

# Foldspace

## Phase Modulation x Wavefolding Processor

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Foldspace is a phase modulation and wavefolding effect built around one signal chain with a wavefolder available at three points inside it: on the modulator, on the output, and inside a feedback loop. The input audio can be phase-modulated directly, or it can play an internal carrier oscillator that follows the input's pitch - or a MIDI note. The result ranges from smooth harmonic enhancement, through growling and metallic textures, to self-oscillating feedback timbres that respond to whatever you feed them.

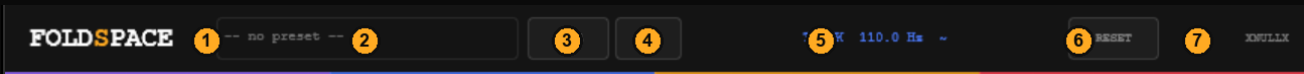
# 1. Interface Overview

The Foldspace window is organized top-to-bottom into a top bar, two live displays, four stage strips, and a bottom global bar. The strips follow the signal flow left to right – MODULATOR (violet), PM (blue), FOLD (spice), FEEDBACK (red) – matching the accent strip under the top bar.



The full Foldspace interface at default settings.

## 1.1 Top Bar



The top bar.

#	Control	Description
1	Logo	The Foldspace wordmark.
2	Preset menu	Selects a saved preset (full plugin state).
3	SAVE	Saves a named preset to Documents/Foldspace/Presets.
4	DEL	Deletes the currently selected preset.
5	Pitch readout	The pitch currently driving the carrier – tracked (TRACK), last MIDI note (MIDI), or the FREE HZ setting. A tilde (~) in TRACK mode means confidence is low and the last good pitch is held.
6	RESET	Returns every parameter to its default value in a single click.
7	XNULLX	Manufacturer branding.

## 2. Signal Chain

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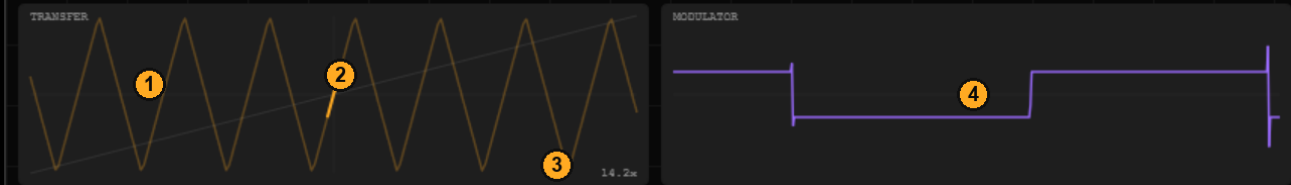
Foldspace is a single chain with three wavefold insertion points. All three folders can be active at once and each is continuously variable, so the classic "patches" – fold the output, fold the modulator, fold the feedback – are corners of one space rather than separate modes.

Stage	Description
<b>In Trim</b>	Global input gain. Sets how hard the input drives everything downstream – the envelope follower, the pitch tracker, the PM stage, and the folders.
<b>Analysis Taps</b>	The pitch tracker and the envelope follower both read the trimmed input. Neither is in the audio path.
<b>Modulator Bus</b>	The signal that will drive the phase modulation: a mix of the internal oscillator (OSC), the input itself (INPUT), and the feedback return (FEEDBACK AMOUNT).
<b>Mod Fold</b>	Insertion point one. Folds the modulator bus before it reaches the PM stage, reshaping the modulation waveform itself.
<b>PM Stage</b>	Phase-modulates the audio. The CARRIER knob blends between two carriers: the input signal itself (via a modulated delay line) and an internal oscillator pitched by the pitch system.
<b>Main Fold</b>	Insertion point two. Folds the PM output through a morphable triangle/sine folder with symmetry bias. A DC blocker follows.
<b>Tone</b>	A gentle lowpass after the main fold, for taming the fold brightness.
<b>Feedback Path</b>	The wet output is folded (insertion point three), damped by FB TONE, DC-blocked, limited, and returned to the modulator bus at the FEEDBACK AMOUNT level.
<b>Dry/Wet</b>	The dry path is delayed to exactly match the wet path's latency, so parallel blends stay phase-coherent.
<b>Out Trim</b>	Final output gain.

