

# FB-3100

## Polyphonic Synthesizer

Version 1.2

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## Introduction

The *FB-3100* is a software synthesizer plug-in for Microsoft Windows (VST2/VST3) and Apple macOS (VST2/VST3/AU) simulating the classic KORG PS-3100 polyphonic analog synthesizer from 1977. It is written in native C++ code for high performance even on "lighter" systems. The main features are:

- Close emulation of behavior and all controls of the original hardware
- Band-limited oscillators, classic two-pole lowpass filters
- Resonators section
- Two Modulation Generators, Sample & Hold
- Additional paraphonic Envelope Generator
- Semi-modular patch panel
- Micro-tuning option
- Additional tweaks
- Plug-in supports Windows and macOS (32 bit and 64 bit)

*FB-3100* is based on the new **iPlug2** framework maintained by **Oli Larkin and the iPlug2 team**. Big thanks, guys!!! Without your work it would not have been possible to create a resizable *FB-3100* user interface.

To resize the plug-in you just grab the yellow triangle at the bottom right of the *FB-3100* window and drag it. You can save the current window size using the menu entry "Save Window Size" in the *Options Menu*.

If you have trouble with the standard version of *FB-3100*, please grab the (sound-wise identical) "N" version of the plug-in which is based on the original **iPlug** framework.

## History

In 1977, KORG released two new synthesizer, the *PS-3100* and the *PS-3300*, where "PS" is short for *Polyphonic Synthesizer*. By that time not many polyphonic synthesizers were around, and being even *fully* polyphonic the PS brothers (in close approximation the PS-3300 consists of three PS-3100) were propelled into the noble company of a Polymoog.

A PS-3100 features no less than 48 voices with 48 filters and 48 envelopes but only 12 oscillators generating the top octave frequencies for the twelve keys C to B; the remaining 36 signals are derived by frequency division. And here it comes again, the stigma of frequency divider circuitry: The PS-3100 (like the Polymoog) is just an *organ* – it uses the same cursed technology! And so it surely sounds like a cheesy organ, too!? I respectfully disagree, although it *can* sound cheesy. ☺

When looking at the PS-3100's front panel, the first thing that catches the eye is the large patch bay to the right – this synthesizer is somehow modular. The affinity to the MS-20 is obvious... but wait: The MS-20 came one year later (in 1978). The PS-3100 was in fact the first synthesizer with the classic KORG patch bay, previewing many of the well-known MS-20 features, and the first (semi-)modular polyphonic synth at all!

Also one year later came the PS-3200, KORG's first *programmable* polyphonic synthesizer... but that's another story.

## Digital Transformation

In 2017 and only forty years after its release, I took a closer look at the PS-3100 and to my surprise found many features that are pretty unique to this amazing machine. Having just finished versions 2.0 of the *Mono/Fury* and *the blooo* I started my next project: The *FB-3100*.

Aim of the project was to provide a close simulation of the original hardware and not some highly evolved, hyper-extended, next generation *SuperPS-3100++ deluxe*. As usual, this included some decisions that maybe some folks do not like:

- The FB-3100 is not stereophonic (although you can pan the *Final* and *Direct* outputs in the stereo field) and does not react to Velocity.
- The monophonic/paraphonic modulation options of the PS-3100 remain monophonic/paraphonic in the FB-3100.
- There is still only one oscillator per voice.
- The UI is too small. This is *always* true. ☺
- The patch bay of the FB-3100 does not use virtual patch cords but "patch menus".

I am pretty sure that especially the last bullet will cause a storm of protest. But here is my point: Since the panel is already pretty crowded (and of course too small, see above) I strongly believe that lingering "patch cords" will not help to visualize the current patch connections either. Another advantage is that *patch junctions* (ports that provide multiple "copies" of the original source) are no longer needed. Overall the patch bay of the FB-3100 looks much cleaner this way.

