STEAMGARDEN

Hybrid morphing synthesizer

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Key features

- Dual OSC with morphable waveforms
- TZFM
- Cross FM
- AM
- Morphable filter
- Aggressive filter feedback drive
- Global Filter
- Built-in effects
- DAHDSR envelopes with curve controls
- LFOs with shape controls
- Shared and voice level mod matrix

SteamGarden in 60 Seconds

SteamGarden is a hybrid morphing synthesizer built around two oscillators and two filters.

At its core, each voice follows a simple signal path:

Oscillator 1 + Oscillator 2 → **Voice Filter** → **Amplifier** → **Global Filter** → **Effects** → **Output**

What makes SteamGarden unique is that nearly every stage can continuously morph between different behaviors instead of switching between fixed modes.

1. Create a Sound Source

Each oscillator can use a different synthesis algorithm.

Some algorithms emulate classic analogue waveforms, while others provide advanced morphing engines that allow you to continuously move through large timbral spaces using the **X**, **Y**, and **Z** controls.

2. Add Interaction Between Oscillators

The two oscillators can interact in several ways:

- **Mix** blends between Oscillator 1 and Oscillator 2.

- **FM** allows the oscillators to frequency-modulate each other, from subtle harmonic enrichment to aggressive Through-Zero FM textures.
- **AM** (Ring Modulation) multiplies the oscillators together to create metallic and inharmonic sounds.

3. Shape the Tone

Each voice passes through a **State-Morphable Filter**.

Instead of selecting a fixed Lowpass, Bandpass, or High pass mode, the filter can smoothly morph between them. An additional **All-Pass** axis introduces phase-based coloration and phaser-like effects when modulated.

4. Animate the Sound

Envelopes, LFOs, MIDI performance controls, CV inputs, and the Mod Matrix can be used to create movement throughout the synthesizer.

Most modulation sources are available in both **Voice** and **Global** forms, allowing modulation to operate either independently per note or across the entire instrument.

5. Finish the Sound

After all voices are summed together, the signal passes through the **Global Filter**, built-in **Effects**, and the final output stage.

The result can range from classic analogue tones to complex FM, harmonic-spectrum, phase-distortion, and West Coast-inspired textures without changing instruments.

Where to Start

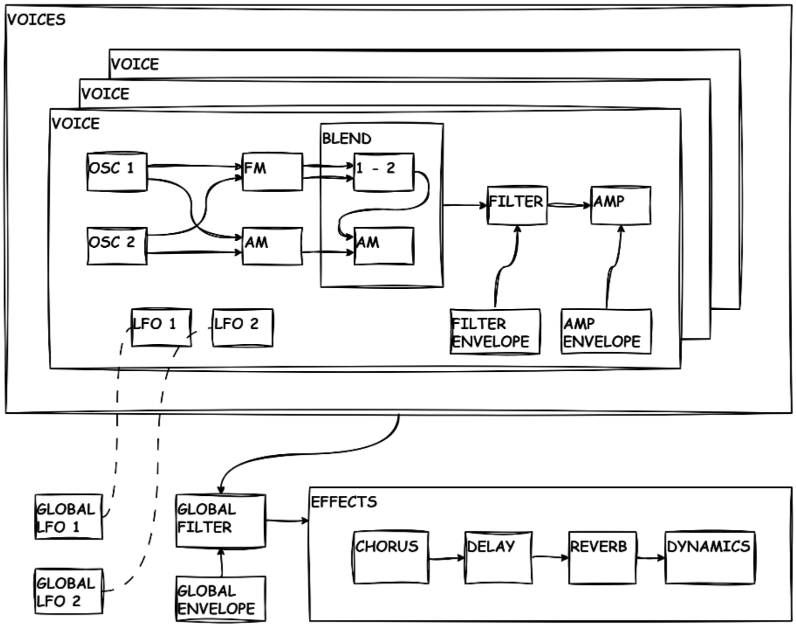
If you are exploring SteamGarden for the first time:

1. Select **Shape Morph** on both oscillators.
2. Experiment with the **X**, **Y**, and **Z** controls.
3. Add a small amount of **Detune**.
4. Sweep the **Voice Filter**.
5. Increase **FM Depth**.
6. Add **Chorus** and **Reverb**.

This simple workflow quickly demonstrates the core ideas behind the instrument and provides a good starting point for deeper sound design.

Signal Flow

To help understand how SteamGarden generates and processes sound, here is a visual map of the entire signal path, from the initial oscillator triggers to the final stereo outputs.



Signal Path Description

The signal flow is split into three main stages: the individual voice level, the global summing stage, and the stereo effects processor.

1. Per-Voice Processing (Mono)

Each note you play triggers an independent, self-contained synth voice. Inside each voice, the signal remains strictly monophonic:

- **The Oscillators:** `OSC 1` and `OSC 2` generate raw waveforms based on their selected algorithms.
- **Modulation & Interaction:** The oscillators interact via Frequency Modulation (`FM`) and Ring Modulation (`AM`).
- **Blending:** The `Blend` section mixes the direct outputs of the oscillators with the AM signal.
- **Sculpting:** The combined sound passes through the state-morphable Voice `Filter` (modulated by the Filter Envelope) and the `Amp` stage (modulated by the Amp Envelope).
- **Voice LFOs:** `LFO 1` and `LFO 2` run independently for each active voice, restarting their cycles with every new note.

2. Summing & Global Filtering (Mono)

Once the individual voice stages are complete:

- **Summing:** All active voices are combined into a single, master mono signal.
- **Global Filter:** This summed mono signal passes through the `Global Filter`, which is modulated by the Global Envelope. This envelope triggers when the first note is played and remains active until the last note is released.
- **Global LFOs:** Unlike the voice LFOs, `Global LFO 1` and `Global LFO 2` run continuously in the background, affecting all voices simultaneously.

