

# Poison

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fidelity at work.

# Introduction

**Poison** combines the best of the analog and digital worlds in a single synthesizer. The core concept is to temper the rather cold, cutting quality of FM-synthesis by using analog-style filters to provide additional warmth. Through the use of a multimode oscillator and an LFO as FM operators, Poison can produce extremely vibrant and lively sonic spectra. You will be amazed!

## Poison's Frequency Modulation Implementation (FM)

In FM synthesis, one signal is used to alter the frequency of another. Altering a signal this way is called modulation, and the signal that produces the modulation is called the 'modulator'. The signal whose frequency is being modulated is called the 'carrier'.

If the frequency of the modulator falls within the audible range, the effect of the modulation is a distinct change in the carrier's tone quality (spectrum).

An FM circuit requires at least two signal generators. In FM parlance, these signal generators are known as 'operators'. With Poison, the carrier and the multimode oscillator furnish the first two operators, with a modified LFO as a third. Other modulation sources can be used in addition to the multimode oscillator.

The spectrum of the carrier depends on the amplitude of the modulator, its selected wave shape, and the relationship of its frequency to that of the carrier. Because Poison allows you to select complex modulator waveforms such as sawtooth and square, in addition to the standard sine, a wide range of spectra can be produced with just a few operators.

# The Interface

If you've read and understood the previous section, you already have a general idea of what FM synthesis is all about. In the sections that follow, experiment with some of the parameters described. Soon you'll discover that FM programming isn't so mysterious after all. And with the added availability of Poison's analog-style filter, effective FM synthesis has never been so easy!



## The Carrier Section

The carrier plays the central role in Poison synthesis. It produces the sound spectrum as modulated by the multimode oscillator and LFO1. The carrier also determines the amplitude, or volume, of the signal. In Poison, the carrier can also use an external signal as a frequency modulation source.

### Mix

**Ext In:** Controls the depth of a connected external modulation source. You must connect an audio signal to Poison's **In** pad in the Project window to supply the modulation signal.

**FB:** The signal is fed from the output back to the input, and the feedback control (**FB**) adjusts the portion of the signal

returned. To enrich the sound by the addition of a few additional harmonics, move the control upward only slightly. As you move it toward or past the central position the result becomes distinctly electronic sounding.

**Note:** Using feedback with aperiodic (non-tonal) external modulation sources can result in chaotic effects or excessive noise. For this reason, use **FB** with **Ext In** with caution.

**6dB VCF:** This lowpass filter lies in front of the modulation inputs for the oscillator and LFOs. As the oscillator and LFOs offer complex modulation waveforms such as sawtooth and square, which produce particularly rich FM spectra, you will often use the lowpass filter to reduce the harmonic content of these waveforms somewhat. This provides important additional spectral control. To adjust the cutoff, click with the left mouse button within the blue graphic and move the mouse left or right to lower or raise the frequency respectively.



**Keyfollow:** Controls modulation depth according to keyboard position. MIDI note number 64 (E3) is the fixed crossover point for **Keyfollow** modulation (i.e. no keyfollow modulation is produced at E3). When keyfollow is set to 100%, the relationship of the cutoff frequency to the current note is the same over the entire keyboard range. At a setting of 50% the relative frequency displacement is lowered by 50% per octave for notes above E3, and raised by 50% per octave for notes below E3. This prevents high notes from becoming too shrill, and helps keep lower notes bright sounding.

Keyfollow is particularly useful for limiting the strength of the frequency modulation on high notes. For this purpose use a value of around 70%.

## Carrier



**Coarse/Fine:** The **coarse** and **fine** tuning controls are used to adjust the pitch and the sound spectrum (through frequency modulation) of the carrier. **Coarse** adjustments alter the basic frequency in integer steps, creating simple spectra with recognizable pitch. **Fine** adjustments create more complex spectra with inharmonic components producing effects reminiscent of bells or ring modulation. In order to make **Coarse/Fine** adjustments, the blue indicator LED between the two rotary controls must be lit, and **Fixed** must be set to 0.

