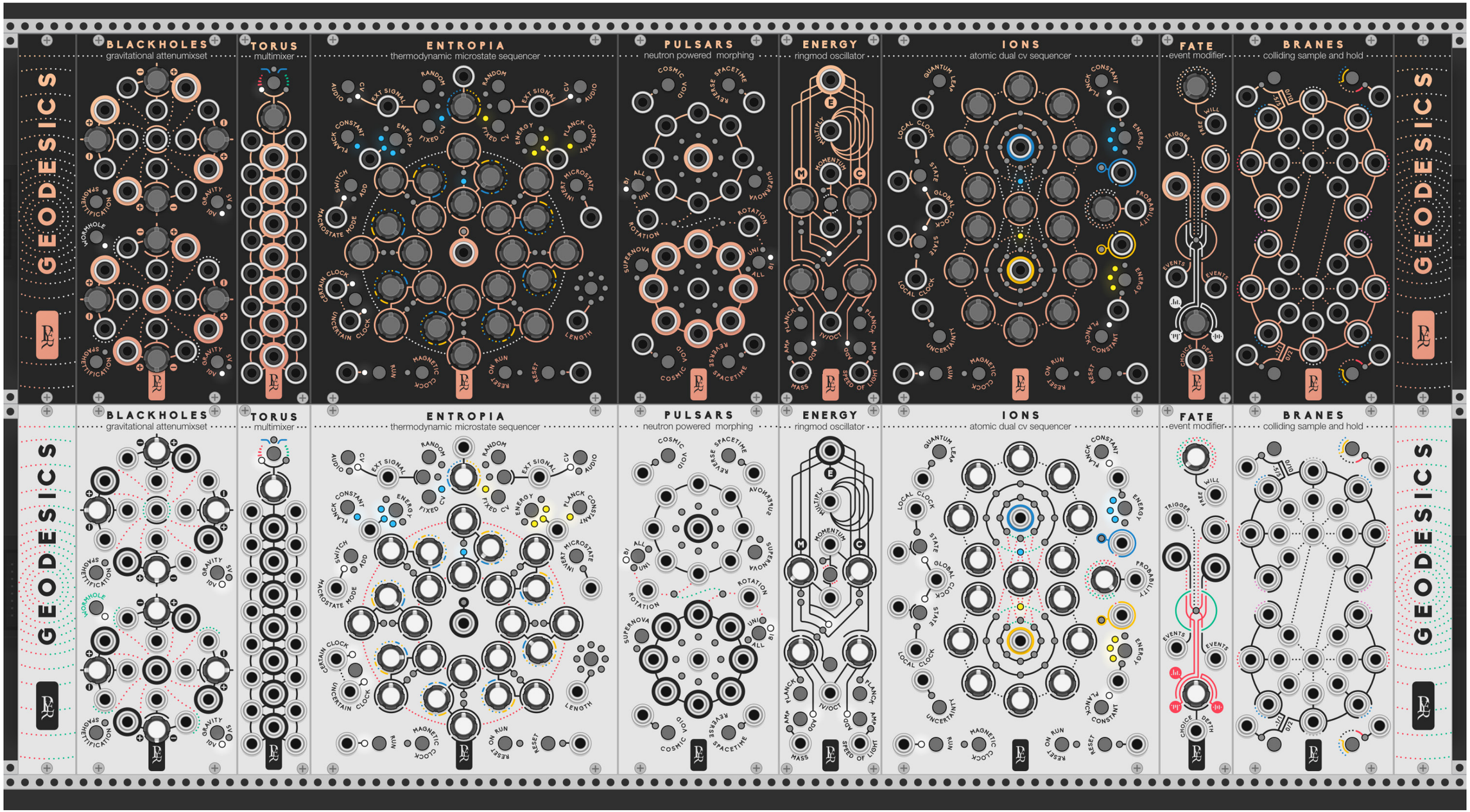
GEODESICS

A modular collection for VCV Rack by Pyer & Marc Boulé

User Manual


GEODESICS
BLACKHOLES
gravitational attenumixset
TORUS
multimixer
ENTROPIA
thermodynamic microstate sequencer
PULSARS
neutron powered morphing
ENERGY
ringmod oscillator
IONS
atomic dual cv sequencer
FATE
event modifier
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PHILOSOPHY

science inspires music

The modules are loosely inspired by astronomic events and physical theories. The goal is just to see how science can inspire us to create new music.

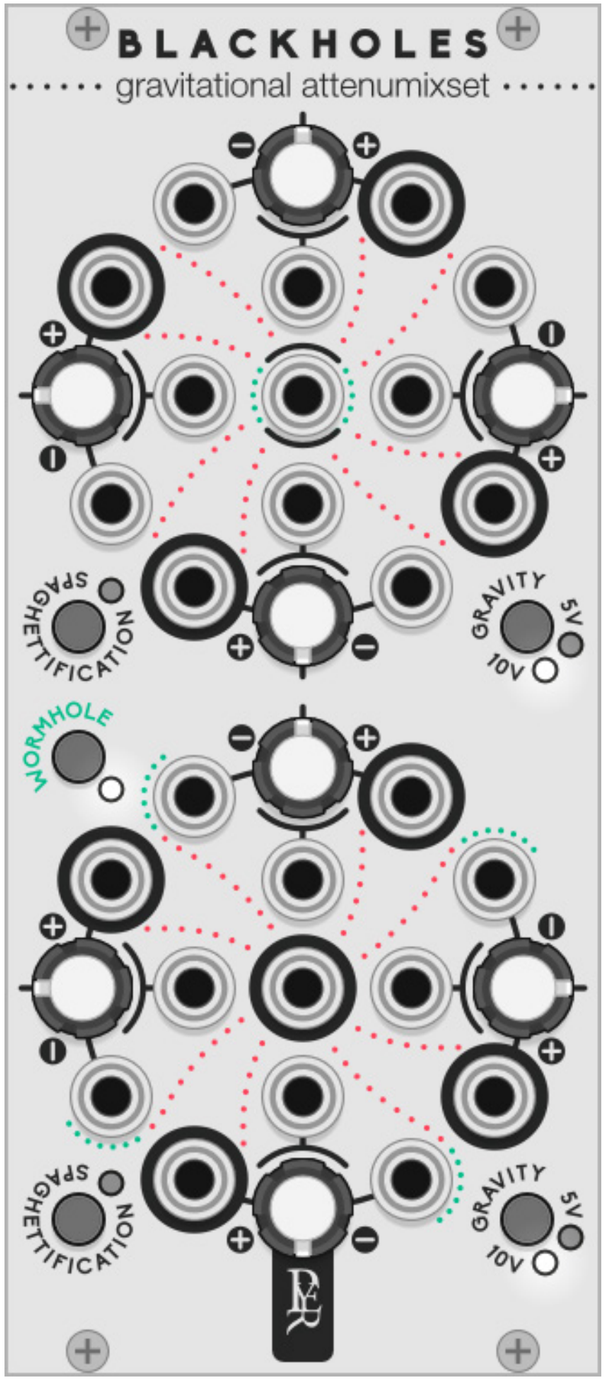
Every module is feasible in the hardware world, interacting elements are only knobs, buttons, LEDs and serigraphy. There is no right click option other than skin change.

For a more immersive concept, each parameter uses some terms related to the scientific phenomenon that inspires the module. It might be confusing at first but that's why this manual is here. As every unusual musical instrument, a learning curve is required to make the best of it.

While a lot of advanced science is involved, the final purpose is to create musical and creative instruments, effective and friendly to use.

GEODESICS

In Depth Concept

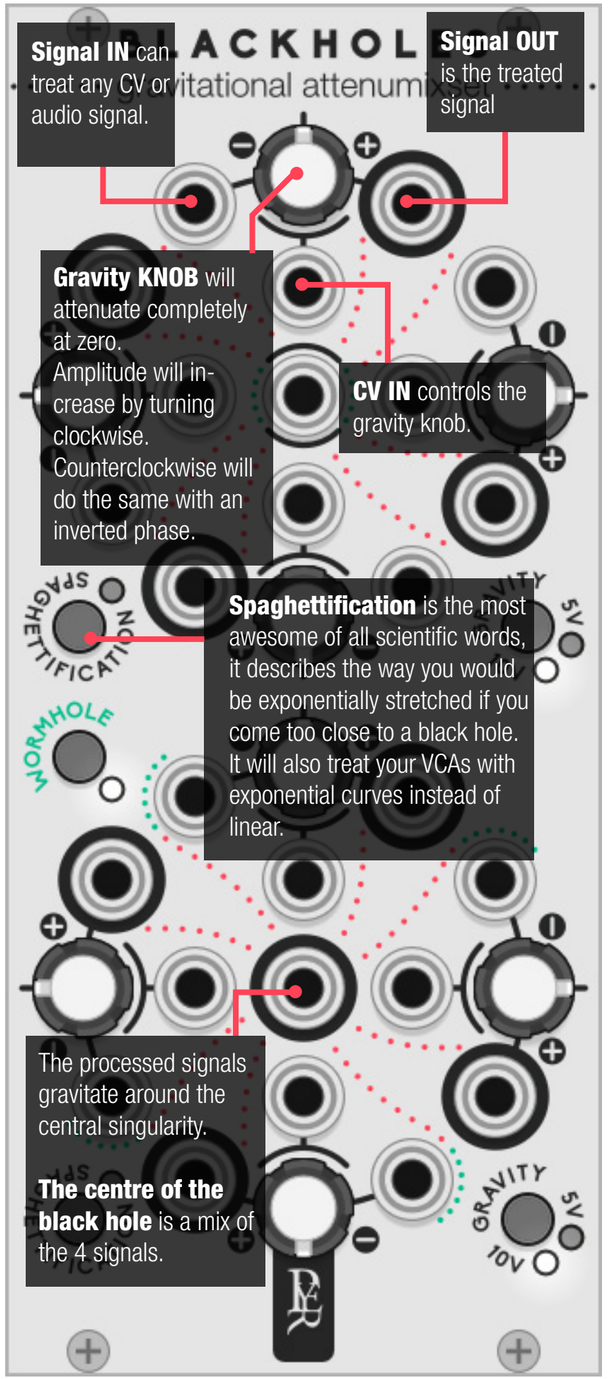


BLACK HOLES

gravitational voltage controlled attenumixset

A black whole attracts everything that gravitates around its centre, even audio and CV signals…

BLACK HOLES is 8 VCAs in two groups of 4, it's also two mixers with 4 channels each.



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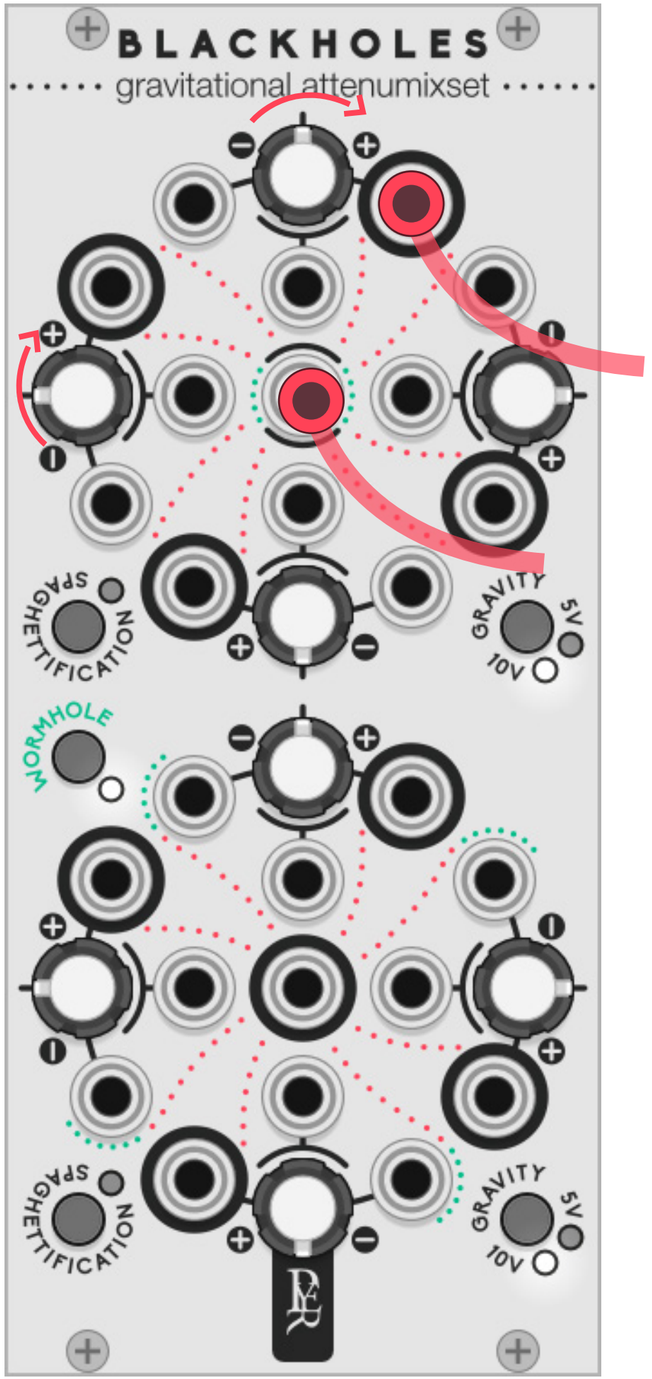


BLACK HOLES

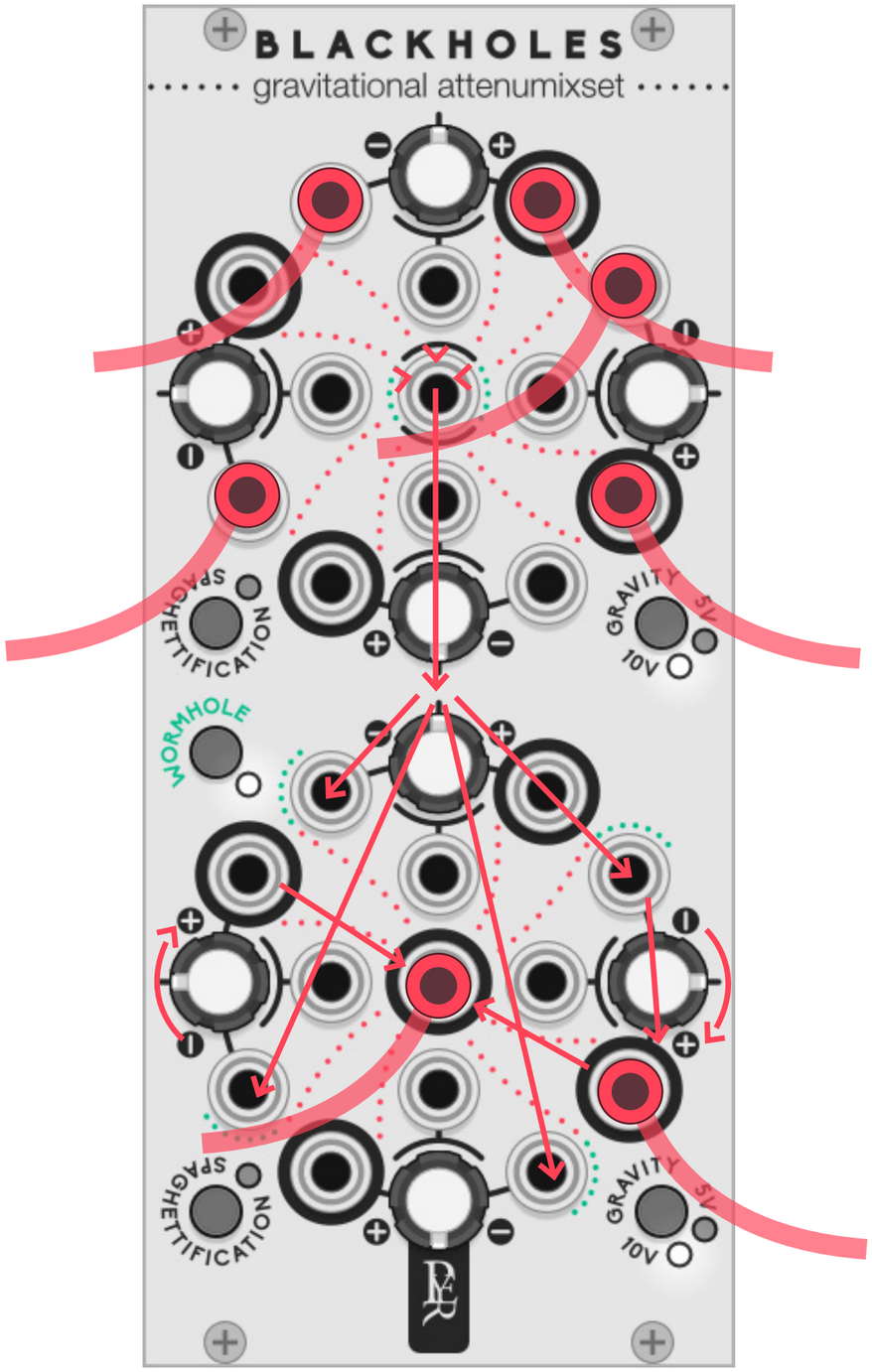
gravitational voltage controlled attenumixset

Mass control

When no input is plugged in, the knob acts to the output as a fixed CV generator. The centre still acts as a mixer. The values of the gravity knobs are all summed up in the mixer.

Gravity control

The modulation input can be set to –/+10 volts for envelope and gate sources, or –/+5 volts for LFO and VCO sources.



BLACK HOLES

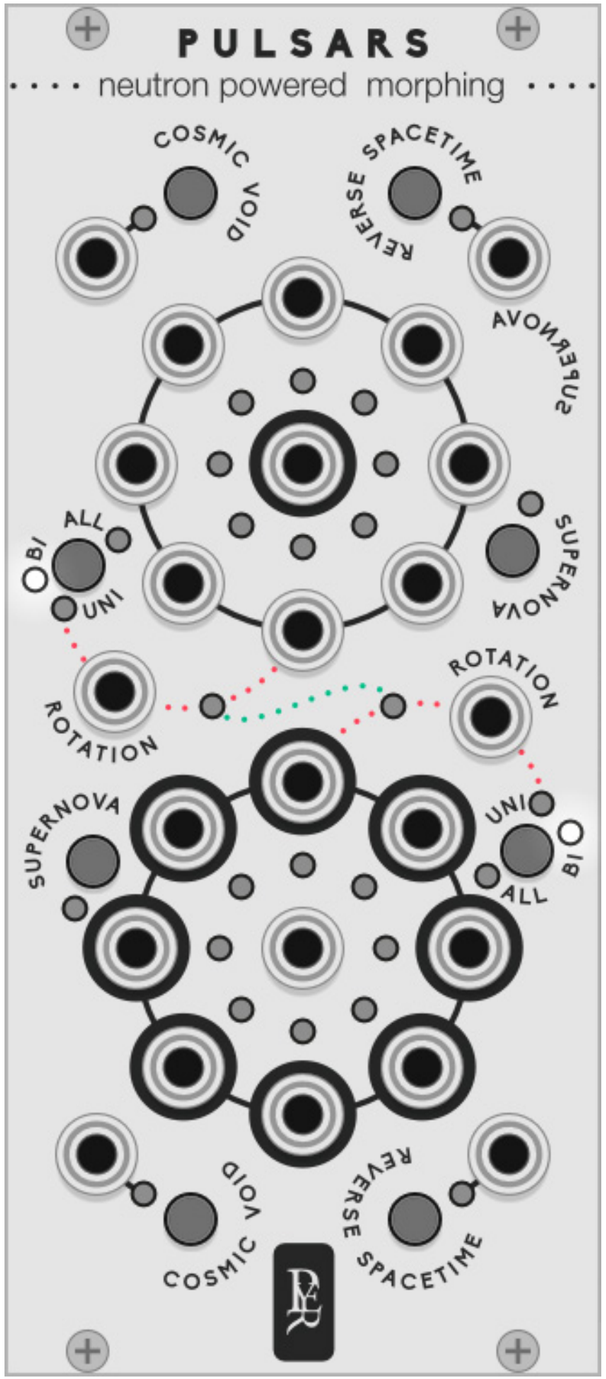
gravitational voltage controlled attenumixset

The Worm hole

No one knows what is inside a black hole. Some people think there could be a worm hole to a ‘white hole’ that ejects everything the black hole has absorbed…

Black Hole 2 can become a white hole. The mixed signal from Black Hole 1 travels through the wormhole and feed the unused inputs of Black Hole 2. It then becomes a 1x4 multiplier. The signal can be treated differently by each output. The worm hole can be closed if needed with the button.

The mass control combined with the worm hole trick will manage both amp and offset of an external signal.

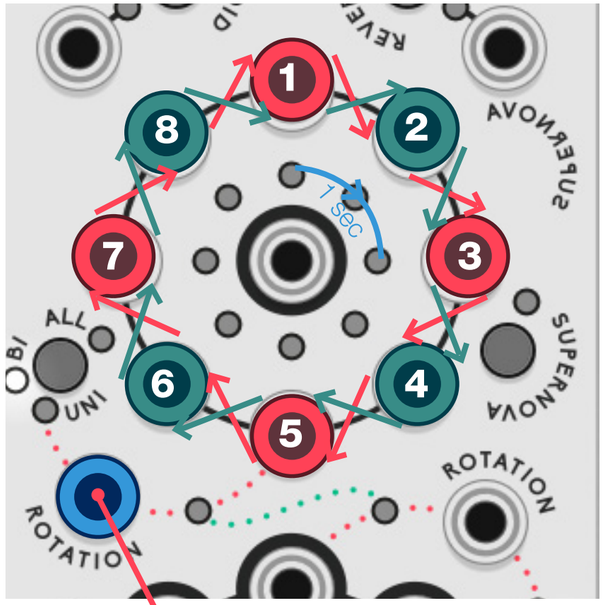


PULSARS

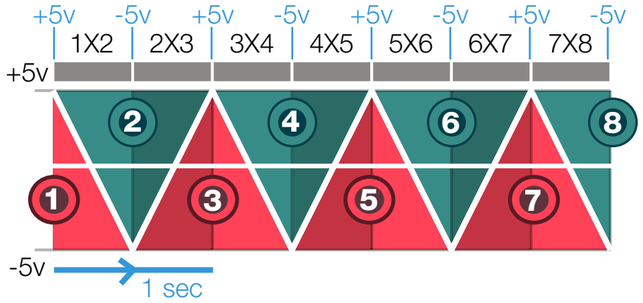
neutrons powered rotating crossfader

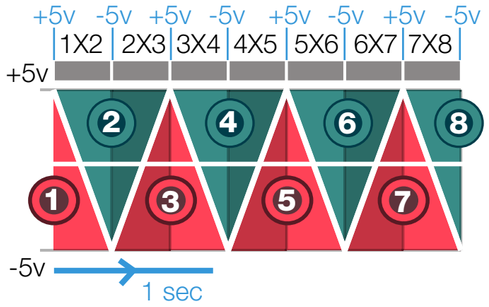
A pulsar is a star rotating around its axis and emitting very high and precise frequencies on its spinning axis.

PULSARS is a rotating 8 to 1 and 1 to 8 selectors with crossfade in between each signal. It can be used to create cross fade mix of audio, complex wave tables with CV, standard sequential switch or extreme effects when turning at audio-rate speed.



white line on the graph +/- 5 volts





At each peak, PULSAR starts another crossfade sequence. Any value between +5 and -5 will be interpreted as a mixed value between the first and the second source.

The speed of the sequence is defined by the rate of the rotation signal.

PULSARS

neutrons powered morphing

MC2 is the energy needed for a pulsar to spin on itself.

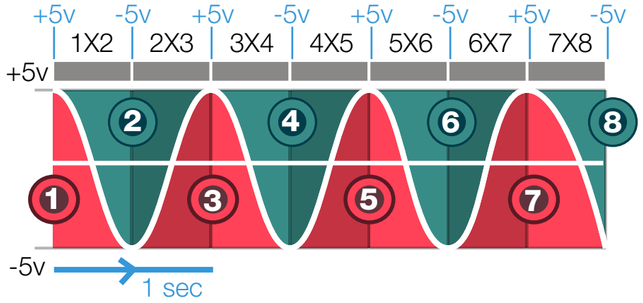
Pulsars needs a 5v binaural CV signal to power its rotation (**rotation IN**). When no signal is connected to the second pulsar, they are both driven by the first rotation signal

The first connected cable defines the start of the cycle

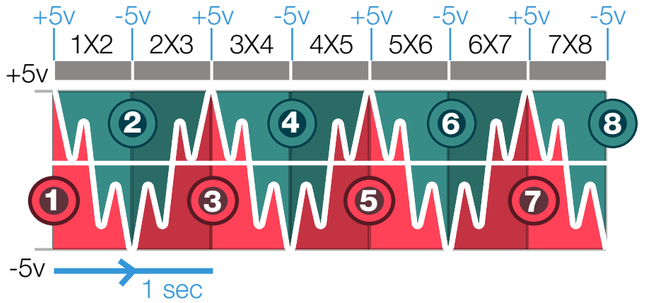
The rotation starts at **source 1** when it receives +5v.

It will reach **source 2** when it receives –5v

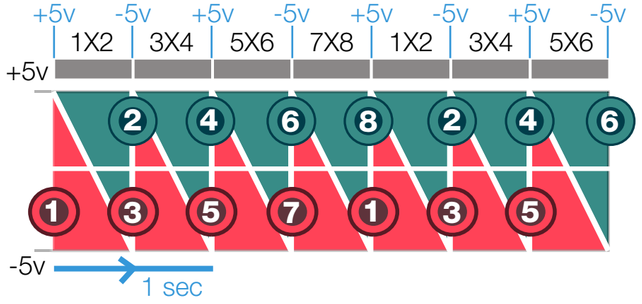
It will reach **source 3** when it receives +5v…



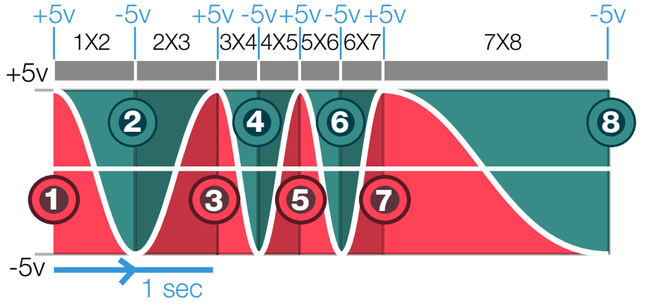
A triangle wave will make linear crossfade, while a **sine wave** will create an exponential cross-fade



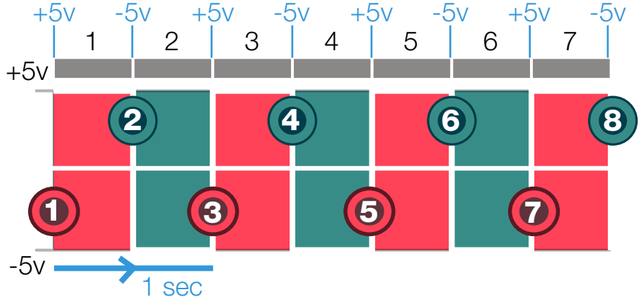
A folded wave source will create backwards and forwards effects



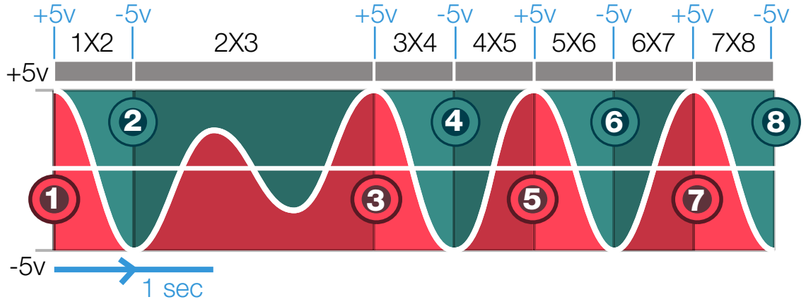
A sawtooth wave will switch from one step to another without transition



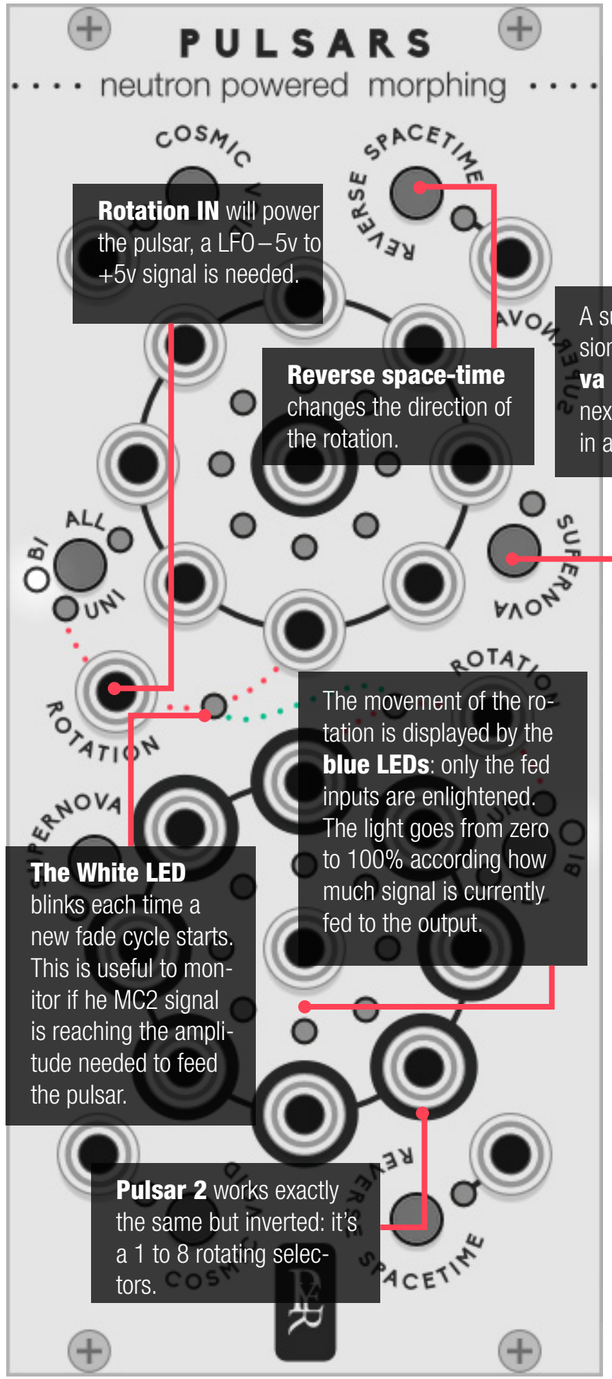
Modulating the rate of the signal will make some steps shorter and can create some rhythmic variations



A square wave won't create a cross fade effect, it can then be used as a standard sequential switch.



