

ISOBAR  INDUSTRIES

# SERRATUS

Polymorphic comb and mutation engine. Nine ways to make a delay line ring, nine ways to mutate a signal, on a single feedback loop.

Firmware 1.0 · Operator's manual

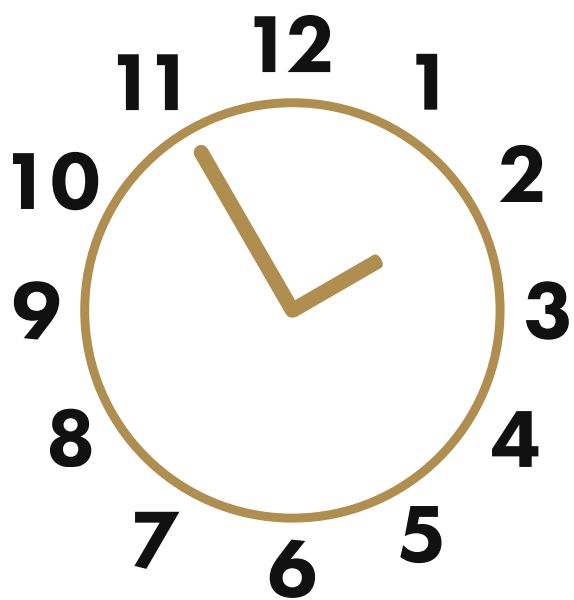
## Introduction.

Serratus is a digital stereo comb filter and mutation engine running on Daisy Patch SM. One of nine comb algorithms is excited by the input through a pitched feedback loop. One of nine mutations, a stereo filter/filterbank and a reverb, can route before that loop ➡ ●, inside it ⤵, or after it ● ➡. Both banks can step or morph from one algorithm into the next.

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## Conventions.

Knob positions use clock notation. 7:00 is fully counter-clockwise (CCW), 12:00 is centered, 5:00 is fully clockwise (CW). A bipolar knob rests at noon. Control names are written in capitals, or as the symbol on the panel where one is used. Buttons appear as descriptive symbols, like [Freeze]. Jacks are named by their panel symbols. Combs and mutations are numbered with roman numerals, I to IX, the same as the panel.



Front panel.



The Serratus front panel.

## Knobs

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### PITCH

The comb's note, across ten octaves. An endless knob. Its LED ring shows two comets: one marks the octave you are in, the other the pitch within that octave, completing a full lap of the ring for each octave. In Clock mode the knob selects a clock ratio instead.

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### FEED \*

Feedback amount and polarity. CCW of noon is inverted, CW is positive, noon is silent. The loop self-oscillates around 9 o'clock inverted, and around 3 o'clock.

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### ORBIT

Orbital feedback. A second endless knob, a full 360 degree rotation, that sets a stereo crossfeed angle inside the loop and a phase rotation. ⓘ

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### MATTER \*

Material damping of the feedback, from Rubber (dark) through Neutral to Crystal-bright. Bipolar. ▽

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### EBB \*

The comb's spectral character, what it rings with. Its exact meaning changes per algorithm.

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### FLOW \*

The comb's temporal character, how it rings. Its exact meaning changes per algorithm.

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### REND \*

A mutation character knob, broadly the intensity. Each mutation utilizes it in its own way.

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### BIND \*

A mutation character knob, broadly the character. Each mutation utilizes it in its own way.

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### ETCH \*

The filter, bipolar in both modes. A DJ filter  or a 16-band filterbank/chordal resonator , chosen by a toggle switch on the panel.

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### Q \*

Etch resonance in the DJ filter, band Q in the filterbank. 

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### MELT \*

Reverb, bipolar. Ore (dark plate reverb) to the left, Aer (bright +1 octave shimmer reverb) to the right, off at noon. 

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### SEEP \*

Reverb decay and size, moved together. 

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## LEECH\*

The self-modulation system, bipolar ξ. Chaotic (semi deterministic, smooth) left ☒, organismic (reactive and unpredictable) right ☒, off at noon.

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## IN LVL

Input gain, trimming around an automatic baseline. Unity at noon. Doubles as Out Lvl when the user holds MOD button.

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## MIX

Dry to wet. 🔥💧

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\* marks a control you can assign to the internal envelope mod bus. See Mod bus.