3. Stereo Conversion & Effects

Immediately after leaving the Global Filter, the mono signal is duplicated into identical Left and Right channels (creating a dual-mono signal) and sent to the `Effects` processor. This is the stage where the sound becomes stereo, using Chorus, Delay, and Reverb to build spatial width.

Voices

Each voice in SteamGarden consists of two main components: a **Dual Oscillator Core** that generates the initial waveform, and a **State-Morphable Filter** that sculpts the final tonal character.

Dual Oscillator Core

SteamGarden's sound engine is built around two oscillators running in parallel. Each oscillator can independently select from a wide range of synthesis algorithms, from classic virtual analogue waveforms to complex 3D morphing engines.

Available Algorithms

Algorithm	Type
Shape Morph	3D Morphing (VA-based)
Spectral Morph	3D Morphing (Spectral Density)
Harmonic Morph	3D Morphing (Harmonic Spectrum)
Phase Morph	3D Morphing (Phase Distortion)
Sync – Fold – Saturation Morph	3D Morphing (West Coast)
Sync – Fold – Chebyshev Morph	3D Morphing (West Coast)
Sawtooth	Classic VA
Square	Classic VA
Pulse	Classic VA (with PWM)
Triangle	Classic VA
Sine	Pure Sine

Oscillator Controls

Common Controls

These parameters affect **both oscillators equally**:

- **Phase:** Sets the starting phase of both oscillators.
- **Octave:** Shifts the pitch in octave increments.
- **Semitone:** Shifts the pitch in semitone increments.
- **Fine:** Fine-tunes the pitch for subtle detuning.

Relative Controls

These parameters set the **difference between** Oscillator 1 and Oscillator 2:

- **Skew:** Sets the phase offset between the two oscillators. The absolute value determines the amount of phase difference. The sign (positive/negative) determines which oscillator is shifted forward and which is shifted backward.

Skew maintains a continuous phase offset by shifting the oscillators in opposite directions. A **positive** Skew: value shifts Oscillator 1 forward (`+Skew`) and Oscillator 2 backward (-`Skew`). The interface displays Skew from **−100% to +100%** (corresponding to an internal phase offset of −0.5 to +0.5 of a cycle). Because both oscillators are offset in opposite directions, the total phase separation between them is **twice the displayed value**.

> **Tip:** In practice, Skew has the most audible impact when **Detune is at or near zero**. Once any amount of Detune is applied, the phase relationship between the two oscillators drifts continuously on its own, and the specific starting offset set by Skew becomes increasingly irrelevant as the note sustains.

- **Detune:** Sets the pitch offset between the two oscillators. The absolute value determines the amount of detuning. The sign determines which oscillator is tuned up and which is tuned down.

  The UI displays Detune from **−100 to +100 cents** (corresponding to an internal pitch range of −1 to +1 semitones). The offset is split equally between the two oscillators: a **positive** Detune value tunes Oscillator **1 up (sharp)** and Oscillator 2 **down (flat)** by the set amount. A negative value reverses this routing (Oscillator 1 flat, Oscillator 2 sharp). Consequently, the total pitch separation between the oscillators is **twice the displayed value**.

- **Multiplier / Divider:** Multiplies or divides the frequency of Oscillator 2 relative to Oscillator 1. These are applied **before** the Detune parameter.

FM – Frequency Modulation

The two oscillators can frequency-modulate each other, ranging from subtle harmonic enrichment to chaotic, metallic textures.

Mode (Crossfade)

The **Mode** knob controls the FM routing:

Value	**Behavior**
0.0	Oscillator 2 modulates Oscillator 1 (one-way FM)
0.5	Full cross modulation (both oscillators modulate each other equally)
1.0	Oscillator 1 modulates Oscillator 2 (one-way FM, reversed)

Intermediate values provide a continuous blend between these configurations.

Depth

The **Depth** knob controls the intensity of the frequency modulation:

Range	Behavior
0 – 1	Classic FM territory. Standard frequency modulation.
1 – 2	Through-Zero FM (TZFM) territory. The modulated frequency can pass through 0 Hz and go negative, producing the characteristic rich, symmetrical TZFM spectra.

Blending

The two oscillators can be blended using two parameters:

- **Mix:** Continuously crossfade between Oscillator 1 and Oscillator 2.
- **AM (Ring Modulation):** Blends the amplitude-modulated (ring-modulated) signal into the mix. This multiplies the two oscillator waveforms together, suppressing the carrier frequency and producing metallic, inharmonic overtones.

> **Note on Terminology:** In synthesizer literature, the terms "AM" and "Ring Modulation" are sometimes used interchangeably. In SteamGarden, the modulator uses the full bipolar waveform, which technically makes this **Ring Modulation (RM)**. The result is a characteristic suppression of the carrier frequency, producing complex, metallic, and inharmonically rich timbres.

Oscillator Algorithms – Detailed Reference

Shape Morph

A 3D morphing oscillator that provides continuous interpolation between classic VA waveforms: Sawtooth, Triangle, Square, Pulse, and Sine.

The **X**, **Y**, and **Z** axes allow you to smoothly navigate through the entire waveform space.

Spectral Morph – Spectral Density Morphing

A 3D morphing oscillator with **perceptually independent axes**. Every position in the XYZ cube produces a unique, musically useful timbre. Moving one axis never changes the "meaning" of another.

Axes

X – Symmetry / Skew
Controls the phase symmetry of all waveforms simultaneously.

Value	Result
0.0	Fully asymmetric: sawtooth ramp-up, narrow pulse (duty ≈ 0.01)
0.5	Fully symmetric: triangle, square (duty = 0.5)

Value	Result
1.0	Fully asymmetric (inverted): inverse sawtooth, narrow pulse (duty ≈ 0.99)

Y – Sharpness / Brightness
Controls the rate of harmonic rolloff – how "buzzy" versus "smooth" the waveform sounds. Perceptually, this is the main brightness axis, like opening a low-pass filter.