On the other hand I added some tweaks not to be found on the PS-3100:

- The funny *Hold* mode behavior can be overridden with the somehow more intuitive "expected standard behavior" of a Hold function.
- The three-step *EM Release* switch can be overridden by a continuous Release control knob.
- Modulation Generators and Sample & Hold can be synchronized to the host.
- MIDI controllers can be used as sources for virtual voltages and triggers.
- The patch bay features a few more modulation sources than the PS-3100.
- An external signal can be fed into the monophonic signal path of the FB-3100 (starting with the *Resonators* section).

Again I am pretty sure that especially the last bullet is a very interesting feature because you can use the FB-3100 as an VST/AU effect!

## Acknowledgments

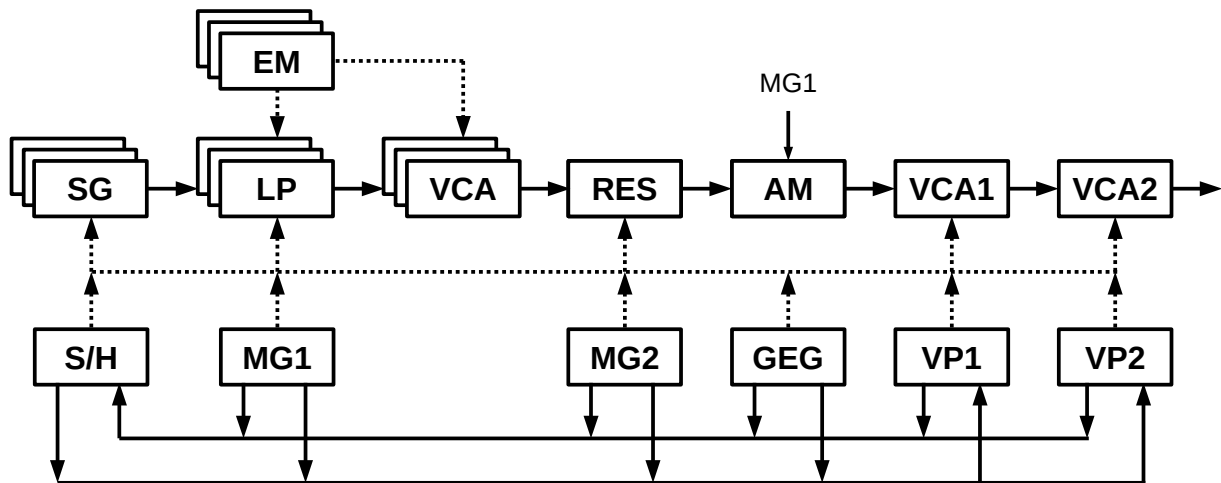
- **Oli Larkin** and the **iPlug2** team.
- A big **Thank you!** goes to all the people who share their information about the PS synthesizers via the Internet.
- Some of the micro-tuning templates are derived from the **Microtonal Synthesis** website at <http://www.microtonal-synthesis.com/>.

- Furthermore a **BIG THANKS** to **Tim Stinchcombe** and **Will Pirkle** for their in-depth analysis of the K35 filter chip.
- Last not least another THANK YOU! to the KVR Audio community and to the KORG engineers.

No, I am not affiliated with KORG in what relation ever except that I always find myself entangled with their instruments. 😊

## Architecture

Each of the 64 voices of the FB-3100 features a band-limited *Signal Generator (SG)*, a 2-pole *Lowpass filter (LP)*, and an *Envelope Modulator (EM)*. The mix of all voices is then sent into a single (!) *Resonators* section consisting of three bandpass filters/resonators, followed by an *Amplitude Modulation* section and two *Voltage Controlled Amplifiers (VCAs)*. For modulation purposes the FB-3100 has two *Modulation Generators (MG 1+2)*, a *Sample & Hold* unit, an additional *General Envelope Generator (GEG)*, and two *Voltage Processors (VP 1+2)*.



