Liber ex Doctrina

Sanguine Modules

MUTANTS

Liber version 2.6.17 for plugin version ≥ 2.6.8

Table of Contents

Some PDF viewers are quirky, to put it nicely, so, if this manual has text sections broken up; covered by images, or parts that render incorrectly, please read it using your web browser or a different application.

Sanguine Modules Mutants

It is our sincere hope these modules excite you as much as they did us when creating them, and that they fuel all your musical ventures for a really long time!

In a hurry? If you are looking for the instructions for a specific module, use the handy provided table of contents (it is clickable!).

Base modules are presented in alphabetical order, followed by their alternative firmwares, if any are available; expanders are explained in a sub-section of the appropriate module.

A lot of modular synthesis enjoyment comes from discovery and experimentation; however these are complex modules. We recommend you carefully read the instructions for your favorite modules so you can learn their possibilities, quirks and limitations, or, better yet, read the whole manual! Who knows what marvelous ideas a module you haven't tried might inspire?

We are aware there are other implementations of some of the modules in this plugin; quite a few of the Sanguine Modules Mutants diverge from or add to the functionality of the familiar implementations, so some things taken for granted might be different in our versions, or some cool new functions not available before may have been added. When in doubt or bathed in curiosity… Consult this manual!

Have fun!

Manual conventions

- This manual uses **bold** text to refer to controls, inputs, outputs and modes.
- This manual uses illustrations to show LEDs, their states and their colors:

Description	Illustration	LED State
LED light off		An unlit LED lamp.
LED light on		A solid, lit LED lamp. The illustrations show the lamp's color (yellow in the provided example).
Multistate LED light	↔	LED lamps that switch between a number of states. The illustrations show the colors of the states. In this example, the lamp is cycling between being off and lit green.
Fast multistate LED light	⇔	LED lamps that quickly switch between a number of states. The illustrations show the colors of the states. In this example, the lamp is rapidly cycling between being off and lit red.

Module polyphonic conventions

Quite a few Sanguine Modules are polyphonic and can handle up to 16 channels.

Module polyphony is always set by port detection, the modules are smart like that.

Port detection works as follows: the number of channels carried by a polyphonic cable connected to a detector port sets the number of channels the module handles; the instructions for the different modules explain which ports are detectors.

Some modules can detect polyphony using more than one port; if that is the case, polyphony is set by the port with the highest channel count.

If a port has a golden jack, it can handle polyphonic signals, conversely, a port with a silver jack can handle monophonic signals *only*.

Polyphonic port with golden jack 

Monophonic port with silver jack 

As a general rule, parameters set using the controls on the faceplate affect every polyphonic channel processed by the module equally (exceptions to this rule are noted when applicable); however, parameters can be offset (or overridden, when noted), per channel, if the parameter has a polyphonic CV port and a polyphonic cable, carrying a voltage to manipulate the desired channel, is connected to it; exceptions to this rule will be noted, if applicable.

Bypassed module behavior

Some modules have special behaviors when bypassed that supersede the Rack standard of simply ignoring the module. If a module is internally wired to, for example, transfer signals when bypassed, it will be noted in the appropriate section of its manual.

Some technical terms

What is a module instance?

Every module added to a patch, even if one of the same kind is already present, is considered a different instance.

For example: a Nodi module is already present in an intergalactic sounds patch to generate some cool drones; the user decides he wants another, different, Nodi to synthesize the drums, so he adds a new Nodi… Despite the modules having the same names and faceplates, Rack considers them to be two different instances internally.

What is an engine?

Every module present in this collection generates or modifies signals in some manner using a number of algorithms working together to achieve the desired result, we call the described system an **engine** in this manual.

An **engine** processes a single Rack channel.

When a module is polyphonic, a separate **engine** is created for every channel it can handle: each Rack polyphonic channel requires its own **engine**.

For example: an Anuli instance is created in a patch and a polyphonic cable carrying 6 channels is connected to its **STRUM** (8) input. That single user-facing Anuli instance will, internally, process the 6 channels using 6 different **engines**.

Sanguine Modules themes

Sanguine Modules include two, user selectable, faceplate themes:

- **Vitriol**: colorful Sanguine Modules theme, this is the default.
- **Plumbago**: dark Sanguine Modules theme.

The image below shows an example using the “Aleae” module; results for other modules are similar.

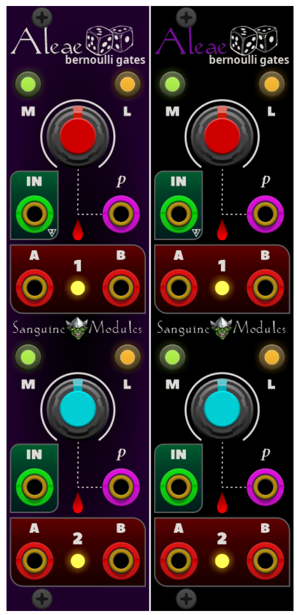
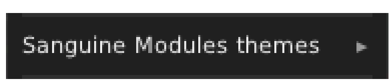


Figure 1: Sanguine Module themes: left: “Vitriol”, right: “Plumbago”.

Every Sanguine Module has the same context menu entries to change themes for the whole plugin and for every individual module instance:



Theme selection options are organized under the **Sanguine Modules themes** context menu entries, individual entries include a little label tip describing what they affect:

- **Module**: sets the theme for the selected module instance.
  - Module themes can be selected individually for every instance of the same module in the same patch.
  - Module themes for individual modules are stored in presets and patches.
- **Default**: sets the theme to be used for every newly created Sanguine module.

- When a new **Default theme** is selected, the selected module instance applies the theme immediately; any newly created modules will use selected theme as well.
- Modules shown in Rack's browser will also be displayed using the selected theme (after Rack is reloaded).
- The selected theme is stored in "SanguineModules.json" in the Rack user folder.
- The selected theme applies to both Sanguine Mutants and Sanguine Monsters.

MetaModule port information

MetaModule is a cool piece of hardware created by the 4ms company, it allows running ported **VCV Rack** plugins in a physical module.

The **Sanguine Mutants** have been ported to **MetaModule** thanks to the great work of **Ericxgao** who is also the maintainer of the port, we occasionally chime in to help when we can.

As marvelous as **MetaModule** is, it has, at the time of this writing, a few limitations, some we hope are fixed in the future and one we know cannot be addressed, for it is a hardware factor:

- Expanders are not supported.
- Streams are not supported.
- The module's screen resolution is tiny.
- Textures are Portable Network Graphics (.png) images.

While these factors impact the **Sanguine Mutants** modules to some degree, most functionality is present.

A few changes had to be made to try and offer the best possible experience. **Rack Sanguine Mutants** users will notice a few changes when they load the plugin in **MetaModule**:

- Faceplates are simplified versions more suited to the small screen.
- Shaped lights such as the light up logos are not treated as lights.
- Expanders are not part of the **MetaModule** version of the plugin: they cannot connect or work with their base modules.
- Modules with "acrylic lights" have had those lights replaced with regular LEDs.
- Custom data cannot be loaded.

Specific changes, if any, to a module's functionality are detailed in its instructions.

More information about the **MetaModule** can be found at https://metamodule.info/.

Modules

Aestus – Tidal modulator

Looping envelopes, a digital oscillator or a wave table synthesizer… all at your beck and call.

Generate single shot AD envelopes or sustained ASR envelopes.

A versatile oscillator: from really slow LFOs to a self contained synth voice.

Find that special modulation with a plethora of signal shaping options.

Continuously interpolate between wave forms in a 2D table and design the sound your next hit craves using the built-in wave folder when the module is configured as the Sheep model.

Based on Mutable Instruments' original "Tides" module and the alternative "Sheep" firmware for it, **Aestus** combines both firmwares in a user-selectable manner.

We hope this module can ride the currents of creativity right by your side.

Aestus controls

Aestus offers two different models and a plotter easter egg in the same module:

- **Tidal modulator**: a versatile digital function generator with a large palette of controllable wave forms.
- **Sheep – Wave table synthesizer**: a wave table synthesizer that provides three banks of waves laid out in a 2D grid; the wave forms can be interpolated.

- **Peacocks easter egg**: plots a couple of peacocks; they can be seen when the **UNI** (12), the X coordinate, and **BI** (13), the Y coordinate, outputs are connected to an oscilloscope module set to X-Y mode. This mode can be set using the context menu only. Module controls are disabled when this mode is enabled and have no effect whatsoever on the drawn shape.

Controls adjust different parameters depending on the selected model, functions for both models are explained below.

Knobs and buttons

A. Model selection: twist this knob to select the module's model.

The selected model is shown in the display to the right of the knob as a single letter, in the knob's tooltip and in the context menu.

Aestus offers two models and an easter egg:

Model	Display
Tidal modulator	t
Sheep – Wave table synthesizer	S
Peacocks easter egg[*]	P

The context menu can also be used to directly select the module's model.

B. SYNC: enables and disables the **Clock sync/PLL mode**.

When this mode is enabled, the button's LED lights up and alternates between yellow and red.

↔

When **Clock sync/PLL mode** is enabled, the frequency of the signal the module generates can be locked to an external source connected to the **CLOCK** (9) input.

What is the difference between Clock sync and PLL (Phase Locked Loop)? Clock sync is meant for triggers and PLL for audio signals. **Aestus** can handle both and selects the most suitable one automatically.

Clock sync/PLL mode is functionally identical in both the **Tidal modulator** and **Sheep – Wave table synthesizer** models.

* This mode must be enabled and disabled using the context menu.

Clock sync/PLL mode will activate automatically when the **Tidal modulator** model is selected and a cable is plugged in the **CLOCK** (9) input: no need to press the button.

Clock sync/PLL mode is disabled by default.

C. **Mode select**: the effects of this button are model dependent:

- **Tidal modulator**

  Pushing this button cycles between the three available operation modes.

  The selected mode is shown in the button's LED, the button's tooltip and in the context menu.

  The available modes are:

LED	Glyph	Mode
		AD Envelope.‡
		Cyclic.
		AR Envelope.‡

- **Sheep – Wave table synthesizer**

  Pushing this button cycles between the three available wave banks.

  The selected bank is shown using the button's LED.

  The **Sheep – Wave table synthesizer** model has no single cycle modes.

  The available banks and their LED colors are:

LED	Glyph	Wave table
		Additive harmonics (no phasing effect, little aliasing).
		PWMish (some more aliasing is possible).
		Waves from Nodi's **WMAP mode**.

These options can be selected directly using the context menu.

D. **FREQUENCY**: this is the main frequency control for the module.

Its behavior depends on whether **PLL mode** is enabled or disabled:

- **PLL mode disabled**: adjusts the signal's frequency.

  The knob has a range of ±4 octaves,

- **PLL mode enabled**: controls the ratio between output frequency and clock frequency.

‡ This mode requires trigger pulses or gate signals sent to the **TRIG** (4) input to generate envelopes.

Both clock division and multiplication are possible.

When the knob is centered, the ratio is 1:1 between the output frequency and the clock frequency.

When the knob is turned clockwise, the following ratios are available:

- 5/4, 4/3, 3/2, 5/3, 2, 3, 4, 5, 6, 8, 12,16

When the knob is turned counter-clockwise, the following ratios are available:

- 1/16, 1/12, 1/8, 1/6, 1/4, 1/3, 1/2, 3/5, 2/3, 3/4, 4/5

The LED to the left of the knob shows the amplitude of the generated wave form and its stage:

LED	Mode
🟢	Attack.
🔴	Decay, sustain, release.

This knob behaves the same in both module models.

E. **FM attenuverter**: controls the polarity and amount of frequency modulation from the signal in the **FM** (7) input.

This knob can also act as a fine frequency control when no cable is connected to the **FM** (7) input.

This knob behaves the same in both module models.

F. **Range select**: pushing this button cycles between the three available frequency ranges.

The selected range is shown using the button's LED, the button's tooltip and in the context menu.

The available ranges are:

LED	Glyph	Mode
🟢	L	Low.
⚫	M	Medium.
🔴	H	High.◊

Frequency range can be selected directly using the context menu.

This controls frequency range in both module models.

◊ This mode is optimized for audio frequencies, so the **SHAPE** (G) and **SLOPE** (H) parameters have different response curves better suited for such frequencies.

G. **SHAPE**: this effect of this knob is model dependent:

- **Tidal modulator**

  Adjusts the shape of the wave, therefore providing different combinations of curvatures for the rise and fall segments.

- **Sheep – Wave table synthesizer**

  Controls the X coordinate of the wave map.

H. **SLOPE**: the behavior of this knob is model dependent:

- **Tidal modulator**

  Adjusts the balance between the rise and fall time: when the knob is all the way to the left, there is no rise time and the decay segment takes up the whole cycle (decaying envelope); when the knob is all the way to the right, the attack segment takes the whole cycle and the fall is immediate; both phases have equal duration when the knob is centered.

- **Sheep – Wave table synthesizer**

  Controls the Y coordinate of the wave map.

I. **SMOOTH**: this knob controls how the output wave is transformed: at 12 o'clock, waves are output without modification; turning the knob counter-clockwise progressively attenuates the signal's high frequency content (2-pole low-pass filtering); turning the knob clockwise progressively enriches the signal's high frequency content via wave folding.

   The effect of this knob is the same for both module models.

Inputs and outputs

1. **SHAPE CV**: voltages sent to this input act as offsets added to the value set by the **SHAPE** (G) knob.
2. **SLOPE CV**: voltages sent to this input act as offsets added to the value set by the **SLOPE** (H) knob.
3. **SMOOTH CV**: voltages sent to this input act as offsets added to the value set by the **SMOOTH** (I) knob.

4. **TRIG**: pulses received in this port have a different effect that depends on the selected mode: in **AD envelope** and **AR envelope** modes, they drive the envelope; in **Cyclic mode** they reset the oscillator's phase.

   The effect of this input is the same for both module models. Keep in mind the **Sheep – Wave table synthesizer** model is cyclic only.

   The voltage detection threshold is 0.7V.

5. **FREEZE**: when a signal of 0.7V or higher is present in this input, the oscillator or envelope stops until the input voltage goes back to 0V.

   This input has the same effect on both module models.

6. **V/OCT**: controls the module's frequency.

   This input behaves the same on both module models.

7. **FM**: voltages sent to this port modulate frequency.

   The amount of **FM** can be controlled by the **FM** (E) attenuverter.

   This input is normalled to 0.1V when no cable is connected.

   The effect of this input is the same for both module models.

8. **LEVEL**: the voltage of the **UNI** (12) and **BI** (13) outputs can be scaled using this input, which acts as a VCA (input range: 0V to 8V, higher voltages are clipped).

   Signals are output at full amplitude when no cable is connected: this port is normalled to 8V.

   Both module models react the same to voltages sent to this input.

9. **CLOCK**: the behavior of this input depends on the selected module model and whether **Clock sync/PLL mode** is enabled:

   - **Tidal modulator**
     - The signal in this port will be used to synchronize the internal oscillator.
     - Connecting a cable to this port automatically activates **Clock sync/PLL mode**: this port has no other use in this model.
   - **Sheep – Wave table synthesizer**
     - When **Clock sync/PLL mode** is disabled, pulses sent to this port will cycle the available wave banks.

- When **Clock sync/PLL mode** is enabled, the internal oscillator will synchronize to the signal in this port.
- The **SYNC** button toggles the **Clock sync/PLL mode** on and off.

10. **HIGH tide**: the behavior of this output is model dependent:
    - **Tidal modulator**

      This output goes high at the end of the attack phase and remains in that state until the cycle restarts or the envelope is retriggered.
    - **Sheep – Wave table synthesizer**

      This output contains a low fidelity (1 bit) version of the signal.
11. **LOW tide**: the behavior of this output is model dependent:
    - **Tidal modulator**

      This output goes high at the end of the decay/release phase and remains in that state until the cycle restarts or the envelope is retriggered. Both the **HIGH tide** (10) and **LOW tide** (11) outputs can be used to chain envelopes.
    - **Sheep – Wave table synthesizer**

      This output contains a -1 octave square sub-oscillator.
12. **UNI**: in **Tidal modulator** and **Sheep – Wave table synthesizer** modes, the signal in this output has a range between 0V and 8V and is what you expect in both module models: signal goes to 8 volts then back to 0 volts.

    When the **Peacocks easter egg** is enabled, this port contains the X coordinate.
13. **BI**: in **Tidal modulator** and **Sheep – Wave table synthesizer** modes, the signal in this output has a range between -5V and +5V; when the **Tidal modulator** model is selected, its behavior is not exactly what you would expect.

    When the module is set to the **Tidal modulator** model, the output signal has two bumps: a positive one and a negative one; the **SLOPE** (H) parameter controls the duration ratio between the two, rather than their rise and fall time. In other words: when **AD envelope** mode is selected, the bipolar output is not “A D”; but “A D -A -D”; when **AR envelope** mode is selected, it is not “A R”; but rather “A D … -A -D”; this effect is also applied when audio range is selected. Interesting timbral variations can be obtained by crossfading between the **UNI** (12) and **BI** (13) output signals.

    An example illustration will help make the produced shapes clearer:

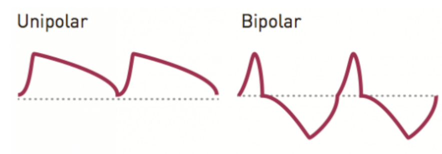


*Figure 2: An **Aestus** envelope signal: **UNI** (12) output on the left, **BI** (13) output on the right.*

When the **Peacocks easter egg** is enabled, this port contains the Y coordinate.

Aestus context menu

In addition to the standard Sanguine Modules context menu, the **Aestus** context menu has several new entries that change dynamically depending on the selected module settings:

- **Model**: select the module's active model directly. This menu is always available.
- **Mode**: select **Tidal modulator** modes directly. This menu is present only when the **Tidal modulator** model is set.
- **Wave table**: select **Sheep – Wave table synthesizer** wave tables directly. This menu is present only when the **Sheep – Wave table synthesizer** model is set.
- **Range**: select the module's frequency range directly. This menu is always available.
- **Compatibility options**: some **Aestus** updates can create problems when the module is used with patches that were created using older versions of Sanguine Mutants, this menu allows users to selectively enable the old behavior so their old patches work as intended:
  - **Frequency knob center is C4**: Rack users expect most modules to be factory tuned to C4 when their frequency controls are centered; **Aestus** did not follow this behavior.

    The module now honors what most users expect.

    We are aware there are existing patches designed for the old behavior or users that prefer the old tuning.

This menu entry sets **Aestus** to use the old tuning when it is disabled.

This option is enabled by default.

- **Peacocks easter egg**: enables and disables the peacocks plotter.

Temulenti – Parasitic tidal modulator

A twisted take on **Aestus** that adds two new module models: a 16-voice harmonic oscillator and a duophonic random walk generator that offers more modulation possibilities; it also makes some changes to the **Tidal modulator** model.

Based on the “Parasite” firmware for Mutable Instruments’ original “Tides”.

We hope this module can help you surf the waves of sound design!

This manual documents the changes made to **Aestus** to create the **Temulenti** module; for basic operating instructions and descriptions of the models already present in **Aestus** (**Tidal modulator** and **Sheep – Wave table synthesizer**) please consult its manual.

Some changes have been made that impact the sound and behavior of the module when the **Tidal modulator** model is selected:

- The **SMOOTH** (I) knob now mutes the sound completely when set all the way to the left. (Feed it an envelope to use it as an LPG, it sounds great.)
- When **RANGE** (F) is set below audio rate (the button’s LED is either off or lit green), the logarithmic and exponential wave forms have been accentuated: their effect is more pronounced.
- When **RANGE** (F) is set to audio rate (button’s LED is lit red), the **SLOPE** (H) knob has a different effect when going from 7 o’clock to 12 o’clock: it sets the wave’s “compression factor”: a technique known as Pulsar synthesis which results in nasal or guttural tones. (This effect is prone to aliasing at high frequencies or high spectral contents, so… now you know). The knob’s response has also been changed to exponential.
- When **RANGE** (F) is set to audio rate (button’s LED is lit red), the **LOW tide** (11) output becomes a square sub-oscillator; when **Clock sync/PLL mode** is disabled, the **CLOCK** (9) input acts as a gate and reset for this sub-oscillator: when the signal to the input is high (≥0.7V), the sub-oscillator is stopped until the signal goes low.

A mode has been removed:

- The **Peacocks easter egg** is not available in **Temulenti**.

Temulenti controls

The controls for **Temulenti** are the same as the ones for **Aestus** with one addition: the **QNTZ** (J) quantizer control, described below.

Temulenti offers four different models in the same module, they are presented below in the order the **Model selection** (A) switches them:

- **Tidal modulator**: the same model explained in the Aestus manual, with the differences noted above and the addition of the quantizer explained below.
- **Two bumps – Harmonic oscillator**: a 16-voice harmonic oscillator[1] with two spectral bumps or notches. Centroids and width can be controlled; harmonics and wave quality selected; it includes a sub-oscillator, and 1 bit and harmonics shuffling outputs for unusual, random timbres.

  In this model, timbre is shaped by choosing two "center frequencies": the loudest harmonics, and a "width": the amount of harmonics adjacent to the two centers that will also ring. The exact mirror of what was just described can also be obtained: the bumps then become potholes: all harmonics ring by default and the quietest harmonics can be selected, digging a notch of varying width in the spectrum.
- **Two drunks – Random walk**: a complex, duophonic random walk generator with selectable interpolation, driven by two clocks.

1 A harmonic generator produces its timbre by summing sinusoidal waves of multiple frequencies (harmonics).

This model is extremely versatile and can be used as an oscillator with PLL; a Bernoulli gate; a random trigger delay; a stepped, smooth or wave shaped random voltage generator; a random burst generator; a filtered noise source…

This model is a dual random walk simulator; each walk is timed by an independent clock featuring a form of randomness: one is jittery, with random control; the other simulates a random, biased coin toss, with controllable bias. Both clocks derive from the same, main clock.

Each step leads the walker to a different, nearby place: a new voltage at one of the outputs. The interpolation between the steps can be chosen (square, linear, sinusoidal, bouncy, pointy, woggly[2]...): a square one will have the effect of sample & hold (on a random walk, not on noise). All the interpolations sound different.

The two output channels share the same knob parameters; but they are inverted[3] (for additional fun)! For example: if a knob is fully counter-clockwise, Channel 1 will act according to the knob's setting and Channel 2 will behave as if the knob was set all the way to the right. The only way to make both channels agree is to center a given knob.

- **Sheep – Wave table synthesizer**: the same model present in **Aestus** and explained in its manual with the quantizer addition.

Controls adjust different parameters depending on the selected model, functions for the new models are explained below.

Knobs and buttons

A. Model selection: twist this knob to select the module's model. The selected model is shown in the display to the right of the knob as a single letter, in the knob's tooltip and in the context menu.

Aestus offers four models:

Model	Display
Tidal modulator	t
Two bumps – Harmonic oscillator	b
Two drunks – Random walk	d
Sheep – Wave table synthesizer	S

The context menu can also be used to directly select the module's model.

2 Between wiggly and wonky.
3 Knob inversion affects the **SHAPE** (G), **SLOPE** (H) and **SMOOTH** (I) knobs.

B. **SYNC**: same behavior as in **Aestus**.

C. **Mode select**: the effects of this button are model dependent:

- **Two bumps – Harmonic oscillator**

  Pushing this button selects which harmonics can ring.

  The selected harmonics mode is shown using the button's LED, the button's tooltip and in the context menu.

  The available modes are:

LED	Glyph	Mode	Description
		Odd harmonics	A more metallic timbre, closer to a square wave.
		First 16 harmonics	The default in most harmonic oscillators.
		Octaves	You'd be forgiven for thinking this sounds like a church organ.

- **Two drunks – Random walk**

  Pushing this button cycles between the three available trigger modes.

  The selected mode is shown using the button's LED.

  The available modes and their LED colors are:

LED	Glyph	Mode	Description
		Trigger[♠♦]	A new cycle begins when a trigger is received in the **TRIG** (4) input. The trigger will be delayed or randomly dropped on the clock outputs of Channels 1 / 2.
		Cycling	The clock ticks away by itself and stops only when a gate is received in the **FREEZE** (5) input.
		Gate[♠]	The main clock cycles while the **TRIG** (4) input is high.

These options can be selected directly using the context menu.

D. **FREQUENCY**: the behavior of this knob is model dependent:

♠ Both channels always finish their current step before stopping, and pick up where they left off (except when the square interpolation is set).

♦ Interpolation time is fixed to the main clock: it will not correspond perfectly to the next trigger, and, therefore, will sometimes "stall". If your triggers are a steady clock, you might be better off enabling **Clock sync/PLL mode** and using the **CLOCK** (9) input.

- **Two bumps – Harmonic oscillator**

  Sets the fundamental frequency.

- **Two drunks – Random walk**

  Sets the frequency of the main clock.

Clock sync/PLL mode can affect both models by synchronizing their respective parameter to an external source.

E. FM attenuverter: the behavior of this knob is model dependent:

- **Two bumps – Harmonic oscillator**

  Attenuverts the amount of FM applied from the signal in the **FM** (7) input.

- **Two drunks – Random walk**

  Attenuates the signal in the **FM** (7) input; it also determines the duration of output gates:

  - Channel 1 (jittery clock): sets the random distribution of the on and off gate states: when the knob is centered, on and off times for the gate are equal; when the knob is all the way to the left, the gate spends more time being off than on, and when the knob is fully to the right, the gate spends most of its time being on.
  - Channel 2 (coin-toss clock): sets the pulse width of each clock tick.

F. Range select: the behavior of this button is model dependent; pushing it cycles between the three available options.

The selected option is shown using the button's LED, the button's tooltip and in the context menu.

- **Two bumps – Harmonic oscillator**

  Selects sine wave quality:

LED	Glyph	Quality	Description
	L	**Low**	Sines are interpolated with the least points: a more pronounced effect than the one obtained in **Medium** quality.
	M	**Medium**[4]	Sines are interpolated with less points and sound closer to a triangle.

4 Waves are decimated; but the effect is not the same as one obtainable when running the output through a bit crusher (such as the one available in Distortiones): all sine waves are decimated independently, at their own frequency.

- **High**[5] Maximum quality sine wave interpolation.

- **Two drunks – Random walk**

  Sets the frequency range of the oscillator.

  Setting the **Range** to **High** can produce an interesting noise generator: crank the frequency to maximum, optionally connect a positive offset signal in the **V/OCT** (6) port and listen! Carelessly wiggling the knobs and self patching can produce fun results!

These options can be set, for both models, using the context menu.

G. **SHAPE**: this effect of this knob is model dependent:

- **Two bumps – Harmonic oscillator**

  Selects the first central frequency.

- **Two drunks – Random walk**

  Sets the interpolation curve between two steps[6]. It morphs, from left to right, between: square (no interpolation), spiky, spiky and bouncy, linear, sinusoidal, bouncy, and woggly.

H. **SLOPE**: the behavior of this knob is model dependent:

- **Two bumps – Harmonic oscillator**

  Selects the second central frequency. The effect of this frequency is, intentionally, always less pronounced, for variety.

- **Two drunks – Random walk**

  Sets the behavior of the two clocks[6].

  - Channel 1: acts as a random delay to the main clock: when the knob is fully counter-clockwise, no delay is applied and the channel follows the main clock; as the knob is turned clockwise, the random delay gets bigger and the clock gets slower and more jittery.

  - Channel 2: sets the probability that a main clock tick will produce a clock tick in Channel 2; when the knob is all the way to the right, probability is 1 and channel 2 accurately follows the main clock; as the knob is turned to the left, more and more clock ticks are dropped; when the knob is centered, probability is ½; when

5 Even in this mode a bit of aliasing can occur due to the low sampling rate.
6 Remember! Knob inversion!

the knob is all the way to the left, probability is very small (but not 0) and *almost* all clock ticks will be dropped.

I. **SMOOTH**: the behavior of this knob is mode dependent:

- **Two bumps – Harmonic oscillator**

  Selects how the timbre is affected by the central frequencies; when the knob is at 7 o’clock, the oscillator is silenced; a little past 7 o’clock to 12 o’clock, only harmonics at the center frequencies ring, with an increasing number of neighbors ringing as the knob is turned; from 12 o’clock to 5 o’clock, all harmonics ring, except those at the centers, with an increasing number of neighbors getting carved.

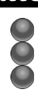
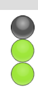
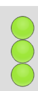
- **Two drunks – Random walk**

  Sets the maximum size of one step[7] (step sizes are random); when the knob is all the way to the left, Channel 1 will take very large steps (so large, that it could be considered completely random) and Channel 2 will be almost steady; when the knob is all the way to the right, this behavior is inverted: Channel 2 takes really large steps and Channel 1 is almost steady. Why is this happening? Remember! Knob inversion is fun, and the model is called “Two Drunks”.

J. **QNTZ**: **Temulenti** has a built-in quantizer that can be used with all module models; twisting this knob turns it on and off and selects the scale it will use.

The selected scale is shown using the LEDs (in binary notation) to the right of the knob, the knob’s tooltip and the context menu.

The available scales and their LEDs pattern are the following:

LEDs pattern	Scale	LEDs pattern (cont’d)	Scale (cont’d)
	Off.		Whole tones.
	Semitones.		Pentatonic minor.
	Major.		Poor pentatonic.
	Minor.		Fifths.

7 The length a walk can travel in one clock tick.

Inputs and outputs

The **SHAPE** (1), **SLOPE** (2), **SMOOTH** (3) and **FM** (7) (normalled to 0.1V) inputs still receive signals that will act as offsets to their corresponding parameter, as in **Aestus**.

4. **TRIG**: the behavior of this port is model dependent:
   - **Two bumps – Harmonic oscillator**

     Triggers randomize the phase of each harmonic and act as a kind of reset.
   - **Two drunks – Random walk**

     Trigger the clocks.
5. **FREEZE**: this input behaves differently depending on the selected model:
   - **Two bumps – Harmonic oscillator**

     When a gate is received, harmonics sent to the **UNI** (12) output are permuted randomly.
   - **Two drunks – Random walk**

     When a high gate (≥0.7V) is active, all clocks are stalled.
6. **V/OCT**: what you expect.
8. **LEVEL**: the behavior of this input is model dependent:
   - **Two bumps – Harmonic oscillator**

     This input acts like a VCA (as in **Aestus**).
   - **Two drunks – Random walk**

     Controls the amplitude of both channels.
9. **CLOCK**: this input is model dependent:
   - **Two bumps – Harmonic oscillator**

     When **Clock sync/PLL mode** is disabled, triggers received in this port will randomize the harmonics distribution and decimation settings. The LEDs in the buttons for **Mode select** (C) and **Range select** (F) will show the selected modes.

     When **Clock sync/PLL mode** is enabled, behavior is similar to **Aestus**.
   - **Two drunks – Random walk**

When **Clock sync/PLL mode** is disabled, triggers received in this port will randomize the range setting. The LED in the **Range select** (F) button will show the selected range.

When **Clock sync/PLL mode** is enabled, behavior is similar to **Aestus**.

10. **HIGH tide**: This output is model dependent:
    - **Two bumps – Harmonic oscillator**

      The 1 bit version of the **BI** (13) output.
    - **Two drunks – Random walk**

      The clock for Channel 1.
11. **LOW tide**: the output of this port is model dependent:
    - **Two bumps – Harmonic oscillator**

      A square sub-oscillator, one octave down from the fundamental.
    - **Two drunks – Random walk**

      The clock for Channel 2.
12. **UNI**: the output of this port is model dependent:
    - **Two bumps – Harmonic oscillator**

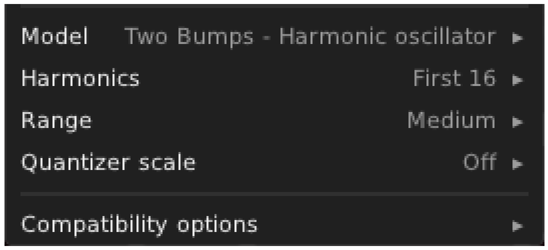
      The unipolar, permuted harmonics output.
    - **Two drunks – Random walk**

      The random walk of Channel 1.
13. **BI**: the output of this port is model dependent:
    - **Two bumps – Harmonic oscillator**

      The main output of the model.
    - **Two drunks – Random walk**

      The random walk of Channel 2.

Temulenti context menu



In addition to the standard Sanguine Modules context menu, the **Temulenti** context menu has several new entries that change dynamically depending on the selected module settings:

- **Model**: select the module's active model directly. This menu is always available.
- **Mode**: select **Tidal modulator** or **Two drunks – Random walk** modes directly. This menu is present only when the **Tidal modulator** or **Two drunks – Random walk** models are set.
- **Harmonics**: select **Two bumps – Harmonic oscillator** ringing harmonics directly. This menu is present only when the **Two bumps – Harmonic oscillator** model is set.
- **Wave table**: select **Sheep – Wave table synthesizer** wave tables directly. This menu is present only when the **Sheep – Wave table synthesizer** model is set.
- **Range**: select the module's frequency range directly. This menu is always available.
- **Quantizer scale**: enable and disable the quantizer and select its active scale directly. This menu is always available.
- **Compatibility options**: some **Temulenti** updates can create problems when the module is used with patches that were created using older versions of Sanguine Mutants, this menu allows users to selectively enable the old behavior so their old patches work as intended:
    - **Frequency knob center is C4**: this option is equivalent to its **Aestus** counterpart.

      This option is enabled by default.