The whole chain runs at the oversampled rate (see section 9), and all three folders use first-order antiderivative antialiasing on top of the oversampling, keeping the folds clean even at extreme drive.

### 3. The Displays

Two live displays sit above the stage strips: the transfer curve of the main fold stage on the left, and an oscilloscope of the modulator bus on the right. The figure below shows them with a square modulator folded into a 14x transfer curve.



The two displays, driven hard.

#	Element	Description
1	Transfer curve	The main fold stage's full transfer shape (input across, output up), drawn dimmed. It redraws live as FOLDS, SHAPE, and SYM change.
2	Live region	The bright segment is the portion of the curve the input is actually traversing right now, derived from the envelope follower. Quiet passages light only the center; hits flare the bright region out across the folds. With an ENV>FLD send active, the whole curve reshapes with the material.
3	Drive readout	The current effective fold drive (for example "4.8x"), including any live envelope contribution.
4	Modulator scope	The modulator bus after the Mod Fold – the actual waveform driving the PM stage. Change the wave, ratio, source mix, or Mod Fold amount and you see exactly what the carrier is about to be modulated by.

Together the displays answer the two questions that matter while sound-designing: what is doing the modulating, and how folded is the result.

## 4. The Pitch System

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The internal oscillators – the modulator oscillator and the carrier oscillator – need a base pitch. The PITCH selector in the bottom bar chooses where it comes from.

Mode	Description
<b>TRACK</b>	The base pitch follows the input's detected pitch. The tracker is tuned for bass and monophonic material (30 Hz - 1 kHz) and holds its last confident value through silence and noisy passages, so brief consonants or drum hits don't yank the pitch around.
<b>MIDI</b>	The base pitch follows MIDI notes sent to the plugin. Mono, last-note priority; the pitch persists after the note is released. There is no envelope – the input audio provides all loudness and articulation, so think of MIDI as writing a pitch line underneath the audio.
<b>FREE</b>	The base pitch is set manually with the FREE HZ knob (20 Hz - 2 kHz).

Parameter	Range	Description
<b>FREE HZ</b>	20 Hz - 2 kHz	Manual base pitch, used in FREE mode.
<b>GLIDE</b>	0 - 500 ms	Smoothing time for base pitch changes in every mode. At 0 the pitch snaps; at 60-120 ms, MIDI note changes become 303-style slides; longer values give slow, seasick drift between pitches.

### 4.1 Routing MIDI to Foldspace in a DAW

In Ableton Live: create a MIDI track (no instrument needed), set its **MIDI To** output to the audio track holding Foldspace, and select **Foldspace** in the sub-routing chooser that appears. Arm the MIDI track or set monitoring to In, then play or sequence notes. Other hosts have equivalent "MIDI to effect" routing.

***TIP:** MIDI mode with CARRIER at 1.0 turns Foldspace into a playable bass voice: a drum loop on the track "plays" a synth bass line that follows your MIDI clip. Add GLIDE for slides.*

## 5. MODULATOR (violet)

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The modulator section builds the signal that will drive the phase modulation, and optionally folds it.

Parameter	Range	Description
<b>Wave</b>	SINE / TRI / SAW / SQR	Waveform of the internal modulator oscillator. Sine gives classic smooth PM sidebands; triangle is slightly brighter; saw and square produce dense, buzzy sideband clusters even before any folding.
<b>RATIO</b>	0.25 - 8	The modulator oscillator's frequency as a ratio of the base pitch. Integer ratios (1, 2, 3, 4) give harmonic, musical sidebands; non-integer ratios (1.5, 0.75) give bell-like and metallic inharmonic spectra.
<b>FINE</b>	±100 cents	Fine detune of the modulator oscillator. Small offsets (3-10 cents) animate the sidebands with slow beating.
<b>OSC</b>	0 - 1.0	Level of the internal oscillator in the modulator bus.
<b>INPUT</b>	0 - 1.0	Level of the input signal itself in the modulator bus – self-phase-modulation. The input's own waveform and dynamics modulate the input (or the carrier), which produces growl that is intrinsically locked to the material.
<b>FOLD</b>	0 - 1.0	Insertion point one: folds the modulator bus. Folding a sine modulator progressively squares it off, multiplying the sideband count and aggression. Watch the result in the Modulator Scope.
<b>SYNC</b>	Toggle	Switches the modulator oscillator from pitch-relative to BPM-synced. The oscillator becomes a tempo-locked sub-audio LFO and the PM turns into rhythmic, phaser-like motion.
<b>DIV</b>	1/1 - 1/16T	The rhythmic division used when SYNC is active.