As you can see from the block diagram, there are many signal (solid) and modulation (dashed) paths between the various modules. The configuration is pretty flexible and can be reconfigured in the *Patch Bay*.

You can see, too, that further processing of the polyphonic signals after the LP section is *monophonic* (better: *paraphonic*). For example the modulation of VCA1 does affect the volume of *all* voices and not that of an *individual* voice. In the same sense the GEG acts as a paraphonic envelope and not *per voice*.

## Polyphonic Section

### Signal Generators (SG)

The Signal Generators offer six selectable waveforms (*Triangle, Sawtooth, Square, Rectangle, Pulse, and Pulse Width Modulation*), four octave ranges (16' to 2'), fine and coarse tuning and frequency modulation controls. Note that per key (C to B) only one *top-octave* oscillator exists – the lower octaves are generated by frequency division. Thus, the signals of the same key at different octaves are always *in phase*; you can verify this by analyzing the output of the FB-3100 with an oscilloscope.

Frequency modulation (FM) can be enabled by the orange switch at the right of the SG section; the other orange switch ("REV.") to the left flips the polarity of the modulation. While the first source for FM is always given by the *MG* signal (see section *The "MG" Signal*), the second modulation source is set to the GEG. However, this setting can be overridden by selecting a different source (see section *Patch Bay*). The same is true for Pulse Width modulation which by default is performed by MG2 but can be set to any other source, too.



An interesting feature is the *micro-tuning* option. Each of the 12 keys can be tuned individually, allowing for other (not necessarily well-tempered) tunings like *Pythagorean* or *Wendy Carlos' Super Just* tuning etc. The small button at the bottom of the tuning knobs opens a menu with 14 predefined micro-tuning templates. Here it is also possible to load and/or save the tuning settings from/to a Scala (\*.scl) file.

### Lowpass Filters (LP)

The output of the Signal Generators is fed into a two-pole lowpass filter section with adjustable resonance (*Peak*). Yes, this is an emulation of the famous KORG K-35 filter but as in the PS-3100 it cannot be pushed to self-oscillation. Sorry.

Cutoff frequency modulation comes in various ways: First of all the cutoff can be controlled by the note played (*KBD Balance*) both in positive and negative direction (here *negative* means that the cutoff frequency will be *lower* for *higher* notes).

The next knob, *Expand*, controls the influence of the Envelope Modifier (see next section) on the cutoff frequency while the remaining options for frequency modulation resemble those of the Signal Generators: Activated by the orange switch, the filter can be modulated by the (fixed) MG signal and a second source (by default the GEG). Again, the latter setting can be changed via the Patch Bay.



## Envelope Modifiers (EM)

The envelopes are of the standard *ADSR* type except that the release time cannot be controlled continuously but only in three steps: *Damp* (very short), *Half Damp* (pretty short) and *Release* (pretty long). FB-3100 owners will love the option to override the Release time by a variable amount (see section *Tweaks*).

Another funny feature is the *Hold* function: When switched on the envelope does not go into the Release phase once a key is unpressed; instead you have to press the same key *again* to release it.

Working with the Hold function can be tricky because it will only get activated if the Attack time setting is higher than 70% (i.e. the Attack knob is turned almost fully to the right). Furthermore, deactivating the Hold function requires the Attack time setting to be less than 30% (i.e. the Attack knob is turned almost fully to the left). If you are confused now: Go to the *Tweaks* section and learn how to override this weird behavior.



## Monophonic/Paraphonic Section

### Resonators

As stated above the individual voice signals are mixed into a single monophonic signal (the *Direct* signal) and sent into the *Resonators* section. This is basically a parallel arrangement of three bandpass filters with high Q (i.e. resonators) and individually adjustable center frequencies. The "INTENSITY" control determines the mix between original and effect signal.

The resonator frequencies can be modulated by MG2 via the "MG2 MOD" switch and/or by an additional source that has to be selected via the Patch Bay. In the latter case the intensity of the modulation can be adjusted continuously using the "EXT MOD" knob.