**Fixed:** Sets the pitch of the carrier to a fixed frequency. You can create particularly impressive sounds this way.

**When using a Fixed frequency, the Coarse/Fine controls are disabled. This is indicated when the LED next to Fixed is lit.**

**Phase:** This adjusts the start offset of the phase of the carrier. The effect on the sound is usually quite small, and only when **Retrigger** is enabled.

**Ret:** Turns **Retrigger** on or off. When retrigger is on, each new note restarts the carrier cycle from the start phase offset as adjusted above. When it is off, the carrier runs continuously.

**Modulators Osc und LFO1:** These two faders are of particular importance as they regulate the depth of the frequency modulation by the oscillator and LFO1. Altering the modulation depth affects the resulting timbre considerably.

To hear this, select preset **00 Reset All**, play a note, and then adjust one of the faders. Hear the difference this makes in the sound? This is FM!

**ADSR:** The carrier's amplitude envelope. This controls the volume characteristics of the instrument.



**A:** Attack time. This adjusts the initial attack of the sound (sharp to gradual).

**D:** Decay time. Sets the amount of time after the attack phase it takes the volume to fall to the sustain level, and for the envelope to enter the sustain phase.

**S:** The sustain segment follows the Attack and Decay phases, and holds the volume level constant as long as the key is pressed. The value here sets the general volume level (if a sustain segment is applicable to the instrument).

**R:** Indicates the duration of the **Release** phase - the segment of the envelope that begins when the key is released, and during which the volume falls to zero.

Move the faders upwards to increase the times or the sustain level.

The maximum time allowable for each of the A, D and R settings is 45 seconds.

**Out Vel:** Controls the degree to which the volume level responds to your keyboard dynamics (velocity sensitivity). Since the adjustment you make here is in the carrier section, the overall volume response of the sound is affected.

**Times - Vel and Key:** These controls determine the type and amount of effect note velocity and keyboard position have over envelope times. If the red knobs are adjusted to the lower range, times become shorter as velocity or note values increase (i.e. sharply struck notes or higher notes shorten envelope times). When adjusted to the upper range, the opposite applies - increasing values increase the times.



## The Oscillator Section

Even though at first glance Poison's oscillator section resembles the carrier section, its function is quite different. The oscillator is a modulator, and as such determines the sound spectrum of the carrier. The carrier's sound depends on the wave shape, frequency, and envelope settings of the oscillator. To hear the effect of the oscillator on the tone, gradually increase the **Modulators/Osc** value in the carrier section. The output of the oscillator can optionally be sent through a filter before performing its role as a modulator. More about this later in this section, and in the description of the **Mix** settings in the Filter section.



**Waveform:** The Oscillator can produce one of five different waveforms: sine, triangle, sawtooth down, sawtooth up, and square. Move the red knob in the waveform selector (to the right of the 'Osc' label) to select the desired waveform. The character of the modulation changes depending on which waveform is selected. In general the following rule applies: waveforms with rich harmonic content (i.e. sawtooth or square) produce timbres also rich in harmonic content.

Remember that you can reduce the harmonic content of the oscillator with the 6db LPF which lies between the modulators and the carrier in the signal path.

**Coarse/Fine:** These controls establish the pitch relationship of the oscillator to the carrier, and therefore the spectrum

that results from the modulation. Adjusting the Coarse setting changes the frequency relationship in integer steps, resulting in relatively simple spectra with easily recognizable pitch. Changes to the **Fine** setting (non-zero values) produce more complex spectra with less recognizable pitch, reminding one of bells or ring modulation effects. For these controls to have an effect, **Fixed** must be set to 0, and the blue LED between the Coarse and Fine controls must be lit. If you add the Oscillator into the mix (**Mix/Osc**) in the filter section, the pitch adjustments will also be heard there.