Aleae – Bernoulli Gates

A two channel, polyphonic trigger and gate randomizer: whenever a trigger is received in one of the two inputs, a virtual coin is tossed, its result affecting the output in different ways.

This handy utility module is great for creating generative patches or adding movement to an existing one.

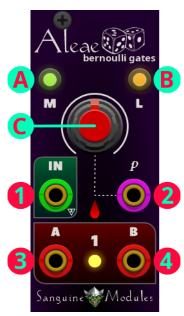
This module can be driven at audio levels to create a noise generator.

This module will produce a different coin toss for every channel present when polyphonic cables are connected to the inputs.

Based on Mutable Instruments' "Branches".

We aim for this module to serve your chaotic needs!

Aleae controls



Aleae consists of two identical sections: one at the top, the other at the bottom, only the top section is pictured here.

Knobs and buttons

A. COIN MODE: selects between the two available "coin toss" modes:

LED	MODE	DESCRIPTION
●	**Direct mode**	Whenever a trigger is received, a virtual coin is tossed, if it lands on "heads" **OUTPUT A** (3) gets a trigger or gate (if **LATCH MODE** (B) is enabled); if the result is "tails" the trigger or gate goes to **OUTPUT B** (4).

	Toggle mode	In this mode the outcome of the coin toss works as follows: • “Heads”: continue sending the trigger to the same output it was being sent to after the last toss. • “Tails”: the trigger is now sent to the opposite output until a new tails result is obtained. When the **PROBABILITY KNOB** (C) is set to its maximum value a trigger toggles between the two outputs.

B. LATCH MODE: toggles **LATCH MODE** on and off.

LED	State	Description
	Off	When a trigger is received, a trigger is, in turn, sent to the output decided by the coin toss depending on the **COIN MODE** (A) setting.
	On	A gate is high in one of the outputs and remains in that state until a trigger that changes the selected output is received or this mode is disabled.

C. PROBABILITY KNOB: changes the odds that a particular result will be obtained from the coin toss.

Mode	Behavior
Direct mode	Setting the knob all the way to the left makes every trigger go to **OUTPUT A** (3) (“heads”); turning it all the way to the right selects **OUTPUT B** (4) (“tails”) every time.
Toggle mode	When the knob is set fully counter-clockwise, every trigger goes to **OUTPUT A** (3); setting it fully clockwise switches outputs on every coin toss.

Inputs, outputs and LEDs

1. **Trigger input**: a trigger sent to this port makes the module throw a virtual coin and send a trigger or gate to one of the outputs depending on the result and the module’s settings.

   This input sets the number of polyphonic channels for its section.

The **Trigger input** for **Section 2** is normalled to the **Trigger input** for **Section 1**: if no cable is connected to the **Trigger input** for **Section 2**, triggers received in the **Trigger input** for **Section 1** will “cascade” to **Section 2** and throw that section’s virtual coin, producing independent results.

2. **Probability CV input**: voltages received in this port change the odds of getting “heads” or “tails” along with the **PROBABILITY KNOB** (C).

3 and 4. Outputs: a 10V trigger or gate, depending on the **LATCH MODE** (B) setting, will be sent to one of these, according to the rules stated above, whenever a trigger is received in **Trigger input** (1).

The LED lamp between the outputs lights up to indicate the output where the trigger or gate was sent to.

LED	Output
	No signal in either output.
	**A** (3).
	**B** (4).

Aleae context menu

The Aleae context menu has one addition to the standard Sanguine Modules context menu:

- **LEDs channel**: Aleae is a polyphonic module and, as such, it can handle up to 16 different channels; yet only two LEDs (one per section) are available to show the currently active output. The solution lies in the context menu: this menu option selects the channel the LEDs show.

  The selected channel applies to both module sections.

  Only available channels are shown in the menu.

  The module is smart and will select the highest available channel automatically if the last user-selected channel is higher than the currently available ones.

Vimina – Clock manipulator

Swing, multiply and divide up to 16 clock channels, per assignable section, with full manual and CV controlled manipulations in a small package.

Vimina is a polyphonic, flexible dual channel clock modulator module.

Based on the “Twigs” alternative firmware for Mutable Instruments’ “Branches”.

We hope this module will help you obtain that perfect pace every time you let it take a swing.

Vimina controls

Vimina derives its morphology from Aleae and shares its context menu: the **LEDs channel** entry is functionally identical; the rest of the module is a different story: its purpose, modes and functions are radically different from Aleae’s.

The module provides two almost identical sections that share the **RST.** (1) and **CLK.** (4) inputs.

Sections are referred to **Section 1** and **Section 2** in the module’s faceplate and in this manual.

The module offers two different, user selectable, independent modes per section:

- **Clock swing**: modifies incoming triggers/clocks to have musical swing.

- **Clock multiplier/divider**: generates additional triggers or skips beats from those received in the **CLK.** (4) input.

Knobs and buttons

A. Section 1 MODE: sets the active mode for **Section 1**, the selected mode is shown in the button's tooltip and the button's LED light.

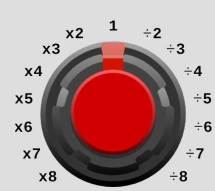
LED	Output
	Clock swing.
	Clock multiplier/divider.

Clock swing is the default mode for **Section 1**.

B. Section 1 R: pressing this button sends a reset signal to **Section 1**; the effect of reset signals is mode dependent:

Mode	Effect
Clock swing	The next trigger received in the **CLK.** (4) input will be treated as a non-swing one.
Clock multiplier/divider	The next trigger received in the **CLK.** (4) input will be passed thru and the internal trigger counter will start over.

C. Section 1 parameter: this knob controls the parameter for **Section 1**; the effect of the parameter depends on the mode selected for the section:

Mode	Effect
Clock swing	Sets the amount of swing: 50% (i.e. No swing) when the knob is all the way to the left, to 70% when it is completely to the right. As the percentage increases, so does the delay of every other input trigger.
Clock multiplier/divider	Sets the operation to perform on incoming triggers and its factor:  When the knob is at 12 o'clock (1 in the diagram), the effect is bypassed; turning the

	knob to the left multiplies the clock, up to x8; turning the knob to the right divides it, up to ÷8.

The effect of the parameter and its set value are shown in the tooltip of the knob.

D. **Section 2 MODE**: sets the active mode for **Section 2**, the selected mode is shown in the button's tooltip and in the button's LED.

   LED and mode behavior is the same as in **Section 1**.

   Clock multiplier/divider is the default mode for **Section 2**.

E. **Section 2 R**: pressing this button sends a reset signal to **Section 2**; reset signals are functionally equivalent to those for **Section 1**; but affect **Section 2**.

F. **Section 2 parameter**: sets the parameter for **Section 2**, it is functionally the same as the **Section 1 parameter** (C) knob; but its value affects **Section 2**.

Inputs, outputs and lights

1. **RST**: *shared* reset input for **Section 1** and **Section 2**; triggers received here send a reset signal to *both* sections; the effects of reset signals are explained in **Section 1 R** (B) above.

2. **Section 1 CV**: voltages received in this port act as an offset to the value set by the **Section 1 parameter** (C) knob.

3. **Section 1 outputs**: the resulting manipulated triggers for **Section 1** are sent to these outputs; the same output signal is copied to both.

   The LEDs reflect where the trigger originated:

LED	Trigger source
●	Rest (no trigger).
●	Trigger generated by Vimina.
●	Trigger copied from **CLK** (4) (thru).

4. **CLK**: *shared* clock input for **Section 1** and **Section 2**: signals received in this port drive the clocks for *both* sections.

   The number of channels present in the cable connected to this port set module polyphony.

5. **Section 2 CV**: functionally identical to **Section 1 CV** (2); but for **Section 2**.

6. **Section 2 outputs**: functionally identical to **Section 1 outputs** (3); but for **Section 2**.

Vimina bypassed module behavior

The signal present at the **CLK** (4) input is copied to every available output unaltered.

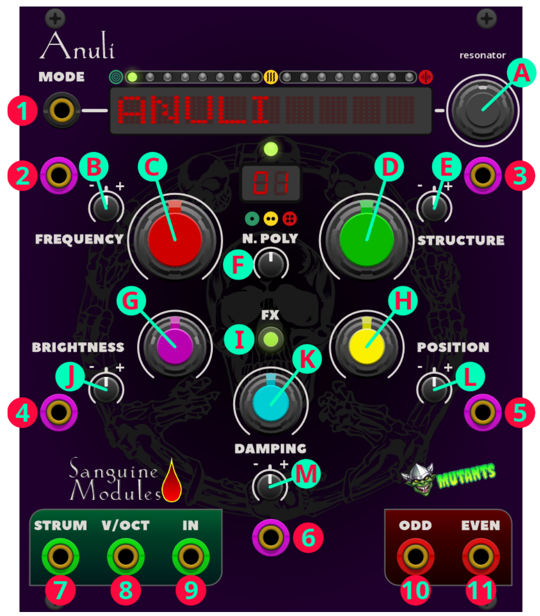
Anuli – Resonator

Physical modeling turned up to eleven! Strings, membranes, tubes and an organ synthesizer together in a single completely polyphonic Mutant package!

Based on Mutable Instruments' "Rings", spiced with up to 16 channel polyphony.

We hope this module helps keep your art resonating with audiences for a really long time.

Anuli controls



Knobs and buttons

A. **MODE:** twist the knob to select the active mode from the available seven.

   The selected mode is shown in the display next to the knob, the LEDs above the display, the knob's tooltip and the context menu.

   Polyphonic channels are represented by the sixteen LEDs above the display; individual lamps light up in the colors listed below to show the selected mode for each active channel.

   The mode selected by the knob applies to every polyphonic channel if the **MODE** (1) input port has no cable connected.

   The modes are described in detail in the "Anuli Module modes" section.

   The available modes, their display names and LED representations are:

LED	MODE	DISPLAY
🟢	Modal resonator	**Modal Reso.**
🟡	Sympathetic strings	**Sym. Strings**
🔴	Modulated/inharmonic string	**M. I. String**
⚫↔🟢	FM voice	**FM voice**
⚫↔🟡	Quantized sympathetic strings	**Q. Sym. Str.**
⚫↔🔴	Reverb string	**Rev. String**
⚫↔🔵	Disastrous Peace	**Disas. Peace**

Module modes can also be selected from the context menu.

B. FREQUENCY CV ATTENUVERTER: this knob can function as a fine frequency control when no cable is patched in the **FREQUENCY CV** (2) input; when a cable is present, it attenuverts the signal present at the **FREQUENCY CV** (2) port.

C. FREQUENCY: For most modes, this knob sets the coarse frequency, adjusted by semi-tone increments; for **DISASTROUS PEACE** mode**,** the knob sets the root note.

The knob spans 5 octaves.

D. STRUCTURE: this knob is mode dependent and will be described in the “Anuli Module modes” section.

E. STRUCTURE CV ATTENUVERTER: attenuverts the signal present at the **STRUCTURE CV** (3) input.

F. NOTE POLYPHONY: sets the number of internal polyphonic voices the module can handle per **engine**.

The effect Anuli’s **NOTE POLYPHONY** has on the output is usually simple: avoid cutting the previous’ note tail off (see the note about **NOTE POLYPHONY mode 3** in the table below regarding that mode’s divergent behavior).

Do note that generation of some harmonics may be reduced by the module at higher **NOTE POLYPHONY** settings.

The selected mode is shown in the display above the knob, the **NOTE POLYPHONY** LED, and the knob’s tooltip.

There are 4 **NOTE POLYPHONY** settings:

LED	MODE	NOTES
🟢	1	1 note can be playing at the same time.
🟡	2	2 notes can be playing at the same time.

↔	3	This mode is different from the others: it is not 3 notes. playing at the same time; but, rather, notes bounce between the **ODD** (9) / **EVEN** (10) outputs according to an 8-step rhythmic pattern (O E E O E E O E).
	4	4 notes can be playing at the same time.

Do not confuse Anuli's **NOTE POLYPHONY** with Rack polyphony!

Anuli is a fully polyphonic module, so it can handle up to 16 different Rack channels, each of those channels will be processed by its own **engine** that respects the module's **NOTE POLYPHONY** setting.

Example: 5 polyphonic channels are fed to Anuli and the module's **NOTE POLYPHONY** setting is dialed in at 2.

5 **engines** will be used (one for each channel) and each of those 5 **engines** will have an internal **NOTE POLYPHONY** of 2.

Rack polyphony channels, and their selected module modes are shown using the LEDs above the display.

NOTE POLYPHONY is shared by every polyphonic channel.

G. **BRIGHTNESS:** adjusts the signal's higher harmonics level by applying a simultaneous low-pass filter on the exciter signal and a damping filter (or Q factor of the higher modes).

- The low-pass filter is fully closed at 8 o'clock and fully open at 12 o'clock.
- The damping filter is adjusted when the knob is past 12 o'clock.

Low values simulate materials like wood or nylon; high values materials like glass or steel.

H. **POSITION:** sets the point of excitation on the string or surface; applying excitation to the middle of a surface will cause, by symmetry, even harmonics to cancel each other, producing a "hollow" sound.

I. **FX:** this button selects the effect to apply to **Disastrous Peace** signals.

The selected **Disastrous Peace FX** is shown using the button's LED, the button's tooltip and the context menu.

The available **Disastrous Peace FX** and their LED representations are the following:

LED	FX
●	No channels are set to **Disastrous Peace** mode, **Disastrous Peace FX** are ignored.
●	Formant filter.
●	Rolandish chorus.
●	Caveman reverb.
● ↔ ●	Formant filter (less abrasive variant).
● ↔ ●	Rolandish chorus (Solinaish ensemble).
● ↔ ●	Caveman reverb (shinier variant).

Disastrous Peace FX can also be set using the context menu.

Effects apply only to polyphonic channels set to **Disastrous Peace mode**.

The selected **Disastrous Peace FX** mode is shared by every polyphonic channel set to **Disastrous Peace** mode.

J. **BRIGHTNESS CV ATTENUVERTER**: attenuverts the signal present at the **BRIGHTNESS CV** (4) input.

K. **DAMPING:** controls sound decay time, from less than 100ms to about 10s.

L. **POSITION CV ATTENUVERTER**: attenuverts the signal present at the **POSITION CV** (5) input.

M. **DAMPING CV ATTENUVERTER**: attenuverts the signal present at the **DAMPING CV** (6) input.

Inputs and outputs

1. **MODE**: polyphonic voltages sent to this input will directly select the mode for each polyphonic channel (up to 16).

   Modes selected using this input override the model selected using the **MODE** (A) knob.

   Voltages sent to this port are *not* offsets: mode selection is always absolute.

   Two direct selection modes, chosen using the context menu, are available:

<table>
<tr><th>Mode</th><th>Description</th></tr>
<tr><td>Direct CV</td><td>Voltages in the 0V to 6V range set the mode for a given channel.

Voltages are mapped as follows:

<table>
<tr><th>Voltage</th><th>Mode</th></tr>
<tr><td>0V</td><td>Modal reso.</td></tr>
<tr><td>1V</td><td>Sym Strings</td></tr>
<tr><td>2V</td><td>M.I. String</td></tr>
<tr><td>3V</td><td>FM Voice</td></tr>
<tr><td>4V</td><td>Q. Sym Str.</td></tr>
<tr><td>5V</td><td>Rev. String</td></tr>
<tr><td>6V</td><td>Disas. Peace</td></tr>
</table>

This mode is active when the C4-F#4 direct mode selection menu entry is unchecked.

This mode is the default.</td></tr>
<tr><td>C4-F#4 direct mode</td><td>Notes starting at C4 and ending at F#4 set the mode for a given channel.

Notes are mapped as follows:

<table>
<tr><th>Note</th><th>Mode</th></tr>
<tr><td>C4</td><td>Modal reso.</td></tr>
<tr><td>C#4</td><td>Sym Strings</td></tr>
<tr><td>D4</td><td>M.I. String</td></tr>
<tr><td>D#4</td><td>FM Voice</td></tr>
<tr><td>E4</td><td>Q. Sym Str.</td></tr>
<tr><td>F4</td><td>Rev. String</td></tr>
<tr><td>F#4</td><td>Disas. Peace</td></tr>
</table>

This mode is active when the C4-F#4 direct mode selection menu entry is checked.</td></tr>
</table>

2. **FREQUENCY CV**: when no cable is connected to this input, the **FREQUENCY CV ATTENUVERTER** (C) works as a fine frequency control; when a cable is connected the voltage present in this port acts as an offset to the value set by the **FREQUENCY** (C) knob.
3. **STRUCTURE CV**: voltages sent to this port offset the value set by the **STRUCTURE** (E) knob.

4. **BRIGHTNESS CV**: voltages sent to this port offset the value set by the **BRIGHTNESS** (G) knob.
5. **POSITION CV**: voltages sent to this port offset the value set by the **POSITION** (H) knob.
6. **DAMPING CV**: voltages sent to this port offset the value set by the **DAMPING** (J) knob.
7. **STRUM:** when a trigger is received in this input, the module freezes the active playing voice; lets it decay, and starts a note on the next voice.

   Normalized to a step detector on the **V/OCT** (7) input and a transient detector on the **IN** (8) input if this port has no cable connected.

   The number of channels for module polyphony is set by whichever input has the highest channel count among the **STRUM** (6), **V/OCT** (7) and **IN** (8) inputs.

   The **NOTE POLYPHONY** LED blinks when the module's selected display channel is strumming.
8. **V/OCT:** controls the resonator's main frequency.

   The number of channels for module polyphony is set by whichever input has the highest channel count among the **STRUM** (6), **V/OCT** (7) and **IN** (8) inputs.
9. **IN:** audio input for the excitation signal.

   Normalized to a pulse/burst generator that reacts to note changes on the **V/OCT** (7) input if this port has no cable connected.

   The number of channels for module polyphony is set by whichever input has the highest channel count among the **STRUM** (6), **V/OCT** (7) and **IN** (8) inputs.
10. **ODD:** audio output that contains odd partials.

    This output, along with the **EVEN** (10) output have different behaviors depending on **NOTE POLYPHONY** (D) and how the outputs are connected.

    - **Monophonic mode**

      The outputs carry two complementary components of the signal.

      - Odd and even numbered partials with the modal resonator.
      - Dephased components due to picking position and pickup placement with the string resonators.

    - **Polyphonic mode**

      The signal is split into odd and even numbered strings/plates.

Both outputs need to be connected in order to split the signals, when only one is patched, both signals are mixed together.

10. **EVEN:** audio output that contains even partials.

    See the explanation for the **ODD** (9) output to learn how the module splits signals and splitting requirements.

The ideal Anuli setup

The best way to run Anuli is to feed it 3 input signals:

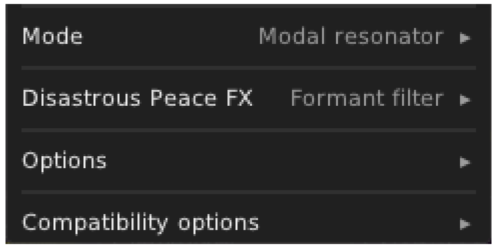
- A trigger signal to the **STRUM** (6) input: tells the module that the currently playing note should fade away because a new one is starting.
- A CV signal to the **V/OCT** (7) input: controls note frequency.
- An audio signal to the **IN** (8) input: hits, strikes or caresses the resonator.

Making all the connections is not always possible, so Anuli assumes the following:

1. If nothing is connected to the **IN** (8) audio input, the module will synthesize an excitation signal whenever a note is strummed; the signal is either a low-pass filtered pulse, or a burst of noise, depending on the resonator type.
2. If nothing is connected to the **STRUM** (6) input, the module will determine that a new string should be strummed either by:
    - Detecting note changes on the **V/OCT** (7) input.
    - If nothing is connected to the **V/OCT** (7) input, Anuli will detect sharp transients in the audio signal connected to the **IN** (8) audio input.

The bottom line: if the ideal setup is not possible, Anuli will happily play with just one CV output from a sequencer or S&H module: note changes in the **V/OCT** (7) input will be detected, and the module will produce suitable excitation signals internally for those note changes to be heard! So... don’t fret too much.

Anuli context menu



Anuli adds several new entries to the standard Sanguine Modules context menu:

- **Mode**: select the module's resonator mode directly.
- **Disastrous Peace FX**: select the active **Disastrous Peace FX** directly, note that the selected effect is ignored for modes other than **Disastrous Peace**.
- **Options**: module display and model CV voltage mode preferences can be adjusted using this menu:
    - **Display channel**: sets the channel to show in the LED display next to the **MODE** (A) knob and the **NOTE POLYPHONY** light when the module is strummed.

      Only available channels are shown in the menu.

      The module is smart and will select the highest available channel automatically if the last user-selected channel is higher than the currently available ones.

      The default display channel is 1.
    - **C4-F#4 direct mode selection:** enables and disables direct mode selection using note voltages. This option is disabled by default.
- **Compatibility options**: some Anuli updates can generate problems when the module is used with patches that were created using older versions of Sanguine Mutants, this menu allows users to selectively enable the old behavior so their old patches work as intended or the module works as they're used to:
    - **Frequency knob center is C**: while the hardware module has to be calibrated to produce the expected tones when notes are played; Rack users expect most modules to output C notes when they are loaded and their frequency is untouched.

      Old Anuli versions did not do this, nor did they allow calibration to take place, to the confusion and frustration of many creators, add to this the difficulty of tuning the module by hand and what is supposed to be a fun, creative experience becomes a harrowing one.

Anuli now comes “factory calibrated” to produce C notes when the **FREQUENCY** (C) knob is centered.

We are conscious that old patches have no way of knowing about this change and would sound wrong with the current behavior. Old module “tuning” can be restored using this menu item.

“Factory calibration” is enabled by default.

Anuli module modes

Modes are presented with the name that appears on the display and in the order the **MODE** (A) knob selects them to make finding descriptions and parameters easier.

Modal Reso.

Modal synthesis simulates the phenomena of resonance at play in vibrating structures: the way, for example, a string or plate will absorb certain frequencies and “ring” on others, called “modes”.

When a string is plucked; a drum struck, or a tube blown, the short burst of energy of the blow/impact contains many frequencies, some fall outside the modes and are absorbed; some others excite the modes, producing a stable, pitched sound.

Each mode corresponds to a harmonic or partial in the spectrum of the sound and is modelled by a band-pass filter; the Q factor of the filter determines how sustained the oscillations of the corresponding partial are.

Anuli recreates how various materials and structures are characterized by different relationships between the frequencies of their modes.

In **Modal Resonator** mode, the **STRUCTURE** (E) knob controls the frequency ratio between partials (in other words, the perceived structure: plate, bar, string).

Sym. Strings

Some instruments (like the sitar and sarod), use strings that are not directly excited by the musician; but respond to the vibration of the other strings and add extra overtones or undertones to them.

Anuli simulates this phenomenon with a bunch of virtual strings, made with comb filters, that allow the addition of extra tones to an incoming audio signal.

In **Sympathetic Strings** mode, the **STRUCTURE** (E) knob controls the set of frequency ratios between all strings (with virtual notches at octaves or fifths).

M. I. String

This mode is based on the extended Karplus-Strong method: an excitation signal is sent to a comb filter with an absorption filter, simulating the multiple reflections of a wave propagating on a string and getting absorbed at the string's ends.

Anuli spices the synthesized sound by adding three ingredients to this classic: a delay-compensated all-pole absorption filter that creates more drastic plucking effects; delay time modulation that emulates the sound of curved bridge instruments (like sitars or tanpuras), and all-pass filters in the delay loop that shift the position of the partials and recreate the tension of piano strings or out of this world inharmonic timbres.

In **Modulated/Inharmonic String Resonator** mode, the **STRUCTURE** (E) knob controls the amount of modulation and detuning of the partials.

FM voice

Two sine oscillators modulating each other's phase, using the same implementation found in Funes.

This mode changes regular knob behavior:

- **STRUCTURE** (E): controls the frequency ratio.
- **BRIGHTNESS** (G): controls the FM index.
- **DAMPING** (J): controls the FM index and amplitude decay.
- **POSITION** (H): controls the feedback path (no feedback at 12 o'clock).

Signals sent to the **IN** (8) input go into an envelope follower and change the FM index and output amplitude.

Q. Sym. Str.

In **Quantized Sympathetic Strings** mode, the sympathetic strings are no longer tuned to perfect fifths or octaves; but, instead, to chords.

In this mode, the **STRUCTURE** (E) knob selects the chord.

Rev. String

The **Reverb String** mode is similar to the **Modulated/Inharmonic String Resonator** mode; but adds a reverb with absorption and decay that follow those of the string.

In **Reverb String** mode, the **STRUCTURE** (E) knob controls the amount of modulation and detuning of the partials.

Disas. Peace

Disastrous Peace mode is an an Organ/String machine synthesizer, loosely based on the Roland RS-09.

This mode changes regular control behavior:

- **NOTE POLYPHONY** (D): sets the chord size. From 10-note fat chords that cannot overlap because they consume all the **NOTE POLYPHONY** (D) voices, to 3-note chords that can overlap with the previous ones when retriggered; in other words, **NOTE POLYPHONY** (D) controls the maximum number of successive chords which can overlap: 1, 2 or 4.
- **FREQUENCY** (C): sets the root note.
- **STRUCTURE** (E): sets the chord type.
- **BRIGHTNESS** (I): scans through various registrations, sorted by brightness. Each registration is a different mixture of octaves of square and saw tooth waves.
- **DAMPING** (J): decay time, then attack time; drones continuously when turned all the way to the right.
- **POSITION** (H): FX amount.
- The **STRUM** (6) input triggers the envelope and allocates a new group of voices for the chord, the previously played chord can still be heard if **NOTE POLYPHONY** (D) is set to 2 or 4.
- The **V/OCT** (7) input controls the root note. If nothing is connected to the **STRUM** (6) input, sudden changes on this input will also trigger the envelope/voice allocation.
- **FX** (M) selects the active effect for the FX processor.
- Signals sent to the **IN** (8) input are simply routed to the FX processor.

Anuli bypassed module behavior

The signal present at the **IN** (9) input is copied to both the **ODD** (10) and **EVEN** (11) outputs, like the hardware version does.

A note on Anuli's perceived tuning

When Anuli is set to the **Modal Reso.** Mode, the tuning may sound off and two people might disagree as to what note is actually being produced. Why does this happen?

Anuli uses a technique called "modal synthesis", briefly described in the "**Modal Reso.**" section of this manual; part of this technique requires generating different harmonics: most objects and instruments don't produce "pure" tones: they have a "root" frequency and a number of additional frequencies derived from it.

How does this impact Anuli's sound?

The frequency of the first mode (the first harmonic of the spectrum (f0)) corresponds to the root note set by the **FREQUENCY** (C) knob transposed by the **V/OCT** (8) input.

If the module is configured to generate a harmonic spectrum (a spectrum with harmonics at f0, 2 x f0, 3 x f0, 4 x f0 or some equivalent) the generated waveform is periodic and the perceived pitch will be the same as the frequency of the first harmonic.

So far, so good, however...

If the module is configured to generate a non-harmonic spectrum: the waveform does not repeat itself, and the spectrum is made of partials at non-integer frequency ratios, then pitch becomes a matter of perception: the produced note is a bit difficult to pinpoint and different people might disagree on what it actually is.

How is this controlled? Easy! Using the **STRUCTURE** (E) knob! The knob has only one position that configures the module to generate a pure harmonic spectrum, this position lies around 10 o'clock. The generated harmonics can be seen using a spectrum analyzer.

Apices – Multifunction Gap Filler

A two-channel multi-mode trigger/gate processor and noise maker. This fun module offers a lot of functionality that is made easier with our no holds barred interface.

Based on Mutable Instruments’ “Peaks”.

We hope this module can keep your beats kicking!

This manual covers basic operation; but some modes are better understood by connecting the module to a scope and experimenting with it.

Apices controls

Knobs and buttons

A. **MODE**: selects one of the ten available modes for both channels or the currently selected channel (**CHANNEL** (B) and **EXPERT MODE** (C) dependent).

The selected mode is displayed for each channel using one of the displays to the left of the **MODE** knob and the LEDs around it.

The modes and their display are as follows (hardware “secret” modes are marked with “■” in the display; hardware “Easter-egg” modes are marked with “&”, and hardware disabled modes enabled in Apices are marked with “@”):

MODE	Display
Envelope	**ENVELOPE**
LFO	**LFO**
Tap LFO	**TAP LFO**
Drum generator	**DRUM GENERAT**
Sequencer	**SEQUENCER■**
Trigger delay/shaper	**TRG. SHAPE■**
Trigger stream randomizer	**TRG. RANDOM■**
Digital drum synth	**DIGI. DRUMS■**
Number station	**NUMBER STAT&**
Bouncing ball	**BOUNCE BALL@**

The different modes and how the knobs affect them are described in the **“Apices module modes”** section.

B. CHANNEL SELECT: selects between channels 1 and 2 when **EXPERT MODE** (C) is enabled, when it is disabled, this button is ignored.

The channel currently being edited is shown using the button’s LED and the red LEDs to the left of the mode displays.

LED colors and behaviors follow the table below in the different modes:

Expert LED	Chan. Select LED	Chan. 1 LED	Cha. 2 LED	Editing
⚫	⚫	🔴	🔴	Both channels.
🔵	🟢	⚫↔🔴	⚫	Channel 1.
🔵	🟡	⚫	⚫↔🔴	Channel 2.

The LEDs around **SPLIT** (G) (see below) change color, following this button, to show the channels the knobs are affecting.

C. EXPERT: enables and disables **EXPERT MODE**.

This versatile module can be operated in one of two modes:

Mode	Behavior
STANDARD	The selected mode is used for both channels, parameter knobs affect both channels. This mode offers simplicity at the expense of granular control.
EXPERT	Channel modes can be set independently, knob parameter changes affect the selected channel only (check the “Context menu” section below for a note about parameter knobs). This mode offers complete granular control at the expense of complexity.

D, E, H, I: these red and blue knobs set the parameters for the currently selected mode and are dependent on it. The OLED displays adjacent to each knob display terse descriptions of the parameter a given knob affects and to which channels it applies, according to module configuration.

Examples:

- The module is set to **STANDARD MODE** (see above) **TWIN** (see below) **LFO** mode: the knob labeled "1" affects the Frequency for both channels and its display reads "1&2. Frequency", while the knob labeled "3" affects the waveform variation for both channels and its display reads "1&2. Wave. Var.".
- The module is set to **STANDARD MODE** (see above) **SPLIT** (G) (see below) **Drum generation** mode: the knob labeled "1" affects the tone for the bass drum in **Channel 1** and its display reads "1. BD Tone", while the knob labeled "3" affects the tone for the snare drum in **Channel 2** and its display reads "2. SD Tone".
- The module is set to **EXPERT MODE** (C) (see above); **Channel 2** is selected, and its mode is **Envelope**: all knobs affect this channel only: the knob labeled "1" affects the envelope's attack, its display reads "2. Attack", and the knob labeled "3" affects the envelope's sustain, it's display reads "2. Sustain".

F, J: manual triggers for **Channel 1** and **Channel 2**, respectively.

G. SPLIT MODE: this button switches **STANDARD MODE** (see above) between **TWIN** and **SPLIT** modes. It is disabled in **EXPERT MODE** (see above).

Expert LED	Split LED	Channel Select LED	Red knobs LED	Blue knobs LED	Mode
● (grey)	● (grey)	● (grey)	● (violet)	● (violet)	**TWIN**: knobs affect both channels.
● (grey)	● (red)	● (grey)	● (red)	● (blue)	**SPLIT**: red knobs affect **Channel 1**; blue knobs affect **Channel 2**.
● (blue)	● (grey)	● (green)	● (green)	● (green)	**EXPERT Channel 1**: every knob affects **Channel 1**.
● (blue)	● (grey)	● (yellow)	● (yellow)	● (yellow)	**EXPERT Channel 2**: every knob affects **Channel 2**.

When the module is set to **TWIN** mode, red and blue knobs affect different parameters for both channels. In this mode you get more control over every parameter but less granularity between channels.

When the module is set to **SPLIT MODE,** red knobs affect parameters for **Channel 1** and blue knobs affect parameters for **Channel 2**. In this mode you get more granularity over channel parameters at the expense of less control over individual parameters.

For complete control… use **EXPERT MODE**!

Inputs and outputs

1. **Trigger 1 input:** receives trigger signals for **Channel 1** (threshold: ≥0.7V).
2. **Trigger 2 input:** receives trigger signals for **Channel 2** (threshold: ≥0.7V).
3. **Channel 1 output:** contains **Channel 1** signals.
4. **Channel 2 output:** contains **Channel 2** signals.

CV control using the Nix expander

Apices by itself offers no CV control for its parameters. CV inputs and control can be added by pairing Apices with a Nix expander.

The expander must be placed immediately to the right of the Apices module.

When a successful connection is established to a Nix module, both the LED at the top right of Apices and the one at the top left of the paired Nix module light up ●.

Nix expanders can be quickly and easily added using the context menu.

Operation instructions for the Nix module are provided in the Nix section.

> ❗ The **Nix** expander is not available in **MetaModule**.

Apices context menu

Apices presents the standard Sanguine Modules context menu with two additions:

- **Knob pickup (snap)**: when this option is disabled; **EXPERT MODE** is enabled, and the selected channel is switched, the knobs immediately affect the parameters of the newly selected channel with their current positions, ignoring the previous value; to prevent this and make the knobs affect parameters for the newly selected channel only after they have been moved to or past their previous value within that channel, enable this menu option.

