PHASEBURN MUSIC

PHASEBURN ONE

User Manual

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About this manual

Phaseburn One is a professional monophonic synthesizer — monophonic by design, built from published research together with algorithms of our own, and an emulation of nothing. This manual is written for producers: each chapter leads with what a section of the instrument does musically, then works down to every control. All parameter tables are generated directly from the instrument's own parameter definitions.

The web version of this manual lives at https://phaseburn.music/docs, where it is searchable and always current. This document is the complete manual — all eleven chapters, typeset as one book.

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CHAPTER 01

Getting Started

Install Phaseburn One as a VST3 or CLAP plugin, find your way around the window, and make your first sound in five minutes.

Phaseburn One is a plugin instrument: it loads inside your DAW like any other synth, and you play it from the keyboard, the piano roll, or its own sequencer. It is monophonic by design — one voice at a time, so every cycle of the engine goes into making that voice as rich as it can be. This chapter gets it installed, walks you around the window once, and has you making sound inside five minutes. Everything after this is depth.

Phaseburn One is free through its beta period. It is early software — version 0.1.0 — and there is one build for everyone: free to use until October 15, 2026, then a demo (with a brief periodic dip) until you register a perpetual license, which you can do any time.

Install

Phaseburn One ships in two plugin formats — **VST3** and **CLAP** — for **macOS** (11 or newer, Apple Silicon and Intel) and **Windows** (10 and 11, 64-bit). Both formats hold the same instrument; install whichever your DAW prefers, or both.

Each platform has a real installer — grab it from the download page, quit your DAW, and run it:

- **macOS:** open the `.pkg` and follow it through. One of its steps is a format pane with **VST3** and **CLAP** both ticked — untick either one to skip it, and note that unticking CLAP re-ticks VST3, so an install can never end up with no plug-in at all. The formats you keep land in the system plug-in folders under `/Library/Audio/Plug-Ins`, or just for your account if you pick that option, and hand-copied builds left in those folders are cleaned up.
- **Windows:** run the setup `.exe` and pick an installation type — **VST3 and CLAP (recommended)**, **VST3 only**, **CLAP only**, or **Custom** to tick the components yourself; Custom will not let you continue with both formats unticked. The plug-ins land in the standard `C:\Program Files\Common Files\VST3` and `\CLAP` folders, where every host looks.

Unticking a format only skips installing it — neither installer removes a copy that is already there. If you want a format gone, delete its bundle from the folder above.

Then start your DAW and let it rescan its plugins — most hosts do this on launch, and most have a “rescan” button in their plugin preferences if not. Once the scan finishes, Phaseburn One appears in your instrument list; add it to an instrument track the way you add any synth. Installing a newer build over an older one is safe for everything that is yours: your user banks, your favorites and your license stay exactly where they were, and saved projects recall the sound they stored. The one thing that does move is the factory library — it ships inside the build and is still being curated, so a new beta

build brings a new set of factory banks. If a factory patch has become the basis of something of yours, press SAVE and put it in a user bank first; **The factory banks (Chapter 9 — Presets & Banks)** has the full story.

During the beta the installers are not yet code-signed, so your operating system may hesitate before a new publisher — that is normal caution, not a sign of trouble. On macOS, if double-clicking the `.pkg` is refused, right-click it and choose **Open**, or allow it under **System Settings → Privacy & Security**. On Windows, if SmartScreen interrupts, click **More info → Run anyway**.

Prefer placing files yourself? The same bundles can be hand-copied into `/Library/Audio/Plug-Ins/VST3` / `CLAP` on macOS or `C:\Program Files\Common Files\VST3` / `CLAP` on Windows — the installer exists so you never have to. If your host does not see the plugin after a rescan, confirm the format you installed is one it loads and that it scans the standard folder.

That is the whole install — no account needed. The build is free to use until October 15, 2026; after that it keeps working as a demo until you activate a license. How that works, and how to activate, is the next section.

Licensing & registration

There is **one build for everyone**, and it never stops working. It is completely free to use until **October 15, 2026**. After that, an unactivated build simply continues as a **demo** — the full instrument, fully playable, with a gentle few-second dip in the sound roughly every couple of minutes. Activating a license removes the dip; nothing else about the plugin changes between the free, demo and activated states.

Buying. A license is **€149 one-time** — perpetual, with free updates across the 0.x series. **Sales open October 15, 2026** on the buy page; pay securely by card and your license key arrives by email the moment payment clears. If you already hold a key — licenses are also granted during the beta — you can activate it at any time.

Activating. Open Phaseburn One and **click the logo** in the corner. Paste your license key and click Activate — that takes an internet connection once, a couple of seconds. The badge disappears, and the help bar along the bottom now reads “Registered to <your email>” when idle. From then on the license is stored on this machine and verified **fully offline** — the plugin never phones home again.

What DRM-free means for you. After that one activation, your license lives on your machine, not on our servers:

- **Activate once, offline forever** — no account, no dongle, no always-online check. It cannot be switched off remotely, and it keeps working even if our servers ever go away.
- **Use it on up to 3 of your machines at once** — studio desktop, laptop, live rig. Moving to a new machine? Free the slot yourself on the license page — self-service, with a fair-use cap of a few deactivations in any 30-day stretch (contact us if you genuinely need more).
- It **survives plugin updates**: install a newer build and you are still registered.

A machine with no internet at all? The plugin's activation panel shows a **machine code**. Type it into the license page from any other device, download the `.pblicense` file it gives you, and drop that onto the activation panel — done, and it stays offline forever.

Moving machines, renaming, reinstalling. The license page is self-service: see your activated machines, rename them, deactivate one to free its slot, or activate an offline machine — sign in with your license key or a link we email you. Reinstalling on the same machine never costs a slot. Lost your key? Re-send it from the same page using the address you bought with.

A tour of the window

Across the top of the window sits the **preset navigator** — the current preset name flanked by prev/next arrows that step through the presets, and which you click to open the browser — then a single row of five tabs. **INIT** resets the engine to a blank default, and the **transport** at the right holds a master volume slider, an output meter and the **L** limiter switch. That switch is also the only thing that gives Phaseburn One any latency: on, it reports 1.5 ms of look-ahead to your host, which compensates for it; off, it reports none. Flipping it mid-session makes the host redo its delay compensation, so set it once and leave it. Playback comes from your DAW — its transport runs the sequencer. The whole instrument lives on those five tabs; you are never more than one click from any of it.

Along the bottom of the window runs a one-line **help bar**. Rest the pointer on any control or module and it describes what you are pointing at — it is always on, and it is the only place the instrument explains itself, so nothing ever floats over what you are working on. Some controls put live readings there too: hover a patchbay cable's gain knob and the bar shows its level in decibels. The **DOCS** button opens the related chapter of this manual right inside the plugin — with a contents list for jumping between chapters and a link to the full version on the website — and every control's right-click menu has an **Open in manual** entry that lands on the same spot. Until you touch anything, the bar shows your licence state — beta, demo or who the instrument is registered to.

OSC, **FX**, **MOD** and **MIX** build the voice — each underlined in its own signature color when active. **OSC** holds the four sound sources — the Phase-Locked Loop (PLL), the VECTOR phase-shaping oscillator, the MORPH oscillator and the sub. **FX** is the filter and the effect rack. **MOD** is the LFOs, envelopes and step modulators that make things move. **MIX** balances the sources and sets the master section. Each is a chapter of this manual: **the oscillators (Chapter 2 — Oscillators)**, **the filter (Chapter 3 — The Filter)**, **the effects (Chapter 6 — Effects & Master)**, **modulation (Chapter 4 — Modulation)** and **the mixer and patchbay (Chapter 5 — Mixer & Patchbay)**.

GROOVE — underlined blue when active — is Phaseburn One's own note engine, a probability engine rather than a step grid. The **SEQ** switch on the tab arms it: with SEQ off it writes no notes while the modulation sequencers and the MIDI you send keep running. That switch is remembered per instance and travels with your DAW project. The **GENERATE** module spans the top of the page, with the three sub-tabs pinned to its right. **Beats** comes first and holds the probability grid; **Strength** decides how hard each beat lands; both carry a row of modules along the bottom for note length, velocity and timing feel. **Notes** holds the pitches the engine draws from, plus the PERFORM module

— pool Density and Register, transpose, MIDI Mode and velocity lock. It has its own two chapters: **the sequencer (Chapter 7 — The Sequencer)** and **Suggest (Chapter 8 — Suggest)**.

There is no separate settings page. What used to live there is now one of three things: in the PERFORM module on the Groove page's Notes tab (MIDI Mode, velocity lock), a right-click away on whichever control it affects (MIDI learn, still covered in **the MIDI chapter (Chapter 10 — MIDI & Your DAW)**), or simply a fixed, DAW-optimized default with no panel control at all — covered in **the reference chapter (Chapter 11 — Reference)**. And the **Presets** browser, reached from the navigator, is **its own chapter (Chapter 9 — Presets & Banks)**.

Your first sound in five minutes

Load Phaseburn One on an instrument track, then click the **preset navigator** at the top to open the browser. Pick anything from a factory bank — the list loads a preset the moment you click it — and play a note. You are hearing the full instrument; every preset is a finished starting point, not a demo.

Now change it with one knob. Open the **OSC** tab and find the **PLL** section — the Phase-Locked Loop is the main voice, a circuit that chases the pitch of a reference and never quite settles. Turn its **TRACK** knob down and play: the loop loosens, hunts and glides into each note instead of landing on it. Turn it up and the pitch locks solid. That one control is the difference between a weighted bass and a siren, and it is the fastest way to hear what makes this synth its own. **The oscillators chapter (Chapter 2 — Oscillators)** covers the rest of the loop.

Now let the instrument play itself. Open the **GROOVE** tab, confirm its **SEQ** switch is on — it is by default — and press **BEATS** in the generate row across the top. Then press play in your DAW: the sequencer runs from the host transport, in time with your project. It writes a groove from music-theory rules and plays it through your sound — hit BEATS again for a different one, press **BOTH** to write a matching melodic voicing with it, or reach for **Vary** on the Beats tab to mutate what you have; **Undo** beside it walks back the last ten grid edits. **The Suggest chapter (Chapter 8 — Suggest)** covers the groove families; **the sequencer chapter (Chapter 7 — The Sequencer)** covers how the notes are chosen.

That is a preset, a signature knob and a generated groove — the shape of most sessions with Phaseburn One. From here, follow whatever you just heard into its own chapter.

No sound? Check these

Silence almost always traces to one of a few ordinary things. Walk this list before suspecting the plugin:

Nothing loaded. If the preset footer reads "No preset loaded," click the navigator and choose one, or press a key with INIT's default patch — a blank engine can sit very quiet until you raise a source.

Playing the keys, still silent. Confirm your DAW is sending MIDI to this track: the track is selected or record-armed, and your controller feeds it. Phaseburn One plays notes you send in its default input mode; **the MIDI chapter (Chapter 10 — MIDI & Your DAW)** covers the routing.

The sequencer won't run. Start your DAW's transport — with Host Sync on, the default, the sequencer plays exactly when the host plays, so a stopped host holds it still. If the host is rolling and you still hear no pattern, check the **SEQ** switch on the Groove tab: with it off the note sequencer stays quiet while the rest of the instrument carries on. **The MIDI chapter (Chapter 10 — MIDI & Your DAW)** covers Host Sync and free-run.

Levels down somewhere. Each source has its own volume, the master section has one more, and the transport carries a master volume slider. A single source turned down can silence the voice while everything else looks fine — check the section volumes on the **MIX** tab and the master volume in the transport, and watch the transport's output meter for signal. **The mixer chapter (Chapter 5 — Mixer & Patchbay)** maps the levels.

Anything that survives this list is worth telling us about. Phaseburn One is v0.1.0, and the open beta exists to find exactly these edges — the contact form reaches the people building it.

Where to go next

This manual follows the signal. For the voice itself, start with **the oscillators (Chapter 2 — Oscillators)**, then shape it through **the filter (Chapter 3 — The Filter)** and **the effects (Chapter 6 — Effects & Master)**, and set it moving with **modulation (Chapter 4 — Modulation)**. For rhythm and generated lines, read **the sequencer (Chapter 7 — The Sequencer)** and **Suggest (Chapter 8 — Suggest)**. For routing anything into anything, see **the mixer and patchbay (Chapter 5 — Mixer & Patchbay)**. To play it from hardware or your DAW's timeline, **the MIDI chapter (Chapter 10 — MIDI & Your DAW)**. When you want the browser and the factory banks in depth, **the presets chapter (Chapter 9 — Presets & Banks)**. And when you need an exact number, **the reference (Chapter 11 — Reference)** lists every parameter.

> Why the host transport matters
>
> With Host Sync on — the default — your DAW's transport is the instrument's transport: the sequencer plays when the host plays and stops when it stops. It keeps its own beat clock and continuously corrects it against the host's timeline, so it lands on the right step wherever you drop the playhead and follows tempo changes and loops. A stopped host leaves it nothing to correct against, so it waits. Switch Host Sync off — it is a host parameter, reached from your DAW's automation rather than the window — and the sequencer free-runs instead, catching the host's phase once at the start and taking its run state from the host-exposed Sequencer Enable parameter. The SEQ switch is a separate question: it decides whether the note sequencer takes part at all, while the transport keeps driving the modulation sequencers either way. **The MIDI chapter (Chapter 10 — MIDI & Your DAW)** has the detail.

CHAPTER 02

Oscillators

The four sound sources — the Phase-Locked Loop voice, Vector Phase Shaping, the MORPH oscillator and the sub — and how to play each one.

Everything you hear from Phaseburn One starts with four sources: the Phase-Locked Loop (PLL) that gives the instrument its voice, a VECTOR phase-shaping oscillator, the MORPH oscillator with its twelve waveform families, and a sub. This chapter walks through each one — what it is for, how to play it, and every control it exposes.

Four sources, one voice

Pick the sources you need, balance them with four volume knobs, and the instrument plays them as a single line. All four live on the **OSC** tab — a section each for the PLL, VECTOR, MORPH and the sub — and every section ends in its own volume knob. Their outputs sum into one voice: Phaseburn One is monophonic by design, so the entire processing budget goes into making that one voice deep rather than eight shallow ones.

Each source has a distinct job. The PLL is the lead character — a feedback circuit whose struggle to stay in tune is the tone itself, covered in the next two sections. VECTOR is the sculptor: two knobs bend a wave from soft to snarling, with a formant mode for vowel-like resonances. MORPH is the conventionalist, holding every classic waveform and a few less classic ones on a single morphing knob. The sub is the anchor: low-end weight with shape and saturation controls, and routing that keeps it clean when the rest of the patch gets violent.

Blending is direct: raise the volume of what you want, pull down what you don't. The volume knobs top out at unity, so the balance you set is the level the mix bus receives, and the same four volumes reappear as channel faders on the Mixer tab. There, each pitched source also gets a PAN knob — a constant-power stereo balance that is bit-transparent at centre and a modulation destination in its own right, so a source can sit off to one side or swing across the field under an LFO. Stereo character itself comes from the pitched sources — the PLL, VECTOR and MORPH each run independent left and right engines, so width is built at the point of generation instead of being pasted on afterwards. The sub is the exception: it is mono, feeding both channels equally with no pan, which keeps the low end centered where it belongs.

The tables at the end of each section in this chapter list every parameter with its range and default; the same data, compact and complete, lives in **the full parameter index (Chapter 11 — Reference)**. Prose in this chapter deliberately avoids repeating numbers the tables already carry.

The Phase-Locked Loop

Make a note lock solid and weighty, then loosen the loop until the pitch has to fight its way to every note. The Phase-Locked Loop (PLL) is Phaseburn One's main voice, and the fight is the sound.

A phase-locked loop comes from radio engineering. One oscillator listens to a reference signal, measures how far its phase has drifted, and corrects itself continuously. In every textbook application the loop exists to erase that error as fast and as invisibly as possible. Phaseburn One is built on the opposite idea: the error is the interesting part. An ordinary oscillator jumps to a new pitch instantly and perfectly. A loop has to *get there* — it notices it is wrong, accelerates, brakes, overshoots, corrects again — and that whole struggle happens at audio rate, in the waveform itself. Engineers spend careers suppressing this behavior. Here it has knobs.

Keep the loop tight and it locks: solid pitch with analog character, because the correction never fully rests — a live feedback process breathes under the tone. Loosen it and the chase becomes audible: the oscillator glides toward each note, overshoots, rings around the target before settling. Fast lines turn into sirens; held notes with the loop barely holding on turn into growls.

Three knobs are the core, and they map directly onto the physics:

TRACK sets how fast the oscillator chases the reference. High values snap to the note; low values drag, so every interval becomes a glide the loop has to earn. Push TRACK high enough and it overtracks — the loop overshoots in bursts.

DAMP sets how hard the correction brakes. Heavy damping eases into the target pitch. Light damping arrives too fast, overshoots, and rings — a pitch that wobbles around the note before it lands.

INFLUENCE sets how much the reference pulls at all. Back it off and the oscillator only half-believes the note you played; the loop drifts, leans, and finds its own way there.

None of these are macros over hidden parameters — they are the loop's actual coefficients, scaled to musical ranges. The reference the loop chases is an oscillator of its own, and you can move the target: transpose it with the octave and tune controls, or detune it slightly with the fine control so the lock leans and slowly beats. OCTAVE reaches four octaves down from whatever you play, which on a low note takes the reference under hearing — territory with its own rules, described at the end of the next section.

Pushing the loop

Sirens, growls, interval chases and squelching acid lines all come out of the same handful of controls, because they are all the same circuit failing in different directions. No matter how hard you shove the loop, it always wants to come home — every excursion bends back toward the note you played. That gravity is what keeps the chaos playable.

MULT, DIV and DIV LOCK. The loop can track at a ratio of the reference instead of the note itself. MULT climbs in doublings, octave by octave; DIV divides. Together they set the ratio the loop chases

— note × MULT ÷ DIV — and RATIO SLEW glides between settings over a musical length of time, so interval sweeps become something you perform rather than program.

Both ratio knobs carry an **S** badge, and both arrive with it lit. Snapped, they land only on the whole ratios above, one detent per drag step. Switch the badge off and the same knob sweeps everything in between — ×3, ×5.5, ÷2.75 — for ratios that beat against the note instead of consonating with it. Toggling the badge never moves the sound: it changes how the knob travels, not where the loop is, so you can find a ratio free-hand and then relight the badge to keep the dial on the detents.

Alone, MULT only ever reaches octaves, which the OCTAVE knob already does. DIV is what makes the ratio *musical*: it is the second divider of every hardware frequency synthesiser, and dividing by something that is not a power of two lands the loop on intervals no amount of MULT can reach. Divide by three and the oscillator drops a twelfth below the note; by five and by seven it descends the undertone series, the mirror image of the harmonic series and the reason organ builders bothered with subharmonics at all. Combine the two and the ratios turn into intervals: MULT 4 over DIV 3 is a perfect fourth above, 8 over 5 a minor sixth, 8 over 3 an octave and a fifth. Because the whole ratio is one number to the loop, DIV inherits everything MULT has — the glide, the modulation and the snap grid.

The DIV LOCK switch — a divider lock, and a different control from DIV — decides what “track at a ratio” means. Off, the loop chases the ratio the way it always has: the correction never finds a true resting point at the target interval, and the residue is a gritty shimmer of extra frequencies clustered around the note. On, a divider goes into the loop’s feedback path, and the oscillator genuinely locks to the ratio — MULT and DIV become an interval selector with the solid, glued quality of a true lock, a slow hunting wobble when disturbed, and an audible swoop as it captures each new note. Ratios that are not whole harmonics need that lock to hold their tuning; without it they are a pitched fight rather than a note, which is its own instrument.

Four detectors. The part of the loop that measures being wrong is the phase detector, and the detector selector picks its temperament. **PD** is a smooth analog-style comparator: it measures continuously and produces a rounded, elastic error — the misbehavior stays melodic. **EDGE** reacts only at signal edges, so the error arrives in abrupt decisions: locks are snappier, failures are harsher, and the same TRACK and DAMP settings turn noticeably more aggressive. **XOR** is the classic logic-gate comparator: it settles a quarter-cycle off-center and lets a fast ripple leak into the correction as a constant buzz, and because it hard-limits whatever reference it hears, it will happily lock onto odd harmonics instead of the note — a detector with opinions. **S&H** samples the loop’s position once per reference cycle and holds it, so the correction moves in steps: quiet and steady when the loop is relaxed, audibly hunting in staircase wobbles when TRACK and INFLUENCE push it — and with GRIT feeding the detector noise, the held value itself turns random, a pitch that stumbles around the note. A companion parameter, edge sensitivity, sets how small an edge still counts for the edge-triggered detectors — it has no panel control and is reachable only as a host automation parameter.

The reference below hearing. Wind OCTAVE far enough down on a low note and the reference falls under the bottom of the audio range — a few cycles per second, then less than one. The loop keeps working; it stops being about pitch. Its edges become rhythm, and the controls you were using to tune a note now shape a pulse. PD compares phase continuously, so it simply follows the reference

down: the oscillator sits on it, and with OUT SHAPE toward pulse the voice turns into a click train you play from the keyboard, or a drone you can beat against another voice. EDGE has nothing to measure between one edge and the next, so it ratchets — long still stretches broken by a fast chirp each time the reference crosses. XOR breaks into bursts. S&H holds its last measurement until the next edge arrives, which down here is a very long hold; below a couple of cycles per second it wanders rather than tracks, exactly as hardware sample-and-hold loops do. Nothing in the signal path strips this material out: sub-audio output moves woofers and pumps a limiter at the reference rate, so the master high-pass is worth switching on when a patch lives down there.

Patches saved before the reference could go this low keep the behavior they were written against, where it stopped at the bottom of hearing and the lowest OCTAVE settings on a bass note all sounded the same. The switch that carries that choice, PLL Ref Floor, has no panel control and is reachable from a host's parameter list; setting it to FULL opens an older patch up. It also clears a tuning error the old limit caused — with the reference pressed against the bottom the loop's hunt was cut off on one side only, which dragged the pitch of low EDGE patches sharp by as much as a third of an octave.

Injection, bursts, and the loop lab

Past the detectors and the lock, the loop takes passengers: signals fed into its correction path on purpose, a chaos drive that takes its stability away, and a rack of four ways to break the servo itself. This is where growls, whoops and glitches live.

BURST and INJECT. BURST is overtrack intensity: push TRACK above the threshold you set with BURST THR and the loop's own overshoot feeds back into the correction as extra kick, scaled by BURST AMT — chirps, whoops and squeals that always resolve back to pitch. The threshold works in every color mode, so it is always on the panel. INJECT feeds the reference straight into the correction path, from a subtle undertow of growl at the bottom of its range to controlled chaos at the top. A switch beside it picks what the injection *is*: **INJ FM** modulates the pitch with the reference waveform for sideband growl, while **INJ LOCK** is true injection locking — the reference captures the oscillator and holds it within a range set by the amount, so detune the reference and the tone bends, fights, then breaks free at the edge of the capture range and snaps back when you return. (It is a different lock from DIV LOCK — one couples the injection, the other divides the feedback path.) RANGE narrows the main loop's own lock bandwidth — the chase, not the injection — so low settings hunt slowly toward the note like a worn analog circuit.

CHAOS. The loop normally settles at a stable equilibrium; CHAOS takes it away. The knob — first in the advanced row — overdrives the detector's error curve until competing lock points appear, raises the loop gain past where the servo can settle, and slows the error smoothing so every correction arrives a little too late — while a slight keytracked wander keeps the fight seeded. Low settings ring the loop into a vibrato-like growl. The middle mode-hops between rival equilibria in period-doubled warbles. At the top the correction scribbles chaotically around the note without ever abandoning it, because everything still happens inside the loop's own limits — RANGE, the integrator's saturation and the detector all keep their say, so each detector breaks down with its own accent.

The COLOR switch adds harmonics drawn from the loop's core, with a mode menu picking the flavor. **HARM** blends in an upper partial that climbs with MULT — bright, glassy, sometimes gloriously rude — and **SAT** drives the output itself into saturation, from a gentle analog warmth at zero to a soft square rasp at full; in both, SATURATE sets how much. **FOLD** synthesizes a fold-back partial — the clang of a harmonic reflected off a virtual rate at RATIO times the note — with FOLD setting its level and RATIO choosing the inharmonic interval, which stays constant across the keyboard because the fold rate tracks the note. SATURATE, FOLD and RATIO all stay on the panel in every mode; the mode menu decides which of them the engine is listening to. Beside the mode menu sits the **RAW / CLEAN** switch: RAW, the default, lets the FM operator and HARM's partial fold past the audio band into the rich high-register hash the factory sounds were voiced against; CLEAN tapers and clamps them for clean ringing at the top of the keyboard. An FM section modulates the output oscillator at a ratio of the pitch — the FM and FM RATIO knobs in the advanced row. An envelope-to-FM depth — for attacks that clang and then settle — exists as a host automation parameter only, with no panel control.

The loop lab. Four knobs break the servo itself — they follow CHAOS in the advanced row — each one a real defect of hardware loops pushed to musical extremes, each a modulation destination, and all of them at zero by default, where the loop is exactly the stock circuit. **STEP** samples-and-holds the whole correction at a servo rate: continuous at the bottom, and as it slows the pitch hunting starts moving in discrete steps — R2-D2 chirps, bubbling glitch arps, gated glissandi. **GRIT** feeds noise into the phase detector upstream of the loop smoothing, so TRACK sets its color: analog fizz at low drive, a drunk wobble in the middle, a full random stumble at the top — every detector gets the trick the old noise reference reserved for S&H. **LAG** inserts a transport delay into the correction path, up to thirty milliseconds, so the loop steers by where the note *was*: metallic servo flutter at short settings, standing-wave hunting and time-smeared chases at long ones. **RELOCK** opens and closes the loop in a cycle, from a slow breath up to twelve times a second: while open the corrections freeze and the pitch sags away; at close the loop wakes to everything it missed and fights its way home — the capture swoop, the best sound a PLL makes, on demand.

The Tight switch and the loop math

The TIGHT switch selects the precision loop: coefficients derived from control theory's natural-frequency and damping-ratio formulation, on a cubic response curve. TRACK is a real loop bandwidth in hertz there and DAMP a real damping ratio, and the two gains stay in the relationship the mathematics requires, which is why the controls stay independent of each other. Switched off, a looser legacy loop with simpler coefficients takes over, and the controls change meaning: TRACK stops setting the gains at all — it moves only the error filter — while DAMP scales both gains down together rather than braking the loop. Same controls, baggier feel, and a noticeably narrower swing when the loop hunts. Edge timing is not part of the switch: the edge-triggered detectors interpolate their crossings between samples in both modes. The loop runs per-sample on the 64-bit signal path, with a sine core whose distortion figure is vanishingly low (our own measured targets). Stereo is two complete, independent loops: TRACK Δ and DAMP Δ give the left and right channels different chase behavior, so the channels arrive at each note differently and the width comes from the physics rather than a widener.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
PLL FM Amount	0 – 2	0	FM depth on the loop's output oscillator — from gentle shimmer to clangorous sidebands.
PLL FM Ratio	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8	1	Whole-number FM ratio steps for harmonic sidebands; the continuous FM RATIO knob is the UI's version.
PLL FM Ratio Free	Off / On	Off	Unlocks the FM ratio from whole-number steps for inharmonic in-between ratios.
PLL FM Ratio Float	0.10 – 32.00	1.00	The FM modulator's frequency as a multiple of the pitch — whole numbers stay harmonic, fractions clang.
PLL FM Expand	Off / On	Off	Widens the selectable FM ratio range for more extreme sideband spreads.
PLL Track Speed	0 – 1	0.5	How fast the loop chases the reference — low drags and glides, mid locks solid, high overtracks into bursts.
PLL Damping	0 – 1	0.3	How hard the correction brakes — low overshoots and rings around the pitch, high settles smoothly.
PLL Multiplier	x1 – x64	x1	Locks the loop onto a multiple of the reference, ×1 to ×64 — continuous, so ×3 and ×5.5 are reachable with SNAP off.
PLL Mult Snap	Off / On	On	SNAP for MULT — constrains the knob to the whole doublings ×1 … ×64. Toggling it never moves the ratio, only how the knob travels.
PLL Divider	/1 – /8	/1	Divides the loop ratio, ÷1 to ÷8, so MULT ÷ DIV reaches intervals octaves cannot — undertones below, fourths and sixths above.
PLL Divide Snap	Off / On	On	SNAP for DIV — constrains the knob to the whole divisors ÷1 … ÷8. Toggling it never moves the ratio, only how the knob travels.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
PLL Colored	Off / On	Off	Switches the loop's coloring stage on — HARM or SAT flavor, with Saturate setting how much.
PLL Color Mode	HARM · SAT · FOLD	HARM	Color flavor: HARM adds a bright upper partial, SAT drives into warm saturation, FOLD synthesizes a keytracked fold-back clang.
PLL Fold Amount	0 – 1	0.5	Level of the FOLD partial — how loud the synthesized fold-back clang sits against the core tone.
PLL Fold Ratio	1.0 – 64.0	11.4	Virtual fold rate as a multiple of the note pitch — which inharmonic interval the clang lands on, constant across the keyboard.
PLL Raw Mode	Off / On	CLEAN	RAW / CLEAN — RAW lets FM and the HARM partial fold past the audio band for rich high-register hash (the voiced default); CLEAN tapers and clamps them for clean top-end ringing.
PLL Ref Floor	Off / On	FULL	FULL / LEGACY — how low the reference may go. FULL reaches below hearing on any note; LEGACY keeps the old bottom limit of the audio range, which patches saved before the change were voiced against.
PLL Divider Lock	Off / On	Off	DIV LOCK — puts a divider in the feedback path so MULT and DIV become an interval selector the loop genuinely locks to.
PLL Detector	PD · EDGE · XOR · S&H	EDGE	How the loop measures being wrong: PD is smooth, EDGE snaps at edges, XOR buzzes, S&H holds and hunts in steps.
PLL Mult Slew	Off / On	On	On = MULT changes glide between steps instead of jumping.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
PLL Ratio Slew Time	0 – 1	0.15	Glide length for MULT and DIV changes, in beats — from a sixteenth-note snap to a slow eight-beat sweep.
PLL Ref Octave	-4 … 4 (9 steps)	0	Octave shift for the reference oscillator — the loop chases the transposed target. Four octaves down takes the reference under hearing on low notes, where its edges become rhythm rather than pitch.
PLL Ref Tune	-12 … 12 (25 steps)	0	Semitone offset for the reference — sets fixed intervals for the loop to chase.
PLL Ref Fine	-100 ct – +100 ct	+0 ct	Fine detune of the reference; small offsets make the lock lean and slowly beat.
PLL Chaos	0 – 1	0	Drives the loop past stability — wobble, then mode-hopping warbles, then bounded chaotic scribble that still gravitates to the note.
PLL Feedback	0 – 1	0	Feeds the output back into the reference — thickens the tone, then destabilizes the lock.
PLL Influence	0 – 1	0.50000006	How strongly the reference pulls — low lets the pitch drift and find its own way to the note.
PLL Volume	-inf dB – 0.0 dB	-inf dB	PLL level in the oscillator mix.
PLL Pan	L100 – R100	C	Stereo balance of the PLL voice — constant-power, transparent at centre, and a modulation destination.
PLL Stereo Damp Δ	0 – 0.5	0	Splits damping between L and R so each channel rings differently — stereo width from the loop itself.
PLL Glide	0.0 – 5000.0	0.0	Always-on portamento — how long pitch takes to reach each new note.
PLL Burst Threshold	0 – 1	0.7	Error level that trips a burst — lower thresholds make the loop panic sooner.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
PLL Burst Amount	0 – 20	3.2999997	How hard the loop is kicked when the error trips the threshold — chirps, whoops and squeals.
PLL Loop Limit	1.0 – 500.0	100.0	Ceiling on the loop's internal correction — low limits choke the chase into gritty, compressed motion.
PLL Color Amount	0 – 1	0.25	Amount of harmonic saturation inside the loop — thickens and dirties the core tone; in SAT mode this is the drive.
PLL Edge Sensitivity	0.001 – 0.200	0.020	How big an edge the edge-triggered detectors need — smaller values react to the faintest edges.
PLL Range	0 – 1	1	Lock bandwidth — low hunts slowly toward the note like a worn analog circuit, high locks fast.
PLL Stereo Track Δ	0 – 0.5	0	Splits track speed between L and R — the channels arrive at each note at different times.
PLL Stereo Phase	0 – 0.5	0	Static phase offset between the L and R references for fixed stereo decorrelation.
PLL Precision	Off / On	On	Tight: strict loop mathematics with faster, more predictable locks; off is the looser legacy loop.
PLL FM Env Amount	-1 – 1	0	Routes the envelope to FM depth — bright, clanging attacks that settle as the note decays.
PLL Anti-Alias	Off / On	On	Alias suppression on the loop output; switch off only for deliberately raw digital edge.
PLL Injection Amount	0 – 2	0	Injects the reference straight into the correction path — a subtle undertow of growl at the bottom of the range, controlled chaos at the top.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
PLL Injection Mode	Off / On	Off	INJ FM / INJ LOCK — switches INJECT from FM to true injection locking; the reference captures the pitch within a range set by the amount.
PLL Feedback Div	0 · 1 · 2 · 3 · 4 · 5 · 6 · 7	0	Divider on the feedback path — steps the fed-back signal down before it re-enters the loop.
PLL Advanced	Off / On	Off	Swaps the PLL row for the advanced controls: output shape, FM, stereo offsets and the PLL filter.
PLL Out Shape	0 – 1	0	Morphs the loop's output from sine through triangle and saw to square — brighter as it rises.
PLL Step	0 – 1	0	Sample-and-holds the loop correction at a servo rate — pitch hunting turns into discrete steps: chirps, glitch arps, gated glissandi.
PLL Grit	0 – 1	0	Noise into the phase detector, colored by TRACK — analog fizz at low drive, drunk wobble, full random stumble at the top.
PLL Lag	0 – 1	0	Transport delay in the correction path — the loop steers by where the note was: servo flutter short, time-smeared hunting long.
PLL Relock	0 – 1	0	Cyclically opens the loop and lets it recapture — pitch sags while open, then swoops home on every relock.
PLL Enable	Off / On	On	Turns the PLL voice on or off.
PLL Tail	0.0 ms – 5000.0 ms	0.0 ms	Lets the PLL ring past release — extra fade time after the shared envelope has closed. Flip SYNC to set it as a note division instead.
PLL Tail Sync	Off / On	Off	Locks the PLL tail to the host tempo — the fade length follows a note division instead of a time in milliseconds.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
PLL Tail Div	1/1 … 1/128 (18 steps)	1/8	The note division the PLL tail rings for when SYNC is on.
PLL Input Ref	0 – 1	0	INPUT REF — blends the PLL's own reference against whatever is patched into PLL REF; at INT the loop is untouched, toward EXT it chases the incoming signal. It glides rather than steps, and it modulates.