**Fixed:** Sets the pitch of the oscillator to a fixed frequency. This setting can produce particularly interesting spectral effects. When **Fixed** is non-zero, the **Coarse/Fine** controls are disabled (as indicated by the respective blue LEDs). If you add the Oscillator into the mix (**Mix/Osc**) in the filter section, fixed pitch adjustments will also be heard there.

**PWM:** When the square wave is selected you can use the **PWM** control to adjust the pulse width of the waveform. LFO2 can also be used to regulate Pulse Width Modulation dynamically.

**LFO2:** Switches LFO2 on or off so it can be used to control the depth of **PWM**.

**LFO1 P/A:** These sliding controls adjust the pitch (P) and/or amplitude (A) modulation. As the oscillator is itself a modulator, amplitude modulation affects the tone color only. You will not hear amplitude modulation via **Mix Osc** in the filter section, although you will hear the effect of pitch modulation there.

**Ret:** Sets Retrigger on or off. Retrigger determines whether the oscillator will play continuously, or will start a new cycle with each new note played.

**ADSR:** This envelope controls the level of the modulator and therefore the spectral evolution of the output signal.



Unlike with the carrier, this envelope does not change the overall volume; rather, it controls the progression of the changes in tone quality throughout the duration of the note in play. Experiment a bit with these settings to learn how they affect the resulting sound (make sure the **Modulators/Osc** control in the carrier section is not set to zero). It should be noted that changes made in the envelope settings do not affect the signal at **Mix/Osc** in the filter section. The signal here is the original oscillator output without envelope modulation. As you begin programming sounds you will understand the advantage of this arrangement.

**A:** Attack time. This sets the initial attack duration of the modulation signal (sharp to gradual).

**D:** Decay time. Sets the amount of time after the attack phase it takes the signal to fall to the sustain level and for the envelope to enter the sustain phase.

**S:** The sustain phase follows the Attack and Decay phases, and holds the level constant as long as the key is pressed. This value, then, indicates the sustained modulation depth and the steady state of the spectrum.

**R:** Indicates the duration of the **Release** phase, the segment of the envelope that begins when the key is released, and during which the level falls to zero.

Move the faders upwards to increase the times or the sustain level.

The maximum time available for each of the A, D and R settings is 45 seconds.

**Out Vel:** Sets the velocity sensitivity, or how much the sound responds to keyboard dynamics. Remember that this applies to the modulator, and so will affect the spectral response to keyboard velocity, and not the overall volume.

**Times - Vel and Key:** These controls determine the type and amount of effect note velocity and keyboard position have over envelope times. If the red knobs are adjusted to the lower range, envelope times become shorter as velocity or note values increase (i.e. sharply struck notes or higher notes shorten the times). When adjusted to the upper range, the opposite applies - increasing values increase the times.



## LFO1

LFO1 can serve either as a classic LFO or as an additional modulator for the carrier. It is as a modulator that the LFO1 is perhaps most useful. Its function as a frequency modulator is possible because LFO1 can produce higher modulation frequencies than are normally available in a typical low-frequency oscillator. While Poison's oscillator can produce an evolving spectrum using its envelope generator, LFO1 is more suitable for static spectral adjustments. Nevertheless, LFO1 does have what could be considered a basic envelope generator in the form of its **Delay**, **Fade In** and **Fade Out** parameters.

**Waveform:** LFO1 can produce six different waveforms: sine, square, sawtooth up, sawtooth down, triangle, and Sample&Hold. Drag the red knob in the waveform selector (upper-right corner of the LFO1 area) to engage the desired waveform.



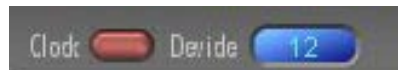
**Using LFO1 as an FM Modulator** (**Modulators/LFO1** in the Carrier section must be adjusted to a value greater than 0): Here, as with the oscillator, the choice of waveform used for frequency modulation affects the resulting tone quality. Generally speaking, waveforms with rich harmonic content (such as sawtooth and square) produce timbres also rich in harmonic content.