The Resonators section has become pretty famous and is one of the key features giving the PS-3100/3300 brothers their "signature sound". Unfortunately, it was replaced in the PS-3200 by a static (!) 7-stage equalizer.





## Amplitude Modulation

Following the Resonators, the signal runs through an *Amplitude Modulator* which multiplies it with the signal of MG1 (can be disabled by using the orange switch to the bottom of the Amplitude Modulation section). Here, the "AMP MOD" knob sets the intensity and character of the effect as follows:



- The range from 0% to 50% (i.e. from the very left to the center of the knob range) will result in a *Cross Modulation* effect. This means that the amplitude of the signal is modulated from  $-\infty$  dB to a maximum of 0dB.
- The range from 50% to 100% (i.e. from the center to the very right of the knob range) will result in a *Ring Modulation* effect meaning that negative values of the MG1 signal will (apart from attenuation) cause the modulated signal to be *inverted*. This makes perfect sense if you think of Ring modulation as a *multiplication*.

The interesting thing is that MG1 is able to generate signals in the kilohertz range which allows for drastic sound effects. But even in the low range a Ring Modulation with a sawtooth wave can result in unusual gate effects.

## The Remaining Signal Path

After Amplitude Modulation the signal passes through a (switchable) *Ensemble* effect as known from classic string synthesizers of the 70's. Compared to the PS-3100, the FB-3100 Ensemble effect does produce much less noise!

Next to follow are two individual VCAs (Voltage Controlled Amplifiers) for further amplitude modulation. The purpose of these amplifiers is the dynamic control of the



loudness contour by the General Envelope Generator and Voltage Processor 1 (both VCAs have respective switches to enable these modulation sources) but nothing prevents you from patching your own sources via the Patch Bay.

Another unique feature is the *Keyboard Balance* that adjusts the volume of notes as played on the keyboard. With this control you can attenuate notes on the lower end or vice versa.

Finally, the *Final* knob controls the output volume of the full signal path while the *Direct* knob controls the volume of an additional outlet of the polyphonic signal i.e. a mix of all voices after the lowpass filters but before the Resonators section. This is because the original PS-3100 offers two mono outputs, namely the *Final* and the *Direct* signals. On the FB-3100 you can pan both signals individually (see *Tweaks* section) which gives a bit more flexibility.

# Modulation Generators

## MG1 and MG2

The FB-3100 has two *Modulation Generators* (LFOs). The second one, *MG2*, only offers a triangle wave while the first one, *MG1*, is much more flexible and can produce a triangle, a falling or rising sawtooth, and a square wave as well as (pretty uncommon!) *Pink Noise* and *White Noise*. Except for the noise waves (which have a continuous frequency range) the frequency of MG1 can be set up to about 1.6kHz – again a very uncommon but nice feature!

Both MGs can be synchronized to the host tempo. Furthermore, by patching an appropriate source one can *modulate* the frequency of MG1.



## Sample & Hold

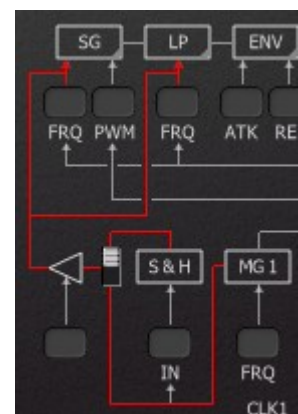
Next on the list is the *Sample & Hold (S/H)* unit. By default, the S/H samples the output of MG1 at a fixed clock rate which can be synchronized to the host tempo. Again the input can be overridden via the Patch Bay.



The "SYNC" switch (called "SYNCHRO" on the PS-3100) is bit curious. KORG's original documentation states that "when the sampled frequency is near the clock frequency multiplied by an integer, the clock is synchronized". Well, better check it out by yourself. Fact is that a regular/periodic input signal can produce some regular, repetitive output while noise will create random patterns. In any case the SYNC function is disabled when the S/H clock is synchronized to the host tempo.

