



# PlaitsXplorer

## RC4

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A port of Emilie's Plaits DSP algorithms adapted for the Korg Prologue with Front Panel control of MultiEngine parameters.

## **PlaitsXplorer** – Plaits Explorer for Prologue.

This release of 'Plaits for Prologue' features Front Panel control of the MultiEngine User Oscillators. The knobs in the VCO control section have been repurposed to provide direct manipulation of Plaits Timbre, Morph, and Harmonics input values and PlaitsXplorer's dynamic modulation Intensity channels. Additionally, the VCO Octave switches now select among several useful matrix modulation configurations for Timbre and Morph inputs. Further controls implemented in the MultiEngine menus control the various Key Tracking and Built-in modulation types and their timing, while direct access to Prologues hardware EG Envelope, LFO, and EG Note Velocity vastly extend Oscillator modulation expressiveness.

These are the Plaits DSP models currently included with PlaitsXplorer:

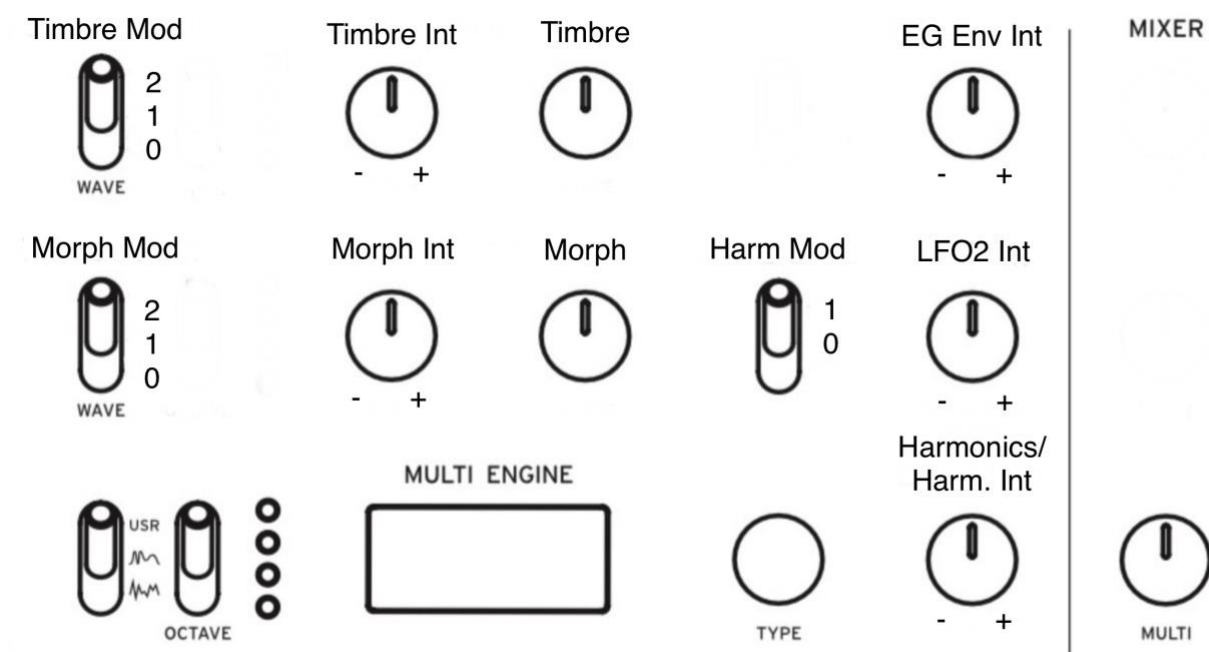
- VA; Virtual Analog with classic waveforms.
- VAsync; Hard Sync Virtual Analog, lots of squelch on this one.
- Tides; Wavefolder found in Tides.
- Warps; Wavefolder found in Warps.
- FM; 1 and 2 operator Frequency Modulation with variable feedback.
- Grain; Granular formant synthesis.
- Zbraids; filter simulation with Peaking/LP/BP/HP response.
- Additive; Additive mixture of harmonically related sine waves.
- SWARM; Granular swarm of 8 enveloped SAW Waves.
- Noise; Variable-clock white noise processed by a resonant filter.
- NoiseDBP; Variable-clock white noise processed by a resonant filter with dual bandpass filters.
- Bassdrum Analog/Synth; simulations of two types of bass drum.
- Snare Analog/Synth; simulation of two types of snare drum.
- Hi Hat Harsh/Clean; simulation of two types of hi hat.
- Plaits 2D Wavetables; 6 sets of 32 spectrally related Wavecycles arranged in a 4x8 entry Wavecycle table for modulating in two directions.
- VCFHP/LP; Virtual LP and HP filters with Classic waveforms from Plaits final 1.2 release.