Value	Result
0.0	Smooth: sine (Z=0) or triangle (Z=1)
1.0	Sharp: sawtooth/inverse saw (Z=0) or pulse (Z=1)

Z – Harmonic Series
Controls which harmonics are present. Moving Z from 0 → 1 progressively removes even harmonics, producing a hollow, nasal quality.

Value	Result
0.0	All harmonics (even + odd): saw family, sine

Value	Result
1.0	Odd harmonics only: square/pulse family, triangle

Corner Map

Position	Waveform	Character
(0.5, 0, 0)	Sine	Smooth, symmetric, all harmonics
(0, 1, 0)	Sawtooth	Sharp, asymmetric, all harmonics
(1, 1, 0)	Inverse Saw	Sharp, asymmetric, all harmonics
(0.5, 1, 0)	Saw ↔ Inv. Saw	Sharp, symmetric via morph
(0.5, 0, 1)	Triangle	Smooth, symmetric, odd only
(0, 1, 1)	Narrow Pulse	Sharp, asymmetric, odd only
(0.5, 1, 1)	Square 50%	Sharp, symmetric, odd only

Position	Waveform	Character
(1, 1, 1)	Narrow Pulse (inv.)	Sharp, asymmetric (inv.), odd only

Harmonic Morph – Harmonic Spectrum Control

A harmonic-spectrum-oriented 3D oscillator. Each axis controls a distinct property of the harmonic content, providing direct access to timbral dimensions that most subtractive synths typically reach through filtering or additional processing.

Rather than controlling individual partials like a traditional additive synthesizer, Harmonic Morph manipulates broad spectral characteristics, allowing rapid movement through musically useful timbral spaces.

The Harmonic Morph oscillator is inspired by harmonic-domain synthesis techniques. Instead of editing individual harmonics directly, the X, Y and Z dimensions shape large-scale spectral properties such as harmonic balance, brightness and harmonic parity.

Note: Harmonic Morph is not a traditional additive synthesizer. Rather than exposing individual harmonic partials for direct editing, it provides macro-level control over harmonic structure and spectral balance through a compact three-dimensional interface.

Axes

X – Sub-Fundamental Weight
Introduces a controllable sub-fundamental component one octave below the main waveform, adding weight and low-frequency richness.

Value	Result
0.0	No sub-oscillator; pure YZ waveform
1.0	Maximum sub-fundamental (organ-like warmth and low-end weight)

Y – Harmonic Rolloff / Brightness
Controls how fast upper harmonics decay. Perceptually equivalent to opening a low-pass filter, but the spectral shape is built into the waveform itself.

Value	Result
0.0	Fast rolloff ($1/n^2$): soft, dark, flute/string-like
1.0	Slow rolloff ($1/n$): bright, buzzy, reed/brass-like

Z – Harmonic Parity / Series
Controls whether even harmonics are present.

Value	Result
0.0	All harmonics (even + odd): full, asymmetric spectrum
1.0	Odd harmonics only: hollow, nasal, clarinet/oboe-like

Corner Map

Position	Waveform	Character
(Y=0, Z=0)	Parabolic	Soft, all harmonics, $1/n^2$ spectrum
(Y=0, Z=1)	Triangle	Soft, odd only, $1/n^2$ spectrum
(Y=1, Z=0)	Sawtooth	Bright, all harmonics, $1/n$ spectrum
(Y=1, Z=1)	Square	Bright, odd only, $1/n$ spectrum

Phase Morph – Phase Distortion

A Casio CZ-style phase distortion oscillator with fully orthogonal X/Y/Z axes.

The timbral character is fundamentally different from the PolyBLEP-based oscillators (Shape Morph, Spectral Morph, Harmonic Morph): vocal, nasal, formant-rich, and capable of sounds that subtractive synthesis cannot easily replicate.

Axes

X – Distortion Amount
Controls how aggressively the phase is warped each cycle.

Value	Result
0.0	No distortion: pure sine regardless of Y and Z
1.0	Maximum warp (depth is frequency-limited to prevent aliasing)

Y – Warp Shape
Selects the character of the phase warp function.

Value	Result
0.0	**Formant:** Piecewise-linear warp with a "knee." The sine rushes through one part of the cycle and crawls through the rest, producing formant-like harmonic clusters with a vocal/reed character. Equivalent to the Casio CZ "resonance" waveforms.

Value	Result
1.0	**Sync:** The sine phase is multiplied and wrapped (or folded), producing sync-like harmonic stacks. Equivalent to hard/soft sync sweep without requiring a separate slave oscillator.

Intermediate Y values morph continuously between these two characters.

Z – Symmetry / Even Harmonics
Controls the symmetry of the warp function.

Value	Result
0.0	Symmetric warp: mirrors across the half-period. Produces **odd harmonics only** (hollow, nasal, clarinet-like).
1.0	Asymmetric warp: one continuous warp across the full period. Produces **all harmonics** (even + odd), resulting in a fuller, more complex timbre.

> *At X = 0 (no distortion), Z has no audible effect – the output is always a pure sine.*

Sync – Fold – Saturation Morph

A West Coast / aggressive oscillator combining three signal-processing effects chained in series, each controlled by one axis. The processing order is **X** → **Z** → **Y**, which produces the most musically useful interactions: Phase Feedback (Z) modulates the waveform before Sync (X) sculpts it, then Wave Folding (Y) adds harmonic density on top.

Axes

X – Soft Sync Ratio
Blends between a free-running sawtooth and a sync-reset sawtooth.

Value	**Result**
0.0	Free-running saw (no sync)
1.0	Fully synced saw (classic sync sweep character)

Intermediate values create a "soft sync" effect – the phase is drawn toward the reset point without a hard discontinuity, avoiding the abrupt clicks of true hard sync while preserving the harmonic sweep character.

Y – Wave Fold Amount
Folds the waveform back on itself when it exceeds ±1.