**Remember that the 6db LPF lies upstream from the modulation sources and can be used to smooth the waveform, reducing the harmonic content. This is of no concern, however, when using LFO1 as a classic LFO.**

**Coarse/Fine:** These controls establish the pitch relationship of LFO1 to the carrier, and therefore the spectrum that results from its use as a frequency modulator. Adjusting the **Coarse** setting changes the frequency relationship in integer steps, producing relatively simple timbres with easily recognizable pitch. Changes to the **Fine** setting produce more complex spectra with less recognizable pitch, reminding one of bells or ring modulation effects. For these controls to have an effect, **Fixed** must be disabled (adjusted to 0) and the blue LED between the Coarse and Fine controls must be lit.

**Fixed:** Establishes a fixed modulation frequency. When using LFO1 as a classic LFO (to modulate the filter for a filter-sweep effect, for example) use low values. With low values, the LFO behaves as you would expect an LFO to behave. Higher values produce FM spectral effects. When **Fixed** is non-zero the Coarse/Fine settings are automatically disabled as indicated by the blue LEDs.

### Clock : Enabling Clock



synchronizes the LFO frequency to an external or internal MIDI clock.

**Divide:** The following example illustrates the use of the **Divide** setting: A MIDI Clock signal consists of 24 clock 'pulses' per beat. Therefore, in order to generate a clock frequency corresponding to a quarter-note, enter a value of 24 ( $24/24 = 1$  beat). For an eighth-note, divide by 12 ( $12/24 = 0.5$ , or half a beat). You can use any integer value, even those that produce asymmetric results (such as 7 or 13). A value of 8 generates a frequency corresponding to an eighth-note triplet.

**Phase:** Sets the start phase offset of the selected LFO1 waveform. **Ret** (Retrigger) must be enabled for this to have an effect.



**Ret:** Sets Retrigger mode on or off. When switched on, the modulation waveform starts at the phase offset set above each time a new note is played. When off, the LFO runs continuously.

**Delay:** Sets a delay time for LFO1 modulation. This lets you set the modulation effect to kick in at some point after the note is played.

The maximum delay is 20 seconds.

**Fade In:** can be compared to the attack segment of an envelope. The longer the Fade In time, the longer it takes to reach full modulation. For the modulation to kick in immediately, set the value to minimum (leftmost position).

The maximum Fade In time is 20 seconds.

**Fade Out:** You can compare **Fade Out** to the release segment of an envelope. The longer the **Fade Out** time, the longer it takes the modulation to fall to zero after the key is released. Set the control to the furthest left position to switch **Fade Out** off.

The maximum Fade Out time is 20 seconds.

## The Filter Section

The brilliant and sometimes cold tones of FM synthesis are well suited to further treatment by a filter. A filter can lend warmth to a sound, or can be used to add the characteristic 'bight' to the attack of a synth-bass. The filter has its own envelope generator, and can also be modulated by Poison's two LFOs. It can be set to function as a lowpass, bandpass, or highpass filter with a slope adjustable to 12dB/octave. The resonance is also adjustable. Three signals, Noise, Multimode Oscillator, and Carrier, are passed through the filter stage. The **Mix** section controls the relative levels of these signals. As you can see, the filter section opens up a wide variety of additional synthesis possibilities!



### Mix

**N:** N (Noise) produces an audio noise (white noise) signal. The controller governs the level of the noise in the mix.

**OSC:** The input for the Multimode Oscillator's signal. The controller sets the level of this signal in the mix. Note that the effects of the oscillator's envelope or of **LFO1** on the amplitude of the signal are not heard here, as they are used only for the purpose of modulating the carrier.

**Carrier:** This controller determines the level of the carrier signal in the mix. Note that unlike the oscillator, the effects of the carrier's envelope are heard in this signal, as the carrier's envelope controls the overall volume of the sound.