## Overview of Features

PlaitsXplorer (PX hereafter) is designed as a platform for players. It features an identical control schema for all Plaits models, so memorizing multiple oscillator control schemas is unnecessary. PX is a comprehensive polyphonic synthesis workbench expressed as an extremely wide range of synthesis techniques all with a common, simple control schema. PX's front panel modulation controls allow performing keyboardists to easily explore a wide range of sonic spaces without digging into menus, looking up obscure settings, and all without managing the complexity of individual programming schemas for each type of synthesis method.

## Front Panel Description

PX reuses existing controls saved and restored with normal Prologue Preset functionality. Plaits Timbre, Morph, and Harmonics DSP model inputs, plus the PX Modulation Channel control schema, map onto VCO controls in a straightforward manner, grouping functions related to Timbre or Morph in the same physical rows. While Harmonics, takes the remaining two controls.



Pictured above, are the PX control assignments for the VCO section with unused controls removed for simplicity.

Timbre's modulation controls are in the top row knobs and switches; Morph's controls are the next row down; and Harmonics controls populate the remaining switch and the Shape/Shift-Shape knob. A large pointer knob is recommended for the Shape control to aid in both pitch accuracy, and performance ease of use for VA and VAsync models and other models. Timbre and Morph Matrix Modulation operations combine available modulators to serve as matrix operators for complex modulations.

Hardware LFO and Envelope modulators may serve as dynamic operators in certain modes across all three inputs. This allows a non key-synched Global LFO, and a fully variable Envelope may be applied to any channel. Built-in LFO and Envelope modulations are always synchronized with the beginning of the note. Main Modulation Intensity controls allow multiple instances of the same modulator to appear as different polarities per instance for opposing or concerted modulations.

N.B. For proper operation of PX, the remaining unused controls should be set to the following positions:

- VCO1 & 2 Octave switches to 16'. These affect Timbre and Morph Intensity range calibration.
- Pitch EG switch to VCO1+2. You may use ALL for digital pitch effects.
- VCO1&2 Mixer Level's to zero. Use layering to bring in VCO's. Or zero out front modulation controls and use builtins on Harmonics.

## Hardware Modulation Types

PX provides MultiEngine access to Logue hardware modulation sources not supported by Korg's SDK1.

Hardware LFO:

- PX recreates Logue's Bipolar hardware LFO internally. PX's LFO is independent of Logue's LFO Target and Intensity controls. PX's LFO follows Logue's LFO Key Sync Menu settings and Waveform Selection and Rate control. This allows you to use the hardware LFO for PX as well as Cutoff or Pitch at the same time. Use Shift to Invert the Logue LFO from the PX's independent LFO, or use Main Modulation channel to invert PX's LFO.
- PX also creates a Unipolar LFO version for use in Matrix Modulation(2). This allows a cleaner multiply modulation between LFO and builtins.

Key Tracking:

- PX uses note data normally supplied to the oscillator to provide emphasis and note dependent voicing and modulations. In Matrix Modulation mode 2, KT varies the modulation intensity curve across the keyboard for dynamic voicing. In all other Modes KT provides a static modulation.

