

# *the blooo*

## Software Synthesizer

Version 2.1

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## Introduction

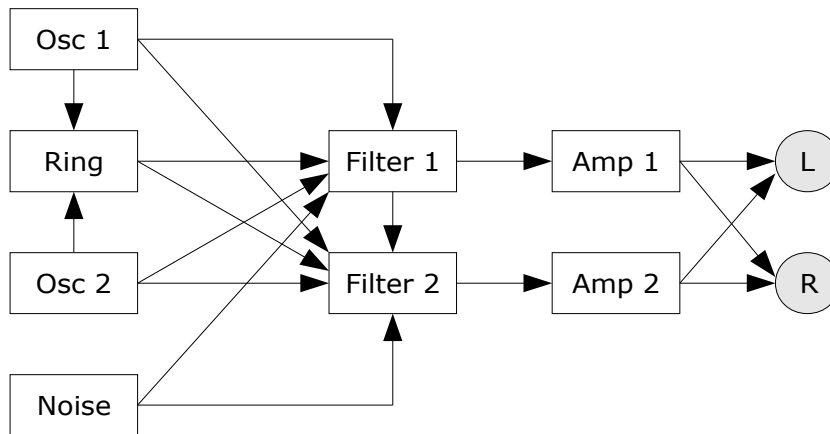
The *blooo* is a software synthesizer plug-in for Microsoft Windows (VST) and Apple macOS (VST/AU) based on the classic subtractive synthesis architecture. It is written in native C++ code for high performance even on “lighter” systems. The main features are:

- Up to 64 voices polyphony including portamento
- Two band-limited oscillators including Ring modulation and Soft/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
- Double precision audio processing
- All parameters can be controlled by MIDI controllers
- *Plug-in supports Windows and macOS (32 bit and 64 bit)*

## What's New With Version 2.1?

Apart from macOS compatibility, most changes are under the hood. Version 2.1 of the *blooo* is fully compatible with the previous versions; it should be safe to replace the old plug-in with the new one.

## Architecture

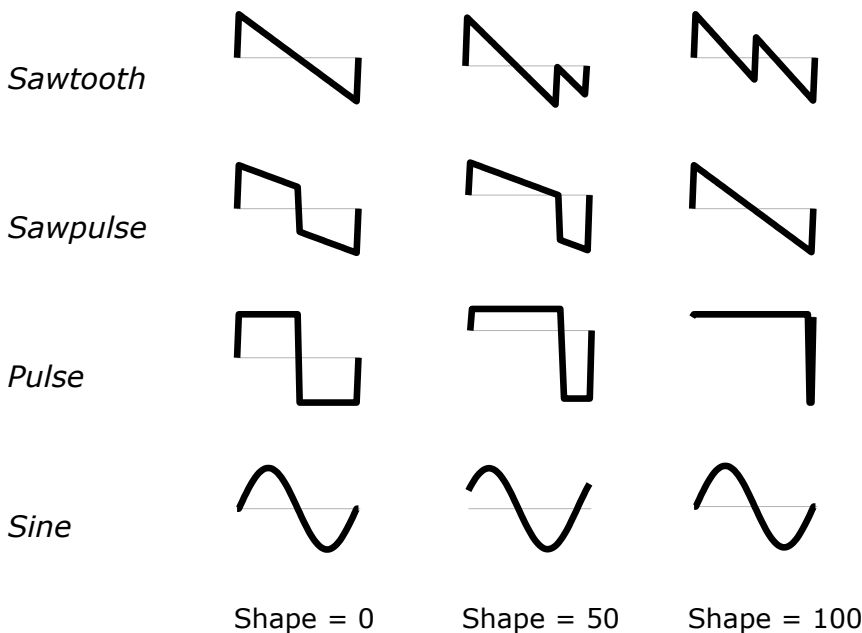


Each voice of the *blooo* features two oscillators feeding a Ring modulator. The individual outputs of the oscillators, the Ring modulator, and an additional white noise generator are sent to the input mixers of two multi-mode filters; furthermore, Filter 2 can receive the output of Filter 1. The filter 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 waveforms can be modulated by any unipolar modulation source (see below); in case of the pulse waveform, this is equivalent to pulse width modulation.



