the blooo

VST™ Software Synthesizer

Version 1.0

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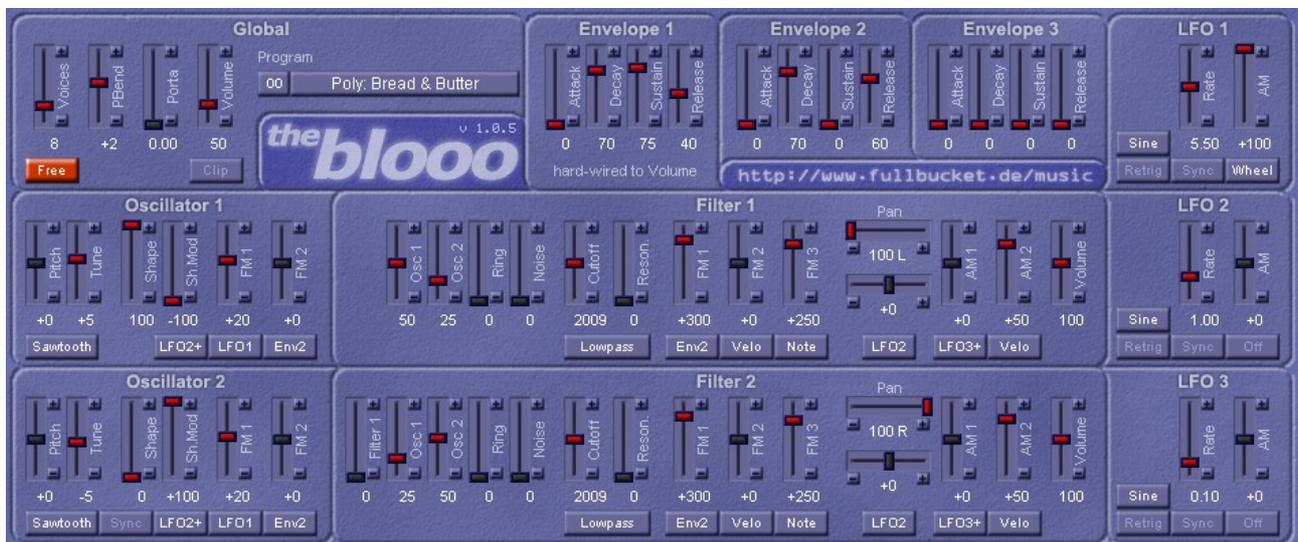
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Introduction

The *blooo* is a VST™2.4 polyphonic software synthesizer plug-in based on the classic subtractive synthesis architecture. It is written in native C++ code for high performance even on "lighter" systems. The main features are:

- Up to 32 voices polyphony including portamento
- Two band-limited oscillators including Ring modulation and hard sync
- Four oscillator waveforms (sawtooth, pulse, sawpulse, sine) with shape control
- Additional white noise generator
- Two multi-mode four-pole filters (lowpass, highpass, bandpass, allpass, phaser) with resonance and panorama control
- Three envelopes (ADSR) with exponential slopes
- Three low frequency oscillators (LFOs) with tempo synchronization

Architecture
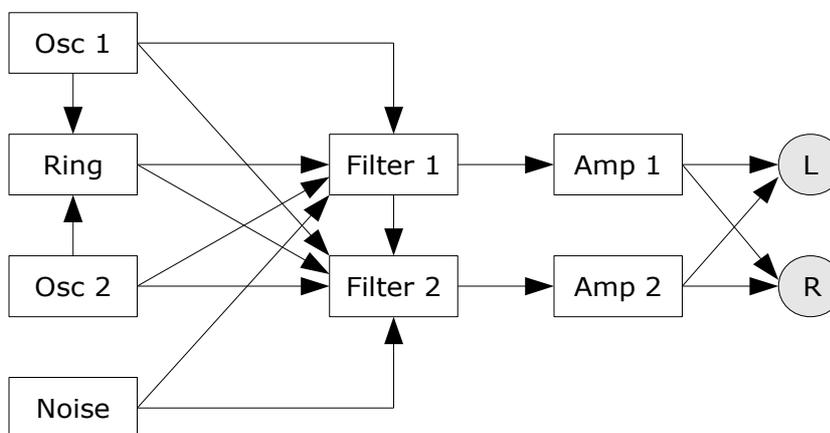
Each voice of the *blooo* features two oscillators feeding a Ring modulator. The individual outputs of the oscillators, the Ring modulator, and an additional white noise generator are sent to the input mixers of two multi-mode filters; furthermore, Filter 2 can receive the output of Filter 1. The filter outputs are routed to two individual amplifiers with panorama control which are connected to the main stereo output bus.