## Toggle Switches

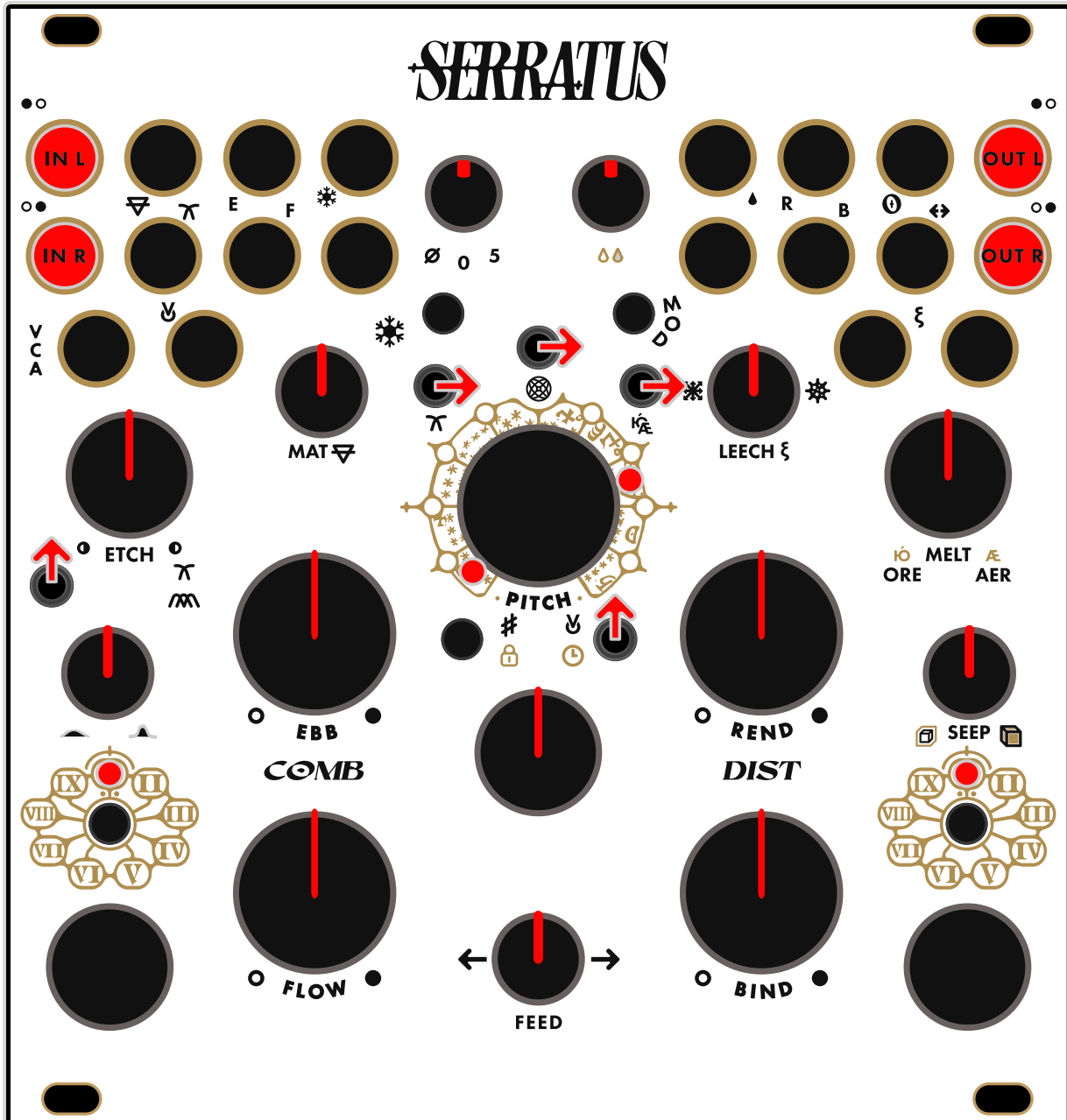
- V/Oct, Clock. How the Pitch CV jack is read: a V/Oct pitch voltage across ten octaves, or a clock that the Pitch knob then divides and multiplies depending on if it is in PITCHED ⚡ or CLOCKED ⌚ delay mode.
- Etch route. Etch before the comb, inside the loop, or after it.
- Mutation route. Mutation before the comb, inside it, or after it.
- Reverb route. The reverb before the comb, inside the loop, or after it.
- Etch mode. DJ filter or filterbank.

## Buttons

- [Freeze] captures and loops the buffer. ☀
- [Lock] tap cycles the pitch quantize mode; hold locks pitch. In Clock mode the tap cycles the clock-ratio mode (Divisions, Octave, Free) instead. 🔒
- [Mod] controls the envelope follower and its modulation bus. ⚡
- Each algorithm ring has a button at its center and an encoder of its own. The button toggles that bank between step and morph mode; the encoder selects the algorithm, and pressing the encoder mutes or unmutes the one the cursor is on (see The matrix and Gestures).

## Neutral starting point.

Set all pots to NOON. Set the comb algorithm to I. Set the mutation algorithm to I. Set Feedback to NOON. Set pitch mode to pitched, not clocked mode (switch UP position). Set all routing switches to RIGHT, or POST mode.



A neutral starting layout for the panel.

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## Signal path.

Serratus is one feedback loop with three movable inserts. Knowing where the mutation, reverb, and **Etch** sit on that loop is the difference between a sound that bites and one that shimmers.



The input passes through the input gain stage and splits. One branch stays dry and goes to Mix. The other enters the comb loop, where Pitch sets the delay length, Feed sets the loop gain, and Matter filters what survives each pass. The three inserts can each sit at one of three points:

- **PRE.** Before the comb, on the input branch.
- **MID.** Inside the feedback loop. The wildest territory, and the one that rewards a careful Feed setting.
- **POST.** After the comb's wet output. You can consider this end of chain.

The switches are independent, so a mutation can run PRE while the reverb runs POST and **Etch** can run MID feedback loop. Changing a route can trigger pops, clicks or brief audio dropouts.

When two or more inserts share a position they run in a fixed order. At PRE it is **Etch**, then the mutation, then the reverb. At MID and POST it is the mutation, then the reverb, then **Etch**. One quirk worth knowing: the POST **Etch** sits after the dry and wet are mixed, so there it shapes the dry signal as well.

You do not have to lean on both halves at once. Put the mutation PRE and turn Feed down, and the combs pass an almost dry signal you are mostly mutating; turn the mutation off by routing it to PRE, setting it to mutation I, Transformer Sat, with Rend and Bind knobs full CCW. This lets you use it with comb being the whole voice. They are built to interlock, but either can sit in the background.

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## The matrix.

Two encoders, two banks of nine. The comb encoder runs one axis, nine ways to make a delay line ring. The mutation encoder runs the other, nine ways to mutate a sample. Eighty-one named intersections, and the whole continuum between them. Every comb pairs with every mutation.