  This option is disabled by default.

  > A logical consequence of **Knob pickup (snap)** behavior is that when **EXPERT MODE** is first set; **Knob pickup (snap)** is enabled, and the 2nd channel is selected for the first time, parameter knobs must be moved all the way to the left before the 2nd channel acknowledges new settings.

- **Add Nix expander**: a convenient option to quickly add a Nix expander to the right of the selected Apices module.

  This menu item is not available when running **Apices** in **MetaModule**.

Apices module modes

The OLED displays always show what the knobs affect in your selected configuration.

Whenever a trigger is mentioned below it refers to either a trigger from the jack input or a button press.

Modes are presented with the names used on the matrix display.

ENVELOPE

The classic envelope generator. Triggers start and hold the envelope.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Attack	Ch. 1 Attack

Knob 2	Ch. 1 & 2 Decay	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Sustain	Ch. 2 Attack
Knob 4	Ch. 1 & 2 Release	Ch. 2 Decay

LFO

A low-frequency oscillator for all your modulation needs. Triggers reset the waveform cycle.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Frequency	Ch. 1 Frequency
Knob 2	Ch. 1 & 2 Waveform, from left to right: • Sine • Linear slope • Square • Steps • Random	Ch. 1 Waveform
Knob 3	Ch. 1 & 2 Waveform variation: • Sine: wave folder • Slope: Ascending / Triangle / Descending balance • Square: pulse-width • Steps: number of steps • Random: interpolation method	Ch. 2 Frequency
Knob 4	Ch. 1 & 2 Phase on restart	Ch. 2 Waveform

TAP LFO

A pair of low-frequency oscillators with tap tempo. Triggers set the period of the LFO oscillations. Apices can learn irregular trigger sequences.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Amplitude	Ch. 1 Waveform
Knob 2	Ch. 1 & 2 Waveform	Ch. 1 Waveform variation
Knob 3	Ch. 1 & 2 Waveform variation	Ch. 2 Waveform
Knob 4	Ch. 1 & 2 Phase on restart	Ch. 2 Waveform variation

DRUM GENERAT

A bass and snare drum generator. Triggers start the drum sounds.

Channel 1 is the bass drum, **Channel 2** is the snare.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Base frequency	Ch. 1 Tone
Knob 2	Ch. 1 & 2 Frequency modulation ("Punch" for BD, "Tone" for SD)	Ch. 1 Decay
Knob 3	Ch. 1 & 2 High-frequency content ("Tone" for BD, "Snappiness" for SD)	Ch. 2 Tone
Knob 4	Ch. 1 & 2 Decay	Ch. 2 Snappy

SEQUENCER

Just what it says on the tin.

In **TWIN** and **EXPERT** modes the module is a 4 step mini-sequencer with each knob controlling a step. **Channel 1** is clocked by **Trigger 1** and reset by **Trigger 2**; **Channel 2** is clocked by **Trigger 2**.

In **SPLIT** mode the module is a dual 2 step mini-sequencer. No reset is available and each channel has its own clock controlled by its respective trigger.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Step 1	Ch. 1 Step 1
Knob 2	Ch. 1 & 2 Step 2	Ch. 1 Step 2
Knob 3	Ch. 1 & 2 Step 3	Ch. 2 Step 1
Knob 4	Ch. 1 & 2 Step 4	Ch. 2 Step 2

TRG. SHAPE

Trigger delayer/shaper. A trigger starts a trigger/gate sequence as configured by the knobs.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Pre-delay	Ch. 1 Delay
Knob 2	Ch. 1 & 2 Gate duration	Ch. 1 Number of repeats
Knob 3	Ch. 1 & 2 Delay	Ch. 2 Delay
Knob 4	Ch. 1 & 2 Number of repeats	Ch. 2 Number of repeats

TRG. RANDOM

Trigger stream randomizer. Delay! Repeat! Burst! Get surprised! A trigger has a chance to start a burst of triggers as configured by the knobs.

	Knobs	
	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 Probability of accepting incoming triggers	Ch. 1 Acceptance/regeneration probability
Knob 2	Ch. 1 & 2 Probability of regenerating triggers after the delay	Ch. 1 Delay
Knob 3	Ch. 1 & 2 Delay time	Ch. 2 Acceptance/regeneration probability
Knob 4	Ch. 1 & 2 Jitter	Ch. 2 Delay

DIGI. DRUMS

Synthesized FM drums! Synthesized FM drums! Get your FM drums here! A trigger starts the drum sound.

Channel 1 is the bass drum, **Channel 2** is the snare.

	Knobs	
	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 Frequency	Ch. 1 BD preset morphing
Knob 2	Ch. 1 & 2 FM intensity	Ch. 1 BD preset variations
Knob 3	Ch. 1 & 2 FM and AM envelope decay time[8]	Ch. 2 SD preset morphing
Knob 4	Ch. 1 & 2 Color. At 12 o'clock, no modification is applied to the oscillator signal. Turn right to increase the amount of noise (for snares). Turn left to increase the amount of distortion (for 909 style kicks).	Ch. 2 SD preset variations

NUMBER STAT&

Number station. A mode reminiscent of one of those mysterious number stations, it simulates a noisy AM receiver.

A trigger in **Trigger 1** generates one of several digital tones in **Channel 1**.

8 The FM envelope has a shorter decay than the AM envelope, but the two values are tied to this parameter.

A trigger in **Trigger 2** generates a voice that speaks one of several different numbers in **Channel 2.**

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Frequency	Ch. 1 Frequency
Knob 2	Ch. 1 & 2 Variation probability	Ch. 1 Variation probability
Knob 3	Ch. 1 & 2 Noise	Ch. 2 Frequency
Knob 4	Ch. 1 & 2 Distortion	Ch. 2 Variation probability

BOUNCE BALL@

Bouncing ball mode. This envelope generator produces signals not unlike bouncing a ball in a basketball court.

Experiment with the parameters and an oscilloscope to get a feel (and visual representation) of how the different parameters affect the envelope.

A trigger throws the ball.

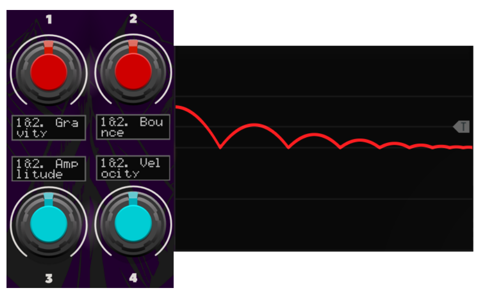


*Figure 3: A sample of the signal generated by **BOUNCE BALL@** mode using the default knob settings.*

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Gravity	Ch. 1 Gravity
Knob 2	Ch. 1 & 2 Bounce	Ch. 1 Bounce
Knob 3	Ch. 1 & 2 Amplitude	Ch. 2 Gravity
Knob 4	Ch. 1 & 2 Velocity	Ch. 2 Bounce

Parameters

- **Gravity:** how fast the ball drops to the ground: the further clockwise the knob is, the floatier the ball gets.

- **Bounce:** how much potential energy the ball keeps when falling to the ground. Setting the knob to high, clockwise values can make the ball bounce forever (paired with a high gravity this can also make the ball bounce really high!).
- **Amplitude:** how much force is applied to the initial ball throw. The further the knob is counterclockwise the lower the ball starts when triggered. A fully counterclockwise knob means the ball doesn't get off the ground at all.
- **Velocity:** how much the ball travels forward initially. Lower, counterclockwise values, produce envelopes with an initial sharper peak.

Nix – Apices expander

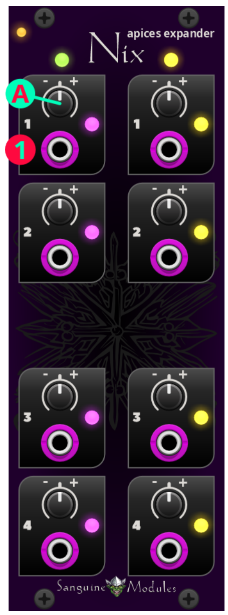
Satisfy your Apices CV control cravings with this handy expander!

Inspired by the “Rainier” version of the Peaks module.

We hope this expander keeps your Apices usage always fresh and mutating!

This module is not available in **MetaModule**.

Controls



Nix presents 8 identical sections with the same controls.

Knobs

A. **VOLTAGE ATTENUVERTER**: controls the polarity and amount of control voltage to apply to the corresponding Apices knob value.

Inputs

1. **VOLTAGE INPUT**: voltages present in this port will offset the corresponding Apices knob value.

Using Nix

For a Nix expander to function, it must be paired with an Apices module: it does nothing by itself.

To pair a Nix expander with an Apices module, just place it immediately to the right of an Apices module.

Nix expanders can also be added quickly and easily using Apices' context menu.

When a successful connection to an Apices module is established, both the LED at the top left of the Nix module and the one at the top right of the paired Apices module light up .

The module presents 8 identical inputs: 4 on the left side and 4 on the right side.

The 4 ports on the left side influence the corresponding Apices parameter when the module is in **TWIN** or **SPLIT** modes, or the parameters for **Channel 1** if the module is in **EXPERT** mode; the 4 inputs on the right side are active only when the paired Apices module is set to **EXPERT** mode and influence the parameters for **Channel 2**.

The LEDs at the top of both input columns indicate whether the column is active and what it influences:

Apices mode	Column 1 LED	Column 1 influence	Column 2 LED	Column 2 influence
TWIN		Parameters for both channels		Disabled
SPLIT		Parameters for both channels		Disabled
EXPERT		Apices' **Channel 1**		Apices' **Channel 2**

Each input has its own LED light that corresponds to the light of the same numbered Apices knob.

Light	Apices TWIN Mode	Apices SPLIT mode	Apices EXPERT mode	Influenced Apices knob
Column 1 Input 1				Parameter 1[Δ]
Column 1 Input 2				Parameter 2[Δ]
Column 1 Input 3				Parameter 3[Δ]
Column 1 Input 1				Parameter 4[Δ]

Δ This input influences both channels when Apices is set to **TWIN** or **SPLIT** modes and Apices' channel 1 when Apices is set to **EXPERT** mode.

Column 2 Input 1				**Channel 2**, parameter 1
Column 2 Input 2				**Channel 2**, parameter 2
Column 2 Input 3				**Channel 2**, parameter 3
Column 2 Input 3				**Channel 2**, parameter 4

Mortuus – Embalmed multifunction gap filler

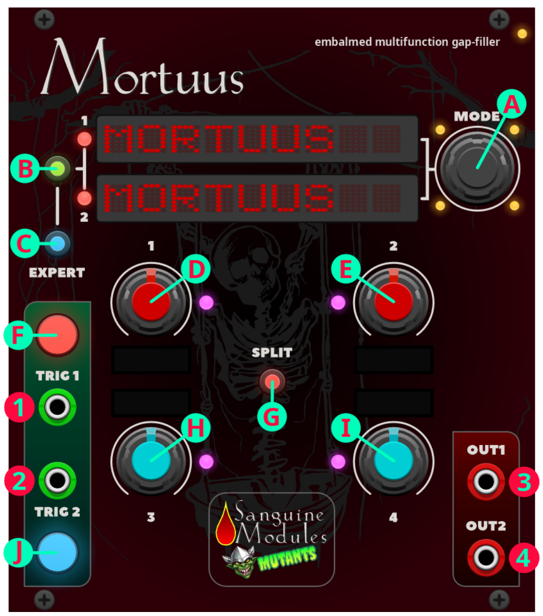
A reworked two-channel multi-mode trigger processor, envelope generator, LFO and noise maker with 25 different modes. This complex module puts a multitude of functions right at your fingertips.

Based on the “Dead Man’s Catch” alternative firmware for Mutable Instruments’ “Peaks” and the “Cymbal” patch for the alternative firmware.

We hope this module can envelope your musical desires!

This manual documents the changes made to Apices to create the Mortuus module; for basic operating instructions and descriptions of the modes already present in Apices, consult its manual.

Changes to Apices



- New algorithms have been added:
  - Double attack envelope.
  - Repeating attack envelope.
  - Looping envelope.
  - Randomized AD envelope.
  - Frequency modulated LFO.

- Random frequency modulated LFO.
- Varying wave shape LFO.
- Random varying wave shape LFO.
- Phase-locked loop oscillator.
- Mod sequencer.
- Turing machine.
- Bytebeats.[9]
- Cymbal.[10]
- Randomized bass & snare drums.
- Randomized hi-hat.

- The hi-hat is no longer available at the right extreme of the snare drum knobs: it has its own function now.

Module controls remain the same, and their letter or number reference has not been changed in the diagram above, if you need a refresher on their basic functions, check the Apices manual.

A list of all the modes, old and new; their display name; a description of their parameters, and how the knobs alter them follows.

> The **Ansa** expander for **Mortuus** is not available in **MetaModule**.

Mortuus mode list

Original hardware basic modes have no extra markings in the display; original hardware “secret” modes are marked with “■”; original hardware “Easter-egg” modes are marked with “&”, and Dead Man’s Catch firmware (and variants) modes are marked with “#”.

The modes are presented in the order they are selected by the **Mode** knob (A).

9 Many of the available equations may not produce the exact results you expect: some of them had to be modified to prevent divisions by zero from crashing Rack.
10 Not available in the official Dead Man’s Catch firmware.

MODE	Display
Envelope	**ENVELOPE**
LFO	**LFO**
Tap LFO	**TAP LFO**
Drum generator	**DRUM GENERAT**
Double attack envelope	**D. ATK. ENV#**
Repeating attack envelope	**R. ATK. ENV#**
Looping envelope	**LOOPING ENV#**
Randomized AD envelope	**RANDOM ENV#**
Bouncing ball envelope	**BOUNCE BALL#**
Folded sine frequency modulated LFO	**FM LFO#**
Random frequency modulated LFO	**RND. FM LFO#**
Folded sine varying wave shape LFO	**V. WAVE LFO#**
Random varying wave shape LFO	**R.V.W. LFO#**
Phase-locked loop oscillator	**P.L.O#**
Sequencer	**SEQUENCER■**
Modified Sequencer	**MOD SEQ.#**
Trigger delay/shaper	**TRG. SHAPE■**
Trigger stream randomizer	**TRG. RANDOM■**
Turing machine	**TURING#**
Bytebeats	**BYTE BEATS#**
Digital drum synth	**DIGI. DRUMS■**
Cymbal	**CYMBAL#**
Randomized bass and snare drum generators	**RANDOM DRUM#**
Randomized hi-hat	**RAND. HIHAT#**
Number station	**NUMBER STAT&**

Mortuus context menu

In addition to the standard Sanguine Modules context menu, Mortuus presents two additional menu options:

- **Knob pickup (snap)**: this option works just like the one for Apices, consult the “Apices context menu” section of its manual if you need a refresher.
- **Add Ansa expander**: adds an Ansa expander directly to the right of the selected Apices module.

  This menu item is not available when running Mortuus in **MetaModule**.

Mortuus module modes

Only modes new to Mortuus are explained here, for an explanation of modes already present in Apices consult its manual.

The modes are presented as they appear in the display so parameters can be consulted quickly.

Whenever a trigger is mentioned below it refers to either a trigger from the jack input or a button press.

A lot of insight can be obtained by looking at the output of the modes through an oscilloscope.

D. ATK. ENV#

Double attack envelope. An ADSAR (Attack-Decay-Sustain-Attack-Release) envelope: the attack stage is engaged when the gate signal rises and also when the gate signal falls.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Attack	Ch. 1 Attack
Knob 2	Ch. 1 & 2 Decay	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Sustain	Ch. 2 Attack
Knob 4	Ch. 1 & 2 Release	Ch. 2 Decay

R. ATK. ENV#

Repeating attack envelope. This mode repeats the Attack-Decay phases whenever the Decay phase reaches the sustain level and the gate is high.

This produces a series of peaks like in the image below, obtained using short Attack and Decay phases:

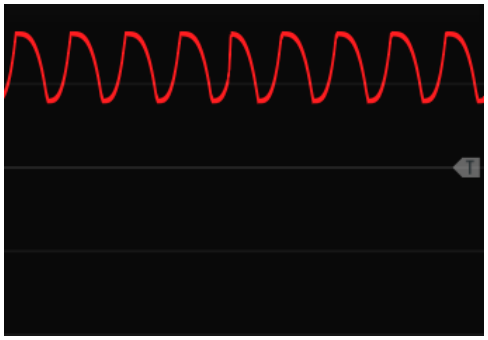


*Figure 4: An **R. ATK. ENV#** envelope sample.*

The Sustain parameter controls when a new Attack phase begins.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Attack	Ch. 1 Attack
Knob 2	Ch. 1 & 2 Decay	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Sustain	Ch. 2 Attack
Knob 4	Ch. 1 & 2 Release	Ch. 2 Decay

LOOPING ENV#

Looping envelope. This mode implements an ADR envelope that repeats itself indefinitely whenever the Release phase completes. There is no Sustain phase; the Sustain parameter sets the inflection point between the Decay and Release phases.

In this mode, triggers reset the cycle back to the start of the Attack phase.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Attack	Ch. 1 Attack
Knob 2	Ch. 1 & 2 Decay	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Sustain	Ch. 2 Attack
Knob 4	Ch. 1 & 2 Release	Ch. 2 Decay

RANDOM ENV#

Randomized AD envelope. This mode implements an AD envelope with random amplitude variations (at the peak of the Attack phase) and Decay time.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Attack	Ch. 1 Attack
Knob 2	Ch. 1 & 2 Decay	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Amplitude variation	Ch. 2 Attack
Knob 4	Ch. 1 & 2 Decay time variation	Ch. 2 Decay

FM LFO#

Folded sine frequency modulated LFO. This mode's implements an LFO that can be frequency modulated by an internal foldable sine wave.

Frequency modulation parameters set in **TWIN** or **EXPERT** modes continue to apply in **SPLIT** mode.

Triggers reset the phase of both the LFO and its internal modulator.

Knobs	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 LFO base frequency	Ch. 1 LFO base frequency
Knob 2	Ch. 1 & 2 LFO wave form preset Left to right: • Sine • Triangle • Sawtooth • Square • Stepped triangle • Random/noise	Ch. 1 LFO wave form preset
Knob 3	Ch. 1 & 2 LFO FM frequency	Ch. 2 LFO base frequency
Knob 4	Ch. 1 & 2 FM depth • CCW pure sine wave modulation • CW folded sine wave modulation	Ch. 2 LFO wave form preset

RND. FM LFO#

Random frequency modulated LFO. This mode is mostly the same as **FM LFO#**; but random values are used to modulate the LFO instead of a sine wave. The LFO wave form presets are the same.

Knobs	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 LFO base frequency	Ch. 1 LFO base frequency
Knob 2	Ch. 1 & 2 LFO wave form preset	Ch. 1 LFO wave form preset
Knob 3	Ch. 1 & 2 LFO FM frequency (random sampling rate)	Ch. 2 LFO base frequency
Knob 4	Ch. 1 & 2 FM depth • CCW: linear random values interpolation • CW cosine interpolation of random values	Ch. 2 LFO wave form preset

V. WAVE LFO#

Folded sine varying wave shape LFO. This LFO can be modulated by an internal wave shaper, the wave forms are different than those of the standard and FM LFOs.

Frequency modulation parameters set in **TWIN** or **EXPERT** modes continue to apply in **SPLIT** mode.

Triggers reset the phase of both the LFO and its internal modulator.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 LFO base frequency	Ch. 1 LFO base frequency
Knob 2	Ch. 1 & 2 LFO wave form preset • Folded sine • Power-folded sine • Overdriven sine • Triangle/sawtooth/ramp • Square (with pulse-width set table)	Ch. 1 LFO wave form preset
Knob 3	Ch. 1 & 2 Wave shaper frequency	Ch. 2 LFO base frequency
Knob 4	Ch. 1 & 2 Wave shaper depth	Ch. 2 LFO wave form preset

R.V.W. LFO#

Random varying wave shape LFO. This mode is functionally identical to the **V. WAVE LFO#** mode described above; but for one important difference: random values are used to modulate the wave shape instead of a sine wave.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 LFO base frequency	Ch. 1 LFO base frequency
Knob 2	Ch. 1 & 2 LFO wave form preset	Ch. 1 LFO wave form preset
Knob 3	Ch. 1 & 2 Wave shaper frequency (sampling rate)	Ch. 2 LFO base frequency
Knob 4	Ch. 1 & 2 Wave shaper depth • CCW: linear random values interpolation • CW cosine interpolation of random values	Ch. 2 LFO wave form preset

P.L.O#‘

Phase-locked loop oscillator. When a signal is connected to either or both inputs, Mortuus will try to follow the signal(s) present in them.

The channels work independently.

Triggers *do not* reset phase in this mode.

This mode works best with clean, regular, unfiltered wave forms.

This mode tracks the frequency; but not the phase of input signals.

‘ This mode requires an external oscillator connected to the **TRIG 1** (F) or **TRIG 2** (J) inputs.

An audible “slew” can be heard when changing notes as Mortuus tracks frequencies. It’s similar to what portamento does on a Moog or Roland System 100.

The parameters set in **TWIN** or **EXPERT** modes continue applying in **SPLIT** mode.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Frequency divider/multiplier • CCW Lower octaves (up to 4 octaves below the input signal) • CW Increase octaves (up to 3 octaves above the input signal)	Ch. 1 Frequency divider/multiplier
Knob 2	Ch. 1 & 2 LFO wave form preset • Folded sine • Power-folded sine • Overdriven sine • Triangle/sawtooth/ramp • Square (with pulse-width set table)	Ch. 1 LFO wave form preset
Knob 3	Ch. 1 & 2 Wave shaper frequency	Ch. 2 Frequency divider/multiplier
Knob 4	Ch. 1 & 2 Wave shaper depth	Ch. 2 LFO wave form preset

MOD SEQ.#

Modified Sequencer. This mode is quite similar to the original **SEQUENCER**■ mode; but it offers 8 steps instead of 4.

Steps 5 to 8 are the complements of steps 1 to 4; for example if step 2 is set to 4V; step 6 will be -4V.

Clock and reset work the same as in Apices’ **SEQUENCER**■ mode: in **TWIN** and **EXPERT** modes **TRIG 1** (F) clocks **Channel 1** and **TRIG 2** (J) resets **Channel 1** and clocks **Channel 2**; in **SPLIT** mode there is no reset and each channel is clocked independently.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Voltage for steps 1/5	Ch. 1 Voltage for steps 1/3
Knob 2	Ch. 1 & 2 Voltage for steps 2/6	Ch. 1 Voltage for steps 2/4
Knob 3	Ch. 1 & 2 Voltage for steps 3/7	Ch. 2 Voltage for steps 1/3
Knob 4	Ch. 1 & 2 Voltage for steps 4/8	Ch. 2 Voltage for steps 2/4

TURING#

Dual turing machines.

While the implementation present in Mortuus is not exactly the same as the original, it is still useful to be familiar with Tom Whitell's explanation of the Turing Machine.

Independent Turing Machines are available in each of Mortuus' channels.

Triggers on **TRIG 1** (F) advance the shift register for the **Channel 1** Turing Machine that outputs voltages in **OUT 1** (3); triggers on **TRIG 2** (J) advance the shift register for the Turing Machine in **Channel 2** that outputs voltages in **OUT 2** (4).

This mode retains the parameters set in **TWIN** or **EXPERT** modes when operating in **SPLIT** mode.

A few key concepts:

- Probability

  The chance that a bit in the LSB (Least Significant Bit) portion of the shift register will be flipped.

  The further the knob controlling this parameter is to the left, the lower the probability.

  The knob at the rightmost position sets the probability to 1: every bit is flipped on every step; this doubles the sequence length to a maximum of 64 steps.

  Low probabilities tend to be the sweet spot.

- Span

  The range of voltages[11] the Turing Machine will output: from 0V to 0V by setting the corresponding knob all the way to the left to 0V to 5V by setting the control to its rightmost position.

- Length

  The length of the shift register adjusted in 4 bit steps: 8 bits at the leftmost position of the appropriate knob to 32 bits when it is turned all the way to the right.

  Length controls how many steps are taken before the pattern loops.

- Clock division

  Controls how many triggers are required for the shift register to advance.

11 Voltages are not quantized.

When the knob is turned all the way to the left a ratio of 1:1 is set: every trigger advances the register; when it is set completely clockwise a ratio of 8:1 is imposed: 8 triggers are required for the shift register to advance one step.

	Knobs	
	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 Probability	Ch. 1 Probability
Knob 2	Ch. 1 & 2 Span	Ch. 1 Span
Knob 3	Ch. 1 & 2 Length	Ch. 2 Probability
Knob 4	Ch. 1 & 2 Clock division	Ch. 2 Span

BYTE BEATS#

This mode provides eight different "bytebeats" equations[12].

Information on bytebeats can be found here.

Knobs in this mode are inter-dependent.

	Knobs	
	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 "Pitch"	Ch. 1 "Pitch"
Knob 2	Ch. 1 & 2 Parameter 0	Ch. 1 Parameter 0
Knob 3	Ch. 1 & 2 Parameter 1	Ch. 2 "Pitch"
Knob 4	Ch. 1 & 2 Equation select	Ch. 2 Parameter 0

CYMBAL#

A hi-hat modification with different parameters.

	Knobs	
	TWIN & EXPERT	SPLIT
Knob 1	Ch. 1 & 2 Pitch	Ch. 1 Noise cross-fade
Knob 2	Ch. 1 & 2 Clipping level	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Noise cross-fade	Ch. 2 Noise cross-fade
Knob 4	Ch. 1 & 2 Decay	Ch. 2 Decay

RANDOM DRUM#

Randomized bass and snare drum generators. This mode is similar to the regular **DRUM GENERAT**; but includes controls to get random sound variations when advancing beats.

12 The way bytebeats are handled has been altered to prevent Rack from crashing due to divisions by zero; we've tried to keep the results as close to the original as possible.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Pitch	Ch. 1 Bass drum pitch
Knob 2	Ch. 1 & 2 Tone/decay time	Ch. 1 Bass drum tone/decay
Knob 3	Ch. 1 & 2 Pitch randomization	Ch. 2 Snare drum pitch
Knob 4	Ch. 1 & 2 Amplitude randomization	Ch. 2 Snare drum decay/"snap"

RAND. HIHAT#

Randomized hi-hat. A separate mode to implement the hi-hats that used to be at the "right" of the snare drum knob in Apices: they are no longer available in **DRUM GENERAT** mode if using Mortuus.

The hi-hats are no longer running at twice the sample rate, so they sound different.

The hi-hat in **Channel 1** is assumed to be closed and the one in **Channel 2** is deemed to be open; whether the settings reflect that is up to you; but keep in mind they are meant to function in tandem: if **Channel 1** and **Channel 2** receive triggers at the same time, **Channel 2** will inhibit **Channel 1** and only **Channel 2** will play. This is useful for sequences with accent outputs.

	Knobs	
	TWIN & EXPERT	**SPLIT**
Knob 1	Ch. 1 & 2 Pitch	Ch. 1 Pitch
Knob 2	Ch. 1 & 2 Decay	Ch. 1 Decay
Knob 3	Ch. 1 & 2 Pitch randomization	Ch. 2 Pitch
Knob 4	Ch. 1 & 2 Decay randomization	Ch. 2 Decay

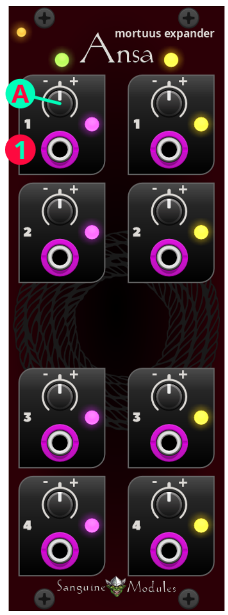
Ansa – Mortuus expander

Twist and ply Mortuus' parameters using CV!

We hope this expander keeps your Mortuus fueled creations constantly evolving!

This module is not available in **MetaModule**.

Controls



Controls, LEDs and usage are the same as those for Nix, the only difference is that Ansa is meant to be paired with a Mortuus module and won't react when placed to the right of an Apices module.

Mutants Blank – Rack sleekerizer

It’s not Mutable, Audible, Parasitic or anything else; but who doesn’t want a lovely goblin sitting on their Rack along with the Mutants logo?

Makes your Rack look sleek.

Mutants don’t control, like Machete don’t text.

Bypassing the module turns its lights off.

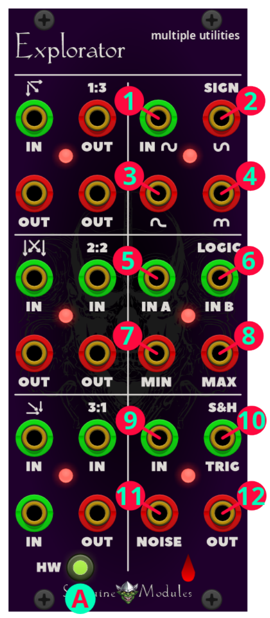
Explorator – Multiple utilities

Multiplex, multiply, mix, sample, invert and subvert audio and CV signals with a polyphonic module that fulfills every mad scientist's dream[13].

Explorator is based on a combination of Mutable Instruments' "Links" and "Kinks", presented in a single module with polyphonic capabilities for every section.

We hope this module multiplies your creativity to infinity.

Explorator controls



The module is comprised of six different, independent sections; they will be described in the "Explorator Module sections" chapter below, going left to right and top to bottom.

Buttons

A. **HW:** This button toggles the **3:1 Section**'s hardware emulation on and off.

LED	State
	Disabled.
	Enabled.

---

13 Mutator general's warning: running audio through some sections of this module may cause undesired effects such as aliasing, DC signals, lo-fi feelings, weird sensations, lycanthropy, philanthropy, apanthropy and, horror of horrors, may cause your audio to experience therianthropy. You've been warned, sternly.
Now go experiment!

The **3:1 Section** of the hardware module averages the mixed signal by applying a 1/3 gain to the mix before it is sent to the output, great for preventing audio clipping!

When this option is enabled, Explorator emulates the hardware's behavior, acting as an averager; when this option is disabled, output signals are just mixed and the result is sent to the output as is.

This option is disabled by default.

Explorator context menu

In addition to the standard Sanguine Modules context menu, the Explorator context menu has one new entry:

- **Noise mode**: the noise model for the **S&H section** can be selected using this menu, CPU usage for both options increases as more polyphonic channels are used; but their CPU impact changes:
    - **White noise (High CPU)**: this mode demands a generous amount of CPU; but is closest to other Mutable Instruments Kinks ports.

      This is the mode used before version 2.6.3 of the plugin.
    - **Prism noise (Low CPU)**: this mode is more CPU friendly and produces results quite similar (but not equal) to white noise.

      This is the default.

The selected **Noise mode** is saved with patches and presets.

Explorator module sections

The LED lights in the different sections show the polarity and amplitude of the voltages in a given section.

The voltages shown depend on each section and will be explained in the appropriate part for each one.

The lights share the same rules in every section when it comes to light colors:

LED	Channels	Voltage
●	**Monophonic and polyphonic**	0V
●	**Monophonic**	<0V
●	**Monophonic**	>0V
●	**Polyphonic**	<0V
●	**Polyphonic**	>0V

Every section accepts audio and CV signals.

1:3 Section

A buffered multiple: the signal present at the **IN** port is duplicated to all three **OUT** ports without voltage loss.

Polyphony for this section is set by the number of channels present at the **IN** port.

The LED light shows the voltage present at the **IN** voltage.

SIGN Section

This section offers an inverter, a half wave rectifier and a full wave rectifier.

1. **IN** input for the signal to be processed by the different outputs.
2. **INVERTED**: this output contains the input signal with its sign inverted (e.g. An input voltage of 5V is converted to an output voltage of -5V).
3. **HALF WAVE RECTIFIED**: this output clips the negative half of the input signal to 0V. This can add harmonics to audio signals.
4. **FULL WAVE RECTIFIED:** this output inverts the negative half of a signal. On symmetrical signals, this can result in an “octaver” effect.

Polyphony for this section is set by the number of channels present at the **IN** input (1).

The LED light shows the voltage present at the **IN** input (1).

2:2 Section

A precision adder/mixer that can work as a 1:2 multiple.

The signals present at the **IN** inputs are added and the result is sent to the two **OUT** outputs.

When only one of the inputs is patched, this section can be used as a 1:2 multiple.

An example application for the precision adder is transposing sequences: patch the output of a sequencer to the first **IN** input and the CV output of an instrument to the second **IN** input; patch the output to a VCO with a V/Oct input. The sequence will be transposed by the notes played on the instrument.

Polyphony for this section is set by the **IN** input with highest channel count among the two inputs.

The LED light shows the voltage sum of both **IN** inputs.

LOGIC Section

A logic signal processor.

5. **IN A:** input for the first signal to be compared.
6. **IN B:** input for the second signal to be compared.
7. **MIN:** the minimum signal of the two inputs is sent to this output, behaves like an analog AND.
8. **MAX:** the maximum signal of the two inputs is sent to this output, behaves like an analog OR.