Modulating the amplitude of the signal can create some interesting rhythmic effects as it only switches to the next step when it reaches +/- 5 volts.

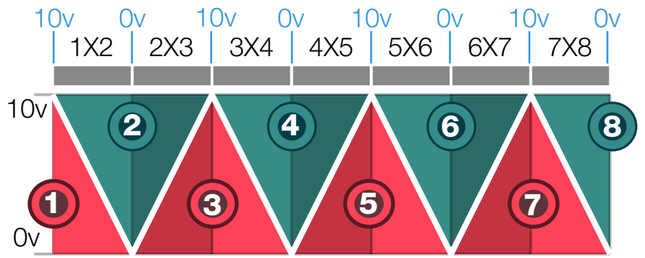


PULSARS

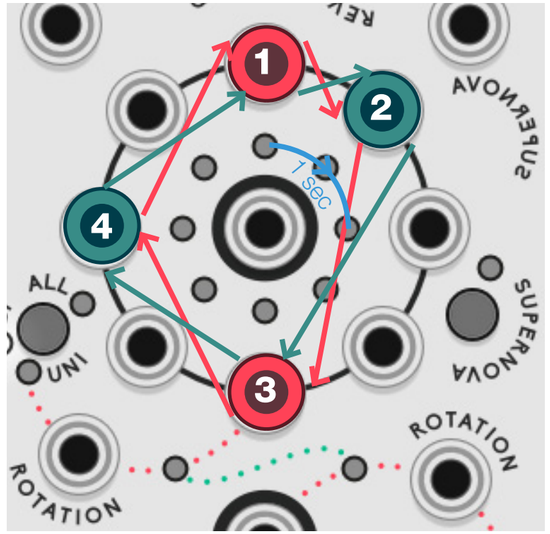
neutrons powered rotating crossfader

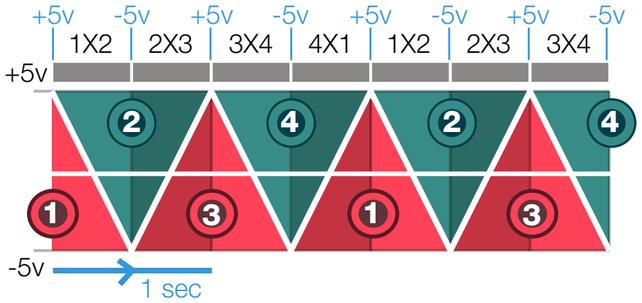
Unipolar – Bipolar

The MC2 is set to receive a –/+5v bipolar signal. When configured to Unipolar, this will set the rotating IN to receive a 0/10v to react with envelope generators. A new cycle will be started each time the MC2 Signal reaches 0 or 10 Volt.



Cosmic void mode **OFF**

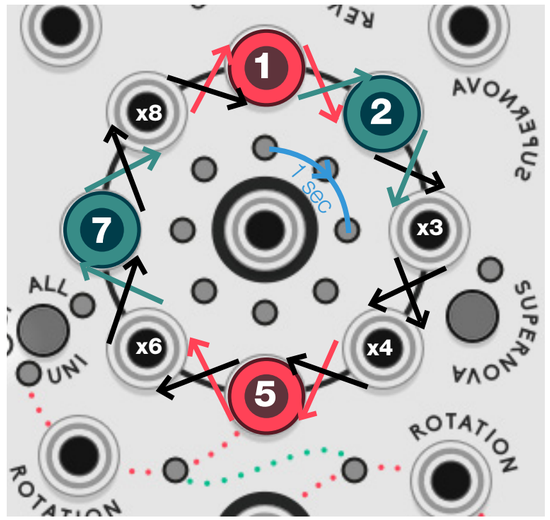


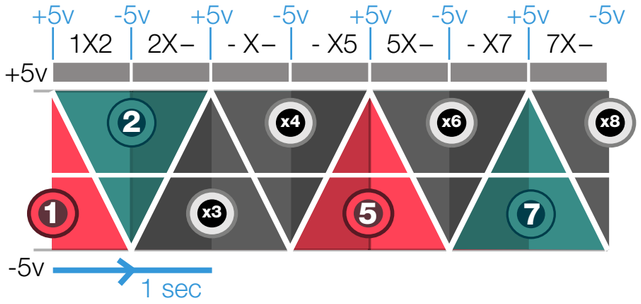


P U L S A R S

neutrons powered rotating crossfader

Cosmic void mode **ON**

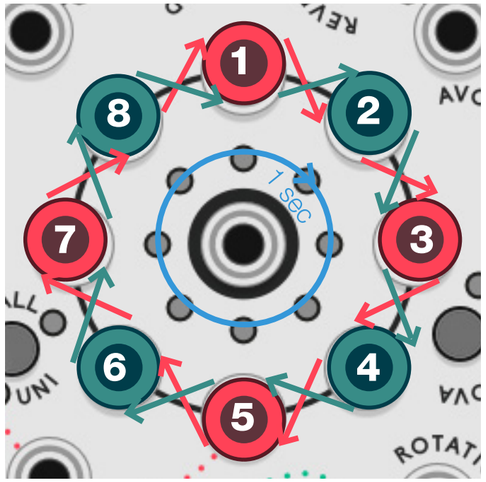




Cosmic Void mode

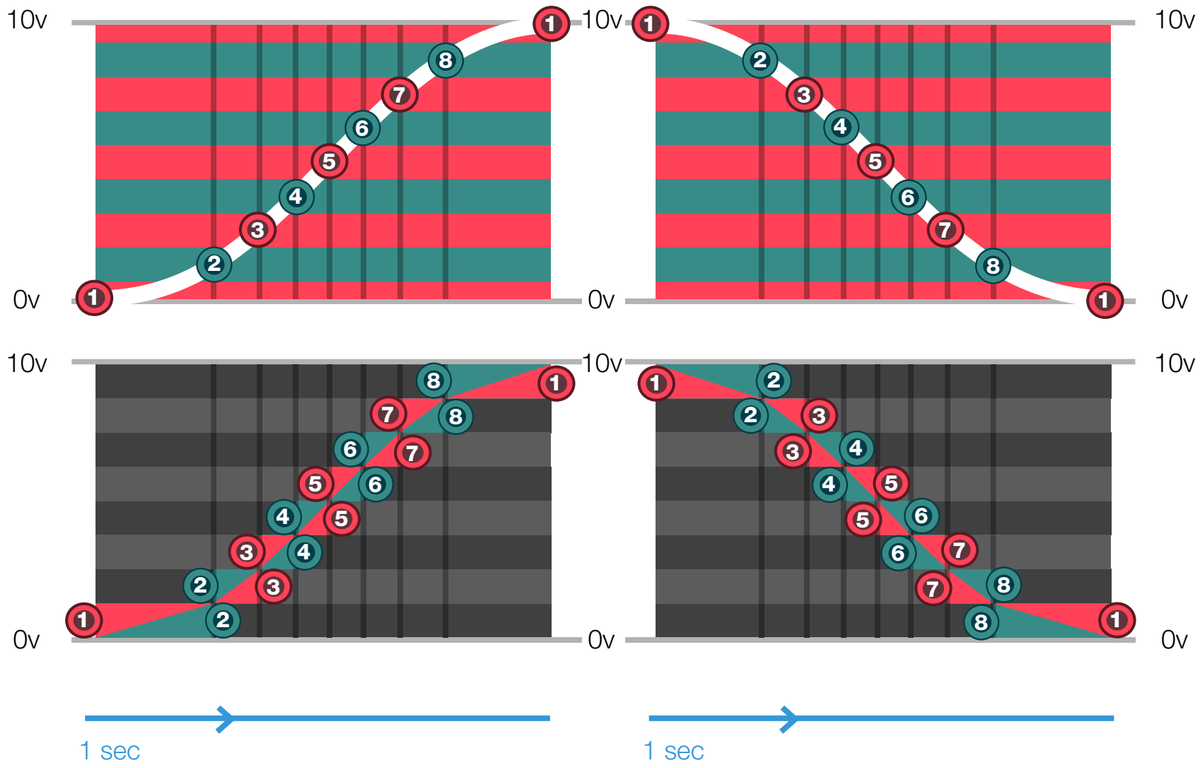
By default, Pulsars takes only account of the fed inputs, wherever they are plugged along the way. If only 3 inputs are fed, Pulsar will be a 1 to 3 switch.

When the cosmic void mode is on, PULSARS take account of the empty inputs, it will always be a 1 to 8 switch, and if it goes through a non-fed input, it will send a zero volts signal. This mode is useful to create rhythmic or tremolo effects.



P U L S A R S

neutrons powered rotating crossfader



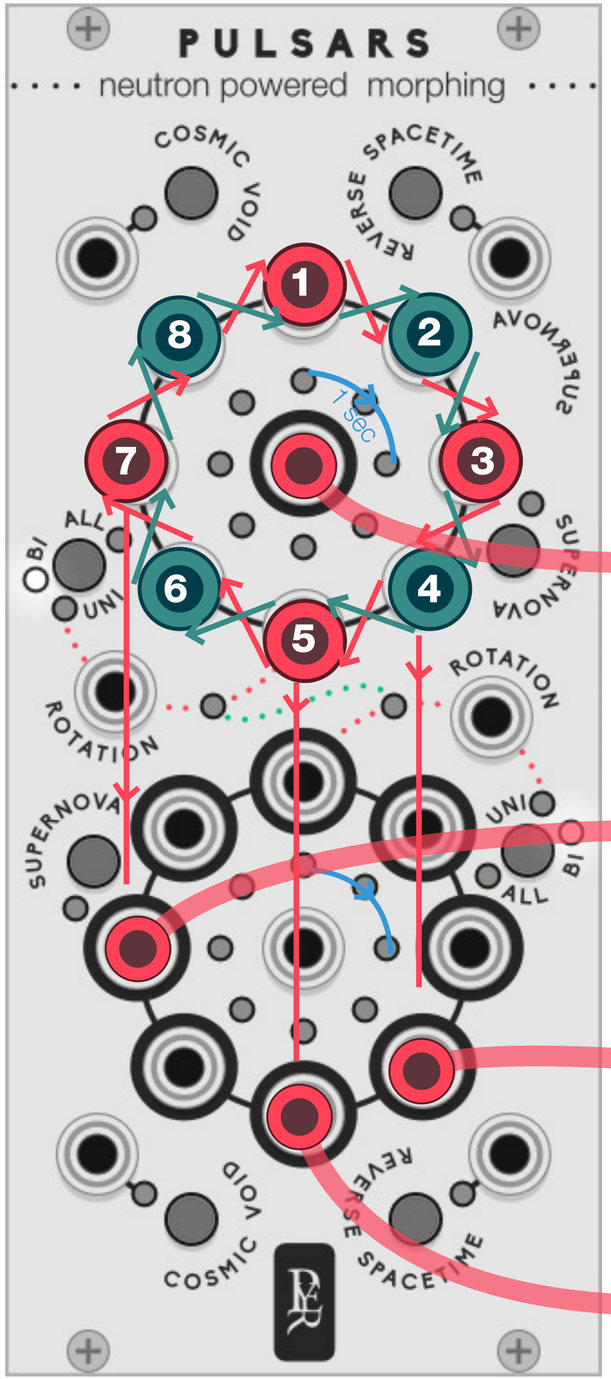
All mode

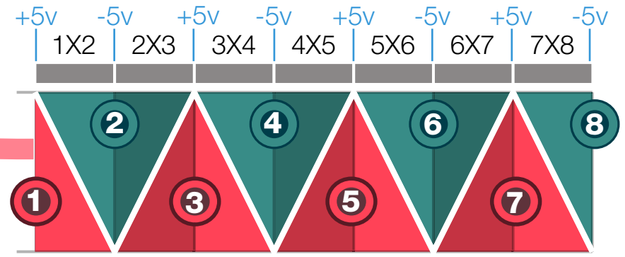
While the uni and bi mode are using the rotation signal to orchestrate a fade between each of the 8 sources, the mode “all” manages a scan trough all the sources in a signle circle.

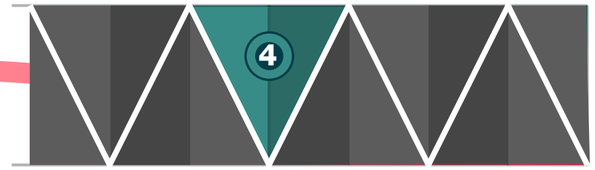
On its way from zero to 10V, the rotation signal will scan every connected jacks from 1 to 8.

Once the rotation signal has reached 10 V, the cycle get inverted and continue it way from jack 1 to 8 as it goes down from 10 to 0V to avoid a back and forward effect and makes a true infitite cycling.

This mode is compatible with the reverse space time, cosmic void and supernova features. The all mode can be usefull in 8 to 1 out for complex wavetable scaning effect. The 1 to 8 out can be used for octophonic rao-tating effect.





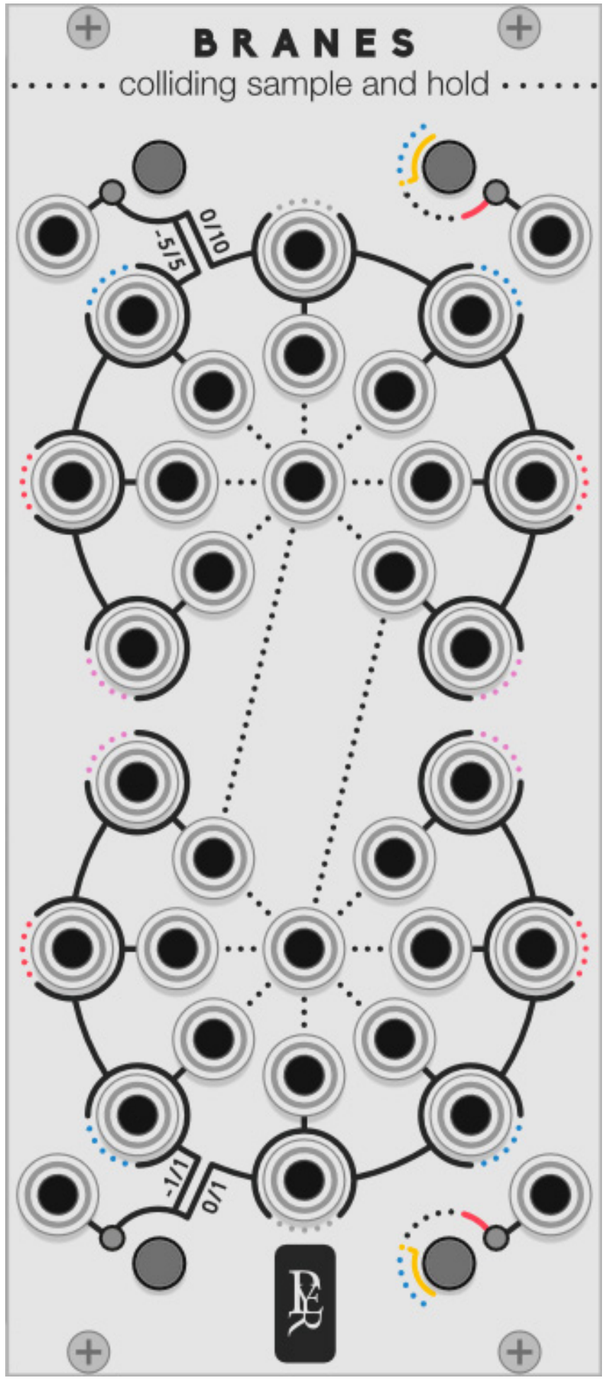


PULSARS

neutrons powered rotating crossfader

Multidimensional trick

If no input is connected to Pulsar 2, it will send the separate input of Pulsar1 amplified by its rotation. This is useful if you want to have stereo effect of post treatment of each source.

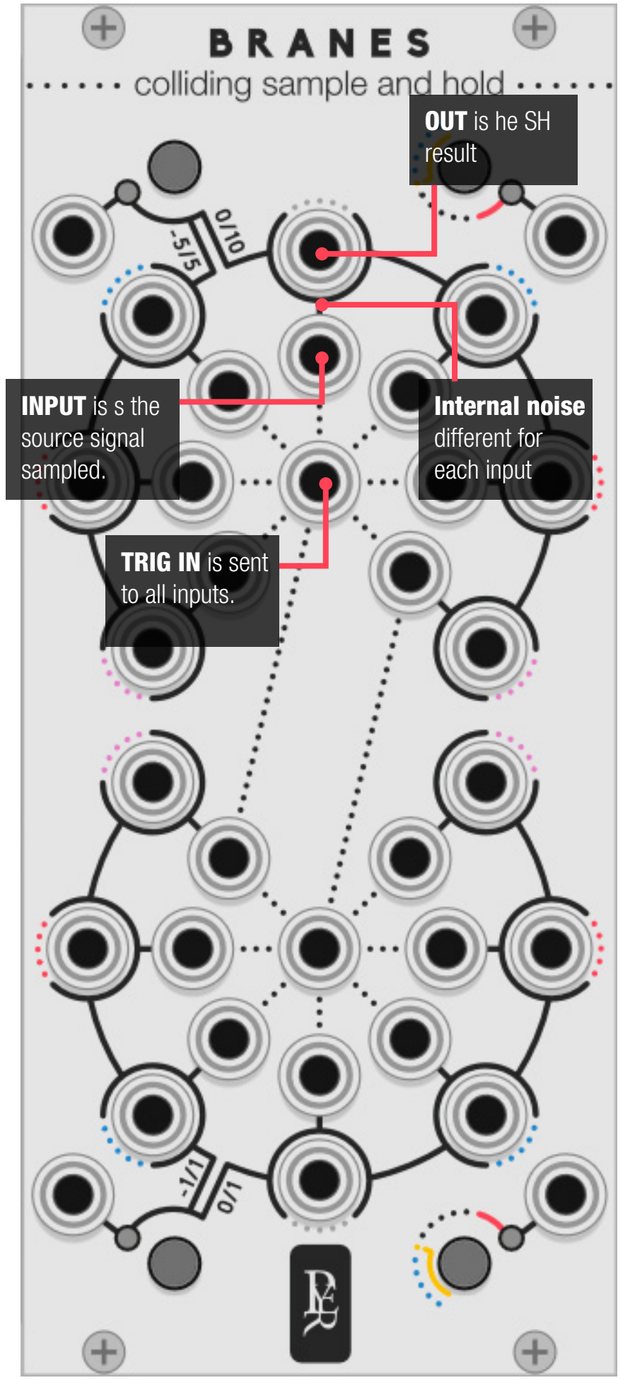


BRANES

colliding sample and hold

Branes are multidimensional objects involved into the ekpyrotic universe theory that describes two parallel universes colliding to create our world…

BRANES is 2 groups of seven S&H driven by the same trigger source. Two of them receive added trigger clocks for polyrhythmic effects.



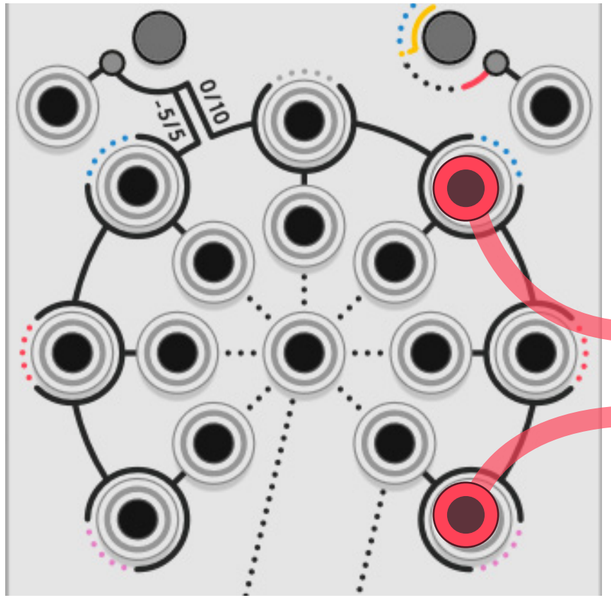
BRANES

colliding sample and hold

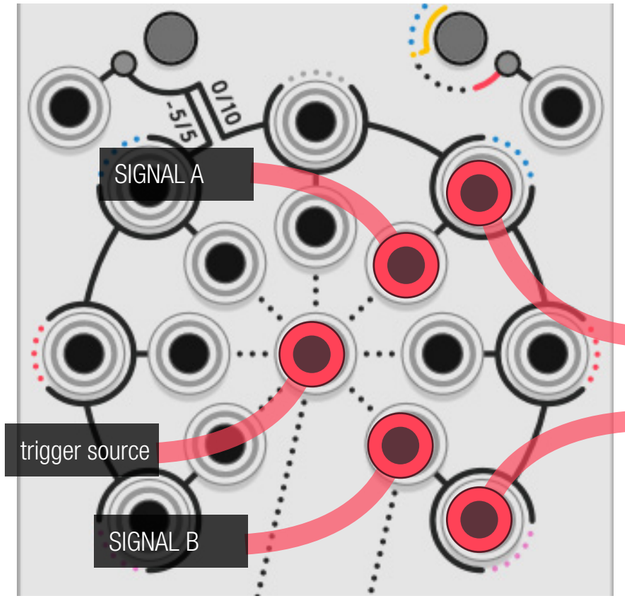
The Idea came from the Buchla Music Easel with its 4 uncorrelated random sources: random and different

Each output has its own internal noise generator, with different colours so you can have 7 different random CV driven by the same trigger without any external input.

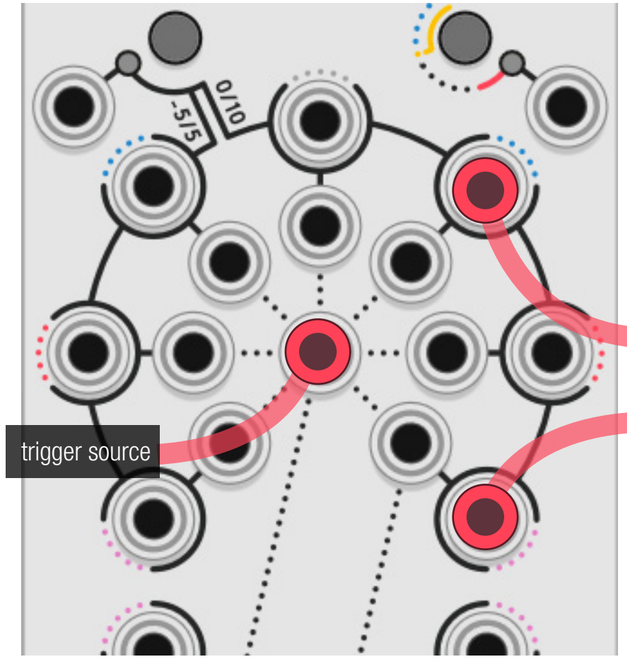
The noise generator is bypassed when an input source is connected.



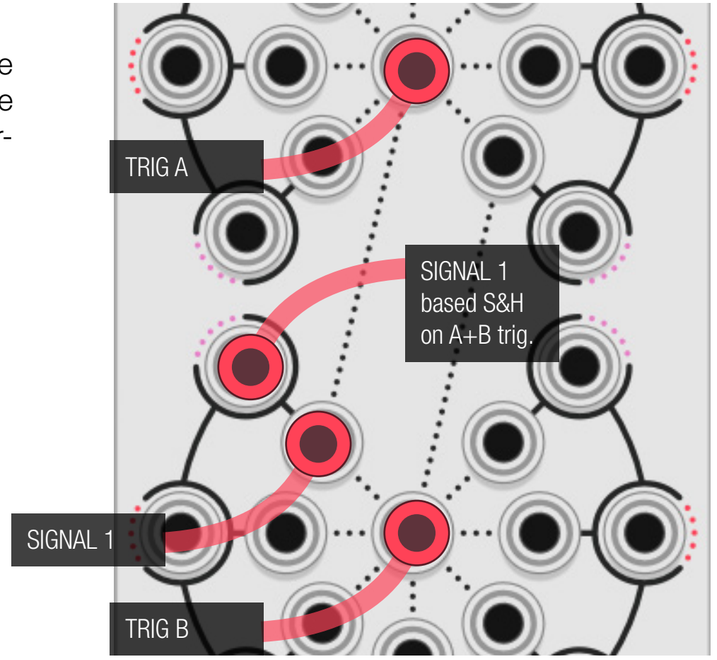
When no trigger or input source is connected: The outputs are just noise sources, different kinds of noise for each.



When a trigger and an input are connected, the noise generator is bypassed, and the S&H uses the input as material.