Locking the loop to something else

Everything above assumes the PLL is chasing its own internal reference. It does not have to. The patchbay has a **PLL REF** jack, and whatever you patch into it becomes what the loop tries to lock to instead — including audio arriving from the host, whether Phaseburn is inserted on an audio track or fed from another track's send. The **INPUT REF** knob — on the PLL section's main row, just before OUT SHAPE — blends between the two: at INT the loop is exactly as described above, and toward EXT it hands the reference over. It is a modulation destination like everything else on that row, and it glides rather than steps, so an LFO or an envelope can open the loop to the outside world and close it again mid-note.

This is not pitch tracking, and it is more interesting than pitch tracking. The note you play still decides where the loop sits; the reference pulls it around within the capture range. Every control you already know becomes a way of shaping how the oscillator reacts to the incoming signal — how hard it grabs, how far it can be dragged, how it recovers:

- Feed a **drum loop** and open RELOCK and BURST. The pitch lurches on every transient and resolves back, so you get a tuned follower locked to the groove without a clock anywhere in the patch.
- Feed a **bass line or a vocal**, switch DIV LOCK on and bring MULT up. The loop locks a harmonic of the input rather than the input itself.
- Play deliberately **against** the incoming pitch. The servo cannot decide, and you get beating, chirping and slow chaotic wandering — the sound of a loop failing, which is the reason to have it.
- Switch the detector to **XOR**. It multiplies the input and the oscillator square together, which is ring modulation bound to the source's rhythm.

Level matters. The comparator only registers an edge once the reference crosses ±0.02 — about −34 dBFS — so a quiet input never triggers a lock at all. Drive AUDIO IN until its meter peaks near the top, which is roughly the amplitude of the internal pulse it is standing in for; the strip has +12 dB above unity for exactly that. The input is soft-clipped above −3 dBFS, so pushing hard costs character rather than stability.

The detector matters here. **XOR**, **S&H** and **EDGE** all read the incoming waveform directly. **PD** compares phase against a signal the input does not carry, so it keeps following the played note — useful when you want part of the loop anchored.

PLL REF also takes Phaseburn's own oscillators. Patch **MORPH**, **VECTOR** or **SUB** into it and you have cross-modulation with no host routing at all: one oscillator steering the loop. Those taps are one sample behind — the PLL is computed before the other oscillators inside the voice — which is exactly how patching one analog oscillator into another's reference input behaves.

Effects returns are deliberately not offered as reference sources. The effects run after the voice, so a reverb tail would arrive a whole block late, and a lock reference that stale smears every transient.

Coloration

Perfect stability is a digital habit; the coloration stage is where you break it. It applies its character to the PLL voice — the core of the instrument — rather than politely post-processing the mix, which is why its knobs — DRIFT, DRIFT RATE and TUBE — live in the PLL section of the Oscillators tab rather than next to the filter.

DRIFT lets the pitch wander. It applies a slow wobble to the PLL's reference — the pitch the loop chases. Low amounts read as an aged oscillator that no longer quite trusts its tuning; higher amounts become an audible, seasick waver. DRIFT RATE sets how fast the wander moves. When the PLL is spread into stereo (raise TRACKΔ or DAMPΔ — see **the oscillators chapter (Chapter 2 — Oscillators)**), the right channel's loop gets its own wander at a slightly different speed from a different starting point, so the two sides slip against each other and the stereo image slowly leans; on a mono PLL both channels share one wander. Because the wobble goes through the loop rather than around it, the PLL's own tracking behavior — lag, damping, overshoot — shapes the drift on its way to the output, which is why it feels like a machine misbehaving rather than an LFO on pitch.

TUBE is the matching wear on the amplitude side: soft-clip saturation on the PLL voice's output. Low settings round the peaks and thicken the tone; pushed hard it compresses the waveform's edges into a denser, warmer growl, and the dial keeps going past 100 into outright crush. DRIFT and TUBE are both live modulation destinations, so an LFO or step modulator can make the mess itself move — see **the modulation chapter (Chapter 4 — Modulation)**.

> Inside the drift
>
> The wander is a slow sine per channel rather than a random walk. With the PLL spread into stereo, the right channel's sine runs a tenth faster than the left's and starts from an offset phase, so the two sides slip against each other through a long, slow cycle instead of moving in lockstep; on a mono PLL both channels carry the identical wander. Both channels stay locked to the same note frequency — only the reference the loop chases is bent — so the effect detunes the chase, not the tuning.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Drift Amount	0 – 1	0	Slow sine wobble on the PLL reference; knob lives in the PLL section of Sound → Oscillators, not the FX tab. Per-channel divergence only when the PLL stereo path is engaged.
Drift Rate	0.01 – 5.00	0.30	Speed of the drift wander (Drift Rate knob, PLL section of Sound → Oscillators); right channel runs 1.1× the left's rate when the PLL is in stereo.
Tube Drive	0 – 2	0	Soft-clip saturation on the PLL voice output, past 100 it leans into heavy crush; Tube knob in the PLL section of Sound → Oscillators.

The VECTOR oscillator

Two knobs take one wave from soft and hollow to snarling — and the same two knobs can park a vowel-like resonance on any harmonic you choose. That is VECTOR — vector phase shaping, a technique published by Kleimola, Lazzarini, Timoney and Välimäki in 2011, implemented here in double precision.

Instead of filtering a bright wave or crossfading between stored shapes, VECTOR bends the *phase* that reads the waveform. Picture the wave's single cycle being traced by a clock hand: **X** and **Y** grab that clock hand and bend its path through one inflection point. **X** places the bend horizontally — how early or late in the cycle the distortion strikes — and **Y** sets its depth, which is the main timbre sweep. Low X with moderate Y is smooth and rounded; high X with low Y turns aggressive. Because you are shaping phase rather than amplitude, the sweep has a vocal, resonant quality that a filter sweep does not.

Formant mode. The FORMANT switch extends Y's reach into true formant synthesis: the resonant peak locks onto a harmonic of the note, and sweeping Y walks it up the harmonic series. Peaks are strongest when they sit exactly on a harmonic, so slow Y sweeps produce the stepped, vowel-like character of a voice changing shape. Melodies keep their formants in tune because the peaks are multiples of the fundamental.

Stereo divergence. X Δ and Y Δ spread the bend coordinates symmetrically around the panel values: the left channel shifts down by the offset, the right channel up. Both channels run at identical frequency, but because their phase paths differ, they gradually drift apart and the stereo image evolves over the length of a note — width generated by the shaping itself, not by delay or detune. This is deliberate, and for pads it is the VECTOR section's quietest strength.

Phase modes. A phase-mode parameter — host automation only, with no panel switch — chooses how each note begins. FREE starts each note at a slightly randomized phase, so repeated notes

vary. SYNC resets the phase to zero at every note-on for a consistent, hard-sync-like attack on each note.

A sine-based wavefolder (FOLD, with a range switch that folds far deeper) and a waveshaper (SHAPE, with Soft, Hard and Fold curves) stack on top for saturation and buzz. At extreme X and Y settings, raise the oversampling — a host-automatable engine setting with no panel control, fixed at 2x by default (see **Engine settings (Chapter 11 — Reference)**) — and the engine applies strong alias suppression, giving its cleanest results with headroom to work in.

Like MORPH, the VECTOR section carries TUNE and FINE: the interval in semitones and the cents either side of it, which is what you reach for when stacking VECTOR against another source and you want beating rather than a chord.

> **Where the formants land**
>
> With FORMANT on, the Y control maps to the range described in the Kleimola paper, and the formant peak lands at the harmonic $(2y-1)\times f0$ — Y at zero is the fundamental, mid-travel reaches the tenth harmonic, full travel the nineteenth. Peaks are strongest at whole-number harmonics. High Y positions add substantial harmonic content, which is the other reason to give this mode more oversampling.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Vector X	0 – 1	0.5	Horizontal position of the phase bend — higher X distorts the phase harder for a fiercer, brighter tone.
Vector Y	0 – 1	0.5	Depth of the phase bend — the main timbre sweep; with FMT on it chooses the formant harmonic.
Vector Stereo Y Δ	0 – 0.3	0	Gives L and R different Y values — the channels shape apart and slowly drift for evolving width.
Vector Volume	-inf dB – 0.0 dB	0.0 dB	VECTOR level in the oscillator mix.
Vector Pan	L100 – R100	C	Stereo balance of the VECTOR oscillator — constant-power, transparent at centre, and a modulation destination.
Vector Octave	-4 … 4 (9 steps)	0	Octave transpose for the VECTOR oscillator.
Vector Tune	-12 … 12 (25 steps)	0	Semitone offset for the VECTOR oscillator.
Vector Fine	-100 ct – +100 ct	+0 ct	Fine detune within a semitone — slow beating against the other sources.
Vector Fold	0 – 1	0	Sine-based wavefolder on the VECTOR output — folds peaks back into buzzing harmonics.
Vector Stereo X Δ	0 – 0.3	0	Gives L and R different X values — stereo divergence from a single oscillator.
Vector Shape Type	0 · 1 · 2	0	Waveshaper curve used by Shape: Soft, Hard or Fold — each clips with a different edge.
Vector Shape Amount	0 – 1	0	Drives the selected waveshaper for extra saturation on top of the phase shaping.
Vector Fold Range	0 · 1	0	Fold depth range — PI folds far deeper than 1X.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Vector Formant	Off / On	Off	Extends Y into formant territory — resonant, vowel-like peaks parked on harmonics.
Vector Phase Mode	0 · 1	0	Free starts each note at a random phase; Sync resets on the PLL reference cycle for hard-sync bite.
Vector Enable	Off / On	On	Turns the VECTOR oscillator on or off.

MORPH: twelve families on one knob

When a patch needs a saw that becomes a square, a vowel, a rising sync lead or a wall of detuned width, MORPH is where you go. It is the conventional-oscillator section — with the convention stretched: one knob, and a mode selector that decides which of twelve waveform families that knob travels through.

The six crossfade families blend their waveform pairs with equal-power crossfades, so perceived loudness stays even along the travel, and switching families mid-performance crossfades in a few milliseconds — no clicks, even with the knob under heavy modulation. The knob itself is a modulation destination, which is where this section gets fun.

The everyday crossfades. Saw to square, sine to saw, and triangle to square cover most bread-and-butter needs — pick the pair, set the knob, done. Saw-to-pulse narrows the pulse as it fades, turning increasingly nasal and resonant.

The sweeps. FULL runs five waveforms in a single travel — sine, triangle, half-rectified sine, saw, square — the complete gentle-to-bright range on one control, made for a slow LFO. RECT morphs sine through half- to full-rectified shapes: buzzy and organ-like, doubling in pitch at the top. HARM builds a saw additively, one harmonic at a time, and is inherently band-limited.

The performers. SYNC turns the knob into a hard-sync ratio — the classic rising harmonic sweep for leads, corrected at the sync point so it stays clean. SWRM (Swarm) is a detuned unison saw: seven voices per channel, the knob setting the detune spread, with the STEREO Δ control taking it from a true mono stack to full stereo width. STRS quantizes a sine into coarse steps for digital, retro grit.

The voice. FMNT is real formant synthesis: a bank of vocal-tract resonances shapes the oscillator the way a mouth shapes the vocal folds, and those resonances stay **fixed in frequency** no matter what note you play — so a vowel keeps its identity up and down the keyboard, and vibrato or glide sweeps the harmonics through the standing formants exactly the way a singer's does. The knob sweeps the vowel — A, E, I, O, U — for vocal pads and leads; with the PITCH switch on, the played note also shifts the vowel position — higher notes land on later vowels — and the knob offsets from there, stopping at the last vowel. Two controls appear only in this mode: **BREATH** mixes in aspiration noise shaped by the same resonances — from a hint of air to a whispered pad — and **SIZE** scales

the whole vocal tract, from big and dark to small and bright. Both are modulation destinations, so an LFO on SIZE talks and a slow ramp on BREATH exhales.

The wavetable. SPCL walks a spectral table from plain harmonics through tilted, combed and resonant spectra.

Around the morphing core: FOLD and SHAPE are the same wavefolder and waveshaper tools as the VECTOR section. TUNE and FINE set the interval and the cents — FINE is the control for the small detunes that thicken a stacked patch without pulling it out of key. STEREO Δ outside of Swarm detunes the left channel down and the right channel up for immediate width and slow chorus-like motion.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Morph Enable	Off / On	Off	Turns the MORPH oscillator on or off.
Morph Volume	-inf dB – 0.0 dB	-inf dB	MORPH level in the oscillator mix.
Morph Pan	L100 – R100	C	Stereo balance of the MORPH oscillator — constant-power, transparent at centre, and a modulation destination.
Morph Octave	-4 … 4 (9 steps)	0	Octave transpose for the MORPH oscillator.
Morph Tune	-12 … 12 (25 steps)	0	Semitone offset for the MORPH oscillator.
Morph Fine	-100 ct – +100 ct	+0 ct	Fine detune within a semitone for slow beating.
Morph Fold	0 – 1	0	Sine-based wavefolder on the MORPH output — buzzy folded harmonics.
Morph Fold Range	0 · 1	0	Fold depth range — PI folds far deeper than 1X.
Morph Shape Type	0 · 1 · 2	0	Waveshaper curve used by Shape: Soft, Hard or Fold.
Morph Shape Amount	0 – 1	0	Drives the selected waveshaper for extra saturation after the morph.
Morph Amount	0 – 1	0	The morph slider — sweeps through the family chosen by Mode with an equal-power, click-free crossfade.
Morph Mode	0 … 11 (12 steps)	0	Picks which of the twelve waveform families the morph slider travels through.
Formant Pitch Track	0 · 1	0	The played note also slides the vowel — higher notes land on later vowels; the knob offsets from there.
Formant Breath	0 – 100	0	Aspiration noise shaped by the same vowel resonances — from a hint of air to a whispered pad.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Formant Size	-100 – 100	0	Scales the whole vocal tract: big and dark below centre, small and bright above.
Morph Stereo Detune	0 – 1	0	Detunes L down and R up by up to 50 cents each — immediate width and unison-style thickness.

The sub

Anchor the low end with a source whose only job is weight. The sub tracks the played note at a whole-octave offset — the OCTAVE control chooses how far down, with its top position sitting at the played pitch itself. Like the other sources it rides the mix bus, so by default the main filter shapes it along with everything else; when a screaming resonance sweep must not hollow out the foundation, the routing choices below keep the floor solid.

SHAPE morphs the sub's waveform continuously through five stops: **sine, triangle, saw, square, and a narrowing pulse**. Leave it at sine for pure, invisible weight that a mix feels rather than hears; triangle and saw add just enough edge for the sub to read as a note, and square is the classic hollow foundation. Past square the pulse narrows continuously, down to a tenth of the cycle — reedy and nasal, with the energy moving up out of the fundamental. That last stretch is level-compensated, so the sub keeps its weight as the pulse thins instead of disappearing the moment you leave the square. SATURATE adds harmonics on top of whatever shape you chose — the practical effect is that the bass becomes audible on laptop speakers and earbuds, where the fundamental itself does not survive.

Routing is where the sub differs from the other three sources. On the patchbay a dedicated **SUB → FILTER cable** adds a direct send into the main filter — useful once you have pulled the sub off the mix bus but still want it filtered. And an **FX BYPASS** switch in the SUB section's own header — the same control as the FX BYPASS button on the mixer's SUB strip and the patchbay's SUB → OUT cable, all three mirrored — routes the raw sub around the tone-shaping chain entirely when engaged, injecting it near the output: heavy coloration, distortion and character stages on top, untouched fundamental underneath. Because the direct injection happens after the master high-pass, the bypass is also how a sub survives aggressive low-end cleanup. It is the difference between a bass patch that gets dirty and a bass patch that gets dirty while the floor stays solid.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Sub Volume	-inf dB – 0.0 dB	-inf dB	Sub level in the oscillator mix.
Sub Filter Route	off – 2.00	off	Direct line for the sub into the filter; connected or not — any level above zero opens the path in full.
Sub Octave	-3 · -2 · -1 · 0	-1	How far below the played note the sub sits, up to three octaves down.
Sub Shape	0 – 4	0	Morphs the sub through sine, triangle, saw, square and a narrowing pulse — the last stretch thins the pulse to a tenth of the cycle, level-compensated so the weight holds.
Sub Saturate	0 – 1	0	Saturates the sub — adds harmonics so the low end reads on small speakers.

Glide and legato

Make lines slur, slide and breathe instead of stepping. Phaseburn One has two independent glide mechanisms, and knowing which one fires when is the whole trick.

GLIDE lives in the PLL section and is always-on portamento: every note transition slides, taking the time you set to reach the new pitch. At zero, pitch changes are instant. Because the PLL is a loop chasing a reference, glide interacts musically with TRACK and DAMP — a slow glide with light damping arrives at the note, overshoots it, and rings, which no ordinary portamento does.

Legato is conditional: it fires only when notes overlap — a new note-on before the previous note-off. Raise the **Legato** slider off its bottom Off detent — it lives in the GLOBAL module below the beat grid on the **Groove** page — and an overlapping note does not retrigger the envelope; the sustain carries through and the pitch glides over the time you set, independent of GLIDE. A velocity-lock option, in the PERFORM module on the Groove page's Notes tab, keeps the held note's velocity through the transition, so a phrase keeps one dynamic level instead of jumping with every new finger.

The sequencer participates fully. When a step's note length pushes past its beat division, consecutive sequenced notes overlap — and with legato mode on, they take the legato path automatically: no envelope retrigger, smooth glide. Shorter steps articulate normally. This means one sequence can mix tied, sliding passages and punchy re-attacks purely through the note-length lane.

When several MIDI notes are held at once, the note-priority setting decides which one sounds: the most recent, the lowest, or the highest. It has no panel control — it is exposed to the host rather than drawn on the window — and low priority with legato gives the classic bass-player behavior: hold the root, hammer notes above it, and the line always falls back home when you release.

Oscillator independence

Pull pseudo-polyphony out of a monophonic instrument. Each of the four sources — PLL, VECTOR, MORPH and the sub — can independently sit out a note or play a different pitch than the one the voice was given. Two knobs in the OSC INDEPENDENCE module on the Groove page's Notes tab control it.

SKIP is a per-note probability that a source stays silent. When a note fires, every targeted oscillator rolls the dice separately: at moderate settings roughly half the sources sound on any given note, and the timbre thins and thickens from note to note. A four-source patch stops being one fused tone and becomes a small ensemble that does not always show up in full.

DRIFT is a per-note probability that a source plays a *different* note — chosen from the same note pool, with the same chance-and-strength weighting, that drives the sequencer's own note selection. At low values, an occasional source leans away from the line and adds interval color. At high values, each oscillator effectively walks its own melody: moving harmony out of one voice.

Four target switches decide which sources participate. Anything untargeted always plays the base note at full presence, so the usual move is to protect the anchor — leave the sub untargeted so the low end never gambles — and let the upper sources skip and drift above it. Both knobs are modulation destinations, so an LFO or step modulator can push a sequence from disciplined to scattered and back across a phrase.

Skip and drift are saved with the preset and roll fresh on every note, so no two passes through a sequence land identically — which is the point.

CHAPTER 03

The Filter

Two filter machines — transistor-ladder and state-variable — the dedicated filter envelope, and formant color built from filter technique.

Phaseburn One's four sound sources — the Phase-Locked Loop (PLL) voice, the VECTOR phase-shaping oscillator, MORPH and the sub — are summed into one mix, and that mix runs into one filter. Because the instrument is monophonic by design there are no per-voice filter copies to manage: a single filter with the whole CPU budget behind it, sitting after the oscillator mix and ahead of every effect. By default the whole mix goes through it, sub included, and the patchbay lets you re-cable which sources reach it. The filter section lives on the FX tab; the filter envelope is edited in the envelope panel at the bottom of the Oscillators tab. The coloration stage — the analog-mess controls that keep the voice from sitting perfectly still — belongs to the PLL and is covered in **the oscillators chapter (Chapter 2 — Oscillators)**.

The filter

Pick the machine before you sculpt. TOPOLOGY chooses between two complete filter designs that share one set of controls. The transistor-ladder is four saturating filter stages in series — the thick, vintage-flavored lowpass lineage — built after D'Angelo and Välimäki's published research on nonlinear ladder filtering. It colors everything it touches: push level into it and the stages bend, sweeps sound expensive, resonance turns vocal. The state-variable filter (SVF) is the surgical alternative, built on Zavalishin's zero-delay-feedback (ZDF) designs: its resonance peak stays exactly where you put it and the response is clean until you deliberately dirty it. When a patch needs weight and grime, start with the ladder; when it needs a precise, repeatable sweep, start with the SVF.

The response shape is one knob: the pole morph. It blends the filter smoothly from one landmark shape to the next, and the in-between positions are real filter responses, not crossfades between two signals; the knob's tick marks name the landmarks. On the ladder the journey runs from a steep lowpass through a gentler lowpass and a bandpass, past a notch, to a steep highpass. On the SVF it is longer — lowpass, bandpass, highpass, notch, peak and allpass. Steep slopes cut decisively — bass patches keep their focus; the gentler lowpass leaves more of the upper harmonics breathing. Park the knob on a tick when you want a textbook response; sweep it slowly from an LFO and you get response morphing that no fixed shape selector can play.

The filter is bypassed until you engage it, and it opens fully wide when you do — so switching it on never dulls a patch by surprise. By default all four sources feed it together: each has a cable into the mix bus, and the mix bus has a cable into the filter — sub included, so engaging the filter shapes the low end along with everything else. The patchbay on the Mixer tab re-cables this. Pull a source out of the mix bus and it leaves the filtered path — and the output — until you patch it somewhere else:

straight back into the filter through its direct filter send, or around the filter with a direct-to-master cable that arrives unfiltered. To keep a sub solid under a closing filter, route the raw sub around the whole chain with the sub's FX BYPASS switch (see **the oscillators chapter (Chapter 2 — Oscillators)**).

MIX, the last knob in the filter row, sets a dry/wet blend between the signal that entered the filter and the filtered output — fully wet by default. Back it off to fold parallel dry signal back in: a way to keep the low end and transient attack intact while the ladder does its coloring above, or to dial the whole effect in gently. It is the filter's own internal blend, and there is no output-gain knob to manage beside it: the engaged filter is automatically loudness-matched to bypass, so bringing it in colors the sound without a level jump. The blend is click-free and only acts while the filter is engaged; with the filter off, the mix bus passes through untouched.

Two controls shape how the cutoff itself moves. SLEW smooths every cutoff change with a lag applied in log-frequency space, so a glide across the top octaves takes as long as one across the bottom — portamento for the filter, and a way to soften stepped modulation. STEREO SEP splits the left and right cutoff frequencies apart — left shifts down, right up — which widens a mono patch without touching a single effect.

Resonance, drive and self-oscillation

Turn RES up until the filter starts to sing. Resonance emphasizes the region around the cutoff, and on the ladder topology the feedback is deliberately allowed past the point where the filter becomes its own oscillator: pushed to the top of its range it self-oscillates at any cutoff frequency, with the per-stage saturators bounding the level instead of a damping fudge that would thin the sound. The SVF crosses into self-oscillation only in the last stretch of its resonance range, and does it with a cleaner, steadier whistle. A self-oscillating filter plus full key tracking (next section) is a playable voice in its own right — tune it, sequence it, treat it as a fourth oscillator.

Resonance costs bass. As the peak grows, the region below it thins — the classic complaint about ladder designs. BASS LOCK is the fix: it tracks the low-frequency energy entering the filter and restores what resonance steals. It stays out of the way at low resonance and engages progressively as resonance rises, so it never bloats a non-resonant patch. BL FREQ sets the corner of that low-frequency tracker — low values guard the sub range, higher values reach into the low mids.

DRIVE pushes the input into the filter's saturating stages, from clean through thick to overdriven — one knob now spanning the full 0 to +24 dB, with no separate boost step. The TYPE knob beside it selects the nonlinearity every stage uses — transistor, diode or tube, three saturation curves with progressively different edges. Because TYPE feeds both the drive input and the filter's own per-stage saturation, it colours the sound whenever the filter is working, not only when DRIVE is up; sweep it and keep the curve that flatters the patch. CHARACTER sharpens the saturation curve itself across all stages, and it is loudness-matched end to end: the cutoff frequency stays put *and* so does the level, so the knob can be swept as a pure texture control from smooth to snarling with nothing else moving under it. Hard settings still read as more squash — the peaks come down and the harmonic content thickens — they simply no longer read as less volume. It is audible at any

resonance setting, not only extreme ones. The match is calibrated for normal program level; a very quiet filter input or a fully-driven one can still drift a couple of decibels across the knob's travel.

> ZDF, TPT and the ladder solve
>
> Both topologies are built from topology-preserving-transform (TPT) integrators with tan-prewarped cutoff, after Zavalishin's zero-delay-feedback method: the feedback loop is solved within the current sample instead of borrowing the previous sample's output. On the ladder this is why resonance depth and the onset of self-oscillation no longer drift with cutoff. The per-stage nonlinear integrators — saturation applied to both input and state with proper gain scaling — follow D'Angelo & Välimäki's transistor-ladder research. The filter section runs at 4× oversampling internally (a polyphase FIR upsampler into a Butterworth anti-alias downsampler) on a 64-bit floating-point path, cutoff smoothing operates in log-frequency space so sweeps feel uniformly paced across the audible range, resonance-related level loss is compensated frequency-dependently, and a DC blocker keeps self-oscillation well-behaved. The level lost to saturation hardness — what CHARACTER changes — is compensated too, from measured tables kept separately for the two topologies because the state-variable filter's saturators squash harder at the top of the knob. That correction is a level-only term applied outside the filter core: putting it inside the zero-delay-feedback loop would multiply the integrator gain and open the response by octaves, which is exactly what "the cutoff stays put" forbids.

The filter envelope

This is where the filter starts playing notes with you. The filter has its own envelope — attack, hold, decay, sustain, release, fully independent from the volume envelope — so the brightness of a note can move on a completely different schedule from its loudness: a slow volume swell with an instant filter bite, or a percussive amplitude hit whose harmonics bloom afterwards. The stages are edited in the envelope panel at the bottom of the OSC tab — its tab strip reads VOLUME / FILTER / PERCUSSION — switched to FILTER; the depth knob also sits in the filter section on the FX tab.

That depth knob, ENVELOPE, sets how far it reaches. It is bipolar: positive values sweep the cutoff up from where you parked it, negative values flip the whole movement downward — the same envelope becomes a closing gesture instead of an opening one — and at full amount the sweep spans eight octaves. KEY TRACK completes the picture by making the cutoff follow the played note, semitone for semitone at the full setting: without it, high notes duck under a fixed cutoff and low notes sail through; with it, the filter keeps the same voicing across the keyboard — mandatory for basslines that walk, and for playing a self-oscillating filter in tune.

The stages themselves are shapeable. Attack, decay and release each have a shape control that bends the curve from logarithmic through linear to exponential, plus an S-curve switch that splits the curve into an ease-in/ease-out pair — the shape slider then sets how pronounced the S is. HOLD pins the envelope at its peak between attack and decay, useful when a sweep should sit fully open for

a beat before falling. DIP pulls the envelope down briefly when a held note retriggers, giving re-articulated notes a percussive filter pluck; it runs the same law as the volume envelope's Dip, where depth buys length as well as depth — see **The volume envelope (Chapter 4 — Modulation)**. LOOP switches the envelope from one-shot to a repeating attack–hold–decay cycle for as long as the note is held — a rhythmic wobble with no LFO involved. The four time stages — attack, hold, decay and release — can also leave milliseconds behind: each has its own sync toggle and division selector, locking that stage's time to the host tempo.

The filter envelope also answers your playing the way the volume envelope does. A key-track slider shortens its stages as you play higher and lengthens them lower down — this is envelope timing, distinct from the KEY TRACK knob above, which moves the cutoff itself — and four bipolar velocity routes scale the attack, decay and release times and offset the sustain level with how hard you hit, using the same formulas as the volume envelope's routes (see **Velocity and aftertouch (Chapter 4 — Modulation)**). All five sit at zero by default and only act when raised, so a patch that never touches them keeps its filter movement identical on every note. A copy button (COPY VOL) pulls the volume envelope's settings across — key track and velocity routes included — when you want both movements to start in lockstep. One housekeeping note: RANGE, in the table below, rescales the envelope panel's editing time axis so long stages stay visible — in the current v0.1.0 early-access builds it does not itself change the sound.