Value	Result
0.0	No folding: clean waveform
1.0	Maximum folding: 4–5 reflections, dense metallic spectrum

Unlike clipping, folding adds harmonics without introducing a harsh high-frequency noise floor. A post-fold RMS compensation keeps the perceived level approximately constant.

Z – Phase Feedback
Feeds the previous output sample back into the current phase calculation (FM self-feedback). Identical in principle to the Yamaha DX7 feedback operator.

Value	Result
0.0	Clean: no feedback, output depends only on current phase
1.0	Maximum self-modulation, approaching chaotic/buzzy edge

> *Feedback is applied **before** Sync, so it implicitly modulates the sync ratio, creating complex interactions between all three axes.*

Sync – Fold – Chebyshev Morph

A West Coast / aggressive oscillator with three signal-processing stages chained in series.

Axes

X – Soft Sync Ratio
Blends between a free-running sawtooth and a phase-multiplied sawtooth.

Value	Result
0.0	Free-running saw
1.0	Synced saw (classic sync sweep character)

The sync ratio automatically adapts to pitch to reduce aliasing artifacts. The soft blend (linear interpolation of phases) ensures no hard discontinuity at intermediate X values.

Y – Wave Fold Amount
Folds the waveform back within ±1 when it exceeds that range.

Value	Result
0.0	No folding: clean shaped saw
1.0	Heavy folding: 4–5 reflections, dense metallic spectrum

Z – Chebyshev Harmonic Shaping
Applies a Chebyshev polynomial waveshaper to the normalized sawtooth, progressively adding harmonically tuned upper partials.

Value	Result
0.0	Clean sawtooth, all harmonics
0.5	Adds strong octave above the fundamental
1.0	Adds octave + fifth (open fifth character)

Classic VA Waveforms

Algorithm	Description
Sawtooth	Classic virtual analogue sawtooth wave.

Algorithm	Description
Square	Classic virtual analogue square wave.
Pulse	Classic virtual analogue pulse wave with pulse width modulation (PWM).
Triangle	Classic virtual analogue triangle wave.
Sine	Pure sine wave.

State-Morphable Filter

SteamGarden features a **State-Morphable Filter** with aggressive nonlinear feedback drive, based on a **Topology-Preserving Transform** architecture.

Filter Morphing

Unlike a traditional State Variable Filter (SVF) that switches discretely between modes, SteamGarden's filter allows you to **continuously morph** between filter states using two independent axes:

- **LP ↔ BP ↔ HP Axis:** Smoothly blends between Lowpass, Bandpass, and High pass responses. At the center position, the filter behaves as a pure Bandpass.
- **All-Pass (AP) Axis:** Crossfades the filter response toward an All-Pass state.

> **What is All-Pass?** An All-Pass filter passes all frequencies at equal amplitude (nothing is "filtered out"), but it shifts the phase relationships between frequencies. While this may seem subtle on a static sound, **modulating the cutoff frequency** while in full AP mode produces distinctive phaser-like sweeps and movement.

Feedback Drive

The filter includes a continuously adjustable **nonlinear feedback drive** for adding harmonic saturation directly within the filter circuit.

- **Character:** Continuously morphs between two different feedback saturation curves.
- **Symmetry:** Controls the symmetry of the feedback waveshaping.

Value	Behavior
Near 0	**Symmetric** feedback. Produces only odd harmonics, resulting in a warmer, rounder tone.
Near ±1	**Asymmetric** feedback. Introduces even harmonics, resulting in a brighter, edgier, colder tone.

Envelopes

All envelopes are DAHDSR envelopes with customizable slopes.
DAHDSR stands for:
D: Delay
A: Attack
H: Hold
D: Decay
S: Sustain
R: Release

Sustain is a level parameter, all others are time parameters. Attack, Decay and Release have curve control to shape the envelope between exponential, linear and logarithmic slopes.

Filter Envelope and Modulation

The filter envelope modulates the cutoff frequency. There are three available modes that determine how the envelope interacts with the Filter Frequency knob.

R - Relative Mode

In this mode, the Filter Frequency knob represents the **maximum** peak of the envelope.

- **Envelope Amount:** Determines how much the envelope "pulls" the filter down from the current knob setting. At 100%, the envelope starts from the filter's minimum value (20Hz) and rises to the knob's position.

A - Additive Mode

In this mode, the envelope is added to the base frequency set by the Filter Frequency knob.

- **Envelope Amount:** Determines the range of the modulation added on top of the base cutoff frequency.

X - Exponential Additive Mode

Like Additive Mode, but with exponential scaling applied to the modulation. While the envelope itself has curve controls, this mode adds extra "punch" to the attack and decay.

- **Envelope Amount:** Determines the intensity of the exponential modulation added to the base cutoff frequency.

KB - Keyboard Tracking

Keyboard tracking modulates the cutoff frequency based on the MIDI note played.

- **At 0%:** The filter cutoff remains constant regardless of which note is played.
- **At 100%:** The filter follows the keyboard pitch perfectly (e.g., playing one octave higher raises the cutoff by one octave).

Note on Keyboard Tracking Center:
To maximize the usable range of the frequency knob, the tracking is calculated differently per mode:

- **A and X Modes:** Tracking is centered around **MIDI Note 60** (Middle C).
- **R Mode:** Tracking is centered around **MIDI Note 0**.

Velocity

The Velocity knob determines how note velocity affects the filter cutoff frequency. This control functions similarly to velocity-to-amplitude modulation on most classic synthesizers.

- **At 0%:** Velocity has no effect; the filter remains at the set cutoff frequency regardless of how hard a key is struck.
- **At 100%:** The filter becomes highly sensitive to velocity. Lower velocities will drastically scale down (close) the cutoff frequency.

Note: Unlike many other synthesizers where velocity *adds* a fixed amount to the cutoff, this implementation uses velocity to **scale** the existing frequency value, allowing for more organic and expressive control.