The following diagram will help make things a bit clearer:

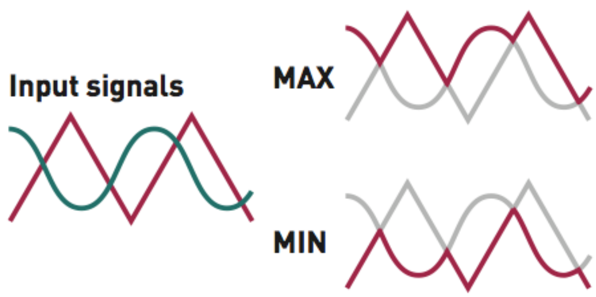


*Figure 5: The resulting output of two input signals after passing through the **LOGIC** section.*

Due to the way the module behaves, it can produce some interesting results:

- If only one input is patched, it can be used to split signals into their positive and negative halves using the **MAX** (8) and **MIN** (7) outputs, respectively.
- The resulting wave forms of audio signals have the same inharmonic partials and side bands that could be obtained from a ring modulator.

Polyphony for this section is set by **IN** input with the highest channel count among the two inputs.

The LED shows the voltage sum of both inputs.

3:1 Section

This section acts as a mixer with an optional averager.

The signals sent to the three **IN** inputs are mixed together.

If the **3:1 Averager** (A) is enabled, a 1/3 gain is applied.

The resulting mixed signal is sent to the **OUT** output.

Polyphony for this section is set by the **IN** input with the highest channel count among the three inputs.

The LED shows the voltage sum of the three inputs.

S&H Section

A sample & hold with internal noise generators.

9. **IN:** signal input, normalled to the internal noise generators.
10. **TRIGGER:** when triggers are received in this port, channel voltages present at the **IN** (9) input are sampled; stored in the module, and sent to the **OUT** (12) output, on the appropriate channel.

    Stored voltages for each channel will remain until a new trigger is received in the corresponding channel and a new voltage is sampled.[14]

    This input sets the number of polyphonic channels of the **S&H section**.
11. **NOISE:** this port contains the output of the polyphonic internal noise generators. Two different generator models, with different CPU loads, are available; the preferred model can be selected using the context menu.
12. **OUT:** polyphonic voltages held in the module are contained in this port.

The LED shows the voltages held in the module.

14 Just like in an analog module, voltages will not be held indefinitely: they will be lost when the module is turned off (i.e. When Rack is closed).

Funes – Macro oscillator

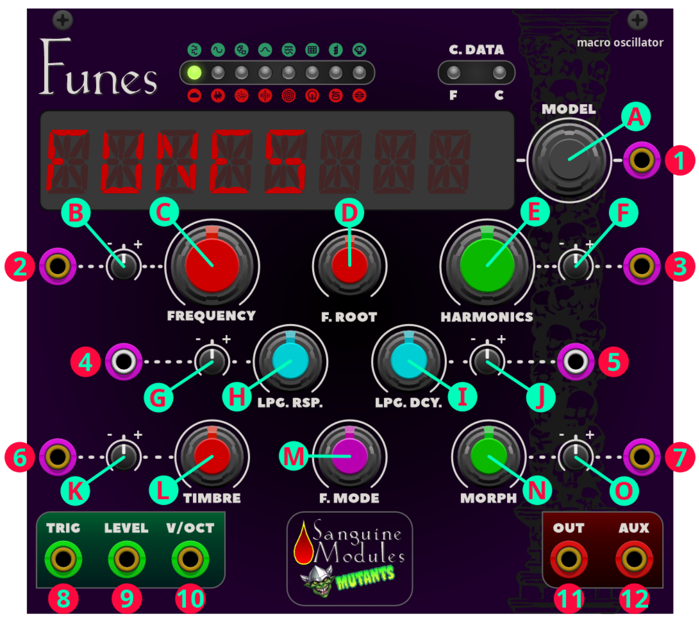
Featuring twenty four synthesis models that range from filtered classic wave shapes to synthetic hi-hats, Funes is a polyphonic macro oscillator that caters to your every musical need.

Funes is based on Mutable Instruments' well known macro oscillator "Plaits", with the last released firmware: 1.2.

We aim for this module to be an endless source of inspiration!

This manual covers basic operation; but a lot of enjoyment comes from experimentation and discovery. Have fun!

Funes controls



Knobs

A. MODEL: twist it back and forth to select the synthesis model. The available models are separated in three banks of eight.

Each of the LEDs at the top represents one of the models.

The LEDs reflect both the selected model and its bank using one of three colors.

Model banks are separated as follows: pitched (green LEDs), noise/percussive (red LEDs) and new synthesis (orange LEDs). The character display uses an eight character code to show the active selection.

The available synthesis models are:

Model #	LED	Model	Display	Note[15]
1	🟠	Classic wave shapes with filter	**FLTRWAVE**	C0
2	🟠	Phase distortion and modulation	**PHASDIST**	C#0
3	🟠	6-operator FM 1	**6 OP.FM1**	D0
4	🟠	6-operator FM 2	**6 OP.FM2**	D#0
5	🟠	6-operator FM 3	**6 OP.FM3**	E0
6	🟠	Wave terrain synthesis	**WAVETRRN**	F0
7	🟠	String machine emulation	**STRGMACH**	F#0
8	🟠	Chiptune	**CHIPTUNE**	G0
9	🟢	Pair of classic wave forms	**DUALWAVE**	G#0
10	🟢	Wave shaping oscillator	**WAVESHAP**	A0
11	🟢	Two operator FM	**2 OP.FM**	A#0
12	🟢	Granular formant oscillator	**GRANFORM**	B0
13	🟢	Harmonic oscillator	**HARMONIC**	C1
14	🟢	Wave table oscillator	**WAVETABL**	C#1
15	🟢	Chords	**CHORDS**	D1
16	🟢	Vowel and speech synthesis	**VOWLSPCH**	D#1
17	🔴	Granular cloud	**GR.CLOUD**	E1
18	🔴	Filtered noise	**FLT.NOIS**	F1
19	🔴	Particle noise	**PRT.NOIS**	F#1
20	🔴	Inharmonic string modeling	**STG.MODL**	G1
21	🔴	Modal resonator	**MODALRES**	G#1
22	🔴	Analog bass drum	**BASSDRUM**	A1
23	🔴	Analog snare drum	**SNARDRUM**	A#1
24	🔴	Analog hi-hat	**HI-HAT**	B1

Synthesis models can also be selected directly using the context menu (see below).

Module controls change different parameters that depend on the selected model.

For a more in depth explanation of the specific models and what the controls affect when they are selected, please refer to the "Funes synthesis models" section.

The polyphonic channel to show in the display can be set using the context menu.

15 Only available when "C0 model modulation" is checked in the context menu.

B. **FM ATTENUVERTER**❥: controls the polarity and amount of modulation from the voltage present in the **FREQUENCY INPUT** (2) to the **FREQUENCY** (C).

C. **FREQUENCY** (coarse): its range can be adjusted using the “Frequency mode” item in the context menu or the **F. MODE** (M) knob. By default, it is eight octaves (C0-C8).

   “Octaves” and “LFO” modes are also available.

D. **FREQ. ROOT**: when “Octaves” is selected as the “Frequency mode” this knob controls the root note.

E. **HARMONICS**: model dependent tone control. In general it controls the frequency spread of the tone.

F. **HARMONICS ATTENUVERTER**: controls the polarity and amount of voltage modulation to the **HARMONICS** (E) value from the **HARMONICS INPUT** (3).

G. **LPG. RSP. ATTENUVERTER**: controls the polarity and amount of voltage modulation from the **LPG. RSP. INPUT** (4) to the **LPG. RSP.** (H) value.

H. **LPG. RSP.**: controls the response of the internal low-pass gate from VCFA (counter clockwise) to VCA (clockwise).

I. **LPG. DCY.**: adjusts the ringing time of the internal low-pass gate and the decay time of the internal envelope.

J. **LPG. DCY. ATTENUVERTER**: controls the polarity and amount of voltage modulation to the **LPG. DCY.** (I) value from the **LPG. DCY. INPUT** (5).

K. **TIMBRE ATTENUVERTER**❥: controls how much the voltage present at the **TIMBRE INPUT** (6) affects the **TIMBRE** (L) value.

L. **TIMBRE**: model dependent tone control. In general it controls the “darkness” of the tone.

M. **F. MODE**: sets the range for the **FREQUENCY** (C) knob, can also be set using the context menu.

N. **MORPH**: model dependent tone control. In general it controls lateral timbral variations.

O. **MORPH ATTENUVERTER**❥: controls how much the voltage present at the **MORPH INPUT** (7) affects the **MORPH** (N) value.

❥ This attenuverter adjusts the modulation amount from the internal decaying envelope generator when its input is left unpatched and the **TRIG** (8) input is patched.
If you disconnect the CV input, and the **TRIG** (8) input is patched, any attenuverter value other than “0” will allow the internal envelope to take over.

Inputs and outputs

1. **MODEL CV:** this input has two modes of operation that be selected using the context menu selection:

   ○ **C0 model modulation (monophonic) unchecked (Offset modulation)**: when the input is patched, two or more LEDs (depending on polyphony) light up. The blinking LED indicates the central value (the selected model) while the steady LEDs indicate the currently active one for each polyphonic channel. The input voltage functions as an offset to the currently selected central value: negative voltages decrease it and positive voltages increase it. This behavior is the closest to the original “Plaits” with the addition of polyphony: every polyphonic channel can have its own offset.

     This is the default.

   ○ **C0 model modulation (monophonic) checked**: when the input is patched, the notes C0 to B1 select the current model. Selection is absolute and not influenced by the manually selected model.

   In both modes the display updates, by default, to reflect the currently active model for the first, if polyphonic, or only channel connected to the input. This behavior and the channel to display can be adjusted in the context menu (see below).

   This port is, by nature, polyphonic.

2. **FM**: frequency modulation input.

3. **HARMONICS CV**: voltages sent to this port offset the **HARMONICS** (E) value.

4. **LPG. RSP. CV**: voltages sent to this port offset the **LPG. RSP.** (H) value.

   Important notice: This port uses monophonic signals only![∂]

5. **LPG. DCY. CV**: voltages sent to this port offset the **LPG. DCY.** (I) value.

   Important notice: This port uses monophonic signals only![∂]

6. **TIMBRE CV**: voltages present in this port offset the **TIMBRE** (L) value.

7. **MORPH CV**: voltages sent to this port offset the **MORPH** (N) value.

8. **TRIG:** trigger input; it serves four different purposes:

   ○ Triggers the internal decaying envelope generator.

∂ This is due to how module internals work and is indicated by the port’s silver jack.
Voltages sent to this port will behave in the following manner:
- Only the first channel of a polyphonic cable is considered.
- The voltage present in that first channel will affect every polyphonic channel equally.

    - Excites the physical and percussive models.
    - If the **LEVEL** (9) input is not patched, it strikes the internal low-pass gate.
    - Samples and holds the value of the **MODEL CV** (1) input.

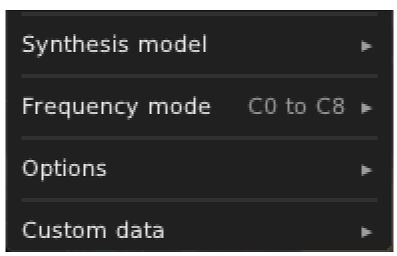
    Polyphony for the module is set by the highest channel count among the **TRIG** (8) and **V/OCT** (10) inputs.

9. **LEVEL:** opens the internal low-pass gate; it also acts as an accent control when triggering physical or percussive models.
10. **V/OCT:** controls the fundamental frequency of the produced sound, from -3 to +7 octaves relative to the root note set by the **FREQUENCY** (A) knob.

    Polyphony for the module is set by the highest channel count among the **TRIG** (8) and **V/OCT** (10) inputs.

11. **OUT:** main output signal (model dependent).
12. **AUX:** carries a variant or by-product subordinate to the **OUT** (11) output signal (model dependent).

Funes context menu



The Funes context menu makes several additions, divided into categories, to the standard Sanguine Modules context menu:

- **Synthesis model**: allows direct selection of the specific synthesis model for the base engine of the module; it contains three subcategories: **New**, **Pitched** and **Noise/percussive**. Item order in the subcategories corresponds to the order models are selected using the **MODEL** (A) encoder.
- **Frequency mode**: sets the range for the **FREQUENCY** (B) knob; **FREQUENCY** (B) range can be set using the **FREQ. MODE** (M) knob as well.

- **Options**: module display, CV model selection and host CPU demands preferences can be adjusted using this menu:
  - **Display follows modulated model**: when enabled, the LED display changes to reflect the model currently selected by the voltage present in the **MODEL CV** (1) input for the selected channel. If it is desired for the display to change only when a model is selected using the knob or the effect is disliked, disable this option.

    Enabled by default.
  - **Display channel**: selects the channel to show in the LED display next to the **MODEL** (A) knob.

    Only available channels are shown in the menu.

    The module is smart and will select the highest available channel automatically if the last user-selected channel is higher than the currently available ones.

    Default display channel: “1”.
  - **C0 model modulation (monophonic)**: when enabled, the selected model is changed by sending note voltage values to the **MODEL** CV input. Selection is absolute. This disables the default Plaits-like behavior and is monophonic only.

    Disabled by default.
  - **Low CPU (disable resampling)**: if the host computer is struggling, enabling this will save some CPU at the expense of sound quality.

    Disabled by default.
- **Custom data**: options for managing custom data for models that support it.

  More information about custom data can be found in the appropriate section.
  - **Load...**: loads custom data for one of the supported models.

    This menu item is not functional in **MetaModule**.
  - **Reset to factory default**: this menu option clears custom data and loads the built-in, default data for the selected model.
  - **Open custom data editors in web browser...**: opens the default web browser and points it to the Funes editors website: https://bloodbat.github.io/Funes-Editors/

    The editors have been tested using Firefox.

> The **Reset to factory default** and **Load...** menus are displayed only for models capable of handling custom data, otherwise, a notice is displayed; the notice states which models have custom data capabilities.

Funes synthesis models

Models are presented with the name that appears on the display to make finding parameters easier.

FLTRWAVE

Classic wave shapes with filter.

Controls Knobs	
HARMONICS (E)	Resonance and filter character: • CCW: gentle 24dB/octave. • CW: harsh 12dB/octave.
TIMBRE (L)	Filter cutoff.
MORPH (N)	Waveform and sub level.
Outputs	
OUT (11)	LP output.
AUX (12)	12dB/octave HP output.

PHASDIST

Phase distortion and modulation.

Controls Knobs	
HARMONICS (E)	Distortion frequency.
TIMBRE (L)	Distortion amount.
MORPH (N)	Distortion asymmetry.
Outputs	
OUT (11)	Synchronized carrier (phase distortion).
AUX (12)	Free running carrier (phase modulation).

6 OP.FM1, 6 OP.FM2, 6 OP.FM3☻

2 voice, 6 operator FM synthesizer. 3 models with banks of 32 presets each.

Controls	
Knobs	
HARMONICS (E)	Preset selection.
TIMBRE (L)	Modulators level.
MORPH (N)	Envelope and modulation stretching / time travel.
Inputs	
TRIG (8)	The two voices play alternatively when a trigger is received. If **TRIG** (8) is not patched, a single voice plays as a drone and **MORPH** (N) allows time travel along envelopes and modulations.
LEVEL (9)	Velocity control (loudness or timbre, depending on preset).
Outputs	
OUT (11)	Synchronized carrier (phase distortion).
AUX (12)	Free running carrier (phase modulation).

WAVETRRN☻

Wave terrain synthesis. Use 2D maps as sound! Continuous interpolation between eight terrains.

Controls	
Knobs	
HARMONICS (E)	Terrain. **Important!** Loaded custom data can be found when this knob is turned all the way to the right.
TIMBRE (L)	Path radius.
MORPH (N)	Path offset.
Outputs	
OUT (11)	Direct terrain height (z axis).
AUX (12)	Terrain height as phase distortion (sin(y+z)).

☻ These models can load custom data.

STRGMACH

String machine emulation with stereo filter and chorus.

Controls Knobs	
HARMONICS (E)	Chord.
TIMBRE (L)	Chorus/filter amount.
MORPH (N)	Waveform.
Outputs	
OUT (11)	Voices 1&3 predominantly.
AUX (12)	Voices 2&4 predominantly.

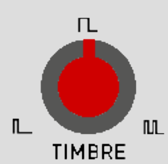
CHIPTUNE

Four variable square voices or arpeggios.

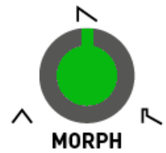
Controls Knobs	
HARMONICS (E)	Chord.
TIMBRE (L)	Arpeggio type or chord inversion.
TIMBRE attenuverter (K)	Envelope shape.
MORPH (N)	PW/Sync.
Inputs	
TRIGGER	Arpeggiator clock.
Outputs	
OUT (11)	Square wave voices.
AUX (12)	NES triangle voice.

DUALWAVE

Virtual-analog synthesis of classic wave forms.

Controls Knobs	
HARMONICS (E)	Detuning between the two waves.
TIMBRE (L)	Variable square: from narrow pulse (CCW) to full square (12 o'clock) to hardsync formants (CW).[16] 

16 A narrow pulse results in silence. This can be used to silence the oscillator.

	Variable saw: from triangle (CCW) to saw (12 o'clock) with an increasingly wide notch (Nodi's CSAW).[17]
MORPH (N)	

Outputs	
OUT (11)	Main signal.
AUX (12)	Sum of two hard sync'ed waveforms: shape is controlled by **MORPH** (N) and detuned by **HARMONICS** (E).

WAVESHAP

An asymmetric triangle processed by a wave shaper and a wave folder.

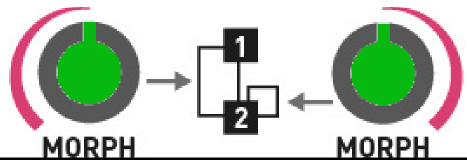
Controls Knobs	
HARMONICS (E)	Wave shaping waveform.
TIMBRE (L)	Wave folder amount.
MORPH (N)	Wave form asymmetry.
Outputs	
OUT (11)	Main signal.
AUX (12)	Variant with different wave folder curve.

2 OP.FM

Two sine oscillators modulating each other's phase.

Controls Knobs	
HARMONICS (E)	Frequency ratio.
TIMBRE (L)	Modulation index.

17 A wide notch results in silence. This can be used to silence the oscillator.

	Feedback. Operator 2 modulates its own phase (past 12 o’clock: rough) or operator 1’s phase (before 12 o’clock: chaotic).[18]
MORPH (N)	

Outputs	
OUT (11)	Main signal.
AUX (12)	Sub-oscillator.

GRANFORM

A simulation of formants and filtered wave forms through the multiplication, addition and synchronization of sine wave segments.

Controls Knobs	
HARMONICS (E)	Frequency ratio between formants 1 and 2.
TIMBRE (L)	Formant frequency.
	Formant width and shape.
MORPH (N)	Controls the shape of the window by which a sum of two synchronized sine oscillators is multiplied.

The diagram illustrates the relationship between the knobs:

Outputs	
OUT (11)	Main signal.
AUX (12)	Simulation of filtered wave forms by windowed sine waves. **HARMONICS** (E) controls the filter type (peaking, LP, BP, HP).

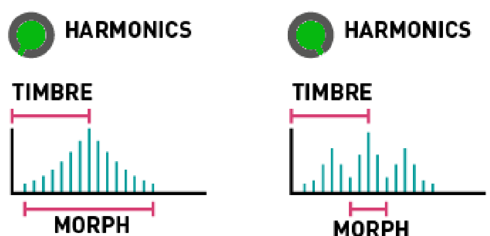
18 Turn **MORPH** (N) all the way to the left to obtain the same range of sounds as Nodi's **WTFM**. Turn **MORPH** (N) completely to the right to recreate the sounds of Nodi's **FBFM**. When **MORPH** (N) is at the center, A gentler palette equivalent to Nodi's **FM** is found.

HARMONIC

An additive mixture of harmonically related sines.

Controls Knobs	
HARMONICS (E)	Frequency ratio between formants 1 and 2.
TIMBRE (L)	Formant frequency.
MORPH (N)	Formant width and shape. Controls the shape of the window by which a sum of two synchronized sine oscillators is multiplied.

The diagram illustrates the relationship between the knobs:

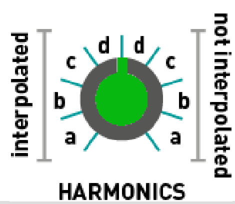


Outputs	
OUT (11)	Main signal.
AUX (12)	Simulation of filtered wave forms by windowed sine waves. **HARMONICS** (D) controls the filter type (peaking, LP, BP, HP).

WAVETABL

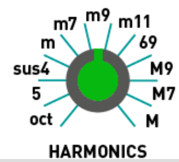
Four banks of 8x8 wave forms, accessible by row and column.

With or without interpolation.

Controls Knobs	
HARMONICS (E)	Bank selection. The first 4 are interpolated banks (CCW); the next 4 are the same banks, in reverse order, without interpolation (CW). • **Bank A**: harmonically poor waveforms from additive synthesis (sine harmonics, drawbar organ wave forms). • **Bank B**: harmonically rich wave forms from formant synthesis or wave shaping. • **Bank C**: wave tables from the Shruti-1 / Ambika, sampled from classic wave table or ROM playback synthesizers. • **Bank D**: a semi-random permutation of wave forms from the other 3 banks. **Important!** Loaded custom data is available in **Bank D** and **Bank D** only. 
TIMBRE (L)	Row index. Waves are sorted by spectral brightness in banks A-C.
MORPH (N)	Column index.
Outputs	
OUT (11)	Main signal.
AUX (12)	Low-fi (5 bit) output.

CHORDS

Four note chords played by virtual analogue oscillators (emulating a stack of harmonically related square or saw tooth wave forms generated by vintage string & organ machines), or wave table oscillators.

Controls Knobs	
HARMONICS (E)	Chord type. Chords types are organized like the following diagram: 
TIMBRE (L)	Chord inversions and transpositions.
MORPH (N)	Wave form. The first half of the knob goes through a selection of string machine like raw wave forms; the second half scans a small wave table with 16 wave forms.
Outputs	
OUT (11)	Main signal.
AUX (12)	Root note of the chord.

VOWLSPCH

A bunch of speech synthesis algorithms.

Controls Knobs	
HARMONICS (E)	Crossfades between formant filtering, SAM and LPC vowels, then goes through several banks of LPC words.
TIMBRE (L)	Species selection, from Daleks to chipmunks. This parameter shifts the formants up or down independently of the pitch, or underclocks / overclocks the emulated LPC chip (compensating to maintain pitch).
MORPH (N)	Phoneme or word segment selection. When **HARMONICS** (E) is past 11 o'clock, a list of words can be scanned by turning this knob or sending CV to its input.
FM Attenuverter (B)	Word intonation.
MORPH Attenuverter (N)	Word speed.

LPG. RESP. (H) **& LPG. DECAY** (I)	The low-pass gate affects word production in Funes; to obtain sounds like the ones the hardware module generates, both knobs must be turned clockwise all the way.
INPUTS	
TRIG (8)	Utter word.
Outputs	
OUT (11)	Main signal.
AUX (12)	Unfiltered vocal chords signal.

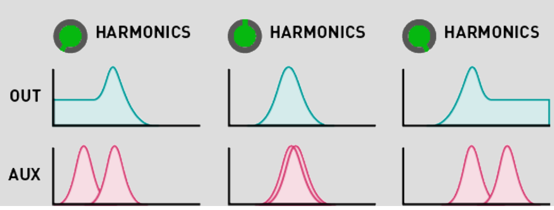
GR.CLOUD

A swarm of 8 enveloped saw tooth waves.

Controls **Knobs**	
HARMONICS (E)	Pitch randomization.
TIMBRE (L)	Grain density.
MORPH (N)	Grain duration and overlap. When fully CW, grains merge into each other, resulting in a stack of eight randomly frequency modulated wave forms.
Outputs	
OUT (11)	Main signal.
AUX (12)	Variant with sine wave oscillators.

FLT.NOIS

Variable clock white noise processed by a resonant filter.

Controls **Knobs**	
FREQUENCY (C)	Filter cutoff frequency.
HARMONICS (E)	Filter response: from LP to BP to HP. The diagram shows the effect of the **HARMONICS** (E) knob on the output signals: 
TIMBRE (L)	Clock frequency.

MORPH (N)	Filter resonance.
Inputs	
V/OCT	Filter cutoff frequency.
Outputs	
OUT (11)	Main signal.
AUX (12)	Variant with two band-pass filters; their separation is controlled by the **HARMONICS** (E) knob.

PRT.NOIS

Dust noise processed by networks of all-pass or band-pass filters.

Controls **Knobs**	
HARMONICS (E)	Amount of frequency randomization.
TIMBRE (L)	Particle density.
MORPH (N)	Filter type: • Reverberating all-pass network before 12 o'clock. • Increasingly resonant band-pass filters past 12 o'clock.
Outputs	
OUT (11)	Main signal.
AUX (12)	Raw dust noise.

STG.MODL & MODALRES‡

A mini version of a simplified Anuli[19]; **STG.MODL** implements inharmonic string modeling, and **MODALRES** implements a modal resonator; please refer to the Anuli manual for more information about those synthesis methods.

Controls	
Knobs	
HARMONICS (E)	Amount of inharmonicity or material selection.
TIMBRE (L)	Excitation brightness and dust density.
MORPH (N)	Decay time (energy absorption).
Inputs	
TRIG (8)	Excite the string or resonator. When this input is patched, the string is excited by a short burst of filtered white noise or by a low-pass filtered click; when this input is not patched, the string or resonator is excited by particle noise.
Outputs	
OUT (11)	Main signal.
AUX (12)	Raw exciter signal.

BASSDRUM‡

Analog bass drum. Behavioral simulation of the circuits from classic drum machines.

Controls	
Knobs	
HARMONICS (E)	Attack sharpness and amount of overdrive.
TIMBRE (L)	Brightness.
MORPH (N)	Decay time.
Outputs	
OUT (11)	Bridget T-network excited by shaped pulse.
AUX (12)	Frequency modulated triangle VCO turned into a sine with a pair of diodes, shaped by dirty VCA.

SNARDRUM‡

Analog snare drum. Like a marching band!

‡ This mode uses its own decay envelope and filter. The internal LPG is disabled for it. The **TRIG** (8) input triggers the signal; but doesn't strike the LPG. When the **TRIG** (8) input is patched, the **LEVEL** (9) input works as an accent control. When the **TRIG** (8) input is not patched, a continuous signal is produced.

19 The processor in the original hardware module is not as powerful as Anulis', so this module is limited to 3 voices of polyphony in inharmonic string modeling mode, and 1 voice of polyphony with 24 partials in modal resonator mode. This module does not let you control excitation position: it is set to 25% of the length of the string/bar/tube.

Controls Knobs	
HARMONICS (E)	Balance of the harmonic and noisy components.
TIMBRE (L)	Balance between the different modes of the drum.
MORPH (N)	Decay time.
Outputs	
OUT (11)	Bridget T-networks, one for each mode of the shell, excited by a nicely shaped pulse, and some band filtered noise.
AUX (12)	Frequency modulated pair of sine VCOs, mixed with high-pass filtered noise.

HI-HAT‡

Analog hi-hat. Metallic counter-point

Controls Knobs	
HARMONICS (E)	Balance of metallic and filtered noise.
TIMBRE (L)	High-pass filter cutoff.
MORPH (N)	Decay time.
Outputs	
OUT (11)	6 square oscillators generating a harsh, metallic tone mixed with clock noise; sent to a high-pass filter and, finally, through a dirty transistor VCA.
AUX (12)	3 pairs of square oscillators ring modulating each other, sent through a clean, linear VCA.

Funes custom data

Some **Funes** synthesis models have the ability to load and use custom data.

Custom data must be prepared as a ".bin" file using the Funes editors before it can be used with **Funes**.

Custom data can be managed using the context menu.

‡ This mode uses its own decay envelope and filter. The internal LPG is disabled for it. The **TRIG** (8) input triggers the signal; but doesn't strike the LPG. When the **TRIG** (8) input is patched, the **LEVEL** (9) input works as an accent control. When the **TRIG** (8) input is not patched, a continuous signal is produced.

Custom data capable models	
Model	**Features**
6-operator FM models	Load banks of 32 patches in DX7 SysEx format. Banks can be converted, created and reordered using the editor. Custom data can be loaded in any of the three available models.
Wave terrain synthesis	Can load an image created by the user or generated mathematically using the editor. Popular image formats are supported.
Wave table synthesis	Up to 15 individual custom wave forms can be integrated into a wave table. Wave forms can be supplied by the user or generated mathematically using the editor.

Custom data capable models and their current state are indicated by the **C. DATA** LED lights at the top of the module:

F LED	C LED	Custom data
off	off	Not available for the selected model.
green	off	Available for the selected model. Factory data loaded.
off	green	Available for the selected model. Custom data loaded.
green	off ⇔ red ⇔ off	Available for the selected model. An error occurred when trying to load custom data. The **C LED** will briefly flash red and then turn off when an attempt to load custom data was unsuccessful.

Custom data limitations:

- Replaces the built-in default for the selected model.

  The factory built-in can be restored using the context menu.

- Only one model can use custom data at a time.

- Applies to every polyphonic channel for the selected model.

Custom data loading is not available in **MetaModule**.

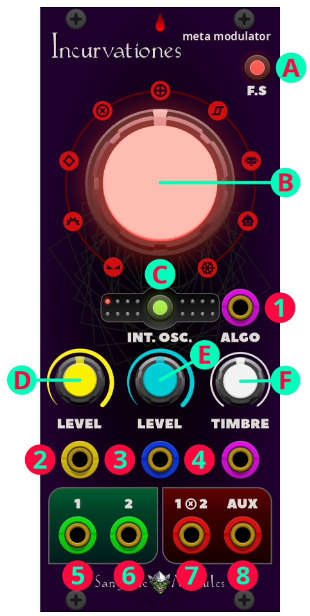
Incurvationes – Meta modulator

A polyphonic sound sculpting module: blend; combine, and warp two audio signals with a variety of cross-modulation modes, or frequency shift signals to capture that magical feel!

Based on Mutable Instruments' "Warps".

We hope this module can keep your sounds always evolving and twisting in new and different ways.

Incurvationes controls



This module is polyphonic and can handle up to 16 channels.

The **INT. OSC.** (C) setting affects every channel.

Active polyphonic channels are indicated by the lit leds around the **INT. OSC.** (C) button.

> It is important to distinguish between **Module channels** and **Polyphonic channels**: the module, internally, has 2 channels: **Channel 1** and **Channel 2**.
>
> The source of those channels can be internal for **Channel 1** when the **Internal oscillator** is enabled and external for **Channel 2** from the signal present at the **INPUT 2** (6) port, or external for both channels, using the **INPUT 1** (5) and **INPUT 2** (6) ports.
>
> The module uses different algorithms to produce a resulting signal using both **Module channels** for every **Polyphonic channel** present: each polyphonic channel is processed by its own internal **engine** with 2 **Module channels**
>
> The module's output will be a polyphonic signal when two or more **Polyphonic channels** are present.
>
> The following pages mention **Channel 1** and **Channel 2** often, whenever they are referenced, they mean **Module channels** 1 and 2, not **Polyphonic channels** 1 and 2!

Knobs and buttons

A. **F.S:** enables and disables the **Frequency shifter/Quadrature cross-modulator mode**.

LED	State
	Disabled.
	Enabled.

This mode, and the modulation algorithms for **Standard mode** are described in detail in the "Incurvationes module modes" section.

Disabled by default.

B. **MODULATION ALGORITHM:** twist the big knob around to select the algorithm applied to signals in **Standard mode**; the amount of frequency shifting in **Frequency shifter mode**, or the amount of phase shifting in **Quadrature cross-modulator mode**.

Different values light up the knob in different hues.

C. **INT. OSC.**: cycles between the available internal oscillator states.

The effects of the internal oscillator are mode dependent:

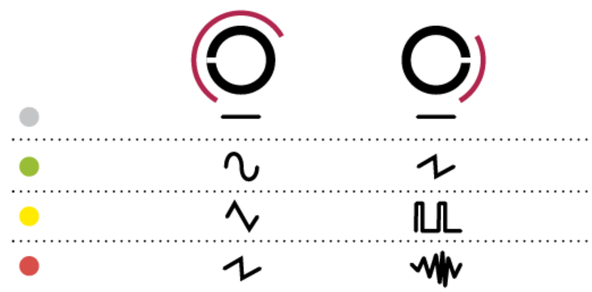
- **Standard**:

  When the button's LED is off, the **Internal oscillator** is disabled; when the button's LED is lit, the **Internal oscillator** is enabled, its wave form indicated by the lamp's color.

  The **Internal oscillator** provides different wave forms that depend on the algorithm selected by the **MODULATION ALGORITHM** (B) knob: cross-modulation algorithms work best with harmonically simple signals, while vocoders work better with harmonically rich signals.

  Sine, triangle and saw tooth wave forms are provided for the cross-modulation algorithms, and saw tooth, pulse and low-pass filtered noise are available for the vocoder algorithms.

  The graphic below shows the different wave forms and their LED colors in relation to the **MODULATION ALGORITHM** (B) knob's position:



  The oscillator's frequency is controlled by the yellow **LEVEL 1** (D) knob and the **LEVEL 1 CV** (2) input; signals received in **INPUT 1** (5) can phase modulate the Internal oscillator or provide an external noise source for the low-pass filter when vocoder algorithms are selected and the **INT. OSC.** (C) button LED is lit red.

  The **AUX** (8) output usually contains the signal generated by the Internal oscillator.

- **Frequency shifter/Quadrature cross-modulator mode**:

  Enables and disables **Quadrature cross-modulator mode**, and cycles between the three wave forms available for the **Frequency shifter mode**.