Cutoff, resonance, drive and envelope amount are all live modulation targets beyond this envelope — see **the modulation chapter (Chapter 4 — Modulation)** for LFOs and step modulators pointed at the filter.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Filter Cutoff	20.0 – 20000.0	20000.0	Sets the filter's corner frequency — lower values darken the sound, higher values open it up.
Filter Resonance	0 – 1.05	0	Emphasizes the region around cutoff; at the top of the range the filter sings on its own.
Filter Drive	0 – 1	0	Pushes the input into the filter's saturating stages across the full 0 to +24 dB — from clean through thick to overdriven.
Filter Mode	LP24 · LP12 · BP12 · HP24	LP24	No on-screen control; the pole-morph knob sets the response shape, and this discrete mode only applies on the ladder when morph is at zero.
Filter Key Track	0 – 1	0	Makes cutoff follow the played note; at full, the filter keeps the same voicing across the keyboard.
Filter Env Amount	-1 – 1	0	Bipolar sweep depth; full amount moves the cutoff up or down by eight octaves (hardcoded 96 semitones in ladder_filter.rs).
Filter Stereo Sep	0 – 0.5	0	Splits left and right cutoffs apart in octaves — left down, right up — for width without effects.
Filter Env Attack	0.1 – 5000.0	10.0	Time for the filter envelope to sweep to its peak after note-on.
Filter Env Attack Shape	-1 – 1	0	Bends the attack curve: negative logarithmic, zero linear, positive exponential.
Filter Env Decay	0.1 – 10000.0	100.0	Time for the envelope to fall from its peak to the sustain level.
Filter Env Decay Shape	-1 – 1	0	Bends the decay curve between logarithmic, linear and exponential.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Filter Env Sustain	0 – 1	0.7	Envelope level held for as long as the note is down.
Filter Env Release	0.1 – 10000.0	200.0	Time for the envelope to fall away after note-off.
Filter Env Release Shape	-1 – 1	0	Bends the release curve between logarithmic, linear and exponential.
FE Atk S	Off / On	Off	S-curve mode for attack — an ease-in/ease-out pair; the attack shape slider sets its intensity.
FE Dec S	Off / On	Off	S-curve mode for decay — an ease-in/ease-out pair; the decay shape slider sets its intensity.
FE Rel S	Off / On	Off	S-curve mode for release — an ease-in/ease-out pair; the release shape slider sets its intensity.
Filter Env Dip	0 – 1	0	Dips the envelope on retrigger for a percussive filter pluck on re-articulated notes; deeper also means longer, so the top of the range reads as a gap.
Filter Env Range	1 – 8	4	Rescales the filter-envelope panel's editing time axis (1-8 s); does not change the sound in current v0.1.0 builds — cutoff travel is fixed at ±96 st × ENV AMT.
Filter Env Hold	0.0 – 5000.0	0.0	Holds the envelope at its peak before decay begins; zero skips straight to decay.
Filter Env Loop	0 · 1	0	OneShot runs the envelope once; LoopAHD repeats attack-hold-decay for as long as the note is held.
FE Key Track	0 – 1	0	Scales the filter envelope's times with pitch — higher notes get shorter envelopes, lower notes longer.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
FE Vel → Attack	-1 – 1	0	Velocity control of the filter envelope's attack time; positive means harder hits attack faster.
FE Vel → Decay	-1 – 1	0	Velocity control of the filter envelope's decay time; positive means harder hits decay faster.
FE Vel → Sustain	-1 – 1	0	Velocity offset on the filter envelope's sustain level: positive raises it for hard hits, lowers it for soft ones.
FE Vel → Release	-1 – 1	0	Velocity control of the filter envelope's release time; positive means harder hits release faster.
Filter Drive Boost	0 · 1 · 2 · 3	0	Legacy boost that once stacked extra gain on Drive; retired from the UI now that Drive spans the full range, but retained so older presets that stored it still load and apply.
Filter Enable	Off / On	Off	Switches the filter into the signal path; when off, the oscillator mix bypasses it untouched.
Filter Sat Type	Transistor · Diode · Tube	Transistor	Chooses each stage's saturation curve: odd-harmonic transistor, harder asymmetric diode, or softer tube.
Filter Mix	0 % – 100 %	100 %	Dry/wet blend between the pre-filter signal and the filtered output — full wet by default; back it off to keep parallel dry body and transients when driving the ladder hard.
Filter Morph	0 – 1	0	Pole morph — sweeps continuously between the responses, passing through real in-between shapes like the notch.
Filter Bass Lock	0 – 1	0	Restores the low end that rising resonance steals — engages progressively, essential for resonant bass.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Filter Res Character	0 – 1	0	Hardens the saturation curve in every stage, smooth to snarling, without moving the cutoff frequency or the level — a pure texture sweep.
Filter Cutoff Slew	0 – 1	0	Adds lag to cutoff changes in log-frequency space — portamento for the filter; zero responds instantly.
Filter Bass Lock Freq	20.0 Hz – 500.0 Hz	120.0 Hz	Corner of the bass tracker Bass Lock listens to — low guards the sub range, high reaches the low mids.
Filter Topology	0 · 1	0	Picks the filter machine: transistor-ladder (thick, saturating) or state-variable (clean, precise resonance).
FE Atk Sync	Off / On	Off	Locks attack time to a musical division of the host tempo instead of milliseconds.
FE Attack Div	0 … 17 (18 steps)	3	Musical division used for the attack stage when its sync is on.
FE Hold Sync	Off / On	Off	Locks hold time to a musical division of the host tempo instead of milliseconds.
FE Hold Div	0 … 17 (18 steps)	4	Musical division used for the hold stage when its sync is on.
FE Dec Sync	Off / On	Off	Locks decay time to a musical division of the host tempo instead of milliseconds.
FE Decay Div	0 … 17 (18 steps)	2	Musical division used for the decay stage when its sync is on.
FE Rel Sync	Off / On	Off	Locks release time to a musical division of the host tempo instead of milliseconds.
FE Release Div	0 … 17 (18 steps)	2	Musical division used for the release stage when its sync is on.

Formant

A formant is a resonant peak that stays put while the pitch moves underneath it — it is why a singer holding two different notes still sounds like the same vowel. Phaseburn One has no single formant knob; it has three honest ways to build one, and they stack.

The first is the filter you just met. A bandpass response with moderate resonance and KEY TRACK left at zero is a formant by definition: the emphasized band stays fixed while the sequencer walks notes under it, and the patch takes on a vowel-like identity. Automate the cutoff gently between two positions and the vowel mouths open and closed; on the SVF, the peak region of the pole-morph path is made for exactly this. Keep the resonance short of self-oscillation — a formant is an emphasis, not a whistle.

The second lives in the VECTOR oscillator. Its FORMANT switch retunes the Y control into a formant-position control, planting resonant peaks directly on chosen harmonics of the played note — formant synthesis as described in the original Vector Phase Shaping research (Kleimola et al. 2011). This produces vocal, resonant character at the source, before any filtering happens. The third is MORPH's formant wavetable mode, which sweeps through vowel shapes directly with the morph slider. Both are covered in **the oscillators chapter (Chapter 2 — Oscillators)**.

The combinations are the point. Generate a vowel at the source with the VECTOR FORMANT switch, then focus it with a fixed bandpass from this chapter — the oscillator supplies the character, the filter supplies the mouth. Or run MORPH's vowel sweep into a slowly morphing SVF and let two formant systems drift against each other. Because everything upstream is monophonic by design, the result stays a single voice with a single throat — which is precisely what makes it read as vocal.

CHAPTER 04

Modulation

The volume envelope, percussion engine, three LFOs, four step modulators, velocity and aftertouch routing — every mover in the engine, and how to think in sources.

Phaseburn One is monophonic by design, and modulation is what keeps that one voice alive. This chapter collects every mover in the engine: the volume envelope that shapes every note and the percussion engine that sharpens its first milliseconds — both in the envelope panel on the Oscillators tab, whose VOLUME / FILTER / PERCUSSION tab strip also holds the filter envelope — the three LFOs and four step modulators on the Modulation tab, which can reach most of the instrument, and the velocity and aftertouch routes that make playing dynamics count. Filter cutoff has its own dedicated envelope — that one is covered with the filter in **the filter chapter (Chapter 3 — The Filter)**.

Think in sources, not targets

Decide what should move, then give the movement a shape. Phaseburn One's modulation is source-centric: you do not open a giant routing matrix under a knob — you go to a source (an LFO, a step modulator or aftertouch), and give it destinations. Each LFO and each step modulator carries three routing slots, and aftertouch brings three more, so a patch can run up to twenty-four routes at once. Every slot is a pair: a destination picked from one list shared by all sources, and a bipolar amount — positive pushes the target up as the source rises, negative inverts the movement, and small values matter more than you expect on sensitive targets. Every route is visible from the other side too: the target control draws a modulation ring showing the live range, whichever source — an LFO, a step modulator, aftertouch, velocity, the note-character module or the distortion's input envelope — is pushing it.

That shared list covers more than a hundred destinations, and the browser presents it the way the panels do: groups in page order, and each group's entries in the order its knobs sit on the panel — finding a destination is the same gesture as finding its knob. Above the groups it offers the control you last touched, so routing to the knob you just moved needs no search at all. The Phase-Locked Loop (PLL) oscillator exposes its output shape, the multiplier and the divider — each in a stepped and a continuous form — the input-reference blend, its loop controls — track speed, damping and influence — the burst threshold and amount, injection, the chaos drive, the four loop-lab controls (step, grit, lag and relock), FM depth and ratio, and the color stage and its fold ratio. The VECTOR oscillator exposes its X and Y shaping pair, fold and stereo offsets. The MORPH oscillator exposes its morph amount, fold, shape and stereo detune. Each of the three pitched sources also exposes its mixer pan, so a route can place a source off-centre or swing it across the stereo field. Beyond the oscillators (all introduced in **the oscillators chapter (Chapter 2 — Oscillators)**) the list reaches the filter — cutoff and resonance through to its dry/wet mix — the coloration stages, the delay, the reverb

(mix, early-reflection level and wet gain), the chorus, the distortion, the BitCrusher, the freezer (freeze, window, grain, position and mix), and a MIXER group holding the mix-bus level and the master's stereo width — pumping and widening moves at the very end of the chain. And, unusually, the modulators themselves: every volume envelope stage time, shape, sustain and even three of the velocity routes are destinations, so one source can reshape how another behaves. The freezer's FREEZE latch is a button-style destination that engages on any positive value, so a bipolar LFO or step lane gates it on its positive half rather than having to cross a midpoint.

When several sources land on the same destination their contributions sum. Amount changes are smoothed, so riding a depth mid-performance never steps audibly; the destination selector itself switches instantly, so pull the amount toward zero first when you re-route a running patch. Coming the other way, right-clicking the *target* control and choosing **Unlink modulation** clears every route aimed at it in one gesture — the amounts stay put, so picking a destination again restores the depth that route had. The practical method: build the static patch first, then add one source at a time and give it one clear job — an LFO breathing the filter, a step lane accenting the PLL multiplier, the envelope holding the whole thing together. Because the instrument is a single voice, every route you add changes the one sound you are hearing, which makes cause and effect easy to keep track of — and easy to push much further than a polyphonic patch would tolerate.

The volume envelope

Shape how every note starts, carries and lets go. The volume envelope runs five stages — attack, hold, decay, sustain, release — and attack, decay and release each have their own curve control: at zero the segment is a straight line, negative values bend it into a fast-start logarithmic curve, positive values into a slow-start exponential one. Each of the three also has an S-curve switch that turns the bend into a symmetric ease-in, ease-out shape — the positive half of the shape slider then sets how pronounced the S is, while negative values fall back to a straight line in this mode. Hold sits between attack and decay and keeps the envelope pinned at full level for a moment, which fattens sustained transients without touching the decay itself.

Every timed stage can sync to the host tempo. Flip a stage's sync switch and its time is derived from a musical division instead of milliseconds, each stage with its own division selector — a release that is always exactly one beat long survives any tempo change. The PLL tail carries the same switch, so a ring-out can be locked to the grid rather than set in milliseconds. The ONE/LOOP button turns the one-shot envelope into a cycling one: while a note is held, attack, hold and decay repeat, which reads as tremolo at short settings and slow rhythmic swells at long ones. Depth blends between the enveloped signal and a constant level — pull it down and the envelope loses its grip, all the way to a steady drone that ignores note shape entirely. Key track shortens the envelope as you play higher and lengthens it lower down, the way acoustic instruments behave.

Because the instrument is monophonic by design, fast lines retrigger the same envelope constantly, and the retrigger behavior is tuned for that: a new note starts its attack from the current level rather than snapping to silence, so runs stay smooth. When you want audible re-articulation instead, raise the retrigger dip — whenever the sequencer retriggers a note while the previous one is still sounding, held or still releasing, it ducks the level before the new attack for a plucked, percussive restatement.

Depth buys time as well as depth: at low settings the notch is a brief softening of the retrigger, and as you push it the fall lengthens and then holds at the bottom, so the top of the control is a real gap in the sound — a re-articulation of the note rather than a smoothing of it. A retrigger arriving while a dip is still running keeps the dip in progress instead of ducking again, so fast rolls cannot ratchet the voice down toward silence. The dip acts on sequenced lines only; notes played live over MIDI always take the smooth path. Oscillator phases reset only when a note starts from silence; while the previous note is still sounding, a retrigger leaves the oscillators running, which is part of what keeps fast runs smooth. With legato phrasing, overlapping notes glide without retriggering at all.

The range control — the first slider in the row — is a pure editing zoom: it sets how far the time sliders reach, nothing more. It never changes the sound, and the envelope preview always draws the actual stage times.

Anti-click protection

The envelope runs in 64-bit precision, and several guards keep extreme settings clean: the release stage has an internal 3 ms floor even when the control is set lower, so cutting bass-heavy material never clicks; a retrigger dip falls over 2 ms at the bottom of the control, growing with the square of depth to 25 ms and then dwelling at the floor for half of whatever it grew — about 37 ms of duck at full depth — with an ease-out fall rather than a straight ramp, so the level drops quickly and settles; sustain-level changes are smoothed over 3 ms; on a fresh trigger the MORPH oscillator resets to its zero-crossing phase so its first sample is never at full displacement; and a forced stop (a preset change, for instance) fades over 2 ms instead of hard-cutting. Attack and decay share a single 0.5 ms floor in both normal and percussion mode, so the fastest setting is the same number wherever you are — fast enough to read as instant, long enough to round the corner on a full-scale swing. A hold shorter than that floor is skipped rather than played, the same as a hold of exactly 0. The release floor stays 3 ms in both modes.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Vol Attack	0.1 – 5000.0	10.0	Time to rise from silence to full level after note-on — short snaps, long swells.
Vol Attack Shape	-1 – 1	0	Bends the attack curve: negative is logarithmic (fast start), 0 linear, positive exponential (slow start).
Vol Decay	0.1 – 10000.0	100.0	Time to fall from peak to the sustain level once attack (and hold) complete.
Vol Decay Shape	-1 – 1	0	Bends the decay curve: negative logarithmic, 0 linear, positive exponential.
Vol Sustain	0 – 1	0.7	Level the envelope holds for as long as the note is held.
Vol Release	0.1 – 10000.0	200.0	Time to fade to silence after note-off; a short internal floor keeps fast releases click-free.
Vol Release Shape	-1 – 1	0	Bends the release curve: negative logarithmic, 0 linear, positive exponential.
Vol Atk S	Off / On	Off	S-curve mode for attack — ease-in/ease-out halves; the shape slider then sets S intensity.
Vol Dec S	Off / On	Off	S-curve mode for decay — symmetric ease-in-out instead of a one-way curve.
Vol Rel S	Off / On	Off	S-curve mode for release — symmetric ease-in-out instead of a one-way curve.
Vol Hold	0.0 – 5000.0	0.0	Holds the envelope at peak between attack and decay — fatter sustained transients; skipped when near zero.
Vol Depth	0 – 1	1	How much the envelope shapes loudness — 0 is a constant drone, 1 gives the envelope full control.
Vol Loop Mode	0 · 1	0	OneShot plays the envelope once; LoopAHD repeats attack-hold-decay while the note is held.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Env Key Track	0 – 1	0	Scales envelope times with pitch — higher notes get shorter envelopes, lower notes longer.
Vel → Attack	-1 – 1	0	Velocity control of attack time; positive means harder hits attack faster.
Vel → Decay	-1 – 1	0	Velocity control of decay time; positive means harder hits decay faster.
Vel → Sustain	-1 – 1	0	Velocity offset on sustain level: positive raises sustain for hard hits, lowers it for soft ones.
Vel → Release	-1 – 1	0	Velocity control of release time; positive means harder hits release faster.
Vol Atk Sync	Off / On	Off	Locks attack time to the host tempo using the attack division.
Vol Attack Div	0 … 17 (18 steps)	3	Musical division for the attack stage when tempo sync is on.
Vol Hold Sync	Off / On	Off	Locks hold time to the host tempo using the hold division.
Vol Hold Div	0 … 17 (18 steps)	4	Musical division for the hold stage when tempo sync is on.
Vol Dec Sync	Off / On	Off	Locks decay time to the host tempo using the decay division.
Vol Decay Div	0 … 17 (18 steps)	2	Musical division for the decay stage when tempo sync is on.
Vol Rel Sync	Off / On	Off	Locks release time to the host tempo using the release division.
Vol Release Div	0 … 17 (18 steps)	2	Musical division for the release stage when tempo sync is on.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Retrigger Dip	0 – 1	0	Dips the level before each sequencer re-attack for a plucked re-articulation; deeper also means longer, so the top of the range reads as a gap rather than a softening.
Env Range	20.0 – 10000.0	500.0	Reserved legacy control — has no audible effect in current v0.1.0 builds.

Percussion mode

Turn the first few milliseconds of every note into a drum designer. The percussion engine is a dedicated transient system that rides on top of the volume envelope, with three independent tools that fire together at the start of every hit and decay on their own clocks. Every non-legato hit fires: a note starting from silence additionally resets the VECTOR oscillator phase so repeated hits sound identical, while a retrigger over a still-ringing note keeps the oscillators running click-free and simply restarts the transient clocks. Only legato slurs skip the transient entirely.

Sweep is a pitch envelope in semitones. Positive values start the pitch above the note and drop onto it — the classic falling drum attack; negative values rise into the note from below. Time sets how long the settle takes, from a barely-there flick to long drawn-out drops, and curve reshapes the trajectory: negative straightens it into a linear glide that lands exactly on the note, zero is a natural exponential, positive holds the offset and then dives — the zap and laser end of the range. The slider gives half its throw to the musical ±24 st zone, with the extremes still reachable at the ends.

Click adds an onset strike in one of three characters: NOISE is a burst of bandpass-filtered noise, PING a single damped sine at the TONE frequency, and METAL an inharmonic three-partial strike for rim, cowbell and cymbal-adjacent colors. The click deliberately bypasses the volume envelope, running its own short decay, so it punches through even when the envelope attack is slow — the snap arrives first, the body follows. Tone places the strike from sub-thump up into bright cymbal territory, and TRACK tunes it to the played note — at zero the tone stays absolute, at full it rides the pitch line, so clicks stay proportioned across the keyboard. Width shapes character at constant loudness: narrow is a resonant ring, wide a dry thud (in PING and METAL it sets how long the strike rings), and the click has its own decay — short ticks up to snare-scale noise bodies — and curve controls.

T.Fold is extra wavefolding that is strongest at the attack and decays into the clean tone, adding a harmonically dense bite to the first instant of a note. It applies to the VECTOR and MORPH oscillators only.

All three respond to the VEL control, which decides how much MIDI velocity scales their depth — at zero every hit lands full strength, at maximum soft notes barely trigger the transients. The four target switches choose which oscillators get processed, so the sub can stay round while VECTOR takes the fold; on notes that start from silence the VECTOR oscillator uses a fixed phase reset so every hit sounds identical. Reach for percussion mode when you are building kicks, snares, hats and zaps from the synth voice — but also when a bass or pluck patch needs attack definition that the envelope

alone cannot give. Most of the percussion controls are modulation destinations too — sweep amount, time and curve; click level, tone, decay and width; fold amount and decay — so an LFO or step lane can vary the drum from hit to hit.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Perc Enable	Off / On	Off	Turns the percussion engine on — transient shaping replaces the soft anti-click fade at note start.
Perc PLL	Off / On	On	Includes the PLL oscillator in percussion transient processing.
Perc VECTOR	Off / On	On	Includes the VECTOR oscillator in percussion transient processing.
Perc MORPH	Off / On	On	Includes the MORPH oscillator in percussion transient processing.
Perc SUB	Off / On	On	Includes the sub oscillator in percussion transient processing.
Perc Sweep	-96.0 st – 96.0 st	0.0 st	Pitch sweep depth in semitones: positive drops onto the note from above, negative rises from below.
Perc Sweep Time	0.1 ms – 500.0 ms	5.0 ms	How fast the pitch sweep settles onto the note — short flicks to long drawn-out drops.
Perc Sweep Curve	-1.00 – 1.00	0.00	Sweep shape: -1 a straight linear glide that lands exactly, 0 natural exponential, +1 holds then dives (zap).
Perc Click	0 % – 100 %	0 %	Level of the filtered noise burst at note start — it bypasses the envelope and lands even under slow attacks.
Perc Click Tone	20.0 Hz – 16000.0 Hz	1000.0 Hz	Center frequency of the click bandpass filter — sub-thump lows up to cymbal-bright ticks.
Perc Click Decay	0.1 ms – 500.0 ms	2.0 ms	How fast the click fades — very short ticks up to snare-scale noise bodies.
Perc Click Width	0 % – 100 %	50 %	Click character at constant loudness: 0 is a narrow resonant ring, 1 a wide dry thud; in PING/METAL it sets the ring length.
Perc Click Curve	-1.00 – 1.00	0.00	Click decay shape: -1 straight linear fade, 0 exponential, +1 holds then cuts sharply.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Perc Click Track	0 % – 100 %	0 %	Tunes the click to the played note: 0% keeps TONE absolute, 100% follows the pitch line fully.
Perc Click Mode	Noise · Ping · Metal	Noise	Click character: NOISE is the filtered burst, PING a damped sine at TONE, METAL an inharmonic three-partial strike.
Perc TFold	0 % – 100 %	0 %	Extra wavefolding at the attack that decays into the clean tone (VECTOR and MORPH only).
Perc TFold Decay	0.5 ms – 50.0 ms	5.0 ms	How fast the transient fold settles back to the base tone.
Perc TFold Curve	-1.00 – 1.00	0.00	Fold decay shape: -1 straight linear settle, 0 exponential, +1 sustained bite that then drops sharply.
Perc Velocity	0 % – 100 %	0 %	How much MIDI velocity scales sweep, click and fold depth — 0 ignores velocity, 1 follows it fully.

The three LFOs

Give any control a pulse. The three LFOs are identical, run from very slow drift up to a rate that borders on audio, and each drives three destinations, every one with its own bipolar amount. Six waveforms cover the useful space: sine and triangle for smooth breathing, saw for ramps and falls, square for hard toggles, sample-and-hold for stepped random motion (with a small output slew so the steps do not click), and smooth random for wandering curves that never repeat — the organic setting for filter and pitch drift.

Each LFO free-runs at a rate in hertz or locks to the host tempo through a division selector that spans cycles several bars long down to very fast subdivisions, with dotted and triplet variants. The trigger mode decides what a new note does to the cycle: Free ignores notes entirely, Retrigger restarts the LFO from its phase offset for identical motion on every note, and Random Phase starts each note somewhere new for per-note variation. Fade-in ramps the LFO's depth up after note-on — the standard recipe for vibrato that develops on a held note. One-shot makes the LFO run a single cycle and then hold its final value, which quietly turns any waveform into an extra modulation envelope. The bipolar switch sets the output range: bipolar swings both ways around the target's set value, unipolar only pushes it one way from where you parked it.

The LFOs can also modulate each other. Pick a source LFO in the cross-mod selector, then blend two effects: phase mod softly pulls the LFO's phase toward zero on the source's rising edge — a

gentle sync that locks two rates into a rhythmic relationship without hard resets — and rate mod bends the LFO's speed with the source's output, up to two octaves in either direction at full amount. A slow sine rate-modulating a fast triangle produces accelerating, decelerating wobbles no single LFO can draw; sample-and-hold rate-modulating anything produces controlled ratchets.

Sample-accurate, tiered delivery

All three LFOs generate at full sample rate. Destinations on oscillators, filter and volume parameters consume the signal every sample; control-rate destinations such as envelope times are read every 8 samples. Routing amounts pass through a 30 ms slew so changing a depth mid-note never steps audibly; the destination selector switches instantly. Inside the voice, per-parameter slews smooth the knob and automation values themselves — 20 ms for most targets, longer for some shaping, drift and feedback controls — and modulation is added after that slew, so an LFO reaches its target at full speed.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
LFO 1 Rate	0.01 – 150.00	1.00	Free-run speed of LFO 1, from slow drift up to 150 Hz audio-rate flutter; ignored when tempo sync is on.
LFO 1 Waveform	Sine · Triangle · Saw · Square · S&H · Smooth Random	Sine	Shape of LFO 1's cycle: smooth waves, ramps, square jumps, stepped random or smooth random curves.
LFO 1 Tempo Sync	Off / On	Off	Locks LFO 1's rate to the host tempo using its division.
LFO 1 Division	1/1 … 1/128 (18 steps)	1/4	Musical division for LFO 1 when tempo sync is on.
LFO 1 Sync Source	-1 · 0 · 1 · 2	-1	Picks another LFO as LFO 1's cross-mod source; -1 means none.
LFO 1 Phase Mod	0 – 1	0	How strongly the source LFO nudges LFO 1's phase toward zero on its rising edge — a soft sync.
LFO 1 Dest 1	None – Dist Bias	None	First modulation target for LFO 1.
LFO 1 Amount 1	-1 – 1	0	Depth and polarity of LFO 1's first routing; negative inverts the movement.
LFO 1 Dest 2	None – Dist Bias	None	Second modulation target for LFO 1.
LFO 1 Amount 2	-1 – 1	0	Depth and polarity of LFO 1's second routing; negative inverts the movement.
LFO 1 Dest 3	None – Dist Bias	None	Third modulation target for LFO 1.
LFO 1 Amount 3	-1 – 1	0	Depth and polarity of LFO 1's third routing; negative inverts the movement.
LFO 1 Trigger	Free · Retrigger · Random Phase	Free	What note-on does to LFO 1: free-run, reset to the phase offset, or start at a random phase.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
LFO 1 Phase Offset	0 – 1	0	Start phase LFO 1 resets to in Retrigger mode.
LFO 1 Fade In	0.0 ms – 5000.0 ms	0.0 ms	Ramps LFO 1's depth from zero after note-on — vibrato that develops on held notes.
LFO 1 One-Shot	Off / On	Off	LFO 1 runs a single cycle then holds its end value — an extra modulation envelope.
LFO 1 Bipolar	Off / On	On	Output range of LFO 1: bipolar swings both ways around the set value, unipolar pushes one way only.
LFO 1 Rate Mod	0 – 1	0	How strongly the source LFO bends LFO 1's speed — up to two octaves either way at full.
LFO 2 Rate	0.01 – 150.00	1.00	Free-run speed of LFO 2, from slow drift up to 150 Hz audio-rate flutter; ignored when tempo sync is on.
LFO 2 Waveform	Sine · Triangle · Saw · Square · S&H · Smooth Random	Sine	Shape of LFO 2's cycle: smooth waves, ramps, square jumps, stepped random or smooth random curves.
LFO 2 Tempo Sync	Off / On	Off	Locks LFO 2's rate to the host tempo using its division.
LFO 2 Division	1/1 … 1/128 (18 steps)	1/8	Musical division for LFO 2 when tempo sync is on.
LFO 2 Sync Source	-1 · 0 · 1 · 2	-1	Picks another LFO as LFO 2's cross-mod source; -1 means none.
LFO 2 Phase Mod	0 – 1	0	How strongly the source LFO nudges LFO 2's phase toward zero on its rising edge — a soft sync.
LFO 2 Dest 1	None – Dist Bias	None	First modulation target for LFO 2.
LFO 2 Amount 1	-1 – 1	0	Depth and polarity of LFO 2's first routing; negative inverts the movement.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
LFO 2 Dest 2	None – Dist Bias	None	Second modulation target for LFO 2.
LFO 2 Amount 2	-1 – 1	0	Depth and polarity of LFO 2's second routing; negative inverts the movement.
LFO 2 Dest 3	None – Dist Bias	None	Third modulation target for LFO 2.
LFO 2 Amount 3	-1 – 1	0	Depth and polarity of LFO 2's third routing; negative inverts the movement.
LFO 2 Trigger	Free · Retrigger · Random Phase	Free	What note-on does to LFO 2: free-run, reset to the phase offset, or start at a random phase.
LFO 2 Phase Offset	0 – 1	0	Start phase LFO 2 resets to in Retrigger mode.
LFO 2 Fade In	0.0 ms – 5000.0 ms	0.0 ms	Ramps LFO 2's depth from zero after note-on — vibrato that develops on held notes.
LFO 2 One-Shot	Off / On	Off	LFO 2 runs a single cycle then holds its end value — an extra modulation envelope.
LFO 2 Bipolar	Off / On	On	Output range of LFO 2: bipolar swings both ways around the set value, unipolar pushes one way only.
LFO 2 Rate Mod	0 – 1	0	How strongly the source LFO bends LFO 2's speed — up to two octaves either way at full.
LFO 3 Rate	0.01 – 150.00	1.00	Free-run speed of LFO 3, from slow drift up to 150 Hz audio-rate flutter; ignored when tempo sync is on.
LFO 3 Waveform	Sine · Triangle · Saw · Square · S&H · Smooth Random	Sine	Shape of LFO 3's cycle: smooth waves, ramps, square jumps, stepped random or smooth random curves.
LFO 3 Tempo Sync	Off / On	Off	Locks LFO 3's rate to the host tempo using its division.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
LFO 3 Division	1/1 … 1/128 (18 steps)	1/1	Musical division for LFO 3 when tempo sync is on.
LFO 3 Sync Source	-1 · 0 · 1 · 2	-1	Picks another LFO as LFO 3's cross-mod source; -1 means none.
LFO 3 Phase Mod	0 – 1	0	How strongly the source LFO nudges LFO 3's phase toward zero on its rising edge — a soft sync.
LFO 3 Dest 1	None – Dist Bias	None	First modulation target for LFO 3.
LFO 3 Amount 1	-1 – 1	0	Depth and polarity of LFO 3's first routing; negative inverts the movement.
LFO 3 Dest 2	None – Dist Bias	None	Second modulation target for LFO 3.
LFO 3 Amount 2	-1 – 1	0	Depth and polarity of LFO 3's second routing; negative inverts the movement.
LFO 3 Dest 3	None – Dist Bias	None	Third modulation target for LFO 3.
LFO 3 Amount 3	-1 – 1	0	Depth and polarity of LFO 3's third routing; negative inverts the movement.
LFO 3 Trigger	Free · Retrigger · Random Phase	Free	What note-on does to LFO 3: free-run, reset to the phase offset, or start at a random phase.
LFO 3 Phase Offset	0 – 1	0	Start phase LFO 3 resets to in Retrigger mode.
LFO 3 Fade In	0.0 ms – 5000.0 ms	0.0 ms	Ramps LFO 3's depth from zero after note-on — vibrato that develops on held notes.
LFO 3 One-Shot	Off / On	Off	LFO 3 runs a single cycle then holds its end value — an extra modulation envelope.
LFO 3 Bipolar	Off / On	On	Output range of LFO 3: bipolar swings both ways around the set value, unipolar pushes one way only.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
LFO 3 Rate Mod	0 – 1	0	How strongly the source LFO bends LFO 3's speed — up to two octaves either way at full.

Step modulators SEQ 1 to SEQ 4

When modulation should follow the grid, draw it. Step modulators SEQ 1 to SEQ 4 are four identical lanes on the Modulation tab, each a row of bipolar step values played back at a tempo-synced rate, one step per division, looping at whatever length you set. Each drives three destinations with bipolar amounts, the same routing capacity as an LFO.

What a step lane gives you that an LFO cannot is rhythm as a first-class shape. An LFO repeats one curve; a step lane holds an exact value per grid position, so you can write accents, rests, sudden jumps and asymmetric patterns that correspond to no waveform at all — a filter that opens only on beats two and four, a PLL multiplier that leaps between intervals in a fixed riff. Set the lane length to an odd count against a square sequencer pattern and the lane phases against the bar, a polymeter that keeps a short loop evolving for minutes. Leave retrigger off and the lane free-runs with the tempo regardless of what notes play; switch it on and every note restarts the pattern from step one, tying the modulation to phrasing instead of the bar. Either way, a transport start — pressing Play, or the DAW beginning playback — resets every step modulator to step one of bar one and every LFO to the top of its cycle, so a take always begins the same way.

Two controls decide how steps connect. Ties glide between adjacent steps with a smooth S-curve interpolation — the acid-style slide, drawn per step. Untied steps use the slew control instead: at zero they snap, higher values round every transition. Snap quantizes step values to a twelve-tone grid, which matters the moment a lane drives anything pitch-shaped — the PLL multiplier, the tracked-filter offset, oscillator tuning territory — because steps then land on musical intervals instead of arbitrary values, and ties glide between the snapped levels.

BARS is the pattern’s length in bars. Leave it at one and the lane behaves exactly as above. Raise it and the lane plays bar 1, then bar 2, and so on before looping — each bar carrying its own steps, its own probabilities and its own tie row, and a tie on a bar’s last step gliding into the first step of the next. A strip of numbered segments appears in the panel header as soon as BARS is above one; click a segment to edit that bar, and a dot marks whichever bar the playhead is currently in. Pulling BARS back down hides the later bars without erasing them, so you can try a shorter loop and go back.

TOOLS act on the bar you are looking at. RANDOM, INVERT, MIRROR and CLEAR each apply to the visible bar only — CLEAR included, so emptying a long pattern means clearing each bar in turn. There is no undo on the step lanes, which is exactly why CLEAR is scoped this way. Loading one of the built-in step patterns always sets BARS back to one, because those patterns are single-bar and would otherwise be followed by empty bars.

The four lanes are fully independent, switched with the SEQ 1 to SEQ 4 tabs, and a productive habit is giving each one a clear job: SEQ 1 as a fast rhythmic accent lane, SEQ 2 as a slow, long-loop drift

that keeps the patch from standing still, the other two held in reserve for accents you add as the patch grows. SEQ 3 and SEQ 4 are newer than the first pair and default to silence — no destination, zero amount, an empty pattern — so a preset or session saved before they existed loads and sounds exactly as it always did.