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 Soft and Hard sync (the phase angle of it's waveform will be inverted or 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 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
<i>Off</i>	unipolar	constant value 0
<i>On</i>	unipolar	constant value 1
<i>LFO1+</i>	unipolar	output of LFO1 ranging from 0 to 1
<i>LFO2+</i>	unipolar	output of LFO2 ranging from 0 to 1
<i>LFO3+</i>	unipolar	output of LFO3 ranging from 0 to 1
<i>Env1</i>	unipolar	output of envelope 1 ranging from 0 to 1
<i>Env2</i>	unipolar	output of envelope 2 ranging from 0 to 1
<i>Env3</i>	unipolar	output of envelope 3 ranging from 0 to 1
<i>Velo</i>	unipolar	MIDI note velocity
<i>Note+</i>	unipolar	MIDI note value
<i>PBnd+</i>	unipolar	MIDI pitch bend wheel (value at center position is 0.5)
<i>Wheel</i>	unipolar	MIDI modulation wheel
<i>LFO1</i>	bipolar	output of LFO1 ranging from -1 to 1
<i>LFO2</i>	bipolar	output of LFO2 ranging from -1 to 1
<i>LFO3</i>	bipolar	output of LFO3 ranging from -1 to 1
<i>Note</i>	bipolar	MIDI note (value at C3 is 0)
<i>PBend</i>	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.



## Global Section

The Global Section hosts common parameters such as *Volume*, *Pitch Bend Amount*, and *Portamento Time* as well as the controls for program selection/naming, the *Options* menu, and the *MIDI Learn* button.



## Options Menu

When clicking on the *Menu* button in the Global section, a context menu opens with the following options:

<b>Copy Program</b>	Copy current program to internal clipboard
<b>Paste Program</b>	Paste internal clipboard to current program
<b>Load Program</b>	Load a program file containing a patch to the <i>blooo's</i> current program
<b>Save Program</b>	Save the <i>blooo's</i> current program to a program file
<b>Load Bank</b>	Load a bank file containing 64 patches into the <i>blooo</i>
<b>Save Bank</b>	Save the <i>blooo's</i> 64 patches to a bank file
<b>Init Program</b>	Initialize the current program
<b>Reload Configuration</b>	Reload the <i>blooo's</i> configuration file (see section <i>The blooo.ini Configuration File</i> )
<b>Save Configuration</b>	Save the <i>blooo's</i> configuration file (see section <i>The blooo.ini Configuration File</i> )
<b>Select Startup Bank</b>	Select the bank file that should always be loaded when the <i>blooo</i> is started
<b>Load Startup Bank</b>	Load the Startup bank file; can also be used to check what the current Startup bank is
<b>Unselect Startup Bank</b>	Unselect the current Startup bank
<b>Check Online for Update</b>	When connected to the Internet, this function will check if a newer version of the <i>blooo</i> is available at fullbucket.de
<b>Visit fullbucket.de</b>	Open fullbucket.de in your standard browser

## The *blooo.ini* Configuration File

The *blooo* is able to read some settings from a configuration file (*blooo.ini*) located in the same directory as the *blooo* VST DLL (*blooo.dll* or *blooo64.dll*) or Mac VST/AU (*Blooo.component* or *Blooo.vst*) itself. After you have edited this INI file in a text editor, you have to reload it using the *Reload Configuration* command from the *File* menu (see section *Options Menu*).

## MIDI Control Change Messages

All parameters of the *blooo* can be controlled by MIDI controllers, or more precise: Each MIDI controller (except *Modulation Wheel* and *Sustain Pedal*) can control one of *blooo's* parameters. The mapping is defined in the *blooo.ini* for example like this:

```
[MIDI Control]
CC7  = 4  # Volume
CC70 = 32 # Filter 1 Cutoff
CC71 = 33 # Filter 1 Resonance
...
```

The syntax is straight forward:

```
CC<controller number> = <parameter ID>
```

Given the above example, controller 7 directly controls the overall *Volume* parameter, controller 74 the *Filter 1 Cutoff* etc. As you can see, comments are introduced by the Pound sign (#); they are here just for description purposes and completely optional. Note that the *controller number* can run from 0 to 110, with the exception of 1 (*Modulation Wheel*) and 64 (*Sustain Pedal*); the latter two are simply ignored.

## MIDI Learn

The easiest way to assign MIDI controllers to *blooo* parameters is to use the MIDI Learn function. To activate *MIDI Learn*, click on the respective button and wiggle both the MIDI controller and the *blooo's* parameter that you want to link. If you want to unlearn the assignment, right-click the *MIDI Learn* button (the label now reads "Unlearn") and activate it. Now wiggle the MIDI controller or the parameter that you want to unlearn.