*The third modulator source – the feedback return – has its level set by AMOUNT in the FEEDBACK section (see section 8), so all three sources of the modulator bus are mixable: oscillator, input, and the plugin's own output.*

## 6. PM (blue)

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The phase modulation stage. The modulator bus drives one of two carriers – or a blend of both.

**SIGNAL carrier** (CARRIER at 0): the input audio itself is phase-modulated through a modulated delay line. This is true phase modulation of arbitrary audio – every partial of the input grows FM-style sidebands. It works on anything: drums, chords, vocals, full loops.

**OSC carrier** (CARRIER at 1): an internal sine oscillator at the base pitch is phase-modulated by the bus, and the input's envelope controls its loudness – the input plays the oscillator. This is the synthesis voice: clangorous FM tones that track your audio's pitch and dynamics, or follow MIDI.

Parameter	Range	Description
<b>INDEX</b>	0 - 1.0	Phase modulation depth. Low values add gentle harmonic motion; high values produce deep, snarling spectra. In SIGNAL mode this is the delay modulation depth; in OSC mode, the phase deviation (up to 4 pi at maximum).
<b>CARRIER</b>	0 - 1.0	Blend between the SIGNAL carrier (0) and the OSC carrier (1). Mid positions layer the modulated audio with the synthesized tone.
<b>ENV&gt;IDX</b>	-1 to +1	Envelope follower send to INDEX. Positive values increase modulation on hits – the effect bites with the playing. Negative values duck modulation on transients so it blooms on tails instead.
<b>STEREO</b>	0 - 180°	Phase offset of the right channel's modulator oscillator. Decorrelates the sidebands between channels for width. The widening is mono-compatible.
<b>ATK</b>	0.1 - 100 ms	Envelope follower attack time. Short values track transients tightly (squelch); longer values smooth the envelope into a slow swell.
<b>REL</b>	10 - 1000 ms	Envelope follower release time. The envelope drives ENV>IDX, ENV>FLD, the OSC carrier's loudness, and the transfer display's bright region.

## 7. FOLD (spice)

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Insertion point two – the main wavefolder, applied to the PM output.

Wavefolding reflects the signal back on itself each time it exceeds the fold boundary, instead of clipping it. Each reflection adds another band of harmonics, so the FOLDS control behaves like a harmonic density knob rather than a distortion amount.

Parameter	Range	Description
<b>FOLDS</b>	0 - 1.0	Fold drive, from unity (no folding) up to roughly 16x. At low values the signal grazes the first fold on peaks only; at high values the waveform is folded many times over. The transfer display's drive readout shows the current effective value.
<b>SHAPE</b>	0 - 1.0	Morphs the folder character from triangle folding (0 – hard, buzzy, West Coast) to sine folding (1 – rounder, smoother, vocal). The transfer display redraws as you morph.
<b>SYM</b>	-1 to +1	Symmetry bias applied before the folder. Off-center values fold one polarity earlier than the other, generating even harmonics – the difference between "hollow" and "full" fold tones. The output is DC-corrected automatically.
<b>ENV&gt;FLD</b>	-1 to +1	Envelope follower send to FOLDS. Positive values fold harder on hits – dynamic, touch-sensitive saturation. Negative values clean up the transients and fold the sustains.
<b>TONE</b>	500 Hz - 20 kHz	Gentle lowpass after the folder. Folding generates substantial high-frequency energy; TONE pulls it back without undoing the density. Fully clockwise is bypassed.