EG note Velocity:

- EG Velocity is adjustable in Menu Location [Modulation Menu 6:EG Velocity], this will vary Timbre's EG Envelope, and Morph LFO2 modulations with note velocity for exceptional dynamic expression.

Filter EG Envelope:

- Provides direct access to the EG Envelope with an independent bipolar Intensity control. This allows the models Timbre input to track filter envelope response. Pitch EG Intensity controls Envelope amplitude and polarity. The EG Envelope along with Note Velocity appears in Timbre Velocity Channel, as well as the MultiMod selector without Velocity, for use in Morph and Harmonics modulation channels.

## Built-in Modulation Types

In addition to enhanced platform modulations, PX also provides two built-in dynamic modulators; an LFO with normal and velocity sensitive vibrato modes, plus MultiMod; a multifunction waveform generator, capable of multiple envelopes or LFO modulations.

LFO2 features:

- Variable rate Triangle wave.
- Tremolo: positive values produce a triangle wave with frequency proportional to the value of LFO2rate.
- Vibrato: negative values produce a triangle wave with a frequency proportional to the absolute value of LFO2 rate, with rate further modulated by EG Velocity.

MultiMod Envelopes:

- AD: Attack, Decay envelope.
- ASR: Attack, Sustain, Release type envelope.
- ADSR 40%: an ADSR with 40% Sustain level. Release is a fixed multiple of Decay.
- ADSR 70%: an ADSR with 70% Sustain level. Release is a fixed multiple of Decay.
- Linear Ramp: linearly increasing Ramp. (set Decay +100, Attack to taste).

MultiMod Envelope features:

- Logarithmic or Linear Envelope Attack (model dependent).
- Linear Decay and Release slopes.
- Log Attack features 'advance to Decay on Note Off' modeling analog synth envelopes for more dynamic behavior.

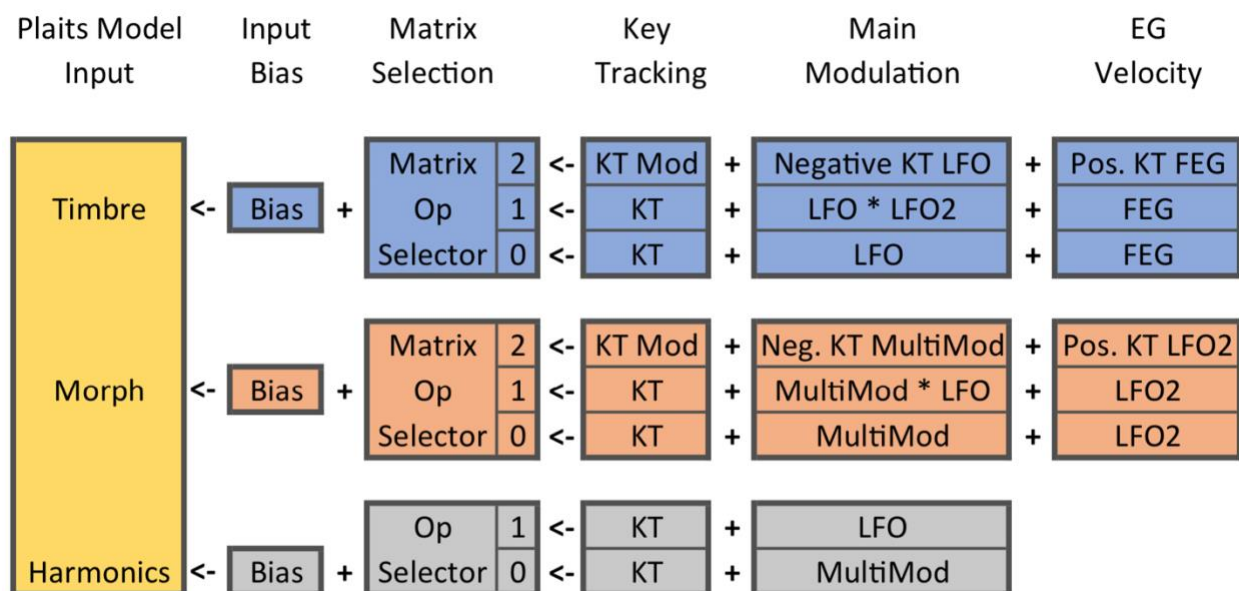
MultiMod LFO3 features:

