GEODESICS

A modular collection for VCV Rack by Pyer & Marc Boulé

User Manual–version 1.0.0

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

BRANES
colliding sample and hold

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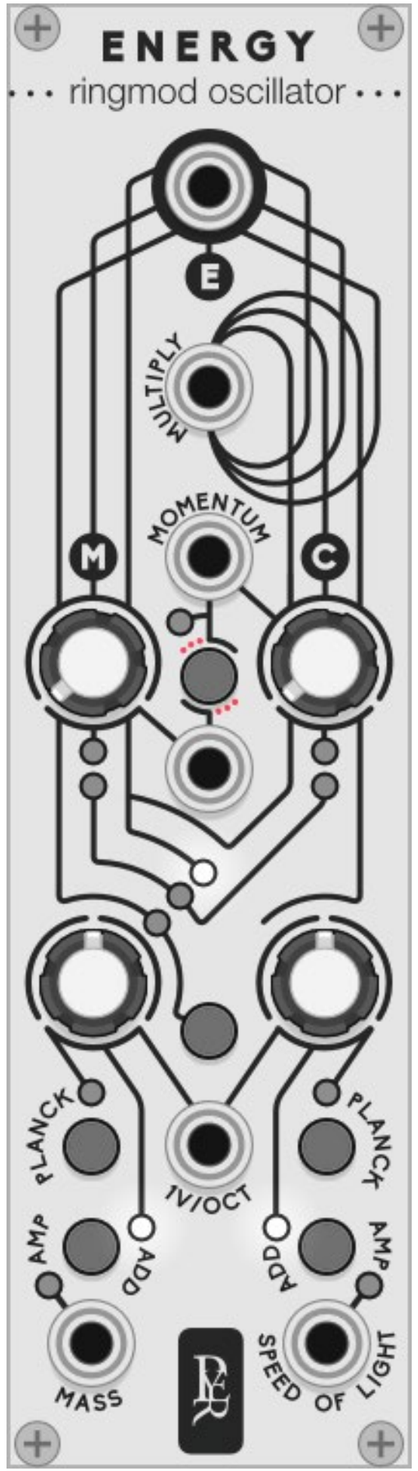


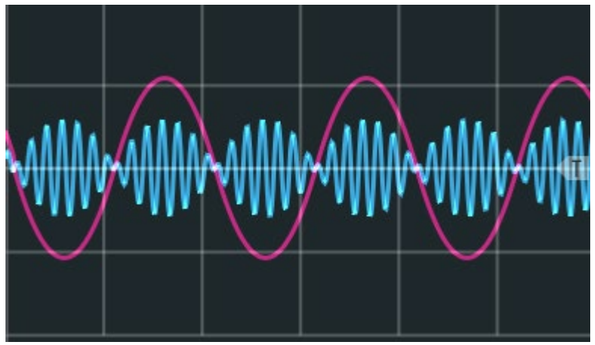
ENERGY

relativistic ring modulation oscillator

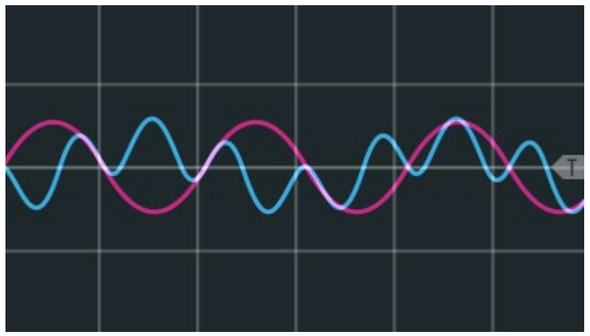
How would the most meaningful equation of modern physics sound? If a small amount of mass can be turned into an incredibly big amount of energy, two simple sine waves can create unexpected tones with rich harmonic content.

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.