Amp Envelope and Modulation

As with most synthesizers, the Amp Envelope modulates the volume level (amplitude) of the individual voice over time.

Velocity

The Velocity knob determines how note velocity affects the output volume.

- **At 0%:** Velocity has no effect; every note plays at the same volume regardless of how hard the key is struck.
- **At 100%:** The volume becomes highly sensitive to velocity. Lower velocities will drastically scale down the volume, allowing for maximum dynamic range.

Volume Knob

The Volume knob in this section adjusts the output level of the synth engine.

Signal Flow Note: It is important to note that this volume control is positioned **after** the Global Filter in the signal chain. Because the Global Filter processes the summed signal of all voices rather than individual voices, the Volume knob will affect the level of the signal entering the effects and the final output stage. (See the **Global Filter** chapter for more details.)

Global Filter

After all individual voices are summed, the combined signal passes through the **Global Filter**. This filter processes the entire mix as a single signal, rather than individual voices.

Filter Modes

Mode	Type	Slope	Poles
LP12	Lowpass	12 dB/oct	2-pole
LP18	Lowpass	18 dB/oct	3-pole
LP24	Lowpass	24 dB/oct	4-pole
BP12	Bandpass	12 dB/oct	1 HP + 1 LP pole
BP18	Bandpass	18 dB/oct	1 HP + 2 LP poles
BP24	Bandpass	24 dB/oct	1 HP + 3 LP poles
HP12	High pass	12 dB/oct	2-pole
HP18	High pass	18 dB/oct	3-pole
HP24	High pass	24 dB/oct	4-pole

Parameters

- **Frequency:** Sets the cutoff frequency of the filter.
- **Resonance:** Controls the resonance emphasis at the cutoff point. At maximum, the resonance remains musical and does not reach extreme self-oscillation levels.
- **Mix:** Blends between the dry (unfiltered) and wet (filtered) signal. At 0%, the filter is effectively bypassed; at 100%, only the filtered signal is heard.

Global Filter Envelope and Modulation

The Global Filter Envelope modulates the cutoff frequency of the Global Filter. The modulation behavior follows the same principle as the **X Mode (Exponential Additive)** used in the voice-level filter.

Envelope Behavior

Unlike the voice-level envelope (which triggers independently per note), the Global Filter Envelope operates across the entire voice stack:

- **Start:** The envelope is triggered when the **first voice** begins playing.
- **End:** The envelope completes its release phase only after the **last voice** has fully rung out.

Keyboard Tracking & Velocity

- **Keyboard Tracking:** Functions identically to the voice-level keyboard tracking but is **locked to the first note played**. Subsequent notes do not affect the tracking position.
- **Velocity:** Functions identically to the voice-level velocity modulation but is also **locked to the first note played**.

CV Output

On the **rear panel** of the device, a dedicated **CV output** provides the current level of the Global Filter Envelope. This can be patched to other Reason devices for external modulation.

LFOs

SteamGarden features **2 LFO units**, each of which operates simultaneously at two levels:

- **Voice-Level LFO** (`LFO 1`, `LFO 2`): Each voice spawns its own independent instance of the LFO. These appear as **"LFO 1"** and **"LFO 2"** in the Mod Matrix **Source** list.
- **Global LFO** (`Global LFO 1`, `Global LFO 2`): A single shared instance that runs across all voices. These appear as **"Global LFO 1"** and **"Global LFO 2"** in the Mod Matrix **Source** and **Scale** lists.

Voice LFO vs. Global LFO

Behavior	Voice LFO	Global LFO
Starts when...	Each new voice is triggered	The first voice starts (runs indefinitely)
Stops when...	The voice ends	Pauses when no voices are playing
Delay & Ramp	✅ Yes	❌ No
Rate modulation via Matrix	✅ Yes	❌ No

LFO Parameters

- **Wave:** Selects the LFO waveform.
    - Sine
    - Triangle
    - Pulse
    - Random
- **Shape:** Adjusts the character of the selected waveform:
    - *Sine / Triangle:* Controls the slope ratio (skew).
    - *Pulse:* Controls the pulse width.
    - *Random:* Blends between a stepped (sample & hold) signal and a smoothly interpolated signal.
- **Offset:** Shifts the starting phase of the LFO waveform.
- **Smoothing:** Applies smoothing to the LFO output.
    - *At 0%:* No smoothing; the raw waveform is used.

    - *At higher values:* The waveform is smoothed, but the LFO may no longer reach its full minimum and maximum values.
- **Rate:** Sets the LFO speed. Ranges from **0.1 Hz to 50 Hz** (Free Mode) or **1/64 to 3/2** (Sync Mode).
- **Sync Mode:** On / Off. When enabled, the LFO rate locks to the host tempo.
- **Delay:** The number of LFO cycles during which the output remains at zero before the LFO begins.
- **Ramp:** The number of LFO cycles over which the output gradually scales up from 0% to 100%.

> **Pro Tip:** The **Delay** and **Ramp** parameters allow you to create complex modulation behaviors without needing additional scaling in the Mod Matrix. For example, setting a moderate Delay and Ramp on a pitch-modulating LFO creates a natural vibrato that slowly fades in after each note is played - a classic expressive technique for leads and solo patches.

Effects

SteamGarden features 4 built-in effects, and their routing order can be completely customized.

Mono to Stereo Transition

As shown in the main Signal Flow diagram, the core synthesizer engine operates entirely in mono.

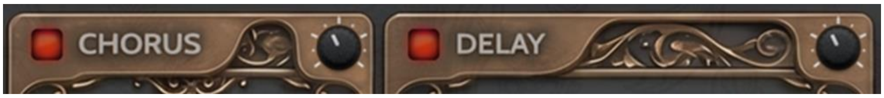
The effects section is where SteamGarden transitions into a stereo instrument. Immediately before entering the effects chain, the summed mono signal is duplicated into identical Left and Right channels. The **Chorus**, **Delay**, and **Reverb** modules then process these channels with phase offsets, delay times, and reflections to generate stereo width and space.