## The "MG" Signal

Studying the PS-3100 schematics shows that the label "MG1" on the original PS-3100 panel (for example as a modulation source for SG and LP) is a bit misleading. Taking a sneak preview of the Patch Bay one finds that the hard-wired modulation path (marked red in the image to the right) can be the *attenuated* output of MG1 **or** the S&H unit – depending on the state of the white switch. So I decided to name this source signal "MG" instead of "MG1".



Furthermore, in contrary to the FB-3100 the PS-3100 does not offer an individual outlet of the MG1 signal; the outlet labeled "MG1" on the original PS-3100 panel is in fact equivalent to the "MG" signal on the FB-3100.

## General Envelope Generator (GEG)

The GEG is a simple *AR* envelope with an additional *Delay* parameter; by default it will modulate VCA1 (provided the respective orange switch is set). It can be turned into an *AD*-like envelope by enabling the "AUTO" switch: In this case the GEG – once triggered – will ignore the Sustain phase and go immediately into the Release phase.

Since there is only one GEG for all voices, the KORG engineers found a nice solution for triggering the envelope. First of all the GEG can be triggered by any trigger signal patched in the Patch Bay. But even more interesting is the "TRIGGER" switch: Here you can select how many keys (1 to 5) have to be pressed before the GEG is triggered (in the "Off" position the keyboard by default does not trigger the GEG at all).

The polarity switch changes the output polarity of the GEG. Note that in the upper ("positive") position the output will range from -5 to 0 (virtual) Volts while in the lower ("negative") position from 0 to +5 Volts. This may seem a bit odd but that's what it is on the original PS-3100 too.

What's not on the PS-3100 is the status LED that shows the current on/off state of the GEG – I think this is a very convenient yet non-obstructive addition.



## Voltage Processors

There are two *Voltage Processors*, VP1 and VP2, on board the FB-3100. They are used to process the signal of a modulation source (e.g. MG1 or GEG) and to produce a modified signal. Here is how that works:

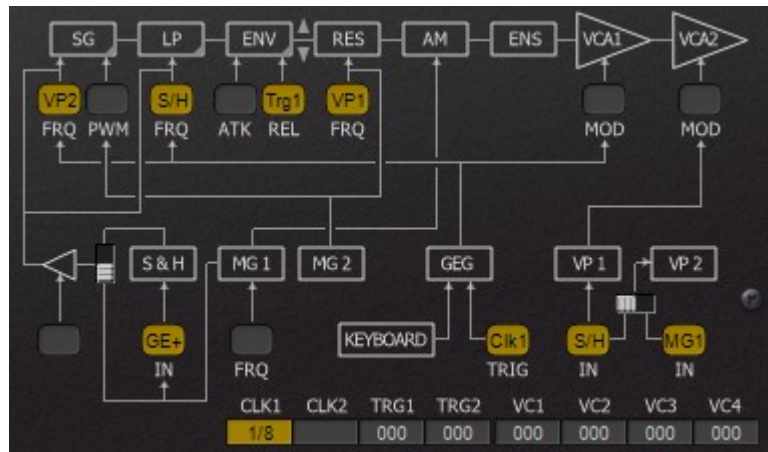
Typically, a signal source can vary from something like -5 to +5 (virtual) Volts. A Voltage Processor will change the range these input values will be mapped to, for example from -2.5 to +1.8 Volts. The input range even can be inverted, for example from +3.4 to -4.2 Volts. The limits of the output ranges are set by the "LIMITER A" and "LIMITER B" knobs where "LIMITER B" defines the low end of the range (in the examples above -2.5 and +3.4 Volts) and "LIMITER A" the high end (in the examples above +1.8 and -4.2 Volts).