## 8. FEEDBACK (red)

Insertion point three – the wet output, folded, filtered, limited, and fed back into the modulator bus. The output modulates the phase of the thing that produces the output: at low levels this thickens and destabilizes the timbre; at high levels it crosses into bounded self-oscillation.



*Foldspace with the feedback loop engaged: a folded square modulator, deep folding, and the loop ringing through a dark FB TONE.*

Parameter	Range	Description
<b>AMOUNT</b>	0 - 1.0	Feedback level into the modulator bus. The knob response is shaped so most of the travel covers the musical region: subtle thickening low down, growl and ring past the middle, and self-oscillating drone behavior reserved for the top. An internal limiter keeps the loop bounded – it screams, but it never runs away.
<b>TONE</b>	200 Hz - 18 kHz	Damping lowpass inside the loop. Dark settings (under 1 kHz) give dub-style warm regeneration; bright settings let the loop ring metallicly.
<b>FOLD</b>	0 - 1.0	Folds the signal inside the feedback path. Each pass through the loop folds again, so even small amounts compound into rich chaotic spectra.
<b>DRIFT</b>	0 - 1.0	A slow random modulator that wobbles the feedback amount and the fold symmetry. At self-oscillating settings, DRIFT makes the drone wander and evolve on its own.

**TIP:** For "alive but controlled," try **AMOUNT** 0.5-0.65, **TONE** around 2 kHz, **FOLD** 0.3, **DRIFT** 0.3. The input perturbs the loop rather than disappearing into it. Then pull **DRY/WET** back to taste.

## 9. Global Controls

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The bottom bar carries the pitch system (section 4) and the global signal controls.

Parameter	Range	Description
<b>IN</b>	-24 to +24 dB	Input trim, before all processing. Because the envelope follower and both fold stages are level-dependent, IN doubles as a global intensity control – hotter in means more envelope, more folding.
<b>DRY/WET</b>	0 - 1.0	Blend between the latency-matched dry signal and the processed signal. Parallel settings (0.3-0.6) are where the "enhancement" presets live.
<b>OUT</b>	-24 to +24 dB	Output trim, after the blend.
<b>OS</b>	OFF / 2X / 4X	Oversampling for the whole processing chain. 2X (default) with the built-in antiderivative antialiasing is clean for nearly everything; 4X is for maximum-drive folding with bright material; OFF minimizes CPU and latency at some aliasing cost at high drive.
<b>BYPASS</b>	Toggle	True bypass of all processing.
<b>IN / OUT meters</b>	–	Peak meters at the input (post-trim) and output.

Foldspace reports its processing latency (the PM center tap plus the oversampler) to the host, so it stays time-aligned with other tracks under plugin delay compensation.

## 10. Factory Presets

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The factory set walks the plugin's range from invisible enhancement to self-oscillation. Presets are a starting point – IN, DRY/WET, and the ENV sends are the fastest ways to adapt one to your material.

Preset	Character
<b>Melange</b>	The subtlest: sub-octave sine PM with fully rounded folds at 45% wet. A low-end glow.
<b>Stillsuit</b>	Clean parallel thickener with stereo offset – harmonics and width, no obvious effect.
<b>Heighliner</b>	Warm PM bass enhancement with rounded folds and gentle envelope motion.
<b>Arrakis Sub</b>	OSC-carrier synth sub that tracks the input's pitch. Switch PITCH to MIDI to play it.
<b>Sandworm</b>	Self-PM growler: the input modulates itself, the envelope opens the folds, a dark feedback ring underneath.
<b>Navigator</b>	Folded-saw modulator at 2x ratio – metallic, clangorous, wide.
<b>Crysknife</b>	Square modulator teeth with hard symmetry; modulation ducks on hits and bites on tails.
<b>Spice Must Flow</b>	Envelope-pumping squelch – almost all of its motion comes from your playing dynamics.
<b>Water of Life</b>	BPM-synced rhythmic PM into ringing folded feedback. Tempo-locked squelch.
<b>Golden Advent</b>	The feedback patch: hovering at the edge of self-oscillation, drifting, alive. Named for the first ship to fold space.