Each bank works two ways. In step mode, one detent lands one algorithm. Tap the button at the center of the ring to put that bank into morph mode: now three detents span each algorithm and the encoder crossfades continuously between neighbors, parkable mid-blend and drivable from the matching CV

input. A short press of the encoder mutes the cursor's current algorithm. It keeps sounding while the cursor sits on it, but is skipped the next time you navigate past it, so muting several lets the encoder step only through the ones you keep. You can mute all but one, and you can always land the cursor back on a muted algorithm to bring it back.

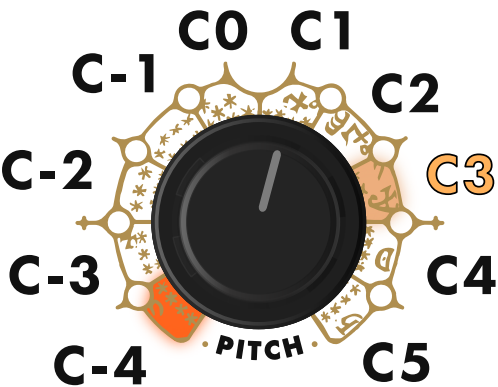
Where a mutation sits relative to the comb, before it, inside the loop, or after it, is set by its route switch: it can shape the input, the resonance on every pass, or the output. See Signal path.

## Delay Time Modes.

The switch above the Pitch jack does more than change how a voltage is read. It puts the comb in one of two ranges, and they do not overlap.

### Pitched

The switch in its UP position. The delay is a note. The ring spans ten octaves, from 978 ms at the bottom to under a millisecond at the top, and the grid is anchored to C, so every octave detent is a C and each cell of the ring is one C-rooted octave. LED 8 is the C3 octave, and it is where the module powers up.



**PITCHED MODE**  
**DEFAULT PITCH: C3**



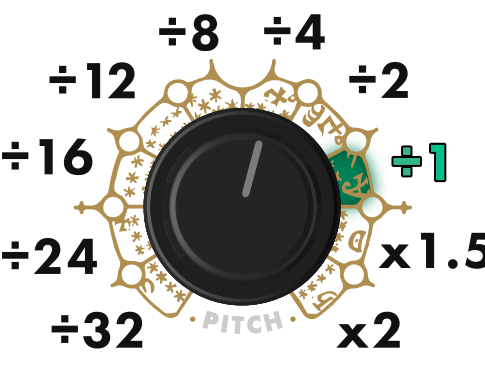
**UNQUANTIZED - FREE**  
**SEMITONES**  
**OCTAVES**

| LED | Octave | Fundamental | Delay   |
|-----|--------|-------------|---------|
| 1   | C-4    | 1.0 Hz      | 978 ms  |
| 2   | C-3    | 2.0 Hz      | 489 ms  |
| 3   | C-2    | 4.1 Hz      | 245 ms  |
| 4   | C-1    | 8.2 Hz      | 122 ms  |
| 5   | C0     | 16.4 Hz     | 61.2 ms |

|    |    |          |         |
|----|----|----------|---------|
| 6  | C1 | 32.7 Hz  | 30.6 ms |
| 7  | C2 | 65.4 Hz  | 15.3 ms |
| 8  | C3 | 130.8 Hz | 7.6 ms  |
| 9  | C4 | 261.6 Hz | 3.8 ms  |
| 10 | C5 | 523.3 Hz | 1.9 ms  |

### Clocked

The switch in its DOWN position. The delay is a division of whatever clock you patch. The knob picks a ratio instead of a note, and because the delay follows the incoming period instead of an absolute time, it reaches far longer than pitched mode can. At 120 BPM the longest ratio is eight bars, sixteen seconds, and the hard ceiling is near twenty-two seconds. LED 8 is unity, one clock period, and it is marked in white as the home position.





**CLOCKED MODE**  
**DEFAULT DIVISION: ÷1**

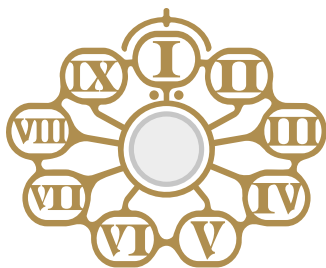
**SNAP TO DIV/MULT**  
**SNAP TO LARGE DIV/MULT**  
**UNQUANTIZED - FREE**

| LED | Ratio | In 4/4 | At 120 BPM |
|-----|-------|--------|------------|
| 1   | x32   | 8 bars | 16 s       |
| 2   | x24   | 6 bars | 12 s       |
| 3   | x16   | 4 bars | 8 s        |
| 4   | x12   | 3 bars | 6 s        |
| 5   | x8    | 2 bars | 4 s        |
| 6   | x4    | 1 bar  | 2 s        |
| 7   | x2    | half   | 1 s        |

|    |      |                 |        |
|----|------|-----------------|--------|
| 8  | x1   | quarter         | 500 ms |
| 9  | ÷1.5 | quarter triplet | 333 ms |
| 10 | ÷2   | eighth          | 250 ms |

A tap of [Lock] sets how the knob lands between them. Divisions snaps to every ratio above, Octave snaps only to the binary ones, and Free sweeps continuously without snapping.

## Combs .



The comb ring navigates nine resonant delay algorithms.

Nine ways to build a unique delay. In every algorithm, Pitch sets the loop's period, the note, across ten octaves, and Feed sets how long it rings. Feed is bipolar: left of noon inverts the loop for a more hollow, odd-harmonic voice, right of noon is positive feedback, and around 9 o'clock and 3 o'clock the loop self-oscillates and rings without any input. What changes from algorithm to algorithm is the pair Ebb and Flow. Ebb is what the comb rings with; Flow is how it rings (mostly).