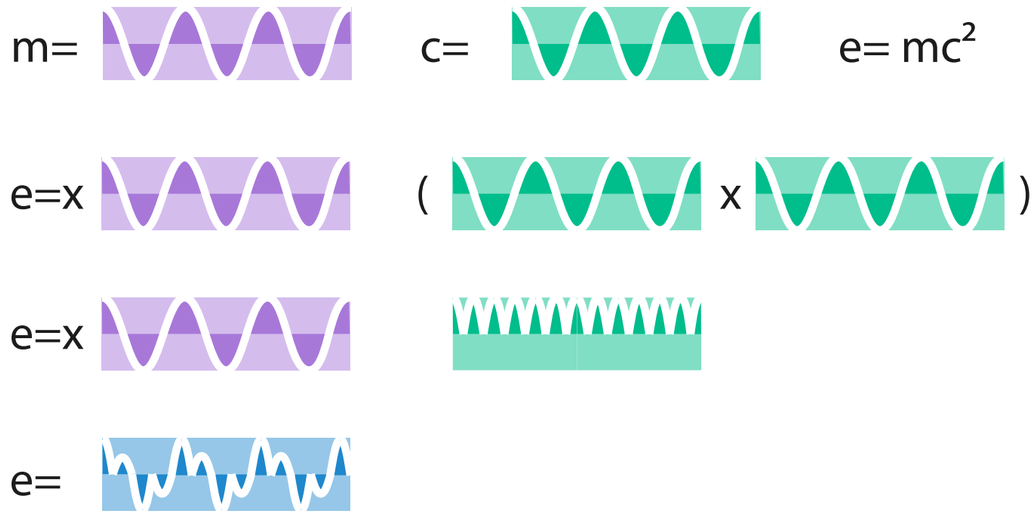


Ring mod synthesis
Creating a complex sound by modifying the volume of a pure sine wave might be counter-intuitive but, as often, audio rate is full of surprise.

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.

