful when calibrating other modules, such as VCOs, or V/O Filters, etc.

References



http://ornament-and-cri.me

More Online...

* Full manual at http://ornament-and-cri.me
  (this is just an overview...)

* Many good videos at :

  VCL (Voltage Control Labs)
  DivKid
  mylarmelodies
  Others...

Questions/Workshop

* Questions?

  Workshop -
* We have several O&C units built up in racks
* These are paired with our new Miasma dual CEM3340 VCOs
* Several other basic voice modules (VCO, VCF, VCA, etc.)
* We'll do some basic polyphonic and sequencer patches
* If you don't understand something, please ask …

HALCYON

Summing Up

* Thanks to Modular8 for Hosting!
* We brought several O&C demo units
* There is more information at : http://ornament-and-cri.me/
* Please sign up on our mailing list for new Workshops HalcyonModular.com

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Thank You!

Tom Moxon
Justin Patrizi