Aside from the audio modules, the *blooo* has three envelopes and three LFOs for modulation purposes.

Oscillators

The oscillators of the *blooo* feature four different waveforms: *Sawtooth*, *Pulse*, *Sawpulse* (a mixture of sawtooth and pulse), and *Sine*. The shape of the the waveforms can be modulated by any unipolar modulation source (see below); in case of the pulse waveform, this is equivalent to pulse width modulation.

Sawtooth

Sawpulse

Pulse

Sine

Shape = 0   Shape = 50   Shape = 100
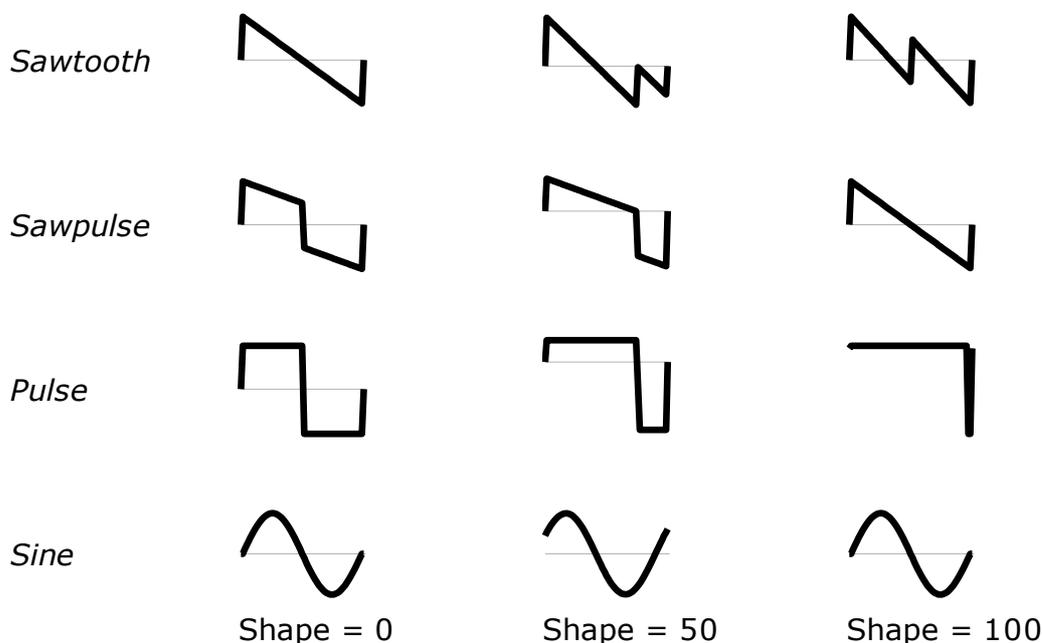
Note that *Sawtooth* with a shape value of 100 equals a mixture of a sawtooth wave and an additional sawtooth wave transposed by one octave. For *Sine* the shape value controls the phase of the sine waveform only.

On a new note event, digital oscillators typically start at the same initial phase angle of the waveform (e.g. the zero-crossing of a sawtooth's rising edge) while classic analog oscillators do not; they are "running free" (which means they are still oscillating even if no note is played). The *blooo* will emulate this behaviour when the *Free* parameter in the Global section is turned on.

The frequencies of both oscillators can be modulated independently by two different modulation sources (unipolar or bipolar). Furthermore, Oscillator 2 features a hard sync option (the phase angle of it's waveform will be reset whenever Oscillator 1 has finished a complete waveform cycle) to create rich harmonic spectra.

Filters

Each of the two filters of the *blooo* can be divided into three sections: input mixer, filter stage, and output amplifier. The input mixer accumulates the output signals of Oscillator 1 and 2, the Ring modulator (output of Oscillator 1 multiplied by the output of Oscillator 2), and a white noise generator. Furthermore, Filter 2 can also add the the output of Filter 1's filter stage.