The step values themselves are pattern data, not host parameters: they travel with the preset and with your saved project, but they do not appear in the DAW's parameter list and cannot be automated from a lane there. Everything that shapes the lane — rate, length, bars, slew, polarity, retrigger, snap and the three routes — is a normal automatable parameter.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
MSeq Division	1/1 … 1/128 (18 steps)	1/8	Playback rate of modulator A — one step per musical division, synced to the host tempo.
MSeq Slew	0 – 200	5	Smoothing between untied steps in modulator A — 0 snaps, higher values round every transition.
MSeq Dest 1	None – Dist Bias	None	First modulation target for modulator A.
MSeq Amount 1	-1 – 1	0	Depth and polarity of modulator A's first routing; negative inverts the pattern.
MSeq Dest 2	None – Dist Bias	None	Second modulation target for modulator A.
MSeq Amount 2	-1 – 1	0	Depth and polarity of modulator A's second routing; negative inverts the pattern.
MSeq Length	1 … 32 (32 steps)	16	Number of steps modulator A loops over; odd lengths phase against the bar for polymeter.
MSeq Retrigger	Off / On	Off	When on, modulator A restarts from step 1 on every note-on; off free-runs with the tempo.
MSeq Bipolar	Off / On	On	Step range of modulator A: bipolar swings both ways, unipolar keeps steps pushing one way only.
MSeq Dest 3	None – Dist Bias	None	Third modulation target for modulator A.
MSeq Amount 3	-1 – 1	0	Depth and polarity of modulator A's third routing; negative inverts the pattern.
MSeq Snap	Off / On	Off	Snaps modulator A's step values to a twelve-tone grid — musical intervals on pitch-like targets.
MSeq2 Division	1/1 … 1/128 (18 steps)	1/8	Playback rate of modulator B — one step per musical division, synced to the host tempo.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
MSeq2 Slew	0 – 200	5	Smoothing between untied steps in modulator B — 0 snaps, higher values round every transition.
MSeq2 Dest 1	None – Dist Bias	None	First modulation target for modulator B.
MSeq2 Amount 1	-1 – 1	0	Depth and polarity of modulator B's first routing; negative inverts the pattern.
MSeq2 Dest 2	None – Dist Bias	None	Second modulation target for modulator B.
MSeq2 Amount 2	-1 – 1	0	Depth and polarity of modulator B's second routing; negative inverts the pattern.
MSeq2 Dest 3	None – Dist Bias	None	Third modulation target for modulator B.
MSeq2 Amount 3	-1 – 1	0	Depth and polarity of modulator B's third routing; negative inverts the pattern.
MSeq2 Length	1 … 32 (32 steps)	16	Number of steps modulator B loops over; odd lengths phase against the bar for polymeter.
MSeq2 Retrigger	Off / On	Off	When on, modulator B restarts from step 1 on every note-on; off free-runs with the tempo.
MSeq2 Bipolar	Off / On	On	Step range of modulator B: bipolar swings both ways, unipolar keeps steps pushing one way only.
MSeq2 Snap	Off / On	Off	Snaps modulator B's step values to a twelve-tone grid — musical intervals on pitch-like targets.
MSeq Bars	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8	1	Pattern length of modulator A in bars — it plays bar 1 through bar N and loops. Each bar has its own steps, probabilities and ties.
MSeq2 Bars	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8	1	Pattern length of modulator B in bars — it plays bar 1 through bar N and loops. Each bar has its own steps, probabilities and ties.
MSeq3 Division	1/1 … 1/128 (18 steps)	1/8	Playback rate of modulator C — one step per musical division, synced to the host tempo.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
MSeq3 Slew	0 – 200	5	Smoothing between untied steps in modulator C — 0 snaps, higher values round every transition.
MSeq3 Dest 1	None – Dist Bias	None	First modulation target for modulator C.
MSeq3 Amount 1	-1 – 1	0	Depth and polarity of modulator C's first routing; negative inverts the pattern.
MSeq3 Dest 2	None – Dist Bias	None	Second modulation target for modulator C.
MSeq3 Amount 2	-1 – 1	0	Depth and polarity of modulator C's second routing; negative inverts the pattern.
MSeq3 Dest 3	None – Dist Bias	None	Third modulation target for modulator C.
MSeq3 Amount 3	-1 – 1	0	Depth and polarity of modulator C's third routing; negative inverts the pattern.
MSeq3 Length	1 … 32 (32 steps)	16	Number of steps modulator C loops over; odd lengths phase against the bar for polymeter.
MSeq3 Retrigger	Off / On	Off	When on, modulator C restarts from step 1 on every note-on; off free-runs with the tempo.
MSeq3 Bipolar	Off / On	On	Step range of modulator C: bipolar swings both ways, unipolar keeps steps pushing one way only.
MSeq3 Snap	Off / On	Off	Snaps modulator C's step values to a twelve-tone grid — musical intervals on pitch-like targets.
MSeq3 Bars	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8	1	Pattern length of modulator C in bars — it plays bar 1 through bar N and loops. Each bar has its own steps, probabilities and ties.
MSeq4 Division	1/1 … 1/128 (18 steps)	1/8	Playback rate of modulator D — one step per musical division, synced to the host tempo.
MSeq4 Slew	0 – 200	5	Smoothing between untied steps in modulator D — 0 snaps, higher values round every transition.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
MSeq4 Dest 1	None – Dist Bias	None	First modulation target for modulator D.
MSeq4 Amount 1	-1 – 1	0	Depth and polarity of modulator D's first routing; negative inverts the pattern.
MSeq4 Dest 2	None – Dist Bias	None	Second modulation target for modulator D.
MSeq4 Amount 2	-1 – 1	0	Depth and polarity of modulator D's second routing; negative inverts the pattern.
MSeq4 Dest 3	None – Dist Bias	None	Third modulation target for modulator D.
MSeq4 Amount 3	-1 – 1	0	Depth and polarity of modulator D's third routing; negative inverts the pattern.
MSeq4 Length	1 … 32 (32 steps)	16	Number of steps modulator D loops over; odd lengths phase against the bar for polymeter.
MSeq4 Retrigger	Off / On	Off	When on, modulator D restarts from step 1 on every note-on; off free-runs with the tempo.
MSeq4 Bipolar	Off / On	On	Step range of modulator D: bipolar swings both ways, unipolar keeps steps pushing one way only.
MSeq4 Snap	Off / On	Off	Snaps modulator D's step values to a twelve-tone grid — musical intervals on pitch-like targets.
MSeq4 Bars	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8	1	Pattern length of modulator D in bars — it plays bar 1 through bar N and loops. Each bar has its own steps, probabilities and ties.

Velocity and aftertouch

Make how hard you hit part of the patch. Velocity in Phaseburn One arrives from two places: your MIDI playing, and the sequencer itself, which generates velocity per note on its Strength tab. Either way, the same routes apply.

Four bipolar routes feed the volume envelope: velocity to attack, decay, sustain and release. The time routes scale their stage exponentially — with positive amounts, harder hits snap faster and softer hits bloom slower, which is the natural direction for plucked and struck sounds; negative amounts invert the response for pads that open up when you dig in. The sustain route offsets level

directly, so hard notes carry more body, not only a faster front. The filter envelope carries the same four routes of its own, plus its own key track, applied with the same formulas — so a note's brightness can answer touch independently of its loudness; they live on the envelope panel's FILTER tab and are covered in **the filter chapter (Chapter 3 — The Filter)**. A fifth dynamic control lives in the percussion engine: its VEL parameter scales the sweep, click and fold transients, which turns velocity into hit intensity when you play the synth as a drum. Three of the four envelope velocity routes — attack, decay and sustain — are themselves modulation destinations, so an LFO or step lane can vary how dynamic the instrument feels across a phrase. During legato playing, the velocity lock option keeps velocity pinned to the held note so overlapped transitions do not jump in character.

Aftertouch is the third continuous source. The engine listens to both channel pressure and polyphonic pressure and follows whichever presses harder, then feeds that pressure through three routing slots of its own — each a destination picked from the same shared list, with a bipolar amount, exactly like an LFO slot. Route pressure into filter cutoff for swells that live under your fingers, into VECTOR fold for a growl that answers how hard you lean, or into envelope sustain so held notes bloom under pressure. The first slot lives in the AFTERTOUCH module on the Modulation page; the other two are reachable through the host's parameter list or automation. These routes travel with the preset. If your keyboard sends no aftertouch at all, an LFO with a long fade-in or a one-shot LFO acting as a slow secondary envelope covers similar ground.

The distortion listens back

The DIST ENV module turns the distortion's input envelope into a modulation source: how hard the module is being hit at this moment, smoothed and normalized, drives one destination from the shared list with a bipolar amount. It is the classic sidechain trick generalized, keyed on playing dynamics rather than on a gain reduction: route it into filter cutoff and the patch opens as you dig in, into sub volume for a low end that gets out of the way when the drive is working, into delay feedback so echoes stretch out in the gaps. Its route draws a modulation ring on the target like any other source, so you can see the envelope working from the knob it is moving. The envelope is measured one audio block behind the signal that caused it — at modulation rates that is impossible to hear, and it is what keeps the loop of "distortion shapes sound, sound feeds distortion" stable by construction. With the distortion bypassed the source simply sits at zero.

> The velocity and pressure math
>
> The time routes compute a scale factor of `2^(-amount × (velocity − 0.5) × 4)` — velocity at the midpoint leaves the stage unchanged, and at full amount the extremes scale the stage time by up to a factor of four in either direction. The sustain route adds a linear offset of `amount × (velocity − 0.5)` to the sustain level. Release uses the same exponential form as attack and decay, and the scaled release also governs the PLL tail so the two decay in lockstep. Aftertouch is smoothed with a 20 ms slew on its way in and each route amount with a 30 ms slew, so pressure never zippers even from a coarse controller.

CHAPTER 05

Mixer & Patchbay

The Mixer tab: balance the four sources, then rewire the instrument — gain cables between oscillators, filter and effects, feedback inserts, and three patches worth stealing.

The **Mixer** tab is where Phaseburn One stops behaving like a fixed-architecture synth. The top of the tab balances the four sources; the rest of it is a patchbay — the routing system every other chapter keeps pointing at, drawn as modules and cables you can rearrange while the sound plays. This chapter explains how the patchbay thinks, how its feedback jacks work without breaking the no-loops rule, and hands over three patches worth stealing.

Faders above, patchbay below

Balance first, rewire second — the Mixer tab is arranged in that order. Across the top runs a row of channel strips: the four sources — the Phase-Locked Loop (PLL) voice, the MORPH and VECTOR oscillators and the sub — then the mix bus they sum into, the PRESET fader, and the master at the end. The strips run the full width of the page as console-style faders: a cap riding in a recessed groove, a live stereo level meter beside each, and a proper dB scale up the travel — every mark labelled, 0 at unity down through −6/−12/−24/−36, with the ceiling at the top where a strip has gain past unity. The meters read past full scale — the scale runs to +6 dBFS with a reference line at 0, because the engine's 64-bit signal path never clips internally: levels above the line fill red and latch the clip lamp at the top of the meter (amber on the source strips, where an over is informational; red on the master, where it is the level your host actually receives), instead of pinning at the top and hiding how hot the signal really is. The source faders are the same volume parameters that end each section of the Oscillators tab, mirrored here for mixing, and they top out at unity — the balance you set is the level the bus receives. The mix bus fader trims all four sources at once with up to +6 dB of push into whatever it feeds, and the master fader carries up to +12 dB for the final send to your host. The MASTER strip is the output stage in miniature: the limiter's gain-reduction meter beside the fader, a LIMIT switch — the same output limiter as the header's L button, duplicated here so the whole output stage is in one place, and the one switch that decides whether the plug-in reports any latency to your host at all (see **The master section (Chapter 6 — Effects & Master)**) — and an RMS/PEAK ballistics switch for its meter.

Above the PLL, MORPH and VECTOR faders sits a small PAN knob: a stereo balance with a constant-power law, so a source keeps its perceived weight as it moves off-centre, and bit-transparent at centre — presets saved before the knob existed sound identical. Each pan is a modulation destination in its own right, with a modulation ring on the knob, so an LFO or step lane can swing a source across the field (**the modulation chapter (Chapter 4 — Modulation)** covers routing). The sub has no pan: it is mono by design, and the low end stays planted in the centre.

The **PRESET** fader, between the MIX and MASTER strips, is a per-preset volume offset of ±24 dB saved with each patch, there to level-match presets against one another; the master fader itself stays a global performance control, and loading a preset never moves it. Aim for the amber −6 dB mark on its scale, or let the instrument do it: press **AUTO** above the fader while the preset plays and it measures two seconds of peaks — read from an engine tap taken just before this fader — then sets the offset so those peaks land on −6 dBFS in one shot. Because the tap sits after the master tone chain but before the preset offset, the master fader and the limiter, the calibration is absolute: the master fader's position never skews the result, pressing AUTO again changes nothing, and a silent patch reports NO SIG instead of guessing.

The effects have no strips here — their levels live where the effects do. Each module's MIX knob on the FX tab sets its dry/wet blend, the distortion adds a LEVEL knob for output level on the processed signal, and the gain of the cable an effect returns into the master — set in the patchbay below — decides how loud that effect lands in the sum. The cables are the effects' faders.

Below the faders is the patchbay: every routing decision in the instrument, drawn as boxes and cables. The oscillators, the mix bus, the filter, the six effects and the master appear as modules; the lines between them are cables, and dragging a cable is rewiring the instrument. By default the modules sit in two rows — the core chain (mix, filter, BitCrusher, distortion) on top and the time-and-space effects (chorus, delay, reverb, freezer) below, with the oscillator sources anchoring the left edge and the master and output the right. Modules can themselves be dragged anywhere on the canvas to keep a busy patch readable — the layout is cosmetic, the cables are the signal path.

Nothing here needs to be patched before the instrument makes sound. A fresh preset arrives with the backbone already wired: mix bus → filter → BitCrusher → distortion → chorus → delay → reverb → freezer → master, every cable at unity gain — passing signal at exactly the level it receives — and every effect powered off. A powered-off effect passes its input straight through, so the default patch is a transparent wire from the oscillators to the output; the chain only starts sounding like a chain when power buttons come on (**the effects chapter (Chapter 6 — Effects & Master)** walks through each module). The patchbay is not setup work — it is where you go when the stock order stops being the arrangement the music wants.

Phaseburn One is monophonic by design, and this tab is one of the places that budget shows: there is exactly one of every module — one distortion, one delay, one reverb — each running full-depth processing on the single voice, with the cables deciding where in the story each one sits.

The stereo meter

To the right of the MASTER strip sits the stereo meter — the output stage's eyes. It listens to the same signal the master meter does, after the limiter, exactly what your host receives, and answers three questions at a glance: what shape is the stereo image, will it survive a mono fold-down, and where in the spectrum the width actually lives.

The square display is a goniometer, drawn the way hardware draws it: mono material traces a vertical line up the middle (the M axis), a source that exists only in the left channel leans onto the L diagonal, and the wider and less correlated the signal gets, the rounder the amber figure blooms.

Anything stretching horizontal is anti-phase energy — the part a mono playback system cancels. The beam persists for a moment like a phosphor trace, and the display gently rescales quiet passages so the figure stays readable instead of collapsing into a dot at low level.

Beside the goniometer sit the instrument's stereo controls, so the image is adjusted right where it is measured. WIDTH and M BASS are the master chain's stereo-control stage, placed here beside the display that judges them: width scales the whole image from mono up to three times its recorded spread, and the mono-bass crossover sums everything below its frequency — up to 500 Hz — to the centre. Under them, **MONO** is a monitor check, not a parameter: it folds the output to the mono sum so you can hear exactly what a single-speaker system receives while the meters show it — the figure collapses to the M axis and the correlation bar pins to +1. It is click-free, never saved with anything, and always off when the editor reopens, so a forgotten mono check can't follow a project home.

Under it, CORR is the classic phase-correlation meter, integrated over a few hundred milliseconds so it reads as a tendency rather than a flicker: +1 means the channels agree (perfectly mono-compatible), values around 0 mean wide, decorrelated material, and negative readings fill red toward −1 — real phase cancellation that will lose level in mono. A red tick holds the deepest negative excursion for a couple of seconds, so a brief polarity problem is caught even when you look up late.

SPREAD breaks the same question across the spectrum: six bands from the sub region to the air (split at 120, 350, 1k, 3k and 8k Hz), lowest at the bottom, each drawn as a horizontal bar whose position is the band's left/right balance and whose length is its width. A healthy mix for club playback shows exactly the ladder you would hope for — a centred dot or a stub in the bottom rows where the bass stays mono, bars widening toward the top where the chorus and reverb live. A band with no energy collapses to a small dot at its balance position, so the ladder keeps its shape even in sparse material.

The meter needs no switch: it is always on, and the analysis runs only while the Mixer tab is actually visible, so it costs nothing the rest of the time.

How the patchbay thinks

Route anything anywhere and the result stays predictable, because the whole system obeys three rules you can hold in your head: inputs sum, outputs fan out, loops are refused.

The pieces. Every box is a node with ports. The four oscillators and **AUDIO IN** have outputs; the mix bus, the filter and the six effects each have an input and an output; the master and **PLL REF** have only an input. A cable connects one output to one input, and every cable carries its own gain: silence at the bottom of its travel, unity most of the way up, and up to +6 dB of push at the very top — enough to drive a return hot straight from the patchbay. Drag vertically on a cable's knob to set it, hold Shift for fine moves, and the help bar along the bottom reads the level out live in dB; a cable pushed toward the top shows an amber halo as a near-clip warning. The knob bottoms out at silence with the cable still patched — a lane held open, ready to fade back in — and removing a cable is a click on the cable itself. Cables also show their traffic: one carrying live signal streams a faint run of dashes from its source toward its destination, glowing brighter the more signal it carries, so a patched-but-silent

cable sits still while the working path shimmers. Brush the pointer across a cable and it sways once, like a nudged patch lead, then settles. The filter's cables carry gain like everything else: the per-source direct lines, the mix bus's feed and the effect returns into FILTER IN all scale their signal continuously (the sub's filter line stays a simple switch). Presets from earlier builds, where these read as plain on/off, load at exactly off or unity — the old sound, untouched.

Inputs sum. Several cables can land on one input and their signals are mixed — all the oscillators into the filter, or the filter and the delay together into the reverb.

Outputs fan out. One output can feed any number of destinations at once, each through its own cable at its own level — the filter into the chorus, the delay and the master simultaneously.

The filter is a node like any other. FILTER IN takes cables from every effect output and from the feedback taps, so the classic orders that used to be impossible are one drag away: distortion into filter, a delay tail through a resonant sweep, a reverb feedback loop squeezed through the ladder. While nothing external feeds it, the filter keeps its place in the voice exactly as before; patch an effect into it and it steps out onto the bus — the voice's envelope then shapes only the oscillators' share of its input, and effect tails keep flowing through the filter after the note ends. The filter's output can also return into any of the feedback inserts — the dub classic of a delay's feedback path squeezed through a resonant sweep is a tap, a return and a cutoff knob away.

Loops are refused. The patchbay only offers connections that keep signal flowing one way; a cable that would close a circle cannot be drawn, and the engine enforces the same rule underneath. The only feedback anywhere is each effect's own internal loop — plus the explicit feedback jacks in the next section.

Cables carry the whole signal. Every effect is a true insert: its output cable carries the effect's complete result — the input it received blended with the processed signal according to its MIX control — not a wet-only tap. Chaining delay into reverb therefore sounds like a delay feeding a reverb, and a fanned-out output gives every destination the same full signal. Which blend law each MIX uses varies by effect and is covered in **the effects chapter (Chapter 6 — Effects & Master)**.

Power off means wire. Switching an effect off turns it into a clean pass-through while its tail rings out naturally — signal routed through an off module always keeps flowing.

Power on without cables warns. The opposite state — a module switched on with no cable into its input or none leaving its output — is a dead end: the module runs, but its sound never reaches the master. The patchbay flags it in yellow, on the module's outline and its power ring, until both jacks carry a cable; the module's power button on the FX tab turns yellow too and reads **PATCH**. Switching a module on from that tab while it is unwired also opens a prompt that can fix it for you: one click splices the module into the current chain at its most natural point — re-routing the cable it replaces so no dry shortcut dilutes the effect — or jump straight here with the module pulsing and wire it by hand.

The master is a sum, not a default. Nothing reaches the output without a cable into the **MASTER FX** node; a fixed wire then carries its sum on to the **OUT** node. Across the two, one fixed chain runs

— high-pass, box cut and brilliance in MASTER FX, then stereo control, then volume and the limiter in OUT — described in **the master section (Chapter 6 — Effects & Master)**.

Bus and filter picks stand alone. An effect fed from the mix bus or from the filter output takes that source exclusively — patching either one releases every other source cable on that effect, and patching an oscillator releases the bus or filter cable in turn. The per-oscillator sends are the loose end: several oscillators can feed the same effect side by side, summing at its input — and the sub's direct sends sit outside the exclusivity rule entirely, so a patched sub cable survives a bus or filter pick. Cables between effects, and the feedback pairs, stack freely.

> What happens every block
>
> Once per audio block the engine rereads every cable level, orders the modules so each one runs after everything that feeds it, scales every incoming cable by its gain before the module's input, processes, and passes the result on — ending in the master sum. The whole pass reuses fixed buffers with no memory allocation on the audio thread, and every gain change ramps across the block — a moved cable fades over one block instead of stepping. Rewiring while the sequencer runs is an ordinary move, not a stunt.

Audio from outside

Phaseburn has a stereo **audio input**, and it appears in the patchbay as a source: **AUDIO IN**, alongside the four oscillators. There are two ways to feed it, and they sum, so whichever your host makes easy is the right one:

- **Insert Phaseburn on an audio track.** The track's signal arrives on the main input.
- **Send to it from another track.** Phaseburn also exposes a stereo sidechain, which is what you want when it is sitting on an instrument track playing notes.

Two things follow from that.

The effects work on outside audio. Patch AUDIO IN into the filter, the granular freezer, the BitCrusher — any of them — and on to Master. The effects chain runs whether or not a note is held, so this needs no key press and no sequencer: Phaseburn becomes a processor. The freezer in particular has only ever been able to hear Phaseburn's own oscillators, and now it can hear anything.

The PLL can lock to it. The **PLL REF** jack, second from the top of the source column directly under AUDIO IN, feeds the phase-locked loop's reference. Patch AUDIO IN into it, turn up the PLL's INPUT REF knob, and the oscillator starts chasing the incoming signal. See **Locking the loop to something else (Chapter 2 — Oscillators)** — that is where the musical part lives.

PLL REF also accepts MORPH, VECTOR and SUB, which is cross-modulation inside the instrument with no host routing at all.

Set the input level. The AUDIO IN strip is the first fader on the mixer, and it is the only place the input trim lives — the ROUTING panel's header carries a RESET button and nothing else. Its AUTO button

sets the level for you: feed the input, press AUTO, and it lands the peaks on −6 dBFS. That matters most for PLL REF — the phase comparator only registers an edge once the signal crosses ±0.02, about −34 dBFS, so anything quieter never locks at all.

Nothing here is on until you patch it. With no cable from AUDIO IN the input is inert and the instrument behaves exactly as it did before — an insert with nothing patched passes no audio through, because the plugin still owns its own output.

Feedback without forbidden loops

Put one effect inside another effect's feedback loop — a distortion that dirties every repeat of a delay, a chorus that re-blurs each pass — without ever breaking the no-loops rule. That is what the FB jacks are for.

The delay, the chorus and the reverb each carry a pair of extra jacks on their bottom edge: a feedback **tap**, which emits what is circulating inside that effect's loop, and a **return**, which accepts signal back into the loop. Patch the tap through another module and into the return, and the loop now runs through your insert — every pass of the feedback is processed again on its way around. For the delay and the chorus, the moment anything lands on the return the effect hands its loop to the external path — so a return patched without its tap feeding the insert starves the loop. The reverb is gentler: its return *adds* into the tank while the reverb's own decay keeps running, so it behaves as an injection port rather than a replacement. Pull every return cable back to zero and the internal behavior is restored exactly.

Here is why this is not a forbidden circle. The tap plays what the loop recorded on its previous pass; the return records what will circulate on the next one. The inserted effect sits *between passes* of the loop rather than inside a closed circle of the outer graph, so signal through the patchbay still flows strictly one way. However hard a loop is pushed, the routing graph can never stall the audio — signal always keeps flowing to the output. What stays your responsibility is level: the inserted effect runs whole inside the loop, including any feedback of its own, and no limiter guards the loop internally. Insert the chorus into the delay's loop with both feedbacks pushed high and the nested loop can still run away — when a loop starts climbing, back one of the two feedbacks off.

Each of the three loops accepts an insert, and the choice is wide: the distortion, the BitCrusher, the freezer, the filter, or one of the other time effects — every pairing wired as its own tap-and-return pair. A tap also fans out like any other output, so you can listen to a loop without inserting into it: send the delay's tap through the distortion and onward into the reverb, and everything circulating in the loop — the first echo included — blooms into space, while the dry note passing through the delay stays out of that lane.

> One block of grace
>
> The block delay lives on the return side. The tap emits what the loop is playing during the present block; whatever lands on the return is recorded and handed to the loop on its next pass, one block later. That hand-off is the entire mechanism — it is what lets an effect live inside a feedback path while the outer graph stays acyclic. Removing every return cable restores the internal self-loop bit-exactly, so an unused pair of FB jacks costs nothing.

Three patches worth stealing

Three routings that earn their cables. Each one starts from the default patch, takes under a minute to wire, and produces something the stock chain cannot.

A distortion inside the delay's feedback. Power on the delay and the distortion, and raise the delay's feedback further than good taste normally allows. In the patchbay, patch the delay's FB tap into the distortion and the distortion back into the FB return (`delay_fb_to_comp` and `comp_to_delay_fb` — cable ids that predate the module and were kept so old patches keep working). Every repeat now passes through the drive before re-entering the loop, so the echo does not simply fade: it degrades, each pass grittier and more compressed than the last, until the tail is pure texture. Start with OD and a low DRIVE — the cascade squares off fast once it is fed its own output, and a loop already past unity does not need much help. LOW to the right keeps the sub clean so the low end does not turn to mud as the tail thickens, and TONE pulled down stops the repeats from getting brighter each pass, which is what runs a feedback loop away. Nothing here limits the loop, so if a swell keeps climbing, pull the delay's feedback back down first. There is one distortion in the instrument, so while it lives in this loop it does this job everywhere it is patched. **Its controls (Chapter 6 — Effects & Master)** move with it — only its address changed.

A BitCrusher parallel to the dry signal. In the default chain the BitCrusher sits in series, so powering it on damages everything downstream. For weight without total destruction, move it beside the chain instead of inside it. Unpatch BitCrusher → distortion, patch the filter's output into the distortion to close the clean backbone again, then give the BitCrusher a new cable straight to the master and power it on. The filter's output now fans out into two lanes: the untouched chain, and a crushed lane that meets it again at the master sum. Set the BitCrusher's MIX fully wet so the parallel lane is pure grit, then balance the blend with the gain knob on the BitCrusher → master cable — that one knob is the clean/destroyed balance. **BITS and FREQ (Chapter 6 — Effects & Master)** choose the flavor of damage.

The sub straight to the output. Build a bass patch that gets filthy — filter drive, coloration, the crushed lane above — and the low end usually gets filthy with it. Flip the sub's FX BYPASS switch — on the SUB section header of the Oscillators tab, or on the mixer's SUB strip right above the patchbay — and the sub steps out of the graph entirely: its normal cables dim, a single loose-hanging cable appears from the sub to the OUT block — the final volume-and-limiter stage, drawn past the master — and the raw sub, still shaped by its volume, envelope and velocity, is summed in after the master tone stages, ahead of only the master volume and the limiter. The fundamental now

ignores the filter sweep, the distortion, even the master high-pass: chaos on top, a clean floor underneath. Clicking that cable (or the switch — they mirror each other) puts the sub back into the graph. For a milder split that keeps the master tone stages in play, use the sub's master-direct cable instead: it adds the raw sub into the master sum ahead of the tone chain. **The sub's section (Chapter 2 — Oscillators)** covers its shape and saturation controls.

Every cable is a parameter

Automate the wiring itself. Every cable in the patchbay is a plug-in parameter, visible to your host like any knob, and the cables of the effects graph — sends, links between effects, feedback pairs, master lanes — are continuous levels, not on/off switches. Draw a slow ramp on a reverb send and the space fades in across a phrase; snap a delay send between zero and unity per section and the arrangement gains an effects lane the instrument performs by itself. Cable moves are smoothed inside the engine, so automated patching connects and disconnects without clicks. At the parameter level an exact zero still means disconnected — automation that writes 0 unpatches the cable; the knob's on-screen floor stops just above it, keeping the lane patched. The cables into the filter now have the same real travel as every other lane — ramp `mix_to_filter` and the whole bus fades out of the ladder. One quiet consequence: the bus-and-filter exclusivity from earlier is patchbay courtesy, not engine law — automation is free to raise several source sends into the same effect at once, and the graph sums them.

The cable families, compactly:

- **Front end.** Each source into the mix bus (`mix_in_pll` and its siblings), the bus level (`osc_mix_volume`), the bus into the filter (`mix_to_filter`), and direct lines into the filter for filtering one source alone — `filter_in_pll`, `filter_in_vps`, `filter_in_saw`, and `synth_sub_filter_route` for the sub.
- **Sends.** Every effect's inputs: one cable from each oscillator — the sub included (`sub_to_delay` and its siblings; the sub's sends sit out while SUB DIRECT is engaged, keeping that path clean) — one from the mix bus, one from the filter output (`chorus_send_pll`, `delay_send_mix_bus`, `bitcrusher_send_flt_out`, …). The reverb adds a send from the delay, the cable that closes the default chain.
- **Between effects.** A cable from every effect's output to every other effect's input, in both directions (`comp_to_reverb`, `rvb_to_chorus`, `delay_to_bitcrusher`, …) — chains in any one-way order, or parallel banks that meet at the master. The filter joins that mesh: every effect output and every feedback tap can land on FILTER IN (`comp_to_filter`, `delay_fb_to_filter`, …). Plus the feedback tap and return pairs from the previous section (`delay_fb_to_comp`, `comp_to_delay_fb`, …).
- **Into the master.** One cable per effect (`reverb_to_master`, …), the filter and the mix bus directly (`flt_to_master`, `mix_to_master`), and raw oscillator lanes (`master_direct_pll` through `master_direct_sub`) that skip the processing chain and add straight into the output sum.

The complete listing — every cable with its range and default — lives in **the full parameter index (Chapter 11 — Reference)**, most of it under the routing module; the sub's filter line is listed with the sub's own parameters, and SUB DIRECT with the master section. The routing module also carries the four oscillator-independence switches; those belong to the skip-and-drift story in **the oscillators chapter (Chapter 2 — Oscillators)**.

Everything survives the session. Every cable — backbone, parallel lanes, feedback inserts — is saved with the preset, and so are the module positions on the canvas; positions persist with the DAW project too, so a patch reopens looking the way you left it. Presets from earlier builds that stored connections as plain on/off load those cables at off or unity. And when a patch has drifted past understanding, the patchbay's RESET button restores both the default cable set and the default layout, while double-clicking the empty canvas tidies only the layout and leaves the wiring alone.

CHAPTER 06

Effects & Master

The frequency-shifter delay, reverb, chorus, distortion, BitCrusher and freezer — plus the master section: brilliance, stereo control, mono bass and the output limiter.

Everything in this chapter happens after the voice. The oscillators, filter and coloration stages hand over one finished stereo signal; the six effects and the master section decide where that signal appears to live — how it repeats, how much space surrounds it, how wide it spreads, and how it leaves the plug-in. Phaseburn One is monophonic by design, and the effects spend the budget that buys: each one runs real per-sample processing on the same 64-bit signal path as the voice itself.

Every effect listens where you point it

Most synths run their effects as a fixed chain: whatever leaves the filter passes through everything, in one factory-set order. Phaseburn One ships with a chain too — but nothing about it is fixed. Each effect is a module whose inputs are cables you patch, and the first thing to learn about the effects is that *what goes in* is a decision you make per effect.

An effect can listen to the mix bus — the summed oscillators before the filter — or to the filter's output, or tap one oscillator directly: the Phase-Locked Loop (PLL) voice, the VECTOR phase-shaping oscillator, the MORPH oscillator, or the sub. That idea unlocks arrangements a fixed chain cannot express: echo only the MORPH line while the PLL bass stays bone dry; send only the VECTOR into a long reverb so the sustain blooms while the attack stays close; crush one oscillator and leave the rest clean. Out of the box everything is already patched: the default chain runs mix bus → filter → BitCrusher → distortion → chorus → delay → reverb → freezer → master, every cable at unity — and every effect powered off. A powered-off effect passes signal straight through, so the chain stays transparent until you press a module's power button. Effects come alive with power, not with patching.