## I Fractured Prism

*Stretched strings, and glass pulling apart.*

A delay tap pushed through a four-stage allpass cascade that bends each frequency's travel time. High partials arrive a few samples late, so the harmonic series smears into bell-like, glassy inharmonicity that builds with every pass.

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### FEED

Decay. Left of noon inverts the loop for a thinner, glassier ring.

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### EBB

Dispersion depth. Low is a clean delay, harmonically pure; high is full group-delay smear and glassy inharmonicity.

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### FLOW

Per-stage spread. Noon is a uniform, chorus-like smear; toward either extreme the stages diverge into a bell-shaped dispersion curve.

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## II Filamentum

*A struck or bowed string, modeled.*

A bidirectional waveguide: two traveling-wave delay lines reflecting at a bridge and a nut, with a movable pickup. It wants a transient to excite it. Pluck it with a click, bow it with anything sustained.

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### FEED

Round-trip gain: how much energy comes back on each pass.

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### EBB

How much the string's end soaks up. Against intuition, high Ebb damps more, for a shorter, less ringing tone; low Ebb lets the reflections run.

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### FLOW

How tightly the string is anchored, and where the pickup sits along it. Low is loose and fluttery; high is tight and defined.

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### III Perpetuum

*A loop that refuses to die quietly.*

A comb with an automatic gain control inside the loop. As the ring fades, the control pushes it back toward a threshold, and a trace of noise keeps it alive even in silence. Loop gain can pass unity without running away. Can give its feedback a sidechaining effect.

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|             |                                                                                                      |
|-------------|------------------------------------------------------------------------------------------------------|
| <b>FEED</b> | Drive into the loop. Past 3 o'clock it self-sustains as a breathing, pumping drone in its own right. |
|-------------|------------------------------------------------------------------------------------------------------|

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|            |                                                                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>EBB</b> | Control speed, plus the depth of the compression below noon. Full counter-clockwise breathes slowly and squeezes hardest; high grabs transients fast and chirps. |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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|             |                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>FLOW</b> | Knee and asymmetry. Low is a hard knee and symmetric saturation; high adds a soft knee and a warm offset that loads in even harmonics. |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------|

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### IV Empyrean Cascade

*Bells, bars, struck metal.*

Eight tuned resonators in parallel excited by a delay. Can go from raindrops on metal to gongs.

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|             |                                                           |
|-------------|-----------------------------------------------------------|
| <b>FEED</b> | Ring time. Long Feed sustains the bell; short Feed thuds. |
|-------------|-----------------------------------------------------------|

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|            |                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------|
| <b>EBB</b> | Tuning and stiffness. A pure harmonic series at the bottom, sliding to stiff, inharmonic bell ratios at the top. |
|------------|------------------------------------------------------------------------------------------------------------------|

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|             |                                                                                                                                                                                                                                                                                                                                                                             |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>FLOW</b> | Coupling. Low, the modes ring independently and it behaves as a clean resonator bank. High, they are wired into a ring that passes energy between them, and past a threshold the bank stops filtering and starts generating partials belonging to no mode at all, the crash regime of a gong or cymbal. Hard strikes also bend the pitch slightly, the way real metal does. |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## V Oiler

*Thick oil, churning under pressure.*

A comb that will not sit still. Every pass shifts the repeats a few hertz off the harmonic grid, and because a feedback loop compounds, that walk builds into an evolving metallic smear. Segments of the delay are read backwards inside the loop, so the reversal composes pass on pass: even ones forward, odd ones back, transients folding into palindromes, and the seams between them sputter. A deep resonant phaser sits after the comb, swept by your playing, not by a fixed rate..

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### FEED

Decay. With Ebb counter-clockwise the loop loses less on each pass, so it reaches self-oscillation earlier than the other combs.

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### EBB

Extremity. Counter-clockwise is a pure phased comb; turning it up scales everything at once, how far the notches travel, how fast they drift, the depth of the sweep, and how much of the loop is read backwards.

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### FLOW

Syrup. It raises the phaser's regeneration until the peaks stand tall and ring, and stretches the reversed segments toward quarter speed, which compounds every pass into a descending tape spiral.

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## VI Pneuma

*Breath broken into grains, each one a different vowel.*

Four long taps read the comb's buffer, each filtered to a formant detected in your input, and each firing its own grain stream at a rate taken from that formant: low formants fire slow, long grains, high formants fire fast, short ones. The result is polyrhythmic and it shifts when the input does, because the formants do. The lowest tap is a lowpass and the highest a highpass, so the bass and the top pass through instead of being trapped inside the bands.

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### FEED

Decay, ordinary comb behavior.

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### EBB

Formant shift and splay across the detected set. At noon the sound's own formants are left alone; toward either extreme they are shifted and spread somewhere no throat goes.

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### FLOW

Grain length against the grain period. Low is sparse and staccato, separate events; high overlaps them into a continuous wash.

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## VII Stochastic Automaton

*A delay played by something that is not you.*

Eight taps spread across five octaves, gated by a one-dimensional cellular automaton that steps in time with the pitch. A noise-assisted threshold sets how strongly each active tap rings. Alive, and never quite the same twice.

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### FEED

Decay of each struck tap.

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### EBB

Rule and speed. Sweeps eight cellular-automaton rules from periodic through complex to chaotic, evolving faster as you turn up.

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### FLOW

Noise level and tap release. Low is flickery, percussive switching; high blooms and sustains as the noise lifts the weak taps over their threshold.

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## VIII Cataract

*A transient unfolding into a wobbly frequency-staggered cloud.*

A long cascade of allpass filters in series with the delay, giving strong frequency-dependent group delay. A single attack unfurls into a spectral waterfall.