From the input mixer the signal is sent to a four-pole filter stage of selectable mode: *Lowpass*, *Highpass*, *Bandpass*, *Allpass* and *Phaser* (*Allpass* added to the input mixer's output). The filter stage may also be bypassed (i.e. the input mixer signal is routed directly to the output amplifier) or even turned off completely.

The *Cutoff* parameter adjusts the cutoff or center frequency of the filter stage. Like the oscillators, the cutoff/center frequency can be modulated independently by three modulation sources. *Resonance* controls the amount of feedback from the output to the input of the filter stage. If *Resonance* is set to a value near 100 the filter will start to self-oscillate.

The output of the filter stage is sent to an amplifier section with stereo panorama control which can be modulated by a unipolar or bipolar source. The output volume is controlled by the *Volume* parameter, the output signal of Envelope 1, and two optional unipolar modulation sources. Note that Envelope 1 is hard-wired to the amplifiers of both filters.

Modulation Sources

The *blooo*'s oscillator/filter frequencies, waveform shapes, amplitudes etc. can be modulated by various modulation sources. Sources that produce a control signal of positive values only (including zero) are called *unipolar* while sources producing either positive or negative values are called *bipolar*. The following table lists the available modulation sources and their polarity.

source	polarity	description
Off	unipolar	constant value 0
On	unipolar	constant value 1
LFO1+	unipolar	output of LFO1 ranging from 0 to 1
LFO2+	unipolar	output of LFO2 ranging from 0 to 1
LFO3+	unipolar	output of LFO3 ranging from 0 to 1
Env1	unipolar	output of envelope 1 ranging from 0 to 1
Env2	unipolar	output of envelope 2 ranging from 0 to 1
Env3	unipolar	output of envelope 3 ranging from 0 to 1
Velo	unipolar	MIDI note velocity
Note+	unipolar	MIDI note value
Pbnd+	unipolar	MIDI pitch bend wheel (value at center position is 0.5)
Wheel	unipolar	MIDI modulation wheel

source	polarity	description
LFO1	bipolar	output of LFO1 ranging from -1 to 1
LFO2	bipolar	output of LFO2 ranging from -1 to 1
LFO3	bipolar	output of LFO3 ranging from -1 to 1
Note	bipolar	MIDI note (value at C3 is 0)
PBend	bipolar	MIDI pitch bend wheel (value at center position is 0)

Envelopes

The three envelopes of the *blooo* are standard ADSR generators with exponential slopes as featured in classic analog synthesizers. Envelope 1 is hard-wired to the filter amplifiers and directly controls the overall amplitude contour.

LFOs

The three low frequency oscillators (LFOs) generate a periodic control signal from 0 to 100 Hz or can be tempo-synchronized to the host. Six waveforms are available: *Sine*, *Square*, *Saw Up* (rising sawtooth), *Saw Dn* (falling sawtooth), *S/H* (Sample and Hold, i.e. random values), and *3-Step* ("stair"-shaped waveform with three steps). The *Retrig* parameter controls whether the LFO is restarted for each new note or is "running free" (similar to the Free Run mode of the oscillators).

It is possible to modulate the magnitude of the LFO's output by any unipolar modulation source (even by the LFO itself). This can be used to control the LFO via the modulation wheel or to create complex modulation signals, "magic vibrato" effects, etc.

Parameters

Global

parameter	description
Voices	number of polyphonic voices (up to 32)
PBend	maximum pitch bend amount (± 24 semitones) of the oscillators
Porta	portamento time (0 to 5 seconds)
Volume	the overall volume
Free	Free Run mode: when a new note event occurs, *Free* controls whether the oscillators start at the beginning of the wave form (typical for "digital" oscillators) or are "running free" (like classic analog oscillators)
Clip	controls whether the overall output is unlimited or clipped to unity (tanh clipping function)

Oscillators

parameter	description
Waveform	four types are available: *Sawtooth*, *Pulse*, *SawPulse*, and *Sine*
Pitch	the relative pitch (± 24 semitones)
Tune	fine tuning of the oscillator (± 1 semitone)
Shape	waveform shape control; for *Pulse* this is equivalent to pulse width
Sh.Mod	amount of waveform shape modulation
Sh.Mod Source	the source of the shape modulation; this can be any unipolar modulation source (see *Modulation Sources* below)
FM1 / FM2	amount of frequency modulation
FM1 / FM2 Source	the source of the frequency modulation; this can be any modulation source (see *Modulation Sources* below)
Sync	controls whether Oscillator 2 is hard-synchronized to Oscillator 1