  Frequency shifter mode requires one of the three wave forms to be active.

  The active mode and the selected wave form are indicated by the LED lamp of the **INT. OSC.** (C) button:

LED	Mode
	Quadrature cross-modulator
	Frequency shifter: sine

- 🟡 **Frequency shifter**: three harmonics
- 🔴 **Frequency shifter**: “random”: 7 harmonics + random amplitudes/phases

D. LEVEL 1:

The effects of this knob are mode dependent:

- **Standard mode**

  The knob controls a different parameter that depends on whether the **Internal oscillator** is enabled or disabled:

  - **Disabled**:

    Controls the amplitude of the **INPUT 1** (5) signal or the amount of amplitude modulation from the **LEVEL 1 CV** (2) input

  - **Enabled**:

    Controls the frequency of the **Internal oscillator**.

- **Frequency shifter mode**

  Controls the amount of feedback.

- **Quadrature cross-modulator mode**

  Controls the amplitude of **Channel 1**’s signal.

E. LEVEL 2: controls the amplitude of the **INPUT 2** (6) signal, or the amount of amplitude modulation from the **LEVEL 2 CV** (3) input. Gains above 1.0 can be achieved using CV for a warm overdrive effect.

F. TIMBRE:

- **Standard mode**

  The effect of this knob is algorithm dependent, check the “Incurvationes module modes” section for more information.

- **Frequency shifter mode**

  This knob controls the balance between the lower and upper side bands; when the knob is at the center, both side bands are present (ring-modulation).

- **Quadrature cross-modulator mode**

  This knob controls the intensity of the high harmonics created.

Inputs and outputs

1. **ALGO CV:** the voltage present in this input acts as an offset to the position set by the **MODULATION ALGORITHM** (B) knob.

   Polyphonic voltages offset their channels independently.

   The active algorithm for each channel sets its indicator LED to the appropriate hue.

2. **LEVEL 1 CV input:**

   - **Standard mode**

     When the internal oscillator is off, this input modulates gain for the signal present at **INPUT 1** (5); when the internal oscillator is enabled, if functions as a V/Oct input for the oscillator's frequency.

   - **Frequency shifter mode**

     Modulates the feedback amount.

   - **Quadrature cross-modulator mode**

     Modulates gain for the signal present at **INPUT 1** (5).

   This input is normalled to +5V.

3. **LEVEL 2 CV:** modulates gain for the signal present at **INPUT 2** (6).

   This input is normalled to +5V.

4. **TIMBRE CV:** offsets the value set by the **TIMBRE** (F) knob.

5. **INPUT 1:** this input behaves differently depending on how the rest of the module is configured; check the information above for specifics, or the diagram in the "Incurvationes module modes" section to visualize signal paths and their interactions.

   This input usually receives the carrier signal.

   Polyphony for the module is set by the cable with the highest channel count connected to either this or the **INPUT 2** (6) ports.

6. **INPUT 2:** this input usually accepts modulator signals; check the diagram in the "Incurvationes module modes" section to visualize signal paths and their interactions.

   Polyphony for the module is set by the cable with the highest channel count connected to either this or the **INPUT 1** (5) ports.

7. **1 x 2:** this output's behavior is dictated by the module's selected mode:

   - **Standard mode**

The main audio output for the module.

- **Frequency shifter mode**

  The **1 x 2** and **AUX** (8) outputs are the opposite of the **TIMBRE** (F) knob; e.g. If **TIMBRE** (F) is all the way to the left, **1 x 2** will output the lower side band and **AUX** (8) will output the upper side band.

  Great for generating wide stereo images!

- **Quadrature cross-modulator mode**

  The real part of the calculated result.

8. **AUX:** this output's behavior is dictated by the module's selected mode:

- **Standard mode**

  When the internal oscillator is disabled, this output contains the post VCA sum of the **INPUT 1** and **INPUT 2** signals; when the internal oscillator is enabled, this output contains the raw signal from the internal oscillator.

- **Frequency shifter mode**

  Check the information above for the **1 x 2** (7) output.

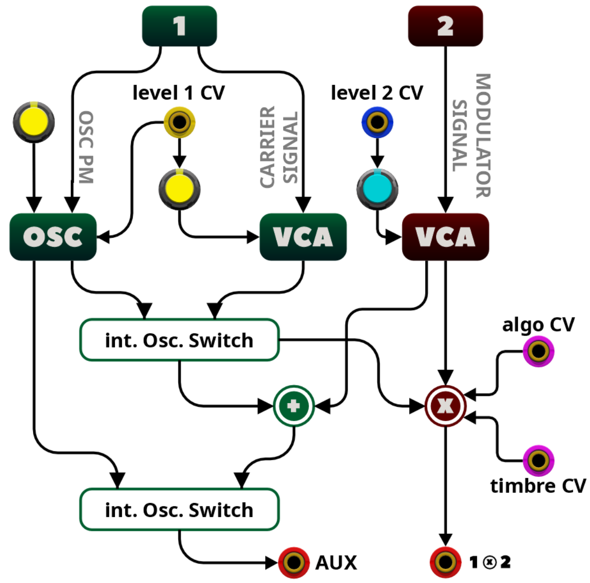
- **Quadrature cross-modulator mode**

  The imaginary part of the calculated result.

Incurvationes module modes

Most cross-modulation algorithms distinguish between the carrier and modulator signals: the carrier signal will be filtered or modulated to acquire some of the characteristics of the modulator signal. Some other algorithms emulate symmetrical circuits and do not make that distinction.

Incurvationes signal route diagram



Standard mode algorithms

Crossfading

The carrier and modulator are cross faded into each other using a constant-power law. **TIMBRE** (F) controls where the cross fading occurs: signals are mixed equally at 12 o'clock.

Crossfolding

The carrier and modulator are summed; a little bit of cross modulation product is added, and the resulting signal is sent to a wave folder.

TIMBRE (F) controls the amount of wave folding.

Diode ring modulation

The carrier and modulator are crudely multiplied on a digital model of a diode ring-modulator.

TIMBRE (F) post-processes the resulting signal with a variable amount of gain and emulated diode clipping.

Digital ring modulation

This algorithm uses proper multiplication and results in a gentler version of the previous algorithm; the resulting sound is more akin to AD633-based analog ring-modulators.

TIMBRE (F) post-processes the signal with a gain boost and soft-clipping.

XOR modulation

The carrier and modulator are converted to 16-bit integers; the resulting numbers are XOR'ed bit by bit.

TIMBRE (F) controls which bits are XOR'ed together.

Comparison and rectification

A handful of signals are synthesized through comparison operations.

TIMBRE (F) morphs through the signals, some have an octave pedal flavor.

Vocoder

Classic implementation of an analog vocoder, with a bank of 20 analysis and 20 synthesis third-octave 48dB filters.

The modulator's sub-band signals are processed by envelope followers to derive the gains for each of the carrier's sub-band signals.

TIMBRE (F) warps the connections between the modulator's envelope followers and the carrier's gain elements, shifting the formants extracted from the modulator signal up or down.

Turning the **ALGORITHM** (B) knob clockwise increases the release time of the envelope followers; when the knob is fully clockwise, the modulator signal is frozen and the carrier is filtered by the formants that were present in the modulator signal before the knob reached this position.

Frequency shifter mode

This mode is selected by enabling both **F.S** (A) and **INT. OSC.** (C).

The **ALGORITHM** (B) knob and **ALGORITHM CV** (1) input change the amount of frequency shifting:

- No shifting at the 12 o'clock position.
- Positive frequencies when turning the knob to the right.
- Negative frequencies when turning the knob to the left.

The control curve is linear until 50 Hz then it becomes exponential.

The response of the **ALGORITHM CV** (1) input, that modulates shifting amount, depends on the position of the **ALGORITHM** (B) knob: it is linear when the knob is near the center, and 1V/Octave-ish when the knob is above 50 Hz or below -50Hz.

The **INT. OSC.** (C) button selects the carrier wave form.

LEVEL 1 (D) knob and **LEVEL 1 CV** (2) input: control the feedback amount.

LEVEL 2 (E) knob and **LEVEL 2 CV** (3) input: control the dry/wet mix.

TIMBRE (F): controls the balance between the lower and upper side bands; at 12 o’clock, both side bands are present (ring-modulation).

INPUT 1 (5) and **INPUT 2** (6) inputs: audio inputs summed together and processed by the frequency shifter.

1 x 2 (7) and **AUX** (8) outputs: two audio outputs described in the controls section.

Quadrature cross-modulator[*]

This mode is selected by enabling **F.S** (A) and disabling **INT. OSC.** (C).

When this mode is enabled, the module computes the product of the analytic signals obtained from the **INPUT 1** (5) and **INPUT 2** (6) ports and another complex exponential; the real and imaginary parts of the result are sent to the two outputs.

This mode can be thought of as a form of frequency shifting; but instead of setting the frequency with the knob, a sine wave is directly fed to **INPUT 1** (5) to shift the **INPUT 2** (6) signal; more complex wave forms will shift the signal in **INPUT 2** (6) multiple times and create very complex inharmonic tones.

The **ALGORITHM** (B) knob controls the amount of phase shifting on the result; differences can’t really be heard when the knob is moved slowly: for the effect to be actually fruitful, CV modulation should be applied using the **ALGORITHM CV** (1) input.

Incurvationes bypassed module behavior

The signal present at **INPUT 2** (6) is sent to the **1 x 2** (7) output as is.

[*] This mode requires signals to be connected to both **INPUT 1** (5) and **INPUT 2** (6).

Distortiones – Doctored meta modulator

A remixed, polyphonic sound sculpting module and effects processor: add doppler, wave folding, wave shaping, and more, or use any of the Incurvationes modes to achieve the sound you imagine with 7 new modes!

Based on the “Parasite” alternative firmware for Mutable Instruments’ “Warps”.

We hope this module can help you achieve the quirky, evolving sounds you can’t get out of your head.

This manual documents the changes made to Incurvationes to create the Distortiones module; consult the Incurvationes manual for basic operating instructions and descriptions of modes already present in that module: **Frequency shifter/Quadrature cross-modulator mode**, and the **Standard mode** algorithms, available when Distortiones’ active **Mode** is **Meta-mode**.

Some adjustments have been made that impact the sound and behavior of the module:

- Different smoothing on the Level CV for a snappier response e.g. fast attacks.
- Increased the TZFM modulation index of the **Internal sine oscillator** (The button’s LED for **Int. Osc.** (C) is green and audio is fed to the **CARRIER** (5) input).
- In **Meta-mode**, the volume of the wave folder has been lowered a bit, and its phase inverted (avoids phase cancellation between the first two modes).
- The **Vocoder**’s volume has been raised a bit.

A lot of enjoyment for this module comes from experimenting with the modes and listening to the possibilities, rather than reading the manual.

Distortiones controls

The controls for Distortiones are the same as the ones for Incurvationes with two exceptions.

Knobs and buttons

G. MD: this button replaces the F.S button present in Incurvationes, it enables and disables the **MODE SELECT** function.

LED	State
	Disabled.
	Enabled.

Whenever **MODE SELECT** is engaged, the **MODULATION ALGORITHM** (B) knob jumps to the currently active module mode; the knob returns to its last value when **MODE SELECT** is disengaged.

When **MODE SELECT** is enabled, twisting the **MODULATION ALGORITHM** (B) knob changes the module's mode, akin to the mode select feature in the hardware module; in this mode, the knob is notched and will snap to valid modes.

Normal **MODULATION ALGORITHM** (B) knob operation is disabled when **MODE SELECT** is enabled.

The knob glows a different color as modes are changed in **MODE SELECT**.

The selected mode is shown in the context menu.

Modes can also be selected directly using the context menu.

MODE SELECT is disabled by default.

Inputs

9. **MODE**: polyphonic voltages sent to this input will directly select the mode for each polyphonic channel (up to 16).

   Voltages sent to this port are *not* offsets: mode selection is absolute and direct in the available modes.

   Two direct selection modes, chosen using the context menu, are available:

<table>
<tr><th>Mode</th><th>Description</th></tr>
<tr><td>Direct CV</td><td>Voltages in the 0V to 8V range set the mode for a given channel.

Voltages are mapped as follows:

<table>
<tr><th>Voltage</th><th>Mode</th></tr>
<tr><td>0V</td><td>Binaural doppler panner</td></tr>
<tr><td>1V</td><td>Wave folder</td></tr>
<tr><td>2V</td><td>Chebyshev wave shaper</td></tr>
<tr><td>3V</td><td>Frequency shifter</td></tr>
<tr><td>4V</td><td>Dual bit mangler</td></tr>
<tr><td>5V</td><td>Comparator with Chebyschev wave shaper</td></tr>
<tr><td>6V</td><td>Vocoder</td></tr>
<tr><td>7V</td><td>Variable rate delay</td></tr>
<tr><td>8V</td><td>Meta-mode</td></tr>
</table>

This mode is active when the C4-F#4 direct mode selection menu entry is unchecked.

This mode is the default.</td></tr>
<tr><td>C4-F#4 direct mode</td><td>Notes starting at C4 and ending at F#4 set the mode for a given channel.

Notes are mapped as follows:

<table>
<tr><th>Note</th><th>Mode</th></tr>
<tr><td>C4</td><td>Binaural doppler panner</td></tr>
<tr><td>C#4</td><td>Wave folder</td></tr>
<tr><td>D4</td><td>Chebyshev wave shaper</td></tr>
<tr><td>D#4</td><td>Frequency shifter</td></tr>
<tr><td>E4</td><td>Dual bit mangler</td></tr>
<tr><td>F4</td><td>Comparator with Chebyschev wave shaper</td></tr>
<tr><td>F#4</td><td>Vocoder</td></tr>
</table></td></tr>
</table>

G4	Variable rate delay
G#4	Meta-mode

This mode is active when the **C4-G#4 direct mode selection** menu entry is checked.

Mode selection is polyphonic and every channel can have a different mode.

Lights

- The selected mode for channel 1 is shown using a green LED next to the corresponding mode glyph.
- LED lamps around the **INT. OSC.** (C) button light up for active channels and change color according to each channel’s selected mode.

Distortiones context menu

Distortiones offers the standard Sanguine Modules context menu with two additions:

- **MODE:** select the module’s operation mode directly, without going through the **MODE SELECT** function documented above.
- **C4-G#4 direct mode selection:** enables and disables direct mode selection using note voltages.

Distortiones module modes

Binaural Doppler Panner

Recreate the effect of capturing a moving sound source with two, different microphones separated by a small distance (e.g. Having ears).

The setup described above has several consequences:

- The microphone closer to the sound source receives the signal earlier and louder (known as binaural effect; human computers known as brains use this to locate sound sources).

- The farther a sound source is to the microphone's position, the more delayed it is… speed of sound and all that.
- Distance affects pitch: the closer a sound source is, the higher its apparent pitch (A.K.A. Doppler effect).

This mode can also be used as a dual cross fader, a panner, a simple delay, or a VCA; but it will feel a little sad: it is at its best when using it as the whole Doppler package.

The **MODULATION ALGORITHM** (B) controls the X coordinate of the sound source.

The **TIMBRE** (F) controls the Y coordinate of the sound source.

Two internal LFOs are present to move the sound source in a circle around the center's X and Y coordinates; the **LEVEL 1** (D) knob controls the frequency of the LFOs and the **LEVEL 2** (E) knob their amplitude.

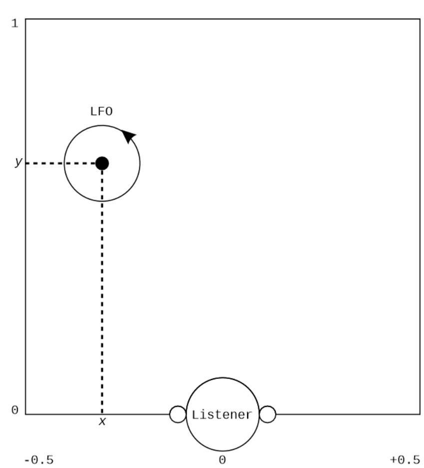
The **INT. OSC.** (C) button controls the size of the simulated space:

LED	Size
Grey	Tiny.
Green	Big.
Yellow	Bigger.
Red	Huge.

INPUT 1 (5) receives one sound source; INPUT 2 (6) receives another sound source that is placed symmetrically to INPUT 1, on axis, on the other side of the "head".

Outputs **1 x 2** (7) and **Aux** (8) should be used as a stereo pair.

The diagram below will help illustrate some of the concepts of this mode:



Wave Folder

Fold your waves like clean laundry!

The **MODULATION ALGORITHM** (B) sets the number of folds.

The **TIMBRE** (F) controls the input bias.

The **LEVEL 1** (D) knob controls the amplitude of the **INPUT 1** (5) signal or the internal oscillator's frequency, if it is enabled.

The **LEVEL 2** (E) knob controls the amplitude of the **INPUT 2** (6) signal.

The **INT. OSC.** (C) button enables and disables the internal oscillator and selects its wave form:

LED	Oscillator
Grey	Disabled.
Green	Sine.
Yellow	Triangle.
Red	Saw.

1 x 2 (7) contains the module's main output.

AUX (8) contains either the sum of the **INPUT 1** (5) and **INPUT 2** (6) signals or the output of the internal oscillator, if it is enabled.

Chebyschev Wave Shaper

Shape signals using Chebyschev polynomials; the result is shifting harmonics non-linearly by harmonics, producing interesting timbres out of simple, harmonically poor ones.

This mode can provide a full synthesis voice, close to additive synthesis and wave folding, when combined with the internal oscillator.

The **MODULATION ALGORITHM** (B) sets the Chebyschev function's order: from 0th to 16th. When the knob is all the way to the left, sound is unaffected (order 0); as the knob is rotated right, input harmonics are increasingly shifted.

The **TIMBRE** (F) knob sets the wave shaper's gain, when fully turned right it will shift the internal sine oscillator's harmonics, so it can be used as a simple additive voice.

The **LEVEL 1** (D) knob controls the amplitude of the **INPUT 1** (5) signal or the internal oscillator's frequency, if it is enabled.

The **LEVEL 2** (E) knob controls the amplitude of the **INPUT 2** (6) signal.

The **INT. OSC.** (C) button enables and disables the internal oscillator and selects its wave form:

LED	Oscillator
⚫	Disabled.
🟢	Sine.
🟡	Triangle.
🔴	Saw.

1 x 2 (7) contains the module's main output.

AUX (8) contains either the sum of the **INPUT 1** (5) and **INPUT 2** (6) signals or the output of the internal oscillator, if it is enabled.

Frequency Shifter ⊗

This mode is documented in the appropriate section of the Incurvationes manual.

Dual Bit Mangler ⊕

Degrade and bit crush audio signals.

The **MODULATION ALGORITHM** (B) sets the bit degradation amount.

The **TIMBRE** (F) controls X-modulation.

Morphs between:

- Dry.
- Bitwise And.
- Bitwise Xor.

The **LEVEL 1** (D) knob controls the amplitude of the **INPUT 1** (5) signal or the internal oscillator's frequency, if it is enabled.

The **LEVEL 2** (E) knob controls the amplitude of the **INPUT 2** (6) signal.

The **INT. OSC.** (C) button enables and disables the internal oscillator and selects its wave form:

LED	Oscillator
⚫	Disabled.
🟢	Sine.
🟡	Triangle.
🔴	Saw.

1 x 2 (7) contains the module's main output.

AUX (8) contains either the sum of the **INPUT 1** (5) and **INPUT 2** (6) signals or the output of the internal oscillator, if it is enabled.

Comparator with Chebyschev Wave Shaper

The Chebyschev wave shaper with integrated analog-like comparator functions.

The **MODULATION ALGORITHM** (B) morphs between 8 analog like comparator functions.

The **TIMBRE** (F) sets the Chebyschev function's order.

The **LEVEL 1** (D) knob controls the amplitude of the **INPUT 1** (5) signal or the internal oscillator's frequency, if it is enabled.

The **LEVEL 2** (E) knob controls the amplitude of the **INPUT 2** (6) input.

The **INT. OSC.** (C) button enables and disables the internal oscillator and selects its wave form:

LED	Oscillator
● (grey)	Disabled.
● (green)	Sine.
● (yellow)	Triangle.
● (red)	Saw.

1 x 2 (7) contains the module's main output.

AUX (8) contains either the sum of the **INPUT 1** (5) and **INPUT 2** (6) signals or the output of the internal oscillator, if it is enabled.

Vocoder

Versatile synthetic voices!

The **MODULATION ALGORITHM** (B) controls frequency warping.

The **TIMBRE** (F) sets the release time.

The **LEVEL 1** (D) knob controls the amplitude of the **INPUT 1** (5) signal or the internal oscillator's frequency, if it is enabled.

The **LEVEL 2** (E) knob controls the amplitude of the **INPUT 2** (6) input.

The **INT. OSC.** (C) button enables and disables the internal oscillator and selects its wave form:

LED	Oscillator
	Disabled.
	Saw tooth.
	Pulse.
	Low-pass filtered noise.

1 x 2 (7) contains the module's main output.

AUX (8) contains either the sum of the **INPUT 1** (5) and **INPUT 2** (6) signals or the output of the internal oscillator, if it is enabled.

Variable Rate Delay

A model of a tape loop, moving at a defined speed, and two separate heads, one for reading and one for writing, that can be moved along the loop.

Simulate classic tape loop effects with a versatile delay mode!

The **MODULATION ALGORITHM** (B) controls the speed and direction of the tape.

Fully clock-wise, the tape goes forward at full speed, as the knob approaches noon, the tape slows down and delay time increases while sound quality degrades: less ferrite grains present to record audio.

At 12 o'clock the tape is stopped, so delay time is infinitely long and audio quality is infinitely bad, in other words: silence.

Turning the knob to the left reverses tape direction.

The **TIMBRE** (F) knob controls the distance between the read and write heads on the tape loop.

All the way to the left, the write head is right next to the left of the read head: if the tape is running forward, delay times will be extremely short as what is read has just been recorded; if the tape is running backwards, delay times will be the longest: the recorded signal has to go through the whole loop before it is played back.

Fully clock-wise, the logic presented above is reversed: longest delay times are achieved running the tape forward and the shortest ones are obtained by running the tape backwards.

At 12 o'clock, the read and write heads have the same length of tape to work with, so delay times are the same when running the tape forwards or backwards.

The **LEVEL 1** (D) knob controls the feedback amount.

The **LEVEL 2** (E) knob sets the dry/wet mix level.

The **INT. OSC.** (C) controls the delay's topology:

LED	Topology	Description
⚫	**Open feedback loop**	**INPUT 1** (5) signal is the audio input, **1 x 2** (7) contains the audio output. **AUX** (8) is the feedback output and **INPUT 2** (6) is the feedback input.
🟢	**Dual delay**	**INPUT 1** (5) and **1 x 2** (7) act as one channel; **INPUT 2** (6) and **AUX** (8) act as another. Delay time is shared between the two pairs.
🟡	**Dual analog modeled delay**	Tape delay simulation model. The feedback path goes through LP/HP filters and light distortion, also a little hiss is added. Inputs and outputs are paired as in the Dual Delay topology.
🔴	**Ping-pong delay**	**INPUT 1** (5)'s signal feedback goes into **INPUT 2** (6)'s signal, and vice versa. Sounds great in stereo!

Meta-mode

This mode includes every algorithm from Incurvationes' **Standard mode** and mimics their behavior.

The algorithms are documented in the "Standard mode algorithms" section of the Incurvationes manual.

Mutuus – Experimental meta modulator

A convolved, polyphonic flexible sound manipulation module and effects processor evolved from the Distortiones firmware: filter, reverberate, chorus, wave fold, bit crush, and manipulate your signals to obtain that sound you can't get out of your head! 3 new modes, 4 modes from the Distortiones module and, of course, the original Incurvationes modes available in **Meta-mode**!

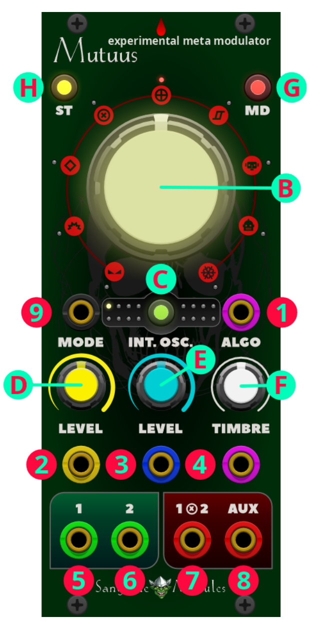
Based on the "Symbiote" alternative firmware, an evolution of the "Parasite" firmware, for Mutable Instruments' "Warps".

We aim for this module to provide you with endless sound transformation possibilities and satisfy that craving to contort sounds!

This manual documents the changes made to Distortiones to create the Mutuus module; the manual for Incurvationes and the manual for Distortiones should be consulted for basic operating instructions and descriptions of the modes already present in those modules.

This module is best enjoyed when experimenting with the modes and listening to the results.

Mutuus controls



The controls for Mutuus are the same as the ones for Distortiones with one addition (note: Mutuus sports red selected mode LEDs).

Knobs and buttons

H. ST: enable and disable stereo for the **Dual State Variable Filter** mode.

LED	State
⚫	Disabled.
🟡	Enabled.

Disabled by default.

Mutuus module modes

Dual State Variable Filter

This mode offers two independent State Variable Filters, arranged in default configurations; implemented using the Mutable Instruments' State Variable Filter code.

These filters drive resonance up to distortion levels and sound pretty close to an MS-20 filter.

The low-pass filter is two pole, and the band-pass and high-pass filters are one pole.

The **MODULATION ALGORITHM** (B) controls cutoff frequency for the first filter.

The **TIMBRE** (F) controls the cutoff frequency for the second filter.

LEVEL 1 (D) controls filter 1's resonance.

LEVEL 2 (E) controls filter 2's resonance.

The **INT. OSC.** (C) button switches filter configurations for the outputs, where the signal from filter 1 is contained in **1 x 2** (7) output and the signal from filter 2 is contained in **AUX** (8).

LED	1 x 2 (7)	AUX (8)
⚫	LP	HP
🟢	LP	BP
🟡	BP	HP
🔴	BP	BP

The **LEVEL 1 CV** (2) input modulates the VCA for Filter 1.

The **LEVEL 2 CV** (3) input modulates the VCA for Filter 2.

Ensemble FX

The Ensemble FX from the Funes String Machine: a low-pass stereo filter with chorus.

MODULATION ALGORITHM (B) controls cutoff frequency.

TIMBRE (F) controls chorus depth.

LEVEL 1 (D) controls the amplitude of **INPUT 1** (5)'s signal or the internal oscillator's frequency.

LEVEL 2 (E) controls the amplitude of the **INPUT 2** (6) signal.

INT. OSC. (C) switches the internal oscillator on and off and sets its wave form.

The **LEVEL 1 CV** (2) input modulates the VCA for the signal in **INPUT 1** (5) or V/OCT for the internal oscillator, if it is enabled.

The **LEVEL 2 CV** (3) input modulates the VCA for the signal in **INPUT 2** (6).

1 x 2 (7) contains the left channel.

AUX (8) contains contains the right channel.

Reverbs

A compiled collection of a few Mutable Instruments stereo reverb implementations, based on the configurations for Rings, Clouds and Elements.

This mode adds control over parameters not available in the original implementations.

The four available reverbs are selected using the **INT. OSC.** (C) button:

LED	Reverb	Origin
Grey	**Caveman**	Rings' Disastrous Peace mode.
Green	**Rings**	Rings' KarplusVerb resonator.
Yellow	**Clouds**	Clouds reverb.
Red	**Elements with added input gain control**	Elements reverb.

The **MODULATION ALGORITHM** (B) controls diffusion.

The **TIMBRE** (F) controls reverb time, when the **Elements** reverb is selected and the knob is completely clock-wise, reverb freeze is achieved.

The **LEVEL 1** (D) knob controls reverb amount for the **Caveman**, **Rings** and **Clouds** reverbs and gain for the **Elements** one.

The **LEVEL 2** (E) knob controls the low-pass filter for **Caveman**, **Rings** and **Elements** reverbs and feedback for the **Clouds** one.

The **LEVEL 1 CV** (2) input modulates the VCA for the signal in **INPUT 1** (5).

The **LEVEL 2 CV** (3) input modulates the VCA for the signal in **INPUT 2** (6).

1 x 2 (7) contains the left channel signal.

AUX (8) contains the right channel signal.

Frequency Shifter

This mode is documented in the appropriate appropriate section of the Incurvationes manual.

Bit Crusher

This mode is documented in the appropriate section of the Distortiones manual.

Chebyschev Wave Shaper

This mode is documented in the appropriate section of the Distortiones manual.

Doppler panner

This mode is documented in the appropriate section of the Distortiones manual.

Delay

This mode is documented in the appropriate section of the Distortiones manual.

Meta-mode

This mode includes every algorithm from Incurvationes' **Standard mode** and mimics their behavior.

The algorithms are documented in the Standard mode algorithms section of the Incurvationes manual.

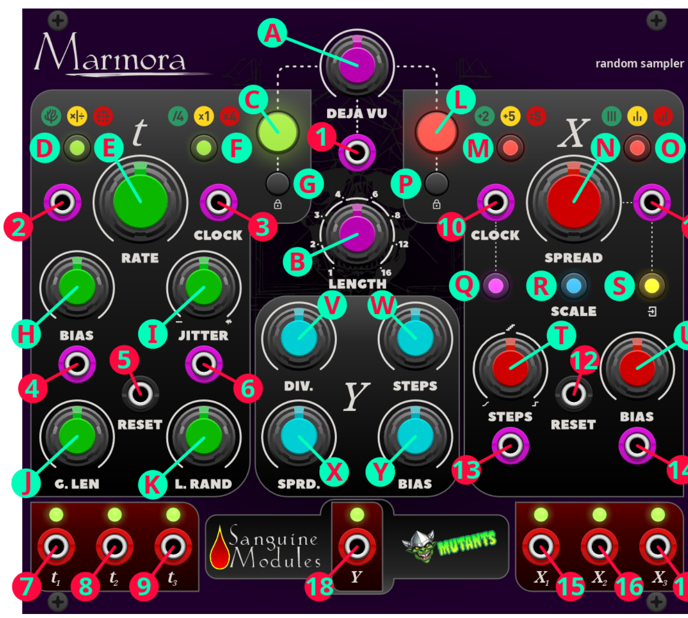
Marmora – Random sampler

Chaos… under your control. Random gates, random voltages and some spice! Use Marmora's internal clock or sync it to an external one, and modify a plethora of parameters to get the perfect combination of elements to capture lightning in a bottle!

Based on Mutable Instruments' "Marbles".

We hope this module helps keep your performances evolving and surprising every one… including you!

Marmora controls



Marmora's quick start formula

I. You need a clock, internal or external.

II. Add slight or extreme variations to it: jitter.

III. Generate 2 more random, contrasting rhythmic patterns, that complement the main clock.

IV. Generate random voltages, 3 of them, synced with the rhythms from step 3.

V. Transform those voltages.

VI. Add slight lag processing or quantize them to obtain smooth random modulations or random tunes, respectively.

Steps I-III are taken care of by the ***t* generator** of the module (the left half).

Steps IV-VI are handled by the ***X* generator** of the module (the right half).

To top it all off, how about letting everything be managed by a controllable, evolving loop? That's what the top center half of the module does: the **Deja Vu** section.

Marmora is a complex module with many controls and possibilities, so knobs related to a specific section are the same color.

To make explaining sections easier, each one will be described below separately, starting with…

The Deja Vu section

This section controls module decision making: whenever the module has to make a random choice, it queries this section; the **Deja Vu** section responds by either recycling a previous random choice or sampling fresh random data.

Deja Vu's influence on the ***t*** and ***X*** generators can be set independently for each one: **Deja Vu**'s influence on the ***t* generator** is controlled by the **t SUPER LOCK** (G) and **t DEJA VU** (C) buttons; **Deja Vu**'s influence on the ***X* generator** is controlled by the **X SUPER LOCK** (P) and **X DEJA VU** (L) buttons.

Two examples:

- The module can generate a non-repeating sequence of voltages locked to a looping rhythm (**Deja Vu** enabled for the ***t* generator** and disabled for the ***X* generator**).
- The module can cycle through the same sequence of voltages on an ever-changing rhythm (**Deja Vu** disabled for the ***t* generator** and enabled for the ***X* generator**).

Knobs

A. **DEJA VU:** controls the probability of recycling random decisions from the past:
    - From 7 o'clock to 12 o'clock the probability goes from 0, completely random, to 1, a locked loop: the module never generates fresh random data; when the module is in a locked loop state, the **t DEJA VU** (C) and **X DEJA VU** (L) buttons blink, if they are enabled.
    - From 12 o'clock to 5 o'clock, the probability of randomly jumping within the loop goes from 0 to 1, hence, at 5 o'clock, the module plays random permutations of the same set of decisions/voltages.

B. **LENGTH:** controls how long the internal loop is, in other words, how many values the module can choose from.

Lengths of 5, 7, 10 and 14 can be obtained by setting the knob between the markings printed on the panel.

> **LENGTH** *does not* adjust a global loop length, if that were the case, *every* system in the module would reset itself after *n* clock ticks.
>
> Setting the loop length to, for example, 3 does not mean that a looping 3 beat pattern will be created; it means that each "decision" (sampling a value from the internal random source) will cycle over 3 possible values.
>
> Please, don't expect that setting **LENGTH** to *n* will create an *n* beat pattern: *it won't!* It will, however, allow for *n* possible values when the module makes decisions.