The reverse mistake — a module powered on whose cables have been unpatched — would otherwise fail silently: the effect runs, but no signal reaches it, so the sound never changes. The instrument flags it instead. A power button on the FX tab turns yellow and reads **PATCH** while its module is on but not fully wired, and switching such a module on opens a small prompt with a way out: **Connect** wires the module into the playing chain in one click — the button names the exact patch it will make, FILTER → BITCRUSHER → COMP for example, and re-routes the cable it interrupts so the dry shortcut does not dilute the effect; **Open Patchbay** jumps to the Mixer tab with the module's box pulsing so it is easy to find; **Not now** dismisses the prompt. The yellow state clears the moment both jacks carry cables.

Two more conventions are shared by every effect. First, each input is a cable with its own level — off, unity, or pushed a few decibels hot — so a send can be a whisper or a shove. Second, every effect

has a MIX control. For the delay and the chorus, MIX adds wet signal on top of the effect's own input, which always passes at full level; for the reverb, distortion and BitCrusher, MIX crossfades between the effect's input and the processed signal. The distortion pairs MIX with a LEVEL knob — a true output level on the processed signal, independent of the blend. Cable levels set what an effect hears; MIX sets what it contributes; and the cable each effect sends toward the master sets how loud that contribution lands in the sum.

The chain is the front door to a larger routing system: a patchbay on the Mixer tab, where effects can feed each other in any non-circular order or run in parallel. The delay, chorus and reverb also expose feedback tap and return jacks there, and each of those three loops accepts an insert — the distortion, the BitCrusher, the freezer, another time effect, even the filter. This chapter describes each effect as a unit; **the patchbay chapter (Chapter 5 — Mixer & Patchbay)** covers the cables between them. The effect panels themselves — knobs and power buttons, no routing — live on the FX tab.

Delay: repeats that slide in pitch

Set an eighth-note delay, then raise FREQ SHIFT a few hertz and hold a note. The repeats stop being copies: each one comes back slightly higher than the last, sliding up through the harmonics of your patch and then out of them entirely. The defining feature of this delay is a frequency shifter inside the feedback loop.

Frequency shifting is not pitch shifting. A pitch shifter multiplies every frequency by a ratio, so harmonics stay in tune with each other. A frequency shifter *adds* a fixed number of hertz to every partial — a tone with partials at 100, 200 and 300 Hz, shifted up by 50 Hz, reappears at 150, 250 and 350 Hz. The harmonic series is broken, and that is the appeal: the technique goes back to Harald Bode's analog frequency shifters, and its inharmonic sheen is a sound no filter or chorus can make. Because the shifter sits inside the loop, the shift compounds — each repeat is shifted again, so tails spiral steadily upward or downward like a barber pole, seemingly without end.

Three controls define the shift. SHIFT sets the amount per pass: with WIDE off it spans a fine window, and WIDE opens the full range for extreme mangling (see table). A few hertz gives slowly rotating, phasing tails; tens of hertz turns repeats into metallic bells; hundreds shreds them into clangs. SIDEBAND chooses which sideband survives: at the USB end repeats shift up, at the LSB end they shift down, and the midpoint keeps both sidebands for a ring-modulated echo character.

SHIFT carries the **S** snap badge. Lit, the knob stops being a hertz control and becomes a semitone one: twenty-five stops from an octave down to an octave up, with the readout and the tick ring naming notes instead of hertz — C4 is no shift at all. Three things are worth knowing before you trust the note names. **Only the fundamental lands on the named note**: this is a true frequency shifter, so tuning the shift to a fifth puts the fundamental a fifth up and leaves every harmonic somewhere inharmonic — the note name is a tuning reference for the root, not a transposition. **The reference is middle C**, because a linear shift has no intervals of its own and one had to be chosen. And **the grid stops at one octave in each direction**, because shifting down the fundamental reaches DC an octave and a bit below and there is no pitch left to name; the full sweep is one click away with the

badge off. WIDE hides while the badge is lit, since the note grid brings its own span. Engaging the snap never moves a shift you have already set, and a value that is not on a semitone still reads out in hertz, so the readout can never name a note the delay is not actually at.

The rest of the panel shapes the trail. FEEDBACK sets how long repeats regenerate — and past 100 the line tips into self-oscillation, blooming into a steady drone instead of running away, because the loop's own saturation bounds every pass. SMEAR diffuses each repeat's transients through an allpass network, from crisp echoes to a reverb-like wash that thickens with every pass. TUBE adds saturation inside the loop, so each repeat returns a little more worn than the one before, and FB LPF / FB HPF darken or thin the trail as it recirculates. The **SYNC** switch in the module header decides how time is set: off — the default — the panel shows a **TIME** knob in milliseconds; on, it swaps that knob for a beat division, from four bars down to 1/128 including dotted and triplet values, with the longest divisions capped at the delay's maximum time (see table). **DUAL** appears only while SYNC is on, because what it selects is a second *division* for the right channel — asymmetric bounces on the grid. Free-running, the right tap is the left one plus **OFFSET**, which pushes it up to 40 ms behind for width. PONG makes repeats alternate left-right.

Single-sideband shifting

The shifter performs single-sideband modulation built on an 8th-order Hilbert transform, which is what allows one sideband to be selected cleanly instead of producing both at once. The left and right shifter oscillators run 90° apart once the shift exceeds about ±1 Hz, so shifted echoes spread into stereo with no extra controls — and collapse back to identical channels at zero shift. Delay-time jumps (division switches, large automation moves) crossfade between two read taps over roughly 30 ms, so changing the time does not chirp; slow modulation still bends repeats like tape.

Frequency-Shifter Delay

FX · 18 parameters

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Delay Enable	Off / On	Off	Switches the frequency-shifter delay on or off.
Delay Mix	0 – 1	0	Dry/wet crossfade — zero is fully dry, full is echoes only.
Delay Time	10.0 ms – 2000.0 ms	375.0 ms	Echo spacing in milliseconds — the knob the panel shows while SYNC is off.
Delay Time Sync	Off / On	Off	SYNC — locks echo spacing to the host tempo, swapping the millisecond TIME knob for a beat division.
Delay Time Division	1/1 … 1/128 (18 steps)	1/8	Beat division for synced echoes, from whole notes to 1/128 with dotted and triplet feels.
Delay Feedback	0 – 1.1	0.35	How much of each echo is fed back in — higher settings regenerate longer trails; past 100 the line self-oscillates into a bounded drone.
Delay Freq Shift	-5000.0 Hz – 5000.0 Hz	0.0 Hz	Shifts every repeat by a fixed Hz amount; repeats slide in pitch and grow inharmonic as they regenerate. With SNAP lit the readout names the note the fundamental lands on.
Delay Freq Shift Snap	Off / On	Off	SNAP — constrains the shift to semitone steps against middle C, an octave each way; off, the knob sweeps hertz freely. Only the fundamental lands on the named note.
Delay Sideband	0 – 1	0	Shift direction: 0 = UP, 0.5 = RING (both sidebands, ring-mod flavor), 1 = DN.
Delay Smear	0 – 1	0	Diffuses each repeat's transients — from crisp echoes to a washy, reverb-like blur that builds per pass.
Delay Saturation	0 – 1	0	Tube-style saturation inside the feedback loop; every repeat comes back slightly more overdriven.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Delay FB LPF	500.0 Hz – 20000.0 Hz	8000.0 Hz	Low-pass on the feedback path — repeats get darker each time around.
Delay FB HPF	20.0 Hz – 2000.0 Hz	80.0 Hz	High-pass on the feedback path — thins low end out of regenerating echoes.
Delay Stereo Offset	0 – 1	0	Delays the right channel up to 40 ms behind the left for wider echoes; inactive when dual time is on.
Delay Freq Range	Off / On	Off	WIDE toggle — expands the frequency shift from a fine ±500 Hz to the full ±5 kHz range. Hidden while SNAP is lit, which brings its own span.
Delay Dual Time	Off / On	Off	Gives the right channel its own beat division for asymmetric, polyrhythmic echoes. Needs SYNC on — it appears only there, since what it picks is a division.
Delay Time Division R	1/1 … 1/128 (18 steps)	1/32	Beat division for the right channel when dual time is on.
Delay Ping Pong	Off / On	Off	Cross-feeds the channels so repeats bounce alternately left and right.

Reverb: rooms you can resize mid-note

The reverb is built in two stages, and both are audible as separate handles. Early reflections — the first fraction of a second of a room answering back — come from banks of discrete stereo taps, and their level is exposed as its own control, which behaves like proximity: high, and the room's first slap is present and close; low, and only the diffuse wash remains. The taps feed an eight-line feedback delay network (FDN) — the late-reverb architecture in the Jot / Stautner–Puckette lineage — which recirculates the sound into a dense tail.

SIZE scales the whole structure. The lower range covers rooms that could exist; past the middle it keeps going, into halls and then into spaces with no architectural excuse. DECAY sets how long the tail rings, from under a second to around a minute, spaced so the musical middle of the range is easy to hit. DIFFUSION controls how quickly reflections blur into a smooth wash — low values keep the grain of individual echoes, high values are instantly dense.

Decay shaping is where this reverb rewards attention. DECAY HF is a relative control: it sets how fast the highs die *compared to* the rest of the tail. Below one, the tail darkens as it fades, the way air

absorbs treble in a real hall; above one, the top end outlives the body. The tank's LPF and HPF are damping filters inside the recirculation itself, draining highs or lows a little more on every pass; together with DECAY HF they sculpt where the tail's energy sits without changing its overall length. MOD speed and depth add slow chorus-like movement inside the tank, which keeps very long tails from settling into a static ring. Saturation warms the recirculating signal with soft clipping, and pre-delay inserts a gap — free or synced to tempo — between the dry note and the room's answer, keeping attacks articulate under heavy wet mixes.

> Inside the tank
>
> The early stage is sixteen stereo taps with per-tap high-frequency rolloff that mimics distance-based air absorption. The late tank is an eight-channel FDN mixed by a unitary Hadamard matrix, with logarithmically spaced prime delay lengths for modal density, modulated allpass diffusers per channel, and per-line decay gains compensated so the decay time you set is the decay time you get. All internal reverb math runs in 64-bit floats.

Wet gain, and the WET/MIX decision

The Reverb header carries a **MIX / WET** switch. MIX is the normal insert behaviour: the Dry/Wet knob blends the room against the signal feeding it. WET removes the dry path entirely and outputs only the tail, which is what you want when the reverb is fed from a send, or when you are layering a room under a part that already exists elsewhere in the chain.

Wet Gain trims that wet path across ±24 dB — in WET mode it is the only level control the return has, so cutting an over-hot room matters as much as boosting a distant one. It sits *after* the tank's own safety limiter, so it behaves as a real output gain rather than as something the limiter quietly eats — useful when a distant, heavily damped room needs to come forward without touching Decay or Size. It is a modulation destination, so an envelope or LFO on Wet Gain swells or ducks the room without disturbing the tail's character; see **the modulation chapter (Chapter 4 — Modulation)** for routing.

Shimmering tails come from two effects cooperating rather than a dedicated knob. The delay already feeds the reverb in the default chain: power both on, put a few hertz of upward shift on the delay, and every repeat entering the room arrives a little higher than the last, smeared by the tank into a slowly climbing, shimmering tail.

DUCKING solves the classic problem of a long reverb swallowing the part that feeds it. An envelope follower tracks your playing and pushes the reverb down while notes sound; the tail swells back in the gaps, with a recovery time set by a tempo division — an easy way to keep a big room from crowding a lead line.

Reverb

FX · 20 parameters

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Reverb Enable	Off / On	Off	Switches the reverb on or off.
Reverb Dry/Wet	0 – 1	0	Dry/wet balance — zero is dry, full is reverb only.
Reverb Pre-Delay	0 – 500	50	Gap before the reverb speaks — keeps the dry attack distinct from the room.
Reverb Pre-Delay Sync	Off / On	Off	Snaps pre-delay to musical divisions of the host tempo.
Reverb Pre-Delay Division	1/1 … 1/128 (18 steps)	1/8	Beat division used for synced pre-delay.
Reverb Size	0 – 3	0.85	Room size — scales the tank's delay lines from tight booth to cathedral and beyond.
Reverb HPF	20.0 – 22000.0	100.0	High-pass damping inside the tank — drains lows from the tail a little more on every pass.
Reverb LPF	20.0 – 22000.0	14000.0	Low-pass damping inside the tank — the tail darkens progressively, like air absorption.
Reverb Mod Speed	0 – 1	0.3	Rate of the slow chorus-like movement inside the tank.
Reverb Mod Depth	0 – 1	0.4	Depth of tank modulation — keeps long tails alive instead of ringing statically.
Reverb Diffusion	0 – 1	0.75	How fast reflections blur into a wash — low keeps discrete echoes, high is instantly dense.
Reverb Decay	0 – 1	0.8	Tail length, from under a second to around a minute on a logarithmic curve.
Reverb Decay HF	0.1 – 2	1	How fast highs die relative to the body — below 1 darker faster, above 1 brighter longer.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Reverb Ducking	0 – 1	0	Pushes the reverb down while you play so the tail swells back in the gaps.
Reverb Duck Division	0 … 17 (18 steps)	2	Tempo division setting how quickly the ducked reverb recovers.
Reverb Stereo Width	0 – 2	1	Mid/side width of the wet signal — mono through full stereo to extra wide.
Reverb Saturation	0 – 1	0	Soft clipping in the tank feedback — the tail thickens and warms instead of staying glassy.
Reverb Wet Gain	-24.0 dB – 24.0 dB	0.0 dB	Level trim on the reverb's wet path, cut or boost across ±24 dB. Sits after the tank's safety limiter, so it is a true gain rather than something the limiter absorbs. A modulation target.
Reverb Wet Only	Off / On	MIX	MIX blends dry and wet with the Dry/Wet knob; WET removes the dry path entirely and outputs only the tail — the setting for send-style use.
Reverb ER Level	0 – 1	0.5	Level of the early reflections — the room's first slap before the diffuse tail.

Chorus: thickness as a choice

One line frames this whole module: Phaseburn One's voice is already stereo at the source, so the chorus is a color you reach for, not a structural repair for a mono engine. It is a **four-mode engine** — the header picker chooses **CHORUS**, **FLANGER**, **ENSEMBLE** or **VIBE**, and the knobs remap to each mode's own vocabulary (in FLANGER, DELAY becomes CENTER, DEPTH becomes SWEEP in octaves, DETUNE becomes STAGGER and FEEDBACK becomes RESO). Beside the picker sit a STEREO / MID-SIDE switch, a **THRU-0** toggle that lets the sweep pass through true zero delay for tape-style flanging, and **SYNC**, which locks the LFO to the host tempo.

The engine is a bank of chorus voices, each a stereo pair of short delay lines whose time is swept by the chorus's own LFO. The swept delay bends pitch slightly, and mixing bent copies against the dry signal produces the familiar ensemble thickening. VOICES sets how many copies run at once. SPREAD distributes the LFO phase across them so they swirl out of step instead of pumping in unison; DETUNE, marked in cents, holds each voice's delay a fixed step apart from its neighbors —

not a sustained pitch offset but a static decorrelation of the copies, a layer of thickening underneath the motion — and PAN fans the voices across the stereo field.

The LFO has its own rate, depth and shape — sine, triangle, random walk, or the two ramp shapes that give the barber-pole modes their endless rise and fall — plus a stereo phase offset that sweeps the left and right channels apart for movement between the ears. In CHORUS mode the base DELAY sets the register of the whole effect — shorter settings comb brighter, the longest drift toward doubling; for true flanging, switch to FLANGER mode, where CENTER parks the sweep and RESO feeds the comb back on itself. ENSEMBLE runs the classic multi-LFO string-machine shimmer, and VIBE bends pitch without a dry blend for throaty, rotary-adjacent movement.

FEEDBACK is bipolar — negative values invert the comb pattern for a hollower resonance — and CROSS FB feeds the loop across channels for spatial swirl. The loop carries its own low-pass filter and saturation, so high feedback turns resonant and dark rather than brittle. On the output side, wet-only high- and low-cut filters confine the effect to a band — the classic move is cutting the wet lows so the bass stays solid while everything above it moves — and a wet-only width control scales the result from mono to extra wide.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Chorus Enable	Off / On	Off	Switches the chorus on or off.
Chorus Mode	Chorus · Flanger · Ensemble · Vibe	Chorus	Engine mode: CHORUS thickens, FLANGE sweeps a resonant comb, ENSEMBLE adds the string-machine shimmer, VIBE bends pitch.
Chorus Through-Zero	Off / On	Off	Delays the dry signal to the sweep center and flips the wet — the sweep crosses zero for the tape-flange null.
Chorus Mix	0 – 1	0.5	Dry/wet balance for the chorus; in VIBE mode it crossfades to full wet for true vibrato.
Chorus Base Delay	0.1 ms – 40.0 ms	7.0 ms	Center delay time — shortest settings flange, the middle is classic chorus, the longest double.
Chorus LFO Rate	0.01 Hz – 50.00 Hz	1.00 Hz	Speed of the chorus's own LFO — slow drift, fast warble, up to audio-rate mangling.
Chorus Rate Sync	Off / On	Off	Locks the sweep LFO to the host tempo; the Rate knob becomes a beat division.
Chorus Rate Division	1/1 … 1/128 (18 steps)	1/1	Beat-locked sweep length when SYNC is on — one LFO cycle per division.
Chorus LFO Depth	0.0 ms – 20.0 ms	2.0 ms	How far the LFO sweeps the delay time — more depth means deeper pitch wobble.
Chorus LFO Shape	Sine · Triangle · Random Walk · Sine · Ramp Up · Ramp Down	Sine	Pattern of the sweep — steady waves, random wander, or the ramp shapes for endless barber-pole motion.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Chorus LFO Stereo	0° – 360°	180°	Phase offset between the left and right sweeps — larger offsets widen the stereo motion.
Chorus Voices	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8	4	How many chorus voices run at once — more voices, thicker ensemble.
Chorus Voice Spread	0° – 360°	360°	Distributes LFO phase across voices so they swirl out of step instead of pumping together.
Chorus Voice Detune	0 ct – 20 ct	0 ct	Fixed pitch offsets in cents spread across the voices — static thickening under the motion. In FLANGE it staggers the combs instead.
Chorus Pan Spread	0 – 1	1	Fans the voices across the stereo field; zero stacks them in the center.
Chorus Feedback	-1 – 1	0	Feeds wet back into the delays for resonant, flanger-like intensity; negative inverts the comb.
Chorus Cross Feedback	0 – 1	0	Sends feedback across channels (left to right and back) for spatial swirl.
Chorus FB Saturation	0 – 1	0.3	Soft clipping in the feedback path — keeps high feedback musical instead of brittle.
Chorus FB Filter	100.0 Hz – 16000.0 Hz	8000.0 Hz	Low-pass inside the feedback loop — each recirculation comes back darker.
Chorus Stereo Mode	Stereo · Mid/Side	Stereo	STEREO processes left/right as-is; M/S runs the engine on mid and side instead.
Chorus Wet HP	20.0 Hz – 2000.0 Hz	20.0 Hz	High-pass on the wet signal only — keeps the chorus off the low end.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Chorus Wet LP	1000.0 Hz – 20000.0 Hz	20000.0 Hz	Low-pass on the wet signal only — softens the top of the wet voices.
Chorus Wet Width	0 – 2	1	Stereo width of the wet signal only — mono to extra wide.

Distortion: four archetypes, one cascade

The distortion is not a single curve with a drive knob in front of it. It is three cascaded soft stages with filters between them feeding a final clipper whose knee tightens as you push — the same arrangement a guitar amplifier uses, and for the same reason. Each stage adds a little harmonic content that the next filter shapes before the following stage multiplies it again, so the buildup is gradual and follows what you play, rather than arriving all at once as a wall of buzz.

The four modes in the section header are voicings of that one cascade, not four separate effects. **OD** is a mild singing overdrive that leaves some dynamics intact — the flattering choice for a resonant filter sweep, where it folds the resonance back into the body of the tone instead of leaving it whistling on top. **DIST** is the classic: harder, flatter, the picture squaring off. **FUZZ** is deliberately broken — heavily asymmetric, and its bias drifts with the envelope, so notes sputter and gate as they die away instead of fading politely. **METAL** is tight and scooped, with a highpass between the stages so the low end cannot smear the ones above it, and the widest gain range of the four. Because the modes differ only in their settings, switching between them glides rather than cutting.

DRIVE reads in decibels, and its ceiling follows the archetype: +30 dB in OD, +42 in DIST, +48 in FUZZ, +60 in METAL. That is a great deal of gain, and the important part is what it does *not* do — every stage is calibrated so that a signal at the synth's nominal level leaves it at the nominal level, and AUTO adds a measured make-up curve on top. Turning DRIVE up changes what the sound is, not how loud it is. Wind it to the top and a thirty-decibel swing of input level comes out within about a decibel: the dynamics have been converted into harmonics, which is exactly the flat, relentless picture that hard electronic music is after.

BITE is the control that keeps that from becoming a smear, and it is not a tone boost. It lifts a mid band going *into* the cascade and puts it back on the way out, so what changes is how hard that band is driven rather than how loud it ends up — five to six times the harmonic content around its centre, at any playing level, while the balance moves only a few decibels. The depth follows the envelope, so a loud note is driven harder than a quiet one: level contrast collapses as you drive, but accent contrast survives, converted into edge and grit. Turn it up on a sequenced line with accents and the line starts speaking rather than buzzing.

LOW decides what happens to the bottom. Left of centre it is a tightening highpass into the drive (from 20 Hz up to around 300), so bass stops eating the headroom the mids need — the control behind a tight, articulate chug. Right of centre it does the opposite: it splits a clean sub band out,

routes it *around* the distortion and sums it back afterwards, so the weight underneath stays intact while everything above it is destroyed. Centre passes everything straight through.

BIAS sets the symmetry. Centred, the curve is symmetric and you get odd harmonics; either way off centre it skews, bringing in the even harmonics that read as thickness and warmth. Pushed far in FUZZ it drives the gated, sputtering behaviour that mode is built around.

The lower row is the voicing after the fact. TONE is a post-distortion lowpass that pulls the fizz down from 22 kHz to 500 Hz, reading OFF at the top of its range. MID scoops or humps at the archetype's own centre frequency — scooped for modern and metal flavours, humped for a lead that has to cut. MIX blends against the dry signal, which is how you keep chords intelligible: distortion on a bus makes notes intermodulate, so a parallel dry path preserves the harmony while the wet path supplies the aggression. LEVEL is the clean trim on top of the auto make-up.

About that make-up: DRIVE holds the *peak* steady by construction, but not the loudness. As the cascade converts dynamics into harmonics it lifts everything that was quiet, and the average level climbs with it — around 6 dB by the top of the knob, more in FUZZ. AUTO measures that per archetype and takes it back out, so you can run the knob end to end and hear the sound change without the level chasing you. Switch it off when you want the drive to push.

The distortion arrives already patched: in the default chain it takes the BitCrusher's output and feeds the chorus. The patchbay allows sharper tricks — it can sit inside the delay's, chorus's or reverb's feedback loop, so every repeat comes back dirtier than the last. **The patchbay chapter (Chapter 5 — Mixer & Patchbay)** maps those routes.

Distortion

FX · 13 parameters

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Distortion Enable	Off / On	Off	Switches the distortion on or off.
Dist Mode	OD · Dist · Fuzz · Metal	OD	Archetype: OD (mild singing overdrive that keeps some dynamics), DIST (classic hard, flat picture), FUZZ (broken and asymmetric, bias drifting with the envelope so decays sputter), METAL (tight, scooped, the widest gain range).
Dist Drive	0 – 1	0.35	Pre-clip gain, in decibels — up to +30 (OD), +42 (DIST), +48 (FUZZ) or +60 (METAL). Every stage is calibrated to leave a nominal signal at nominal level, so DRIVE changes what the sound is, not how loud it is.
Dist Bite	0 – 1	0.25	Lifts a mid band into the cascade and puts it back on the way out, so the band is driven harder rather than made louder — five to six times the harmonic content around its centre at any playing level, balance left within a few dB. The depth follows the envelope, so accents come out grittier than ghost notes: the device that makes a distorted acid line speak instead of buzz.
Dist Low	0 – 1	0.5	What the low end does. Left of centre a tight highpass into the drive (20 Hz up to ~300) so bass cannot eat the headroom; right of centre a clean sub band split out, routed around the distortion and summed back. Centre passes everything through.
Dist Bias	0 – 1	0.5	Asymmetry. Centre is symmetric (odd harmonics only); either side skews the curve and brings in even harmonics — the difference between a clean fold and a tube-ish thickness. Extremes push FUZZ into its gated sputter.
Dist Tone	0 – 1	1	Post-distortion lowpass — pulls the fizz down from 22 kHz to 500 Hz; OFF at the top of the range leaves the signal untouched.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Dist Mid	0 – 1	0.5	Post-clip mid voicing at the archetype's own centre frequency: scoop for modern and metal flavours, hump for a lead-forward push, flat in the middle.
Dist Mix	0 – 1	1	Parallel blend of distorted and dry signal — lower it to tuck the dirt under the intact sound.
Dist Level	-inf dB – 12.0 dB	0.0 dB	Output level after the auto make-up, from mute to +12 dB.
Dist Autogain	Off / On	On	Auto make-up. DRIVE holds the peak steady but not the loudness — converting dynamics into harmonics lifts everything quiet, around 6 dB by the top of the knob (more in FUZZ). AUTO measures that per archetype and takes it back out. On by default; switch it off when you want the drive to push.
GR Dest 1	None – Dist Bias	None	DIST ENV route: the parameter the distortion’s input envelope pushes — playing dynamics into any destination.
GR Amount 1	-1 – 1	0	Depth and direction of the DIST ENV route — negative values pull the target down as playing gets louder.

BitCrusher: controlled damage

Two knobs do the damage. BITS redraws the waveform on a coarser amplitude grid: at the top of its range the grid is fine enough to be transparent, and as it comes down the wave turns to audible steps. The quantizer is dithered the way a real converter is, so through the upper and middle of the range quiet passages and decays dissolve into a gentle noise floor instead of cutting out; keep going down and the dither fades away on purpose, leaving raw grit and, at the very bottom, gated crackle. The control is continuous, and fractional bit depths shift the grid smoothly, so a modulated BITS sweeps rather than clicking between settings. FREQ is a virtual sample rate: at the top of the knob the decimator is off — genuinely off, at any host rate — and as it comes down, a hold-style resampler makes the folded-back image frequencies audible — the classic downsampled alias sheen. This is the one place in the instrument where aliasing is the point. DRIVE is a soft clip before the quantizer; a touch of it tames spiky inputs so they do not splatter into huge quantization jumps, and more of it thickens the crush. It is loudness-compensated, so what grows is density, not volume.

The crush can also be played in tune. Flip **TRACK** and the FREQ knob becomes **RATIO**: the virtual sample rate follows the note you play, RATIO × the fundamental. Because the rate moves with the pitch, the alias partials keep the same musical interval on every key — at whole-number ratios they lock into the harmonic series and the sheen becomes part of the chord instead of a fixed hiss over it. Note changes lock the tracked rate instantly, so the alias pattern is stable from the first sample of every attack. Each mode remembers its own knob position, so flipping TRACK back restores the absolute rate you had dialed.

The TRACK, RISE and WIDE switches sit in the section header beside the power button; the five knobs — MIX, BITS, FREQ (or RATIO), DRIVE and TONE — run in a single row beneath them. **RISE** changes the quantizer's grid: the default (mid-tread) has a level at zero, which is where the gated crackle at low BITS comes from; RISE has no zero level, so quiet passages sputter between the two nearest steps instead of cutting out — at 1 bit it is a true rail-to-rail comparator. **WIDE** runs separate left and right capture clocks half a period apart, so the two channels crush at different instants and the grit spreads across the stereo field. **TONE**, the last knob in the row, is a lowpass after the damage — pull it down to tame the alias sheen while the steps stay.

The BitCrusher is a single node in the routing system, and its character changes with its address. Feed it one oscillator directly and that line alone turns to grit while the others stay clean. Put it after the delay and the tails degrade like worn media. Run it in parallel against the clean mix for weight without total destruction. Its controls have their own panel on the FX tab, and BITS, FREQ, MIX, DRIVE and TONE are all modulation destinations, so the damage can move with the music.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
BitCrusher Enable	Off / On	Off	Switches the BitCrusher on or off.
BitCrusher Mix	0 – 1	1	Dry/wet blend for the crushed signal.
BitCrusher Bits	1.0 – 16.0	16.0	Amplitude grid of the quantizer — full is transparent, low is coarse steps; fractional values sweep smoothly.
BitCrusher Freq	200.0 Hz – 22050.0 Hz	22050.0 Hz	Virtual sample rate — top of the knob is OFF (no decimation); lower it and a hold-style decimator adds the classic downsampled alias tone.
BitCrusher Drive	0 – 1	0	Soft clip before the quantizer — tames spiky inputs and thickens the crush. Loudness-compensated, so it adds density, not volume.
BitCrusher Track	Off / On	Off	Locks the decimation rate to the played note (RATIO × pitch) so the crush stays in tune across the keyboard.
BitCrusher Ratio	×0.5 – ×64.0	×8.0	With TRACK on, the virtual rate as a multiple of the note pitch — whole-number ratios lock the aliasing into the harmonic series.
BitCrusher Tone	300.0 Hz – 22050.0 Hz	22050.0 Hz	Lowpass after the crush — pulls down the alias sheen while the steps stay; top of the range is off.
BitCrusher Rise	Off / On	Off	Quantizer grid with no zero level — quiet passages sputter between steps instead of gating out; at 1 bit a true rail-to-rail comparator.
BitCrusher Wide	Off / On	Off	Separate left/right capture clocks — the two channels crush at different instants and the grit spreads across the stereo field.

The freezer: catch a moment and hold it

The freezer is a tape-stop that never lets go. While the module is on it is quietly recording recent input into a rolling buffer; press **FREEZE** and that recording stops moving, and instead of the live signal you hear a short slice of the captured audio looped back seamlessly — a sustained pad conjured out

of a single instant. Let go and the live sound returns. The freeze is a fast crossfade at both ends, so catching a chord mid-phrase or stuttering the button in time never clicks.

Four knobs shape what you froze. WINDOW sets how much recent audio the capture holds — from 100 ms (a tight stutter) up to two seconds (a wide, evolving pad) — and so bounds how far POSITION can reach back. GRAIN sets the length of the looped slice, from a tight, almost pitched fragment up to a slow half-second swell. POSITION is where in the captured window that slice reads from — at the bottom it sits on the oldest audio in the window, at the top on the newest, the instant you froze, so turning it up seeks forward through the last thing you played without ever crossing a seam. MIX blends the frozen texture underneath anything you keep playing live, so the freeze becomes a drone to solo over rather than a hard replacement. MODE picks the character: SMOOTH is the clean sustained loop, REVERSE plays the grains backwards, and CLOUD scatters four overlapping copies — now decorrelated left and right for real stereo width — into a diffuse, choir-like wash that smears away the metallic tint a single tight loop can have.

SYNC locks the freezer to the beat, the same switch the chorus and reverb carry: with it on, WINDOW and GRAIN become musical time divisions instead of milliseconds — a window of one bar and grains of 1/16 turn a frozen chord into a texture that loops in time with the song, and stuttering FREEZE from a step sequencer lands every repeat on the grid. The divisions track the host tempo live, so a tempo change re-tunes the whole texture without touching a knob.

None of it clicks because the loop is built to hide its own edges: two windowed copies of the grain are always crossfading, arranged so that at the instant one copy wraps around it is silent while its partner sits at full volume in the middle of the grain. The seam is always covered. Grain size, position, mix and window are all smoothed too, so scrubbing the knobs — or aiming an LFO at them — glides instead of stepping. And because **FREEZE** is a control rather than a plain button, it is itself a modulation destination that engages on any positive value: a square — or any bipolar — LFO or mod step-seq on FREEZE turns the effect into a rhythmic stutter that grabs and drops the sound in time, while an LFO on POSITION makes the frozen loop drift through its buffer on its own. The FREEZE button lights whenever the freeze is actually engaged — by hand or by modulation — so a gated stutter shows on the panel. FREEZE, POSITION, GRAIN, MIX and WINDOW are all modulation targets.