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### FEED

Decay. High Feed turns the dispersed cloud into a sustained, drifting wash.

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### EBB

Chirp. The sign sets direction, left descending and right ascending; the distance from center sets intensity.

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### FLOW

Clean to dispersed mix. Low keeps attacks sharp; high smears them into spectral waterfalls.

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## IX Gravity Warp

*Bell to fog in one sweep.*

Four taps that compress or stretch around the fundamental, plus a sub-octave tap for body, all run through a diffusion chain. The sub-octave bleed is what gives this one its weight.

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### FEED

Decay across the tap cluster.

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### EBB

Tap spread and sub-octave mix. Low clusters the taps near unison; high spreads them into inharmonic bell ratios and deepens the sub.

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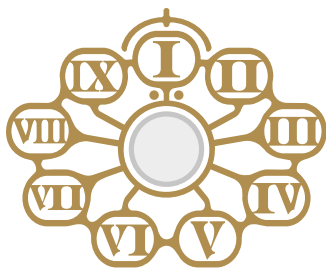
### FLOW

Diffusion. Low keeps tap transients defined; high washes the tap sum into a reverberant smear.

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## Mutations.



The mutation ring navigates nine mutation algorithms.

Nine ways to mutate your sound. Some are distortions, some are stranger. The mutation encoder selects the algorithm, and two knobs shape it: Rend is broadly the intensity, Bind broadly the character, though each algorithm reads them in its own way. There is no separate drive knob; the character knobs carry it. Where a mutation sits relative to the comb is set by its route switch. Inside the loop, on MID, it is re-applied on every pass and becomes part of the resonance.

### I Transformer Sat

*Iron, warmth, weight in the low mids.*

A saturator that splits low from high and pushes the low harder, the way an iron transformer core does, while the top is softened separately. Useful in front to thicken a source, or after to glue the output.

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|             |                                                                                           |
|-------------|-------------------------------------------------------------------------------------------|
| <b>REND</b> | Drive. More Rend pins the low path further into saturation and gently rolls the very top. |
|-------------|-------------------------------------------------------------------------------------------|

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|             |                                                                                  |
|-------------|----------------------------------------------------------------------------------|
| <b>BIND</b> | Asymmetry. Off-centers the waveform before saturation to load in even harmonics. |
|-------------|----------------------------------------------------------------------------------|

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## II Starved Tube

*A vacuum tube fed too little voltage.*

A waveshaper whose bias sags under load, the way a starved plate supply droops. Quiet signals stay clean; loud sustained ones pull back and break up.

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|-------------|-------------------------------------------------------------------------------------------|
| <b>REND</b> | Sag. How far the bias drifts under a loud signal, which reads as compression and sustain. |
|-------------|-------------------------------------------------------------------------------------------|

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|             |                                                                                     |
|-------------|-------------------------------------------------------------------------------------|
| <b>BIND</b> | Drive and bias. Static gain and a fixed offset, asymmetric, for even-harmonic grit. |
|-------------|-------------------------------------------------------------------------------------|

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## III Heterodyne

*Broken tremolo at one end, FM hybrid ring modulation at the other, always in tune.*

The signal multiplied by an internal oscillator locked to the comb's pitch, so the sum and difference sidebands land in tune with the note instead of clashing with it. The carrier is a feedback operator: as it is driven it walks from a clean sine through saw-like brightness into broken-up chaos, so the top of the range keeps going instead of arriving at a square wave and stopping.

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|             |                                                                                                                          |
|-------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>REND</b> | Interval. The carrier's pitch against the comb fundamental, thirty semitones either side of unison, with unison at noon. |
|-------------|--------------------------------------------------------------------------------------------------------------------------|

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|             |                                                                                                                                                                                                               |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BIND</b> | Intensity. It opens the modulation depth and drives the carrier's feedback together, from clean, through sine tremolo and deep AM, to full bipolar ring modulation where the carrier flips the signal's sign. |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## IV Plasma Arc

*Crackle and sputter, not fuzz.*

A gas discharge modeled as an oscillator, not a clipper. The gap charges until it breaks down, collapses, and recharges, striking over and over at its own rate instead of following the input. That self-timed strike is the sound, and it free-runs whether you play quietly or hard.

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|             |                                                                                                                                                                               |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>REND</b> | Strike rate. Around twenty strikes a second at the bottom, chunky and gated and stuttering, through a low-mid body near noon, up to a fast tearing buzz near three kilohertz. |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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|             |                                                                                                                                                                                                                                                                                                             |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BIND</b> | Resistance, and it crosses zero on the way. Low, the output partly follows the input and stays gentle. Mid, you hear the raw discharge on its own. High, it goes negative, so a louder input makes the gap quieter: it chokes on the loud parts and re-strikes, an inverted dynamic nothing else here does. |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## V Strata Fold

*West-coast wavefolding.*

A wavefolder with a morphing rectifier in front. The wave folds back on itself instead of clipping, so harmonics multiply with drive while the level stays roughly constant. The fundamental survives, so it stays musical.

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|             |                                                                                |
|-------------|--------------------------------------------------------------------------------|
| <b>REND</b> | Rectification and fold gain. Sweeps the rectifier and drives the folds harder. |
|-------------|--------------------------------------------------------------------------------|

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|             |                                                                                                       |
|-------------|-------------------------------------------------------------------------------------------------------|
| <b>BIND</b> | Fold threshold. Low is wide and folds less; high is narrow and folds more, for dense upper harmonics. |
|-------------|-------------------------------------------------------------------------------------------------------|

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## VI Octave Fuzz

*An octave up, screaming.*

An octave-up rectifier feeding a hard gain stage and soft clip. The octave layer tracks the input, so it sings with melodic material.