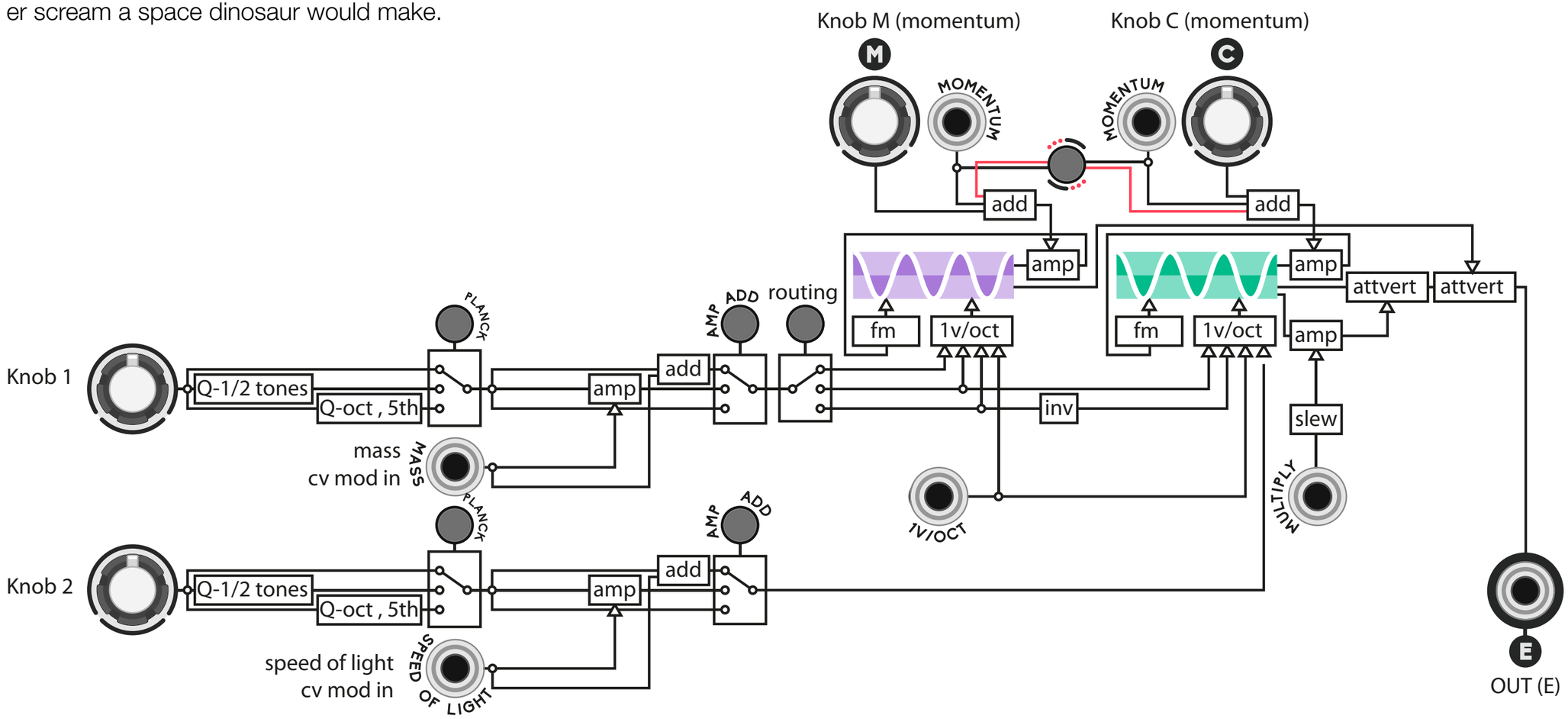
Ring mod synthesis in Energy

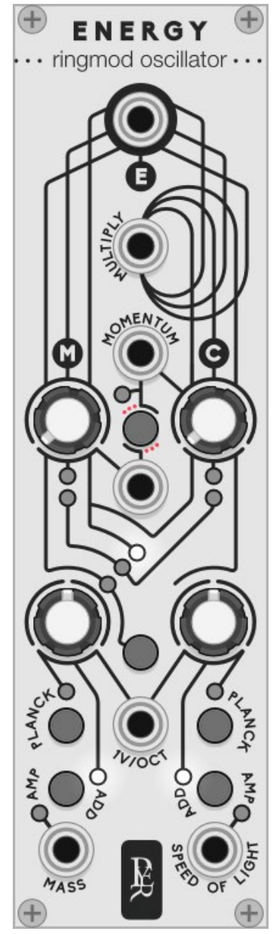
Energy is applying Einstein's equation to ring modulation synthesis: a first sine C (the speed of light) is multiplied by itself. The result is then multiplied by another sine M (the mass of an object) to match the equation e=mc2. The frequency of M and C can be adjusted to explore different types of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