Like every effect here it is one node in the routing graph, and by default it sits just after the reverb on the way to the master — freeze the tail of a reverb and it blooms into an endless pad. Move it earlier to freeze a dry oscillator, or run it in parallel for a frozen layer beside the live line. Its panel is on the FX tab, below the BitCrusher — WINDOW, GRAIN, POSITION and MIX, with the FREEZE latch, the mode picker and SYNC in the header; its output level rides the FREEZER fader on the mixer.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Freezer Enable	Off / On	Off	Switches the freezer on or off; while on it continuously records recent input (up to the Window length), ready to freeze.
Freezer Freeze	0 – 1	0	Latches the captured buffer and loops it back as a sustained tone; release returns the live signal. A modulation target that engages on any positive value, so a square — or any bipolar — LFO or mod step-seq gates rhythmic stutters.
Freezer Grain Size	20 ms – 500 ms	120 ms	Length of the looped slice, 20–500 ms — short is tight and almost pitched, long is a slow evolving swell.
Freezer Window	100 ms – 2000 ms	500 ms	How much recent audio the freeze captures and loops, 100 ms – 2 s — short is a tight stutter, long is a wide evolving pad. A modulation target.
Freezer Position	0 – 1	0.5	Where in the captured buffer the loop reads — oldest audio at the bottom, newest (the freeze point) at the top; sweep or modulate it to travel forward through what you played.
Freezer Mix	0 – 1	1	Blends the frozen texture under any live signal, from dry to fully frozen.
Freezer Mode	Smooth · Reverse · Cloud	Smooth	Grain character: Smooth (clean sustained loop), Reverse (grains play backward), Cloud (four scattered copies for a diffuse wash).
Freezer Sync	Off / On	Off	Locks WINDOW and GRAIN to musical time divisions that follow the host tempo.
Freezer Window Division	1/1 … 1/128 (18 steps)	1/4	Capture window as a musical division while SYNC is on — up to two bars, capped at the 2 s buffer.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Freezer Grain Division	1/1 … 1/128 (18 steps)	1/16	Grain length as a musical division while SYNC is on — repeats land on the grid.

The master section: the last inch of the signal

Every path through the instrument ends here. Once the routing graph has summed everything headed for the output — dry cables, effect outputs, oscillator directs — the master bus runs one fixed chain on that sum: high-pass, box cut and brilliance, then stereo control, then volume and the limiter. The tone controls live in the MASTER FX panel on the FX tab; the stereo controls sit on the Mixer tab next to the goniometer. The limiter itself is a global on/off with a single control — a compact **L** button in the header, reachable from any tab, just past the output meters.

The master tone stage is three continuous knobs. **HPF** sweeps the corner from 20 Hz to 400 Hz, with the bottom of the range reading OFF — so you can trim exactly as much rumble as the track needs rather than picking from fixed steps. **BOOST** adds a resonant emphasis right at that corner: at 0 dB the slope is a clean Butterworth, and as you raise it the cutoff becomes a deliberate bump that can make the low end feel tighter and louder even as everything below it is removed. **BOX CUT** scoops the congested, boxy low-mids around 400 Hz — sweep the depth in dB until the mix opens up. BRILLIANCE is a high-shelf at 4.5 kHz with a twist: AMOUNT sets the lift, and DRIVE saturates the lifted band, generating new harmonics above what the patch contains — a clean shelf at zero drive, an exciter when pushed.

Then the image, which lives on the **Mixer tab (Chapter 5 — Mixer & Patchbay)** beside the goniometer — the display you need to judge it by. STEREO WIDTH scales the whole picture, from fully collapsed — the honest way to hear what a mono system receives — through unchanged, to tripled. MONO BASS is the anchor: below the frequency you set, the two channels are summed to the center, so the low end stays planted on big systems no matter how wide the rest of the patch swims. Width where it helps, mono where it matters.

The sub oscillator has an escape route of its own: SUB DIRECT — the FX BYPASS switch on the sub's Oscillators-tab header and its mixer strip, mirrored by the patchbay's SUB → OUT cable — routes it around the effects and the master tone stages, straight to the output bus, so the foundation stays clean and centered while everything above it is shifted, frozen, crushed or widened.

Last in line is the true-peak limiter, on by default. It is a safety ceiling, not a loudness tool: leave it on and the occasional resonance spike or feedback swell is caught before it clips the output; switch it off at the header's **L** button if you would rather handle overs in your own chain. Its on/off state is global rather than stored in a preset, so it stays where you set it as you browse sounds.

The limiter is also the plug-in's only source of latency. Switched on it looks 1.5 ms ahead of the signal and reports that to the host, which compensates so everything stays in time. Switched off there is nothing to compensate: the output is the input, undelayed, and the reported latency is zero. Flipping the switch therefore genuinely changes the plug-in's delay and asks the host to redo delay

compensation across the project — the instrument crossfades the change over about ten milliseconds so it smears rather than steps, but it is a set-and-forget switch rather than a performance control. With the limiter as the final stage, nothing in this chapter — not runaway delay feedback, not a frozen reverb under a fresh bass line — has to be timid. Push the effects as far as the music wants; the exit is guarded.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Preset Volume	-24.0 dB – 24.0 dB	0.0 dB	The PRESET fader — a per-preset level offset (±24 dB) saved with each patch for level-matching presets; aim for the amber −6 dB mark, or let AUTO set it while the preset plays.
Master HPF	OFF Hz – 400 Hz	OFF Hz	Master high-pass. Sweeps 20–400 Hz; the bottom of the range is OFF, so you can dial in exactly as much low-end clearing as the track needs.
Master HPF	Off · 35 Hz · 80 Hz · 120 Hz · 220 Hz	Off	Compatibility only — the retired three-position selector. Kept so presets saved before the continuous knobs still recall their setting; not shown in the UI.
Master HPF Boost	0.0 dB – 18.0 dB	0.0 dB	Resonant lift right at the high-pass corner — 0 dB is a clean Butterworth slope, higher values put a peak at the cutoff for a firmer, more forward low end.
Master HPF Boost	None · Medium · High	None	Compatibility only — the retired three-position selector. Kept so presets saved before the continuous knobs still recall their setting; not shown in the UI.
Sub FX Bypass	Off / On	Off	Sub FX BYPASS — ON sums the raw sub after the master tone chain (clean of master FX), still pre volume/limiter; mirrored on the sub panel, the mixer SUB strip and the patchbay SUB → OUT cable.
Box Cut	0.0 dB – 18.0 dB	0.0 dB	Scoops the congested, boxy low-mids around 400 Hz — sweep the depth in dB until the mix opens up. 0 dB is off.
Box Cut	Off · Low · Med · High	Off	Compatibility only — the retired three-position selector. Kept so presets saved before the continuous knobs still recall their setting; not shown in the UI.
Brilliance Amount	0.00 – 1.00	0.00	High-shelf lift around 4.5 kHz — the exciter-style sheen on the master.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Brilliance Drive	0.00 – 1.00	0.00	Saturates the lifted band for exciter-style harmonics on top of the shelf.
Mono Bass	0 – 500	0	Sums the channels to mono below this frequency so the low end stays anchored in the center.
Stereo Width	0.00 – 3.00	1.00	Overall image width — zero collapses to mono, one leaves it unchanged, up to triple width at three.
Limiter	Off / On	On	True-peak safety limiter on the final output — catches spikes before they clip; on by default. It is the plug-in's only latency: on reports 1.5 ms of look-ahead to the host, off reports none.

CHAPTER 07

The Sequencer

One bar of weighted chances — the probability grid, beat links, strength map, note pool, style phrases and timing feel that turn dice rolls into lines.

Phaseburn One's sequencer does not play back a pattern you drew — it rolls dice you have weighted. You decide how *likely* a note is at every point in the bar and which pitches are in the running; the instrument performs a fresh take every bar. The whole system lives on the **Groove** page — its one outlying control, the SEQ switch, rides on the Groove nav tab itself — and all of it feeds the one voice built from the Phase-Locked Loop (PLL), VECTOR, MORPH and sub sources covered in **the oscillators chapter (Chapter 2 — Oscillators)**.

One bar, one page

Learn where the three decisions live, and the rest of this chapter reads itself. The sequencer is one page — **Groove** — and one module runs the full width of its top: the **GENERATE** panel, holding the Scale and Pattern selectors, the SPREAD slider and the BEATS, NOTES and BOTH actions covered in **the Suggest chapter (Chapter 8 — Suggest)**, with the three view tabs — **Beats**, **Notes**, **Strength** — pinned to its right-hand end. That module never changes shape, so the pick-a-scale-then-generate flow never leaves the page, and leaving Groove and coming back returns you to the tab — and the beat division — you were working on.

Beats comes first, because a groove starts as rhythm. It decides *when*: the probability grid with its 152 slots, the beat-link tool, and a row beneath the grid carrying the family and division buttons that choose the row you are editing plus the **Undo**, **Vary** and **Clear All** actions. **Notes** decides *what* can play: the bar preview across the top, the note pool with its per-note chances and preferences, octave randomization, the ARPEGGIO phrase controls, the SKIP and DRIFT knobs that let individual oscillators gamble against the line, and the **PERFORM** module — Density and Register, which reshape the pool you already have, then transpose, MIDI mode and velocity lock. **Strength** decides *how much each moment matters*: the map of every bar position's relative weight — beat one strongest in most grooves — that the probability, length and velocity systems target. Along the bottom of the Beats and Strength tabs run the GLOBAL, LENGTH, VELOCITY and POSITION modules, whose sliders set swing, legato and the length, velocity and position modifiers that decide how long notes ring and how they land.

Starting and stopping belongs to your host: the DAW transport runs the sequencer, so bars roll when the project plays and stop when it stops. What you arm is the **SEQ** switch on the Groove nav tab, visible and clickable from every page. It gates the internal note sequencer alone — switch it off and the instrument stops rolling bars of its own while everything else keeps running: host sync, the step modulators, tempo-synced LFOs and the MIDI notes you send. That is the setting for driving Phaseburn One from MIDI in your host. It is per-instance plugin state, saved into the project and

recalled with it, on by default and never changed by loading a patch. Switching it off mid-bar releases the sounding sequencer note cleanly without cutting held MIDI notes; switching it back on re-anchors the bar to the host grid. The modules that only act on sequenced notes — LENGTH, VELOCITY and POSITION on the Groove page, NOTE STRENGTH on the Modulation page — dim and wear a small SEQ OFF tag while the switch is off: they cannot reach the notes your DAW plays, though every control stays editable for when the sequencer returns. The running sequencer emits real note events into the same voice your keyboard plays — there is no separate sequencer sound.

The bar the grid draws is always four quarter notes long. An odd host meter masks its tail rather than stretching it — a sixteenth has to stay a sixteenth — so 3/4 and 6/8 both play the grid's first three quarter notes and never reach the fourth, 7/8 plays three and a half, and meters longer than a 4/4 bar clamp back to the whole grid.

One distinction is worth knowing early. Every slider in the GLOBAL, LENGTH, VELOCITY and POSITION modules is a real host parameter your DAW can automate, and they appear in the table at the end of this chapter. The bar's contents are not: the beat slots, the note pool, the strength map, the beat links and the style settings are pattern data. They travel with the preset and with your saved project, they can be rewritten in one gesture by SUGGEST, VARY and CLEAR ALL, and they are undoable — but they are not automation targets, and they do not appear in your DAW's parameter list.

Chances, not steps

Program a line by deciding how much you want each hit, not whether it happens. The **Beats** tab — the grid names itself **BEAT PROBABILITY** down its left edge — edits one bar as a single grid of chances, one row at a time: in the row beneath the grid, the S, T and D buttons pick a family — straight, triplet or dotted — and the division buttons beside them pick which of that family's rows you are editing. Every other row that holds anything stays visible as translucent shapes hanging from the top of the grid, so you can see what else claims each moment. Each shape is captioned with the division it belongs to — 1/16, 1/8T, 1/4D — and clicking one takes you straight to that row to edit it. Where several rows claim the same stretch the shapes stack, one band per contributing beat, so a mixed moment is still legible band by band; a band too small for its caption still highlights on hover and names itself in the help bar. The straight family runs six rows — one slot for a whole-note hit, two halves, four quarters, eight eighths, sixteen sixteenths, thirty-two thirty-seconds — sixty-three slots. The triplet family adds four rows, half- to sixteenth-note triplets — forty-five slots. The dotted family adds five rows, each holding as many dotted notes as can start inside the bar — forty-four slots, with odd counts like eleven dotted sixteenths because a dotted note is half again as long. That makes 152 slots, all live whether displayed or not, all competing for the same bar.

Raising a slot raises the odds that a note *begins* at that moment with that duration. Only a slot at exactly zero is off; anything above zero is a contender, however faint. When several slots want the same moment — the bar's first sixteenth shares its downbeat with the first eighth, the first quarter and the whole note — one weighted draw picks a winner, and the winner plays out its full duration, silencing every other slot until it ends. Phaseburn One is monophonic by design, and the lottery is how one voice arbitrates 152 claims.

Chance is a shared budget, not a private one. A slot that loses a draw still spends its share: until the span it wanted to fill has passed, its chance stays subtracted from the budget of every later draw. The grid balances itself — piling chance into one row drains the effective odds of the moments around it — which is why a groove keeps its character even when every row is busy.

Edits are reversible. **Undo**, in the same row, walks back up to ten steps: every generated groove, Clear All and link edit stacks the whole grid first — slot chances, links, the strength map, swing and note length — so a run of VARY presses is something you can walk out of. Loading a preset clears the stack.

In an odd host meter the stretch of grid past the end of the bar sits behind a dimmed panel, cut off by a line captioned OUT OF BAR, and its lanes grey out with it. Those slots keep whatever chance they hold — a suggestion always composes a full 4/4 bar, so its closing figures often land there — but nothing behind the cut is ever reached.

A fresh bar is rolled at every bar line, and the next bar is prepared while the current one plays, so edits land cleanly on the next downbeat. Every slot names itself after its row and position — “1/1 Beat 1” is the whole-note slot, “1/16 Beat 3” the third sixteenth, “1/8T Beat 1” the first eighth-note triplet — and the help line reads that name and the slot’s chance out while you drag it. Because CLEAR ALL, SUGGEST, VARY and a link edit each land as a single change, a bar rolling underneath you can never catch a grid halfway through one.

> The lottery, exactly
>
> Each slot stores 0–127, and 127 is the whole budget of a moment: a lone slot at 60 plays in about 47% of bars (60/127), and any value above zero competes. At each start time one number is drawn from the budget the losers have not already spent and walked through the candidates in flat slot order — straight rows first (0–62), then triplet (63–107), then dotted (108–151). Slots at 60 and 120 sharing a moment therefore always produce a note — their sum exceeds the budget — with the earlier slot keeping its ≈47% and the later one taking the rest. Slots that start inside a winner’s span never roll at all, and a candidate that competes and loses — even to silence — stays subtracted from later draws until its own would-be span ends.

Beat links

Build ratchets and fills that only exist when their anchor plays. A beat link is a forward connection between two slots, set on the Beats tab by picking a source beat and then its target: whenever the source actually wins its draw, the target is forced to play too, regardless of the target’s own roll. Links chain — connect A to B and B to C, and one lucky anchor drags a three-hit figure out with it.

The sharpest use is a target with zero chance of its own. A slot at zero never plays by itself, but as a link target it fires every time its source does — a ratchet that exists purely as a consequence. Give the source a middling chance and the figure appears in some bars and not others, always complete

when it does. Generated fills work the same way: the beat generator writes its end-of-bar figures as links (see **Vary (Chapter 8 — Suggest)**), so a fill arrives as one gesture instead of a scatter of independent gambles.

You edit one division at a time, but you see every link at once. An endpoint that lives in another division is drawn on the grid you are on as a semi-transparent ghost — at its true position in the bar, in its own division's color — joined to its partner by a dashed arc that bows clear of the bars. Hover any linked slot and its whole chain lights up, ghosts included, so a sixteenth hanging off a quarter reads without switching rows.

One thing a link cannot do is put two beats on the same instant. Divisions overlap by design — the 1/8, the 1/16 and the 1/32 all start together on the downbeat — and "always plays" has no meaning if it points at two of them at once. So while you are choosing a target, any position already spoken for by the chain you are building is struck through and refuses the click, and the help bar names the beat that holds it. Pick the other one, or unlink the first.

Links reward restraint: they resolve recursively, so long chains turn a single win into a cascade that eats the rest of the bar — short chains of two or three beats stay groove-shaped. A forced beat enters the bar like any other note, so everything downstream still applies: it reads the strength map, rolls its own pitch from the pool, and takes length and position modifiers like its neighbors.

Links are also the sequencer's slide machine. Push the **Length** slider in the GLOBAL module past full so consecutive notes overlap, raise the **Legato** slider off its Off detent, and a linked pair plays as a slide: the second hit glides out of the first without a new attack, along the legato path described in **Glide and legato (Chapter 2 — Oscillators)**. An anchor with a zero-chance target one division later is the recipe for an acid figure that appears only in some bars and always slurs the same way.

Strength and dynamics

Give the bar a spine of accents, then let every other decision lean on it. The **Strength** tab — the grid reads **BEAT STRENGTH** down its left edge — holds one map of the bar: 96 positions, fine enough to give every straight *and* every triplet slot its own cell — edited in a straight view of thirty-two positions or a triplet view of twenty-four, with the other view shown as reference lines. Draw it by hand or start from one of fifteen built-in styles behind the **STYLE** browser in the row beneath the grid, from 4/4 Standard and Backbeat through Polyrhythm 3:4, Reggae and Funk to Ambient and Driving.

Strength is not velocity, and it drives nothing by itself. It is the *relative* strength of each beat position — beat one strongest in most grooves, the backbeats next, the gaps between them weakest — a ranking that other systems *target*: aim a modifier at strong beats and it fires only where the map reads high, aim it at weak beats and it works the ghosts. Five separate systems consult the ranking this way: note selection (pool notes can prefer strong or weak beats), octave randomization (which can be gated to strong beats), the length and position modifiers' targeting, the velocity modifiers — the only route by which strength reaches loudness at all — and the NOTE STRENGTH modulation route (see **the modulation chapter (Chapter 4 — Modulation)**), which lets a strong-beat note push a sound parameter for its duration. Each note reads exactly one cell — the nearest one to its grid start,

measured *before* swing and humanization shift it — so timing feel never changes which strength cell a note obeys.

Contrast is what gives the map meaning, but the targets never lose a timid map: every weak/any/strong target — length, position, velocity and NOTE STRENGTH alike — is judged against the map's own quietest and loudest cells among the beats that can actually play, stretched to the full range. Turned fully to Weak, a target reaches only the beats sharing the map's weakest playable value; fully to Strong, only the beats sharing its strongest; between Any and an extreme its reach narrows linearly, so the knob sweeps from "every note" down to "just those beats". A perfectly flat map carries no ranking at all, and every target simply matches every note. The exception is the note pool's preferences and octave gating, which read raw cell values — a grid hovering around the middle barely steers them, which is why the built-in styles are shaped with low floors and the Suggest generator writes its grids the same way.

Dynamics come from the two velocity modifier slots in the VELOCITY module below the grid. One keys off beat strength, the other off note length; each has a weak/strong/any target, an amount above or below the base hit, and a probability. Amounts randomize "up to" the value you set, so accents breathe from bar to bar. The length-keyed slot ranks notes by the length they will actually play — the base Length share bent by the length modifiers — against the other notes of the same bar, so a note a modifier just clipped short really is the "short" a Short-aimed target finds, and a bar of identical lengths matches the target wherever it points.

Choosing notes

Decide which pitches are allowed to happen — and when each one is welcome. The Groove page's **Notes** tab holds the note pool: every note you enable carries a chance, a strength preference, a length preference and an octave placement. The root note is always present and serves as the fallback, so the line can never paint itself into silence. For each note event the sequencer reads the beat's strength, weighs every pool note — its chance scaled by how well this moment matches its preferences — and draws. A note that prefers strong beats is boosted up to double on accents and cut to a tenth on ghosts; a neutral note is indifferent. This is how one pool produces lines with grammar: stable tones land on the spine, passing tones fill the gaps.

You edit all of that on the keyboard along the bottom of the tab, and it sounds as you work: click or drag across the keys and each one you touch plays, always — there is no audition switch to remember. The selected key's Chance, Strength and Length knobs sit in the **NOTE** module, the module the page is built around, and every key on the roll carries those same three values as three slim bars — chance at the left, strength in the middle, length at the right — painted in the same three colors as the knobs, washed out where a preference points down rather than up. Knob and bar are one reading.

You can fill the pool two ways, both from the GENERATE panel above. Pick one of seventeen scales — Major, Minor, the modes (Dorian, Phrygian, Lydian, Mixolydian, Locrian), Harmonic and Melodic Minor, both pentatonics, Blues, Whole Tone, Chromatic, Japanese, Arabic and Hungarian — and one of eight stability patterns that write the preferences per scale degree: Traditional (stable notes on

strong beats, passing tones on weak), Jazz Melodic (sevenths and thirds prominent, the fourth avoided), Ambient, Bass Heavy, Melodic, Tension, Even and Pentatonic. With a concrete scale selected, changing either selector rewrites the pool immediately. Each selector's first entry is **Auto**. Scale on Auto means any scale: it fills nothing by itself, but every suggestion rolls a scale to suit the groove, tints the roll's in-scale keys with its pick and leaves the selector on Auto so the next press can roll again. Pattern on Auto works the same way — each suggestion rolls a concrete pattern to voice with, and the selector never moves. Or press **NOTES** in the panel, which generates a multi-register voicing in the selected scale and pattern — neither selection is ever overwritten — see **Note voicing (Chapter 8 — Suggest)**. Either way, every per-note value stays editable afterwards.

The pool is octave-aware. The same pitch can sit in it at several octaves with independent settings — a low copy weighted toward grounding bass duty, an upper copy saved for climactic moments — so register becomes part of the probability story. On top of that, global octave randomization can shift the *chosen* note after selection: its own chance, strength and length conditions all have to pass, a direction control restricts the move to down, up or either, and a RANGE control caps the jump at one or two octaves.

The SKIP and DRIFT knobs in the OSC INDEPENDENCE module run a different gamble — individual oscillators sitting out a note or playing a different pool note than the voice — covered in **Oscillator independence (Chapter 2 — Oscillators)**.

> The match formula
>
> A note's weight is chance × strength match × length match. Each match term is clamp(1.0 + pref × (beat – 0.5) × 2.0, 0.1, 2.0) with the preference and the beat value normalized, which is where the "up to double, down to a tenth" range comes from. Scale chances are matched by semitone interval from the root rather than by position in the scale, so the same weighting logic holds for five-note and twelve-note scales alike.

The bar preview

The top of the Groove page's Notes tab is given to the **bar preview** — a piano-roll view of what the engine actually decided. It wears no title bar, just a small badge floating over the grid: a dot reading **LIVE** while bars are rolling or **STOPPED** when they are not, and under it **READ-ONLY PREVIEW**. The whole bar is rolled the moment it begins, and the preview shows it immediately: every chosen note appears as a hollow outline at its pitch, position and length, and turns solid as the playhead sweeps past it. You see the dice land before you hear the result, then watch the line confirm it. When the bar turns over, the old one lingers as a grey ghost and melts away while the new roll draws in; stop the sequencer and the last bar freezes, dimmed, for inspection.

The badge means what it says: pitches, timing and lengths belong to the probability engines, so nothing in the grid responds to clicks. What it does instead is close the loop with the settings around it. Rows glow with each pool note's chance — in the same color the NOTE module's Chance knob wears — so the pitches the dice favor are literally brighter; the root row is amber; when octave

randomization is on, its landing rows carry a dashed guide, and you can watch notes jump register exactly where the guides said they might. Louder notes draw more opaque, notes rolled on stronger beats draw taller, and a small amber tick marks the notes that fired the note-character modulation route. Oscillator independence shows its hand here too: when DRIFT sends an oscillator to a different pool note, a slim teal bar appears on that pitch's row for the note's duration, tethered to the main note by a dotted stem — the chord the gamble built, drawn as it sounds. Each satellite carries a small label naming the oscillator that drifted there — PLL, VEC, MOR or SUB, joined like VEC·MOR when several land on the same pitch — dim until the note sounds and omitted on bars too slim to label. The label always sits clear of the bar it names, flipping to its left near the right edge rather than printing over the teal. Wider notes also carry four small dots reporting each oscillator's fate (lit plays the voice note, teal drifted, hollow sat out to SKIP). These marks only appear as each note fires, because that is when the engine rolls them: the outlines ahead of the playhead genuinely don't know yet. The view scrolls vertically — it auto-centers on your pool, and small amber arrows point at anything sounding beyond the visible rows. Raise a note's Chance and its row brightens; push Length preference up and the bars stretch — the preview is where those abstractions become visible rhythm.

Style patterns

Let the line break into arpeggios, rollers and stabs without programming any of them. After a bar's notes are chosen, the phrase engine can seize runs of consecutive beats and overwrite their pitches with an idiom — a stutter, a climbing arpeggio, a snap to the octave and back. You do not pick the idiom: every bar rolls its own vocabulary, so one bar phrases in one dialect and the next may take another. What you shape is how far the phrasing goes.

Five controls in the ARPEGGIO module on the Notes tab do that shaping. **Chance** sets how often a phrase starts, and it is also the on/off switch: at zero the engine never intervenes and the sequencer plays the pitches the pool drew. **Complexity** is the character control. Every vocabulary carries twenty patterns ordered from simple to complex, and Complexity caps how deep into that list a roll may reach, so low values keep to two- and three-note figures while high values admit the long ornate runs — turn it down for a line that stays recognizable, up for one that keeps surprising you. **Max Notes** caps how many beats a single phrase may consume. **Mode** is one button that toggles its caption between Replace, where a new phrase interrupts one still running, and Finish, where the running phrase completes first. **Start** toggles the same way between Anywhere and Bar Start, which allows phrase starts only on the bar's first note — the setting for arpeggios that always launch from the downbeat. New patches begin on Finish and Bar Start.

Patterns are step sequences through the notes you enabled — relative moves like up one, down one, up three — wrapping into the next octave when they step past the edge of the pool. Because phrases draw only from your pool, one can never play outside your scale: it re-orders what you allowed rather than importing vocabulary, so even with most of the bar handed over to phrase idioms the harmony stays yours, and the rhythm is still whatever the probability grid decided.

> **Presets from earlier builds**
>
> Earlier builds picked the vocabulary from a browser, and switching the arpeggio off meant setting that browser to None. Those patches load with Chance at zero, so they stay exactly as silent as they were saved; patches from before Mode and Start existed load on Replace and Anywhere.

Timing feel

Make the bar lean before you reach for any effect. Three systems, all living in the modules below the beat grid, bend when and how long notes sound, without touching what plays.

Swing, a slider in the GLOBAL module, delays the second eighth of every eighth-note pair inside each quarter. At the neutral setting both eighths are equal; at a setting of 66 the first eighth takes 66 percent of its quarter note and the second squeezes into the rest — the classic shuffle lean. Swing moves playback timing only — accents are still read from the unswung grid.

Length, also in the GLOBAL module, sets the base duration of every sequenced note as a share of its slot. Below full, notes detach and the line turns staccato; past full, consecutive notes overlap — which is fuel for ties and, with the Legato slider raised off its Off detent, slides (see the next section). Two **length modifier** slots in the LENGTH module then bend duration per note: each has a target on the weak-to-strong continuum, an amount, and a probability, and amounts randomize “up to” the configured value so the articulation drifts from bar to bar. At their default targets the two slots aim one at clearly weak beats and one at clearly strong — shorten the ghosts and lengthen the anchors, and a static line starts phrasing itself.

Position modifiers, in the POSITION module, are the humanizers: two slots that shift notes off their grid positions. Each pairs a weak/strong/any target with a shift — negative pushes hits early, positive drags them late — plus a probability, again with “up to” randomization, so the push differs note to note and bar to bar. Position shifts happen after every decision has been made: they never change which slot won its lottery or which strength cell a note read, so the groove’s logic stays on the grid while its feel drifts off it.

When a groove feels stiff: strength-map contrast first, swing second, a length modifier aimed at weak beats third, and only then a touch of position shift — a little of each goes much further than a lot of one.

Playing it live

Treat the sequencer as an instrument you play, not a tape you start. The controls that matter on stage sit one layer up from the grids, most of them together in the **PERFORM** module on the Notes tab, in the order you reach for them: the Density and Register sliders that reshape the pool, the transpose nudges, the MIDI mode pair covered in **Input modes (Chapter 10 — MIDI & Your DAW)**, and Vel Lock. There is no audition control among them: a key you click or drag on the roll always sounds.

Density and Register work on the pool that is already on the piano roll — they generate nothing. Density scales every pool note's chance at once: pull it below the centre and the faintest notes drop out until only the backbone is left; push it above and quiet candidates come forward, so the line fills in. Register stretches or folds the pool's pitch span around the root in whole octaves, so every note keeps its scale degree while the voicing opens out or collapses toward the middle. Both are reversible while your hand is down — drag back to the centre and the pool returns exactly as it was, even though thinning removed notes and stretching merged them — and both commit when you release, at which point the slider springs back to the centre because the pool simply *is* the new result. There is no undo between gestures.

Legato — the slider in the GLOBAL module below the beat grid — makes overlapping notes glide instead of retriggering: raise it off its bottom Off detent and the envelope carries through while the pitch slides over the time you dial in, separate from the PLL's always-on GLIDE — the interplay is described in **Glide and legato (Chapter 2 — Oscillators)**. Since overlap is what triggers it, the note-length lane decides which steps slur. Vel Lock, in the PERFORM module, keeps the held dynamic through each transition so slurred phrases stay on one level. **VCA** mode goes further: the envelope neither triggers nor releases and the voice holds permanently open, so the sequencer re-pitches a continuous drone — run it when the level should come from somewhere else, like a host-side gate or the filter riding an LFO. It has no panel control of its own; reach it from a preset or host automation.

Note priority decides which of several held MIDI keys owns the voice: the last played, the lowest or the highest. Last is what a sequencer-driven monophonic voice wants, so it has no panel control — like VCA mode, it is exposed to the host rather than drawn on the window. Set it from a preset or a host parameter and low priority with legato gives the classic bass-player setup — hold the root, hammer above it, always fall back home.

Host Sync phase-locks the bar to the DAW timeline while playing, and is on by default whenever a host transport is running — which is also what starts and stops the sequencer, so there is nothing to arm before a take beyond the SEQ switch on the Groove tab. A transport start plays from the top: the DAW beginning playback hard-resets the sequencer to beat 1 of bar 1, the step modulators and LFOs restarting with it, rather than re-anchoring to wherever the host clock happens to read, so every take opens the same way. Until a DAW's transport has rolled for the first time, Play merely auditions the patch, resuming the bar where it stopped. Once rolling, loop wraps and relocates re-seek instantly, anchored to the host's bar lines — a take launched on a downbeat keeps the sequencer's downbeat on the DAW's bars throughout, and one launched mid-bar falls into line at the first wrap or relocate — and tempo changes rescale the playing bar in place. Like pitch-bend range, Host Sync has no panel control — it is exposed to the host rather than drawn on the window — so running the sequencer Free instead, on its own clock, is a host-automation move rather than a switch, and in that mode the Sequencer Enable parameter is what runs the bar, pausing and resuming it in place rather than restarting it from the top. External MIDI clock carries no position information, so it behaves as Free regardless — see **Clock and transport (Chapter 10 — MIDI & Your DAW)**.

A probabilistic bar regenerates on every loop wrap, deliberately — no pass is ever a guaranteed repeat of the last. There is no seed control: the random stream is seeded from system entropy when

the instrument loads, and for any given seed the generator's decisions are deterministic. When a pass is *the* take, record it — a bounce is the only permanent copy.

The table below also carries the instrument-wide performance parameters: the three aftertouch routes (covered in **Velocity and aftertouch (Chapter 4 — Modulation)**), the pitch-bend range, the transport's global volume, and the host bypass.