Inputs

1. **DEJA VU CV**: voltages sent to this port offset the value of the **DEJA VU** (A) knob.

The *t* generator

The ***t* generator** produces random gates either by generating a jittery master clock or syncing with an external clock signal (let's call either of these the "base clock")

From the base clock, two streams of random gates are derived.

The base clock is always available in the $\mathbf{t_2}$ (8) output port, the streams of random gates are output in the $\mathbf{t_1}$ (7) and $\mathbf{t_3}$ (9) ports.

Knobs and buttons

C. **t DEJA VU**: this button enables and disables influence from the **Deja Vu** section to the ***t* generator**.

   When it is enabled, the settings for the **Deja Vu** section affect the behavior of the ***t* generator**; when it is disabled, the ***t* generator** behaves as if the **Deja Vu** knob were set to its minimum (random without repetition).

   t SUPER LOCK (G) overrides the behavior explained above.

   Deja Vu's influence on the ***t* generator** is indicated by the button's LED:

LED	Deja Vu influence
	Disabled.

	Enabled.
↔	Super lock.

D. t MODE: this button selects how the clock will be split among the **t_1** (7) and **t_3** (9) ports.

There are 7 different possible modes; pushing the button cycles among them.

The selected mode is indicated by the button's light color and cycle, in the button's tooltip and in the context menu.

The available modes are:

LED	Mode	Description
	Complementary Bernoulli	Every **t_2** (8) pulse generates a coin toss that decides whether the pulse goes to **t_1** (7) or **t_3** (9). **t BIAS** (H) controls the fairness of the coin toss. This is the default mode.
	Clusters	**t_2** (8) is multiplied and divided by a random ratio to generate **t_1** (7) and **t_3** (9), respectively. The ratio is controlled by the **t BIAS** (H) knob; extreme ratios can be achieved by turning the knob all the way to left or all the way to the right.
	Drums	Kick/snare drum patterns are generated by alternating the triggers between **t_1** (7) and **t_3** (9) regularly.
↔	**Independent Bernoulli**	**t_1** (7) and **t_3** (9) are chosen by independent coin tosses, so, both or neither channels can be on at the same time.
↔	**Divider**	The **t BIAS** (H) knob selects a clock division or multiplication ratio that is applied to **t_3** (9), while its reciprocal is applied to **t_1** (7). This mode has no randomness.
↔	**Three States**	The module randomly selects between a trigger on **t_1** (7), on **t_3** (9), or no output at all.

⇔ **Markov**	Heuristics are used to generate “balanced” rhythmic patterns using 4 basic rules: • Repeating what was played 8 ticks ago is favored. • Pulses appearing on both channels is frowned upon. • Sparse patterns (no consecutive hits) are favored. • Patterns where one channel “echoes” what the other channel played 4 ticks before are favored. Each rule has an associated “weight” that can be influenced by the **t BIAS** (H) knob.

The active ***t* MODE** can also be selected using the context menu.

E. **t RATE**: if the **t EXTERNAL CLOCK** (3) input is disconnected, this knob sets the module’s clock rate (120 BPM at 12 o’clock); if the **t EXTERNAL CLOCK** (3) input is patched, this knob acts as a divider/multiplier to the external clock.

F. **t CLOCK RANGE**: divides or multiplies the clock rate by 4. The active factor is indicated by the button’s light color, the button’s tooltip and the context menu.

LED	Clock range
	Clock divided by 4. This is the default.
	Clock multiplied by 1.
	Clock multiplied by 4.

The ***t* generator**’s **CLOCK RANGE** be set from the context menu as well.

G. **t SUPER LOCK**: this button enables and disables **Super lock mode** for the ***t* generator**.

When **Super lock** is enabled, the ***t* generator** behaves as if the **Deja Vu** knob were set at 12 o’clock (locked loop without randomness).

Disabled by default.

H. **t BIAS**: controls whether gates are more likely to be sent to the **t_1** (7) or **t_3** (9) outputs; the specific effect of this knob depends on the ***t* MODE** (D) setting.

I. **t JITTER**: controls the amount of randomness applied to the clock's timing: from perfectly stable to complete chaos, this applies to both internal and external clocks.

J. **t G. LEN**: sets the length of the gates output by **t_1** (7) and **t_3** (9), from 1% to 99%; together with the **L. RAND** (K) knob, this control can be used to introduce variation to the gates produced by the ***t* generator**.

K. **t L. RAND**: controls the amount of length randomness applied to the gates output by **t_1** (7) and **t_3** (9); check the **t G. LEN** (J) section for a helpful diagram.

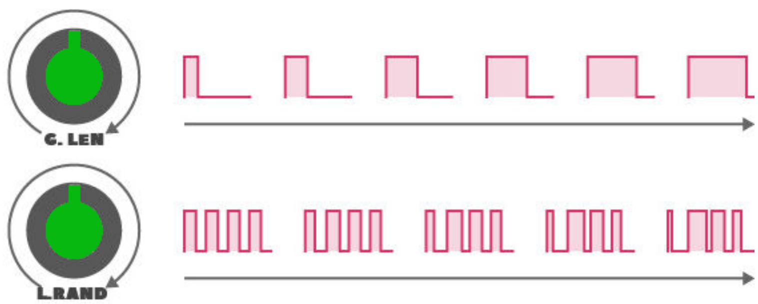


*Figure 6: Marmora gate shaping using the **G. LEN** and **L. RAND** knobs.*

Inputs and outputs

2. **t RATE CV**: CV applied to this input modulates the **RATE** (E).

3. **t EXTERNAL CLOCK**: patching this input overrides the internal clock and synchronizes the ***t* generator** to an external source.

4. **t BIAS CV**: voltages sent to this input modulate the **t BIAS** (H).

5. **t RESET**: triggers received in this port will reset the ***t* generator**: all counters, dividers, patterns and step numbers for the ***t* generator** are reset.

   When the ***t* generator** is reset, the random generator is reseeded.

   A reset can also occur automatically if a long pause (3 seconds or 4 times the interval between 2 clock ticks, whichever is longest) is encountered between triggers received in the **t EXTERNAL CLOCK** (3) input.

   Manual or automatic resets of the ***t* generator** can propagate to the ***X* generator** if the **X EXTERNAL CLOCK** (10) input is not patched.

6. **t JITTER CV**: voltages present in this port modulate the **JITTER** (I).

7. **t_1**: one of the random gate outputs; how random gates are generated and how controls affect them is explained above.

8. **t_2**: the internal or external clock is always output here, affected by **JITTER** (I).

9. **t_3**: one of the random gate outputs; how random gates are generated and how controls affect them is explained above.

The *X* generator

This section generates three independent random voltages output on **X_1** (15), **X_2** (16) and **X_3** (17).

The voltages can be clocked from the internal clock, using various combinations set by the internal **X CLOCK SOURCE** (Q) button, or by a common external clock patched to the **X EXTERNAL CLOCK** (10) port.

Knobs and buttons

L. **X DEJA VU**: this button enables and disables influence from the **Deja Vu** section on the ***X* generator**.

   When it is enabled, the settings of the **Deja Vu** section affect the behavior of the ***X* generator**; when it is disabled, the ***X* generator** behaves as if the **Deja Vu** knob were set to its minimum (random without repetition).

   X SUPER LOCK (P) overrides the settings explained above.

LED	State
●	Disabled.
●	Enabled.
● ↔ ●	Super lock.

M. **X OUTPUT VOLTAGE RANGE**: sets the output voltage range of the **X_1** (15), **X_2** (16) and **X_3** (17) outputs.

   The selected range is indicated by the color of the button's light, the button's tooltip and the context menu.

   The available ranges are:

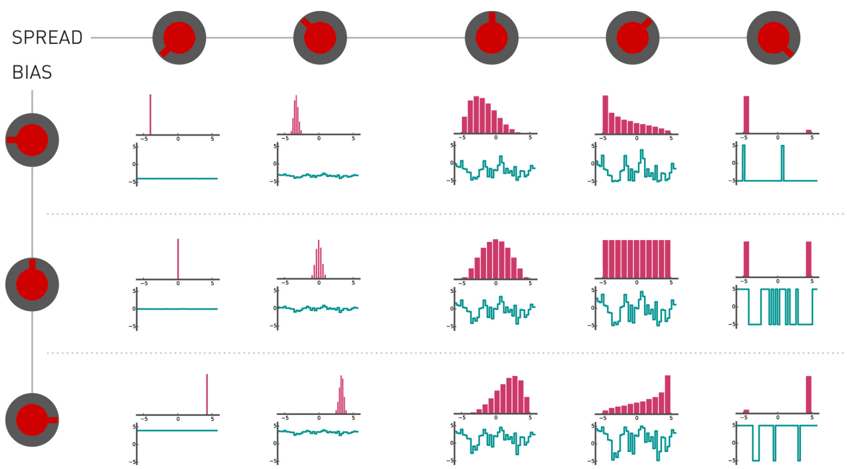
LED	Range	Voltages
●	**Narrow**	0V to +2V. This is the default.
●	**Positive**	0V to +5V.
●	**Full**	-5V to +5V.

   X OUTPUT VOLTAGE RANGE can also be set using the context menu.

N. X SPREAD: controls the width and shape of the voltage probability distribution i.e. How voltages are spread across the selected range:

- At 12 o'clock, voltages follow a bell curve: they are more likely to occur near the center; but are able to reach the extremes.
- As the knob is turned left, voltages are increasingly concentrated near the center of the range.
- When the knob is all the way to the left, constant voltages are output.
- At 2 o'clock, voltages spread across the entire voltage range, with equal probability.
- As the knob is turned right, past 2 o'clock, extreme values become more likely.
- When the knob is turned all the way to right, only minimum and maximum voltages are allowed, turning, in effect, **X₁** (15), **X₂** (16) and **X₃** (17) into random gates.

The graphic below shows the effect of this knob, as it relates to the **X BIAS** (U) knob, the pink bars show the voltage distribution, with the tallest bar being the most likely outcome, the teal oscillogram is an example sequence of output voltages:



O. X MODE: selects how the **X₁** (15), **X₂** (16) and **X₃** (17) outputs react to the settings dialed on the **X STEPS** (T), **X SPREAD** (N) and **X BIAS** (U) knobs, changing the flavor of the output random voltages.

The selected mode is indicated by the color of the button's light, the button's tooltip and the context menu.

The available modes are:

LED	Mode	Behavior
	Identical	All channels follow the settings on the control panel. This is the default.
	Bump	**X_2** (16) follows knob settings; **X_1** (15) and **X_3** (17) take opposite values. Example: if the **X STEPS** (T) knob is set completely to the right, **X_1** (15) and **X_3** (17) will be smooth and **X_2** (16) will be quantized to the root note and its octaves.
	Tilt	**X_3** (17) follows the control panel; **X_1** (15) reacts in the opposite direction, and **X_2** (16) always stays in the middle (steppy, unbiased, bell-curve).

X MODE can also be set using the context menu.

P. **X SUPER LOCK**: this button enables and disables **Super lock mode** for the ***X* generator**.

When Super lock is enabled, the ***X* generator** behaves as if the **Deja Vu** knob were set at 12 o'clock (locked loop without randomness).

Disabled by default.

Q. **INTERNAL X CLOCK SOURCE**: when the **X EXTERNAL CLOCK** (10) is not patched, the ***X* generator** is clocked by the ***t* generator**, this button controls where that information comes from.

The selected clock source is indicated by the color of the button's light, the button's tooltip and the context menu.

The available internal clock configurations are:

LED	Mode	Description
	External clock[20]	Pulses received in the **X EXTERNAL CLOCK** (10) input clock the ***X* generator**.
	$t_1 \rightarrow X_1, t_2 \rightarrow X_2, t_3 \rightarrow X_3$	Each of the ***t* generator**'s outputs directly clock the corresponding ***X* generator** output. This is the default mode when no external clock is connected.
	$t_1 \rightarrow X_1, X_2, X_3$	Pulses from **t_1** (7) clock every X output.
	$t_2 \rightarrow X_1, X_2, X_3$	Pulses from **t_2** (8) clock every X output.

20 This mode is automatically enabled when the **X EXTERNAL CLOCK** (12) port is patched. It can't be enabled any other way.

- $t_3 \rightarrow X_1, X_2, X_3$ — Pulses from t_3 (9) clock every X output.

The **INTERNAL X CLOCK SOURCE** can also be set using the context menu when no external clock is connected.

R. X SCALE: sets the active scale.

Scales are explained in their own section of the manual.

S. X EXTERNAL PROCESSING MODE: enables and disables external CV processing.

The state of the **X EXTERNAL PROCESSING MODE** is indicated using the button's LED lamp:

LED	State
● (grey)	Disabled.
● (yellow)	Enabled.
● (green)	Scale Edit Mode.

When **X EXTERNAL PROCESSING MODE** is enabled, the module's behavior is altered as follows:

- Whenever a random value is needed for one of the ***X*** outputs, the voltage present at the **X SPREAD CV** (11) input is sampled.
- **X BIAS** (U) acts as a transposition control, shifting voltages up and down, while **X SPREAD** (N) controls the transposition's range.
- When the **X EXTERNAL CLOCK** (10) is not patched, the three ***X*** outputs will contain the same melody; but with some notes frozen/sustained on outputs $\mathbf{X_1}$ (15) and $\mathbf{X_3}$ (17): each output is sampled at its own pace.
- The module can be used as a shift register under a specific set of conditions:
  - **X MODE** (O) is set to **Identical** (green).
  - The module is externally clocked.
  - External CV is fed to the module.

  When the above requirements are met, the module switches to shift-register mode and alters its behavior: $\mathbf{X_2}$ (16) contains $\mathbf{X_1}$ (15)'s voltage shifted by one clock tick, and $\mathbf{X_3}$ (17) contains $\mathbf{X_2}$ (16)'s voltage shifted by one clock tick.
- All outputs follow the setting of the **X STEPS** (T) knob. Always. Without regard for **X MODE** (O).

- Some sequencers do not change their output CVs exactly at the same time as their gate signals, so Marmora tolerates up to 3ms of difference between transitions.

This mode is disabled by default.

This button's LED is also used to indicate when the module is in **Scale Edit Mode**.

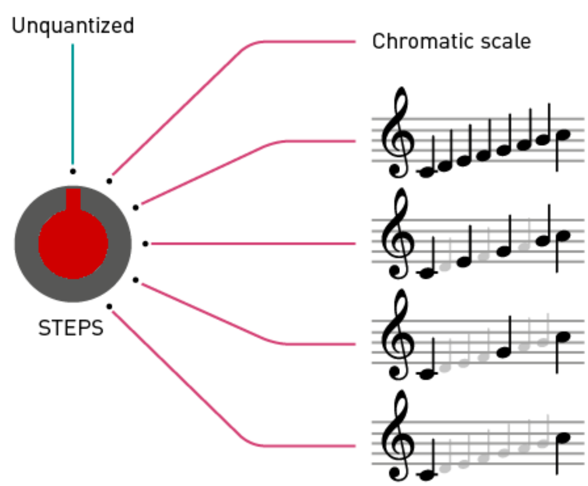
T. X STEPS: controls the horizontal and vertical "steppinness" of the generated voltages.

At 12 o'clock generated voltages follow the typical S&H setups.

Turning the knob to the left generates smoother edges, then random linear segments, then random smooth curves.

Turning the knob to the right quantizes generated voltages to a scale; as the knob is turned right, more and more notes are stripped off the scale, until only the root remains.

An example for the C major scale is shown below.



Marmora comes with 6 prebuilt, selectable, customizable scales, more information can be found in the **Scales** section.

U. X BIAS: skews voltages toward low or high values.

This knob can be thought of as as the probabilistic equivalent of an offset: voltages are not shifted up or down; but decisions are biased toward the bottom or top of the voltage range.

Inputs and outputs

10. X EXTERNAL CLOCK: if an external clock is patched here, every ***X*** output follows that clock instead of the one selected by **INTERNAL X CLOCK SOURCE** (Q).

11. **X SPREAD CV:** CV sent to this input modulates the **SPREAD** (N).

    This input is also used to sample external voltages when **X EXTERNAL PROCESSING MODE** (S) is enabled or editing custom scales.

12. **X RESET:** triggers received in this port will reset the ***X* generator**: all counters, dividers, patterns and step numbers for the ***X* generator** are reset.

    A reset can also occur automatically if a long pause (3 seconds or 4 times the interval between 2 clock ticks, whichever is longest) is encountered between triggers received in the **X EXTERNAL CLOCK** (10) input.

13. **X STEPS CV**: CV present at this input modulates the **X STEPS** (T).
14. **X BIAS CV**: CV applied to this input modulates the **X BIAS** (U).
15. $\mathbf{X_1}$: first ***X* generator** CV output.
16. $\mathbf{X_2}$: second ***X* generator** CV output.
17. $\mathbf{X_3}$: third ***X* generator** CV output.

The *Y* generator

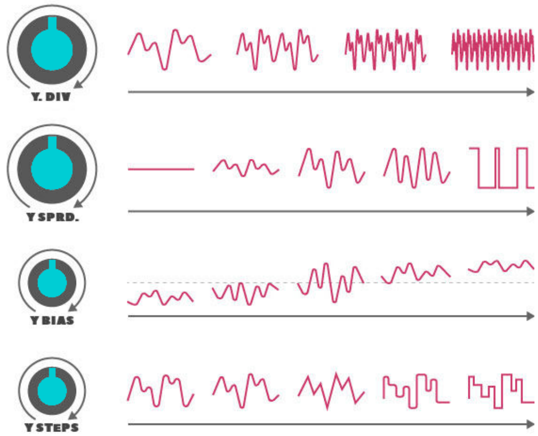
This section is a random voltage source.

By default, it is clocked at 1/16 the rate of $\mathbf{X_2}$ (16), and sends a smooth, full range (-5V to 5V) voltage to the **Y** (18) output.

Knobs

- **V. Y DIV.**: sets the division factor relative to $\mathbf{X_2}$ (16) from 1/64 to 1.
- **W. Y STEPS**: sets the wave form of the voltage sent to the **Y** (18) output.
- **X. Y SPRD.**: sets the amplitude of the voltage sent to the **Y** (18) output.
- **Y. Y BIAS**: skews voltages sent to the **Y** (18) output toward negative or positive values.

The relation between the knobs and the resulting voltages is illustrated in the diagram below:



Outputs

18. **Y**: contains the voltage produced by the ***Y* generator**.

Scales

The voltages output from the ***X* generator** can be quantized to one of 6 different scales.

Selecting scales

The active scale can be selected using the **SCALE** (R) button or the context menu and is shown using the button's light color and cycle, the button's tooltip and the context menu.

Marmora comes with 6 pre-programmed scales:

LED	Scale
↔	Major. (This is the default).
↔	Minor.
↔	Pentatonic.
⇔	Gamelan (Pelog).
⇔	Raag Bhairav.
⇔	Raag Shree.

Customizing scales

Marmora is capable of using custom scales programmed by the user.

To customize a scale:

1. Select the scale to be customized using either the **SCALE** (L) button or the context menu.

2. Connect the CV and gate outputs of a keyboard or MIDI interface to the **X SPREAD CV** (11) and **X EXTERNAL CLOCK** (10) inputs respectively.
3. Enable **Scale Edit Mode** using the context menu.
4. Play a little tune on the connected instrument, 50 notes or more is the recommended length.
5. Exit **Scale Edit Mode** using the context menu.

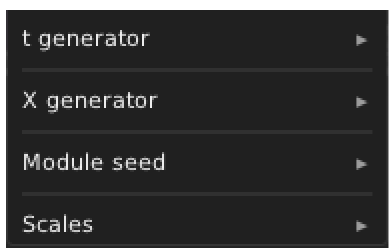
Custom scales are saved with patches and user presets.

Note that while **Scale Edit Mode** is active, the voltage of every ***X* generator** output will be the last note received, and gates received in the **X EXTERNAL CLOCK** (10) input will be copied to every ***t* generator** output. This is done so you can hear (or preview, if you prefer) what you are playing.

Resetting scales

The active scale can be reset to the factory default using the context menu item **Reset current scale**.

Marmora context menu



Marmora adds a comprehensive context menu to the standard Sanguine Modules context menu:

- **t generator**: options for managing the ***t* generator**:
  - **Mode**: select the generator’s mode directly. The generator’s mode can be selected using the button on the faceplate as well.
  - **Range**: select the generator’s range directly. The generator’s range can also be selected using the button on the faceplate.
  - **Reset/reseed**: resets and reseeds the generator (this can also affect the ***X* generator** under certain circumstances, described in the **t RESET** (5) section

above). The ***t* generator** can be reset and reseeded by triggers sent to the input port on the faceplate as well.

- **X Generator**: options for managing the ***X* generator**:
  - **Mode**: select the generator's mode directly. The generator's mode can be selected using the button on the faceplate as well.
  - **Range**: select the generator's range directly. The generator's range can also be selected using the button on the faceplate.
  - **Internal clock source**: select the ***X* generator**'s clock source (ignored if the **X EXTERNAL CLOCK** (10) input is patched). The generator's clock source can, likewise, be selected using the button on the faceplate.
  - **Reset**: resets the generator. The generator can be reset by sending triggers to the input port on the faceplate as well.
- **Module seed**: options for managing the module's random generator seed:
  - **Reseed rng**: sets a new seed for the random generator; the new seed is selected by the module.
  - **User**: lets the user set a new, specific random seed; the menu entry displays a text entry field which contains the current seed; the notice above the field displays the minimum and maximum values, and instructions on how to save changes:
    - **Minimum value**: 1.
    - **Maximum value**: 4294967295.
    - Set the new value using the "Enter" key.

    Values below 1 and above 4294967295 will be ignored.

    User seeds are saved with patches and presets.
- **Scales**: options for managing scales:
  - **Select active**: set the module's active scale directly. The active scale can also be set using the button on the faceplate.
  - **Edit current**: engages and disengages **Scale Edit Mode**. The edited scale will overwrite the currently active one.
  - **Reset current**: sets the currently selected scale to the module's factory default.

  Custom scale edition and management is described in the Scales section above.

Marmora tips and tricks

- If **DEJA VU** (A) is past 12 o'clock and **LENGTH** (B) is set to 1, outputs remain frozen in the same state.
- If **DEJA VU** (A) is around 11 o'clock, the loop will slowly mutate.
- The **DEJA VU** (A) knob has a "virtual notch" around 12 o'clock: even if the knob is not centered exactly, a perfectly non-random loop will still be produced.
- Once a sequence is looping, it is still possible to alter it with the **X SPREAD** (N) or **X BIAS** (U) knobs to map it to a different range of voltages.
- When the ***X* generator** is clocked internally, $\mathbf{X_1}$ (15), $\mathbf{X_2}$ (16) and $\mathbf{X_3}$ (17) are rhythmically independent from each other: each output changes voltage at its own pace. For example: setting **LENGTH** (B) to 3, will cause each output to independently go through a 3-note sequence, creating polyrhythmic effects.
- Self-patching Marmora is a rewarding technique! The **Y** (18) output, in particular, provides a useful, slow modulation source for randomizing other module parameters!

Nebulae – Texture synthesizer

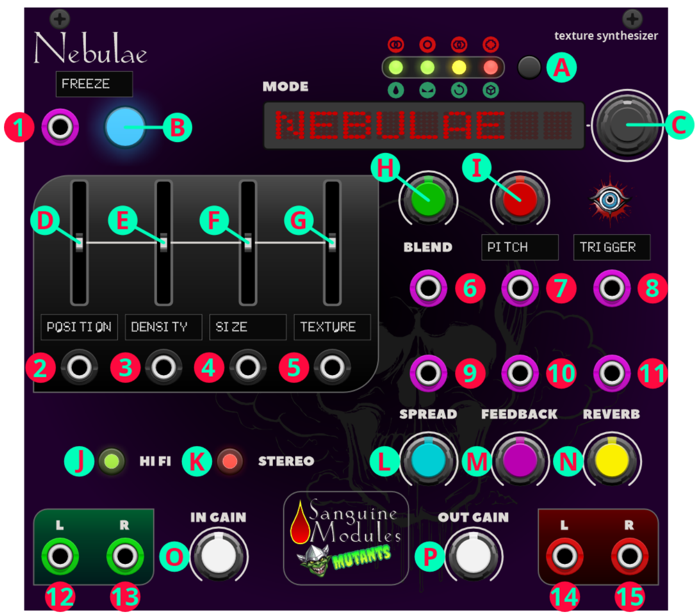
An audio processor that combines multiple overlapping, delayed, transposed and enveloped sound fragments (grains) from a recording buffer.

Generate thick textures in real time from incoming audio signals.

Based on Mutable Instruments' "Clouds"[21] and the "Monsoon" version of the hardware with standard firmware.

We aim for this module to help you propel your mix above the stratosphere and beyond.

Nebulae controls



Knobs and buttons

A. LED MODE: this button cycles between the different LED display modes:

- **Input**: the LEDs act as a VU meter that shows the level of the input signal, the input signal is soft-clipped when the last light is on.
- **Output**: the LEDs act as a VU meter that shows the level of the output signal. The signal is *not* clipped or altered in any way when the last lamp is on.

21 The ability to save audio buffers present in hardware is not available in Nebulae. Want to fix that? Drop me a line.

- **Modulation values**: the LEDs reflect the value of the parameter knobs using different colors and intensities:
  - LED colors go from off for the minimum knob value to green, yellow and finally red for the maximum knob value.
  - The LEDs represent, from left to right, the following knobs:
    - Blend
    - Spread
    - Feedback
    - Reverb

B. FREEZE: this button stops audio buffer recording and lets you manipulate or use the audio in the buffer for different purposes, depending on the selected mode. Its current function is displayed in the OLED display above the button.

LED	State
	Disabled.
	Enabled.

This parameter can be controlled by sending gates to the corresponding input (1): the parameter is enabled when the gate is high and disabled when the gate is low; the button's LED light always informs the user of the current state of the parameter.

C. MODE: twist the knob around to select the module's operating mode.

The selected mode is shown in the matrix display to the left of the knob and in the context menu.

Modes can also be selected using the context menu.

MODE	Display
Granular mode	**GRANULAR**
Pitch shifter/time stretcher	**STRETCH**
Looping delay	**LOOPING DLY**
Spectral processor	**SPECTRAL**

Mode descriptions; an explanation of their parameters, and how the controls affect them are described in the "Nebulae module modes" section.

D. PARAMETER 1: this slider controls a parameter for the selected mode. The OLED display below it displays its current function.

This parameter can be modulated with CV using the appropriate CV input (2). The LED in the slider control shows the current CV value: green for positive voltages and red for negative ones.

E. PARAMETER 2: this slider controls a parameter for the selected mode. The OLED display below it displays its current function.

This parameter can be modulated with CV using its corresponding CV input (3). The LED in the slider control shows the current CV value with the same rules that govern **PARAMETER 1** (D).

F. PARAMETER 3: this slider controls a parameter for the selected mode. The OLED display below it displays its current function.

This parameter can be modulated with CV using its CV input (4). The LED in the slider control shows the current CV value with the same rules that govern **PARAMETER 1** (D).

G. PARAMETER 4: this slider controls a parameter for the selected mode. The OLED display below it displays its current function.

This parameter can be modulated with CV using its appropriate CV input (5). The LED in the slider control shows the current CV value with the same rules that govern **PARAMETER 1** (D).

H. BLEND: this knob controls the dry/wet balance of the signal.

When rotating the knob, the LEDs above the **MODE** display briefly show the current value for this and the **SPREAD** (M), **FEEDBACK** (N) and **REVERB** (O) knobs.

This parameter can be modulated using the appropriate CV input (6).

I. PARAMETER 5: this knob controls a parameter for the selected mode. The OLED display below it displays its current function.

This parameter can be modulated with CV using its appropriate CV input (7).

J. HI FI: Nebulae offers two different resolutions for buffer recording.

The selected resolution is shown using the button's LED light:

LED	Resolution
⚫	8-bit.
🟢	16-bit. This is the default.

When changing resolutions and channel modes, an LED light at the top of the module is briefly turned on red to show the current setting.

Recording resolution, together with the **STEREO** (K) parameter, impacts the length and quality of the recording buffer:

RESOLUTION	CHANNELS	BUFFER LENGTH	GLYPH
16-bit	**Stereo**	1 second.	
16-bit	**Mono**	2 seconds.	
8-bit µ-law	**Stereo**	4 seconds.	
8-bit µ-law	**Mono**	8 seconds.	

Nebulae uses a particular flavor of µ-law companding that makes 8-bit resolution sound more like a cassette or a Fairlight: less hiss, more distortion.

The LEDs above the **MODE** display briefly show the current buffer settings when changing this and the **STEREO** (K) parameter.

K. **STEREO**: Nebulae offers two different channel modes for buffer recording.

The selected channel mode is shown using the button's LED light:

LED	Channels
	Mono.
	Stereo. This is the default.

Buffer channels, together with the **HI FI** (J) setting, impact the length and quality of the recording buffer, consult the table for **HI FI** (J) to get the exact numbers.

The LEDs above the **MODE** display briefly show the current buffer settings when changing this and the **HI FI** (J) parameter.

L. **SPREAD**: controls the amount of random stereo panning of the wet signal.

When spinning the knob, the LEDs above the **MODE** display briefly show the current value for this and the **BLEND** (H), **FEEDBACK** (N) and **REVERB** (O) knobs.

This parameter can be modulated using its corresponding CV input (9).

M. **FEEDBACK**: controls the amount of feedback applied to the wet signal.

When turning the knob, the LEDs above the **MODE** display briefly show the current value for this and the **BLEND** (H), **SPREAD** (M) and **REVERB** (O) knobs.

This parameter can be modulated using its corresponding CV input (10).

N. **REVERB**: controls the amount of reverb applied to the wet signal.

When twisting the knob, the LEDs above the **MODE** display briefly show the current value for this and the **BLEND** (H), **SPREAD** (M) and **FEEDBACK** (N) knobs.

This parameter can be modulated using its corresponding CV input (11).

O. **IN GAIN**: controls input gain for the audio signal present in the **L** and **R** inputs (12 and 13).

You can check input levels using the LEDs above the display when they are set to **Input**.

P. **OUT GAIN**: controls output gain for the audio signal contained in the **L** and **R** outputs (14 and 15).

OUT GAIN can function as an attenuator or an amplifier depending on its value[22].

You can check output levels using the LEDs above the display when they are set to **Output**.

Inputs and outputs

1. **FREEZE** gate input.

2-5. CV inputs for parameters 1 through 4.

6-7. BLEND (H) and **PARAMETER 5** CV inputs.

8. **TRIGGER**: input for the Trigger parameter; the result of sending a trigger to this input varies depending on the selected mode.

9-11. CV inputs for the **SPREAD** (M), **FEEDBACK** (N) and **REVERB** (O) parameters.

12. **LEFT** audio input.

13. **RIGHT** audio input, normalized to the left channel.

14. **LEFT** audio output.

15. **RIGHT** audio output.

Nebulae context menu

The Nebulae context menu adds one entry to the standard Sanguine Modules context menu:

- **Mode**: module modes can be selected directly using the context menu.

---

22 Beware! Save your ears and avoid distortion! Outputs can get **loud**.

Nebulae module modes

The OLED displays always show what the knobs and inputs affect in your selected configuration.

Modes are presented as they are displayed on the matrix display.

GRANULAR

This is the default mode for the module.

Textures are created by playing back short, overlapping segments of the audio in the buffer (grains).

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Freeze**	**Freeze**	When the parameter is enabled, the module stops recording to the buffer and granularization happens on the last seconds of audio present in the buffer. Since live audio is no longer available, the output signal is routed through delays and all-pass filters while feedback builds up. This gives the sound a reverb like nature.
PARAMETER 1 (D)	**Position**	**Grain position**	Selects which part of the recording buffer grains are played from. Set the slider below the center mark to travel back in time.
PARAMETER 2 (E)	**Density**	**Grain density**	When the slider is at the center no grains are generated; set the slider above the center mark and grains will be sown randomly; set it below and grains will be played at a constant rate. The closer to the extremes the slider is, the higher the grain overlap.
PARAMETER 3 (F)	**Size**	**Grain size**	Grain size in milliseconds.

PARAMETER 4 (G)	**Texture**	**Grain texture**	Morph between various grain shape envelopes, from bottom to top: • Square (boxcar) • Triangle • Hann window Setting the slider about ¼ above the middle marker activates a diffuser that smears transients.
PARAMETER 5 (I)	**Pitch**	**Grain pitch**	Transposes grains from the base frequency present at the audio source.
TRIGGER (8)	**Trigger**	**Trigger**	Generates a single grain. Setting the **Density** (E) slider at the middle marker and sending triggers to this input lets you control the module like a micro sample player.

STRETCH

Similar to **GRANULAR**; this mode uses two carefully spliced, overlapping grains synchronized with the most salient period of the sound.

Parameter/Input	Display	Function	Usage
Stutter (Button B and input 1)	**Stutter**	**Stutter**	When this parameter is enabled and a trigger is received in the **Trigger** (8) input, a clock synchronized loop is created.
PARAMETER 1 (D)	**Scrub**	**Scrub audio buffer**	Modulating this parameter when **Stutter** (B) is enabled scrubs through the audio buffer.
PARAMETER 2 (E)	**Diffusion**	**Diffusion**	Creates a granular diffusion effect based on all-pass filters.