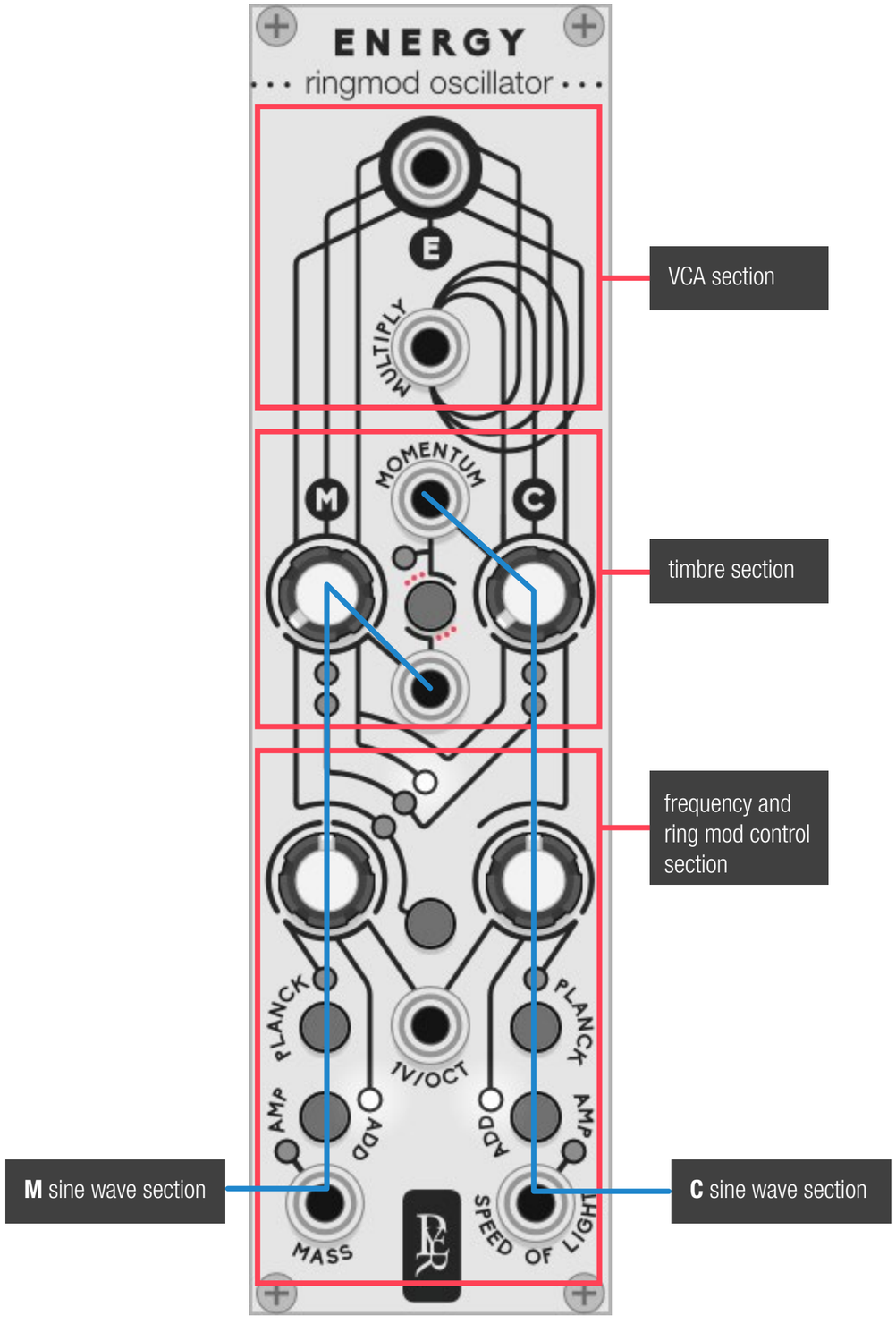


Energy Architecture

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

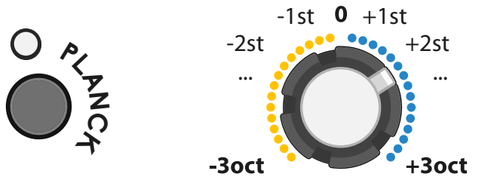
- **Mass CV input:** signal input to modulate the frequency of M sine (1v/octave)
- **Speed of light:** signal input to modulate the frequency of C sine (1v/octave)
- **Add/amp:** define how the mod signal will affect the frequency of each sinus
- **Planck:** define the quantisation for each knob
- **1v/Oct 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

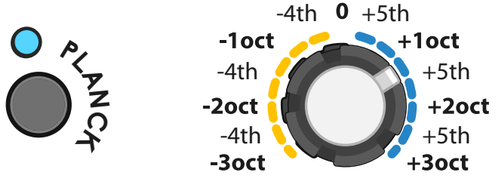
Knob quantisation

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

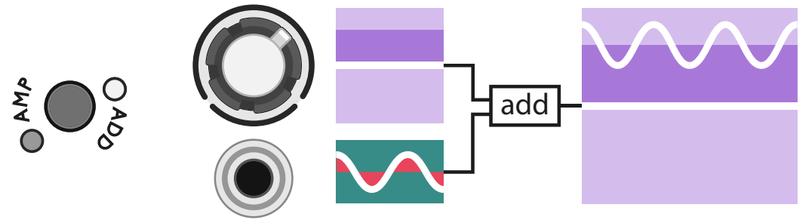


Blue LED Fifth and octaves

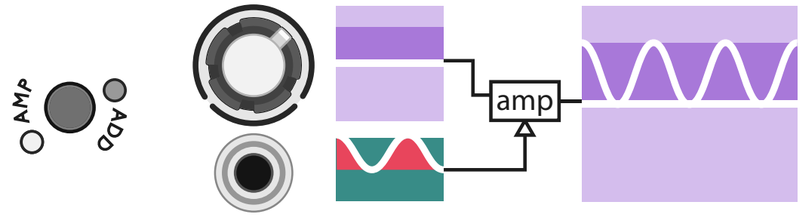
Mod types

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.

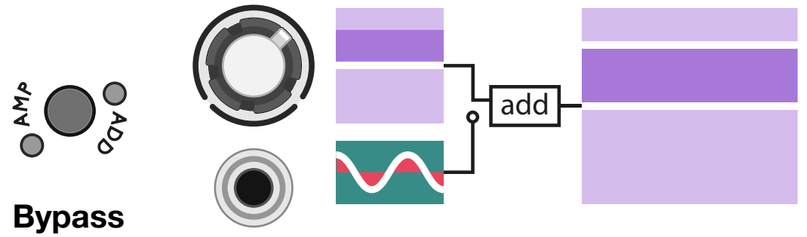
The mod type selector allows different ways to modulate the sound: starting from the knob position (add), or from zero to the knob position (amp).