Filters

parameter	description
Osc 1	filter input mixer: level of Oscillator 1
Osc 2	filter input mixer: level of Oscillator 2
Ring	filter input mixer: level of Ring modulation (Oscillator 1 / Oscillator 2)
Noise	filter input mixer: level of white noise generator
Filter 1	filter input mixer: level of Filter 1
Filter mode	*Off*: the filter is switched off *Bypass*: the filter's input is directly routed to the filter's output *Lowpass*: 4 pole lowpass filter *Highpass*: 4 pole highpass filter *Bandpass*: 4 pole bandpass filter *Allpass*: 4 pole allpass filter *Phaser*: 4 pole allpass filter (output mixed with the filter's input)
Cutoff	cutoff or center frequency of the filter
Resonance	feedback amount of the filter; high values will cause self-oscillation
FM1 to FM3	amount of cutoff frequency modulation
FM1 to FM3 Source	the source of the cutoff frequency modulation; this can be any modulation source (see *Modulation Sources* below)
Pan	stereo position (panorama) of the filter output

parameter	description
Pan Modulation	amount of panorama modulation
Pan Source	the source of the panorama modulation; this can be any modulation source (see *Modulation Sources* below)
AM1 / AM2	amount of amplitude modulation
AM1 / AM2 Source	the source of the amplitude modulation; this can be any unipolar modulation source (see *Modulation Sources* below)
Volume	filter output volume

Envelopes

parameter	description
Attack	attack time of the envelope
Decay	decay time of the envelope
Sustain	sustain level of the envelope
Release	release time of the envelope

LFOs

parameter	description
Waveform	six types are available: *Sine*, *Square*, *Saw Up* (rising sawtooth), *Saw Dn* (falling sawtooth), *S/H* (Sample and Hold, i.e. random values), and *3-Step* ("stair"-shaped waveform with three steps)
Retrig	when a new note event occurs, *Retrig* controls whether the LFO starts at the beginning of the wave form or is "running free" (similar to the *Free* control for the audio oscillators)
Rate	rate or speed of the LFO (in Hertz or note lengths)
Sync	controls whether the LFO is synchronized to the host tempo
AM	amount of amplitude (output level) modulation
AM Source	the source of the amplitude modulation; this can be any unipolar modulation source (see *Modulation Sources* below)

Frequently Asked Questions

How do I install the blooo?

Just copy the file `blooo.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST plug-in folder. Your DAW should automatically register the *blooo* VST plug-in the next time you start it.

What is the VST plug-in ID of the blooo?

The ID is `1 r 7 6` .

How can I decrease the blooo's CPU load?

Always try this:

- If you don't need one of the two filters, set it's mode to *Off*.
- If you don't need Ring modulation, set both *Ring* parameters of the filter input mixers to zero.

Whenever it does not degrade the *sound* you need, try this:

- Reduce polyphony, i.e. the number of voices.
- Turn of Free Run mode of the oscillators.
- Turn of tempo-synchronization of the LFOs.

How can I prevent output clipping (for example when I use high Resonance values)?

Decrease the filter amplifier's and/or the overall *Volume* parameters. Alternatively, switch on the *Clip* parameter in the Global section but that might lead to distortion effects. Hey, maybe that's exactly what you need? ;-)

Why are the maximum values of the FM parameters ±500 and not ±100 like most of the other parameters?

The maximum frequency modulation of the *blooo's* oscillators and filters ranges from five octaves down to five octaves up. Thus, a value of 100 represents a ±1 octave modulation range and a value of 500 the maximum range of ±5 octaves.

However, in case of the *Note* modulation source a value of 500 results in a frequency modulation of one octave per octave on the keyboard (with respect to MIDI key C3). Why that? Because it gives the answer to the following question:

How can I tune the filter frequencies to the note played on the keyboard?

Select the *Note* modulation source for one of the FM parameters of the filter and set the modulation amount to 500. Play MIDI key C3 and adjust the *Cutoff* parameter so that the filter is in tune with the oscillators.

What does the name **blooo** *mean?*

Nothing, except that it sounds like "blue". The same is true for the name *Full Bucket*, excepts that it does not sound like "blue".