PARAMETER 3 (F)	**Overlap**	**Overlap**	Controls the size of the overlapping windows used for pitch shifting and time stretching: from an extremely grainy "drilling" sound to smooth bits of loops.
PARAMETER 4 (G)	**LP/HP**	**Low-pass/ high-pass filter**	Just what the “Function” column says.
PARAMETER 5 (I)	**Pitch**	**Grain pitch**	Transposes grains from the base frequency present at the audio source.
TRIGGER (8)	**Trigger**	**Trigger**	When **Stutter** (B) is disabled, a trigger here creates a stuttering effect; when it is enabled; a clock synchronized loop is created.

LOOPING DLY

In this mode audio is continuously played back from the buffer without any granularization.

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Stutter**	**Stutter**	When this parameter is enabled, the content of the audio buffer is looped (stutter).
PARAMETER 1 (D)	**Time / Start**	**Head position**	Controls the delay (the distance between the playback and recording heads)
PARAMETER 2 (E)	**Diffusion**	**Granular diffusion**	Creates a granular diffusion effect based on all-pass filters.
PARAMETER 3 (F)	**Overlap / Duratn**	**Overlapping window size**	Controls the size of the overlapping windows used for pitch shifting. Set the slider at the top for a smooth result that might smear transients; set it at the bottom for a grainy sound.

PARAMETER 4 (G)	**LP/HP**	**Low-pass/ high-pass filter**	Filters!
PARAMETER 5 (I)	**Pitch**	**Grain pitch**	Transposes grains from the base frequency present at the audio source.
TRIGGER (8)	**Time**	**Delay time**	When **Stutter** (B) is disabled, trigger pulses here set the delay time (as long as it is shorter than the recording buffer); when **Stutter** (B) is enabled, a trigger here creates a clock synchronized stuttering loop.

SPECTRAL

In this mode, input signals are converted into "frames" of spectral data that are stored, transformed, recombined, and resynthesized as time domain signals.

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Freeze**	**Freeze**	Works in concert with the **Buffer** (D) slider to select the input or output audio buffer. 2 to 7 buffers are laid across the **Buffer** (D) slider, depending on the **HI FI** (J) and **STEREO** (K) quality settings. When **Freeze** (B) is disabled, the **Buffer** (D) slider selects the buffer that receives audio; when **Freeze** (B) is enabled, the **Buffer** (D) slider selects the buffer from which output is produced. By recording different buffers you are, in effect, creating a “wave table” off F.F.T. Slices that can be interpolated.

PARAMETER 1 (D)	**Buffer**	**Buffer select**	Selects the current buffer to record or output from, depending on the **Freeze** (B) state.
PARAMETER 2 (E)	**FFT Upd. / Merge**	**F.F.T. Update and merge**	This parameter determines how the results of the analyzer are passed to the resynthesizer. Setting the slider below the center line increases the probability that a given F.F.T. Won't be updated, causing a sort of partial freeze. When the slider is set above the center line, adjacent analysis frames are increasingly merged together. At extreme settings random phase modulation is applied to smooth things out.
PARAMETER 3 (F)	**Polynomial**	**Polynomial coefficients**	The polynomial determines how frequencies are mapped between the analysis and synthesis buffers. Spectral shifting and spectral reversal are performed over the course of the slider.
PARAMETER 4 (G)	**Quantize / Parts**	**Spectral quantizer / weak partial amplifier**	Setting the slider below the middle line increasingly quantizes the amplitudes of spectral components. When the slider is set above the middle line, the module increasingly attenuates the strongest partials and amplifies the weakest, resulting in a noise like spectrum.
PARAMETER 5 (I)	**Transpose**	**Transpose**	This parameter controls pitch-shifting.

TRIGGER (8)	**Glitch**	**Glitch audio**	Triggers in this input create different frequency domain glitches associated with corrupted audio files. The effect considers the pulse length of the trigger (or gate…) input.

Nebulae bypassed module behavior

The signals present at the **Left** (12) and **Right** (13) inputs are sent, unaltered, to the corresponding **Left** (14) and **Right** (15) outputs.

Etesia – Spliced texture synthesizer

A reimagined audio processor, texture generator, reverberator and resonator.

Use your audio signals to generate thick textures; make them reverberate, or resonate at will.

Based on the “Parasite” alternative firmware for Mutable Instruments’ “Clouds”[23]; loaded in the “Monsoon” version of the hardware.

We hope this module can help keep your creativity reverberating!

This manual documents the changes made to Nebulae to create the Etesia module; for basic operating instructions and descriptions of the modes already present in Nebulae consult its manual.

Changes to Nebulae

- Two new modes:
  - **Oliverb**
  - **Resonestor**
- More grain envelopes
- Smaller grains available

23 The ability to save audio buffers present in hardware is not available in Etesia. Want to fix that? Drop me a line.

- Asymmetrical grain envelopes
- Enhanced **Pitch shifter / time stretcher** and **Looping delay** modes
- **REVERSE** audio buffers for certain modes; this is controlled by the new **REVERSE** (Q) button.

LED	State
●	Disabled.
○	Enabled.

  REVERSE can also be controlled by gate signals (≥1 V) present at the **REVERSE INPUT** (16) port.

  REVERSE is disabled by default.

- Some of the familiar modes produce different results due to the changes mentioned above and the fact that, internally, they use different tables.

Module controls and the context menu remain the same as they were in Nebulae (with the addition of the **REVERSE** (Q) button and new OLED screens for familiar knobs: they control different parameters in the new modes). Their letter or number reference has not been changed in the diagram above, if you need a refresher of their basic functions, check the manual for Nebulae.

A list of all the modes, old and new; their display name; a description of their parameters, and how the knobs alter them follows; pertinent changes are noted per mode.

Etesia mode list

MODE	Display
Granular mode	**GRANULAR**
Pitch shifter/time stretcher	**STRETCH**
Looping delay	**LOOPING DLY**
Spectral processor	**SPECTRAL**
Oliverb	**OLIVERB**
Resonestor	**RESONESTOR**

Etesia module modes

Modes are presented with the labels used in the matrix display.

Updated or new parameters are indicated by a different background color in the tables below.

GRANULAR

This is the default mode for the module.

Textures are created by playing back short overlapping segments of the audio present in the buffer (grains).

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Freeze**	**Freeze**	Same as in Nebulae.
PARAMETER 1 (D)	**Position**	**Grain position**	Same as in Nebulae.
PARAMETER 2 (E)	**Density**	**Grain density**	The response curve for this slider has been altered to access slowly sown grains more easily.
PARAMETER 3 (F)	**Size**	**Grain size**	Grain size in milliseconds. The range of the slider has been adjusted and can produce quite smaller grains: when the slider is at the bottom, grains are spikes that can barely be heard; when the slider is at the top, the maximum size is as it was in Nebulae.
PARAMETER 4 (G)	**Texture**	**Grain texture**	Morph between various grain shape envelopes, with new, asymmetric, ones, from bottom to top: • Square • Ramp up • Ramp down • Triangle • Triangle with diffuser When the slider is at the lowest position, the square shape has particularly sharp edges and may click. This behavior is intended. Clicks not your thing? Rise the slider a little.
PARAMETER 6 (I)	**Pitch**	**Grain pitch**	Same as in Nebulae.

TRIGGER (8)	**Trigger**	**Trigger**	Same as in Nebulae.
REVERSE (Button Q and Input 16)		**Reverse playback**	When this parameter is enabled, grains are played back in reverse.

STRETCH

Similar to **GRANULAR**; this mode uses two carefully spliced, overlapping grains synchronized with the most salient period of the sound.

Parameter/Input	Display	Function	Usage
Stutter (Button B and input 1)	**Stutter**	**Stutter**	Same as in Nebulae.
PARAMETER 1 (D)	**Scrub**	**Scrub audio buffer**	Modulating this parameter when **Stutter** (B) is enabled scrubs through the audio buffer. When a clock is sent to **TRIGGER** (8) this slider becomes a clock divider/multiplier for the pre-delay: • Middle line position: the clock is used as is. • Above the middle line: clock is divided. • Below the middle line: clock is multiplied. Multiplication and division rates: • 1/16 • 3/32 • 1/8 • 3/16 • 1/4 • 3/8 • 1/2 • 3/4 • 1 • 3/2 • 2/1 • 3/1

			• 4/1 • 6/1 • 8/1 • 12/1 Clock synchronization is more accurate when the **Overlap** (F) slider is at the bottom position.
PARAMETER 2 (E)	**Diffusion**	**Diffusion**	Same as in Nebulae.
PARAMETER 3 (F)	**Overlap**	**Overlap**	Same as in Nebulae.
PARAMETER 4 (G)	**LP/HP**	**Low-pass/ high-pass filter**	Same as in Nebulae.
PARAMETER 6 (I)	**Pitch**	**Grain pitch**	Same as in Nebulae.
TRIGGER (8)	**Trigger**	**Trigger**	Same as in Nebulae.
PARAMETER 7 (L)	**Spread**	**Spread**	When **STEREO** (K) is disabled, this knob cross-fades between the left and right inputs; needless to say, both inputs need to be connected for this to work. When **STEREO** (K) is enabled, this knob gradually swaps both output channels. When set at the rightmost position, it allows ping-pong delay effects: each time the sound is fed back the channels are reversed.

LOOPING DLY

In this mode audio is continuously played back from the buffer without any granularization.

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Stutter**	**Stutter**	Same as in Nebulae.

PARAMETER 1 (D)	**Time / Start**	**Head position**	Controls the delay (the distance between the playback and recording heads). The slider has been tweaked to make obtaining very short delays easier. Delay time changes are faster.
PARAMETER 2 (E)	**Diffusion**	**Granular diffusion**	Same as in Nebulae.
PARAMETER 3 (F)	**Overlap / Duratn**	**Overlapping window size**	Controls the size of the overlapping windows used for pitch shifting. Set the slider at the top for a smooth result that might smear transients; set it at the bottom for a grainy sound. When **FREEZE** (B) is active and delay time is synchronized to an external clock, this slider controls the repeat time multiplication/division.
PARAMETER 4 (G)	**LP/HP**	**Low-pass/ high-pass filter**	Same as in Nebulae.
PARAMETER 6 (I)	**Pitch**	**Grain pitch**	Transposes grains from the base frequency present in the audio source. When the knob is at 0, pitch shifting is bypassed completely. This enhances delay quality.
TRIGGER (8)	**Time**	**Delay time**	Same as in Nebulae.
REVERSE (Button Q and Input 16)		**Reverse**	When **FREEZE** (B) and **REVERSE** (Q) are enabled, the loop plays in reverse.

SPECTRAL

This mode has no parameter changes; but generated sounds are not the same as those produced by Nebulae due to this mode using different tables.

OLIVERB

This is a full-featured, CV controllable mode-less reverb.

This mode is mono in → stereo-out.

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Freeze**	**Freeze**	When the parameter is enabled, the reverb is set to (near) infinite decay and the input is muted. No pitch shifting combined with a large **Size** (F) is the best way to use this.
PARAMETER 1 (D)	**Pre-delay**	**Pre-delay**	This controls the time it takes for the reverb to kick in after audio has been input (from 0 to about ½ second). When a clock is input at the **TRIGGER** (8) port, this slider becomes a clock divider/multiplier for the pre-delay: • Middle line position: the clock is used as is. • Above the middle line: clock is divided. • Below the middle line: clock is multiplied. Multiplication and division rates: • 1/16 • 3/32 • 1/8 • 3/16 • ¼ • 3/8 • ½ • ¾ • 1 • 3/2 • 2/1

			• 3/1 • 4/1 • 6/1 • 8/1 • 12/1
PARAMETER 2 (E)	**Decay**	**Decay**	The slider controls the reverb's tail. When set near the top the signal is amplified and the reverb enters self oscillation.
PARAMETER 3 (F)	**Size**	**Reverb size**	The size of the emulated room: from a small resonator to a huge hall.
PARAMETER 4 (G)	**Dampen LP-V Λ-HP**	**Reverb dampening**	The slider controls reverb dampening: • From the bottom to the middle a low-pass filter is applied, simulating room absortion. • From the middle to the top a high-pass filter is applied, this allows for unusual, crystalline effects.
PARAMETER 5 (H)	**Dry/Wet**	**Dry/wet mix**	Just what you expect from such a knob.
PARAMETER 6 (I)	**Pitch**	**Pitch shift**	When sound is fed back into the reverb, it can be pitch shifted up to -1 to +1 octaves, as controlled by this knob. When the knob is at 12 o'clock no pitch shifting is applied. Setting the knob to its rightmost position allows for shimmer effects. **Size** (F) has an effect on pitch shifting: the larger the room, the better the shift.
TRIGGER (8)	**Clock**	**Clock**	Clocks pre-delay time.
PARAMETER 7 (L)	**Diffusion**	**Diffusion**	Controls the amount of

			“smoothing” applied to the sound (via diffusers) each time it goes through the loop. The rightmost knob position produces a more dense, continuous sound; while the leftmost lets you hear the sound being repeated, like a multi-tap delay.
PARAMETER 8 (M)	**Mod. Speed**	**Modulation speed**	Each delay in the reverb can be individually modulated by 9 smoothed, random LFOs; this knob controls their speed; it ranges from ~1/100 Hz to ~100Hz. Modulation speed has no effect if the **Mod. Amount** (N) is set to 0.
PARAMETER 9 (N)	**Mod. Amount**	**Modulation amount**	Controls the amount of modulation from the LFOs mentioned above to the delay time. Small modulations produce subtle choruses and ghost tones; large modulations create random pitch shifts.

RESONESTOR

A dual voice, four part resonator with built-in capabilities for polyphonic Karplus-Strong plucked string synthesis.

When voices are switched parameter changes affect only the current voice: the last voice retains its parameters.

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Voice**	**Switch voice**	When this parameter is enabled, the module switches the current voice and prevents further switches when triggers are received in the **TRIGGER** (8) port.
PARAMETER 1 (D)	**Timbre**	**Timbre**	Controls the timbre and duration of the noise burst. Below the middle line it will be longer and more dampened; above the middle line it will be shorter and higher in pitch. When set at the extremes the burst is inaudible: either too short or too dampened; this can be used to “mute” a voice.
PARAMETER 2 (E)	**Decay**	**Decay**	Decay time for the current voice. Setting the slider near the top makes decay infinite (you can play the voice like a traditional oscillator)
PARAMETER 3 (F)	**Chord**	**Chord**	Sets the chord for the current voice. The slider morphs gradually between the following: • Unison • Fat • Superfat • Fat power • Fat octave • Octaves

			• Power • Major • Major7 • Minor7 • Minor • Sus2 • Sus4 • Minor9 • Major9 • Minor11 • Major11 • Major11
PARAMETER 4 (G)	**Filter LP-V Λ-BP**	**Filter**	Controls the filter in the feedback loop of the resonator. When the slider is at the middle line no filtering is applied; below the middle line a low-pass with increasingly low cut-off frequencies is applied; above the middle line a band-pass filter at the frequency of the resonator, with increasingly high resonances, is applied.
PARAMETER 5 (H)	**Distortion**	**Voice distortion**	Randomly distorts the timbre of each of the voices. The leftmost position has the most modulation; but filters the noise out entirely, so there is no effect. The rightmost position leaves the noise unfiltered; but modulation is 0, so there is no effect. The juicy bits are found in between.
PARAMETER 6 (I)	**Pitch**	**Voice pitch**	Sets the base pitch for the current voice. At 12 o’clock pitch is A3 (220

			Hz).
TRIGGER (8)	**Burst**	**Burst**	A trigger in this input switches the voice (if **FREEZE** (B) is disabled) and sends a short burst of noise to its resonator.
PARAMETER 7 (L)	**Stereo**	**Stereo mix**	Assigns each part and voice to an output (**L** (14) or **R** (15)). Setting the knob fully CCW sends each voice to a different output. At 12 o’clock voices are mixed equally for each output. Fully CW voice parts equally distributed to both outputs for a wide stereo effect.
PARAMETER 8 (M)	**Harmonics**	**String harmonics**	Simulates striking the harmonics on a string. Setting the knob at the leftmost position has no effect on the sound, at the rightmost position the 2nd harmonic will ring; at 12 o’clock the third, at 10 the fourth, etc.
PARAMETER 9 (N)	**Scatter**	**Scatter**	Controls the random delay times before sound hits the resonator for the current voice. When used for string synthesis with a chord, this will give the impression that strings are being struck sloppily.

Fluctus – Grafted texture synthesizer

A reenvisioned audio processor, texture generator, auto-modulated multiband filter and real time slicer/beat repeater (ported from the Kammerl Kaske VST plugin suite).

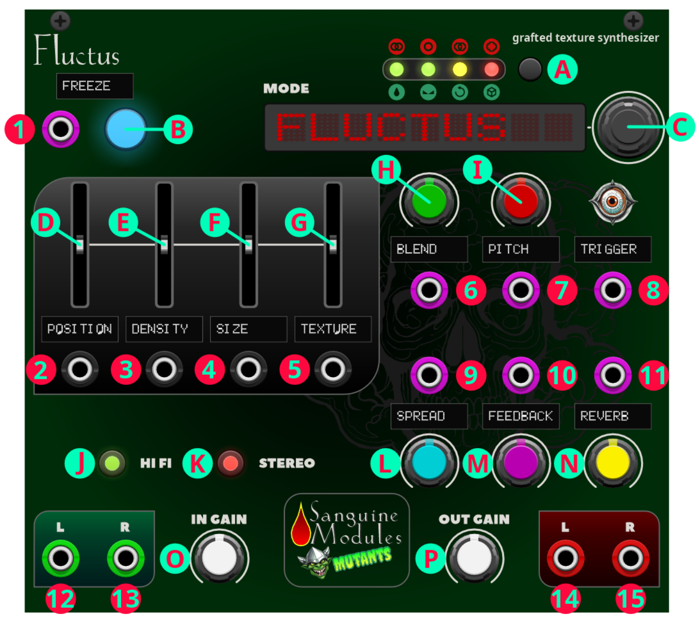
Granulate; stretch; delay; filter, or slice your audio signals to generate the texture your patch needs.

Based on the “Kammerl Kaske” alternative firmware for Mutable Instruments’ “Clouds”[24]; loaded in the “Monsoon” version of the hardware.

It is our sincere hope this module helps you find that perfect beat texture you’re looking for!

This manual documents the changes made to Nebulae to create the Fluctus module; for basic operating instructions and descriptions of the modes already present in Nebulae consult its manual.

Changes to Nebulae



- Two new modes:
  - **Spectral Clouds** (replaces Spectral mode in Nebulae).
  - **Beat-Repeat**

24 The ability to save audio buffers present in hardware is not available in Fluctus. Want to fix that? Drop me a line.

Module controls and the context menu remain the same as they were in Nebulae (with the addition of new OLED screens for familiar knobs: they control different parameters in the new modes). Their letter or number reference has not been changed in the diagram above, if you need a refresher of their basic functions, check the manual for Nebulae.

A list of all the modes, old and new and their display name follows.

Fluctus mode list

MODE	Display
Granular mode	**GRANULAR**
Pitch shifter/time stretcher	**STRETCH**
Looping delay	**LOOPING DLY**
Spectral clouds	**SPCT. CLOUDS**
Kammerl Beat-Repeat mode	**BEAT-REPEAT**

Fluctus module modes

Modes are presented with the labels used in the matrix display. Only the new modes are documented below; information for the original Nebulae modes can be consulted in the “Nebulae” chapter.

SPCT. CLOUDS

This mode can create cloud-like frequency spectra using a high resolution filter with randomly modulated bands.

Parameter/Input	Display	Function	Usage
FREEZE (Button B and input 1)	**Freeze**	**Freeze**	Same as in Nebulae.
PARAMETER 1 (D)	**Fq. Bnd Prb.**	**Grain position**	Controls the probability that a frequency band will be enabled. All bands are disabled when the slider is at the bottom. You’re likely to find a sweet-spot when only a few bands are enabled.

PARAMETER 2 (E)	**Flt. Smooth**	**Filter smoothing**	Controls how intense the smoothing is on the frequency band division and filter band attenuation when receiving triggers in the **RANDOMIZE** (8) port. When the slider is at the bottom, filter changes apply immediately; when the slider is at the top, the current filter configuration is held.
PARAMETER 3 (F)	**Fq. Bnd. Div.**	**Frequency band division**	Controls the number of filter bands and their frequency width. When the slider is at the bottom, the frequency spectrum is split into 4 filter bands; at the top it is split into 128 filter bands. All divisions are logarithmic to make the filter sound musical.
PARAMETER 4 (G)	**Flt. Text.**	**Filter texture**	Controls the degree of randomization in the frequency domain. Wave forms with transients are most affected by this.
PARAMETER 6 (I)	**Pitch**	**Pitch**	Amount of pitch shifting applied to the output.
TRIGGER (8)	**Randomize**	**Randomize**	When a trigger is received in this input, the active frequency bands and their attenuation intensity are randomized. Triggers can be simulated using the **Rnd. Flt. Prob** (L) knob. Setting the knob all the way to the left disables simulated triggers.

PARAMETER 8 (M)	**Warm dist.**	**Warm distortion**	Controls the amount of warm distortion applied to the output. Note: warm distortion is applied post Dry/Wet mixing.

BEAT-REPEAT[25]

This mode analyzes incoming clock signals to enable real time slicing of the audio input.

Multiple slices are managed in real time and can be individually selected and played back with different loops, pitches and distortions.

Parameter/Input	Display	Function	Usage
Freeze (Button B and input 1)	**Freeze**	**Enables and disables slice processing / beat-repeat**	When **FREEZE** (B) is disabled, slice processing is randomly enabled based on the **SLICE PROB.** (H) knob setting.
PARAMETER 1 (D)	**Loop begin**	**Set loop beginning**	Defines the beginning of the loop, relative to the total slice duration. The slider is quantized, to enabled in-sync beat repetition, from bottom to top, as follows: • 0-1/64 free/unquantized • 1/64 • 1/32 • 1/16 • 1/8 • 1/4 • 1/3 • 1/2 • 1
PARAMETER 2 (E)	**Loop size mod.**	**Loop size modulation**	Enables a decreasing loop size towards the end of a slice. This can generate a ping-pong bouncing ball effect.

25 This mode requires a clock signal present in the **CLOCK (8)** input to function.

<table>
<tr><td>PARAMETER 3 (F)</td><td>Loop size</td><td>Loop size</td><td>Sets the size of the loop interval relative to both the total slice duration and the loop mode (regular/alternating).

It is quantized as follows, to allow in-sync beat repetitions:

Regular (bottom to middle of the slider)
• [0-1/64] free/unquantized
• 1/64
• 1/32
• 1/16
• 1/8
• 1/4
• 1/3
• 1/2

Alternating (middle to top of the slider)
• 1/2
• 1/3
• 1/4
• 1/8
• 1/16
• 1/32
• 1/64
• 1/64-0 free/unquantized</td></tr>
<tr><td>PARAMETER 4 (G)</td><td>Slice step</td><td>Slice step</td><td>Controls, along with the SLICE STEP (G) CV input (5), the current slice.

The CV input selects one of the most recently recorded slices; the slider selects individual iteration patterns (and is offset by the SLICE STEP (5) CV input).

The slider behaves, from bottom to top, as follows:</td></tr>
</table>

			• Disabled: slices are selected by CV only. • Slice step 1: repeats the current slice due to synced playback index. • Slice step 2: skip every second slice. • Slice step 3: skip two slices. • Slice step 5: skip four slices. • Slice step 6: skip five slices. • Slice step 7: skip six slices. • Random: selects slices randomly.
PARAMETER 6 (I)	**Playback spd.**	**Playback speed**[26]	Controls playback speed. When the knob is all the way to the left, pitch is zero; at the rightmost position, playback speed is the original. Pitch modulation is determined by the **PARAMETER 8** (M) knob.
TRIGGER (8)	**Clock**	**Clock**	This mode *requires* an external clock to function. The external clock should be connected to this input.
PARAMETER 7 (L)	**Clock div.**	**Clock divider**	Sets clock divider and changes slice lengths accordingly. Available clock divisions are: • 1 • 1/2 • 1/4 • 1/8
PARAMETER 8 (M)	**Pitch mod.**	**Pitch mode**	Selects the pitch modulation mode.

26 This mode does not time correct pitch changes.

Available modulation modes, from left to right, are:

- Fixed pitch, no modulation.
- Fixed pitch, reverse playback.
- Linearly decreasing pitch: from the original pitch to the selected **PARAMETER 6** (I) target pitch.
- Linearly increasing pitch: from the selected **PARAMETER 6** (I) pitch to the original.
- Simulated vinyl scratching: sinusoidal pitch modulation, **PARAMETER 6** (I) defines the intensity.

Nodi – Macro oscillator X

A deep, powerful digital sound source featuring 47 synthesis models (and a fixed morse code generator).

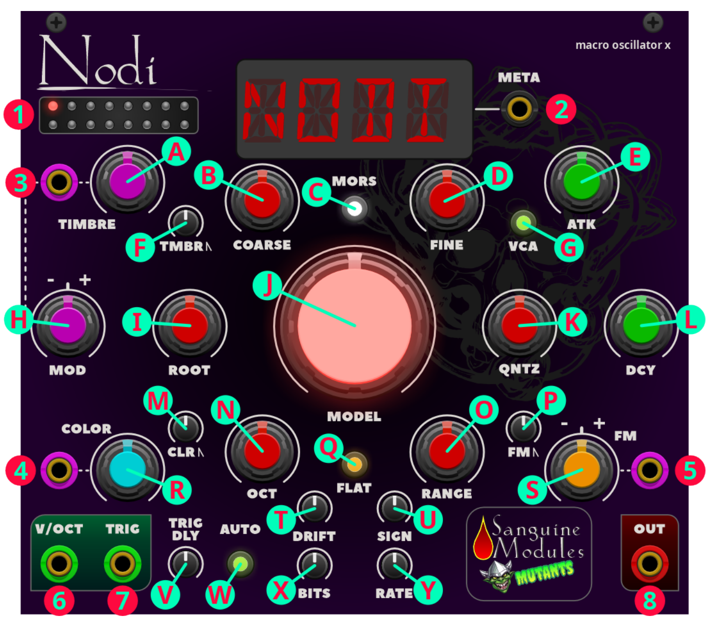
Based on the Mutable Instruments' "Braids".

Nodi includes the sub-oscillator modes from the 1.9 unreleased firmware.

We hope this module can serve as your sonic army knife.

Basic operation is covered in this manual; but playing around and experimenting with the module is sure to be rewarding.

Nodi controls



Knobs and buttons

A. **TIMBRE**: controls the main evolution and motion of the timbre.

B. **COARSE**: controls oscillator tuning in big steps. Its range is affected by the **RANGE** (O) knob.

C. **MORS**: enables and disables the Morse code easter egg from the original module.

LED	State	Effect
	Disabled	Allows selection of regular module models. This is the default.
	Enabled	An excerpt from Pynchon's *The Crying of Lot 49* is output as Morse code. The excerpt is the following: “The Scope proved to be a haunt for electronics assembly people from Yoyodyne. The green neon sign outside ingeniously depicted the face of an oscilloscope tube, over which flowed an ever-changing dance of Lissajous figures. Today seemed to be payday, and everyone inside to be drunk already. Glared at all the way, Oedipa and Metzger found a table in back. A wizened bartender wearing shades materialized and Metzger ordered bourbon. Oedipa, checking the bar, grew nervous. There was this je ne sais quoi about the Scope crowd: they all wore glasses and stared at you, silent. Except for a couple-three nearer the door, who were engaged in a nose-picking contest, seeing how far they could flick it across the room. A sudden chorus of whoops and yibbles burst from a kind of juke box at the far end of the room. Everybody quit talking. The bartender tiptoed back, with the drinks. What’s happening? Oedipa whispered. That’s by Stockhausen.” **TIMBRE** (A) controls symbol duration, and **COLOR** (R) adds some background noise. Model selection is disabled.

- **D.** **FINE**: controls oscillator tuning in small steps: -1 to +1 semitones.
- **E.** **ATK**: controls the attack of the internal VCA AD envelope†.
- **F.** **TMBR |**: controls the amount of modulation from the internal AD to the **TIMBRE** (A).
- **G.** **VCA**: enables and disables the internal AD envelope.

† **VCA** (G) mode must be enabled for the VCA AD envelope to function.

LED	State	Effect
	Disabled	**TRIG** (7) works as a sync/reset input. This is the default.
	Enabled	The AD envelope (controlled by the **ATK** (E) and **DCY** (L) knobs) affects incoming or auto-generated triggers.

H. **MOD**: controls the amount and polarity of modulation applied to the **TIMBRE** (A) parameter from the **TIMBRE CV** input jack (1).

I. **ROOT**: selects the root note the quantizer builds scales upon. For the quantizer to function **QNTZ** (K) must be set to a value other than **OFF**.

The current root note is briefly shown in the display when the knob's value is changed.

The current note is shown in the knob's tooltip.

The default value is **C**.

J. **MODEL**: Rock the big knob back and forth to select the synthesis model.

The knob lights up in different colors depending on the selected model.

The model's abbreviation is shown in the LED display at the top of the module.

The model's full name and abbreviation is shown in the knob's tooltip.

The available models are the following:

Model #	Model	Display
1	Quirky sawtooth	**CSAW**
2	Triangle to saw	**/\\-_**
3	Sawtooth wave with dephasing	**//-_**
4	Wavefolded sine/triangle	**FOLD**
5	Buzz	**uuuu**
6	Square sub	**SUB-**
7	Saw sub	**SUB/**
8	Square sync	**SYN-**
9	Saw sync	**SYN/**
10	Triple saw	**//x3**
11	Triple square	**-_x3**
12	Triple triangle	**/\\x3**
13	Triple sine	**SIx3**
14	Triple ring mod	**RING**
15	Saw swarm	**////**
16	Saw comb	**//uu**
17	Circuit-bent toy	**TOY***
18	Low-pass filtered wave form	**ZLPF**

19	Peak filtered waveform	**ZPKF**
20	Band-pass filtered wave form	**ZBPF**
21	High-pass filtered wave form	**ZHPF**
22	VOSIM formant	**VOSM**
23	Speech synthesis	**VOWL**
24	FOF speech synthesis	**VFOF**
25	12 sine harmonics	**HARM**
26	2-operator phase-modulation	**FM**
27	2-operator phase-modulation with feedback	**FBFM**
28	2-operator phase-modulation with chaotic feedback	**WTFM**
29	Plucked string	**PLUK**
30	Bowed string	**BOWD**
31	Blown reed	**BLOW**
32	Flute	**FLUT**
33	Bell	**BELL**
34	Drum	**DRUM**
35	Kick drum circuit simulation	**KICK**
36	Cymbal	**CYMB**
37	Snare	**SNAR**
38	Wavetable	**WTBL**
39	2D wavetable	**WMAP**
40	1D wavetable	**WLIN**
41	4-voice paraphonic 1D wavetable	**WTx4**
42	Filtered noise	**NOIS**
43	Twin peaks noise	**TWNQ**
44	Clocked noise	**CLKN**
45	Granular cloud	**CLOU**
46	Particle noise	**PRTC**
47	Digital modulation	**QPSK**
48	Paques morse code◊	**49**

Synthesis models can also be selected directly using the context menu.

Depending on the selected model, the module controls change different parameters.

For an in-depth explanation of the specific models and how controls affect them, please refer to the "Nodi synthesis models" section.

K. **QNTZ**: enables; disables, and selects the scale used to quantize voltages entering the **V/OCT** (6) port.

Voltages can be quantized to semitones or to one of several available scales.

The selected scale flashes briefly in the LED display.

◊ This mode is only selectable using the **MORS** (D) button.

The current quantizer mode is shown in the knob's tooltip and in the context menu.

The available scales and their display representation are the following:

Scale	Display	Scale (cont'd)	Display (cont'd)
Off	**OFF**	Gunakri	**GUNA**
Semitones	**SEMI**	Marwa	**MARW**
Ionian	**IONI**	Shree [Camel]	**SHRI**
Dorian	**DORI**	Purvi	**PURV**
Phrygian	**PHRY**	Bilawal	**BILA**
Lydian	**LYDI**	Yaman	**YAMA**
Mixolydian	**MIXO**	Kafi	**KAFI**
Aeolian	**AEOL**	Bhimpalasree	**BHIM**
Locrian	**LOCR**	Darbari	**DARB**
Blues major	**BLU+**	Rageshree	**RAGE**
Blues minor	**BLU-**	Khamaj	**KHAM**
Pentatonic major	**PEN+**	Mimal	**MIMA**
Pentatonic minor	**PEN-**	Parameshwari	**PARA**
Folk	**FOLK**	Rangeshwari	**RANG**
Japanese	**JAPA**	Gangeshwari	**GANG**
Gamelan	**GAME**	Kameshwari	**KAME**
Gypsy	**GYPS**	Pa Khafi	**PAKA**
Arabian	**ARAB**	Natbhairav	**NATB**
Flamenco	**FLAM**	Malkauns	**KAUN**
Whole tone	**WHOL**	Bairagi	**BAIR**
Pythagorean	**PYTH**	B Todi	**BTOD**
EB/4	**EB/4**	Chandradeep	**CHAN**
E /4	**E /4**	Kaushik Todi	**KTOD**
EA/4	**EA/4**	Jogeshwari	**JOGE**
Bhairav	**BHAI**		

Quantizer scales can also be enabled; selected, and disabled using the context menu.

The default value is **OFF**.