- Four types of variable rate Triangle or Saw wave LFO.
- Tremolo: positive values produce a Triangle or Saw waveform with frequency proportional to the value of MultiMod programming
- Vibrato: negative values produce a Triangle waveform with a frequency proportional to the absolute value of MultiMod, with rate further modulated by Key Tracking, or frequency modulated by LFO.

## Modulation System

PX provides three Modulation Channels for each Plaits model input: Timbre, Morph, and Harmonics; plus a Velocity sensitive channel for Timbre and Morph. Modulation Channels provide each input: a static Bias Value used as a baseline value for following dynamic modulations; a Key Tracking channel to provide a note dependent offset for emphasis and deemphasis of each input; a Main Modulation channel to apply time variant dynamic modulations; and for Timbre and Morph, an EG Velocity sensitive modulation channel for expressive performance. Finally, these four channels, summed together, are then presented to the Oscillators Model input.

- **Bias:** These controls are found on the Frontal Panel VCO and Shape section.
- **Key Tracking:** this Bipolar Intensity found in the six entry MultiEngine menus [MultiEngine Menu, Param2-4), governs an instance of Key Tracking for each channel. Negative values accentuate lower pitches, while positive values boost the high end.
- **Main Modulation:** these Bipolar Intensities found on the Front Panel VCO Pitch controls, governs the main dynamic modulations; LFO, MultiMod, and Matrix operations for all three inputs.
- **Velocity Modulation:** these Intensities found on the Front Panels EG Pitch Intensity and Crossmod controls, governs Timbre's EG Envelope, and Morph's LFO2 intensities, both provided with EG Note Velocity.



## Matrix Operations

VCO Octave and Sync switches are repurposed to manage Matrix Modulation Selection settings for Timbre, Morph, and Harmonics inputs.

- Timbre Matrix Modulation Select [VCO1 Waveform] has three settings:
  - (2) Key Track Multiplication; with this Matrix operation, Key Tracking controls the slope of modulation intensity for Bipolar LFO and Timbre's Velocity EG Envelope modulators across the keyboard. Adjusting Timbres Key Tracking channel behaves as described below:
    - Negative values increase Timbres Main Modulation in the low end, and its Velocity EG Envelope Modulation in the high end of the keyboard.
    - Positive values reverse this by increasing Timbres Velocity Modulation in the low end, and its Main Modulation in the high end of the keyboard.
    - A value of Zero will result in no modulation at either end.
  - (1) LFO Multiplication; multiplying Unipolar LFO and LFO2 operators will modulate the intensity of LFO2 by LFO.
  - (0) Normal; no Matrix operation. Only Bipolar LFO modulation
- Morph Matrix Modulation Select [VCO2 Waveform] has three settings:
  - (2) Key Track Multiplication; with this Matrix operation, is Key Tracking controls slope of the modulation intensity of MultiMod and Morphs EG Velocity LFO2 modulators across the keyboard. Adjusting Morphs Key Tracking channel behaves as described below:
    - Negative values increase Morphs Main Modulation in the low end, and LFO2 Velocity Modulations in the high end of the keyboard.
    - Positive values reverse this by increasing Morphs LFO2 Velocity Modulation in the low end, and Main Modulation in the high end of the keyboard.
    - A value of Zero will result in no modulation at either end.
  - (1) LFO Multiplication; multiplying Unipolar LFO and MultiMod operators will modulate the intensity of MultiMod by LFO.
  - (0) Normal; no Matrix operation. Only Multimod modulation.
- Harmonics Modulation Select [Sync/Ring] has two settings:
  - (1) LFO modulator.
  - (0) MultiMod modulator.