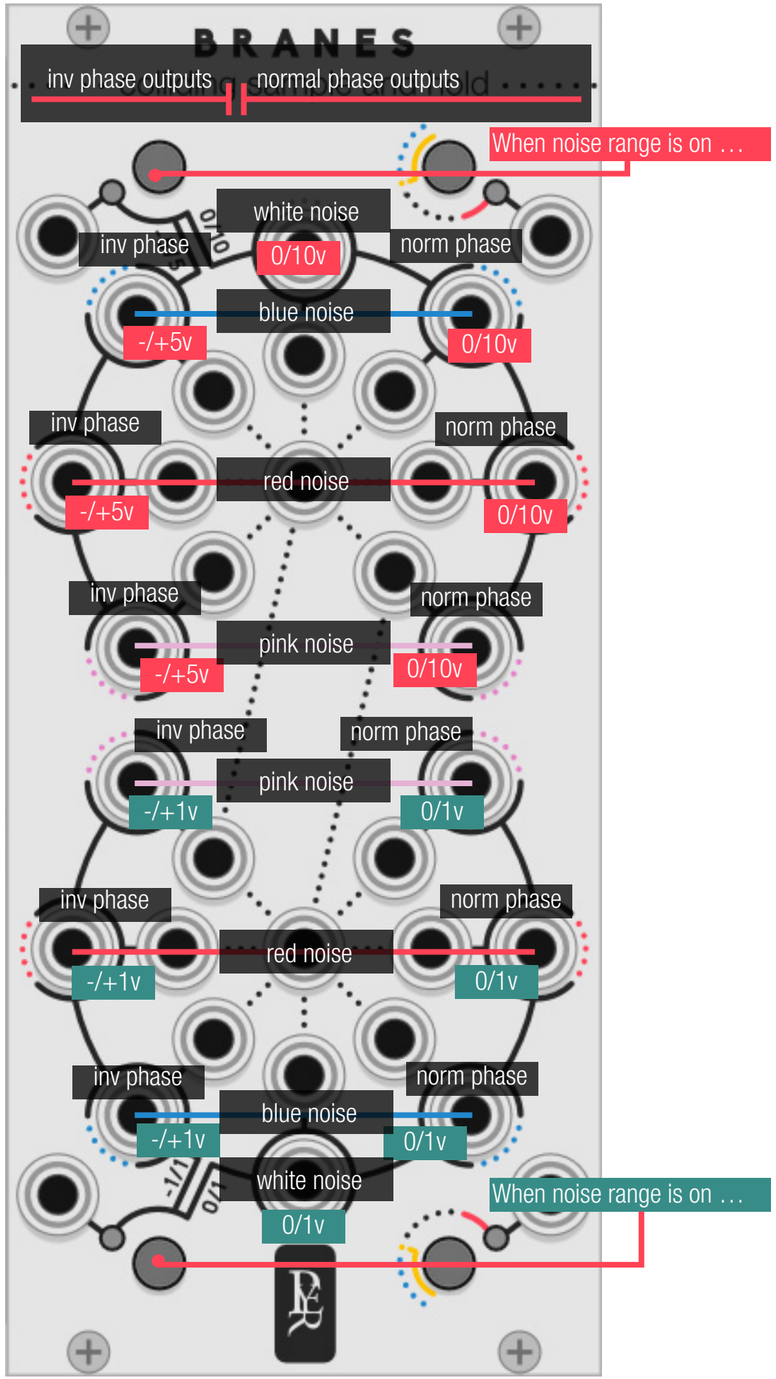


When a trigger is connected, the outputs use the trigger to sample and hold their internal noise generator and send random CV.



The two Colliding S&H

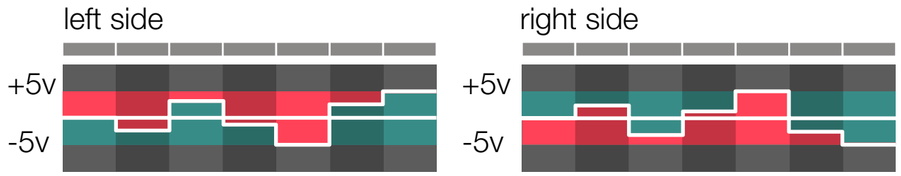
They work as expected, but their trigger source is an addition of the two trigger sources. It allows you to create polyrhythmic melodies.



The inverted phase noise generators

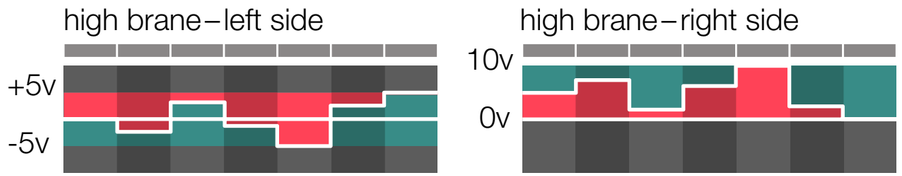
Every noise generator on the left-hand side is the inverted phase version of the right-hand side.

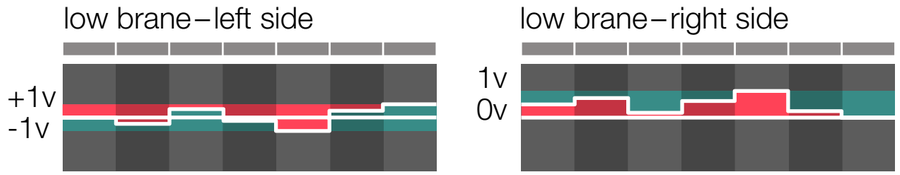
It is not really useful as a noise source, but when the noise is sampled, every left-hand side output will provide the opposite value of the right-hand side.

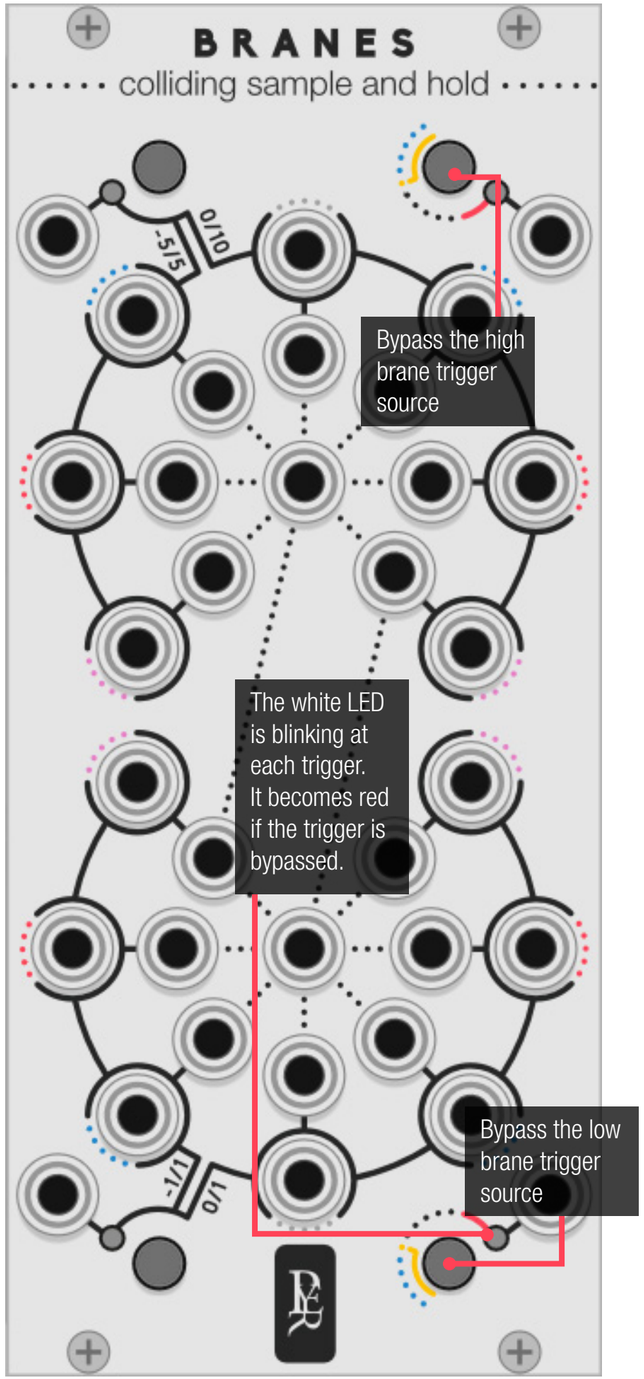


Range noise button

The noise generators are emitting signals from -5 to +5 volts, so will be the sampled signal. This can be too wide for pitch control, or too small for 0 to 10 volts modulation input. While this is usually fixed with an external VCA, the noise range button will change the range and offset of each noise generator according to the following rules:

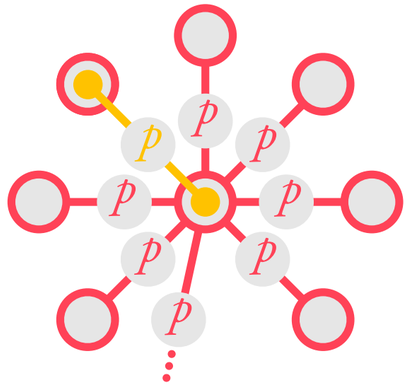






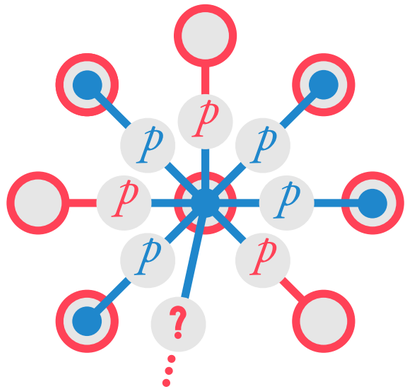
Yellow mode

The trigger can only be in one place, but the place can't be defined with certitude.



Blue mode

The trigger can be at several places at the same time, but it can't be known with certitude.



The vibrations button

When the trigger source connected, the vibration button lights on: the brane starts to vibrate and to sample the signals on every trigger. When the vibrations are bypassed, every output will send the unsampled source input or noise.

This is useful to switch between the original signal and the quantised one.

It can also be used to momentary bypass one of the two triggers of the colliding outputs.

Young Slits mode

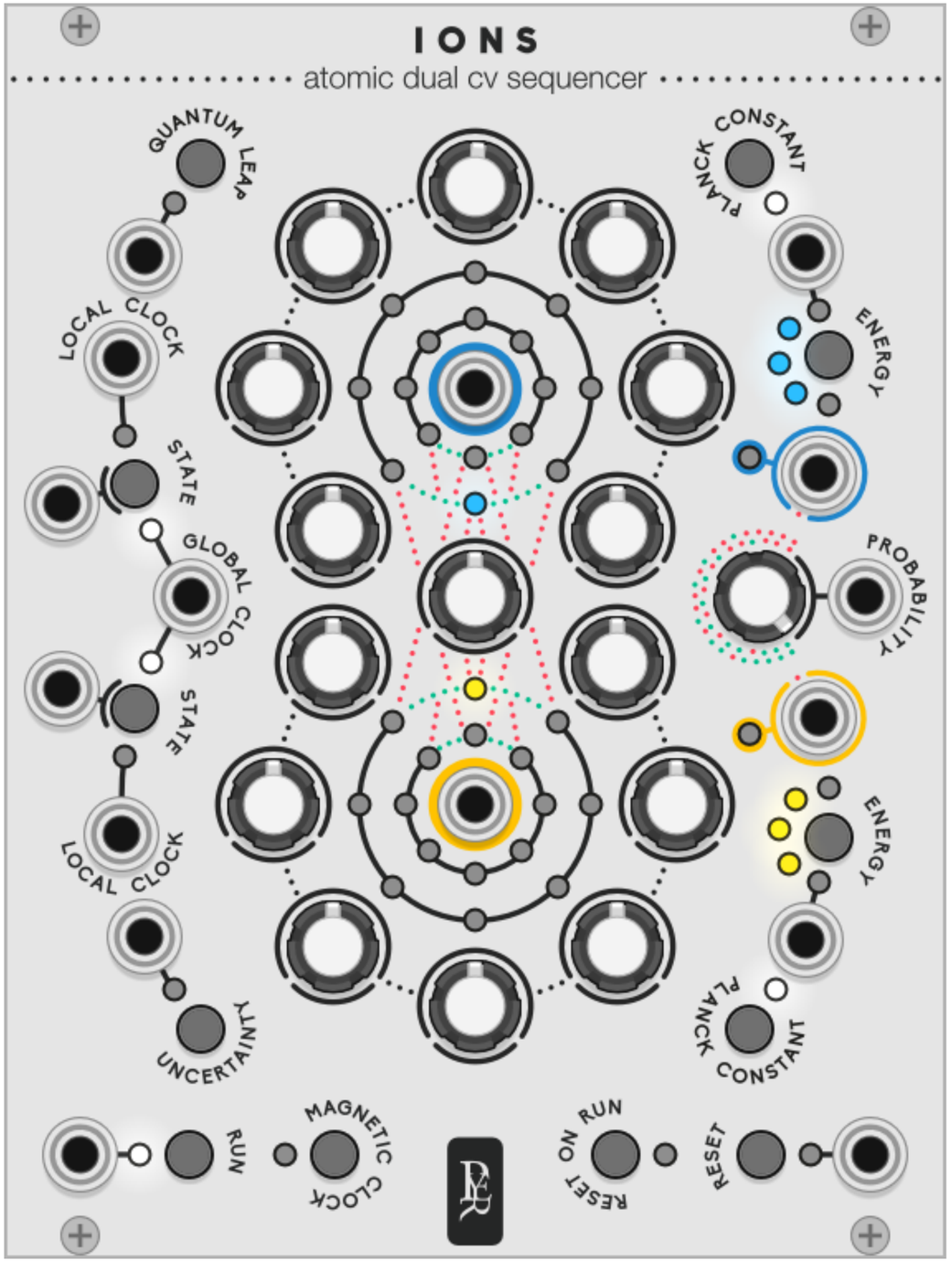
This mode can be accessed by holding the button for 2 seconds. Holding it again will leave the mode. It can also be reached through the right-click menu. The trigger input toggles the state between yellow and blue.

This mode is inspired by a famous experiment by Thomas Young, who shot electrons thought a surface with two slits, to see how they would pass through.

In this mode, the integrated SH sections may or may not receive the trigger. In addition to generating randomness, Branes can now decide whether it will generate it or not. It can be useful for less systematic modulation, but also for complex polyphonic melodies (quantizer needed of course).

In the Yellow mode, only one connected output at the time will receive a trigger, the other ones will hold their own previous values. At each new trigger, every output has the same probability to be selected to receive the trigger. This mode has no effect when just one output is connected.

In the Blue mode, every output has its own 50% chance to receive a trigger or not. The ones that won't receive their trigger will hold their own previous values.

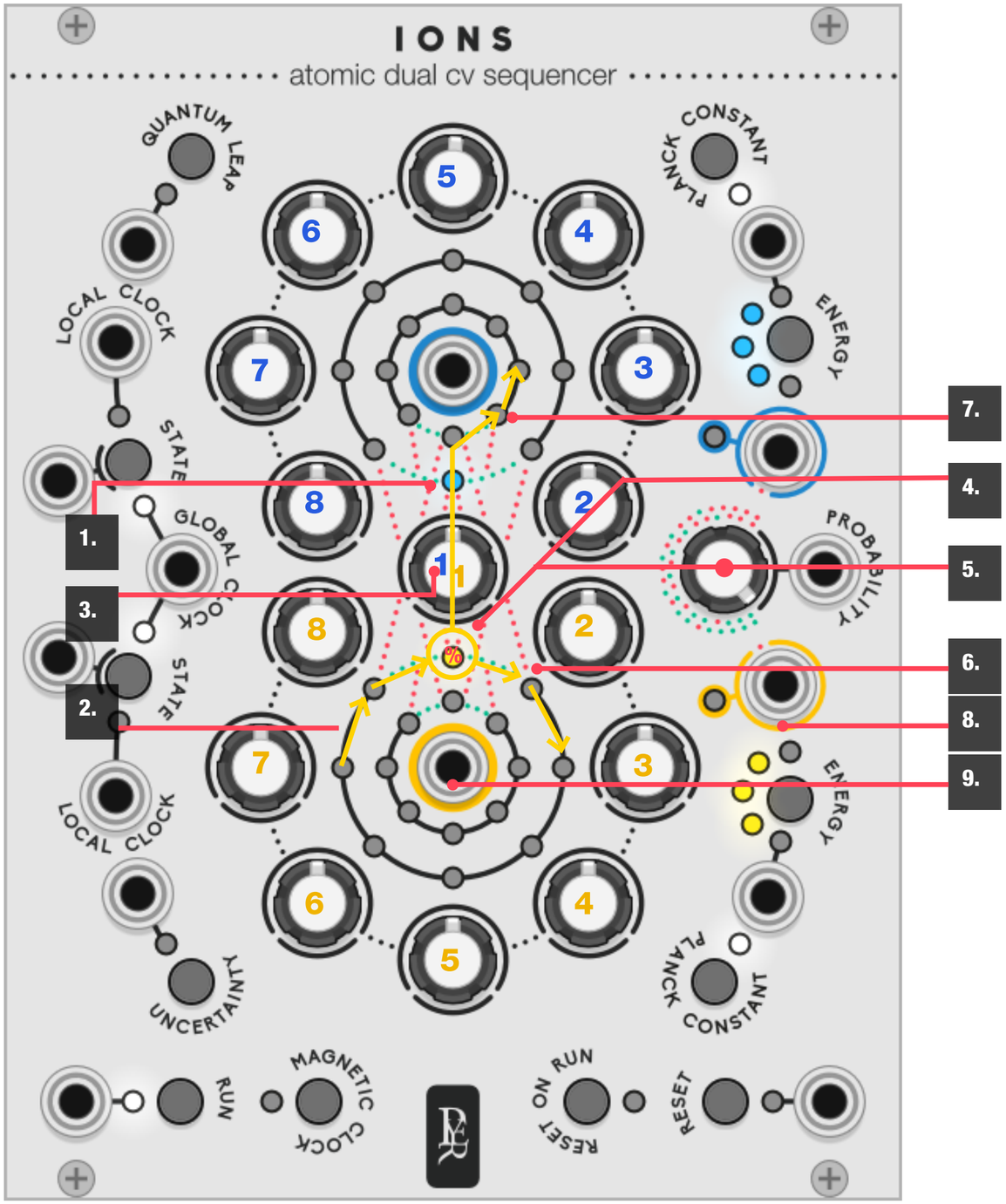


IONS

atomic duophonic voltage sequencer

An Ionic bond describes two atoms that exchanges electrons.

IONS is a two voices sequencer. While each voice has its own sequence, they can exchange their sequences as easily as an electron can jump from one atom to another.



How it handles the sequence

1. The two CV voices are the blue electron and the yellow electron, they each gravitate around their blue and yellow core (CV OUT).

2. The electrons are both cycling through their own 8-step sequence.

3. They share the first step of their own sequence.

4. Each time they pass through step 1, they have a **probability to switch to the other core** and run on through the other sequence. The electron still emits from its original output, but it steals the notes from the other sequence.

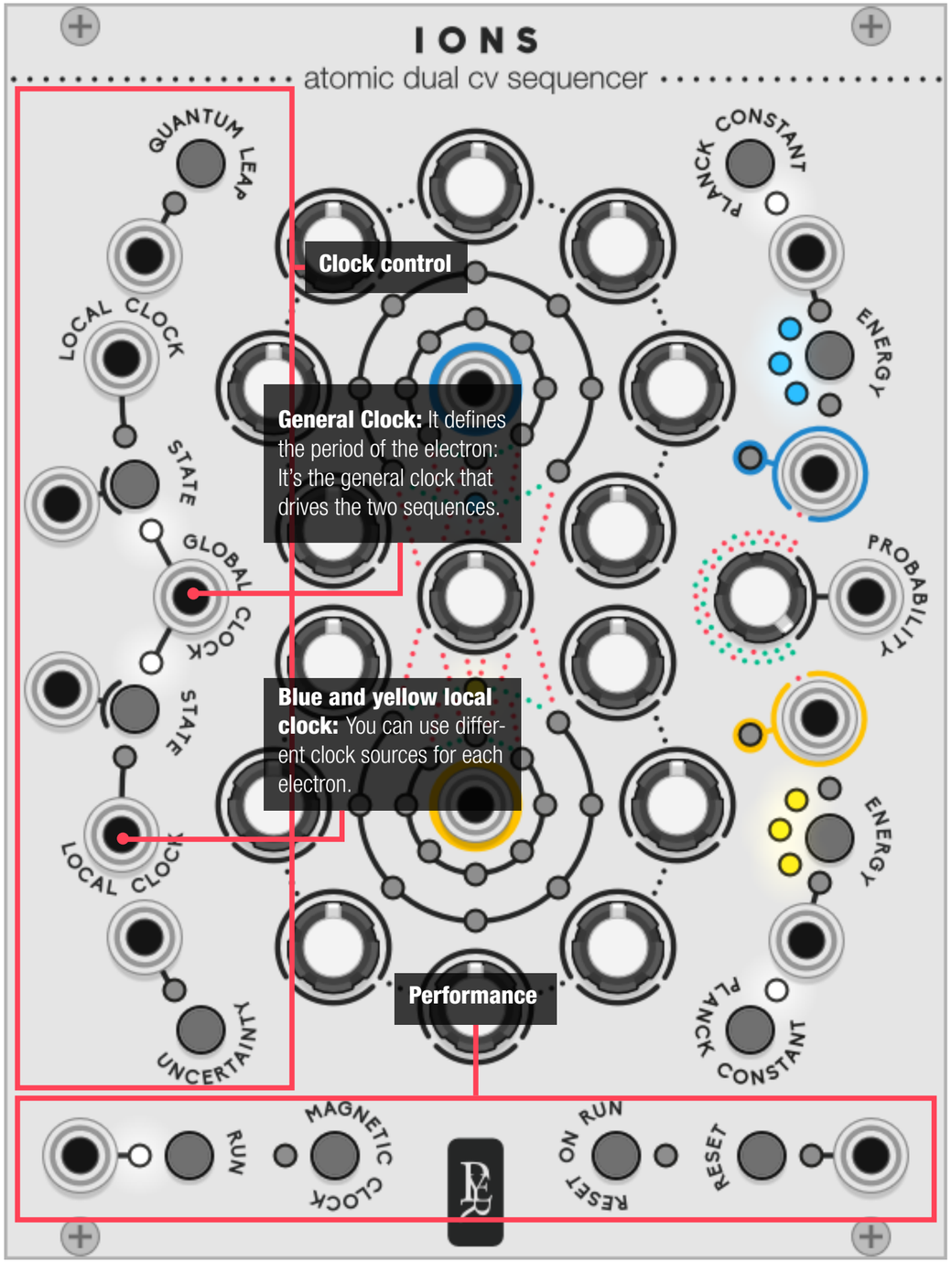
5. The probability to switch is controlled by the probability knob. And can be automated. While they share the same probability knob, they don't have the same engine, so they might be both together on the same core.

6. With a **probability of zero**, they will never switch and always stay a proper 2 voices **8 steps seq**.

7. With a **probability of 100**, they will always switch and always stay a proper 2 voices **16 steps seq**.

8. A trigger is emitted each time an electron jumps from one atom to another.

9. The core is always linked to the original electron. The yellow core is always emitting the CV values that the yellow electron is passing through, even when it gravitates around the blue core.



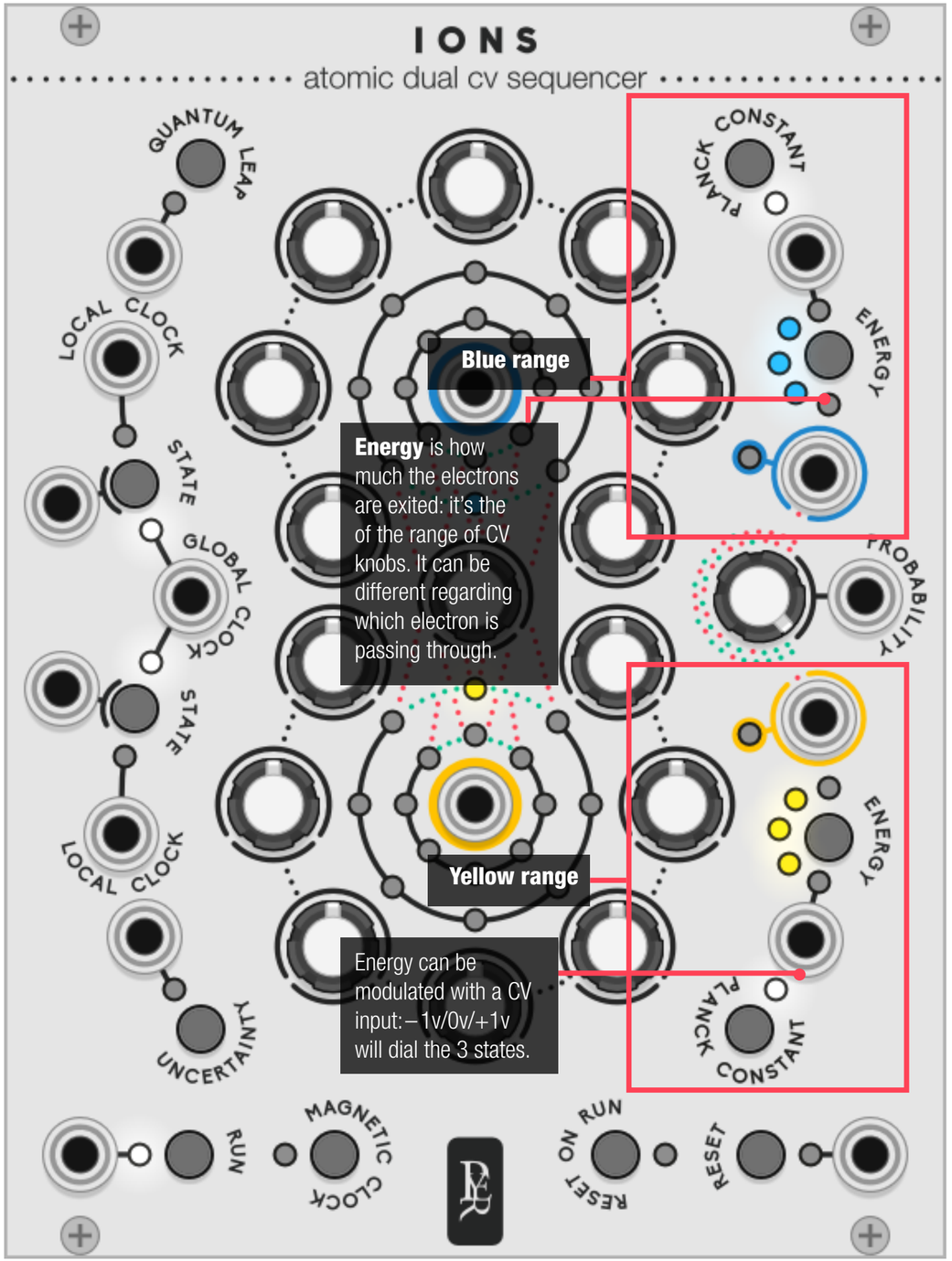
How it handles the clock:

IONS does not have an internal clock. You can use a clock for driving both sequencers at the same time, or a different clock for each sequencer … or both at the same time.

The State button: in our world, nothing can be two opposite things at the same time. But in the quantum world, an electron can have one status, or another … or both at the same time.
The state button cycles between 3 stages: each electron can be driven by the global clock, or their own clock … or the addition of both, for polyrhythmic effects.

State Mod can be modulated with a CV input: –1v will use the local clock. +1v will use the global clock. Anything in between will use both clocks

The magnetic clock will excite the electrons in an alternative way: It's a manual clock. It is active when the experiment is not running, to set the CV value step by step. It is also active when the experiment is running, to interact with the sequence manually, adding a bit of human mess.



How it handles the CV values:

Energy is the range of the CV knobs. Each electron has its own energy setting. When passing through a CV step, the blue electron can interpret the value with a different range than the Yellow one would do if it passes through the same step. The behaviour of energy is depending on the Planck constant.

The Planck Constant: In 1900, Max Planck discovered that the electrons were not sharing energy on a smooth and continuous way, but by very small bits: 'quantums'. The Planck mode will quantise the CV output and modify the energy behaviour.