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|             |                                       |
|-------------|---------------------------------------|
| <b>REND</b> | Drive, from clean through heavy gain. |
|-------------|---------------------------------------|

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|             |                                                                                      |
|-------------|--------------------------------------------------------------------------------------|
| <b>BIND</b> | Octave blend. Subtle low, dominant high, mixing the rectified octave into the drive. |
|-------------|--------------------------------------------------------------------------------------|

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## VII JPEG Codec

*Image compression artifacts as a waveshaper.*

A wavefolder run through the math of a heavily compressed JPEG. The signal is folded, then quantized the way a codec posterizes an image, with the ringing halo you get around the hard edges in a bad JPEG and a square-wave octave underneath. It is mostly wavefolder, with a little sample reduction on top, not a bitcrusher: blocky and ringing in a way nothing else here is.

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|             |                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------|
| <b>REND</b> | Ringing band. Sweeps the center of the edge-halo filter from low to high, moving where the artifacts sing. |
|-------------|------------------------------------------------------------------------------------------------------------|

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|             |                                                                                                                                                                   |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>BIND</b> | Compression depth. Coarsens the palette from many levels down to a few, raising the drive and the fold as it goes; high Bind is a heavily crushed, muffled image. |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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## VIII Waveset

*Shattered intersections, rearranged.*

Works on wavesets, the single cycles between zero crossings, rather than on samples. It records them and plays them back stretched, reversed, or thinned out, so the pitch is preserved while the timbre is bent out of shape.

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|             |                                                                                                            |
|-------------|------------------------------------------------------------------------------------------------------------|
| <b>REND</b> | Playback rate and direction, from half speed (an octave down) through normal to double speed and reversed. |
|-------------|------------------------------------------------------------------------------------------------------------|

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|             |                                                                                  |
|-------------|----------------------------------------------------------------------------------|
| <b>BIND</b> | Density. How many wavesets are affected, from every one to roughly one in eight. |
|-------------|----------------------------------------------------------------------------------|

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## IX Glossa

*A throat growing around the signal.*

The input drives a voice: a pulse generator and closure noise, gated by the input envelope and shaped through a bank of formants. The voice is locked to the comb's note and folded into a vocal register, so it reinforces the pitch instead of fighting it. The vowel follows your playing, quiet a closed "ee" and loud opening toward "ah", and the tearing at the edges is shaped by the formants themselves, so it tears harder as the mouth opens. It makes no sound when the input is silent.

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### REND

Voice intensity, from a light shaped passthrough to full pulse and noise.

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### BIND

Formant surgery in two stages. Through the first part of the throw it narrows the formants from broad to needle-sharp. Past the middle it begins rotating them around the spectrum, wrapping over four octaves, so vowels become shapes that map to no mouth at all. Sub-harmonics and pulse jitter ride the whole range and push the voice toward biphonation.

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## Reverb.

One reverb with two voices, chosen on [Melt](#). [Melt](#) rests at noon, where the reverb is off. Turn it counter-clockwise for Ore, clockwise for Aer; the further from noon, the wetter.

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### MELT

The reverb control, bipolar. It picks the voice and sets the wet level at once: noon is dry with the reverb off, counter-clockwise fades up Ore, and clockwise fades up Aer. The further from noon, the wetter the tail.

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### ORE

A dark, full, plate-like room. The main reverb.

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### AER

An octave up shimmer. A pitch shifter inside the tank runs an octave up, so every regeneration adds an ascending sparkle.

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### SEEP

Decay and size for either voice. It leans on the comb's feedback, so the tail breathes with the ring.

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Matter biases the brightness of the tail. Crossing [Melt](#) through noon swaps voices cleanly, with no leftover from the previous one. Reverb has its own route switch; placed before the comb it feeds a wash into the resonance, placed inside the loop it accumulates on every pass.



**Etch** is the filter, set by the **Etch** mode switch: a DJ filter and a filterbank, with a main cut knob and a **Q** knob.

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## DJ FILTER

Left of noon takes off the top, right of noon thins the bottom, noon is flat, down to a firm cut but never silent. **Q** adds a resonant edge at the corner.

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## FILTERBANK RESONATOR

Sixteen bands tuned as an interval ladder. The lowest and highest bands are shelves, so the extremes pass rather than being rejected. **Etch** sets the interval between bands and spreads them symmetrically about a fixed center, so the knob opens and closes the bank like a chord voicing instead of sliding it up the spectrum, with musical intervals landing at even knob positions: a whole tone near the bottom, a fifth just past the middle, a minor seventh near the top. **Q** sweeps from a broad spectral tilt to a tuned set of sixteen resonators, at constant level. Low and mid bands are split slightly left and right for width.

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**Etch** has its own route switch. Inside the loop at high **Q** in filterbank mode it becomes an aggressive, self-feeding resonator.

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## **Freeze.**

[**Freeze**] captures a short loop, the length of the current delay, and plays it back in place of the input. Press again to release. A gate at the **Freeze** jack does the same, following the gate rather than toggling.

While frozen, the rest of the panel still works. Sweep the encoders and a different algorithm processes the held sound.

Freezing reveals the edit controls right away. Pitch, Ebb, Flow, Rend, and Bind become controls over the loop while the comb holds its settings. Hold [**Freeze**] while frozen to hide them again.