## MultiEngine Menu Params 1-6

PX parameters for the Builtin modulators LFO2, Key Tracking and MultiMod programming are in the MultiEngine Menu. For convenience, on Prologue PX model input name for Timbre, Morph and Harmonics will appear instead of “Key Tracking” in the Menu Text box.

Param1	Param2	Param3	Param4	Param5	Param6
LFO2 Mode	Timbre Key Tracking	Morph Key Tracking	Harmonics Key Tracking	Attack mode LFO3 Mode	Decay Mode LFO3 Mode

### Param 1

LFO2: Positive values for Normal Triangle Wave rate. Negative values produce an increase of LFO rate with EG Velocity. LFO2 appears in Timbre Matrix Op (1) multiplied by the hardware LFO, and as the Velocity sensitive channel for Morph.

### Param 2

Timbre Key Tracking: Negative values accentuate Timbre on the low end of keyboard, while positive values increase Timbre on the higher end. When Timbre Matrix Op (2) is active, Timbre Key Tracking sets the amount and type of modulation that slopes positively and negatively across the keyboard instead of setting a note dependent offset.

### Param 3

Morph Key Tracking: Negative values accentuate Morph on the low end of keyboard, while positive values increase Morph on the higher end. When Morph Matrix Op (2) is active, Morph Key Tracking sets the amount and type of modulation that slopes positively and negatively across the keyboard instead of setting a note dependent offset.

### Param 4

Harmonics Key Tracking: Negative values accentuate Harmonics on the low end of keyboard, while positive values increase Harmonics on the higher end.

### Param5 and Param6

MultiMod Programming: Morph and Harmonics channels feature a choice of nine waveforms programmed by Param 5 & 6 as described in the next section.

## Multimod programming

PX provides a multifunction built in modulator featuring various single shot and periodic modulators. MultiEngine Parameters 5 and 6 value are combined to select one of nine modulation types:

Param5 Attack/TRI	Param6 Decay/Saw	MultiMod Output Waveform
[Positive]	[Positive]	Attack/Decay Envelope
[Positive]	[Negative]	Attack/Sustain/Release Envelope
[Positive]	[Zero]	LFO3 Triangle Tremolo
[Negative]	[Zero]	LFO3 Triangle KT Vibrato
[Zero]	[Zero]	EG Envelope, no Velocity
[Zero]	[Positive]	LFO3 Saw Tremolo
[Zero]	[Negative]	LFO3 Triangle LFO Vibrato
[Negative]	[Positive]	ADSR with 40% Sustain Level
[Negative]	[Negative]	ADSR with 70% Sustain Level

### MultiMod Envelopes

- Two Params are used to define the timing for Envelopes rise and fall times. Positive values for Param 5 yields simple A/D and A/S/R type envelopes. Negative values for Param 5 yields ADSR type envelopes with two Sustain levels. Timing range is a 2-piece linear approximation of a logarithmic range, with a knee at 60%. Values between |1-59| are in the fast range, while values in the |60-100| range are 5x slower.

### MultiMod LFO3

- A single Param defines this LFO rate. Setting a Zero value for Param 6, then setting Param 5 to a positive value will produce a Triangle LFO with Tremolo rate proportional to the value of Param 5. While a negative value for Param 5 produces a Key Tracked note dependent Vibrato. Higher notes produce faster Vibrato.
- Setting a Zero value for Param 5, then setting Param 6 to a positive value will produce a Ramp LFO with Tremolo rate proportional to the value of Param 6. A negative value for Param 6 produces an LFO FM modulated Triangle.

### EG Envelope

- The EG Envelope, provided without Velocity, is selected by setting both Param 5 & 6 to a Zero value.