## Parameters

### Global

parameter	description
<i>Voices</i>	number of polyphonic voices (up to 64)
<i>PBend</i>	maximum pitch bend amount ( $\pm 24$ semitones) of the oscillators
<i>Porta</i>	portamento time (0 to 5 seconds)
<i>Volume</i>	the overall volume
<i>Free</i>	Free Run mode: when a new note event occurs, <i>Free</i> controls whether the oscillators start at the beginning of the wave form (typical for "digital" oscillators) or are "running free" (like classic analog oscillators)
<i>Clip</i>	controls whether the overall output is unlimited or clipped to unity (tanh clipping function)

### Oscillators

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

## Filters

parameter	description
<i>Osc 1</i>	filter input mixer: level of Oscillator 1
<i>Osc 2</i>	filter input mixer: level of Oscillator 2
<i>Ring</i>	filter input mixer: level of Ring modulation (Oscillator 1 / Oscillator 2)
<i>Noise</i>	filter input mixer: level of white noise generator
<i>Filter 1</i>	filter input mixer: level of Filter 1
<i>Filter mode</i>	<p><i>Off:</i> the filter is switched off</p> <p><i>Bypass:</i> the filter's input is directly routed to the filter's output</p> <p><i>Lowpass:</i> 4 pole lowpass filter</p> <p><i>Highpass:</i> 4 pole highpass filter</p> <p><i>Bandpass:</i> 4 pole bandpass filter</p> <p><i>Allpass:</i> 4 pole allpass filter</p> <p><i>Phaser:</i> 4 pole allpass filter (output mixed with the filter's input)</p>
<i>Cutoff</i>	cutoff or center frequency of the filter
<i>Resonance</i>	feedback amount of the filter; high values will cause self-oscillation
<i>FM1 to FM3</i>	amount of cutoff frequency modulation
<i>FM1 to FM3 Source</i>	the source of the cutoff frequency modulation; this can be any modulation source (see <i>Modulation Sources</i> below)
<i>Pan</i>	stereo position (panorama) of the filter output
<i>Pan Modulation</i>	amount of panorama modulation
<i>Pan Source</i>	the source of the panorama modulation; this can be any modulation source (see <i>Modulation Sources</i> below)
<i>AM1 / AM2</i>	amount of amplitude modulation
<i>AM1 / AM2 Source</i>	the source of the amplitude modulation; this can be any unipolar modulation source (see <i>Modulation Sources</i> below)
<i>Volume</i>	filter output volume

## Envelopes

parameter	description
<i>Attack</i>	attack time of the envelope
<i>Decay</i>	decay time of the envelope
<i>Sustain</i>	sustain level of the envelope
<i>Release</i>	release time of the envelope

## LFOs

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

## Frequently Asked Questions

### **How do I install the blooo (32 bit version)?**

Just copy the files `blooo.dll` and `blooo.ini` 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.

### **How do I install the Blooo (Windows 64 bit version)?**

Just copy the file `blooo64.dll` and `blooo.ini` 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.

Note: You may have to remove any existing (32 bit) `blooo.dll` from your VST plug-in folder or else your DAW may screw the versions up..

### **How do I install the Blooo (Mac VST/AU universal 32/64 bit)?**

Locate the downloaded PKG package file `blooo_2_1_5_mac.pkg` in Finder (!) and do a right- or control-click on it. In the context menu, click on "Open". You will be asked if you really want to install the package because it comes from an "unidentified developer" (me ☺). Click "OK" and follow the installation instructions.

### **What is the 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 $\pm 5.00$ and not $\pm 1.00$ 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 1.00 represents a  $\pm 1$  octave modulation range and a value of 5.00 the maximum range of  $\pm 5$  octaves.

However, in case of the *Note* modulation source a value of 5.00 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 5.00. Play MIDI key C3 and adjust the *Cutoff* parameter so that the filter is in tune with the oscillators.

### **How do I know if a new version of the blooo is available?**

When connected to the Internet, open the Options menu (see section *Options Menu*) by clicking the disk icon and select the entry "Check Online for Updates". If a new version of the *blooo* is available on fullbucket.de the respective information will be shown in a message box.

### **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".

### **What...?**

Before I answer this question, let me tell you a bit about the history of the *blooo*...

The *blooo* was the first software synthesizer I ever created; this was back in 2010. It is still my workhorse synth and underwent many UI changes (some of you folks might remember the quirky designs from the past) until it got its current look. But under the hood it is almost the same machine as it was from version 1.0.0 onward (OK, the *Soft Sync* mode was added along with the whole utility paraphernalia...).

The problem with extending or adding functionality is that you loose *backwards compatibility* pretty fast. This has to do with the way (VST) parameters are stored (by values between 0 and 1). I wont go into detail here, but even adding an additional modulation source entry to a parameter can kill backwards compatibility. So I decided to leave the *blooo* as it is and put advanced changes into a potential new plug-in.

Sorry, what was the question? ☺