## VCF

**activated:** This switch turns the entire filter section on or off. If the button is lit, the filter section is engaged (with the implied additional DSP usage). When it is gray, the filter is not in use, and DSP resources are freed.

**It takes a little longer to load a Preset that changes the activation state of the filter section than to load one that maintains the same state ('on' or 'off'). Also, note that when the filter section is switched off, the polyphony increases (greater number of voices possible).**

**Cutoff:** The cut-off frequency is the frequency at which the filter begins to do its work. In a lowpass filter, all frequency components above the cutoff frequency are attenuated. Precisely the opposite is the case with a highpass filter (frequencies below the cutoff frequency are reduced).



A bandpass filter allows frequencies surrounding the cutoff frequency to pass through, but attenuates frequencies lying further away. It's probably easiest to illustrate the effect of the cutoff frequency using a hands-on approach. Select a preset and make adjustments to the cut-off value to hear how it affects the sound. (Make sure the preset is one in which the filter is activated - i.e., the 'activated' button is lit. Otherwise the filter is off.)

**As an alternative to using the knob, you can click within the graphic area with the left mouse button and move the mouse to the left or right to adjust the cutoff frequency.**

**Res:** As you increase this value, the levels of frequencies near the cutoff frequency are increased by resonance. A small amount of resonance brightens the sound. More resonance makes it distinctly strident and electronic sounding, while full resonance results in a sine tone at the cutoff frequency. Again, it is easiest to understand the effect of this setting by experimenting with it using an appropriate preset.

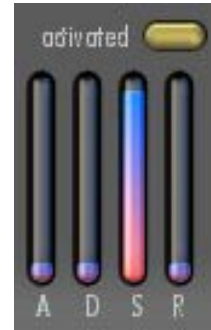
**As an alternative to using the knob, you can click within the graphic area with the right mouse button and move the mouse up or down to adjust the resonance.**

**LPF/BPF/HPF:** This three-state switch selects the desired filter characteristic: Lowpass, Bandpass, or Highpass.

**Pos/Neg:** Switches the 'direction' of the envelope's influence between positive and negative. When positive, the effect of the modulation is as you would expect. When negative, the modulation effect is inverted. That is, the attack segment starts at the maximum level, rather than the minimum; the decay segment rises to the maximum level rather than falling to zero, etc.

**Keyf:** Controls modulation depth according to keyboard position. MIDI note number 64 (E3) is the fixed crossover point for **Keyfollow** modulation (i.e. no keyfollow modulation is produced at E3). When keyfollow is set to 100%, the relationship of the cutoff frequency to the played note is the same over the entire keyboard range. At a setting of 50% the relative frequency displacement is lowered by 50% per octave for notes above E3, and raised by 50% per octave for notes below E3.

**ADSR:** This envelope modulates the cutoff frequency of the filter and so has an effect on the tone of the overall sound. Experiment a little with the envelope and filter settings to familiarize yourself with the effects.



Make sure the Env control in the filter section is set to a non-zero value in order for the envelope to have an effect.

**A:** Attack time. This sets the initial attack time of the modulation signal (sharp to gradual). This affects how quickly the tone initially changes with the onset of a new note.

**D:** Decay time. Sets the amount of time after the attack segment it takes the modulation depth to fall to the sustain level and enter the sustain phase. Naturally, this modulation change affects the tone, too.

**S:** The sustain segment follows the attack and decay segments, and holds the level constant as long as the key is pressed. This value, then, indicates the sustained modulation depth, and therefore the steady state of the tone.

**R:** Indicates the duration of the **Release** phase - the segment of the envelope that begins when the key is released, and during which the modulation level falls to zero (and the cutoff frequency falls to its initial level). The modulation is reflected in the tone quality here, as well.

Move the faders upwards to increase the times or the sustain level.

The maximum time allowable for each of the A, D and R settings is 45 seconds.