When the **Planck constant is OFF**, IONS is a smooth CV sequencer with Energy defining the range of CV:

-/+ 1 volt

-/+ 5 volts

-/+ 10 volts

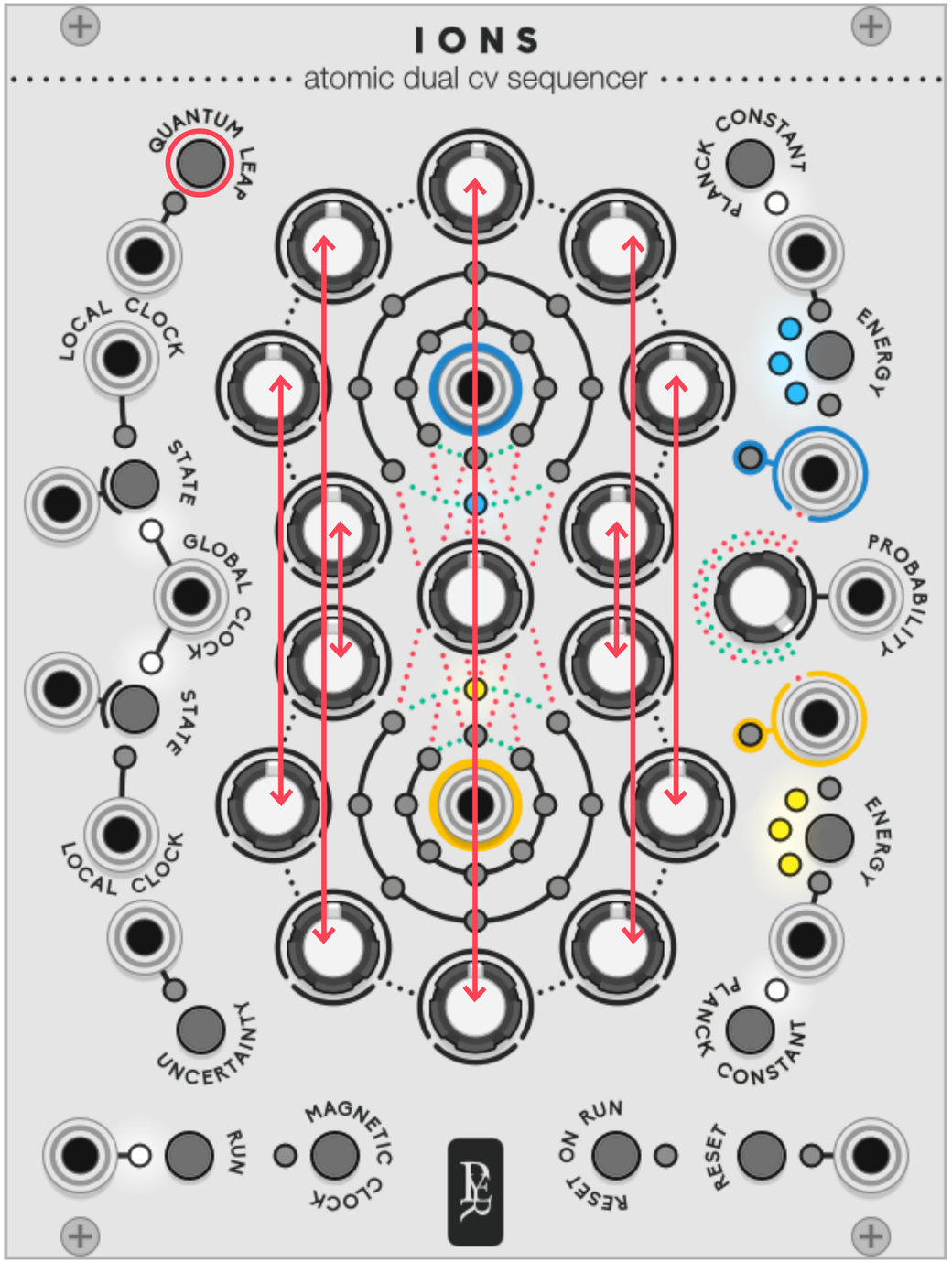
When the **Planck constant is ON**, IONS is a chromatic sequencer with Energy defining the range of CV:

1 octave

3 octaves

5 octaves

The Planck constant can be set for each channel separately to generate both a melody and a free CV sequence at the same time.



Alternate Modes

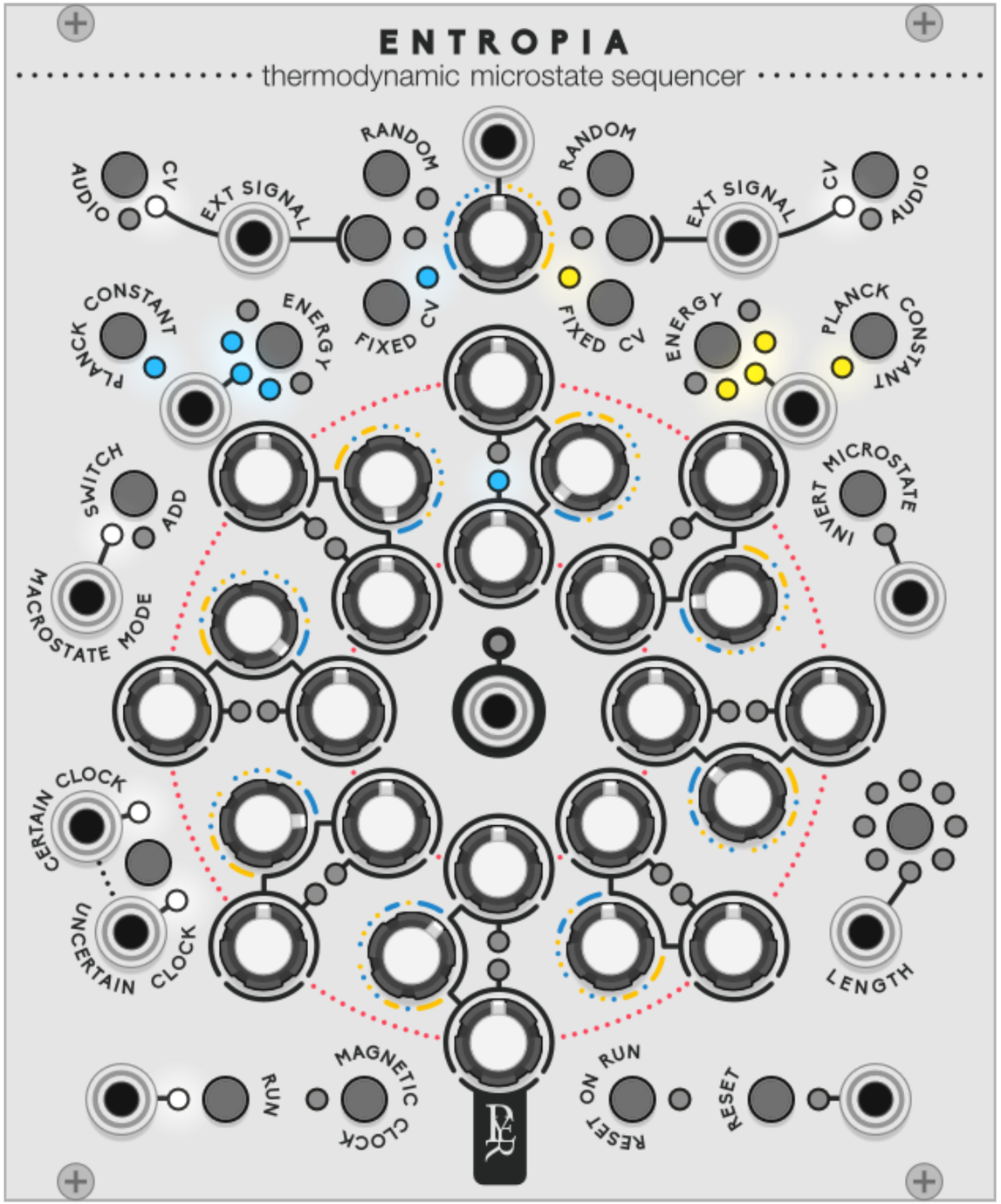
Quantum leap introduces a strange effect from quantum physic. Every step can be a gate to switch to the other core. By a smart automation of the probability knob, you can run an 8 step seq and decide to steal some notes from the other seq to have some variations.

Uncertainty principle. In quantum mechanics, Heisenberg discovered that there is no way to know with certitude both the speed and the position of a particle. Uncertainty will add different flavours of randomness in the position of the electron.

- Every trigger sent by the local clocks will move the electrons forward on a random number of steps (small values are more likely, for musical purposes).
- Every trigger sent by the reset button will place the electrons in a random place in the sequencer.
- Every trigger sent by the global and magnetic clocks will continue to work normally, one step at the time.

With Uncertainty mode ON, 4 levels of randomness can be achieved:

- **Order:** using only the global clock will move the electrons on a regular step by step way.
- **Casual random:** using both global and local clock input, with a regular clock on global and an occasional clock on local (divided, gate sequence or even manual trigger) to have some random jumps in a regular sequence
- **Linear random:** using only the local clock to have a forward random walk.
- **Chaos:** sending a clock into the reset input to have a complete random sequence. In this case, the jump probability becomes useless.



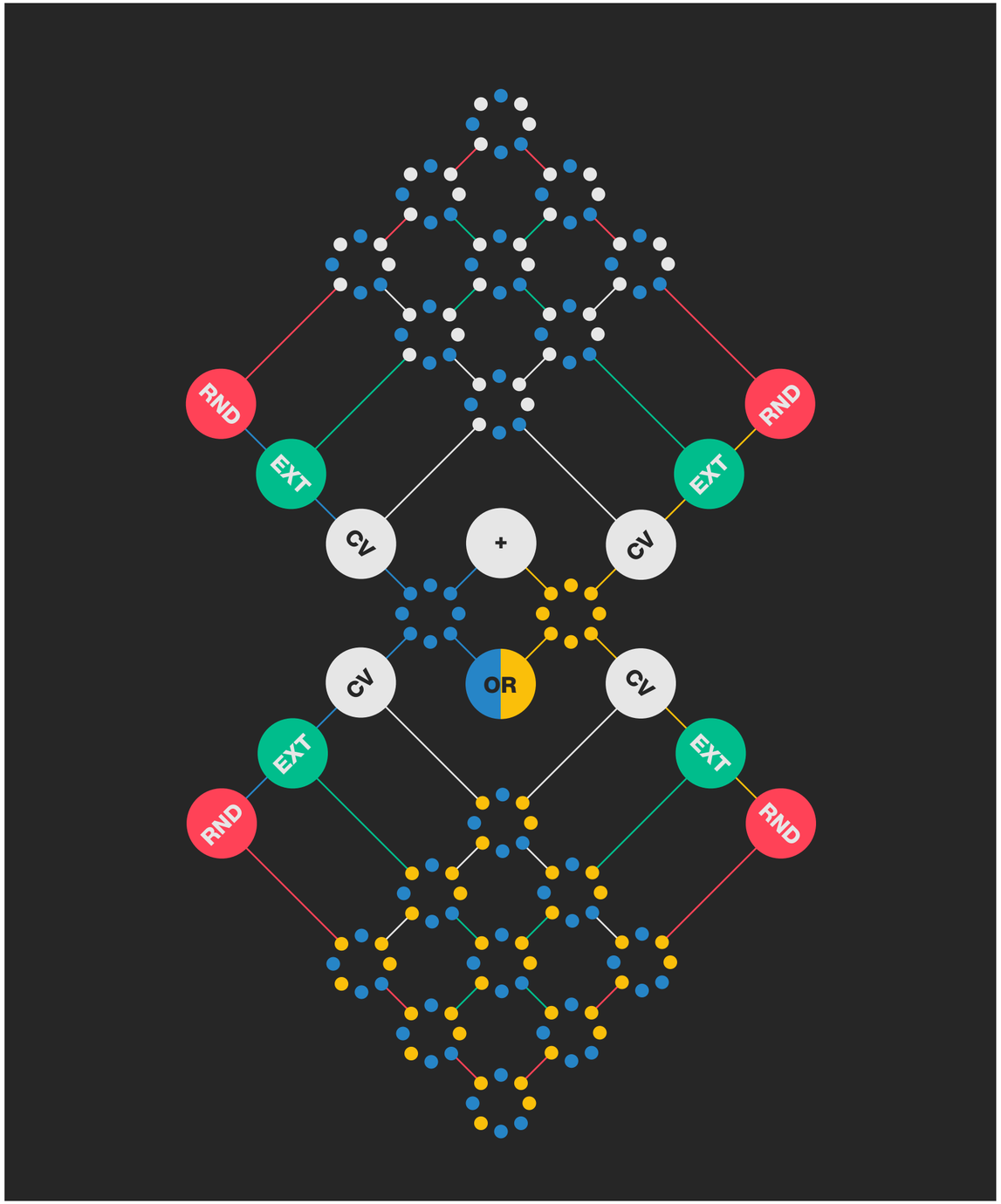
ENTROPIA

thermodynamic microstate sequencer

Entropy is a measure of disorder in a system: many microstates of atoms that create a rich and complex macrostate.

ENTROPIA is an 8-step sequencer with two values per step, and a probability to play one of the two values. Both values can be a defined sequence of voltages, a range controlled random source, or an external source.

While the controls might be intimidating, this manual will present the module in 3 concepts: the two sequences, the way they blend, and their nature to be chosen by the user.



ENTROPIA

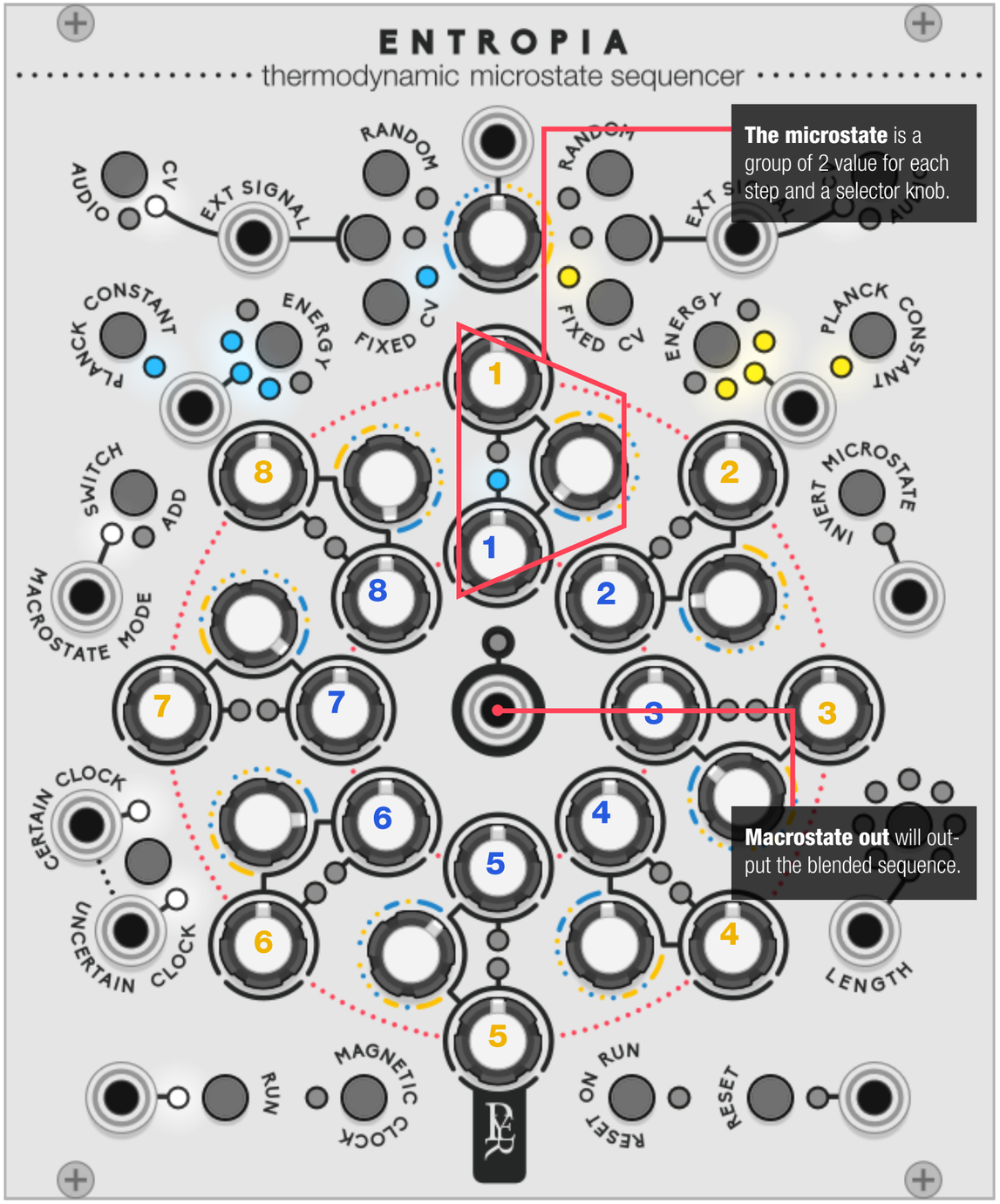
thermodynamic microstate sequencer

While the controls might be intimidating, this manual will present the module in 3 concepts:

The 2 sequences
- Blue
- Yellow

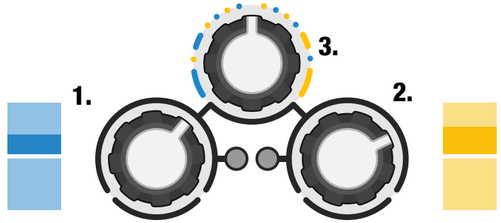
The 2 modes to blend them together
- Switch (OR)
- Add (+)

The 3 sources for each sequence
- Fixed CV
- External
- Random

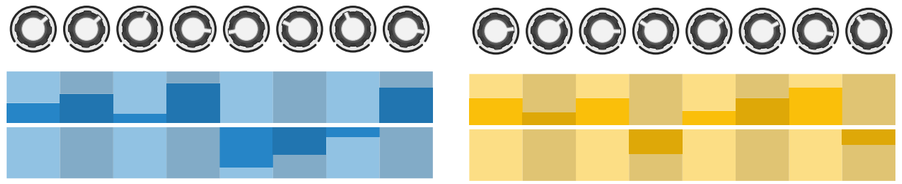


Microstate and macrostate: the two sequences

Each step of the sequencer is a **microstate:** a group of 3 knobs:
1. The blue state – primary (inner circle sequence)
2. The yellow state – secondary (outer circle sequence)
3. The probabilistic state selector

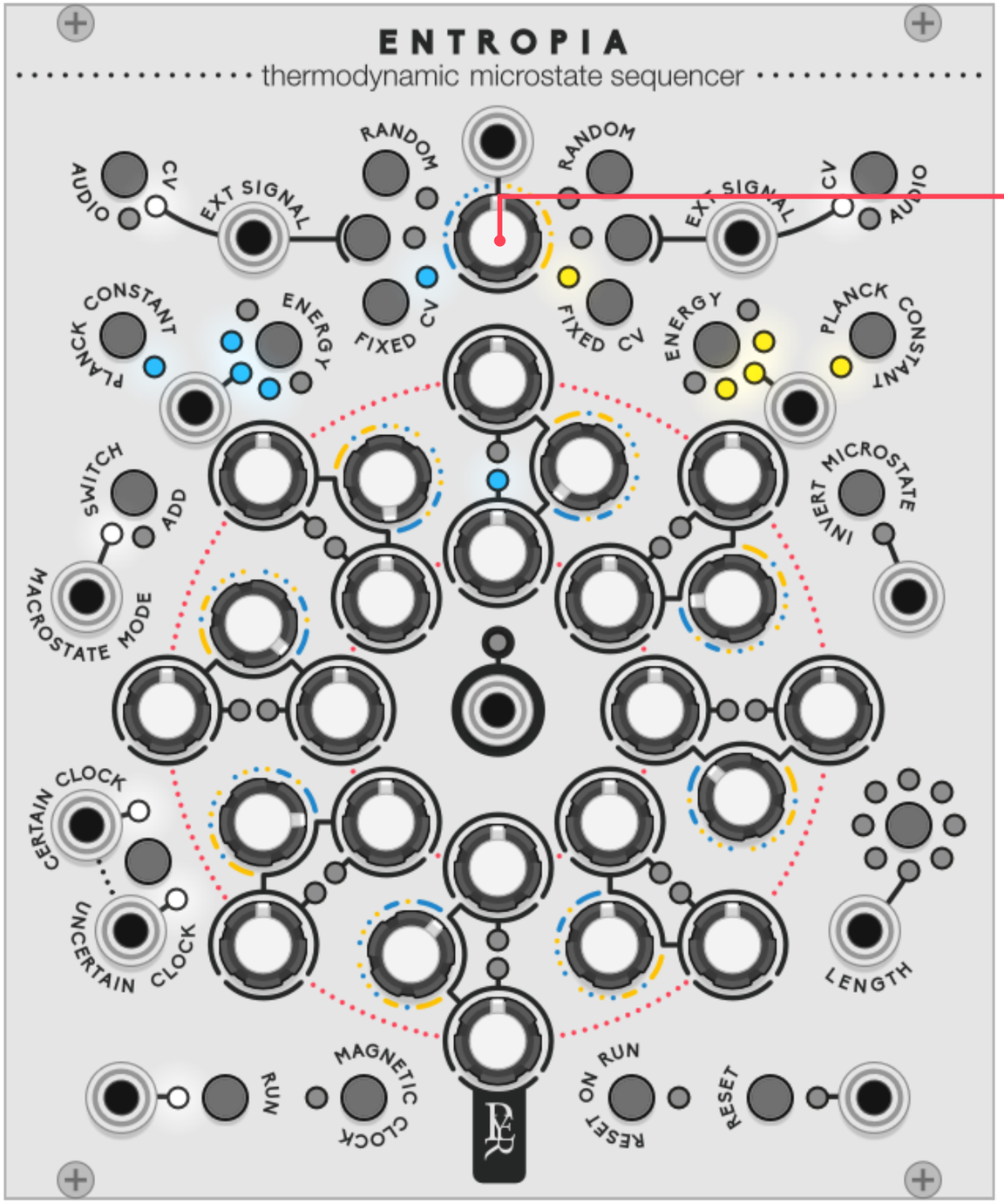


All the blue knobs and the yellow knobs determine a **blue and a yellow sequence**. The position of the state selector will define the probability to play the blue value, or the yellow one. The resulting sequence is the **macrostate.**



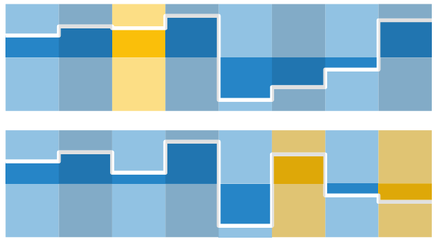
- All selectors set to full blue will only play the blue sequence, same case for yellow settings.

- Some selectors set to full blue and others set to full yellow will mix the sequence in a determined way.

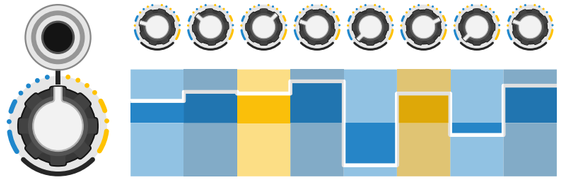


- In between value will create some probabilistic choices for each step.

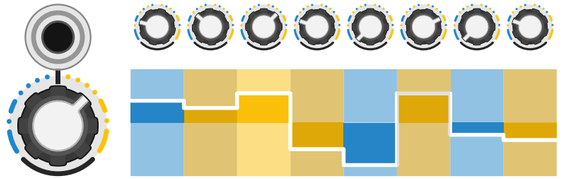
The probabilities for each step can be controlled all together by the **knob on the top**, which will add an offset to each knob. This knob is CV controllable with a –5V to +5V range.



- When the offset knob is centred, it does not affect the knobs.

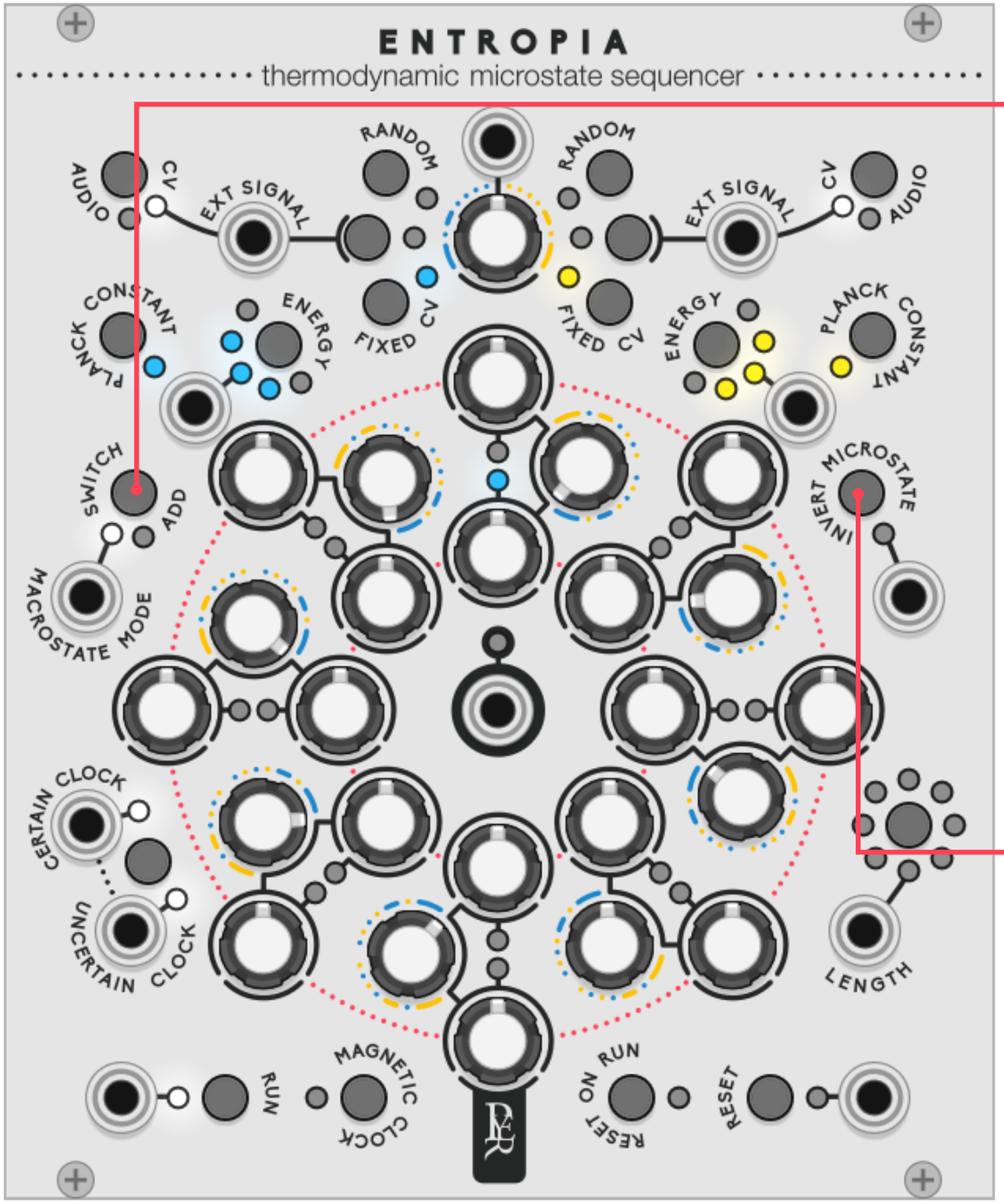


- When the offset knob is turned in the yellow direction, it adds an offset to the yellow direction for every step.



- When the offset knob is fully turned to yellow, every step will play the yellow value, no matter what the knob position is.

Slowly sweeping this knob from blue to yellow will gradually transform one sequence into another. The LED of each step will blink in their colour if they are selected when played. Ultimately, the led linked to the output will continuously light up in the colour of the selected value being played.

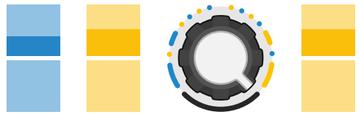


The Modes

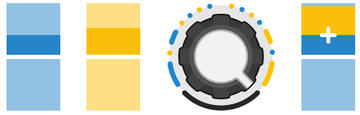
Macrostate switch/add: The default mode for the sequence to blend together is switch: it will select one of the two values for each step, but another mode offers the possibility to add the two values instead of switching them. In this case, the blue sequence is considered as the default sequence, and the yellow is the added value (or subtracted if yellow is negative voltage).

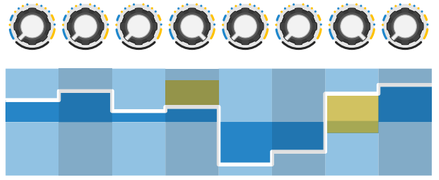
When the yellow value is selected, the output sends the addition of the blue and yellow value. This allows to affect the original sequence instead of replacing it.