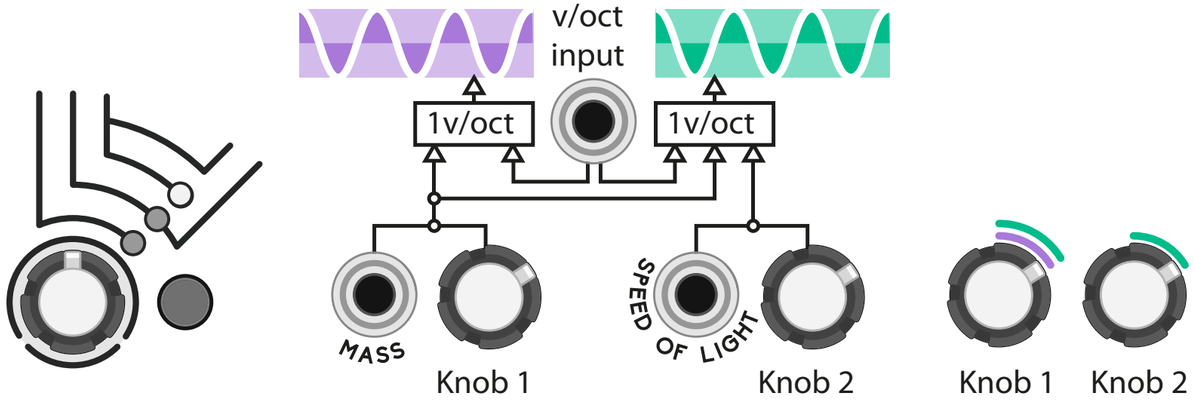
Add (-10V/+10v)

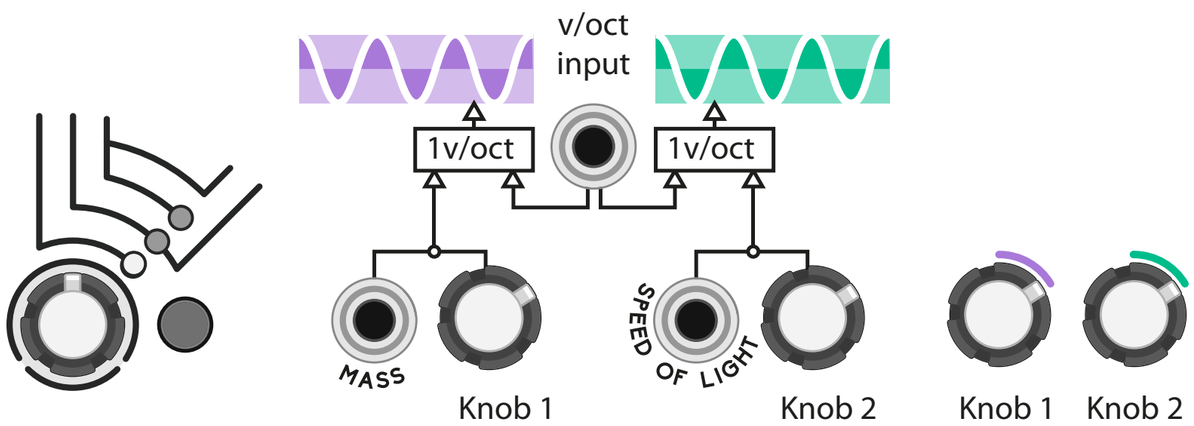


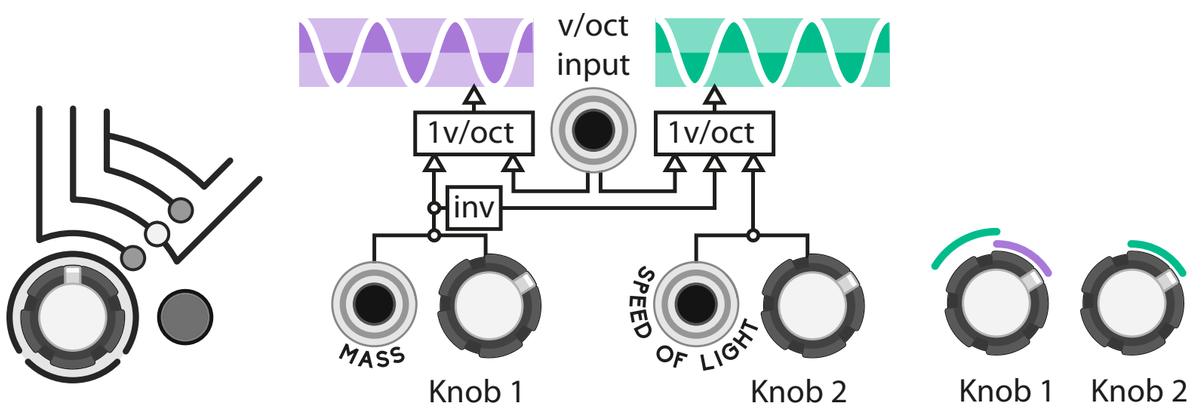
Amp (0/10v)