## 11. Tips & Workflow

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**Start parallel.** Set DRY/WET around 0.4 and push FOLDS and INDEX harder than feels safe, then ride the blend. Folding under a dry signal reads as density and excitement long before it reads as distortion.

**The envelope sends are the life of the plugin.** A static INDEX and FOLDS setting is a tone; the same settings with ENV>IDX and ENV>FLD at 0.3-0.5 are an instrument. Match REL to the material's natural decay.

**Watch the scope while you build the modulator.** The Modulator Scope shows exactly what is driving the PM. A folded sine and a raw square look similar but behave differently under RATIO changes – the scope makes the difference visible.

**Integer ratios are notes, non-integer ratios are bells.** With RATIO at 1-4 the sidebands reinforce the input's harmonic series. Move to 1.5 or 0.75 and the same settings turn metallic and inharmonic. FINE at a few cents adds slow beating either way.

**Negative SYM for bass, positive for presence.** Symmetry's even harmonics sit an octave up from the fundamental. On bass, modest negative SYM tends to keep the low end solid while adding body; brighter material often takes positive SYM more gracefully.

**Self-PM is the honest growl.** INPUT as the modulator source means the modulation is the material – it cannot drift out of character. Sandworm is built on this; steal its skeleton for anything that should snarl in time with itself.

**SYNC turns PM into rhythm.** With SYNC on and a division of 1/8 or 1/16, the modulator becomes a tempo-locked LFO and the PM stage becomes a rhythmic animator – phaser-adjacent, but folding-capable. Water of Life demonstrates this against the feedback loop.

**Feedback staging.** Bring AMOUNT up until the timbre thickens, then add FOLD in the loop rather than more AMOUNT – fold-per-pass compounds, so a little goes further and stays more musical. Use TONE to decide whether the ring is dub-dark or metallic.

**TRACK mode likes monophonic sources.** The pitch tracker is built for bass lines, leads, and vocals. On polyphonic or noisy material it will hold its last confident pitch (the ~ indicator) – which is often fine, but FREE or MIDI mode gives positive control.

**Hit it harder.** IN trim is upstream of the envelope follower and both fold stages. The same preset at +6 dB in is a different, angrier preset. Compensate with OUT.

## 12. Quick Reference

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### Stage Parameters

Control	Section	Range	Default
Wave	Modulator	SINE/TRI/SAW/SQR	SINE
RATIO	Modulator	0.25 - 8	1
FINE	Modulator	±100 cents	0
OSC	Modulator	0 - 1.0	1.0
INPUT	Modulator	0 - 1.0	0
FOLD	Modulator	0 - 1.0	0
SYNC / DIV	Modulator	Off / 1/1 - 1/16T	Off / 1/4
INDEX	PM	0 - 1.0	0.3
CARRIER	PM	0 - 1.0	0
ENV>IDX	PM	-1 to +1	0
STEREO	PM	0 - 180°	0
ATK	PM	0.1 - 100 ms	5 ms
REL	PM	10 - 1000 ms	150 ms
FOLDS	Fold	0 - 1.0	0.25
SHAPE	Fold	0 - 1.0	0
SYM	Fold	-1 to +1	0
ENV>FLD	Fold	-1 to +1	0
TONE	Fold	500 Hz - 20 kHz	20 kHz
AMOUNT	Feedback	0 - 1.0	0
TONE	Feedback	200 Hz - 18 kHz	4 kHz
FOLD	Feedback	0 - 1.0	0
DRIFT	Feedback	0 - 1.0	0

### Global Controls

Control	Range	Default
PITCH	TRACK / MIDI / FREE	TRACK
FREE HZ	20 Hz - 2 kHz	110 Hz
GLIDE	0 - 500 ms	20 ms
IN	-24 to +24 dB	0 dB

Control	Range	Default
<b>DRY/WET</b>	0 - 1.0	1.0
<b>OUT</b>	-24 to +24 dB	0 dB
<b>OS</b>	OFF / 2X / 4X	2X

Foldspace is developed by XNULLX. Built with the JUCE framework. All wavefold stages use first-order antiderivative antialiasing combined with polyphase IIR oversampling; pitch tracking uses a YIN detector tuned for 30 Hz - 1 kHz.