Switch mode



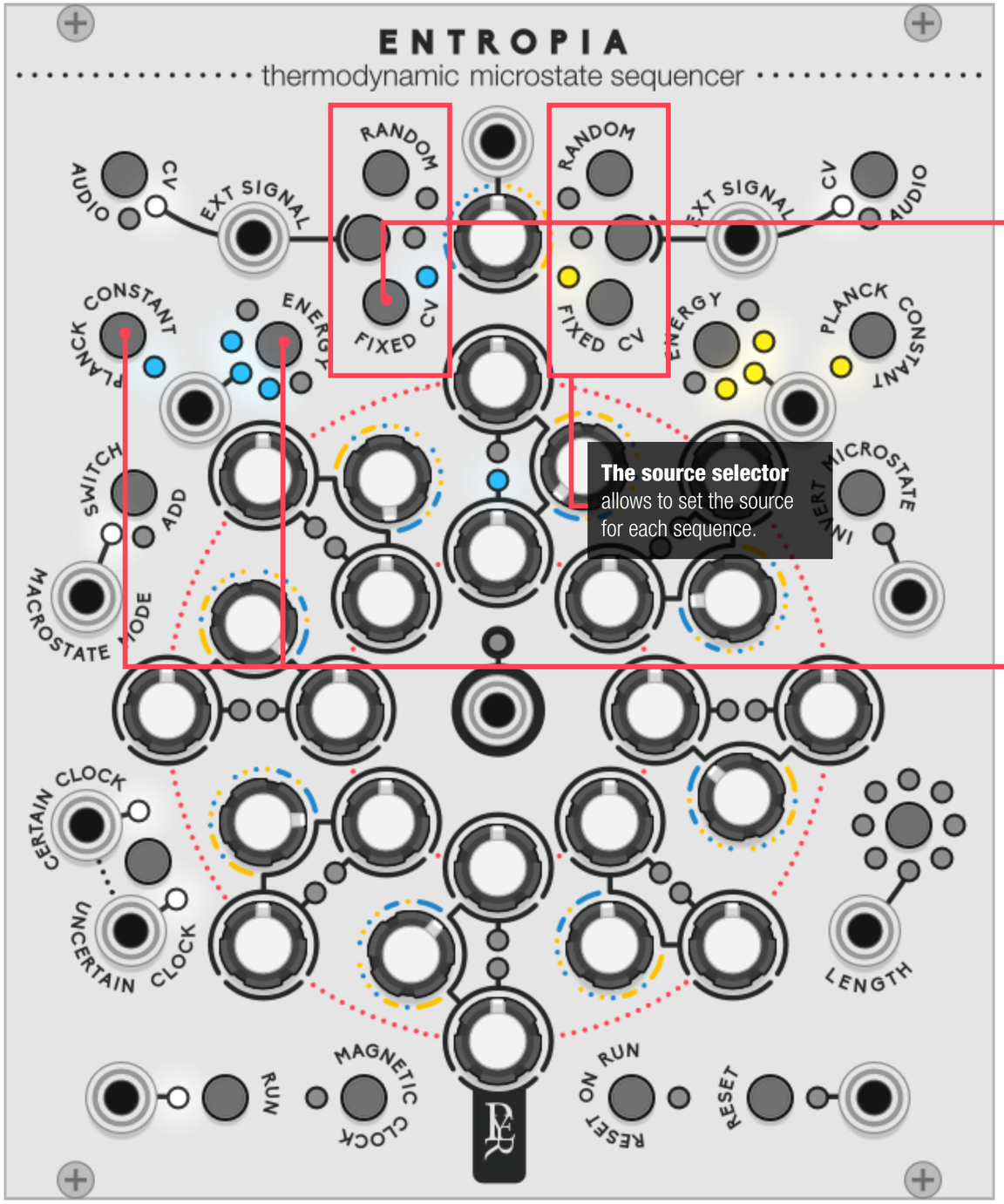
Add mode





Invert microstate: will switch the selected value with the other one. It is active when the sequencer is not running, for composition purposes along with the magnetic clock to monitor each value.

It can also be used while running as a manual intervention, or with a trigger source, faster than the clock to add rhythm and tremolo effect in the sequence.



The 3 sources for each sequence

Each sequence can output CV signals as expected, but they also can have different roles. The nature of each sequence (the blue and the yellow one) can be defined separately.

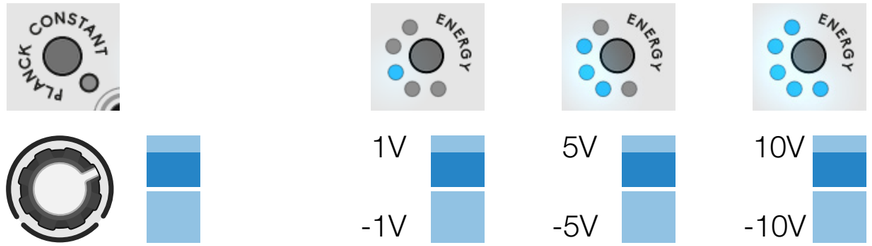
Fixed CV

Each knob defines a fixed voltage value as most sequencers works.

The value can be quantised to musical semi tones using the **Planck Constant** button, which refers to the smallest quantum of energy possible. The range of each knob can be defined with the **Energy** setting. This range will behave differently according to the Planck setting. The Fixed CV mode is the only one affected by the Planck/ Energy system.

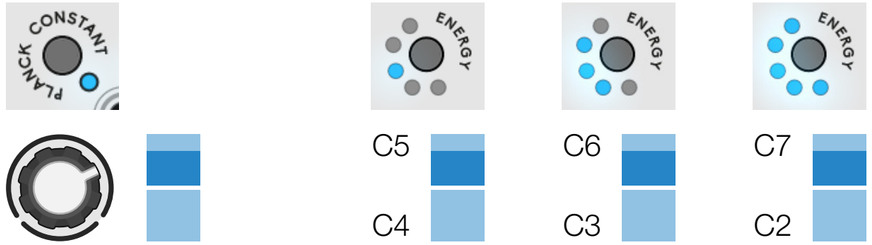
Planck Constant OFF

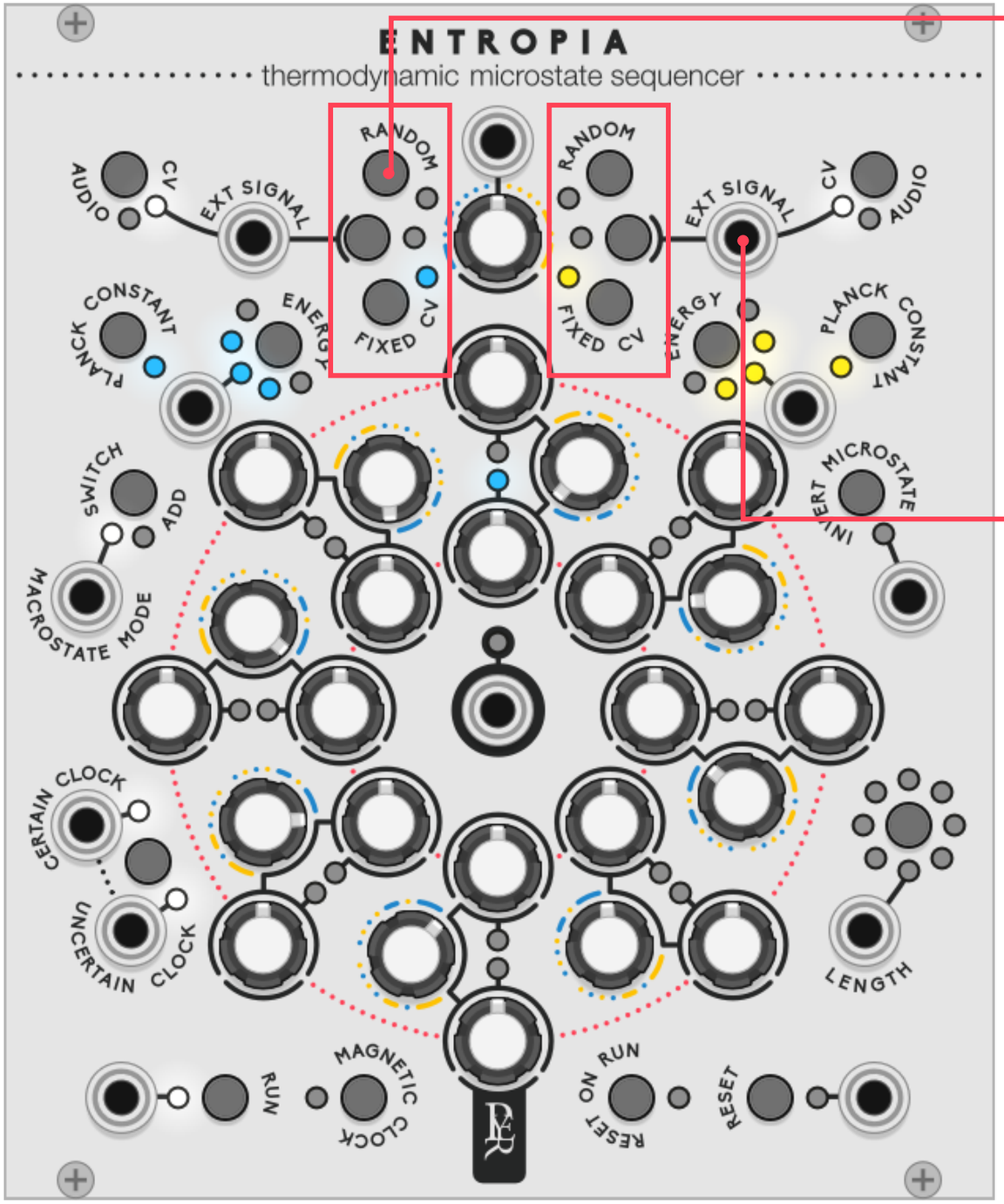
CV sequencer – smooth output



Planck Constant ON

V/Oct sequencer – 1/2 tone quantised output.

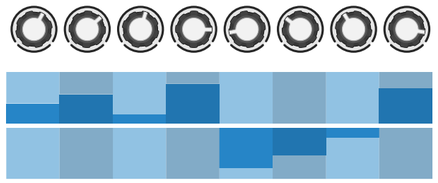




Random

The sequence can be entirely random, with an **internal random source** (0V to 5V) triggered at every clock beat. Each knob acts as an attenuverter for this random source. Extremes knob values will offer a wilder range of randomness (-5V to +5v). The behaviour of the knob is similar to a random sample and hold going through the attenuverter of BLACK HOLES

Knob sequence



Internal random source

Output result

External signal

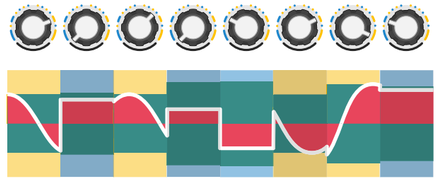
It can be **any CV or audio signal** going through the eternal signal input. The knob will act as an attenuverter for this signal with the same behaviour as BLACK HOLES. The external source can be another sequencer with preset or longer length, lfo signals, audio samples, … Anything synced with the clock of the sequencer will offer more structured result.

Knob sequence

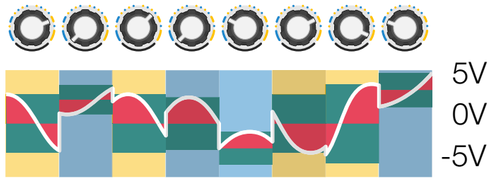
External source (ex: LFO)

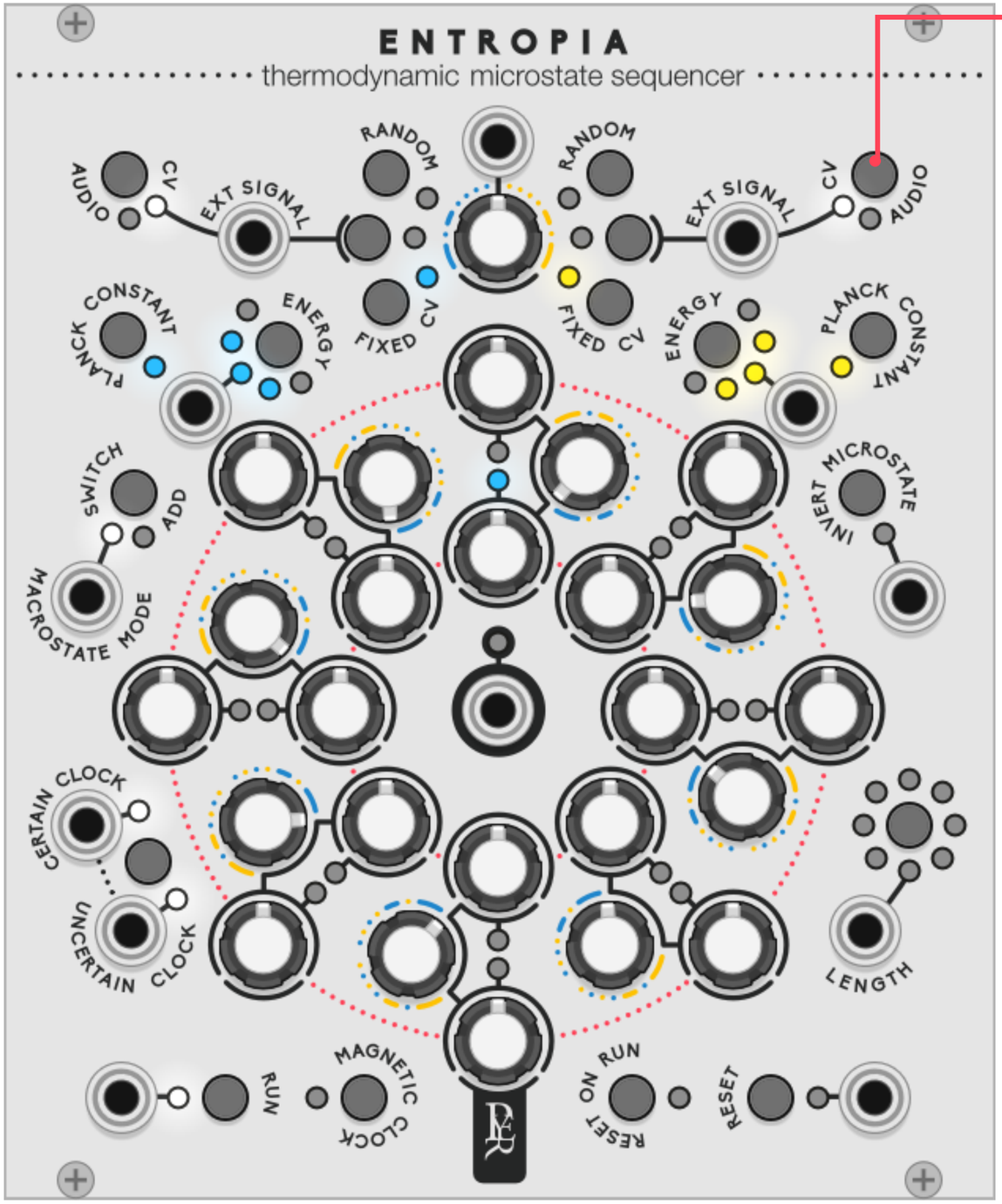
Output result

Result Switch mode



Result Add mode

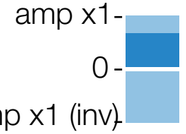




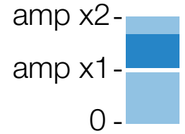
External audio mode

The external input is compatible with CV and audio. Each material will work in both modes, but the audio mode will add a light crossfade between each step to avoid unwanted pop and clicks. The audio mode will also change the knobs behaviour: they will become amplifiers instead of attenuverter.

CV mode



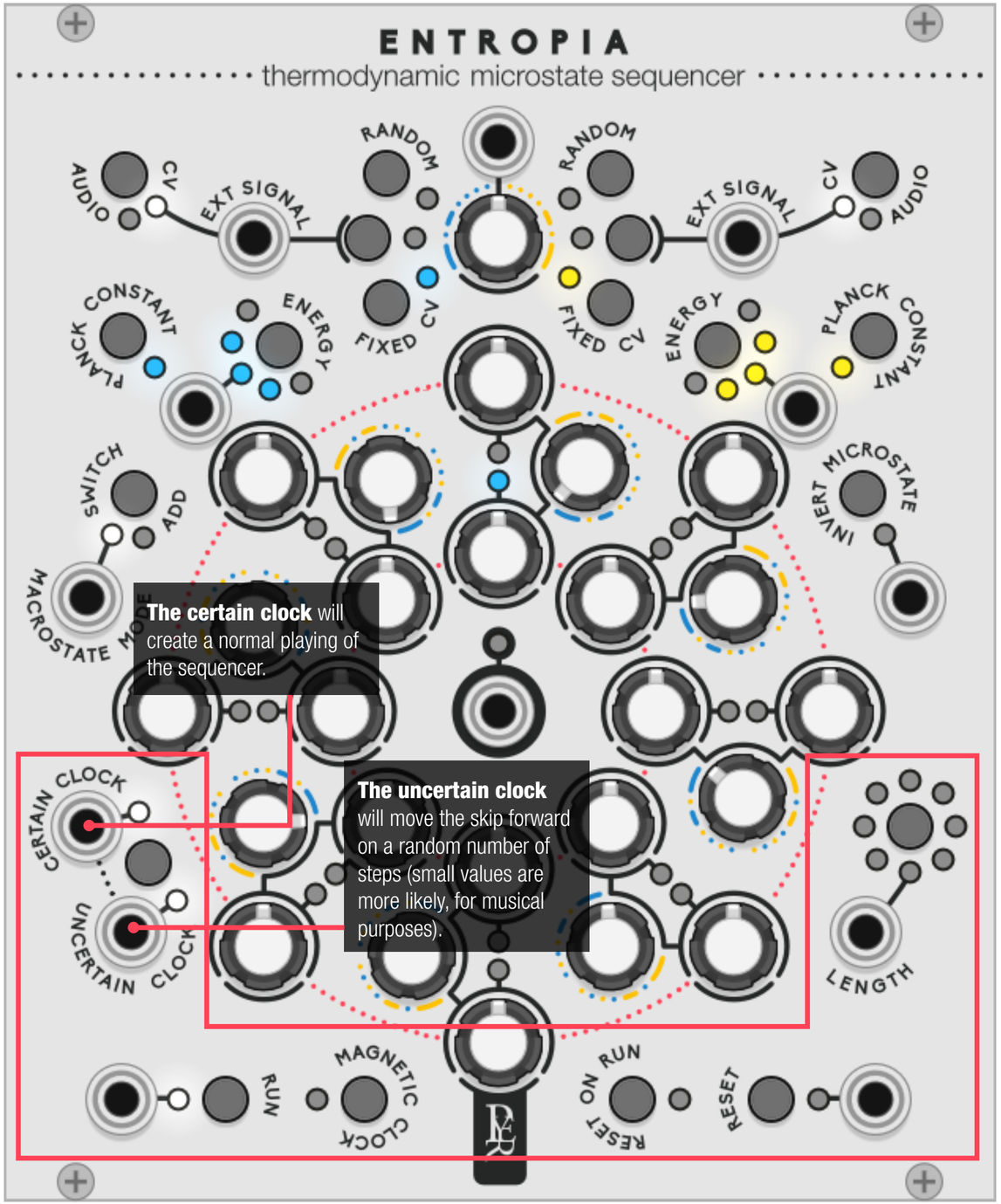
Audio mode



With 3 sources for both sequences and two blend modes there are 18 different ways to use the sequencer.

Some notable examples would be:

- **CV** switch **CV**
  Blending or replacing two sequences, transforming one sequence into another.
- **CV** switch **RANDOM**
  introducing chaos into a determined sequence up to complete random
- **CV** add **RANDOM**
  with small random range, a determined CV sequence can be perturbed for light being out of tune or hitting the next note in the scale instead of the determined one.
- **EXT** add **RANDOM**
  With external receiving another sequencer with clock sync to ENTROPIA, to add a bit of randomness to your favourite sequencer. The external sequence circle needs to be turned fully clockwise to respect the initial received value.
- **EXT** switch **EXT**:
  With each external receiving two different sequencers with clock sync to ENTROPIA, more advanced modules with preset of very long sequence length can be mixed together. Blue and yellow knobs need to be turned fully clockwise to respect the initial received value.
- **EXT** switch **EXT**:
  With two LFO signals (one slow and one fast), this will create a complex LFO signal with an amplitude defined for each step.



- **EXT** switch **EXT**:
  With two audio samples or complete sequenced synth voices. The sound can be step gated with the amp control for each knob, and then switched or mixed together.

Performance control

The bottom controls are the classic commands: play, reset, and reset on run. **The length button** will kill steps. Each push will turn an additional led to red and won't play the matching step. This can be controlled by a 0 to10V input.

The Two clock inputs

There is no internal clock in ENTROPIA, it needs to be fed by a pulse signal. The certain clock will create a normal playing of the sequencer.

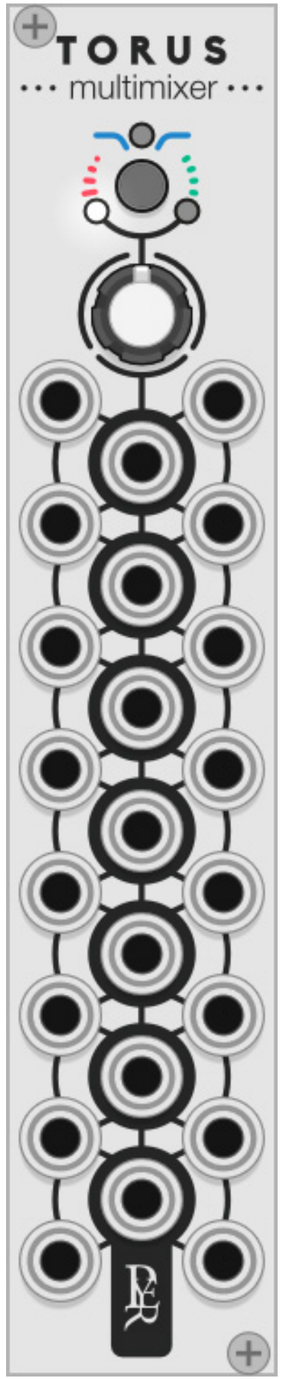
According to Heisenberg, Uncertainty principle means that there is no way to know with certitude both the speed and the position of a particle at the same time. Any pulse received in the uncertain clock input will result in a random jump of steps. The selector will bypass the clocks. Both clocks can be fed at the same time to combine a controlled ratio of chaos and order.

The magnetic clock will excite the electrons in an alternative way: It's a manual clock. It is active when the experiment is not running, to monitor and set the CV value step by step. Combined with the **state switch button**, it will allow to edit every value at will. It is also active when the experiment is running, to interact with the sequence manually, adding a bit of human mess.

A good start...

Here is the most basic way to use the sequencer and start having fun!

- Have the two sequences in fixed CV mode.
- Edit the blue and yellow value with magnetic clock and state switch.
- Turn the general knob to blue.
- Run the sequencer.
- While running, turn slowly the knob to yellow and listen the metamorphose of your sequence from the blue one to the yellow one.



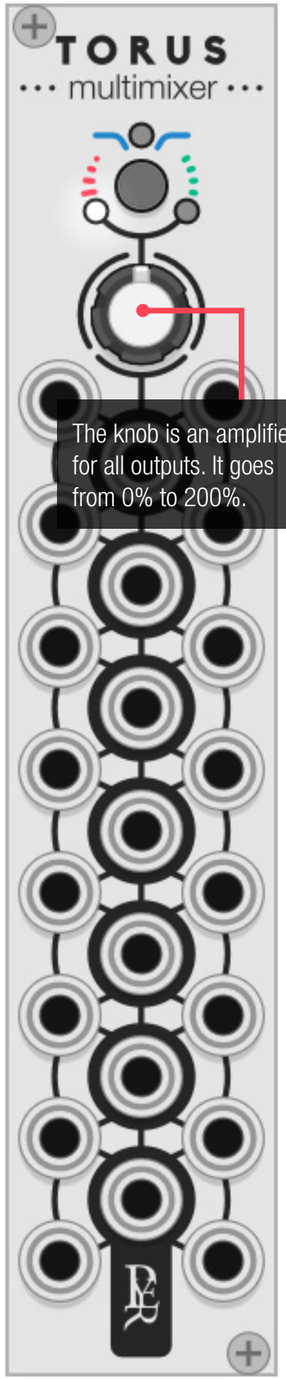
TORUS

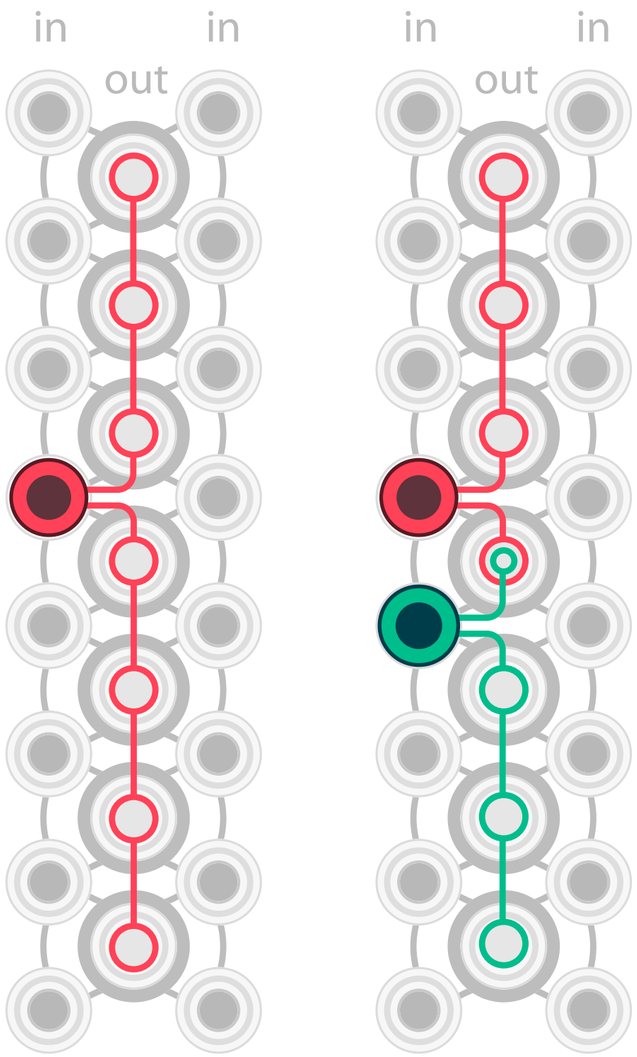
bi-dimensional multimixer

A torus is a 2-dimensional surface closed on itself. Some believe it could be the shape of the universe.

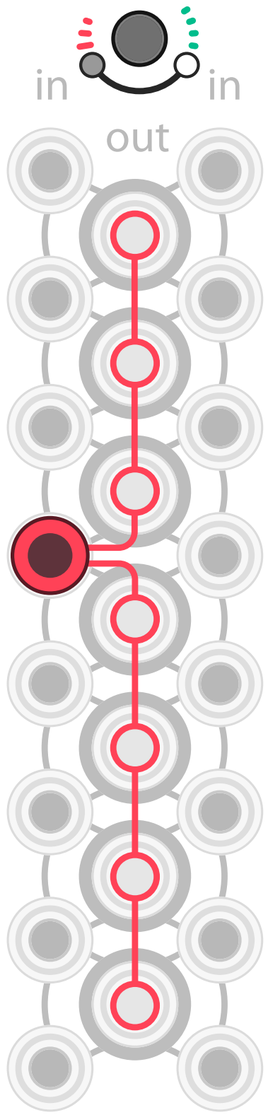
TORUS mixes and attenuates the incoming signal in different ways depending on the distance between the input and output jack.

Torus is a small module that can be many things: up to 6 4-channel adjustable mixers, 3 multipliers, 7 unity mixes with 4 channels, 7 attenuators … and all at the same time.

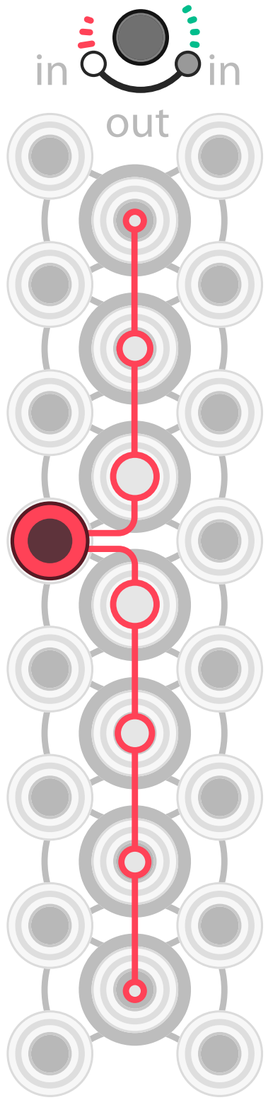




Torus works over a simple concept: the incoming signals are spread and mixed over the different outputs. Each output jack will produce a different mix depending on the proximity of the input jacks.