Bypass





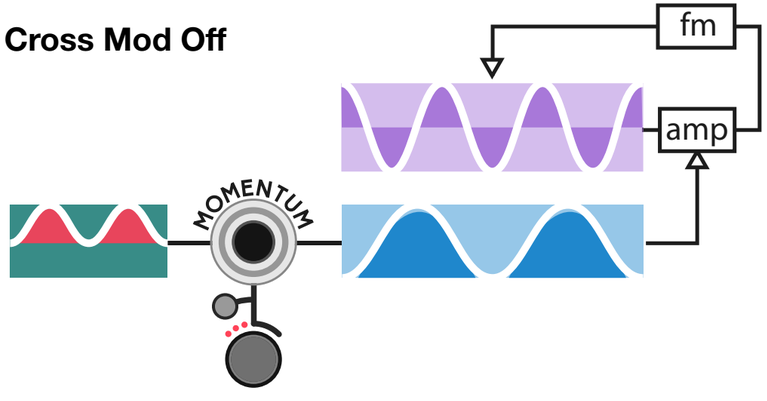


Routing

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



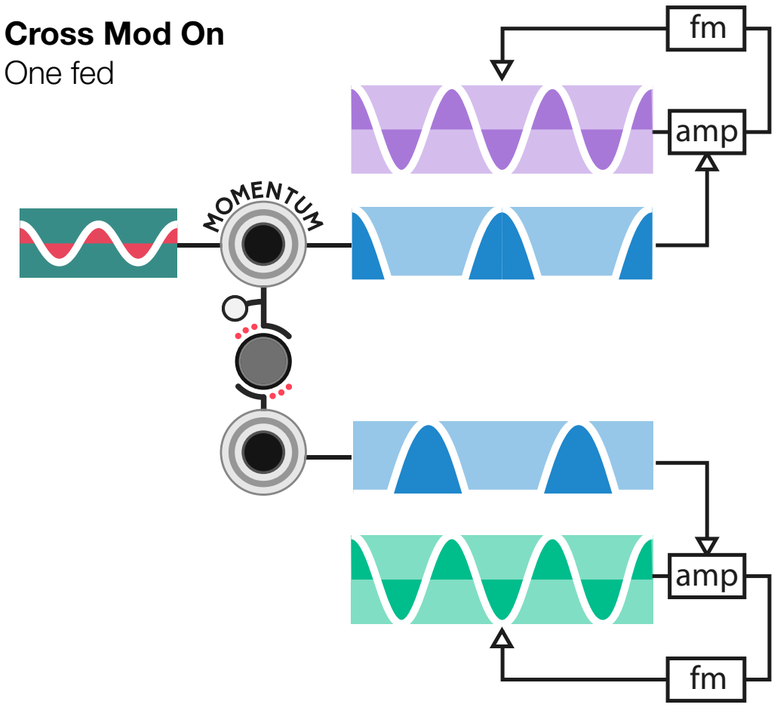
FM Feedback

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.