> How tight is host sync
>
> The engine keeps its own beat clock and compares it to the host's position every block. A jump larger than a quarter beat (loop wrap, relocate) re-seeks immediately; drift beyond 0.02 beats must persist for two consecutive blocks first — the jittery-host tolerance. Re-seeks are bar-anchored when the host reports bar starts, and a material seek (over ten milliseconds) releases the sounding note with a queued note-off instead of cutting it. LFOs re-phase along with the seek; the step modulators follow too, unless they retrigger per note.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Global Volume	-inf dB – 12.0 dB	0.0 dB	Master output level — the MASTER fader and the transport-bar volume; global, never moved by preset loads.
Bypass	Off / On	Off	Standard host bypass switch; the DAW uses it to take the instrument out of the signal path.
Pitch Bend Range	0 … 24 (25 steps)	2	How far the pitch wheel can pull the voice, in semitones each way.
AT Dest 1	None – Dist Bias	None	First aftertouch route: the parameter channel pressure pushes while you press into a held key.
AT Amount 1	-1 – 1	0	Depth and direction of aftertouch route 1 — negative values pull the target down.
AT Dest 2	None – Dist Bias	None	Second aftertouch route: the parameter channel pressure pushes.
AT Amount 2	-1 – 1	0	Depth and direction of aftertouch route 2 — negative values pull the target down.
AT Dest 3	None – Dist Bias	None	Third aftertouch route: the parameter channel pressure pushes.
AT Amount 3	-1 – 1	0	Depth and direction of aftertouch route 3 — negative values pull the target down.
Note Length %	1 – 200	95	Base length of every sequenced note as a share of its slot; past full, notes overlap into ties and slides.
Len Mod 1 Target	-100 – 100	-75	Which beats length modifier 1 aims at, from weak through any to strong, judged against the strength map's own quiet-to-loud range.
Len Mod 1 Amount	0 – 200	100	The length the modifier bends notes toward; each hit randomizes up to it from the base.
Len Mod 1 Prob	0 – 127	0	Chance per note that length modifier 1 fires at all.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Len Mod 2 Target	-100 – 100	75	Which beats length modifier 2 aims at, from weak through any to strong, judged against the strength map's own quiet-to-loud range.
Len Mod 2 Amount	0 – 200	100	The length the modifier bends notes toward; each hit randomizes up to it from the base.
Len Mod 2 Prob	0 – 127	0	Chance per note that length modifier 2 fires at all.
Vel Strength Target	-100 – 100	0	Which beats the strength-keyed velocity modifier hits, judged against the map's own quiet-to-loud range.
Vel Strength Amount	-99 – 27	0	Velocity push above or below the base hit when the strength modifier fires; randomized up to the value.
Vel Strength Prob	0 – 127	0	Chance per note that the strength velocity modifier fires.
Vel Length Target	-100 – 100	0	Which beats the length-keyed velocity modifier hits — ranked by the length each note actually plays this bar.
Vel Length Amount	-99 – 27	0	Velocity push above or below the base hit when the length modifier fires; randomized up to the value.
Vel Length Prob	0 – 127	0	Chance per note that the length velocity modifier fires.
Note Mod Strength	-100 – 100	0	Which notes fire NOTE MOD by strength — weak side, strong side, or Any in the middle, ranked within the map's own range.
Note Mod Length	-100 – 100	0	Which notes fire NOTE MOD by length — short side, long side, or Any in the middle, ranked among the bar's actual played lengths.
Note Mod Prob	0 – 127	0	Chance (0-127) that a matching note fires NOTE MOD — 0 turns the module off.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Note Mod Dest	None – Dist Bias	None	NOTE MOD destination — the parameter pushed for the duration of every note that fires.
Note Mod Amount	-1 – 1	0	NOTE MOD amount — how far the destination is pushed while a fired note sounds (±1, bipolar).
Vel Mod Dest	None – Dist Bias	None	VELOCITY module destination — the parameter the sounding note's velocity drives.
Vel Mod Amount	-1 – 1	0	VELOCITY module amount — how far full velocity pushes the destination (±1, bipolar).
Pos Mod 1 Target	-100 – 100	-75	Which beats humanizer 1 nudges, from weak through any to strong, judged against the strength map's own quiet-to-loud range.
Pos Mod 1 Shift	-50 – 50	0	How far humanizer 1 moves a hit off the grid — negative plays early, positive drags late.
Pos Mod 1 Prob	0 – 127	0	Chance per note that humanizer 1 fires.
Pos Mod 2 Target	-100 – 100	75	Which beats humanizer 2 nudges, from weak through any to strong, judged against the strength map's own quiet-to-loud range.
Pos Mod 2 Shift	-50 – 50	0	How far humanizer 2 moves a hit off the grid — negative plays early, positive drags late.
Pos Mod 2 Prob	0 – 127	0	Chance per note that humanizer 2 fires.
Swing	50 – 75	50	Delays the second eighth of every pair toward a shuffle lean; the bottom of the travel is straight time.
Legato	Off / On	Off	When on, overlapping notes glide into each other without retriggering the envelope.
Legato Time	1.0 ms – 500.0 ms	50.0 ms	How long a legato transition takes to reach the new pitch — separate from the PLL's GLIDE.

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Velocity Lock	Off / On	Off	Keeps the held note's velocity through legato transitions so a slurred phrase stays on one level.
VCA Mode	Off / On	Off	Holds the voice permanently open with no envelope — the sequencer re-pitches a continuous drone.
Note Priority	Last · Low · High	Last	Which held key owns the voice when several are down: the last played, the lowest or the highest.
Osc Skip	0 – 1	0	Per-note chance that a targeted oscillator sits out, thinning the tone from note to note.
Osc Drift	0 – 1	0	Per-note chance that a targeted oscillator plays a different pool note than the voice.
Sequencer Enable	Off / On	Off	Runs the sequencer — the transport play button; off, the synth plays only the MIDI you send. INT SEQ on the Groove page is a separate, persistent setting.
Seq Host Sync	Off / On	On	Phase-locks the bar to the DAW timeline; off runs Free, keeping the phase captured at start.

CHAPTER 08

Suggest

One press writes a working groove — built by explicit music-theory rules, with guaranteed anchors, varying figures and ornaments. No AI involved.

Press one button and the sequencer fills with a groove that already works — the driving quarters of techno, the offbeat spring of house, the scattered chop of a breakbeat. That is Suggest, and there is no AI behind it: no model, no training data, nothing learned from other people's music. Every groove is assembled on the spot by explicit music-theory rules — each style knows its skeleton and its fills, and the generator rolls ordinary dice inside those rules. Same rules every press, different performance every press.

The GENERATE panel

Set up the whole generative flow in one place, then fire it with one press. The **GENERATE** panel is a module running the full width of the **Groove** page's top edge, and it stays put whichever tab is open below it. Left to right it holds its title chip, the **Scale** and **Pattern** selectors, the **SPREAD** slider, and the three actions — **BEATS**, **NOTES** and **BOTH** — with the three view tabs, **Beats**, **Notes** and **Strength**, pinned to the right-hand end of its header. The tabs choose what fills the page underneath and remember which view you left open, so a trip to another page and back puts you where you were. On the Strength tab the panel has nothing to generate, so its title reads **Strength** and it carries that view's one setting, the **STYLE** browser, instead.

Scale and **Pattern** set the harmonic frame. Both selectors' first entry is **Auto**, and both are sticky — no suggestion ever moves them. Scale on Auto lets every press roll a scale to suit the groove family it picked; the roll is reported back by tinting the in-scale keys on the Notes tab's piano roll while the selector stays on Auto, free to roll differently next press. Pick a concrete scale and every suggestion works inside it. Pattern behaves the same way: on Auto, each suggestion rolls one of the eight concrete stability patterns to voice with; pick one and every suggestion biases its voicing by that pattern's per-degree strength, length and octave preferences — the pattern's opinion layered over the generator's own harmonic weighting. With a concrete scale selected, the selectors also rewrite the pool directly, no suggestion needed — see **Choosing notes (Chapter 7 — The Sequencer)**.

SPREAD is the one slider. It shapes the voicing: how many octaves the generated pool opens around the root, read out in octaves on the slider itself. There is no density control here — every press runs the generator at its full figure count, so a generated groove arrives busy and thinning it is something you do afterwards, either by dragging the grid or with the Notes tab's **Density** slider in the PERFORM module (see **Playing it live (Chapter 7 — The Sequencer)**).

The selectors and the slider are *inputs to a press*, not live controls: nothing in the instrument changes until you press an action. Change one and the three actions take a soft accent to say a change is

waiting; press any of them and the accent clears.

BEATS, **NOTES** and **BOTH** are the actions, each wearing a small wand: there is nothing to arm, you press and something is written. BEATS writes a fresh groove — beat chances, links, the strength map, swing and the performance settings. NOTES re-voices the note pool for whatever rhythm is already playing and touches nothing else. BOTH writes the two together, coherently — the voicing knows which groove it was written for. The Beats tab's **VARY**, which shuffles what is already on the grid rather than conjuring a new pattern, keeps its own glyph for exactly that reason. The rest of this chapter is what each press actually writes.

One press writes a groove

Start a track from silence in one press, and audition another take with the next. Fire **BEATS** — or **BOTH** for rhythm and melody together — and the sequencer fills with a working groove. There is no style menu to set first: every press picks one of the sixteen groove families internally, so pressing again is how you audition another style as well as another take. What you can set first is the key: pick a scale in the panel, or leave the selector on **Auto** and let each press roll one to fit. **Vary**, which mutates what is already there instead of replacing it, sits in the row beneath the Beats grid between **Undo** and **Clear All** — it has its own section below.

These are actions, not parameters. Nothing here is a knob the preset stores; each press writes ordinary beat chances, links, strength values and notes into the same lanes you edit by hand, so everything Suggest produces can be inspected, reshaped or deleted step by step — see **the sequencer chapter (Chapter 7 — The Sequencer)** for what those lanes mean. The output has a deliberate shape: some notes are *guaranteed*, some *always play but change their figure*, and some *come and go*. That is the structure of real electronic music — a techno bar does not forget its downbeat — not a fog of middling probabilities.

The no-AI point matters in practice. Because the rules are written out rather than learned, the output is explainable — when a house groove lands its dependable hits on the offbeat eighths, that is a rule you can read below, not a statistical accident — and Suggest runs instantly, offline, on every machine, with no rights questions hanging over what it writes.

Suggest writes one bar for one line — the instrument is monophonic by design. It always composes a full 4/4 bar, because that is what the grid is. In a host running an odd meter the bar is masked rather than stretched, so a 3/4 or 6/8 project plays the first three quarters of what Suggest wrote and never reaches the last one — the fill zone, where the endings live — while 7/8 gets half of it. Nothing is lost or mangled; the groove simply ends early, and 4/4 is where you hear everything a press writes. See **One bar, one page (Chapter 7 — The Sequencer)**. Variety across bars comes from the lanes themselves: what Suggest writes is not a fixed pattern but a field of chances that performs a little differently on every pass.

The region-budget model

Trust the downbeat. Whatever Suggest writes, the notes that define the groove play every single bar — the interesting question is how the rest is allowed to move. The generator thinks in regions, and each region makes a different promise:

Anchors always play. These are the skeleton — the defining hits of the style. They are written at full chance and protected from everything else, so the groove's identity survives whatever the dice do elsewhere.

Varied parts always play, but change their figure. A varied part is a spot that always sounds, holding a small menu of figures — a single eighth note one bar, two linked sixteenths the next. Exactly one option fires every bar, never two piled on top of each other.

Loose parts play most bars and sometimes rest. This is the layer that makes a loop breathe — hits that are usually there, occasionally not.

Ornaments come and go. Ghosts — very quiet notes in the gaps — and pickups, the small notes that lead into a beat, surface only now and then, in whatever room the bar has left.

Fills burst at the end. A fill is a low-chance note that, when it wins, drags a chain of faster linked notes behind it — a sixteenth roll, a ramp of thirty-seconds into the next downbeat, or a ratchet: a double, buzz or drag of fine-grid hits hanging off a proper sixteenth. The chain only exists when its head plays, so fills arrive whole or not at all. Chains may switch grids mid-flight: a straight hit can smear into a triplet drag.

The bar also has a geography. The first quarter of a generated bar stays essentially stable — its hits play near-certainly, bar after bar — and the negotiable layers concentrate toward the bar's tail, where the fill zone lives. The groove keeps its base and lets the ending do the moving, which is how a loop stays recognizable while never repeating exactly. Every press writes the full complement of that negotiable material — each family's maximum figure count, its ornaments and its fills all at full weight — so a generated groove starts busy and you thin it toward the skeleton by hand. Anchors and varied parts are the part you cannot thin away by accident: they play no matter what.

> A lottery with a fixed budget
>
> Playback resolves each start time by a weighted lottery over a 127-point budget shared by every beat slot that overlaps it. Suggest exploits this exactly: an anchor takes the full 127 in a window it holds exclusively; a varied part's figures share one start time — the single draw there crowns at most one of them — and their weights sum to exactly 127, so the spot never falls silent; loose and ornament weights sit lower in the leftover budget of their window. Linked tail notes cost no budget and fire only when their head wins. Generated grooves are budget-exact by construction — validated at build time, never rescued by normalization.

Sixteen groove families

Every press writes in a style that means it. The generator carries sixteen groove families — **Four-on-Floor** (Techno, House, Acid, Minimal), **Breaks** (Breakbeat, Drum & Bass, Electro, 2-Step), **Slow & Wide** (Halftime, Synthwave, Ambient Pulse, Dub) and **Patterns** (Polyrhythm 3:4, Euclidean, Triplet Shuffle, Dotted) — and each press draws one at random, weighted toward the four-on-floor and broken-beat staples. There is no picker: you re-roll rather than choose, and the strength map, note lengths and performance settings each press writes tell you what kind of bar you landed on.

A family is not a stored pattern — it is a recipe. Each one defines its anchor skeleton (quarters for Techno, offbeat eighths for House, the heavy beat three for Halftime; Euclidean guarantees only the downbeat and scatters the rest of its evenly spread hits as varied and loose material), its own menu of figures and fills, and its own swing range — swing being the delay of every second subdivision that turns a straight grid into a shuffle. Techno stays nearly straight; House and 2-Step swing noticeably harder. The figure menus speak real rhythmic grammar: varied parts can favor dotted pushes and holds — the Dotted family cascades on true dotted slots — and Acid, Breakbeat, Drum & Bass and Electro carry the ratchet vocabulary of doubles, buzzes and drags on proper sixteenth heads. Length has grammar too: sub-led Drum & Bass lets its subs ring, acid accents lengthen, big-beat stomps hold their weight.

Many families flip a coin before writing a single note and let it shape the whole bar — a bar narrative. Techno comes out either as a driving on-beat pulse or as a roller whose dependable hits are the offbeat eighths between the kicks. House is deep offbeat bass or a harder-swung, ghost-dense variant; Breakbeat picks between choppy stutters, draggy triplet smears and a quarter-heavy stomp; Drum & Bass is sub-led and sparse, a dense rolling sixteenth web, or a jungle take with ratchet chops around both turnarounds; Halftime ranges from a long heavy downbeat to a wobble snaking off-triplets between its two anchors. Two presses of one family can land on genuinely different bars. A few families go further — House, Acid, Breakbeat, Electro, Drum & Bass, Triplet Shuffle and Techno's driving pulse answer their first half in the second: the answer can mutate a hit, displace it by a sixteenth or break it into a ratchet, and on the triplet families it mirrors on the triplet grid — the call-and-response shape that makes a bar read as a phrase. Dub and Electro add one more idiom: tresillo chains, the 3-3-2 split that carries so much electronic bass music.

Two more things arrive with every generated groove. The **Strength** grid is stamped from the groove itself — anchors strongest, varied and loose hits in the middle, ghosts near the bottom, fill chains rising into their resolution — which is what lets note selection steer registers onto the groove's accents (see **Strength and dynamics (Chapter 7 — The Sequencer)**); driving families also tilt the bar's arc upward into the fill zone, while Dub, Halftime and Ambient Pulse stay heavy and level. And each family applies its own profile to the performance settings in the GLOBAL, LENGTH, VELOCITY and POSITION modules below the beat grid — note-length behavior, velocity response, position shifts — on BEATS and BOTH only; Vary never touches those settings. The character pass runs deeper than the sliders: velocity couples to note length, so long subs bloom and short ticks tuck in; Acid, Electro and the shuffling families get a touch of micro-timing humanize and House its jackin' drag, while the machine-tight families deliberately stay quantized.

Vary and undo

Keep what works, change what does not, and walk back out of a press that went the wrong way. **Vary** sits in the row beneath the Beats grid, between **Undo** and **Clear All**. Vary mutates the current groove without touching its identity: anchors are never altered, and the stable head of the bar — the first quarter that plays near-certainly — is left alone too, so the mutation concentrates where the groove already varies. It re-rolls which figure each varied part favors, nudges the weights of loose parts and ornaments within their window's headroom, re-rolls fills zone by zone — a mid-bar turnaround stays a mid-bar turnaround — sprinkles in up to a couple of fresh ghosts, drifts the swing slightly and re-stamps the Strength grid so it tracks the mutated regions. The result is the same groove with a different temperament — the button to lean on when a loop is right but stale.

Undo is what makes leaning on it safe. It steps back through the last ten presses that rewrote the grid — BEATS, BOTH, Vary, Clear All and beat links — and each step restores the whole picture at once: beat chances, links, the Strength grid, the swing and the base **Length**. That last one is worth knowing, because every Suggest action resets the base Length slider in the GLOBAL module to its default; if you had shortened or stretched the notes, undoing brings your value back with the groove. The button greys out when there is nothing left to step back to, and the history is dropped whenever the pattern is replaced from outside the grid — a preset load, an INIT — so Undo can never pull an older groove into the patch you just opened. Press Vary until a bar lands, then step back to the one you liked.

Vary works on patterns you drew yourself. If the beats in the lanes no longer match the last thing Suggest generated — edited, or built from scratch — it first reads the pattern back into regions: slots at full chance are treated as anchors, a cluster of alternatives at one start time as a varied part, everything else as loose material or ornament, with your existing beat links preserved. Your solid hits stay solid; only the negotiable layer mutates. On a hand-made pattern the Strength grid is only jittered, never re-stamped, so a map you drew survives Vary intact.

Note voicing

Give the groove a bassline that lands on its accents and sparkle that stays out of the way. Note voicing is the pitch half of the generator: **BOTH** writes it together with a fresh rhythm, and **NOTES** writes a voicing for whatever rhythm is already playing — two of the three actions in the panel, shaped by the SPREAD slider beside them.

The generator builds a pool of pitches spanning three registers, weighted by harmonic function. The root is always in the pool — guaranteed, so the line has a home. A bass register an octave down carries the root at high chance with a decisive preference for the groove's strong cells, often bringing the fifth below along with it. The middle octave holds the scale degrees: roots and fifths dependable, thirds and sevenths as color, passing tones kept weak. A sparse high register — the root an octave up, often joined by one color tone — appears rarely and prefers the weak cells. With the Strength grid stamped from the groove's regions, the registers land where they should: bass owns the accents, sparkle falls on the ghosts and pickups between them. The voicing also knows its family: Drum & Bass, Halftime and Dub anchor real sub-bass weight, Acid and Electro carry the octave-

bounce, House and 2-Step stack root-fifth-octave stabs, Ambient Pulse and Synthwave spread wide — and chord tones gravitate to the accents while passing tones fall to the ghosts.

Voicing respects the scale selected in the Scale selector. Leave it on **Auto** — the first entry, meaning any scale — and every Suggest rolls one to suit the groove family: Acid leans Phrygian and minor, Ambient Pulse leans Lydian and pentatonic. The rolled scale is shown rather than written — it tints the in-scale keys on the Notes tab's roll while the selector stays on Auto, so the next press is free to roll differently. Pick a scale yourself and Suggest works inside it without ever touching your selection. The Pattern selector layers its own opinion on top: on Auto each voicing rolls a concrete stability pattern; picked deliberately, it pulls the voicing's strength and length preferences toward the pattern's per-degree tastes and favors its preferred registers — either way the selection never moves. Scales, patterns and the note lanes themselves are covered in **Choosing notes (Chapter 7 — The Sequencer)**.

BOTH goes one step past pitches: it also programs the ARPEGGIO module to match the family — how often the phrase engine takes a note over, how intricate the figures it plays run and how many notes they may reach — and the family's octave-randomization idiom, like Acid's upward snap on weak sixteenths or Electro's both-ways register flip; families without an idiom are set neutral, so stale settings from an earlier suggestion never linger. Acid comes out livelier than Ambient Pulse. There is no style name handed over — the phrase engine rolls its own vocabulary each bar, so the intricacy is the whole character control (see **Style patterns (Chapter 7 — The Sequencer)**). **NOTES** stays a pure re-voice — pitches only, phrase settings untouched.

SPREAD sets how wide the voicing is drawn before the press: the raw voicing spans from an octave below the root to two octaves above, and SPREAD folds those registers tighter around the root or opens them further out. It shapes what the *next* press writes — to re-voice a pool you already have, without re-rolling it, use the Notes tab's **Register** slider instead (see **Playing it live (Chapter 7 — The Sequencer)**).

CHAPTER 09

Presets & Banks

Browse the factory library, save and organize your own presets, move single sounds or whole banks as files, and send yours in for the factory bank.

Presets are the fastest way into Phaseburn One, and a fast way back out of a blank page. The browser holds **eight factory banks and eight user banks — A through H, 32 slots each**. The factory library is **being built through the open beta**: Bank A is being redesigned, the banks after it are reserved for the sounds the beta brings, and the strongest user submissions ship in it, credited. The user side is fully functional today — saving, renaming, import and export all work now. This chapter covers the browser, saving your own work, recalling presets from your host, and sending yours in.

The browser

Click the preset name at the top of the window to open the browser — or step through presets in place with the prev/next arrows beside it, which move through every non-empty preset, factory then user, loading each. Down the left of the browser is a list in two groups: **FACTORY**, the built-in banks, and **USER**, the ones you fill yourself. Each bank shows how many of its 32 slots are in use, and a bank with nothing in it is drawn dimmed — dimmed, not disabled: an empty user bank is exactly where your next save goes, so the row still clicks and still selects, and brightens when it does. Pick a bank and its presets fill the main view as two columns — all 32 slots at once, no scrolling — and clicking any one loads it immediately, so browsing is just clicking down the list and listening.

The ★ button flips to favorites only: star the presets you keep coming back to with the star on each row, then filter to just those when you are working. Rows can carry two badges. A preset that carries its own groove is marked **SEQ** — that patch brings a sequence with it, not only a sound, so loading it hands the **sequencer (Chapter 7 — The Sequencer)** a pattern to play. A preset marked **FX** is built to process external audio: it has AUDIO IN patched somewhere, so it is meant to be loaded on an audio track and used as an insert rather than played from the keyboard. The one cable that does not earn the badge on its own is the Phase-Locked Loop (PLL) reference, which every preset carries by default — that one counts only when the PLL's INPUT REF blend is actually open, either at the knob or through a modulation route pointed at it. No factory preset wears FX today; it lights on the ones you build.

KEEP SEQ flips the SEQ behavior around for browsing: while it is lit, presets load their sound only, so the pattern you are playing carries on while you audition patches. It is a session switch — it holds wherever you leave it for the rest of the session, including closing and reopening the window, and it starts off again the next time you load the instrument.

The strip along the bottom names the loaded preset — its title, author and description — so you always know where you are; hover any row and it previews that preset's info instead, so you can read a description before committing to a click. **INIT** in the window's top bar clears the engine back to a plain default when you want to build from nothing rather than from someone else's patch. Between the browser and favorites, finding a sound is a few seconds' work, which is the point: the browser is a place to pass through on the way to playing.

Saving your own

When a sound is yours, keep it. **SAVE** opens a dialog that writes the current state into one of your **USER** banks — the same A-through-H layout as the factory side, 32 slots each. Pick the bank and slot, give the preset a **Name** and an **Author** (both required), add an optional **Description** for the footer, and save. If the slot is already taken the dialog warns you before it overwrites, so you will not lose a patch by accident. SAVE works from anywhere in the browser, the factory side included: press it while a factory preset is loaded and the same dialog copies that preset into a user slot. Clicking an empty slot does not open the dialog — it clears the engine back to the plain default, like **INIT**, with one difference: it respects **KEEP SEQ**, so a lit switch keeps the running pattern going while the sound resets.

A saved preset captures the whole engine — every source, the filter, the effects and their routing, the modulation, the aftertouch routing. If the sound includes a sequence, that travels with it and the preset shows the **SEQ** tag; recall it later and the groove comes back with the patch. Loading is deterministic: the engine restarts every free-running piece of the sound — the PLL loop's chaos and lab state, the effects' program memory, the parameter glides — from one canonical point, so a preset sounds the same on every recall, never colored by whatever played before it. A handful of things stay deliberately outside presets because they are instrument-wide settings, not sound: the oversampling and base rate, the internal-sequencer switch, the output limiter, host sync, global volume and pitch-bend range.

User banks are yours to reorganize. Double-click a preset's name, or use the pencil on its row, to **rename** it in place. **IMPORT** and **EXPORT** move presets as files: export works on any preset, factory or user — hand a patch to someone, back it up, or pull a factory sound out as a file — while import fills a user slot, with an overwrite warning if that slot is full. That is also how a preset someone sends you gets into your library.

Whole banks travel the same way. **EXPORT BANK** writes the bank you are viewing — factory or user — into a single file, all 32 slots; **IMPORT BANK** replaces a user bank with such a file, after a confirmation when the bank is not empty. One file per bank makes backing up or swapping entire libraries a two-click job.

What a preset is

A preset is a snapshot of the engine's parameters, plus its name, author and description, and — when present — the sequence. Factory presets ship read-only inside the instrument; your saved presets live in your user banks. Import and export move a single preset — or, with the BANK buttons, a whole bank of 32 — between a file and your library, so collections are easy to share and back up.

The factory banks

The factory side has room for eight banks so the library can grow by theme, and during the beta it is being **built bank by bank** rather than shipped full of filler. **Bank A** is being redesigned as the beta runs — treat whatever lineup your build carries as a moving target, not the finished library. The banks after it, **B through H**, are reserved and empty for now: they fill through beta updates that bring new and reorganized factory sounds, and through shipped user submissions — credited to their authors — which is exactly how that library grows. A bank that is still empty shows **0/32** in the sidebar; that is the room the library grows into, not a missing download. Load a bank, click down the column, and keep what stops you.

Because the library moves, keep your own work on your own side of it. **SAVE** stays available while you browse the factory side: press it and the dialog copies the loaded factory preset — reworked into something of yours, or untouched — into one of your **USER** banks. User banks are your files, an installer leaves them alone, and a patch parked there rides through every update. **EXPORT** does the same job as a file, and **EXPORT BANK** does it for all 32 slots at once — that is the copy to keep if you also move between machines. One detail to know while the beta runs: stars on the factory side are remembered by slot rather than by name, so once a bank is reorganized a star can land on a different sound than the one you starred. Anything you lean on is worth a user slot of its own.

Why the factory library moves

Factory banks are not files on your machine — they ship inside the build, so a new beta version arrives carrying a new factory library rather than rewriting an old one. Your user banks and your favorites are separate files that updates never touch. Saved sessions are unaffected too: a project stores the sound itself, not a pointer to a bank slot, so it recalls exactly what you wrote however the factory side is reorganized later.

Presets in your host

Phaseburn One's presets also show up in your DAW, not only in the plugin's own browser. In a host that supports CLAP preset discovery, the instrument publishes its whole factory and user library to the host, so you can browse and recall Phaseburn One patches from your DAW's preset menu the same way you browse any plugin's. Factory presets appear prefixed by their bank — *Factory A* and

so on, then the preset's name — and load the identical patch you would get from the browser inside the window.

Practically, that means two ways to reach the same sounds: the browser in the window, with favorites and the SEQ marker, or your host's preset list, which some producers prefer for tagging and quick recall across projects. Either route loads the same preset. Hosts that do not implement preset discovery still have the full browser inside the plugin, so nothing is lost — this is an extra door, not the only one.

One thing to re-check after a beta update: a host remembers a factory preset by its place in the library, so a reorganized factory bank can leave that recall pointing at a different sound. Presets you saved into a user bank keep the place you gave them, and a project that stored the parameters themselves plays back the same either way.

Send us yours

Made something worth keeping? Send it in. During the open beta — **submissions are open until October 1, 2026** — you can submit presets at /beta/submit-preset — one preset, several at once, or a **whole bank**: EXPORT and EXPORT BANK write exactly the files the form accepts. Any preset you submit **can ship as a factory preset, credited to you by name**. Submitting grants us the right to include it and creates no obligation on our side — but if at least one of your presets ships, a solid discount on the full license is the least you will get, and ten beta users of our choosing get the full license free. All of that is at our discretion, and the beta comes with no guarantees; the full terms live on /download.

Two things to know before you export. First, **level**: shipped presets are brought to a consistent output level, so before saving, click **AUTO** on the Mixer's **PRESET** fader — one click levels your patch to the factory reference, and what we ship will sound the way you sent it. Second, **words**: if a name or description does not fit print we may trim, adjust or drop it — the sound itself is never touched. Standout submissions may also come back to everyone later as free add-on banks, credited the same way.

What makes a preset shippable is not complexity — it is character. A sound that does one thing with conviction, named well and described in a line, is worth more to the bank than a patch with everything turned on. Export it from your user bank, or submit it through the form, and tell us what it is for. The factory bank you browse today is built exactly this way.

CHAPTER 10

MIDI & Your DAW

Map hardware CCs to knobs with MIDI learn, choose what played notes do — voice or sequencer — and keep everything phase-locked to the host timeline.

Phaseburn One lives inside your DAW as an ordinary instrument plugin. Notes play the voice — one voice, because the instrument is monophonic by design. Pitch bend bends the sounding note, ±2 semitones by default; the **Pitch Bend Range** parameter — exposed to the host rather than drawn on the panel — widens that to as much as ±24 semitones, or ignores the wheel at 0. Control changes (CCs — the messages hardware knobs and faders send) can be mapped to the instrument's controls through MIDI learn. Velocity and aftertouch — how hard you strike, then how hard you press — are modulation sources, covered in **the modulation chapter (Chapter 4 — Modulation)**. The host's clock and transport drive everything tempo-synced: LFO divisions, the sequencer's bar lines, and the sequencer itself, which starts and stops with your DAW. This chapter covers the mapping and the clock, plus what to try when a particular host has other ideas.

MIDI learn

Put the filter cutoff under a real knob in ten seconds. Right-click the CUTOFF knob on the **FX** tab, choose **MIDI Learn**, then turn the hardware knob you want to own it. The first CC that arrives is captured, and the control follows your hand from then on.

To map a whole controller, repeat that gesture control by control. Mappings are one-to-one — a CC drives one control, a control listens to one CC — and learning a CC that is already in use, or re-learning a control, replaces the old pairing. There is no separate mapping panel: right-click a mapped control and the same context menu shows which CC it holds, right beside **MIDI Forget**.

The editor is where mappings are made, not where they run. CC handling lives in the audio engine itself, so once a knob is mapped you can close the editor and keep playing. And incoming CC moves are applied as genuine parameter changes through the host, so your DAW records them as automation on that parameter's lane. The instrument brackets each run of CC movement in an automation touch gesture — recording punches in when your hand moves and out when it rests.

To unmap, right-click the control and choose **MIDI Forget**. To reset a control to its factory value without touching its mapping, the same menu offers **Set to default**. The same menu also carries **Unlink modulation**, which clears every modulation route currently aimed at that control in one gesture — the caption tells you how many it will clear before you commit, and it is greyed out when there are none. The routes' amounts are left alone, so picking a destination again restores the depth the route had. There is no undo for it.

> Where a CC becomes automation
>
> Mapped CCs are applied on the audio thread through the plugin framework's engine-side parameter API — the editor event loop only handles learning and assignment. A gesture begins on the first CC movement and ends after 0.4 s of idle, so one continuous twist records as one automation pass, indistinguishable from a mouse drag.

Input modes

Decide what your keys do while the sequencer runs: play the voice yourself, or hand the sequencer your harmony and let it do the playing. The **MIDI Mode** pair in the PERFORM module on the Groove page's Notes tab chooses between two behaviors.

Passthrough is the default and does what the name says: incoming notes play the voice directly, like any synth plugin. It is also the mode for sequencing Phaseburn One from your DAW's piano roll — clips play the voice, and flipping the **SEQ** switch off keeps the internal sequencer out of the way. Leave it on and both feed the same voice — Phaseburn One is monophonic by design, so external and sequenced notes compete and the most recent event wins. That collision is a real technique — stab notes over a running line and the line folds around them — but if it sounds like chaos, it is chaos you asked for: flip SEQ off or switch modes. The switch rides on the Groove nav tab itself, reachable and readable from any page, and it mutes only the internal note sequencer: the modulation sequencers and every tempo-synced division keep running. It belongs to the plugin instance and is recalled with your DAW project rather than with the preset, so a track you drive from the piano roll stays that way through preset changes and reopened sessions — see **One bar, one page (Chapter 7 — The Sequencer)**.

Chord Follow takes your hands off the voice entirely. Held notes stop sounding and instead rewrite the note pool the sequencer draws from: each held note becomes a candidate, and how hard you struck it sets that note's chance of being picked. The sequencer keeps its rhythm, its probabilities and its groove — you steer the harmony by holding chords, and the line moves when your hands do. Lifting your hands does not stop it: the last chord stays latched until you play the next one, so the line keeps moving between changes. Entering the mode before you have played anything leaves your own note pool running, and switching back to Passthrough always hands the sequencer your pool back, exactly as you left it. The Notes tab's piano roll highlights the keys you are holding. This is the performing mode: one hand on chords, the sequencer playing, and every mapped CC still live. **The sequencer chapter (Chapter 7 — The Sequencer)** covers how the note pool turns candidates into lines.

Two more settings shape played notes. **Velocity Lock**, in the same PERFORM module, keeps the first note's velocity through legato transitions. **Note Priority** decides which held note sounds when several arrive — the most recent, the lowest or the highest; it has no panel control, being exposed to the host rather than drawn on the window. Both come up again with glide in **the oscillators chapter (Chapter 2 — Oscillators)**.