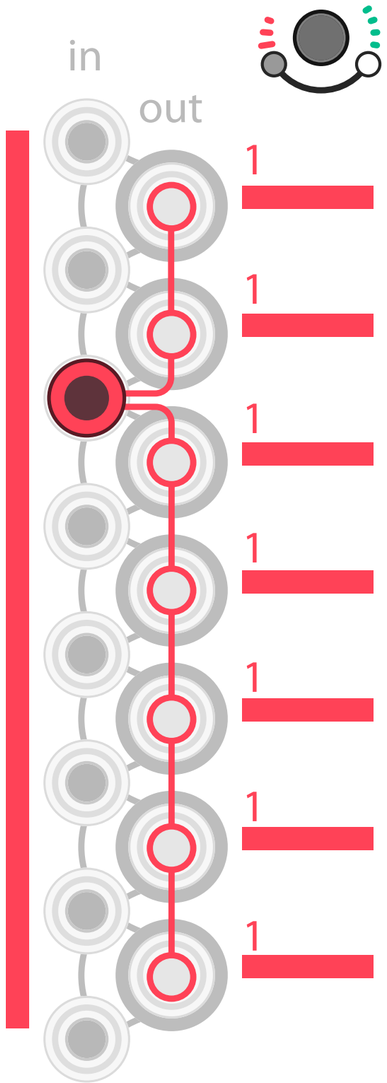


Constant mode gives back 100% of the original signal on each output. When mixed, the two signals are added together.

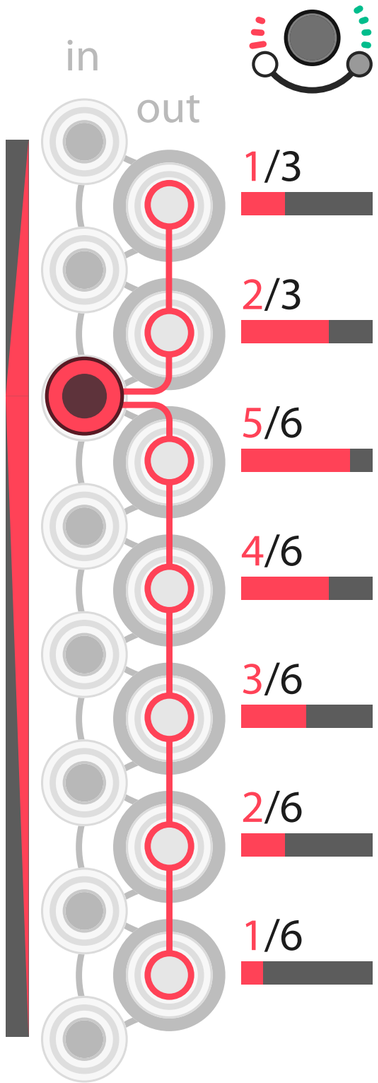


Decay mode: the level of the original signal gets faded away along the outputs. When mixed, the two signals are cross-fading together with different blends depending on the proximity of each input.

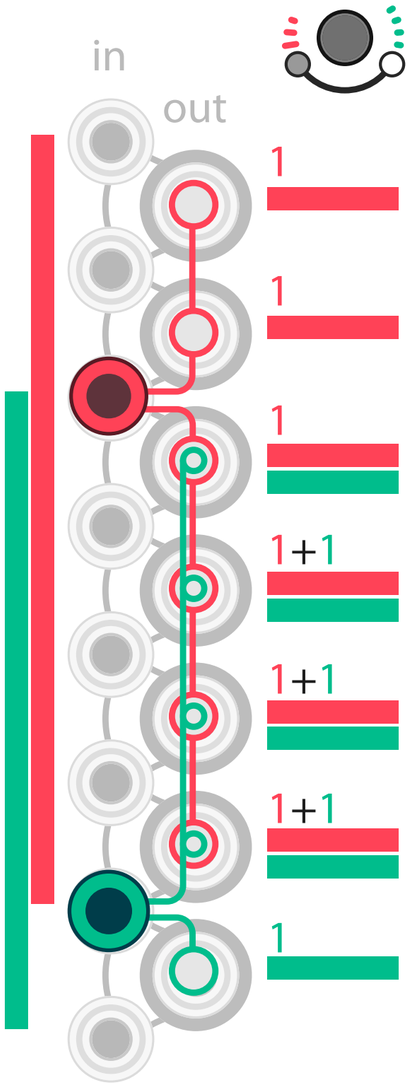
As there are a lot of jacks in Torus, it might be easier to split it in two parts for a better understanding.



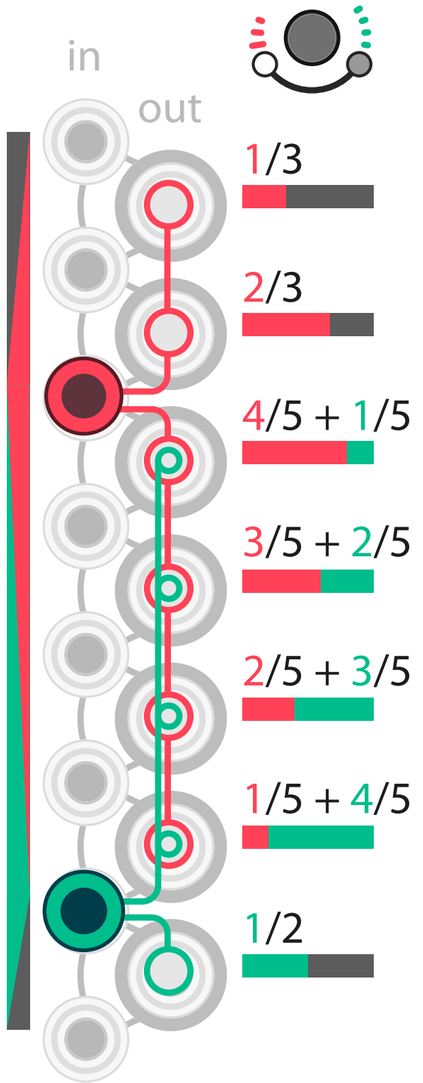
Constant mode: Multiplier



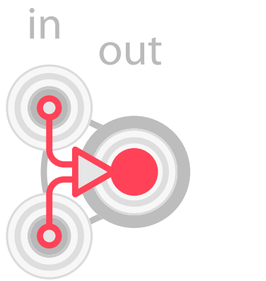
Decay mode: attenuator

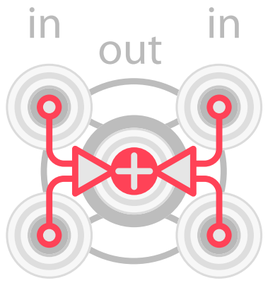


Constant mode: Unity adder



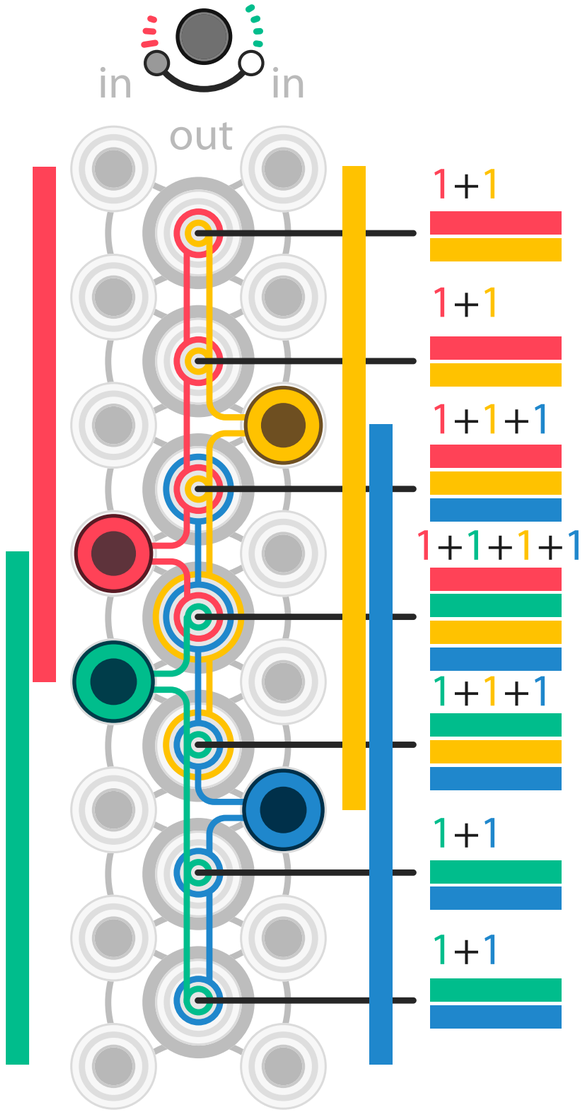
Decay mode: Cross fader

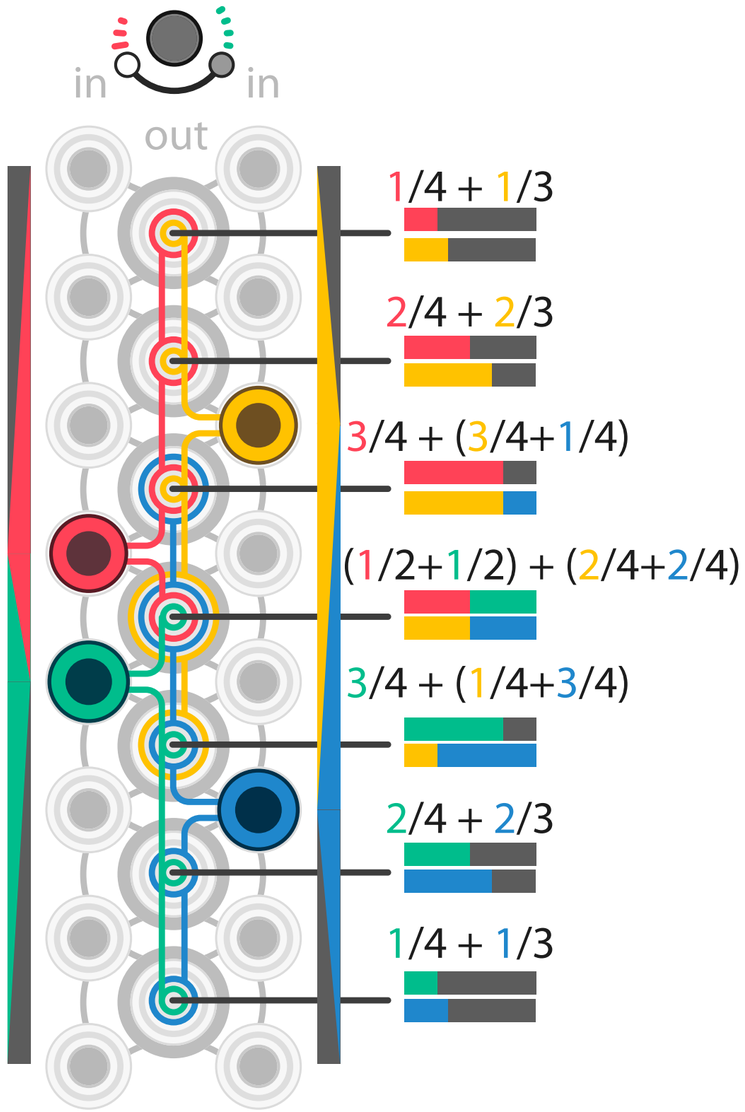


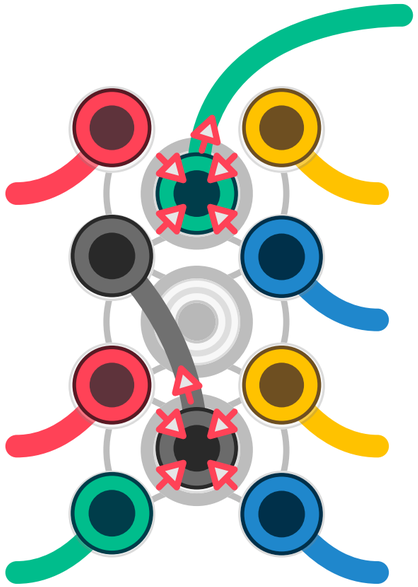


To complete the Torus, another set of input is also connected to the output system.

The result of left and right structure is added in each output.

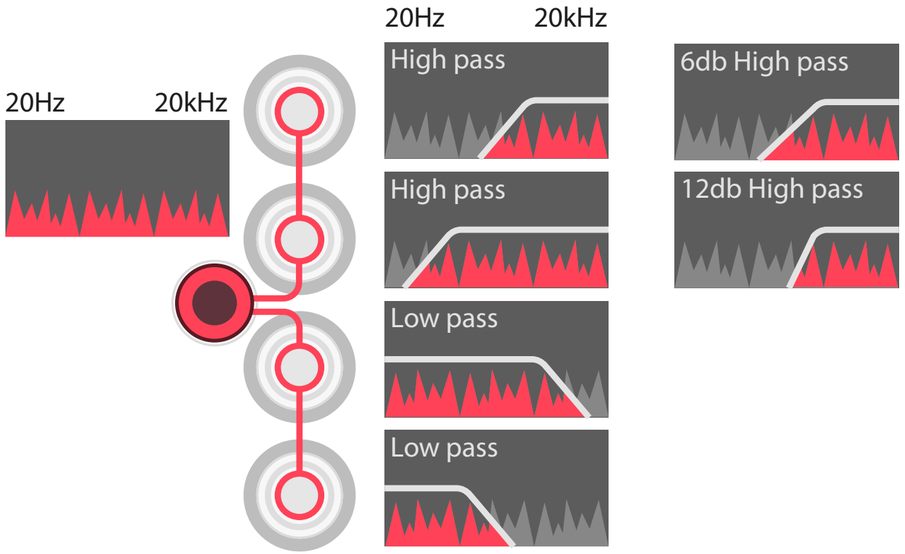






As always, self-patching is full of solutions.

By patching a group of 4 channels to another input, sub-mixes can be created to achieve up to 13 channel mix in one module.



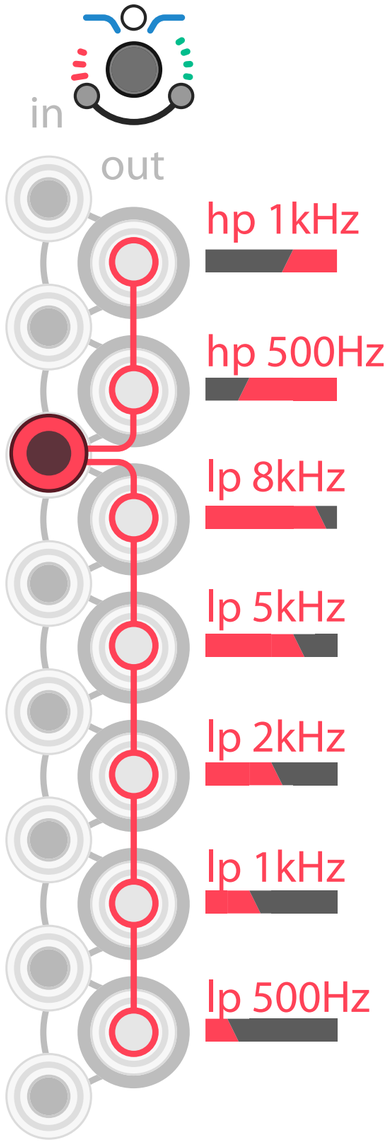
Low/High pass mode

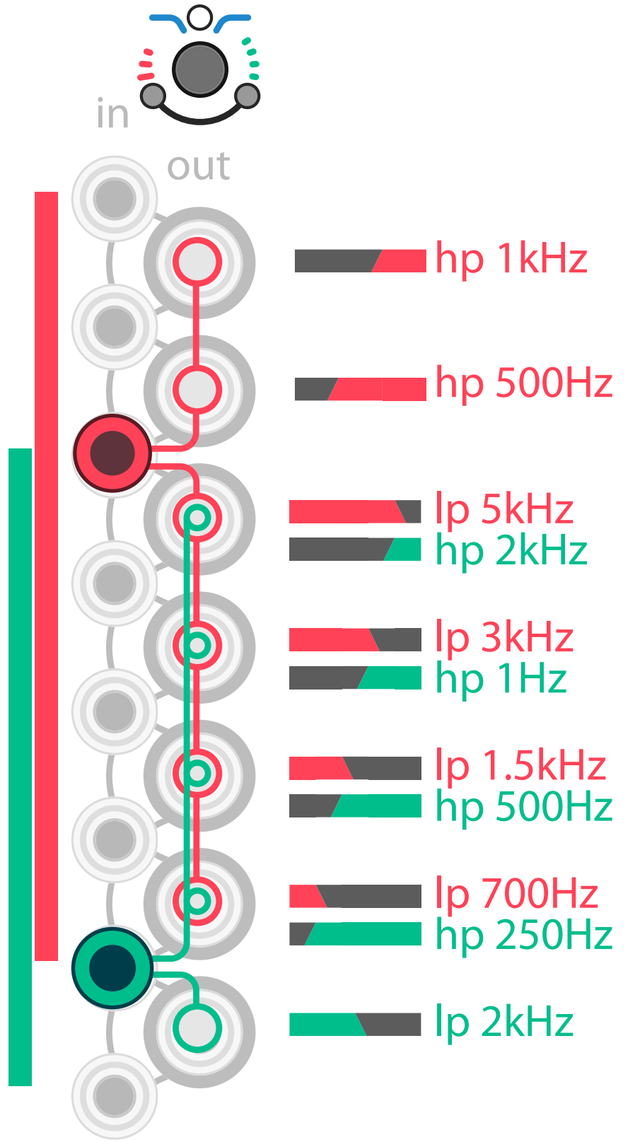
Torus has a third mode dedicated to filtering. The filters can be set in right click to 6db or 12db

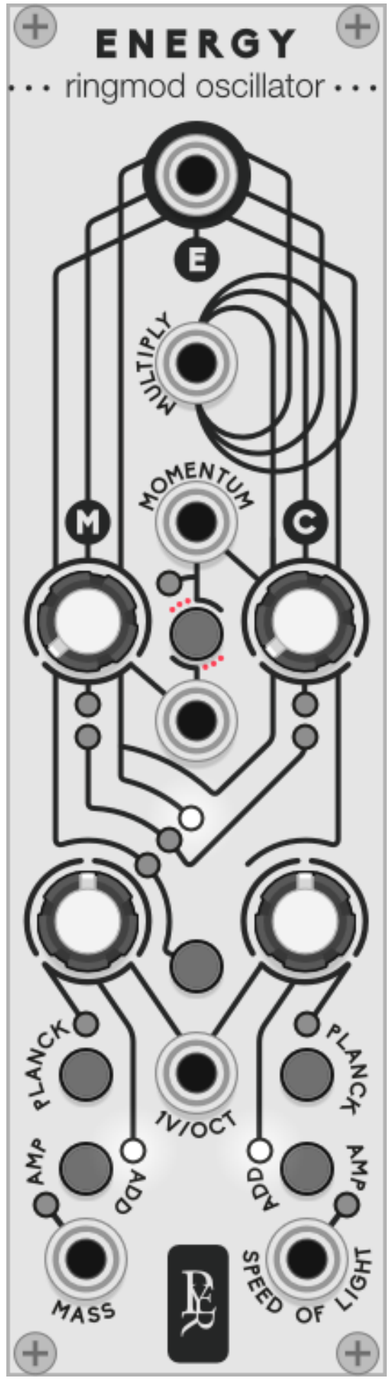
For an incoming signal, any lower output will apply a low pass, and any upper output will apply a high pass.

The more distanced output will have a shorter passing range.

Unlike the other modes, the passing frequencies are not chosen on mathematical ratios, but on an arbitrary way, inspired by some hardware equalisers sweet spots.







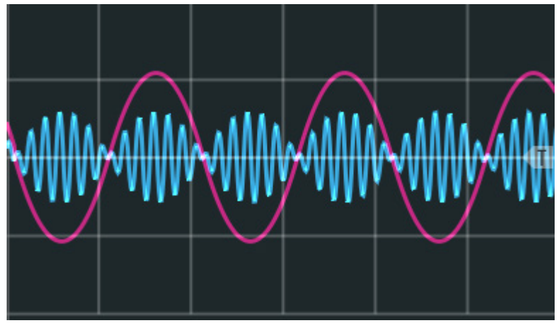
ENERGY

relativistic ring modulation oscillator

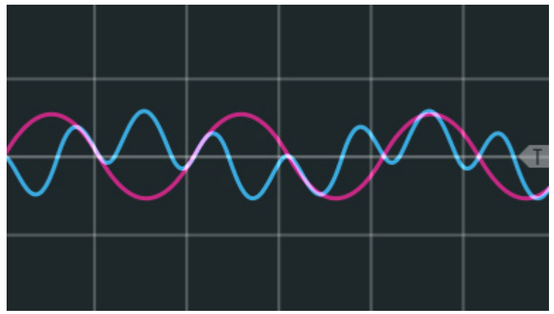
How would the most meaningful equation of modern physics sound? If a small amount of mass can be turned into an incredibly big amount of energy, two simple sine waves can create unexpected tones with rich harmonic content.

ENERGY is a digital oscillator/synth voice that focuses on ring modulation synthesis. Two sines are multiplied according Einstein/Poincaré's famous equation. It is capable of meditative drones, organ tones, extreme noises, and low modulations.

Ring mod synthesis.



Ring modulation
modulating the amplitude of a signal from 100% to -100% (phase inversion). This modulation is usually controlled by an audio rate signal. The two signals are multiplied.

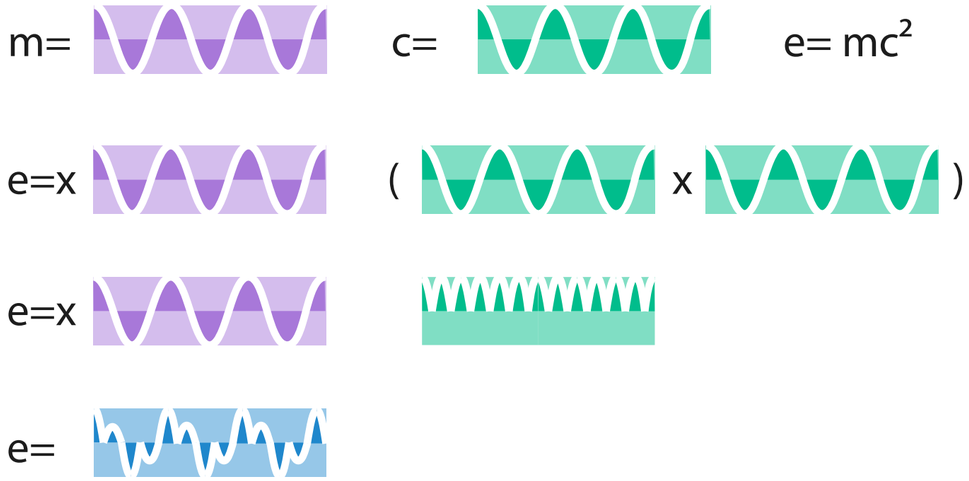


Ring mod synthesis
Creating a complex sound by modifying the volume of a pure sine wave might be counter-intuitive but, as often, audio rate is full of surprise.

The modulator will carve its own wave shape into the processed sine. The result can be pleasant to the ear if the two frequencies are set in harmonic ratios. Breaking this harmony by just a little bit can create some very experimental tones.

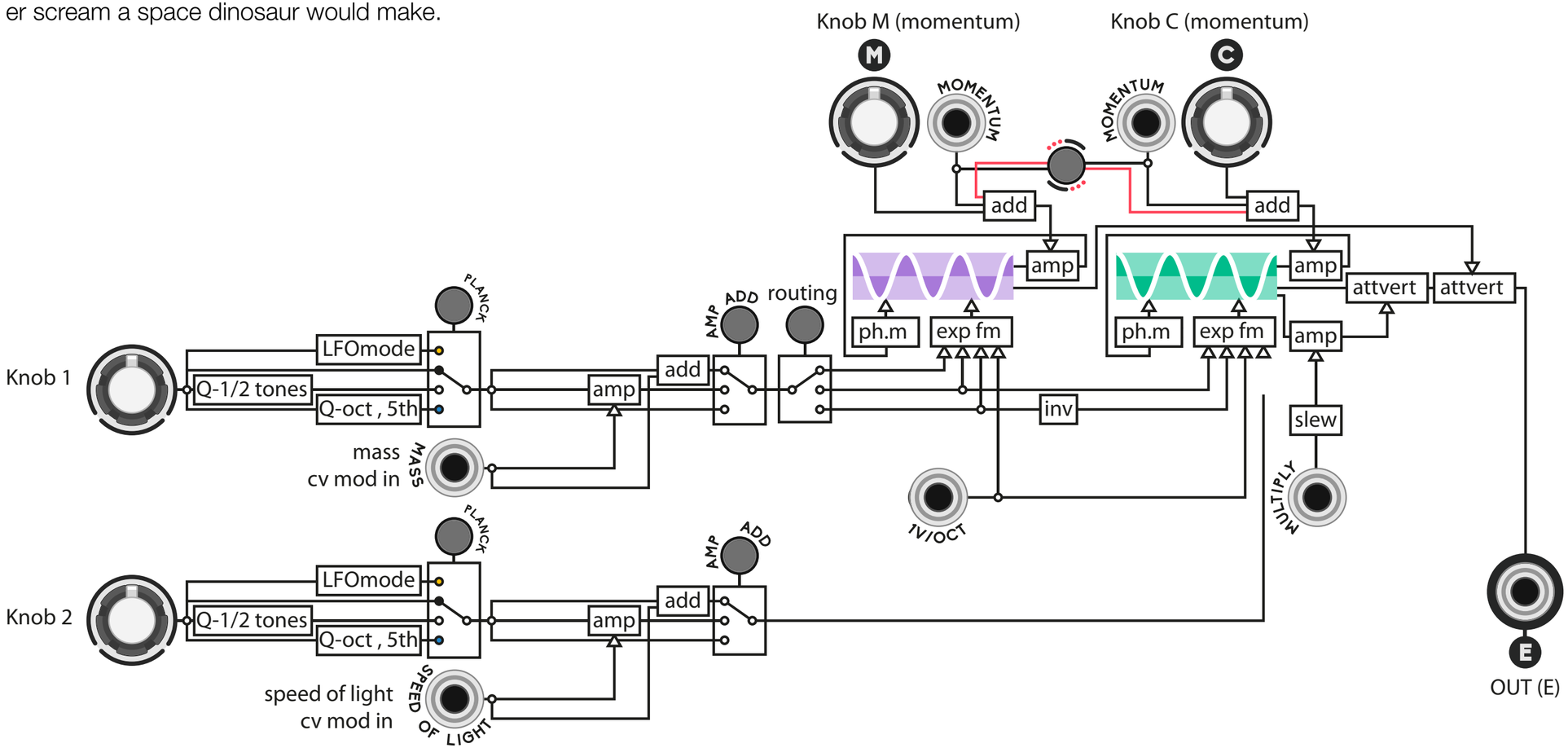
Ring mod synthesis in Energy

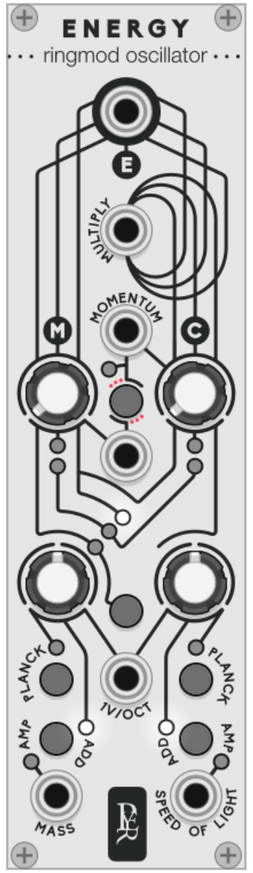
Energy is applying Einstein's equation to ring modulation synthesis: a first sine C (the speed of light) is multiplied by itself. The result is then multiplied by another sine M (the mass of an object) to match the equation e=mc2. The frequency of M and C can be adjusted to explore different types of sounds.