**LFO1:** Controls the degree to which LFO1 influences the cutoff frequency. With the filter set to full resonance, and with LFO1 adjusted to higher frequencies, you can produce an additional sort of frequency modulation effect.



**LFO2:** The modulation depth of LFO2. Since LFO2 can produce lower frequencies than LFO1, it is useful for slower, more relaxed LFO modulation.

**Env:** Controls the overall modulation depth of the envelope and therefore its effect on the cutoff frequency.

**Important!** The ADSR envelope will be in effect only if this control is set to a non-zero value. When set to zero, the envelope settings will have no influence over the filter.

**Out Vel:** Adjusts the degree to which the sound responds to your keyboard playing through velocity sensitivity. Remember that since you are in the filter section, the effect will be heard in the tone color rather than the overall volume.

**Times - Vel and Key:** These controls determine the type and degree of effect note velocity and keyboard position have over envelope times. If the red knobs are adjusted to the lower range, envelope times become shorter as velocity or note values increase (i.e. sharply struck notes or higher notes shorten the times). When adjusted to the upper range, the opposite applies - increasing values increase the times.



# The Options Page

The Options Page provides a convenient location for several diverse functions that are not always required. Here you'll find the **Global** settings, **LFO2**, and the **Pan** and **Chorus** features.



## Global:



**BPM:** Poison's LFOs can be synchronized to an internal or external MIDI clock. The BPM setting allows you to set the internal clock rate using a tempo specification (beats per minute) which is more useful for musical purposes than having to set a frequency value. **BPM** will also display the tempo of an incoming external MIDI clock.

**Internal/External Clock:** Switches between internal and external clock modes. When the button is lit, the internal clock is active.

**Semi:** Adjusts the overall tuning in half-step increments. The range is +/- 64 semitones.

**Cents:** Fine tunes the instrument within a range of +/- 100 cents (hundredths of a semitone).

**Portamento:** This selector sets the Portamento/Glide characteristics. The options are: Off, portamento, glissando, fingered portamento, and fingered glissando.

**Time:** Controls the speed of the selected Portamento/Glide effect.

**PWR:** Sets the Pitch Wheel Range. A setting of 2 indicates a modulation range of +/- 2 semitones. The maximum allowable value is 24 semitones.

## LFO2

**Freq:** Sets the modulation frequency of **LFO2** when it is not controlled by MIDI clock. Adjust the value in Hertz (cycles per second). Note that, unlike **LFO1**, this LFO produces a synchronous modulation of all notes in play regardless of when they were struck relative to one another.

**Clock:** If clock is enabled, the frequency of the LFO is controlled by the internal or external MIDI Clock signal.

**Divide:** The following example illustrates the use of the **Divide** setting: A MIDI Clock signal consists of 24 clock 'pulses' per beat. Therefore, in order to generate a clock frequency corresponding to a quarter-note, enter a value of 24 ( $24/24 = 1$  beat). For an eighth-note, divide by 12 ( $12/24 = 0.5$ , or half a beat). A value of 8 generates a frequency corresponding to an eighth-note triplet.



You can use any integer value, even those that produce asymmetric results (such as 7 or 13).

## Pan

**LFO1:** Enables Pan Modulation using **LFO1**. **LFO1** is not always the **LFO** to use for Pan. Especially at higher frequencies the results can be quite disorienting. Of course, you may choose to use this for effect.

**LFO2:** Controls the Pan Modulation using **LFO2**. As **LFO2** can produce lower modulation frequencies, it is a better choice for typical Pan effects.



## Chorus



**Dry:** Level of the signal without the effect.

**Wet:** Level of the signal with the effect.

**Rate:** The modulation frequency of the effect.

**Depth:** Controls the intensity of the effect by expanding the frequency range.

**FB:** Feedback. Use this controller to route a portion of the effect output back to the input. At high values, this produces a flanger-like effect.

**Phase:** Adjusts the phase offset between the two channels. The range is +/- 180 degrees.

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