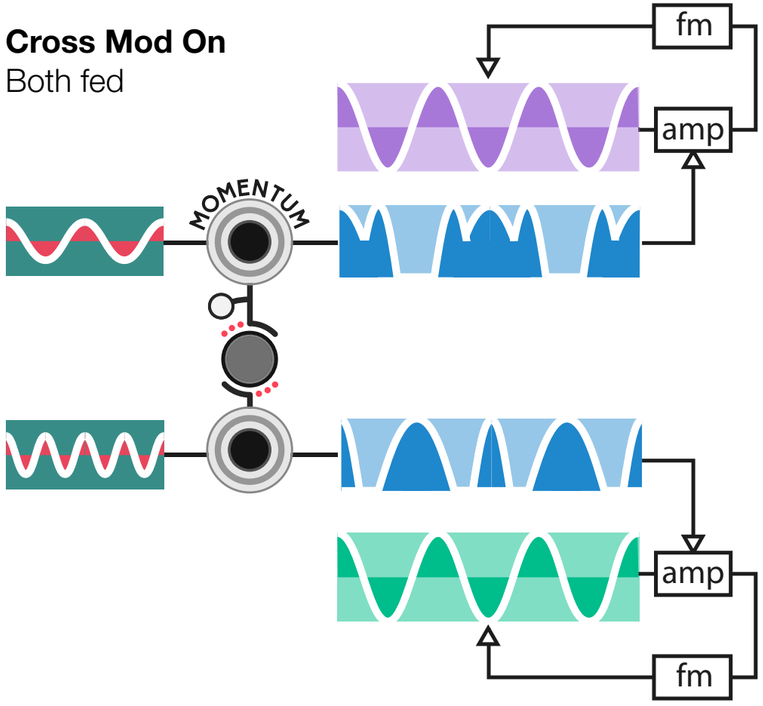
Cross modulation mode

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



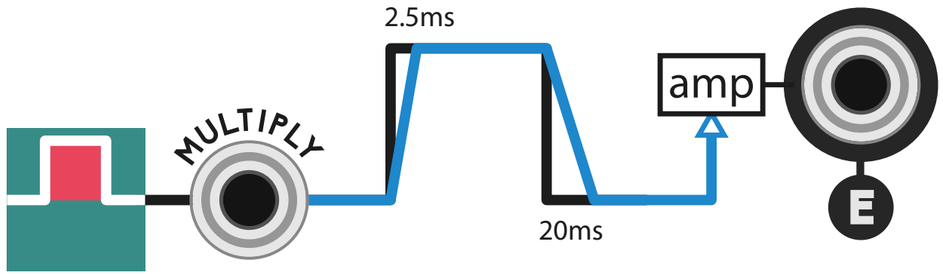
Cross Mod On
Both fed



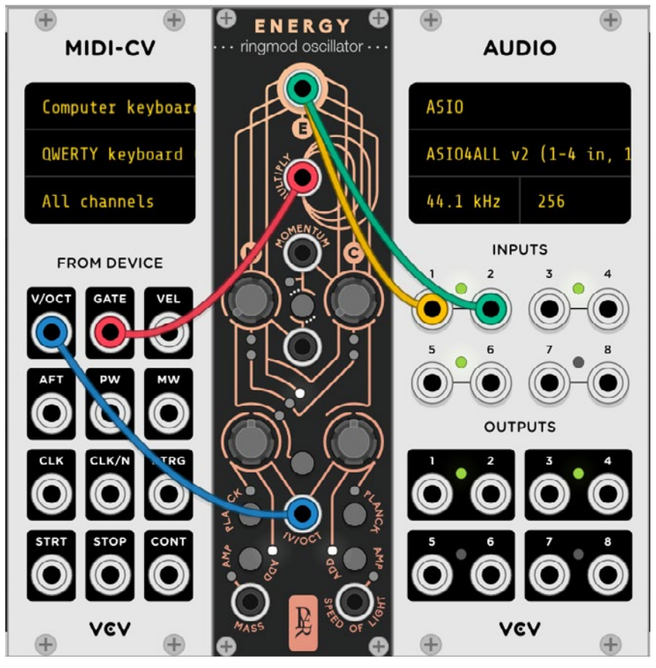
3. Output section

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).