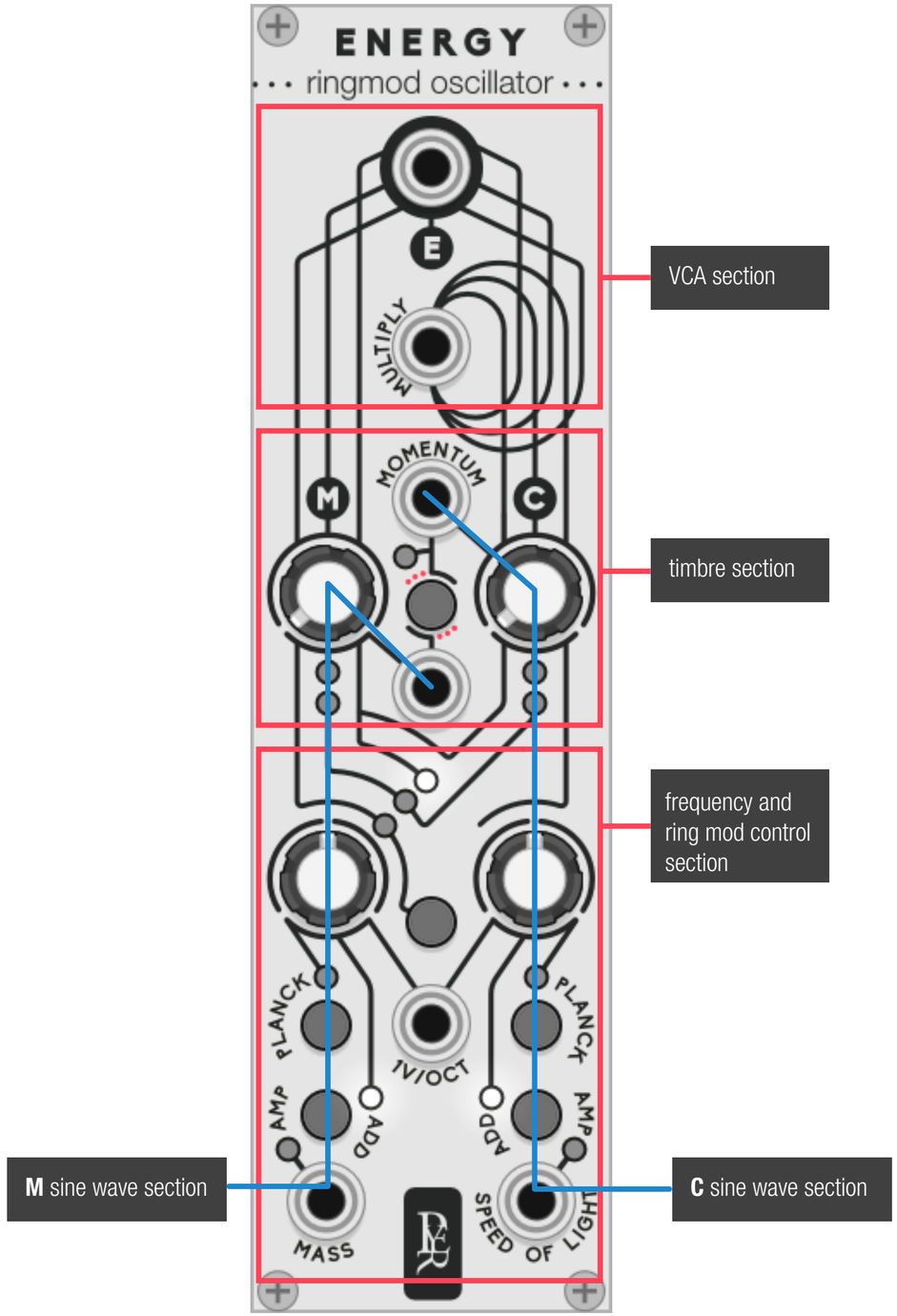


Energy Architecture

Getting melodic results with ring modulation synthesis is complicated and works only with precise values. Therefore, the oscillator has some advanced modulation option that let the user choose to stay focused on harmonic ratios or go to unknown territories from subtle vibrations to whatever scream a space dinosaur would make.







Controls–in separated sections. More detail later.

VCA section

- **Multiply:** It acts as a VCA. It controls the amount of multiplication of the C sine by itself from 0 to 1 (0/10v input). When nothing is plugged to the input, the level is 1. The attenuation will follow the signal with a light slew on the fall to simulate the behaviour of a vactrol/opto vca so it can still sound natural if it receives raw pulses or triggers.
- **E:** oscillator output.

timbre section

- **M momentum knob (top left):** Introduce some FM feedback into M sinus for a metallic low pass effect
- **Momentum inputs:** CV input for the feedback of each sinus (add to knob position)
- **C momentum knob (top right):** Introduce some FM feedback into C sinus
- **Momentum cross mod:** negative CV will modulate the opposite momentum

Freq mod section

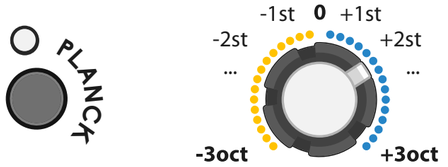
- **Mass CV input:** signal input to modulate the frequency of M sine (1v/octave)
- **Speed of light:** signal input to modulate the frequency of C sine (1v/octave)
- **Add/amp:** define how the mod signal will affect the frequency of each sinus
- **Planck:** define the quantisation for each knob or LFO mode
- **1v/Oct input:** signal input to control the frequency of both sines (1v/octave)
- **Knob 1 (bottom left):** controls the frequency of the M sin by default, but other routing options can be defined
- **Routing button:** defines the routing options for knob 1
- **Knob 2 (bottom right):** Knob 1: controls the frequency of the M sin

1. Frequency control section

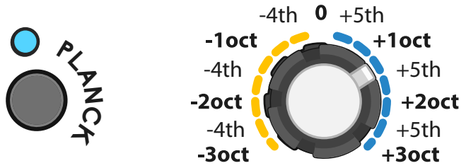
Knob quantisation

Ring modulation can be used to create extreme sound effects, but it can also sound nice when the sines are working in harmony. Therefore, there are different types of quantisation, from smooth to very harmonic ratios.

Off Smooth voltage



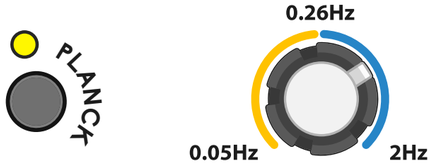
White LED Semitones



Blue LED Fifth and octaves

Low frequency oscillatior mode

The Yellow plank mode sets the knob in LFO mode to be used as a modulation source. Each knob can be set in LFO separately, while the other one still being in audio rate, resulting on a tremolo effect on its own output.

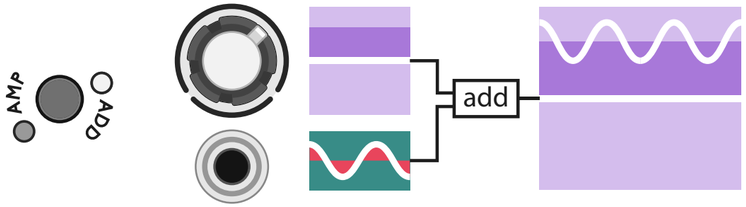


Yellow LED LFO mode

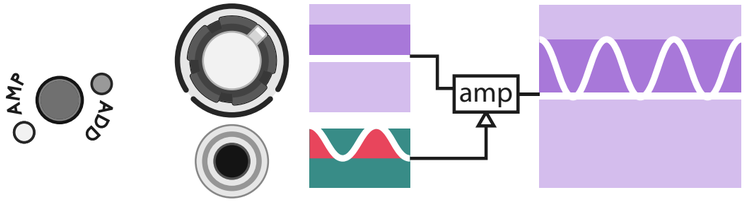
Mod types

Ring modulation techniques require a lot of precision. The frequency of each sine has a huge influence on the sound and introducing modulation might destroy it.

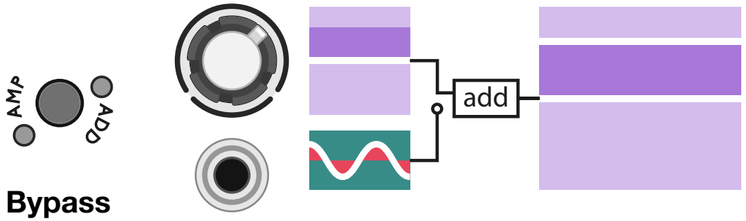
The mod type selector allows different ways to modulate the sound: starting from the knob position (add), or from zero to the knob position (amp).



Add (-10V/+10v)



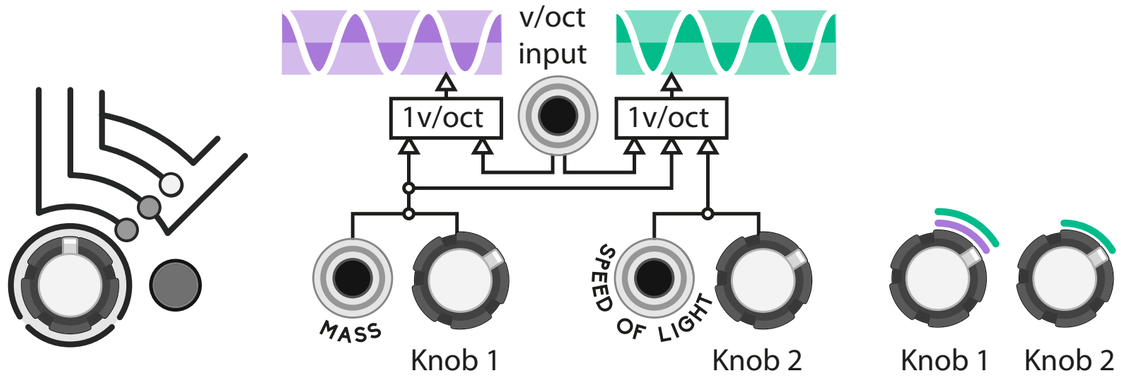
Amp (0/10v)

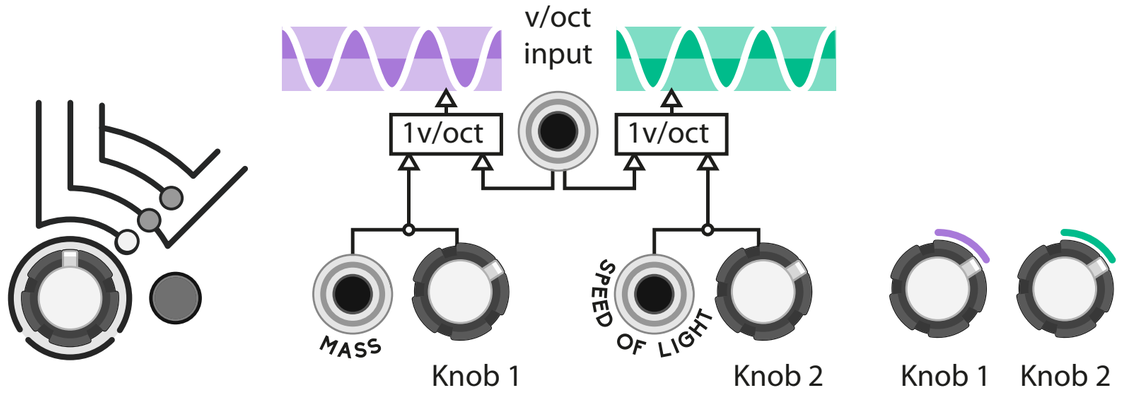


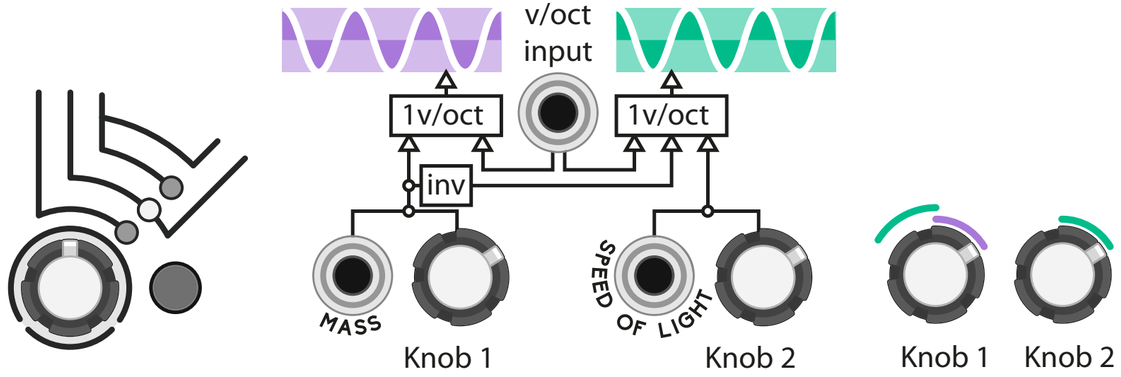
Bypass

Routing

The Mass knob and CV input are modulating the M sine by default, but it can also affect the C sine in different ways. In any routing option, the C sine can always be modulated by its own knob and CV input.

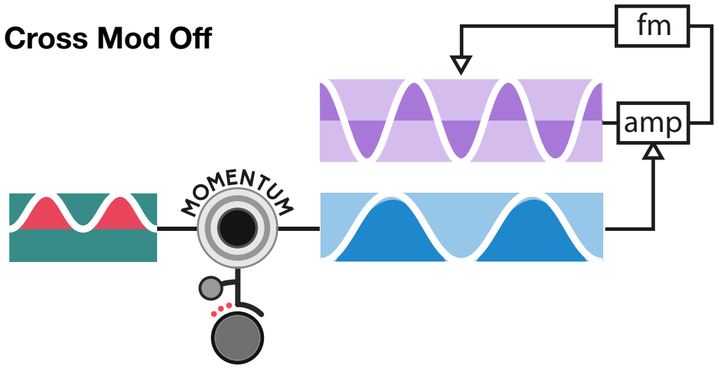






2. Timbre section

Cross Mod Off



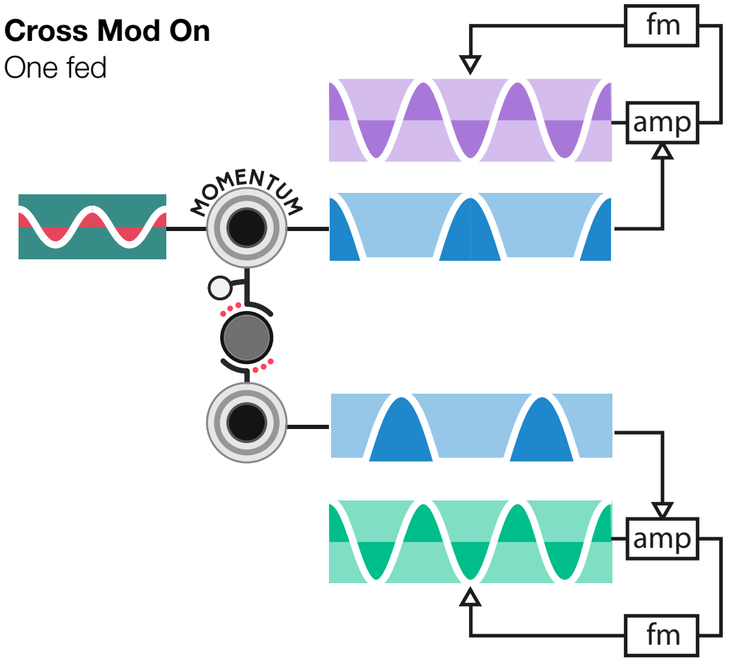
FM Feedback

Energy also use basic FM processing resulting in a sine to saw filtering effect. Each sine can be separately self modulated to have its harmonics stand out.

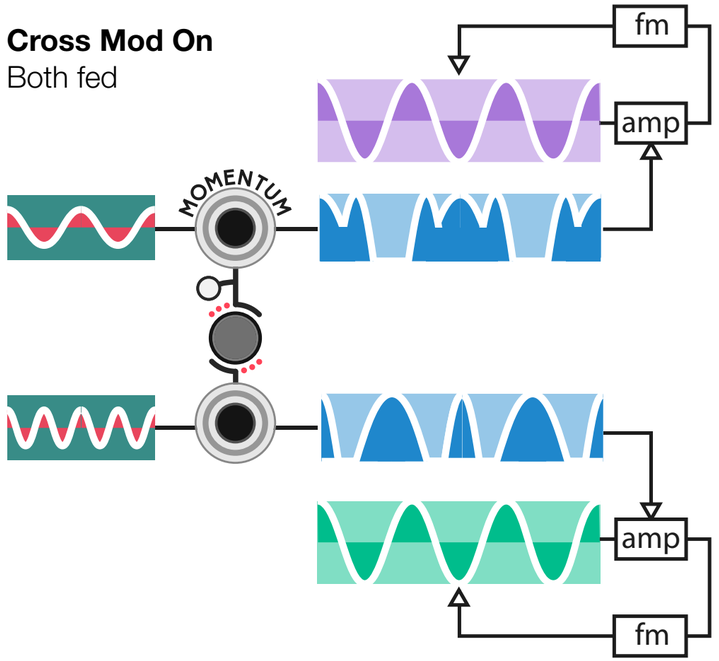
Cross modulation mode

The amount of feedback can be CV controlled as expected, but when the alterative mode is turned on, any negative signal received will modulate the other sine. It allows to modulate both sine with a single bipolar signal.

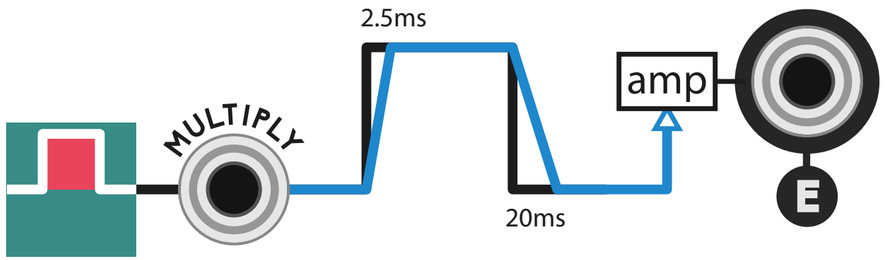
Cross Mod On
One fed



Cross Mod On
Both fed



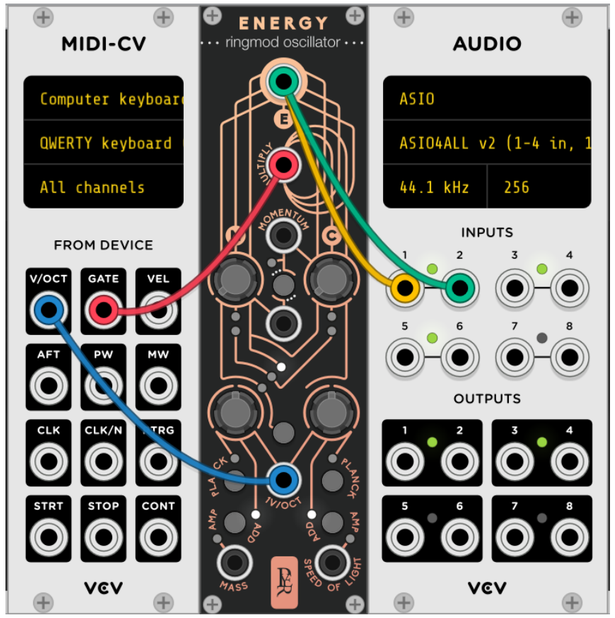
3. Output section



VCA with vactrol style curve response

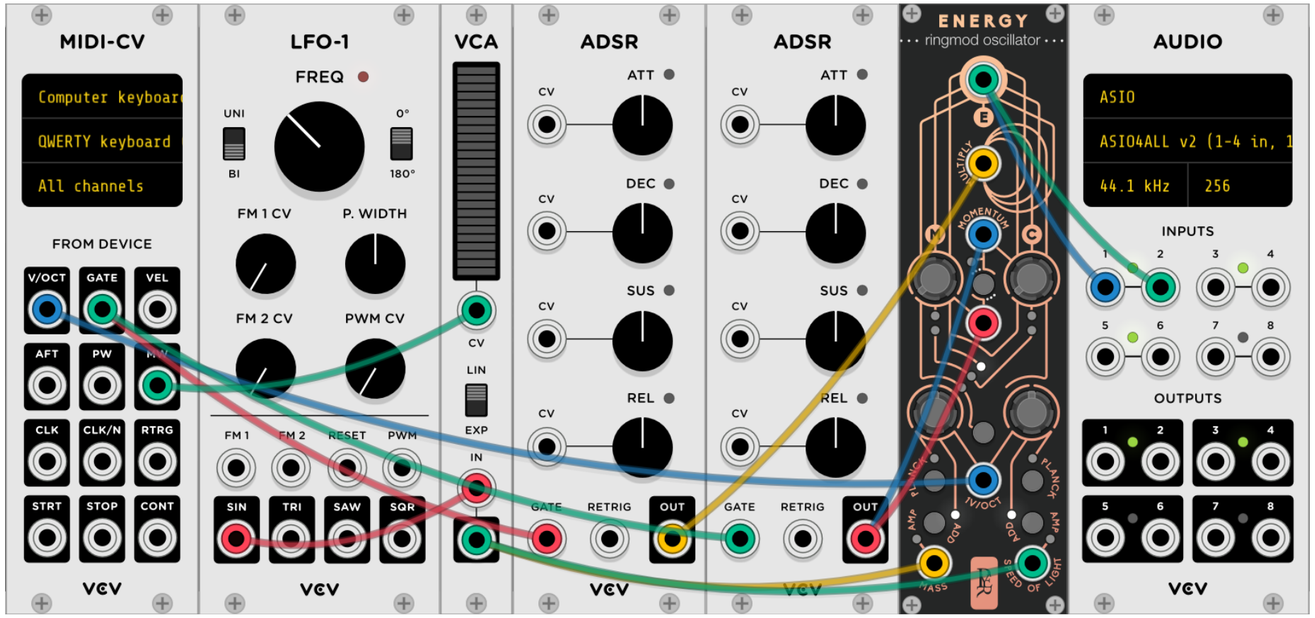
Multiply input CV input controls the amounts on multiplication, and acts as a VCA. It is inspired (not modelled) by the vactrol controlled VCAs, using a short slew limiting that won't audibly modify an envelope signal, but will turn a raw gate into a usable and musical vca with an extremely short attack (2.5 ms) and decay (20ms).

Patch ideas

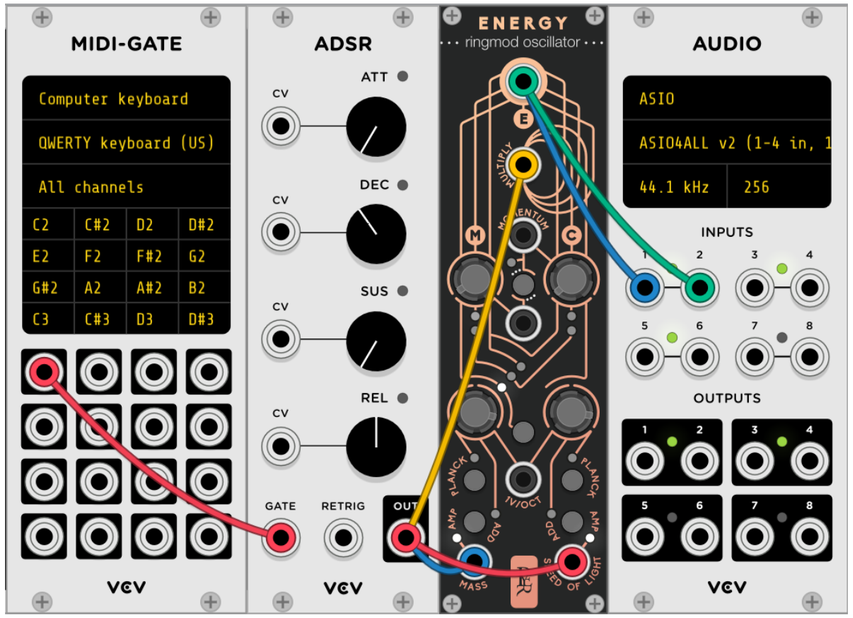


Minimal synth voice: a gate input can be directly connected to the multiply input, thanks to the soft slew limiter.

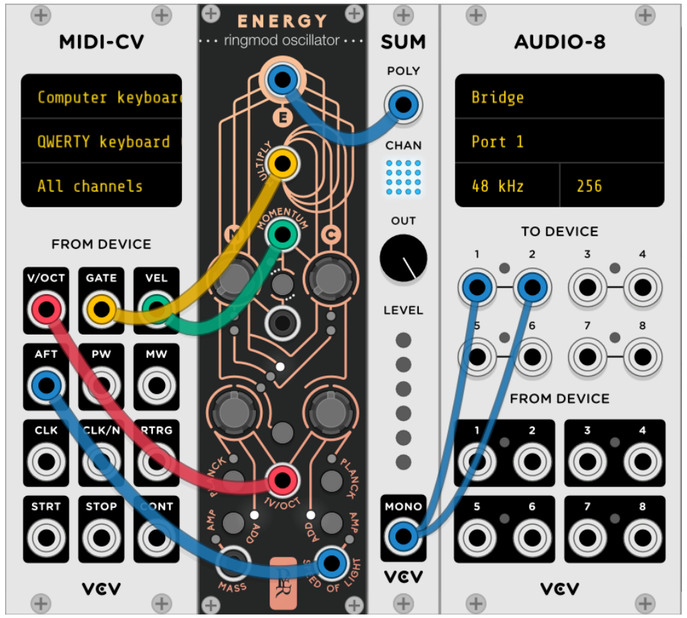
Dual Filter: a bipolar lfo will alternate each momentum harmonic.



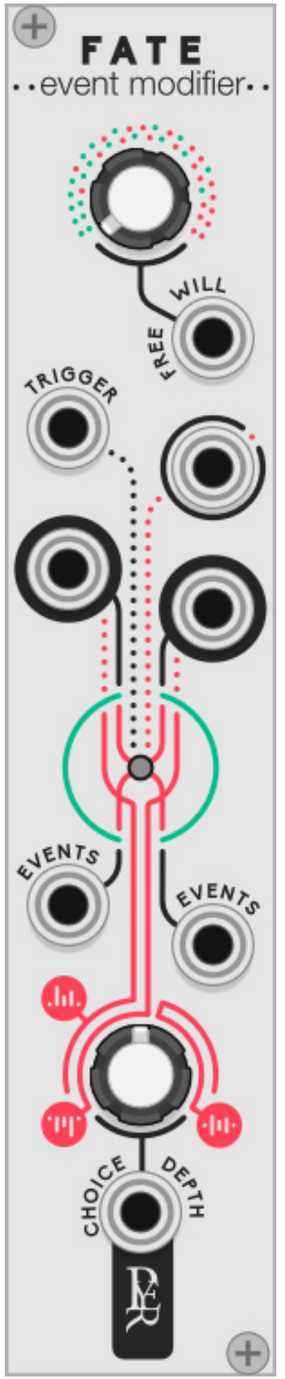
Classic mono synth: with a filter envelope, a vca envelope and a fm lfo



Percussion: in amp mode, fall from the knob position to the centre point, for a decay from aggressive to soft tone.



Polyphony: Energy can be turned into a 16 voice polysynth when a poly cable is connected to the v/oct input. All the CV input are poly-compatible to control each voice separately



FATE

non-deterministic event modifier

Is there such a thing as free will? While scientists and philosophers are debating the question, Geodesics proposes **FATE**, a dual event modifier that will bring any sequencer to life by making its own musical choices.

FATE alters any signal by adding a specific amount of randomness at some chosen points, or by switching in with another signal on a probabilistic way. Without any incoming signal, FATE acts as a dual probabilistic random generator and a Bernoulli gate.

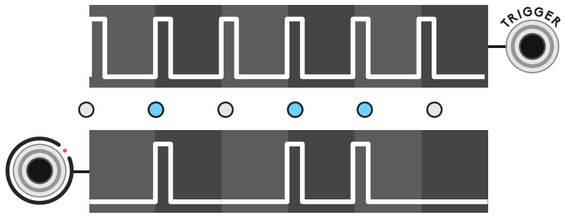
Main Concept

FATE is mainly made to alter a CV sequence but it can be used on LFOs, gate sequences, ...