## Patch Bay

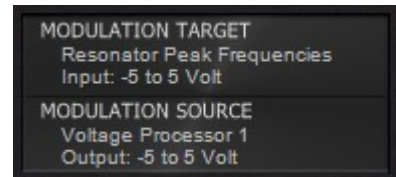
The *Patch Bay* is where the magic happens. Here you can add or replace/override the assignment of modulation sources to targets.

The following rule applies: If you select a source (e.g. "S/H") for a modulation target (e.g. "LP FRQ") then the default assignment will be overridden (in this example this would be "S/H" overriding the default GEG assignment for LP cutoff frequency modulation).



Strictly speaking there are two types of sources and targets: *modulations* and *triggers*. For example the "ATK" target of the EM continuously modulates the Attack time while the "REL" target waits for a trigger signal to release the envelopes.

When hovering with the mouse over a modulation/trigger target, the properties of both the target and the assigned source (if any) will be displayed in the info block at the bottom right of the FB-3100's panel.



There are some additional modulation ("VC1" to "VC4") and trigger sources ("Clk1", "Clk2", "Trg1", "Trg2") available. The "Clk" sources provide variable clock triggers synchronized to the host tempo, the "Trg" sources create trigger signals from assignable MIDI Control Change messages (the trigger occurs when the controller value passes from a value above 63 to a value below 63, emulating a "falling-edge ground trigger"), and the "VC" modulation sources create modulation signals from assignable MIDI Control Change messages. In the Patch Bay you can choose these sources like any other source.

## Tweaks

In the section *Digital Transformation* above it has already been mentioned that the FB-3100 contains some additional features (*tweaks*) that the original PS-3100 hardware synthesizer does not have.

- Additional modulation sources "MG1", "Key", "PB", "PB+", "VC1" to "VC4"
- Additional S/H input sources "Rnd", "Key", "PB", "PB+", "VC1" to "VC4"
- Additional trigger sources "Clk1", "Clk2", "Trg1", "Trg2"
- Panorama control for *Final* and *Direct* output



- Override for PS-3100 EM Hold mode and Release time
- External input (inserted right before the Resonators section)

Not really a tweak (since the PS-3100 does feature a momentary switch) but nonetheless helpful is the "MANUAL TRG1" push button that – when clicked – raises a trigger impulse for the "Trg1" trigger source.

## Options Menu

When clicking on the *Menu* button, 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>Init Program</b>	Initialize the current program
<b>Load Program</b>	Load a program file containing a patch to the current program
<b>Save Program</b>	Save the current program to a program file
<b>Load Bank</b>	Load a bank file containing 64 patches
<b>Save Bank</b>	Save the 64 patches to a bank file
<b>Select Startup Bank</b>	Select the bank file that should always be loaded when the <i>FB-3100</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>Default Path for Program Files</b>	Sets the default path for program and bank files
<b>MIDI Thru</b>	Set globally if MIDI data sent to <i>FB-3100</i> should be sent through to its MIDI output
<b>Ignore Program Change</b>	Set globally if MIDI Program Change data sent to <i>FB-3100</i> should be ignored
<b>Reload Configuration</b>	Reload the <i>FB-3100</i> 's configuration file (see section <i>The fb3100.ini Configuration File</i> )
<b>Save Configuration</b>	Save the <i>FB-3100</i> 's configuration file (see section <i>The fb3100.ini Configuration File</i> )
<b>Check Online for Update</b>	When connected to the Internet, this function will check if a newer version of <i>FB-3100</i> is available at fullbucket.de
<b>Window Size...</b>	Change the window size of <i>FB-3100</i>
<b>Save Window Size</b>	Stores the current window size to the configuration file so that it will be restored next time you load <i>FB-3100</i>
<b>Visit fullbucket.de</b>	Open fullbucket.de in your standard browser

## The *fb3100.ini* Configuration File

The FB-3100 is able to read some settings from a configuration file (*fb3100.ini*). The exact location of this file depends on your operating system and will be displayed when you click on "Reload" or "Save Configuration". 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 *The fb3100.ini Configuration File*).