## Mod Wheel, Expression Pedal, After Touch, and MIDI CC Targets

Since PX reuses existing controls, Prologues performance settings programmed with existing controller channels; Mod Wheel, Expression Pedal, and After Touch are all also available to provide more ‘hands and feet on’ PX modulation controls for even more playability. You may assign any of these controllers, or use MIDI CC’s to modulate the following PX controls:

- [VCO 1 Pitch/Bipolar] Timbre Main Modulation Intensity.  
Since this is a Bipolar control there are two ways to use it with an expression pedal. First is to set Main Modulation Intensity control to 50% (zero modulation) and only use the positive half of the Intensity range with ½ the pedal throw. Or the more challenging way, is to set the Main Modulation Intensity to full CCW, and rock the pedal about the 50% position. Similarly, with Mod Wheel, the rest position is at the 50% mark, assuming a 100+ Mod Wheel Range. After Touch is the same as Expression pedal range matching.
- [VCO 1 Shape/Unipolar] Timbre Bias.  
This is Unipolar control matches Expression Controllers best. Also, Plaits DSP model maps full range linear spectral/frequency response functions, if there is one, to the Timbre Control. This makes it ideal for ‘WhaWha’ types of expression with Expression pedal or After Touch.
- [Pitch Int/Bipolar] Timbre Velocity Modulation Intensity  
The Bipolar control governs the models Timbre Velocity Sensitive EG Envelope response. This modulation channel has numeral matrix operations already, which presents a challenge for further modulation. Reducing EG Velocity will help bring out the Expression Controller Performance.
- [VCO 2 Pitch/Bipolar] Morph Main Modulation Intensity  
Similar Expression Controller use cases apply here as Timbre Main Modulation Intensity. However, the nature of the morph channel is much different from Timbre’s linear response. Morph often controls multiple waveform selection and other transformative changes along its range. Here, you can perform PW modulation, waveform transition mixing, or other morphological changes.
- [VCO2 Shape/Unipolar] Morph Bias  
The Unipolar control also matches Expression controller range best in the Morph Control channel.

### **(Mod Wheel, Expression Pedal, etc... cont)**

- [Crossmod/Bipolar] Morph Velocity Modulation Intensity  
This Bipolar control governs the models Morph Velocity Sensitive LFO2 response. Use case is similar to Timbre Velocity Sensitive channel. However smaller ranges are best here, as well as reduced EG Sensitivity helps.
- [Shape/Unipolar] Harmonics Bias  
This Unipolar control governs a sometimes Unipolar, and sometimes Bipolar Harmonics response, depending on Plaits DSP model. Bipolar types of models are VA's Pitch, Drum Tonality Mix's are 50/50 Bipolar. While FM Freq Ratio, Modal and String Inharmonicity, are Bipolar with model dependent midway point. Other models, such as Particle, SWARM, Noise and the 'Green' Spectral models are mostly Unipolar, with one or two exceptions along the way. As such, each model would adopt a different Expression controller strategy – left to the reader.

## Notes:

1. Modulator values all range between 0 and 1, except LFO which is +/-0.5. Intensity controls will multiply Modulators by -1 to +1. Model Inputs expect values between 0 and 1 and are clipped to that range. When Modulators are multiplied, the result is always in the 0 to 1 range. When Modulation channels are summed, they can quickly add up, so when adjusting modulation channels you can swamp the input by summing all Modulators. Small variations are often the best coupled with key tracking.
2. When initializing a new oscillator, zero out at once the MultiEngine Params before they default to -100. This is a logue bug introduced with bipolar params.
3. You MUST be running firmware 2.10.
4. All Intensity controls are bipolar. To begin a new patch, I null them out with controls at 12 O'clock, and Bias controls at 50%, and Params at zero. Save it, then start the patch.

Caveats: some models are on hold, Particle developed a crash related to front panel DSP, String and Modal are too memory constrained for this system, as are Wavetables which needs more memory reclamation. Braids Wavetables take some compile time switchroo's so I'll leave that for last. RC4 will bring wavetables up to snuff and resolve the Modal and String models.

## Honorable Mentions

A big THANK YOU! Goes out to Emilie, Peter, and Mark for gifting their work as open source; Plaits, First Logue port, and Front Panel code respectively.