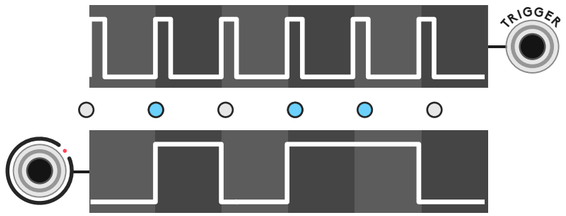
It needs a **trigger input** to make the choice of altering the incoming signal, preferably synced to the incoming signal.

A gate is emitted when the alteration happens.
The **gate output** has two modes (right click):

- **Gate:** the original trigger signal passes through when random is active

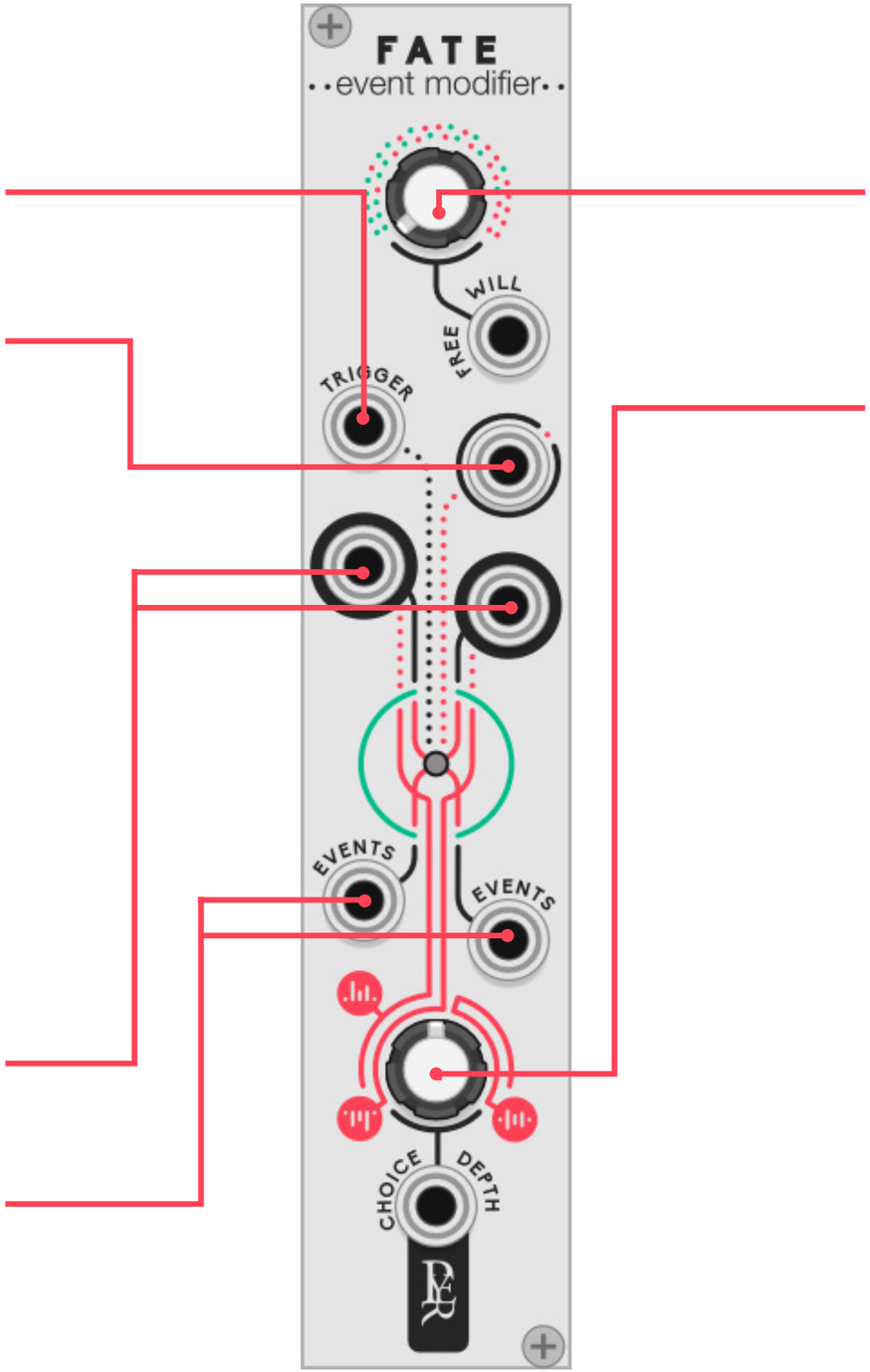


- **Hold trigger:** the gate is open when random is active.



It has two uncorrelated internal random generators, one for each **CV output**. They can be added to the original signal or used on their own.

When a single signal is used (no matter which one), it is normal to both outputs with different flavours of random. When two signals are used at the same time, FATE will switch the two signals together on a probabilistic way.



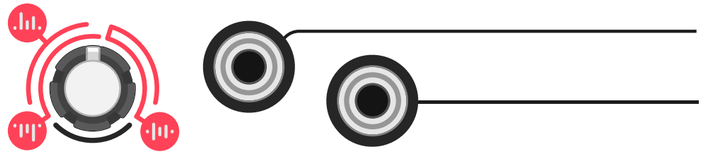
Controlling FATE

The module has its own will but gives control over two parameters:

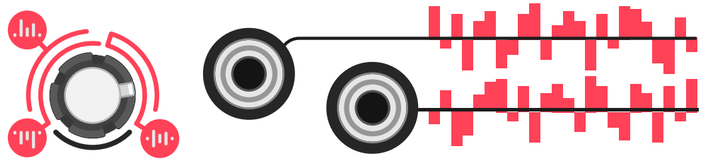
- **Free Will** is the probability to alter the source: How often randomness will be added. a non-zero probability will always trigger both generators at the same time, but giving different values of random at each output.

- **Choices depth:** the range of the random values. The knob is bipolar with different behaviour for each side.

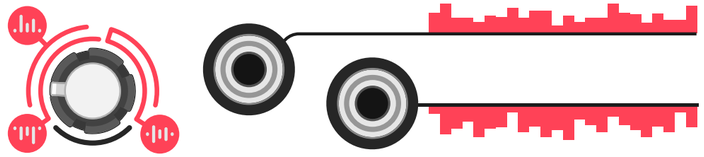
Zero: no random is emitted, this is useful as a probabilistic switch for two signals without adding random.



Clockwise direction: each output emits bipolar uncorrelated random values with a knob range from zero to -5/+5 volts.



Counter-clockwise direction: left output emits random values with a knob range from zero to +5 volts. Right output emits random values with a knob range from zero to -5 volts.



FATE as a dual random CV generator and Bernoulli gate.

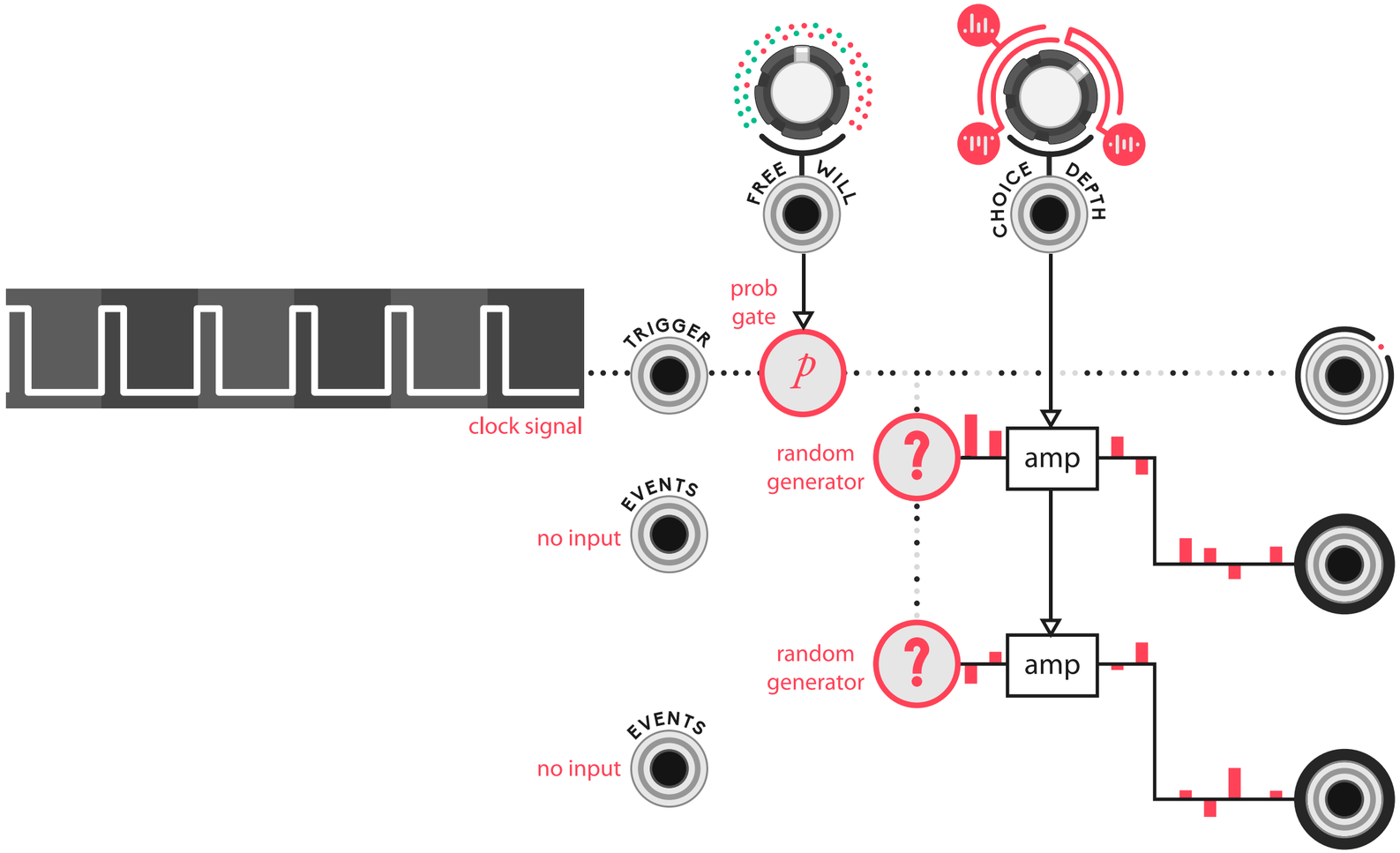
FATE only needs a clock to be effective.

The two CV output emits uncorrelated random values.

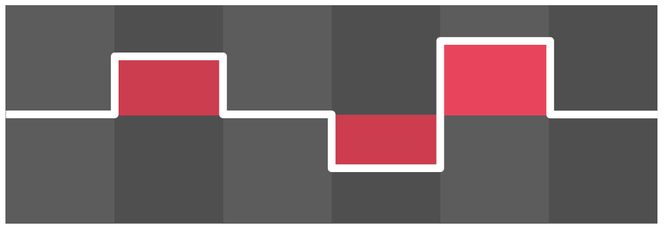
The gate output emits a gate each time the randomness happens.

Free will controls how often random is emitted.

Choice depth control the amplitude of the randomness.



probabilistic gate sequence



probabilistic uncorrelated random sequence

probabilistic uncorrelated random sequence

FATE as a one channel event modifier.

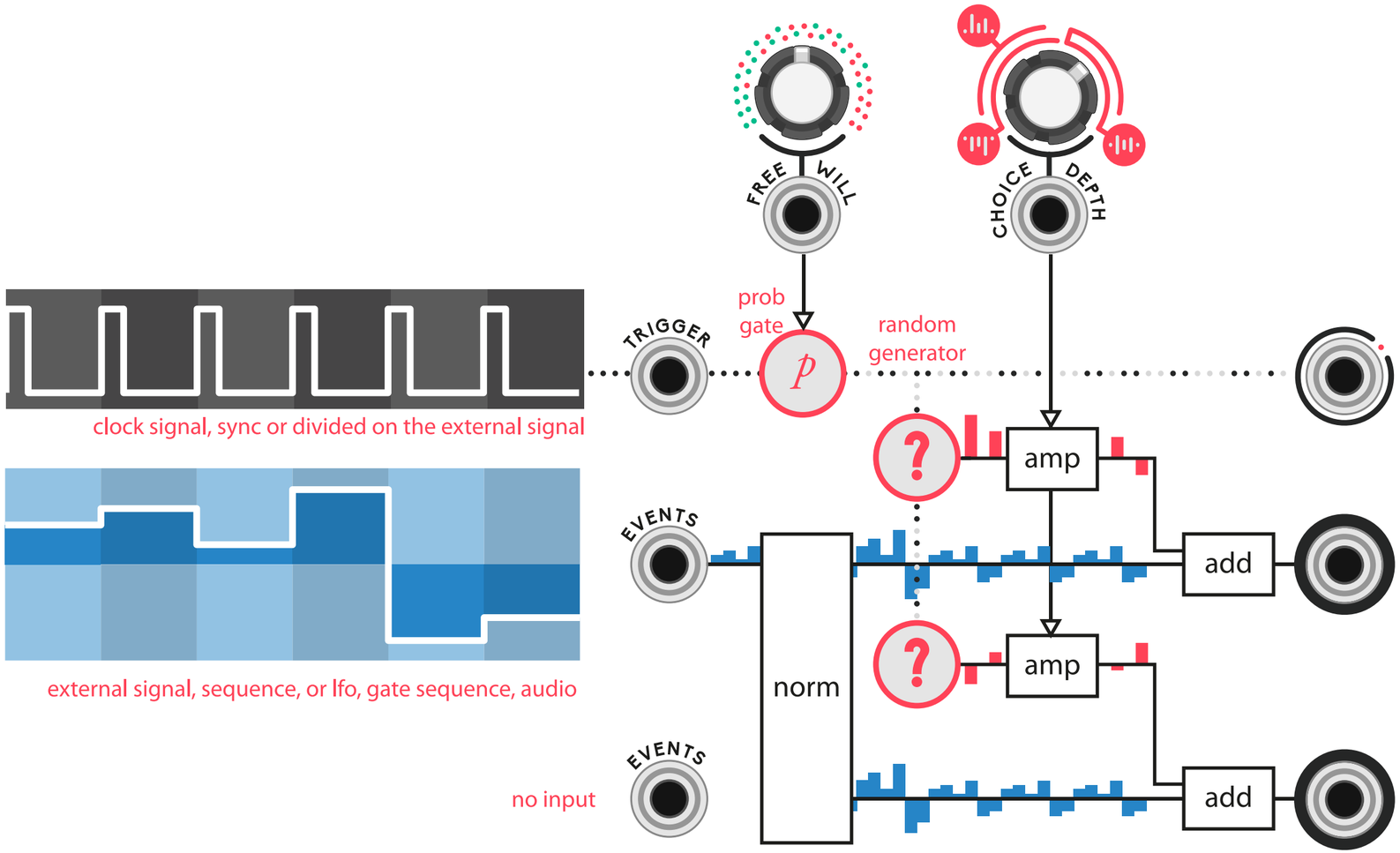
It doesn't matter which input is connected; they are normalled to each other.

Each output will give its own altered version of the original signal.

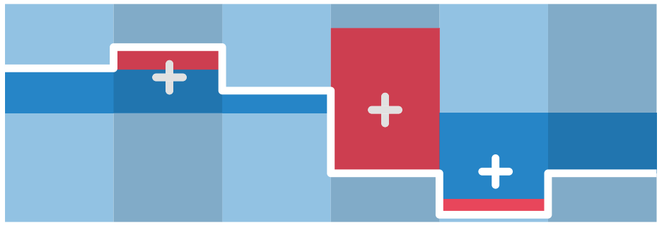
The gate output emits a gate each time the randomness happens.

Free will controls how often randomness is added to the signal.

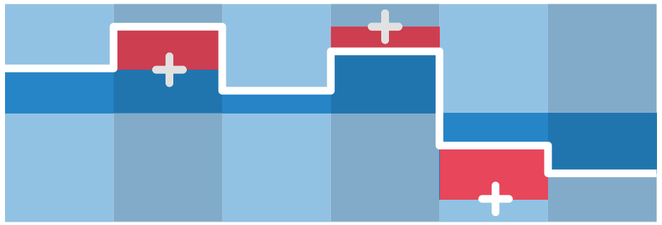
Choice depth controlq the amplitude of the randomness.



probabilistic gate sequence



original signal + probabilistic uncorrelated random



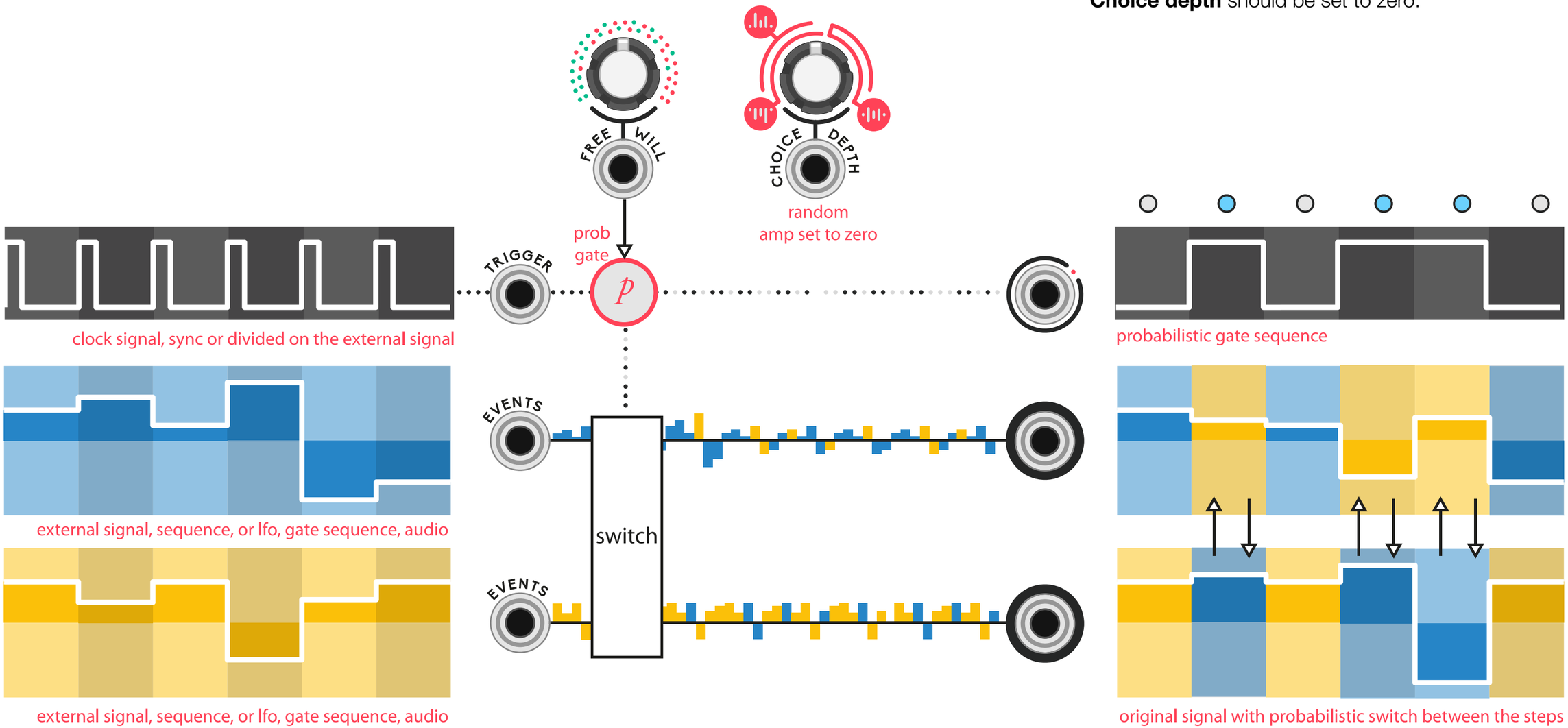
original signal + probabilistic uncorrelated random

FATE as a probabilistic two signal switcher.

The gate output emits a gate each time the switch happens.

Free will controls how often the signals are switched and altered.

Choice depth should be set to zero.

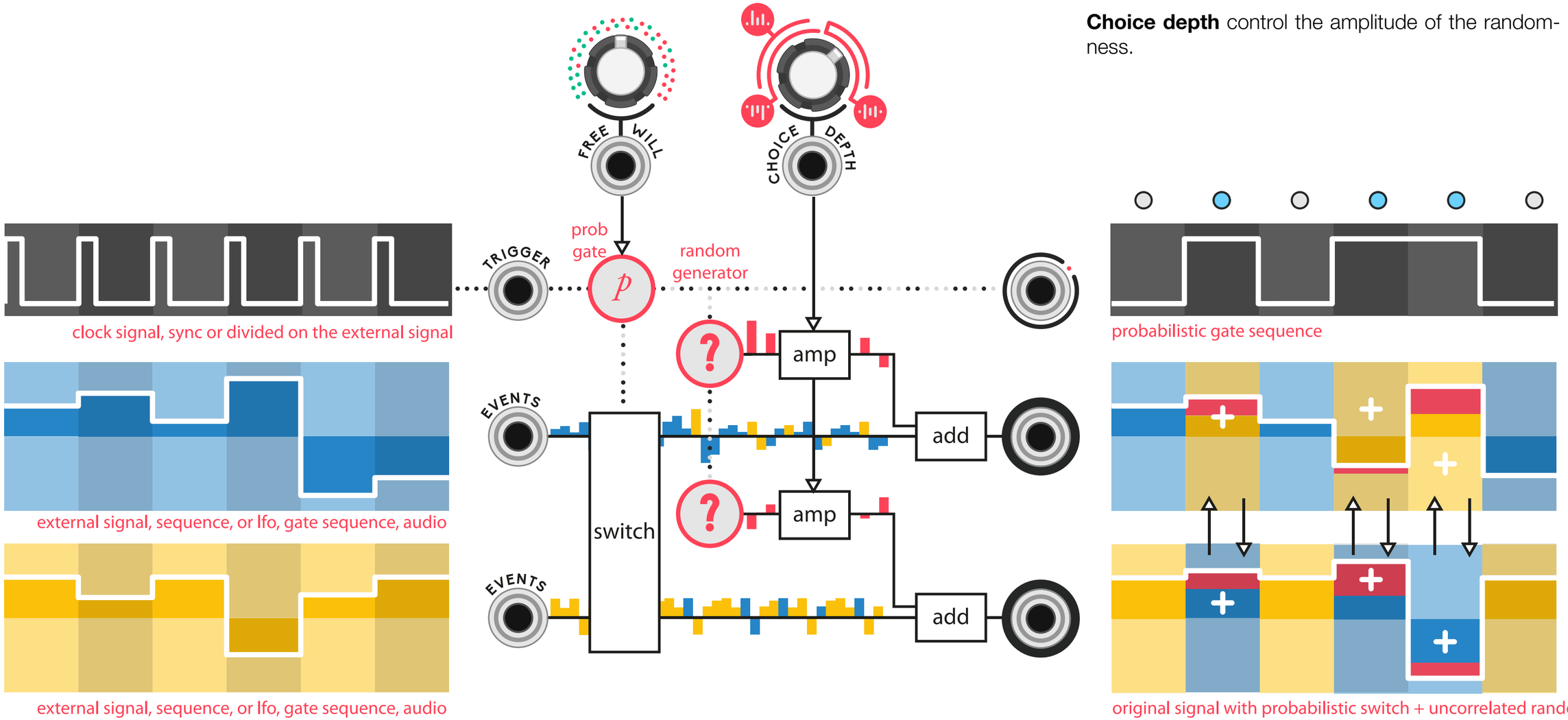


FATE as a probabilistic two signal switcher and modifier.

The gate output emits a gate each time the switch happens.

Free will controls how often the signals are switched and altered.

Choice depth control the amplitude of the randomness.

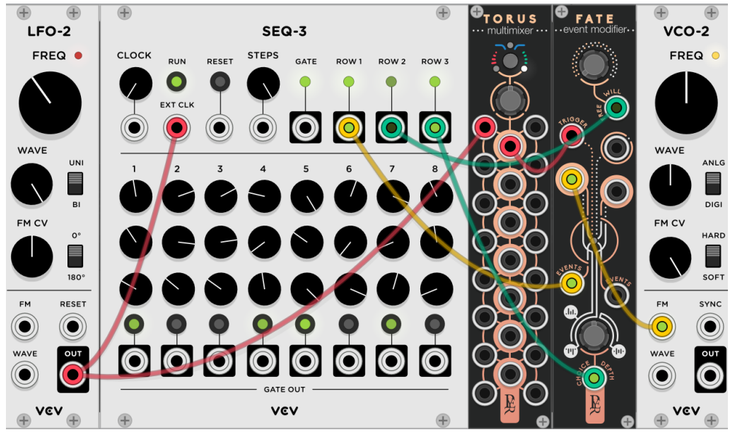


FATE with a multi-channel sequencer.

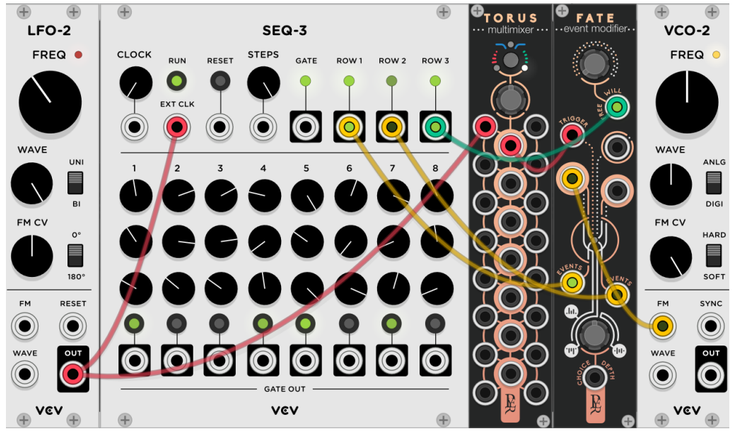
When FATE is used to alter a CV sequencer, **Free will** and **Choice depth** can be controlled by other CV sequences to make the random happen on specific notes of the sequence. FATE can then turn any multi-channel sequencer in our Entropia sequencer.

For a correct timing, FATE and the sequencer has to be triggered by the same clock source to avoid any latency

- Add randomness to a sequence (input 1, output 1).
- Use a second sequence to control which step should be randomised (Free will CV in).
- Use a third sequence to control which step should have a wider random (Choice depth CV in).



- Switch between two sequences (inputs 1 and 2, output 1)
- Use a third sequence to control which step should be switched (free will cv in)



Polyphonic FATE

Fate is also polyphonic. The number of output voices will be defined by the number of event channel or trigger channel, whichever is the highest. Modulation input are also polyphonic. It is recommended to experiment with different trigger sources on the input to add richness to the generated melodies.

GEODESICS

A modular collection for VCV Rack by Pyer & Marc Boulé

Geodesics has been created in July 2018 by **Pierre Collard** (industrial and graphic designer based in Brussels) and **Marc Boulé** (developer and creator of Impromptu Modular based in Montréal).

Just like many projects within VCV Rack, Geodesics is also a community effort and it would not have been possible without the help of many users, composers and developers participating one way or another to enhance the quality of the project.

Among them we would like to address a special thank to those who helped us in the beta testing phases, who made tutorials, who proposed their help in any way and those who brought the collection to life with some great pieces of music: **Omri Cohen, Georg Carlson, Xavier Belmont, Steve Baker, Marc Demers, Adi Quinn, Ben De Groot, Latif Karoumi, Espen Storo, Synthikat, Dave Phillis, Carbonic Acid**, **Martin Luders**, **Ghalebor, Stephen Askew, Lars Bjerregaard, Richard Squires, Lorenzo Fornaciari, Adi Quinn, NO rchestra, Poxbox23** and **Ananda Bhishma.**

Geodesics links
www.pyer.be/geodesics
vcvrack.com/plugins.html#Geodesics
github.com/MarcBoule/Geodesics

Creations from composers using Geodesics:
https://www.youtube.com/playlist?list=PLEh-5QLxa-BlqLl9rBcncUTFm2Lk-ZMgvZ

Tutorials on Geodesics by Omri Cohen:
https://www.youtube.com/playlist?list=PLEh-5QLxa-Blr4dsurkkwUehFsNl7T_Jv-

Marc's work links
github.com/MarcBoule/ImpromptuModular

Pierre's work links
www.pyer.be

Coded and released by Marc Boulé – Concept and visuals by Pierre Collard