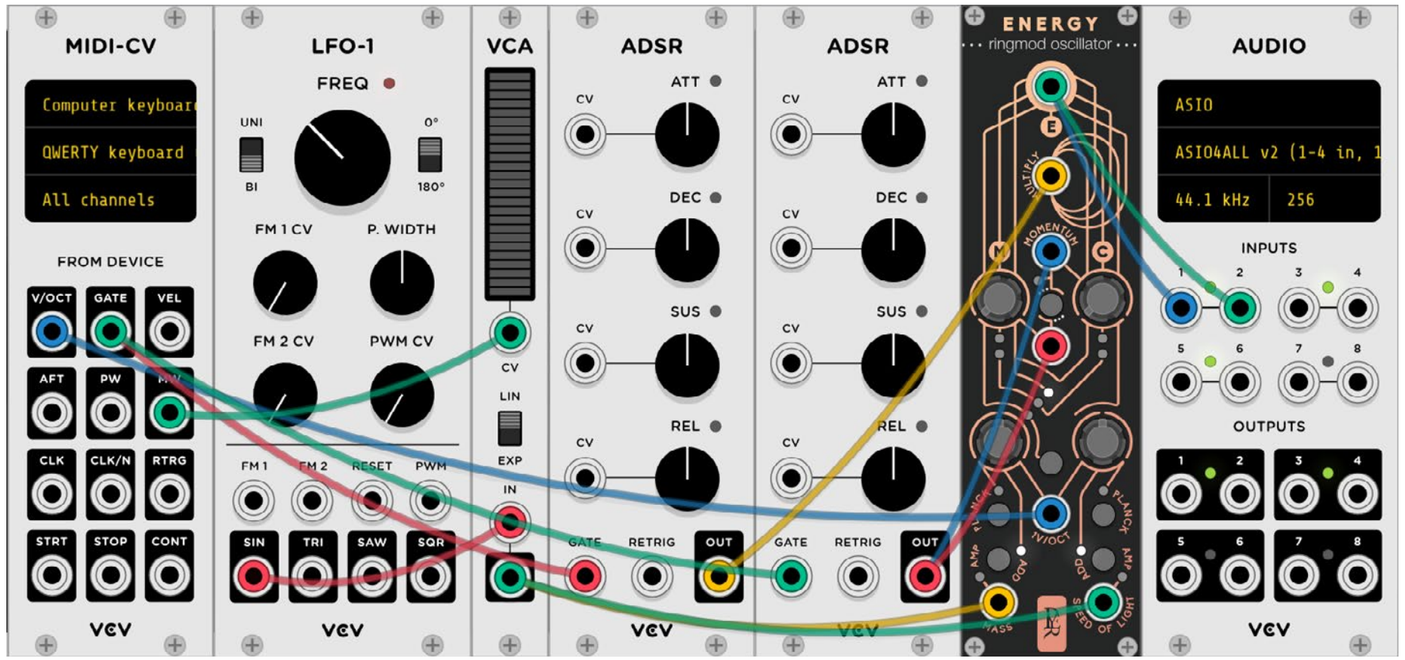


Patch ideas

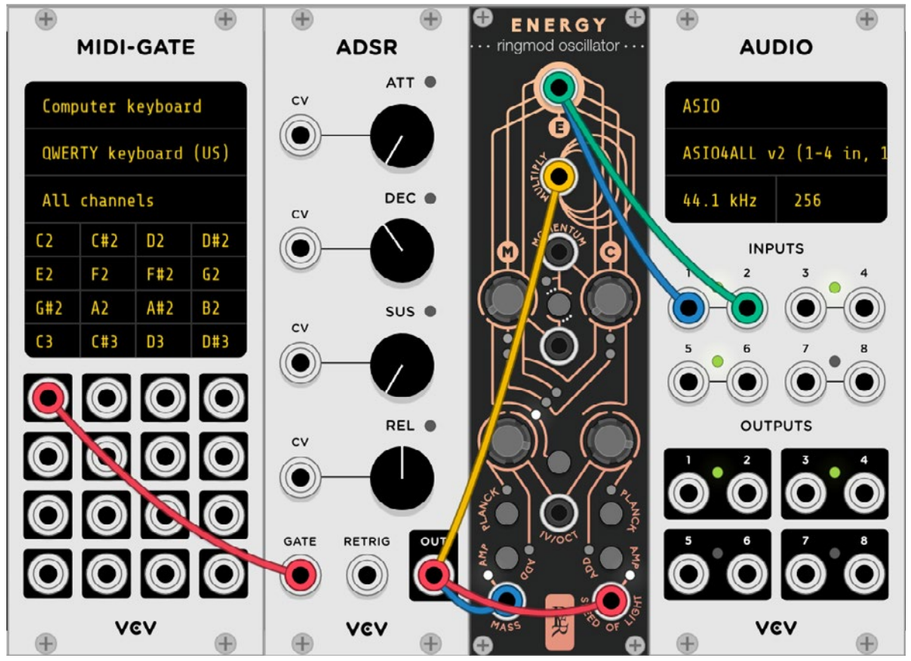


Minimal synth voice: a gate input can be directly connected to the multiply input, thanks to the soft slew limiter.

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.

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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