Clock and transport

Press play in your DAW and the sequencer plays; stop, and it stops. The host transport is the instrument's transport, with nothing to arm on the window, and a transport start plays from the top: beginning playback hard-resets the sequencer to beat 1 of bar 1 — the step modulators and synced LFOs restart with it — rather than picking up wherever the playhead happens to sit, so every take opens the same way. A take launched mid-bar falls into line with the DAW's bar lines at the first loop wrap or relocate. **Host Sync** defaults on, with no panel switch of its own — like pitch-bend range, it is exposed to the host rather than drawn on the window — and while it is on the sequencer phase-locks to the host timeline as it plays: it continuously derives its position from the host's, bar-anchored so its downbeat sits on the DAW's downbeat.

Phase-lock is what makes loop-based work behave. Loop four bars and every wrap snaps the sequencer back into step. Relocate the playhead and it follows. Change tempo — even a ramp — and the playhead and pending notes rescale rather than drift. When the host jumps far enough to matter, the sounding note is released cleanly first — a relocate never leaves a note hanging. And because a Phaseburn bar is probabilistic, every wrap rolls the dice again: the loop plays a fresh variation of itself each pass, by design — record several and keep the take. **The sequencer chapter (Chapter 7 — The Sequencer)** covers what gets re-rolled.

The bar follows the host's meter, and it can only shrink. A Phaseburn bar is a 4/4 grid, so an odd meter masks its tail off instead of stretching it — a sixteenth stays a sixteenth. 3/4 and 6/8 play the first three quarter notes and wrap, 7/8 three and a half; 5/4 and 12/8 clamp back to a full bar. The Beats grid draws that cut — a dimmed panel over the masked region, a cut line, an OUT OF BAR caption. GENERATE still composes a full 4/4 bar, so in an odd meter the tail of what it writes is never reached.

The lock reaches past the sequencer. When it re-seeks, tempo-synced LFOs and the step modulators re-phase too, so synced modulation lands in a bounce where it sat in the room. Step modulators in retrigger mode keep their note-driven phase.

Turn Host Sync off from the host's own automation lane and the sequencer runs free instead, on its own clock, with the host-exposed **Sequencer Enable** parameter as its transport: it pauses and resumes the bar in place rather than restarting it from the top. The host's transport no longer starts or stops it, and loop wraps and relocates no longer pull it back — useful when you want the pattern to drift against the arrangement rather than obey it.

How the lock avoids twitching

The engine keeps a predicted beat clock and compares it with the host's report every audio block. A jump of more than a quarter beat — a loop wrap or a relocate — re-seeks immediately; a drift above two hundredths of a beat must persist for two consecutive blocks before it triggers one, so hosts that report slightly jittery positions do not cause constant micro-corrections. A material seek queues the sounding note's note-off for the first sample of the next block.

When something misbehaves

Phaseburn One is v0.1.0 — early access, free through the beta period — and the plugin–host boundary is exactly where young software meets the most variety. Hosts differ in how they report transport position, when they record automation, and which MIDI they forward to an instrument. We test against a range of hosts but have not met every configuration, and this chapter's features are the most host-dependent in the instrument. Before anything else, walk this list:

The sequencer plays nothing. It runs off the host transport, so the DAW has to be rolling — there is no start switch on the window to look for. Then check the **SEQ** switch on the Groove tab: off mutes the internal note sequencer, and because that switch is saved with the project, a session someone else set up can arrive with it off.

The sequencer feels offset or ignores the loop. Confirm **Host Sync** hasn't been automated off — it defaults on, with no panel switch to check. Phase-lock operates while the host transport is actually running — a stopped host gives the sequencer nothing to lock to. If the pattern stops short instead, that is the meter: the grid is a 4/4 bar and an odd host signature masks its tail.

Notes double-fire while the sequencer plays. That is Passthrough doing its job: played and sequenced notes share the one voice. Switch to Chord Follow, or stop playing along.

A mapped knob does nothing. The editor is not required — mappings run in the engine — so suspect the route: confirm your host forwards CC messages to the instrument's track. Some hosts filter CCs or capture them for their own mapping layers before a plugin ever sees them.

Hardware moves are not recorded. The instrument presents CC movement as parameter gestures; whether the host writes them depends on the track's automation mode. Arm the track and pick a mode that records.

A note hangs after a relocate. Host Sync releases the sounding note on every material jump, so a hanging note is a bug rather than a setting — catch it and we want the steps.

Anything that survives this list is something we want to hear about. Report it through the contact form with your host and its version, your operating system, and steps to reproduce. Per-host quirks are precisely what the open beta exists to find, and fixes ship in updated builds.

CHAPTER 11

Reference

Formats, system requirements, engine settings, the full parameter index and research credits.

This chapter is the lookup layer of the manual: what Phaseburn One runs on, the engine-level settings, every parameter with its range and default, and the published research the engine builds on. Everything in the tables below is generated directly from the instrument's own parameter definitions — when the synth changes, these tables change with it.

Formats and system requirements

Phaseburn One ships as **VST3** and **CLAP** plug-ins.

	MACOS	WINDOWS
Version	macOS 11 or newer	Windows 10 / 11
Architecture	Apple Silicon and Intel	x86-64
Formats	VST3 · CLAP	VST3 · CLAP

Any host that loads VST3 or CLAP should work. Phaseburn One is v0.1.0 early access — if a specific host misbehaves, please report it through the contact form.

Control conventions

A handful of behaviors are the same on every panel, so they are worth learning once here rather than meeting them one chapter at a time.

Knobs. Drag up or down to move a knob; hold Shift while dragging for fine resolution. Scrolling over a knob steps it. Double-click returns it to its factory default. Tick captions around a dial are click targets — clicking one jumps the knob exactly to that value, so a labelled ring doubles as a set of presets for that control.

The S badge. Some knobs carry a small **S** in the top-left of their caption. That is a snap switch, and it constrains the knob to a musical grid rather than to its own raw units: whole ratios on the PLL's MULT and DIV, semitones against middle C on the delay's SHIFT. Lit, the knob lands only on those stops and drags one stop at a time; unlit, it sweeps the full continuous range. Toggling the badge never moves the value — it changes how the knob travels, not where it is — so you can find a setting free-hand and then lock the dial to the grid. The badge is a real switch: it is saved with the preset, and a host can automate it.

Modulation rings. A thin arc outside a knob's own indicator shows where modulation is currently pushing it — the ring moves in real time while the sound plays. Any source can draw it: an LFO,

either step modulator, aftertouch, velocity, the note-character module or the distortion's input envelope.

The right-click menu. Every parameter control has one, and it carries the same entries everywhere: set to default, unlink modulation, MIDI learn and forget, and open in manual. The MIDI and modulation entries are covered in **MIDI learn (Chapter 10 — MIDI & Your DAW)**.

The help line. The strip under the header names whatever the pointer is over and describes it in one line. It is the single place the instrument explains itself — nothing ever floats over the control you are working on — and clicking **Manual** opens the chapter that covers the control in a reader inside the plug-in.

Engine settings

Two settings govern the engine's precision-versus-CPU trade: how many times the signal is oversampled, and what internal sample rate it runs at. Neither has a panel control — both ship at the values tuned for running inside a DAW (2x oversampling, Auto base rate), and both remain real host parameters your session can automate or a preset can override.

Engine Settings — Host automation only · 3 parameters

PARAMETER	RANGE	DEFAULT	WHAT IT DOES
Fold Legacy Curve	Off / On	V2	Wavefold drive law, host automation only: V2 scales the fold exponentially across the knob, LEGACY keeps the older linear curve.
Oversampling	2x · 4x · 8x · 16x · 32x · 64x · 128x	2x	Oversampling factor for the whole voice — higher settings trade CPU for cleaner top end.
Base Sample Rate	Auto · 44.1 kHz · 88.2 kHz · 96 kHz · 192 kHz	Auto	Internal base sample rate; Auto follows the host.

The core signal path — oscillators, envelopes, filters — runs in 64-bit floating point, with strong alias suppression on the stages that need it. Internal figures quoted anywhere in this manual are our own measured targets, not third-party lab results.

Full parameter index

Every parameter the instrument exposes, grouped by module. Chapters embed the same tables with a "what it does" column; this index is the compact, complete listing.

PARAMETER	RANGE	DEFAULT
PLL FM Amount	0 – 2	0
PLL FM Ratio	1 … 8	1
PLL FM Ratio Free	Off / On	Off
PLL FM Ratio Float	0.10 – 32.00	1.00
PLL FM Expand	Off / On	Off
PLL Track Speed	0 – 1	0.5
PLL Damping	0 – 1	0.3
PLL Multiplier	x1 – x64	x1
PLL Mult Snap	Off / On	On
PLL Divider	/1 – /8	/1
PLL Divide Snap	Off / On	On
PLL Colored	Off / On	Off
PLL Color Mode	HARM · SAT · FOLD	HARM
PLL Fold Amount	0 – 1	0.5
PLL Fold Ratio	1.0 – 64.0	11.4
PLL Raw Mode	Off / On	CLEAN
PLL Ref Floor	Off / On	FULL
PLL Divider Lock	Off / On	Off
PLL Detector	PD · EDGE · XOR · S&H	EDGE
PLL Mult Slew	Off / On	On
PLL Ratio Slew Time	0 – 1	0.15
PLL Ref Octave	-4 … 4	0
PLL Ref Tune	-12 … 12	0
PLL Ref Fine	-100 ct – +100 ct	+0 ct
PLL Chaos	0 – 1	0
PLL Feedback	0 – 1	0
PLL Influence	0 – 1	0.50000006

PARAMETER	RANGE	DEFAULT
PLL Volume	-inf dB – 0.0 dB	-inf dB
PLL Pan	L100 – R100	C
PLL Stereo Damp Δ	0 – 0.5	0
PLL Glide	0.0 – 5000.0	0.0
PLL Burst Threshold	0 – 1	0.7
PLL Burst Amount	0 – 20	3.2999997
PLL Loop Limit	1.0 – 500.0	100.0
PLL Color Amount	0 – 1	0.25
PLL Edge Sensitivity	0.001 – 0.200	0.020
PLL Range	0 – 1	1
PLL Stereo Track Δ	0 – 0.5	0
PLL Stereo Phase	0 – 0.5	0
PLL Precision	Off / On	On
PLL FM Env Amount	-1 – 1	0
PLL Anti-Alias	Off / On	On
PLL Injection Amount	0 – 2	0
PLL Injection Mode	Off / On	Off
PLL Feedback Div	0 … 7	0
PLL Advanced	Off / On	Off
PLL Out Shape	0 – 1	0
PLL Step	0 – 1	0
PLL Grit	0 – 1	0
PLL Lag	0 – 1	0
PLL Relock	0 – 1	0
PLL Enable	Off / On	On
PLL Tail	0.0 ms – 5000.0 ms	0.0 ms
PLL Tail Sync	Off / On	Off
PLL Tail Div	1/1 … 1/128	1/8

PARAMETER	RANGE	DEFAULT
PLL Input Ref	0 – 1	0

VECTOR Oscillator

PARAMETER	RANGE	DEFAULT
Vector X	0 – 1	0.5
Vector Y	0 – 1	0.5
Vector Stereo Y Δ	0 – 0.3	0
Vector Volume	-inf dB – 0.0 dB	0.0 dB
Vector Pan	L100 – R100	C
Vector Octave	-4 … 4	0
Vector Tune	-12 … 12	0
Vector Fine	-100 ct – +100 ct	+0 ct
Vector Fold	0 – 1	0
Vector Stereo X Δ	0 – 0.3	0
Vector Shape Type	0 · 1 · 2	0
Vector Shape Amount	0 – 1	0
Vector Fold Range	0 · 1	0
Vector Formant	Off / On	Off
Vector Phase Mode	0 · 1	0
Vector Enable	Off / On	On

MORPH Oscillator

Oscillators · 16

PARAMETER	RANGE	DEFAULT
Morph Enable	Off / On	Off
Morph Volume	-inf dB – 0.0 dB	-inf dB
Morph Pan	L100 – R100	C
Morph Octave	-4 … 4	0
Morph Tune	-12 … 12	0
Morph Fine	-100 ct – +100 ct	+0 ct
Morph Fold	0 – 1	0
Morph Fold Range	0 · 1	0
Morph Shape Type	0 · 1 · 2	0
Morph Shape Amount	0 – 1	0
Morph Amount	0 – 1	0
Morph Mode	0 … 11	0
Formant Pitch Track	0 · 1	0
Formant Breath	0 – 100	0
Formant Size	-100 – 100	0
Morph Stereo Detune	0 – 1	0

Sub Oscillator

Oscillators · 5

PARAMETER	RANGE	DEFAULT
Sub Volume	-inf dB – 0.0 dB	-inf dB
Sub Filter Route	off – 2.00	off
Sub Octave	-3 · -2 · -1 · 0	-1
Sub Shape	0 – 4	0
Sub Saturate	0 – 1	0

Filter & Filter Envelope

PARAMETER	RANGE	DEFAULT
Filter Cutoff	20.0 – 20000.0	20000.0
Filter Resonance	0 – 1.05	0
Filter Drive	0 – 1	0
Filter Mode	LP24 · LP12 · BP12 · HP24	LP24
Filter Key Track	0 – 1	0
Filter Env Amount	-1 – 1	0
Filter Stereo Sep	0 – 0.5	0
Filter Env Attack	0.1 – 5000.0	10.0
Filter Env Attack Shape	-1 – 1	0
Filter Env Decay	0.1 – 10000.0	100.0
Filter Env Decay Shape	-1 – 1	0
Filter Env Sustain	0 – 1	0.7
Filter Env Release	0.1 – 10000.0	200.0
Filter Env Release Shape	-1 – 1	0
FE Atk S	Off / On	Off
FE Dec S	Off / On	Off
FE Rel S	Off / On	Off
Filter Env Dip	0 – 1	0
Filter Env Range	1 – 8	4
Filter Env Hold	0.0 – 5000.0	0.0
Filter Env Loop	0 · 1	0
FE Key Track	0 – 1	0
FE Vel → Attack	-1 – 1	0
FE Vel → Decay	-1 – 1	0
FE Vel → Sustain	-1 – 1	0
FE Vel → Release	-1 – 1	0
Filter Drive Boost	0 · 1 · 2 · 3	0

PARAMETER	RANGE	DEFAULT
Filter Enable	Off / On	Off
Filter Sat Type	Transistor · Diode · Tube	Transistor
Filter Mix	0 % – 100 %	100 %
Filter Morph	0 – 1	0
Filter Bass Lock	0 – 1	0
Filter Res Character	0 – 1	0
Filter Cutoff Slew	0 – 1	0
Filter Bass Lock Freq	20.0 Hz – 500.0 Hz	120.0 Hz
Filter Topology	0 · 1	0
FE Atk Sync	Off / On	Off
FE Attack Div	0 … 17	3
FE Hold Sync	Off / On	Off
FE Hold Div	0 … 17	4
FE Dec Sync	Off / On	Off
FE Decay Div	0 … 17	2
FE Rel Sync	Off / On	Off
FE Release Div	0 … 17	2

Coloration

Oscillators · 3

PARAMETER	RANGE	DEFAULT
Drift Amount	0 – 1	0
Drift Rate	0.01 – 5.00	0.30
Tube Drive	0 – 2	0

PARAMETER	RANGE	DEFAULT
Vol Attack	0.1 – 5000.0	10.0
Vol Attack Shape	-1 – 1	0
Vol Decay	0.1 – 10000.0	100.0
Vol Decay Shape	-1 – 1	0
Vol Sustain	0 – 1	0.7
Vol Release	0.1 – 10000.0	200.0
Vol Release Shape	-1 – 1	0
Vol Atk S	Off / On	Off
Vol Dec S	Off / On	Off
Vol Rel S	Off / On	Off
Vol Hold	0.0 – 5000.0	0.0
Vol Depth	0 – 1	1
Vol Loop Mode	0 · 1	0
Env Key Track	0 – 1	0
Vel→Attack	-1 – 1	0
Vel→Decay	-1 – 1	0
Vel→Sustain	-1 – 1	0
Vel→Release	-1 – 1	0
Vol Atk Sync	Off / On	Off
Vol Attack Div	0 … 17	3
Vol Hold Sync	Off / On	Off
Vol Hold Div	0 … 17	4
Vol Dec Sync	Off / On	Off
Vol Decay Div	0 … 17	2
Vol Rel Sync	Off / On	Off
Vol Release Div	0 … 17	2
Retrigger Dip	0 – 1	0

PARAMETER	RANGE	DEFAULT
Env Range	20.0 – 10000.0	500.0

Percussion Engine

Oscillators · 19

PARAMETER	RANGE	DEFAULT
Perc Enable	Off / On	Off
Perc PLL	Off / On	On
Perc VECTOR	Off / On	On
Perc MORPH	Off / On	On
Perc SUB	Off / On	On
Perc Sweep	-96.0 st – 96.0 st	0.0 st
Perc Sweep Time	0.1 ms – 500.0 ms	5.0 ms
Perc Sweep Curve	-1.00 – 1.00	0.00
Perc Click	0 % – 100 %	0 %
Perc Click Tone	20.0 Hz – 16000.0 Hz	1000.0 Hz
Perc Click Decay	0.1 ms – 500.0 ms	2.0 ms
Perc Click Width	0 % – 100 %	50 %
Perc Click Curve	-1.00 – 1.00	0.00
Perc Click Track	0 % – 100 %	0 %
Perc Click Mode	Noise · Ping · Metal	Noise
Perc TFold	0 % – 100 %	0 %
Perc TFold Decay	0.5 ms – 50.0 ms	5.0 ms
Perc TFold Curve	-1.00 – 1.00	0.00
Perc Velocity	0 % – 100 %	0 %

PARAMETER	RANGE	DEFAULT
LFO 1 Rate	0.01 – 150.00	1.00
LFO 1 Waveform	Sine · Triangle · Saw · Square · S&H · Smooth Random	Sine
LFO 1 Tempo Sync	Off / On	Off
LFO 1 Division	1/1 … 1/128	1/4
LFO 1 Sync Source	-1 · 0 · 1 · 2	-1
LFO 1 Phase Mod	0 – 1	0
LFO 1 Dest 1	None – Dist Bias	None
LFO 1 Amount 1	-1 – 1	0
LFO 1 Dest 2	None – Dist Bias	None
LFO 1 Amount 2	-1 – 1	0
LFO 1 Dest 3	None – Dist Bias	None
LFO 1 Amount 3	-1 – 1	0
LFO 1 Trigger	Free · Retrigger · Random Phase	Free
LFO 1 Phase Offset	0 – 1	0
LFO 1 Fade In	0.0 ms – 5000.0 ms	0.0 ms
LFO 1 One-Shot	Off / On	Off
LFO 1 Bipolar	Off / On	On
LFO 1 Rate Mod	0 – 1	0
LFO 2 Rate	0.01 – 150.00	1.00
LFO 2 Waveform	Sine · Triangle · Saw · Square · S&H · Smooth Random	Sine
LFO 2 Tempo Sync	Off / On	Off
LFO 2 Division	1/1 … 1/128	1/8
LFO 2 Sync Source	-1 · 0 · 1 · 2	-1
LFO 2 Phase Mod	0 – 1	0
LFO 2 Dest 1	None – Dist Bias	None
LFO 2 Amount 1	-1 – 1	0
LFO 2 Dest 2	None – Dist Bias	None

PARAMETER	RANGE	DEFAULT
LFO 2 Amount 2	-1 – 1	0
LFO 2 Dest 3	None – Dist Bias	None
LFO 2 Amount 3	-1 – 1	0
LFO 2 Trigger	Free · Retrigger · Random Phase	Free
LFO 2 Phase Offset	0 – 1	0
LFO 2 Fade In	0.0 ms – 5000.0 ms	0.0 ms
LFO 2 One-Shot	Off / On	Off
LFO 2 Bipolar	Off / On	On
LFO 2 Rate Mod	0 – 1	0
LFO 3 Rate	0.01 – 150.00	1.00
LFO 3 Waveform	Sine · Triangle · Saw · Square · S&H · Smooth Random	Sine
LFO 3 Tempo Sync	Off / On	Off
LFO 3 Division	1/1 … 1/128	1/1
LFO 3 Sync Source	-1 · 0 · 1 · 2	-1
LFO 3 Phase Mod	0 – 1	0
LFO 3 Dest 1	None – Dist Bias	None
LFO 3 Amount 1	-1 – 1	0
LFO 3 Dest 2	None – Dist Bias	None
LFO 3 Amount 2	-1 – 1	0
LFO 3 Dest 3	None – Dist Bias	None
LFO 3 Amount 3	-1 – 1	0
LFO 3 Trigger	Free · Retrigger · Random Phase	Free
LFO 3 Phase Offset	0 – 1	0
LFO 3 Fade In	0.0 ms – 5000.0 ms	0.0 ms
LFO 3 One-Shot	Off / On	Off
LFO 3 Bipolar	Off / On	On
LFO 3 Rate Mod	0 – 1	0

PARAMETER	RANGE	DEFAULT
MSeq Division	1/1 … 1/128	1/8
MSeq Slew	0 – 200	5
MSeq Dest 1	None – Dist Bias	None
MSeq Amount 1	-1 – 1	0
MSeq Dest 2	None – Dist Bias	None
MSeq Amount 2	-1 – 1	0
MSeq Length	1 … 32	16
MSeq Retrigger	Off / On	Off
MSeq Bipolar	Off / On	On
MSeq Dest 3	None – Dist Bias	None
MSeq Amount 3	-1 – 1	0
MSeq Snap	Off / On	Off
MSeq2 Division	1/1 … 1/128	1/8
MSeq2 Slew	0 – 200	5
MSeq2 Dest 1	None – Dist Bias	None
MSeq2 Amount 1	-1 – 1	0
MSeq2 Dest 2	None – Dist Bias	None
MSeq2 Amount 2	-1 – 1	0
MSeq2 Dest 3	None – Dist Bias	None
MSeq2 Amount 3	-1 – 1	0
MSeq2 Length	1 … 32	16
MSeq2 Retrigger	Off / On	Off
MSeq2 Bipolar	Off / On	On
MSeq2 Snap	Off / On	Off
MSeq Bars	1 … 8	1
MSeq2 Bars	1 … 8	1
MSeq3 Division	1/1 … 1/128	1/8

PARAMETER	RANGE	DEFAULT
MSeq3 Slew	0 – 200	5
MSeq3 Dest 1	None – Dist Bias	None
MSeq3 Amount 1	-1 – 1	0
MSeq3 Dest 2	None – Dist Bias	None
MSeq3 Amount 2	-1 – 1	0
MSeq3 Dest 3	None – Dist Bias	None
MSeq3 Amount 3	-1 – 1	0
MSeq3 Length	1 … 32	16
MSeq3 Retrigger	Off / On	Off
MSeq3 Bipolar	Off / On	On
MSeq3 Snap	Off / On	Off
MSeq3 Bars	1 … 8	1
MSeq4 Division	1/1 … 1/128	1/8
MSeq4 Slew	0 – 200	5
MSeq4 Dest 1	None – Dist Bias	None
MSeq4 Amount 1	-1 – 1	0
MSeq4 Dest 2	None – Dist Bias	None
MSeq4 Amount 2	-1 – 1	0
MSeq4 Dest 3	None – Dist Bias	None
MSeq4 Amount 3	-1 – 1	0
MSeq4 Length	1 … 32	16
MSeq4 Retrigger	Off / On	Off
MSeq4 Bipolar	Off / On	On
MSeq4 Snap	Off / On	Off
MSeq4 Bars	1 … 8	1

Frequency-Shifter Delay

PARAMETER	RANGE	DEFAULT
Delay Enable	Off / On	Off
Delay Mix	0 – 1	0
Delay Time	10.0 ms – 2000.0 ms	375.0 ms
Delay Time Sync	Off / On	Off
Delay Time Division	1/1 … 1/128	1/8
Delay Feedback	0 – 1.1	0.35
Delay Freq Shift	-5000.0 Hz – 5000.0 Hz	0.0 Hz
Delay Freq Shift Snap	Off / On	Off
Delay Sideband	0 – 1	0
Delay Smear	0 – 1	0
Delay Saturation	0 – 1	0
Delay FB LPF	500.0 Hz – 20000.0 Hz	8000.0 Hz
Delay FB HPF	20.0 Hz – 2000.0 Hz	80.0 Hz
Delay Stereo Offset	0 – 1	0
Delay Freq Range	Off / On	Off
Delay Dual Time	Off / On	Off
Delay Time Division R	1/1 … 1/128	1/32
Delay Ping Pong	Off / On	Off

Reverb

PARAMETER	RANGE	DEFAULT
Reverb Enable	Off / On	Off
Reverb Dry/Wet	0 – 1	0
Reverb Pre-Delay	0 – 500	50
Reverb Pre-Delay Sync	Off / On	Off
Reverb Pre-Delay Division	1/1 … 1/128	1/8
Reverb Size	0 – 3	0.85
Reverb HPF	20.0 – 22000.0	100.0
Reverb LPF	20.0 – 22000.0	14000.0
Reverb Mod Speed	0 – 1	0.3
Reverb Mod Depth	0 – 1	0.4
Reverb Diffusion	0 – 1	0.75
Reverb Decay	0 – 1	0.8
Reverb Decay HF	0.1 – 2	1
Reverb Ducking	0 – 1	0
Reverb Duck Division	0 … 17	2
Reverb Stereo Width	0 – 2	1
Reverb Saturation	0 – 1	0
Reverb Wet Gain	-24.0 dB – 24.0 dB	0.0 dB
Reverb Wet Only	Off / On	MIX
Reverb ER Level	0 – 1	0.5

Chorus

PARAMETER	RANGE	DEFAULT
Chorus Enable	Off / On	Off
Chorus Mode	Chorus · Flanger · Ensemble · Vibe	Chorus
Chorus Through-Zero	Off / On	Off
Chorus Mix	0 – 1	0.5
Chorus Base Delay	0.1 ms – 40.0 ms	7.0 ms
Chorus LFO Rate	0.01 Hz – 50.00 Hz	1.00 Hz
Chorus Rate Sync	Off / On	Off
Chorus Rate Division	1/1 … 1/128	1/1
Chorus LFO Depth	0.0 ms – 20.0 ms	2.0 ms
Chorus LFO Shape	Sine · Triangle · Random Walk · Sine · Ramp Up · Ramp Down	Sine
Chorus LFO Stereo	0° – 360°	180°
Chorus Voices	1 … 8	4
Chorus Voice Spread	0° – 360°	360°
Chorus Voice Detune	0 ct – 20 ct	0 ct
Chorus Pan Spread	0 – 1	1
Chorus Feedback	-1 – 1	0
Chorus Cross Feedback	0 – 1	0
Chorus FB Saturation	0 – 1	0.3
Chorus FB Filter	100.0 Hz – 16000.0 Hz	8000.0 Hz
Chorus Stereo Mode	Stereo · Mid/Side	Stereo
Chorus Wet HP	20.0 Hz – 2000.0 Hz	20.0 Hz
Chorus Wet LP	1000.0 Hz – 20000.0 Hz	20000.0 Hz
Chorus Wet Width	0 – 2	1

Distortion

FX · 13

PARAMETER	RANGE	DEFAULT
Distortion Enable	Off / On	Off
Dist Mode	OD · Dist · Fuzz · Metal	OD
Dist Drive	0 – 1	0.35
Dist Bite	0 – 1	0.25
Dist Low	0 – 1	0.5
Dist Bias	0 – 1	0.5
Dist Tone	0 – 1	1
Dist Mid	0 – 1	0.5
Dist Mix	0 – 1	1
Dist Level	-inf dB – 12.0 dB	0.0 dB
Dist Autogain	Off / On	On
GR Dest 1	None – Dist Bias	None
GR Amount 1	-1 – 1	0

BitCrusher

FX · 10

PARAMETER	RANGE	DEFAULT
BitCrusher Enable	Off / On	Off
BitCrusher Mix	0 – 1	1
BitCrusher Bits	1.0 – 16.0	16.0
BitCrusher Freq	200.0 Hz – 22050.0 Hz	22050.0 Hz
BitCrusher Drive	0 – 1	0
BitCrusher Track	Off / On	Off
BitCrusher Ratio	×0.5 – ×64.0	×8.0
BitCrusher Tone	300.0 Hz – 22050.0 Hz	22050.0 Hz
BitCrusher Rise	Off / On	Off
BitCrusher Wide	Off / On	Off

Freezer

FX · 10

PARAMETER	RANGE	DEFAULT
Freezer Enable	Off / On	Off
Freezer Freeze	0 – 1	0
Freezer Grain Size	20 ms – 500 ms	120 ms
Freezer Window	100 ms – 2000 ms	500 ms
Freezer Position	0 – 1	0.5
Freezer Mix	0 – 1	1
Freezer Mode	Smooth · Reverse · Cloud	Smooth
Freezer Sync	Off / On	Off
Freezer Window Division	1/1 … 1/128	1/4
Freezer Grain Division	1/1 … 1/128	1/16

Master Section

Mixer · 13

PARAMETER	RANGE	DEFAULT
Preset Volume	-24.0 dB – 24.0 dB	0.0 dB
Master HPF	OFF Hz – 400 Hz	OFF Hz
Master HPF	Off · 35 Hz · 80 Hz · 120 Hz · 220 Hz	Off
Master HPF Boost	0.0 dB – 18.0 dB	0.0 dB
Master HPF Boost	None · Medium · High	None
Sub FX Bypass	Off / On	Off
Box Cut	0.0 dB – 18.0 dB	0.0 dB
Box Cut	Off · Low · Med · High	Off
Brilliance Amount	0.00 – 1.00	0.00
Brilliance Drive	0.00 – 1.00	0.00
Mono Bass	0 – 500	0
Stereo Width	0.00 – 3.00	1.00
Limiter	Off / On	On

PARAMETER	RANGE	DEFAULT
Global Volume	-inf dB – 12.0 dB	0.0 dB
Bypass	Off / On	Off
Pitch Bend Range	0 … 24	2
AT Dest 1	None – Dist Bias	None
AT Amount 1	-1 – 1	0
AT Dest 2	None – Dist Bias	None
AT Amount 2	-1 – 1	0
AT Dest 3	None – Dist Bias	None
AT Amount 3	-1 – 1	0
Note Length %	1 – 200	95
Len Mod 1 Target	-100 – 100	-75
Len Mod 1 Amount	0 – 200	100
Len Mod 1 Prob	0 – 127	0
Len Mod 2 Target	-100 – 100	75
Len Mod 2 Amount	0 – 200	100
Len Mod 2 Prob	0 – 127	0
Vel Strength Target	-100 – 100	0
Vel Strength Amount	-99 – 27	0
Vel Strength Prob	0 – 127	0
Vel Length Target	-100 – 100	0
Vel Length Amount	-99 – 27	0
Vel Length Prob	0 – 127	0
Note Mod Strength	-100 – 100	0
Note Mod Length	-100 – 100	0
Note Mod Prob	0 – 127	0
Note Mod Dest	None – Dist Bias	None
Note Mod Amount	-1 – 1	0

PARAMETER	RANGE	DEFAULT
Vel Mod Dest	None – Dist Bias	None
Vel Mod Amount	-1 – 1	0
Pos Mod 1 Target	-100 – 100	-75
Pos Mod 1 Shift	-50 – 50	0
Pos Mod 1 Prob	0 – 127	0
Pos Mod 2 Target	-100 – 100	75
Pos Mod 2 Shift	-50 – 50	0
Pos Mod 2 Prob	0 – 127	0
Swing	50 – 75	50
Legato	Off / On	Off
Legato Time	1.0 ms – 500.0 ms	50.0 ms
Velocity Lock	Off / On	Off
VCA Mode	Off / On	Off
Note Priority	Last · Low · High	Last
Osc Skip	0 – 1	0
Osc Drift	0 – 1	0
Sequencer Enable	Off / On	Off
Seq Host Sync	Off / On	On

Engine Settings

Host automation only · 3

PARAMETER	RANGE	DEFAULT
Fold Legacy Curve	Off / On	V2
Oversampling	2x … 128x	2x
Base Sample Rate	Auto · 44.1 kHz · 88.2 kHz · 96 kHz · 192 kHz	Auto

Structurally documented families (see their chapters): Patchbay & Routing (144 parameters)

Research credits

Phaseburn One implements published techniques together with algorithms of our own, and emulates no specific hardware or software instrument. Credited foundations: Vector Phase Shaping (Kleimola, Lazzarini, Timoney & Välimäki, 2011); zero-delay-feedback filter design after Zavalishin; nonlinear ladder filtering after D'Angelo & Välimäki (IEEE 2014); antiderivative anti-aliasing (Parker, Zavalishin & Le Bivic, 2016); feedback-delay-network reverberation in the Jot / Stautner–Puckette lineage; single-sideband frequency shifting after Bode; the probability-sequencer concept builds on ideas by Alexey Kurkin (Parasense). Attribution of a published technique does not imply endorsement.

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