> **Note on the Dynamics Effect:** The Dynamics module processes both channels in stereo, but it does not generate stereo width on its own. If Dynamics is placed first in the effect chain (before the Chorus, Delay, or Reverb), the audio will remain dual-mono until it reaches one of the spatial effects.

Bypassing and Routing

The effects can be turned on or off individually, or all bypassed simultaneously. Since many Reason users prefer to build their own extensive external effect chains in the Reason rack, a **Global Bypass** feature is provided to disable all internal effects with a single click. *(Note: Bypassing all effects means SteamGarden will output a pure, dual-mono signal).*

Additionally, each effect features its own dedicated **Dry/Wet Mix knob** located in the top right corner of its panel.



Chorus

The Chorus effect features two distinct modes:

S - Standard

A smooth, lush, modern-sounding chorus. This mode uses three modulated delay lines panned across the stereo field with 120° LFO phase spacing.

- **LFO Waveform:** Sine
- **Voices:** 3

J - Junoish

An emulation of the classic BBD (Bucket Brigade Device) chorus circuit. It uses two voices with inverted LFOs (0° and 180°), and a 1-pole low-pass filter on the wet path to accurately replicate the bandwidth limiting of vintage BBD chips.

- **LFO Waveform:** Triangle
- **Voices:** 2

Common Chorus Parameters

- **Rate:** 0.1 Hz – 5 Hz
- **Depth:** 0% – 100%

Delay

The Delay effect features three distinct modes:

Ping-Pong

A classic stereo ping-pong delay. Echoes alternate between the left and right channels, creating wide rhythmic movement.

- **Width:** (Ping-Pong specific) Adjusts the stereo width of the delayed output.

Offset

Two independent delay lines with a time offset between the channels. This adds stereo width and thickness without the obvious panning movement of a ping-pong delay. Excellent for lush pads and sustained leads.

- **Offset:** (Offset specific) Sets the time ratio between the left and right channels.

Reverse

Uses a double-buffer (ping-pong) system: while one buffer records forward, the other plays the previous audio chunk backward.

- **Window:** (Reverse specific) Controls the Anti-click Window envelope (Splice Smoothing). At 100%, the audio fades halfway in, then halfway out (forming a triangle shape) to prevent clicks when the playback reverses.

Common Delay Parameters

- **Rate:** 50 ms – 1000 ms (Free Mode) or 1/64 – 3/2 (Sync Mode).
- **Sync Mode:** On / Off.
- **Feedback:** 0% – 100%. Controls how much delayed signal is fed back into the delay line.
- **Feedback Drive:** 0% – 100%. Controls the amount of analog-style saturation applied to the feedback loop.
- **Feedback Damping:** 2 kHz – 20 kHz. A low-pass filter inside the feedback loop that darkens successive echoes.
- **Mod Depth:** 0 ms – 20 ms. Modulates the delay lines. At 0 ms, no modulation is applied. Higher values push and pull the delay time to create pitch-shifting tape effects.
- **Mod Rate:** 0.05 Hz – 5 Hz. The speed of the delay time modulation.

> **Pro Tip:** For the cleanest, most modern digital delay, set *Feedback Drive* to 0%, *Feedback Damping* to 20kHz, and *Mod Depth* to 0 ms. Conversely, using high drive, low damping, and heavy modulation will yield wild, unpredictable, and distorted tape-echo textures!

Reverb

A lush, stereo FDN (Feedback Delay Network) reverb.

- **Size:** Sets the reverberation time at mid-frequencies, ranging from 0.3 seconds up to massive, ambient decays.
- **Diffusion:** Controls the density of the reverb tail.
  - *At 0.0:* All-pass gains drop to zero and LFO modulation stops. The reverb acts as a sparse, rhythmic, vintage multi-tap room.
  - *At 1.0:* Transforms into a lush, chorused, Lexicon-style cloud.
- **Damping:** Controls high-frequency absorption.
  - *At 0.0:* Bright (high frequencies decay at the same rate as mid frequencies).
  - *At 1.0:* Very warm (high frequencies decay 6–7x faster than mid frequencies).
- **Predelay:** 0 ms – 100 ms. The amount of silence before the reverb tail begins.
- **Early Reflection:** 0% – 100%. Adjust the volume level of the initial room reflections.

Dynamics

A powerful 2-Band Hybrid Dynamics processor (Body Glue + Air).

The signal is split into low/mid and high-frequency bands using phase-aligned crossover filters.

The "Body" Band (0 Hz – 2.5 kHz)

Downward Compression ONLY.
Role: Acts as a classic mix-bus "Glue" compressor. It catches loud oscillator spikes and thumping bass notes, smoothly leveling out the mid-range without crushing the beautiful high frequencies.

The "Air" Band (2.5 kHz – 20 kHz)

Downward AND Upward Compression.
Role: Tames harsh filter squeaks (Downward), while massively pulling *up* the fading high-frequency echoes of your Chorus, Delay, and Reverb (Upward). This is the secret to creating expensive, modern, cinematic sizzle.

Dynamics Parameters

- **Attack:** 0.1 ms – 250 ms
- **Release:** 10 ms – 2000 ms
- **Dynamics Mode:** Peak or RMS
  - *Peak:* Instant response. Punchy and aggressive.
  - *RMS:* Smooth, 5 ms averaged window. Best for musical "analog glue."
- **Air Low Threshold:** -40 dB to -10 dB (Triggers Upward Compression)
- **Air Up Ratio:** 1:1 to 20:1 (Upward Compression amount)
- **Air High Threshold:** -30 dB to 0 dB (Triggers Downward Compression)
- **Air High Ratio:** 1:1 to 20:1 (Downward Compression amount)
- **Body Threshold:** -60 dB to 0 dB (Triggers Downward Compression)
- **Body Ratio:** 1:1 to 20:1 (Downward Compression amount)
- **Air Makeup Gain:** -12 dB to +24 dB
- **Body Makeup Gain:** -12 dB to +24 dB

Performance Controls

The bottom-left section of the device houses the performance controls, voice mode settings, and MIDI indicators.