Each knob takes on a freeze function:

| KNOB | <b>Freeze</b> | What it does |
|------|---------------|--------------|
|      | function      |              |

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|              |                    |                                                                                                                                                                                                                                                                                                                                                 |
|--------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>PITCH</b> | Jog                | Moves the playhead through the frozen sample. Endless, so it wraps. Its LED ring marks the position.                                                                                                                                                                                                                                            |
| <b>EBB</b>   | Varispeed          | Bipolar. Noon is normal speed, counter-clockwise slows to a standstill and then into reverse, clockwise up to three times faster. Pitch follows the speed, the way tape does.                                                                                                                                                                   |
| <b>FLOW</b>  | Detune             | A small symmetric split between the two sides, for gentle beating and chorus. Off at zero.                                                                                                                                                                                                                                                      |
| <b>REND</b>  | Wander /<br>Mosaic | Bipolar, still at noon. Counter-clockwise the playhead drifts on its own. Clockwise engages Mosaic: the frozen buffer is cut into slices, and on every beat the loop jumps to whichever slice best matches what you are playing right now. Further clockwise imitates more tightly. The two sides take different slices, so the image opens up. |
| <b>BIND</b>  | Rot /<br>Sustain   | Bipolar, plain static freeze at noon. Counter-clockwise rots it: the stored sample degrades as it plays, losing its top end a little more on every pass. It changes the recording itself, not the playback. The longer you hold, the further it goes. There is no undo. Clockwise thickens and sustains the loop.                               |

Mosaic follows your clock when one is patched. With no clock it follows your playing.

## § Leech.

**Leech** is a single bipolar knob that sets the amount of random smooth internal modulation, a small nervous system wired across the voice. Noon is off. Turn either way and that side's modulation ramps in over a few seconds, so there is no jump as it engages, and it deepens the further you go. The **Leech** jack is bipolar around zero volts and can reach a side on its own.

Leech touches feedback, damping, Ebb, Flow, the orbital angle, both mutation knobs, the reverb, and Etch (cut and Q). It leaves Pitch, Mix, and input level alone, so the module stays in tune and at level while everything else drifts. The two sides are different types of modulators.

## ✖ Chaotic

Counter-clockwise. Deterministic chaos in layers: a slow drift that unfolds over minutes, a faster chaotic oscillator beneath it, and a slow re-seeding underneath that, so the motion wanders and never repeats. More predictable and restrained than the organismic side, and the place to go when you want smooth motion that adds interest.

## ✖ Organismic

Clockwise. A reactive, biological modulation that listens to the input, other parameters, and to your hands. It breathes erratically, leans into playing dynamics, and follows the way you move the knobs, overreacting to your actions. These overreactions drift parameters the way a living thing shifts its weight. It listens to other parameters and cross feeds with them in unpredictable ways. Musical and agitated, it makes a patch feel alive and always changing.

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## Ⓜ Mod bus.

The envelope follower has two jobs. It drives the CV output jack, and it can be routed internally to almost any parameter, as if you had patched it to that knob's input with an attenuverter.

### Envelope modes

Tap [Mod] to cycle five shapes. The button's LED RGB value shows which one is active.

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|                |                                           |
|----------------|-------------------------------------------|
| <b>REGULAR</b> | Smooth tracking of the output. LED amber. |
|----------------|-------------------------------------------|

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|               |                                         |
|---------------|-----------------------------------------|
| <b>SLEWED</b> | A slow, breathing follower. LED orange. |
|---------------|-----------------------------------------|

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|             |                                                                      |
|-------------|----------------------------------------------------------------------|
| <b>PING</b> | A sharp attack and a fast decay, like a plucked envelope. LED green. |
|-------------|----------------------------------------------------------------------|

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|             |                                             |
|-------------|---------------------------------------------|
| <b>GATE</b> | A hard on and off at a threshold. LED cyan. |
|-------------|---------------------------------------------|

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|                  |                                                     |
|------------------|-----------------------------------------------------|
| <b>SIDECHAIN</b> | Inverted, so it ducks with the signal. LED magenta. |
|------------------|-----------------------------------------------------|

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The chosen shape feeds both the CV output and the internal routing.

## Assigning

Hold **[Mod]** to enter assign mode. While held, every eligible knob becomes an attenuverter for the envelope into that destination: noon is no modulation, counter-clockwise is negative, clockwise is positive. Turn as many knobs as you like in one hold. Knob values freeze during the hold and catch up smoothly on release, so nothing jumps.

The eleven knobs that pulse red when the **[Mod]** button is held are the assignable destinations, plus the two endless knobs, Orbit and Pitch:

- Feed, the feedback
- Matter, material damping
- Ebb, comb spectral character
- Flow, comb temporal character
- Rend, mutation character
- Bind, mutation character
- **Melt**, reverb voice and amount
- **Seep**, reverb decay
- **Etch**, the filter cut
- **Q**, **Etch** resonance
- **Leech**, self-modulation depth
- Orbit, Feedback orbital value
- Pitch, the note (endless, envelope-only, not available to **Leech**)

In Lvl and Mix are left out on purpose. To clear every routing, tap **[Lock]** while holding **[Mod]** ; to clear one, assign its knob back to noon, where it will blink RED. While you assign, the destination LEDs show the routing depth, and in normal play each parameter's LED follows its modulated value, so you can watch the envelope work.

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## **Orbital feedback.**

Orbit is the second endless knob, a full 360 degree rotation with no stop in either direction. It sets an angle rather than a level, and that angle crossfeeds the left and right channels inside the feedback loop. At the home position (NOON) there is no crossfeed and the stereo image is normal; its LED marks home in teal. Turn away from home and the channels begin to cross, fullest at the quarter turns, with the half turn reading as a phase inversion. Because it is endless, you can keep rotating through these states as a continuous gesture, and because **Leech** can drive the angle, the stereo field can rotate on its own.