L. **DCY**: controls the decay of the internal AD envelope generator.

M. **CLR |**: controls the amount of modulation from the internal AD to **COLOR** (R).

N. **OCT**: transposes notes by octave (-2 to +2).

The selected transpose value flashes briefly in the display.

The active transpose value is shown in the knob's tooltip.

Default value is **0**.

O. **RANGE**: chooses the range of the **COARSE** (B) knob.

The selected range flashes briefly in the LED display.

The selected range is displayed in the knob's tooltip.

The available ranges are:

Range	Effect
EXT-	Sets the range of the **COARSE** (B) knob to ±4 octaves around the note received in the **V/OCT** (6) input. A consequence of this is that when no frequency CV signal is sent to the module (i.e. 0V), the **COARSE** (B) knob will have a bias towards low frequencies, something not always desirable. This is the default.
FREE	Sets the range of the **COARSE** (B) knob to ±4 octaves centered around C3 (261.5 Hz). This is the recommended setting when the module is used with no external signal in the **V/OCT** (6) input.
XTND	(Extended) provides a larger frequency range, but has the side effect of disabling accurate V/Oct scaling.
440	Locks the oscillator's frequency to precisely 440 Hz. Helpful for tuning another VCOs.
LFO	Need a fancy LFO? No problem! Nodi's got you covered! Use Nodi's synthesis models as low-frequency oscillators!

P. **FM|**: controls the amount of modulation from the internal AD to **FM** (S).

Q. **FLAT**: enables and disables oscillator flattening.

LED	State	Effect
●	**Disabled**	Ruler-like oscillators. This is the default.
●	**Enabled**	Oscillators are detuned at lower and higher frequencies in order to recreate some of the tuning imperfections of VCOs.

R. **COLOR**: controls a second dimension of sound. The specifics for this knob vary from model to model, consult each model's description for more details.

S. **FM**: frequency modulation attenuverter: controls the amount and polarity of modulation applied to the frequency from the **FM CV input** jack (5).

T. **DRIFT**: sets the amount of oscillator drift, from **OFF** to **FULL**.

Oscillator drift emulates poorly designed oscillators.

Default is **OFF**.

U. **SIGN**: sets the amount of **Signature Wave Shaper (SIGN)** to apply to the signal, from **OFF** to **FULL**.

The **Signature Wave Shaper** adds grunge and glitches.

The effect of this parameter is different for every module instance created; this “uniqueness” can be disabled using the context menu, where user seeds for the **Signature Wave Shaper** can be set as well.

Default is **OFF**.

V. **TRIG DLY**: adds a delay between the moment when a trigger is received and a note is “struck” on the physical models.

W. **AUTO**: enables and disables automatic note change trigger generation.

LED	State	Effect
● (grey)	**Disabled**	Changes in the **V/OCT** (6) input are ignored for triggering purposes. An external trigger source connected to the **TRIG** (7) input is required to generate sound in some models and to use the internal AD envelope. This is the default.
● (green)	**Enabled**	Changes in the **V/OCT** (6) input larger than a semitone generate a trigger. Generated triggers are useful, for example, to excite the physical models or to use the internal AD envelope with a note sequencer that lacks gate outputs.

X. **BITS**: selects the bit-depth of the data sent to DAC.

Y. **RATE**: selects the refresh rate of the DAC.[27]

27 Do note that Rack sampling rate affects this.
A handful of complex models are rendered internally at 48kHz (instead of 96kHz); so the difference between 48kHz and 96kHz might be non-existent for them.
Some of the simpler models are, conversely, rendered internally at 192kHz or 384kHz to reduce aliasing.

Inputs, outputs and lights

1. **MODEL** lights: these lights change color according to the model selected for each of the possible 16 channels of polyphony.
2. **META**: voltages applied to this input select the active synthesis model for each of the available polyphonic channels.

   Voltages act as an offset to the model selected by the **MODEL** (J) knob: negative voltages select lower models and positive voltages select higher models.

   Discontinuities may be heard when switching models.
3. **TIMBRE CV**: control voltage input for **TIMBRE** (A).

   A value of 0V corresponds to the minimum position of the knob and a value of +5V to its maximum.

   This CV is offset by the knob's current position.
4. **COLOR CV**: control voltage input for **COLOR** (R).

   A value of 0V corresponds to the minimum position of the knob and a value of +5V to its maximum.

   This CV is offset by the knob's current position.
5. **FM CV**: CV input for frequency modulation.

   The scale and polarity of this signal is set by the **FM** (S) attenuverter.
6. **V/OCT**: 1V/Oct frequency CV input.

   Polyphony channels for the module are set by the input with the highest channel count between **V/OCT** (4) and **TRIG** (5).
7. **TRIG**: Trigger input; serves three purposes:

   a) Physical models need to be "excited" by an impulse on this input to produce a sound.

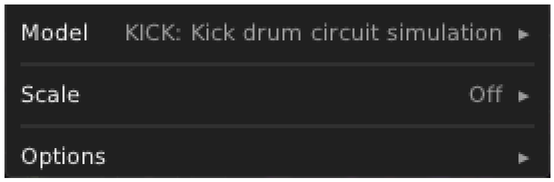
   b) Other models will treat triggers as reset signals, bringing the oscillators' phase to 0.

   c) This input can also be used to trigger an internal AD envelope applied to the parameters of your choice, to create sound animation and attacks without an external envelope module.

Polyphony channels for the module are set by the input with the highest channel count between **V/OCT** (4) and **TRIG** (5).

8. Signal output. Loudness of the output varies among the different synthesis models.

Nodi context menu



Nodi makes some additions to the standard Sanguine Modules context menu:

- **Model**: synthesis models (except for the Morse code “Easter egg”) can be selected directly using this menu entry.
- **Options**: module display, host CPU demands and **Signature Wave Shaper** preferences can be adjusted using this menu:
    - **Display channel**: selects the channel to show in the LED display at the top.

      Only available channels are shown in the menu.

      The module is smart and will select the highest available channel automatically if the last user-selected channel is higher than the currently available ones.
    - **Low CPU**: if your computer struggles with this module, enabling this option can help (at the expense of sound quality).
    - **Signature wave shaper (SIGN)**: this menu entry contains items for controlling the seed of the **Signature Wave Shaper**:
        - **Instance seed**: enables and disables using the “unique” seed for the **Signature Wave Shaper** for this module instance.

          When this option is disabled, the seed is set to “0”; this was the default seed in old plugin versions.

          When this option is enabled, the seed is set to a number generated from the module instance’s Id[28].

          The value of this setting and the corresponding seed are saved with patches and presets.

28 Would you like to know more about instance Ids? Check the Rack source!

This option is enabled by default.

- **Random seed**: sets a new, randomly generated **Signature Wave Shaper** seed.

  Randomly generated seeds are saved with patches and presets.

  This menu item will not appear if **Instance seed** is disabled, a notice: "**Enable "Instance seed" to use random and custom seeds**" will appear instead.

- **User seed**: lets the user set a new, specific **Signature Wave Shaper** seed; the menu entry displays a text entry field which contains the current seed; the note above the field displays the minimum and maximum values allowed, and instructions on how to save changes:

  - **Minimum value**: 0.
  - **Maximum value**: 4294967295.
  - Set the new value using the "Enter" key.

  Values below 0 and above 4294967295 will be ignored.

  User seeds are saved with patches and presets.

  This menu item will not appear if **Instance seed** is disabled, a notice: "**Enable "Instance seed" to use random and custom seeds**" will appear instead.

Nodi synthesis models

Models are presented as they appear on the display and in the order they are selected by the **MODEL** (J) knob to make finding parameters easier.

CSAW

Quirky saw. Inspired by a quirk/defect of the Yamaha CS80 saw tooth wave shape: a fixed-width "notch" after the raising edge.

Controls Knobs	
TIMBRE	Width of the notch.
COLOR	Depth and polarity (good for phasing effects).

/\|-_

Triangle to saw. Produces the classic waveform trajectory from triangle to saw tooth to square to pulse found in synthesizers such as the RSF Kobol or the Moog Voyager.

Controls Knobs	
TIMBRE	Sweep through the wave forms.
COLOR	Morph through several tonal characters by increasingly removing high-frequencies with a 1-pole filter, and recreating them with a wave shaper.

//-_

A blend of a saw tooth wave with dephasing control and a square wave with PWM.

Controls Knobs	
TIMBRE	Amount of dephasing or pulse width.
COLOR	Morph the wave from saw tooth to square.

FOLD

Sine and triangle oscillators sent through a wave folder.

Controls Knobs	
TIMBRE	Wave folder strength.
COLOR	Balance between the sine and triangle waves.

uuuu

A digital synthesis algorithm that generates a smooth sequence of wave forms.

Controls Knobs	
TIMBRE	Transition from sine wave to Dirac comb.
COLOR	Detuning amount of the two blended wave shapes.

SUB-

Square sub-oscillator.

Controls Knobs	
TIMBRE	Pulse width.
COLOR	Steppiness.

SUB/

Saw tooth sub-oscillator

Controls Knobs	
TIMBRE	Morph teeth.
COLOR	Oscillator phase.

SYN-, SYN/

Synthesis of the classic 2-oscillator hard-sync patches, with both oscillators emitting square or saw waves.

Controls Knobs	
TIMBRE	Interval between master and slave.
COLOR	Oscillator balance.

//x3, -_x3, /\x3, SIx3

Three saw tooth (or square, triangle, sine) oscillators that can be individually tuned.

Controls Knobs	
TIMBRE	Frequency of the third oscillator relative to the first. Quantized to musical intervals.
COLOR	Frequency of the second oscillator relative to the first. Quantized to musical intervals.

RING

Three sine wave oscillators ring-modulated together and colored by a wave shaper.

Controls Knobs	
TIMBRE	Frequency of the second sine wave relative to the first.
COLOR	Frequency of the third sine wave relative to the first.

////

A swarm of 7 saw tooth waves.

Controls Knobs	
TIMBRE	Saw tooth detuning.
COLOR	High-pass filter.

//uu

Generate a saw tooth wave form and send it to a comb filter (tuned delay line).

Controls Knobs	
TIMBRE	Transposition of the delay line frequency.
COLOR	Feedback amount and polarity.

TOY*

Traverse a space of timbres typical of circuit-bent electronic musical toys.

Controls Knobs	
TIMBRE	Toy’s clock rate.
COLOR	Glitches or short-circuits on a converter or memory chip's data lines.

ZLPF, ZPKF, ZBPF, ZHPF

Synthesize in the time-domain the response of a low-pass, peaking, band-pass or high-pass filter excited by classic analog wave forms.

This model aims at building the filtered wave shape from scratch.

The technique has been used in the Casio CZ or the Roland D series, but is extended here to cover different filter types and wave shapes.

Controls Knobs	
TIMBRE	Filter’s cutoff frequency.
COLOR	Modifiy the wave shape: from saw to square to triangle.

VOSM

A combination of 3 oscillators arranged in a ring-modulation/hardsync patch to emulate formant synthesis: a technique named VOSIM and described by Kaegi and Tempelaars[29].

Controls Knobs	
TIMBRE	Relative frequencies of the 2 formants.
COLOR	Relative frequencies of the 2 formants.

29 Want to know more about the technique? Read the paper here: https://kaegi.nl/werner/userfiles/downloads/vosim-system.pdf

VOWL, VFOF

Vowel sounds synthesizer.

- **VOWL** recreates early computer speech synthesis.
- **VFOF** is a simplified version of Rodet's FOF synthesis technique.

Controls Knobs	
TIMBRE	Vowel morphing between a, e, i, o, u.
COLOR	Shifts the formants frequency.

HARM

Additive synthesis by summing 12 sine harmonics.

Controls Knobs	
TIMBRE	Central frequency.
COLOR	Distribution of the amplitudes of each of the harmonics around the central frequency.

FM, FBFM, WTFM

Three different versions of 2-operator phase-modulation synthesis.

- **FM** is a well-behaved implementation.
- **FBFM** uses feedback from the carrier to itself to produce harsher tones.
- **WTFM** uses two feedback paths: from carrier to modulator and carrier to itself to achieve droning, unstable tones.

Controls Knobs	
TIMBRE	Modulation amount.
COLOR	Relative frequency interval between modulator and carrier .

PLUK‡

Raw plucked string synthesis.

Controls Knobs	
TIMBRE	Damping.
COLOR	Plucking position.

‡ This model needs to be excited by a trigger.

BOWD‡

Bowed string modeling.

Controls Knobs	
TIMBRE	Friction level.
COLOR	Bowing position.

BLOW, FLUT

Reed or flute instrument model.

Controls Knobs	
TIMBRE	Air pressure.
COLOR	Instrument geometry.

BELL‡

Risset additive synthesis model to recreate the tone of a bell.

Controls Knobs	
TIMBRE	Sound dampening.
COLOR	Sound inharmonicity.

DRUM‡

A variant of the **BELL** model, uses different parameters (partials frequencies and amplitudes) to generate a sound reminiscent of a metallic drum.

Controls Knobs	
TIMBRE	Dampening.
COLOR	Brightness.

KICK‡

Simulation of the TR-808 bass drum circuit.

Controls Knobs	
TIMBRE	Decay time.

‡ This model needs to be excited by a trigger.

COLOR	Brightness.

CYMB

Raw material for cymbal sound synthesis.

Controls Knobs	
TIMBRE	Band-pass filter cutoff.
COLOR	Balance between droning sum of square waves and noise.

SNAR‡

A simulation of the TR-808 snare drum circuit.

Controls Knobs	
TIMBRE	Balance between the two resonator modes ("tone").
COLOR	Amount of noise ("snappy").

WTBL

Classic implementation of wave table synthesis.

Controls Knobs	
TIMBRE	Sweep the wave table.
COLOR	Selects a wave table (20 available) Wave forms are interpolated when traveling through the same wave table; but not when switching among different ones.

WMAP

Two dimensional 16x16 wave table with 256 wave forms. Similar sounding waves forms are laid out adjacent to each other. X and Y are smoothly interpolated when scanning.

Controls Knobs	
TIMBRE	Scan the table in the X direction.
COLOR	Scan the table in the Y direction.

WLIN

One dimensional scanning through every Nodi wave table.

Controls Knobs	
TIMBRE	Move through the waves.
COLOR	Interpolation method: • 7 o'clock: no interpolation • 10 o'clock: interpolate between samples but not waves • 12 o'clock: always interpolate Beyond 12 o'clock interpolation is applied between waves; but playback resolution decreases.

WTx4

Four voice variant of **WLIN**.

Controls Knobs	
TIMBRE	Morph through a small selection of 16 waves.
COLOR	Select the harmonic structure between the 4 voices, from a predefined set of chords. At 7 o'clock all voices play the same note with a variable amount of detuning.

NOIS

Noise through a state variable filter.

Controls Knobs	
TIMBRE	Filter resonance.
COLOR	Cross-fade between the low-pass and high-pass outputs of the filter.

TWNQ

A "Twin Peaks" model that generates white noise and processes it with two band-pass filters (resonators). Both filters track the main frequency.

Controls Knobs	
TIMBRE	Q factor of the filters.
COLOR	Filter spacing.

CLKN

Generate random samples at a rate determined by the main pitch control.

Controls Knobs	
TIMBRE	Periodicity of the generator (up to a 2 sample cycle).
COLOR	Quantization level (from 2 to 32 distinct values).

CLOU, PRTC

Granular synthesis models that create natural textures by mixing short grains of windowed sine waves (**CLOU**) or short decaying "pings" (**PRTC**).

Controls Knobs	
TIMBRE	Density and overlap of the grains.
COLOR	Grain frequency randomization.

QPSK

Generate, in the audio frequency range, the kind of modulated signals used in digital telecommunication systems.

A 16-byte synchronization frame is sent on every trigger or every 256 data bytes.

Controls Knobs	
TIMBRE	Bit-rate.
COLOR	Sets an 8-bit value which is modulated into the carrier using QPSK modulation.

49

This “Easter egg” mode is described in depth in the **MORS** (D) section of the “**Knobs and buttons**” chapter.

Contextus – Resurgent macro oscillator X

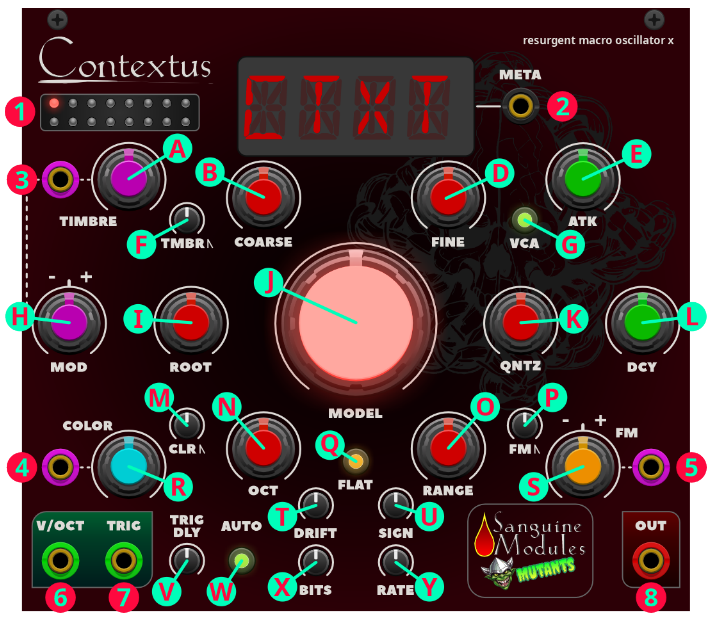
A remixed digital sound source featuring 57 synthesis models.

Contextus is based on the “Renaissance” alternative firmware for the Mutable Instruments “Braids” module.

We hope this module grants you some really tasty and fat sounds!

This manual documents the changes made to Nodi to create the Contextus module; for basic operating instructions and descriptions of the models already present in Nodi, consult its manual in the appropriate section.

Changes to Nodi



- New algorithms have been added:
  - The Commodore 64 “Software Automated Mouth” (**SAM**) robotic text-to-speech algorithm.
  - Five diatonic chord algorithms.
  - Five “chord stack” algorithms.
- A few things have been removed:
  - The “Easter egg” Morse code is gone, along with the **MORS** button on the face plate.

- ○ The **QPSK** algorithm.
- An algorithm was replaced:
  - **WTx4** has been replaced with **WTCH**, an algorithm that offers more features.
- Contextus differs from the hardware firmware in the following way:
  - The option to reverse the encoder knob is inaccessible: we wired the encoder properly.

The module controls and menus remain the same, and their letter or number reference has not been changed in the diagram above, if you need a refresher on their basic functions, check the manual for Nodi.

A description of the new synthesis models and the parameters the knobs alter for them follows.

New Contextus synthesis models

Models are presented as they appear in the display to make finding parameters easier.

\\CH, -_CH, /\CH, SICH, WTCH

Play diatonic chords using different wave forms (saw, square, triangle, sine and wave table).

When the quantizer **QNTZ** (K) is disabled, this model behaves like Nodi's **WTx4** model; but when it is enabled in one of the diatonic modes (dorian, eolian, etc.), chords stay in key and pick the correct major, minor or extension based on the selected scale and root note.

Controls Knobs	
TIMBRE	This parameter controls different aspects depending on the selected waveform: • **\\CH**: detuning between the 2 saw waves that make up each note. • **-_CH**: pulse width of the square wave. • **/\CH, SICH**: the amount of wave folding to apply to each oscillator before summing. • **WTCH**: morph between a small set of wave table entries. The wave table is the same as the one used in Nodi's **WTx4** model

COLOR	The function of this knob depends on the state of the quantizer: • Disabled: blend between 16 predefined chords. • Enabled: control chord extensions.

\\x6, -_x6, /\x6, SIx6, WTx6

6 oscillators starting at the **V/OCT** input (6), spaced evenly across the currently selected quantizer scale.

Controls **Knobs**	
TIMBRE	This parameter controls different aspects depending on the selected waveform: • **\\x6**: detuning between the 2 saw waves that make up each note. • **-_x6**: pulse width of the square wave. • **/\x6, x6**: the amount of wave folding to apply to each oscillator before summing. • **WTx6**: morph between a small set of wave table entries. The wave table is the same as the one used in Nodi's **WTx4** model.
COLOR	The function of this knob depends on the state of the quantizer: • Disabled: control the space (in semitones) between the 6 oscillators. • Enabled: control the number of scale steps between oscillators.

SAM1, SAM2

The classic Commodore 64 robotic voice ready to be used in Rack!

Each **SAM** model contains 16 different words and is similar to a granular sampler.

A **TRIG** (7) makes **SAM** play the selected word starting at the current grain. In this case, the **V/OCT** (6) controls both the speed and pitch of the output.

The selected word can be scrubbed with the **TIMBRE** (A) knob. This way an envelope can control the speed without altering the pitch.

SAM1 and **SAM2** differ only in their word lists.

Controls Knobs	
TIMBRE	Scrub through the selected word; a fully CCW knob plays the first grain of the word while a fully CW knob plays the last.
COLOR	Change the selected word.

Scalaria – LP ladder filter

Design up to sixteen channels of musical or otherworldly sounds with this polyphonic, Moog inspired low-pass ladder filter!

Stirred by the low-pass ladder filter from the original “Symbiote” firmware for Mutable Instruments’ Warps, the module implements logic based on the “Improved virtual analog model of the Moog ladder filter” by Stefano D’Angelo and Vesa Välimäki[30], a model that strives for accuracy and can self-oscillate.

We hope this module helps you find new, exciting sounds for years to come!

Scalaria controls

30 Their research paper can be found here: https://www.researchgate.net/profile/Vesa-Vaelimaeki/publication/261193653_An_improved_virtual_analog_model_of_the_Moog_ladder_filter/links/56d69bc408aee1aa5f73b370/An-improved-virtual-analog-model-of-the-Moog-ladder-filter.pdf

It is important to distinguish between **Module channels** and **Polyphonic channels**: the module uses 2 internal channels: **Channel 1** and **Channel 2**.

The source of those channels can be internal for **Channel 1** when the **Internal oscillator** is enabled and external for **Channel 2** from the signal present at the **INPUT 2** (6) port, or external for both channels, using the **INPUT 1** (5) and **INPUT 2** (6) ports.

The module filters signals using both **Module channels** for every **Polyphonic channel** present: each polyphonic channel is processed by its own internal **engine** with 2 **Module channels**

The module's output will be a polyphonic signal when two or more **Polyphonic channels** are present.

The following pages mention **Channel 1** and **Channel 2** often, whenever they are referenced, they mean **Module channels** 1 and 2, not **Polyphonic channels** 1 and 2!

Knobs

A. **FREQUENCY ATTENUVERTER**: controls the polarity and amount of modulation from the signal in the **FREQUENCY CV** (1) input to the value set by the **FREQ** (B) knob.

B. **FREQ**: turn this knob to set the base cutoff frequency of the filter.

   The right side of the faceplate includes a numbered indicator light for each of the 16 available polyphony channels; the appropriate light turns on when a channel is present, its color shows a rough estimate of the cutoff frequency for that channel: from red for low cutoff frequencies to violet for the highest ones, akin to the color frequencies of the light spectrum.

C. **RESONANCE ATTENUVERTER**: controls the polarity and amount of modulation from the voltage present in the **RESONANCE CV INPUT** (2) to the value set by the **RESO** (D) knob.

D. **RESO**: twist this knob to set the resonance (also known as "Q") of the filter.

   When **RESO** is set high enough, the filter self-oscillates.

E. **I.O.**: enables the **Internal oscillator** and sets its wave form or disables it entirely.

   Lights on the faceplate show the state of the **Internal oscillator** and the wave form it is producing using different colors and symbols:

Light	Internal oscillator	Behavior
OFF	**Disabled**	**Internal oscillator** is disabled.
	Enabled, Triangle	**Internal oscillator** produces a triangle wave.
	Enabled, Sawtooth	**Internal oscillator** produces a sawtooth wave.
	Enabled, Square	**Internal oscillator** produces a square wave.

When the **Internal oscillator** is enabled, its output is summed with the signal from **INPUT 2** (6) and sent to the filter before being output at **1 + 2** (7); its raw, unfiltered output is sent to the **AUX** (8) port.

The **FREQ / LVL 1** (F) knob controls the frequency of the **Internal oscillator** when it is enabled.

F. **FREQ / LVL 1**: the effects of this knob depend on the state of the **Internal oscillator**; the value the knob is controlling is shown using lights and symbols on the faceplate:

Light	Internal oscillator state	Controlled value
FREQ	**Enabled, any wave form**	**Internal oscillator** frequency.
LVL 1	**Disabled**	Amplitude of the signal present at the **INPUT 1** (5) port. Driving the input signal high enough with this knob will clip it.

G. **LVL 2**: controls the amplitude of the signal present at the **INPUT 2** (6) port.

Driving the input signal high enough with this knob will clip it.

Inputs and outputs

1. **F. CV**: input port for the filter's cutoff frequency.

   Voltages sent to this port offset the value of the **FREQ** (B) knob.

2. **R. CV**: input port for the filter's resonance.

   Voltages sent to this port offset the value of the **RESO** (D) knob.

3. **FREQ / LVL 1 input**: the effect of voltages sent to this port depends on whether the **Internal oscillator** is enabled or disabled:

Internal oscillator	Voltage effect
Enabled, any wave form	**Internal oscillator** V/OCT.
Disabled	Offset the value of the **FREQ / LVL 1** (F) knob.

   This input is normalled to +5V.

4. **LVL 2 input**: voltages sent to this port offset the value of the **LVL 2** (G) knob.

This input is normalled to +5V.

5. **INPUT 1**: voltages sent to this input serve two different purposes depending on the state of the **Internal oscillator**:

Internal oscillator	Voltage effect
Enabled, any wave form	Internal oscillator phase modulation.
Disabled	**Channel 1** signal input.

Polyphony for the module is set by the cable with the highest channel count between this and the **INPUT 2** (6) ports; the number of channels present is shown using numbered lights on the right side of the faceplate.

6. **INPUT 2**: **Channel 2** signal input.

Polyphony for the module is set by the cable with the highest channel count between this and the **INPUT 1** (5) ports; the number of channels present is shown using numbered lights on the right side of the faceplate.

7. **1 + 2**: this output contains the signal sum after it passes through the filter, the factors of the filtered sum depend on the state of the **Internal oscillator**:

Internal oscillator	Port contents
Enabled, any wave form	Sum of the signal from the **Internal oscillator** and the signal from **INPUT 2** (6).
Disabled	Sum of the signal from **INPUT 1** (5) and the signal from **INPUT 2** (6).

8. **AUX**: the contents of this output depend on the state of the **Internal oscillator**:

Internal oscillator	Port contents
Enabled, any wave form	Raw output of the **Internal oscillator**.
Disabled	Pre-filter, post-VCA sum of the signal from **INPUT 1** (5) and the signal from **INPUT 2** (6).

Scalaria bypassed module behavior

The signal present at **INPUT 1** (5) is sent, unaltered, to the **1 + 2** (7) output.

Scalaria MetaModule faceplate

When **Scalaria** is running in **MetaModule**, the faceplate is slightly different; but module functionality, control positions and light colors remain the same, the **MetaModule** faceplate is similar to the image below:

Velamina – Quad VCA

Four polyphonic VCAs for any and all your signal needs, enjoy the freedom of adjustable response curves; offset control to dial in the needed gains, and a flexible mixer!

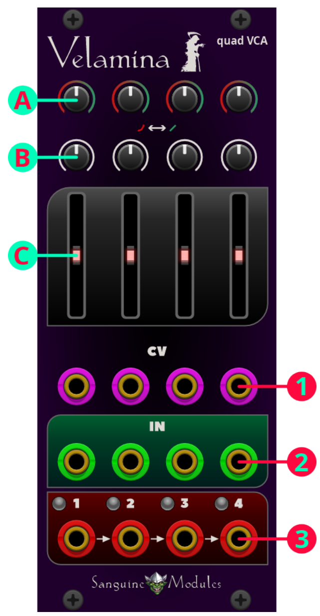
Attenuate or amplify signals using CV and the offset!

Velamina saturates outputs when voltages beyond ±10V are encountered.

Based on the revised version of Mutable Instruments' "Veils".

We hope this module inspires you to push envelopes like none have before and unlocks new mixes for your masterpieces.

Velamina controls



All four **Module channels** share the same controls and ports, the descriptions below apply to all four.

Knobs and sliders

A. **Response curve:** this knob sets the response curve for the channel: continuously variable between exponential (all the way to the left) and linear (all the way to the right).

Remember! Exponential functions grow rapidly, so very high gains can be achieved with an exponential response curve combined with a large positive offset.

B. OFFSET CONTROL: this knob adds a positive offset to the CV signal.

> ! The offset applies to the voltage present in the **CV** (1) input, in other words, offset is applied to the *modulation*, not the main signal or the output!

C. GAIN: this slider directly controls signal gain when the **CV** (1) input has no cable patched, or acts as a gain control for the **CV** (1) input when a signal is connected to that port.

When the **CV** (1) input is patched, unitary gain is achieved when the slider is set at the top and a voltage of +5V is sent to the **CV** (1) input; voltages above +5V may cause distortion when the signal reaches the saturator threshold.

The slider has an LED light with brightness proportional to VCA gain. The light is red for monophonic signals and yellow for polyphonic ones. When the light is off, the signal is muted.

Inputs and outputs

1. **CV:** voltages sent to this port modulate channel gain.
2. **Signal:** the main input port for the channel, can handle both audio and CV.
3. **Signal output:** main output for the channel.

   When no cable is connected, the signal is routed to the next channel and summed with its signal, this allows the module to also function as a mixer.

   The mixer is smart and selects which channels to mix based on the connected cables.

   Some examples:

   - Example 1:

     Signals are connected to the **SIGNAL** (2) inputs of channels 1, 2 and 3.

     Cables are connected to the **SIGNAL output** (3) ports of channels 2 and 3.

     - The signal in the output port of channel 2 contains the mixed signal of channels 1 and 2.

    - The signal in the output port of channel 3 contains the post-gain signal of channel 3 only.
- Example 2:

  Signals are connected to the **SIGNAL** (2) inputs of channels 1, 2, 3 and 4.

  Cables are connected to the **SIGNAL output** (3) ports of channels 1,2 and 4.

    - The signal in the output port of channel 1 contains the post-gain signal of channel 1 only.
    - The signal in the output port of channel 2 contains the post-gain signal of channel 2 only.
    - The signal in the output port of channel 4 contains the mixed signal of channels 3 and 4.
- Example 3:

  Signals are connected to the **SIGNAL** (2) inputs of channels 1, 3 and 4.

  A cable is connected to the **SIGNAL output** (3) ports of channel 4.

    - The signal in the output port of channel 4 contains the mixed signal of channels 1, 2 (0V, because channel 2's **SIGNAL** (2) is not connected), 3 and 4.

An LED above every channel shows the current polarity and amplitude of the voltage mix for that channel and every unpatched channel before it.

The LED shows polarity using color: monophonic voltages are red when <0V and green when >0V; polyphonic voltages are purple when <0V and aqua when >0V.

Polyphony for the module is set by the polyphonic cable carrying the highest number of channels that is connected to any of Velamina's **SIGNAL** (2) inputs.

Acknowledgments & thanks

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Everyone in the VCV Rack forum who got excited with my first “Funes” release.

Christy Marx for making me laugh, to this day, whenever I look at the Conquests of Camelot manual cover (and, in turn, inspiring the cover for this one).

Contact

Found a bug? Have a suggestion? A fix?

Please use the issues section at

https://github.com/Bloodbat/SanguineMutants/

Make sure you provide the required information.

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Attribution for the ByteBeats equations and links to their origin or further information can be found in the source code for Mortuus (in deadman_bytebeats.cc).

Hardware firmware

Sanguine Mutants tries to emulate as much hardware functionality as possible, however, the sources used for our virtual modules is incomplete: anything not required by our versions has been stripped; also some firmwares have been adapted; fixed, or rewritten, to provide a better Rack experience or even just to exist in virtual form; some modules have been created from scratch as well; in other words: building the firmwares required to run hardware modules out of our sources is *not* possible (though some could benefit from a few of our changes).

If you want to study; build; perhaps hack, and, when they are available, download original or custom firmwares for your hardware modules, here are a few links to get you started:

- Mutable Instruments official, almost complete firmware and hardware sources:

  https://github.com/pichenettes/eurorack

- Mutable Instruments official documentation (with an almost complete archive of ready-to-use firmware downloads):

  https://pichenettes.github.io/mutable-instruments-documentation

- Matthias Puech's Parasites (Temulenti, Distortiones, Etesia):

  https://mqtthiqs.github.io/parasites/index.html

- Kammerl Beat-Repeat and Spectral Clouds Effect (Fluctus):

  https://www.kammerl.de/audio/clouds/

- Tim Churches' Mutated Mutables (Mortuus):

  https://timchurches.github.io/Mutated-Mutables

- Doc Polyester's Cymbal for Dead Man's Catch (Mortuus):

  https://github.com/DocPolyester/Mutated-Mutables

- Tom Burns' Braids Renaissance (Contextus):

  https://burns.ca/eurorack.html

- Ari Russo's Twigs for Branches (Vimina):

  https://github.com/arirusso/twigs

- Leandro Bolívar's Symbiotes (Mutuus, Scalaria LP filter):

  https://leandrob13.github.io/Electronic-Ruminations/posts/warps-symbiote/

- Rainier, Peaks with CV control (inspiration for Ansa and Nix).

I could not find the firmware source, perhaps you'll have better luck?

Module information and purchase options:

https://afterlateraudio.com/collections/modulation/products/rainier