Pitch and Modulation

- **Pitch Bend:** Standard pitch-bend control. The **Range** selector below allows you to set the maximum bend interval (in semitones).
- **Mod Wheel:** Standard Mod Wheel control for real-time modulation.

MIDI Performance Indicators

This display area monitors incoming MIDI data for specific performance controllers:

- **Breath Control**
- **Expression**
- **Aftertouch**
- **Sustain Pedal**

Note: Click on the indicator area to select which controller is currently being displayed.

Voice Modes & Polyphony

SteamGarden offers three distinct play modes:

- **Mono Legato:** Monophonic play style where overlapping notes do not retrigger the envelopes, allowing for smooth pitch glides.
- **Mono Retrig:** Monophonic play style where every new note restarts the envelopes.
    - *Note Priority:* This mode features **note-stacking logic**. If you hold multiple keys and release the most recent one, the engine will automatically retrigger the previous held note in the stack.
- **Poly:** Standard polyphonic operation.

Polyphony Count: You can set the maximum number of voices between **2 and 16**. If the limit is reached, the engine uses a **note-stealing** algorithm to manage new incoming notes.

Glide: Adjusts the portamento (glide) time between notes.

> **Unique Feature:** Unlike many synthesizers, SteamGarden's **Mono modes** still utilize the set polyphony level. This allows the release phase of previous notes to "ring out" naturally even while you are playing a monophonic line, preventing abrupt cuts in the sound.

Mod Matrix Toggle

On the right side of this section, you will find the switch to toggle the **Mod Matrix** display. This is covered in detail in the following chapter.

Mod Matrix

SteamGarden features a powerful **24-slot Modulation Matrix**, divided into two categories:

- **Voice Mod Matrix (8 slots):** These modulation routes operate at the individual voice level. Each note you play has its own independent modulation.
- **Shared Mod Matrix (16 slots):** These modulation routes operate globally, affecting all voices simultaneously. Use these slots to modulate global parameters such as the **Effects** or **Global Filter**.

Setting Up a Modulation Route

Each Mod Matrix row has four controls:

1. **Source:** The parameter that drives the modulation (e.g., LFO, Envelope, Velocity).
2. **Destination:** The parameter being modulated (e.g., Filter Cutoff, Oscillator Pitch).
3. **Scale (optional):** A secondary source that scales the modulation amount in real-time (e.g., Mod Wheel controlling LFO depth).

4. **Amount:** The intensity of the modulation, ranging from **-100%** to **+100%**.

> **Note:** The available Sources and Destinations differ between the Voice and Shared Mod Matrix. However, the Scale parameter list is identical for both.

Why Two Types of Mod Matrix?

The Voice Mod Matrix has access to per-note data such as **MIDI Note Number**, **Velocity**, and **Aftertouch**. These parameters are unique to each note you play.

The Shared Mod Matrix, however, cannot use per-voice sources because it would be unclear which voice's data to use when modulating a global parameter (like a reverb or delay). By separating the two, SteamGarden ensures that global parameters are always modulated by smooth, continuous sources, avoiding unexpected jumps or glitches.

How It Works (Technical Details)

For users interested in the underlying math:

- All parameters (Source, Scale, Destination) are internally normalized to a **0 to 1** or **-1 to 1** range.
- The modulation value is calculated as:
  Source × Scale × Amount = Modulation Value
  (If no Scale parameter is selected, it defaults to 1. If no Source is selected, it defaults to 0.)
- This Modulation Value is then **added** to the Destination parameter.
- Finally, the Destination is clamped and scaled to its actual parameter range.

This architecture keeps the modulation system simple, predictable, and highly flexible.

Under the Hood (Advanced Features & Utilities)

At the bottom of the interface, where the Mod Matrix pages are located, you can switch the view to the **"Hood"** panel. This section contains several experimental tools and global utility features.

Randomizer Tools

SteamGarden includes a set of simple randomizers to help you explore new sound possibilities. Unlike standard "total randomizers," these tools use a few internal rules to help keep the results within a usable range.

To randomize a section, **click and drag** inside the designated Oscillator, Filter, or Envelope randomizer area.

- **Directional Mapping:** Moving your mouse in different directions (Horizontal vs. Vertical) will affect different sets of parameters.
- **Subtle Mode (`Shift`):** Hold the **Shift** key while dragging to use smaller random steps. This is ideal for making minor "tweak-style" variations to your existing sound.
- **Alternate Parameters (`Alt`):** For the **Oscillator** and **Filter** randomizers, holding the **Alt** key will change which

parameters are being targeted. *(Note: Alt functionality is not available for the Envelope randomizer).*

These tools are not intended to be "perfect patch generators," but rather a quick way to break out of a creative block or find interesting starting points for further sound design.

Adaptive Oversampling

While SteamGarden's oscillators are designed to produce alias-free waveforms natively, heavy Frequency Modulation (FM) can sometimes introduce digital aliasing artifacts.

To suppress this, the engine uses a highly efficient **Adaptive Oversampling Algorithm**. The synthesizer dynamically increases the internal oversampling rate only, when necessary, based on the current oscillator frequencies and the depth of the FM applied.

- **Max Oversampling:** This setting allows you to cap the maximum allowed oversampling limit. This is highly useful for managing your computer's CPU load during complex projects.

Harmonic Processor

If you want to add an extra layer of organic, analog-style unpredictability to your sound, you can engage the Harmonic Processor.