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## Aeolian self exciter.

When the input goes quiet for about half a second, Serratus starts to play itself. A synthetic resonant pitched noise source fades in at the comb's input, a kind of wind across strings, and the comb rings it at the current value of the Pitch knob. External audio signal coming back in fades it out again, so the module hands the voice back to you the moment you feed it something. Every knob works on the self-played voice exactly as it would on an input, and **Leech** adds drift and life.

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## Gestures.

The complete set of button and encoder gestures.

**FREEZE** **TAP**

Freeze on or off.

**FREEZE** **HOLD**

Latch freeze-edit mode ON or OFF. When freeze is tapped first time, it automatically reveals the freeze edit page.

**FREEZE** **GATE**

Follows the gate, high freezes.

**LOCK** **TAP**

Cycle pitch mode: Free, Semitone, Octave. In Clock mode, cycle clock ratio: Divisions, Octave, Free.

**LOCK** **HOLD**

Pitch lock on or off.

**MOD** **TAP**

Cycle envelope mode.

**MOD** **HOLD**

Enter mod-assign mode.

**MOD** **HOLD** + **IN LVL** **TURN**

Write the hidden output trim.

**MOD** **HOLD** + **LOCK** **TAP**

Clear all modulation routings.

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|                                                          |                                                                                              |
|----------------------------------------------------------|----------------------------------------------------------------------------------------------|
| ENCODER <b>CLICK</b>                                     | Mute or unmute the bank's current algorithm.                                                 |
| ENCODER <b>HOLD</b> + <b>TURN</b>                        | Changes length of bank active sequence.                                                      |
| COMB/MUTATE ALGORITHM BUTTON <b>TAP</b>                  | Toggle step and morph mode for that bank.                                                    |
| ENCODER <b>TURN</b>                                      | Cycles through algorithms.                                                                   |
| MOD <b>HOLD</b> + ENCODER <b>TURN</b>                    | Rolls that bank's un-muted sequence by one slot. Nothing happens if no algorithms are muted. |
| MOD <b>HOLD</b> + COMB ALGORITHM BUTTON <b>TAP</b>       | Roulette wheel-esque random comb algorithm selector.                                         |
| MOD <b>HOLD</b> + MUTATE ALGORITHM BUTTON <b>TAP</b>     | Roulette wheel-esque random mutation algorithm selector.                                     |
| ENCODER <b>HOLD</b> + MUTATE ALGORITHM BUTTON <b>TAP</b> | Fully bypasses Mutation engine. Toggles on or off.                                           |

Pitch modes: Free is continuous (default). Semitone and Octave snap to an equal-tempered grid anchored at C, so the same knob position lands on the same note in either quantized mode.

## Installation.

Serratus is a 24 HP Eurorack module. Power the case down before fitting it. The power header is not marked -12 V; it carries a RED STRIPE label on the back panel instead. Align the ribbon's red stripe with that RED mark (please note the included ribbon cable has a WHITE line instead of RED) which is the -12 V side. Fit the panel screws and power up. The LEDs run a short start sequence and settle within a second.

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## Calibration.

Input level is handled by an automatic baseline; In Lvl trims around it, with unity at noon. The pitch quantize modes, Free, Semitone, and Octave, are selected with a tap of [Lock] and need no setup.

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## Specifications.

|                                                                                                         |                                                                                                 |
|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| FORMAT                                                                                                  | Eurorack, 24 HP                                                                                 |
| DEPTH                                                                                                   | 39mm                                                                                            |
| POWER                                                                                                   | +12 V and -12 V; no +5 V required                                                               |
| CURRENT                                                                                                 | +12 V: 210 mA, -12 V: 30 mA, +5 V: 0 mA                                                         |
| AUDIO I/O                                                                                               | Stereo in, stereo out; rated to $\pm 10$ V                                                      |
| CV INPUTS                                                                                               | Some accept $\pm 5$ V, others accept only 0 to 5 V. Check the CV inputs and outputs list below. |
| SAMPLE RATE                                                                                             | 48 kHz, 32-bit float internal                                                                   |
| PLATFORM                                                                                                | Daisy Patch SM 64MB SDRAM (STM32H750, Cortex-M7, 480 MHz)                                       |
| PITCH RANGE          | 10 octaves, 1 volt per octave                                                                   |
| CLOCKED DELAY RANGE  | 0.05 s to 21.8 s                                                                                |

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### CV inputs and outputs

|                    |                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------|
| BIPOLAR, $\pm 5$ V | Pitch (V/Oct), <a href="#">Etch</a> , Rend, Bind, Ebb, Flow, Feed, In Lvl, Matter, <a href="#">Leech</a> |
|--------------------|----------------------------------------------------------------------------------------------------------|

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|                           |                                        |
|---------------------------|----------------------------------------|
| <b>UNIPOLAR, 0 TO 5 V</b> | Mix, Comb morph, Mutation morph, Orbit |
|---------------------------|----------------------------------------|

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|                |        |
|----------------|--------|
| <b>GATE IN</b> | Freeze |
|----------------|--------|

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|               |                             |
|---------------|-----------------------------|
| <b>CV OUT</b> | Envelope follower, 0 to 5 V |
|---------------|-----------------------------|

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|-------------------|-------------------------------------------------------------------------------------------|
| <b>PROTECTION</b> | Every input is hard-clamped and tolerates out-of-range voltage, although not recommended. |
|-------------------|-------------------------------------------------------------------------------------------|

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In Clock mode the Pitch jack reads a rising-edge clock instead of a pitch voltage.

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## Credits.

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