*Note: To save CPU, the Harmonic Processor uses **zero overhead** when the Amount knob is set to 0.*

- **Amount:** Controls the overall intensity of the harmonic processing.
- **Position & Speed:** These parameters control the internal movement and phase relationships of the harmonic algorithms.
- **Chaos:** Acts as a continuous algorithm selector, allowing you to seamlessly morph between several different harmonic profiles under the hood.

> **Pro Tip:** The effect of the Harmonic Processor is intentionally **very subtle**. It shines best on simpler patches (like pure sine waves, basic vintage brass, or clean plucks), injecting them with organic life and warmth. On highly complex, heavily modulated, or distorted patches, the effect will be much less noticeable.

Patch Notes

At the bottom of the device there is a place to take patch notes. Sometimes this could be helpful.

Output Stage

The final output stage of SteamGarden includes several fixed processing elements to ensure a polished, mix-ready sound. These stages are **not user-configurable**, but understanding their presence can be helpful when designing patches:

- **DC Filter:** Removes any DC offset from the signal to prevent speaker damage and ensure compatibility with external processors.
- **Pre-Gain:** A fixed gain stage that optimizes the signal level before the final clipper.
- **Soft Clipper:** Provides gentle saturation and prevents harsh digital clipping, ensuring the output remains warm and controlled even when driven hard.

> **Note:** There are no user-facing controls for the output stage. These processors are always active and work transparently in the background.

UI Features

SteamGarden's interface supports direct **mouse interaction** on several display areas, allowing for fast and intuitive editing without needing to locate individual knobs.

Oscillator Display

Input	**Action**
Horizontal drag	Adjust **X** parameter
Vertical drag	Adjust **Y** parameter
`Alt` + Horizontal drag	Adjust **X** parameter (alternate)
`Alt` + Vertical drag	Adjust **Z** parameter
`Ctrl` + Click	Reset to default values
`Shift` + Drag	Fine-tune (smooth changes)

Filter Display

Input	**Action**
Horizontal drag	Adjust **Frequency**

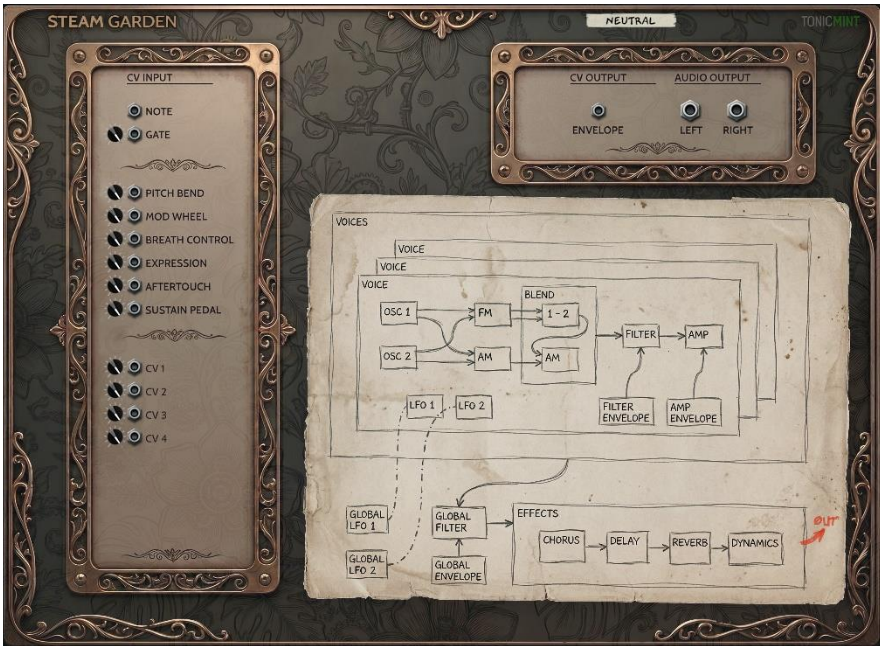
Input	Action
Vertical drag	Adjust **Resonance**
`Alt` + Horizontal drag	Morph between **LP / BP / HP**
`Alt` + Vertical drag	Adjust **All-Pass (AP)** amount
`Ctrl` + Click	Reset to default values
`Shift` + Drag	Fine-tune (smooth changes)

LFO Display

Input	Action
Horizontal drag	Adjust **Shape**
`Alt` + Horizontal drag	Adjust **Offset**
`Ctrl` + Click	Reset to default values
`Shift` + Drag	Fine-tune (smooth changes)

Back Panel

The rear panel of SteamGarden provides all audio and CV connections for integration with other Reason devices and external modular setups.



Audio Output

- **Stereo Output (L/R):** Main audio output of the synthesizer.

CV Output

- **Envelope CV**: Outputs the current level of the **Global Filter Envelope**, allowing you to modulate external devices in sync with SteamGarden's envelope.

CV Inputs

Input	Description
Note	Receives pitch information
Gate	Receives gate/trigger signals for note on/off
Pitch Bend	External pitch bend control
Mod Wheel	External modulation wheel control
Breath Control	External breath controller input
Expression	External expression pedal input
Aftertouch	External aftertouch/pressure input
Sustain Pedal	External sustain pedal input
CV 1 – 4	General-purpose CV inputs, available as modulation sources in the Mod Matrix

> **Pro Tip:** The four **CV 1–4 inputs** can be used creatively with Reason's Matrix, Pulsar, or any CV-generating device to add complex, evolving modulations that go far beyond the built-in LFOs.

Info and Credits

SteamGarden is a Hybrid morphing synthesizer.

in a Rack Extension format for Reason

Made with Rack Extension SDK 4.6

Required Reason version is 10.1 or newer.

SteamGarden made by TONICMINT

2026

https://tonicmint.com

Version History

- 1.0.3 Minor fixes
- 1.0.2 Minor fixes
- 1.0.1 Initial Release
- 1.0.0 Internal build

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