## MIDI Control Change Messages

All parameters of the FB-3100 can be controlled by MIDI controllers, or more precise: Each MIDI controller (except *Modulation Wheel* and *Sustain Pedal*) can control one of FB-3100's parameters. The mapping is defined in the *fb3100.ini* for example like this:

```
[MIDI Control]
CC7  = 0  # Final Volume
CC70 = 17 # LP Cutoff
CC71 = 18 # LP Peak
...
```

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 *VCF Cutoff* etc. As you can see, comments are introduced by the Pound sign (#); they are here just for description purposes and completely optional.

## MIDI Learn

The easiest way to assign MIDI controllers to FB-3100 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 FB-3100'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.

## Modulation and Trigger Sources

Modulation Sources		
Name	Voltage	Description
<b>off</b>	0	off / default
<b>GEG</b>	-5 to 0 or 0 to 5	GEG normal output
<b>GE+</b>	0 to 5	GEG positive output
<b>MG</b>	-5 to 5	MG signal
<b>MG1</b>	-5 to 5	MG1 output
<b>MG2</b>	-5 to 5	MG2 output
<b>S/H</b>	-5 to 5	S/H output
<b>VP1</b>	-5 to 5	VP1 output
<b>VP2</b>	-5 to 5	VP2 output
<b>Key</b>	-5 to 5	last pressed key
<b>PB</b>	-5 to 5	Pitch Bend
<b>PB+</b>	0 to 5	Pitch Bend positive
<b>MW</b>	-5 to 5	Mod Wheel
<b>MW+</b>	0 to 5	Mod Wheel positive
<b>VC1</b>	-5 to 5	assignable MIDI CC
<b>VC2</b>	-5 to 5	assignable MIDI CC
<b>VC3</b>	-5 to 5	assignable MIDI CC
<b>VC4</b>	-5 to 5	assignable MIDI CC

S/H Input	
Name	Description
<b>off</b>	default (= MG1)
<b>GEG</b>	GEG normal output
<b>GE+</b>	GEG positive output
<b>MG</b>	MG signal
<b>MG1</b>	MG1 output
<b>MG2</b>	MG2 output
<b>Rnd</b>	Random (White Noise)
<b>VP1</b>	VP1 output
<b>VP2</b>	VP2 output
<b>Key</b>	last pressed key
<b>PB</b>	Pitch Bend
<b>PB+</b>	Pitch Bend positive
<b>MW</b>	Mod Wheel
<b>MW+</b>	Mod Wheel positive
<b>VC1</b>	assignable MIDI CC
<b>VC2</b>	assignable MIDI CC
<b>VC3</b>	assignable MIDI CC
<b>VC4</b>	assignable MIDI CC

Trigger Sources	
Name	Description
<b>off</b>	off
<b>Sng</b>	Keyboard Single Trigger
<b>Mlt</b>	Keyboard Multiple Trigger
<b>MG1</b>	MG1 clock
<b>MG2</b>	MG2 clock

Trigger Sources (cont'd)	
Name	Description
<b>S/H</b>	S/H clock
<b>Clk1</b>	external clock
<b>Clk2</b>	external clock
<b>Trg1</b>	MIDI CC trigger
<b>Trg2</b>	MIDI CC trigger

## Parameters

### Global

parameter	ID	description
<i>Final Volume</i>	0	the overall volume of the <i>Final</i> signal
<i>Direct Volume</i>	1	the volume of the <i>Direct</i> (polyphonic section) signal
<i>Final Panorama</i>	2	the stereo position of the <i>Final</i> signal
<i>Direct Panorama</i>	3	the stereo position of the <i>Direct</i> signal
<i>Keyboard Balance</i>	4	volume balance of low versus high notes
<i>Pitch Bend Range</i>	5	range of the Pitch Bend modulation

### Signal Generators

parameter	ID	description
<i>SG Waveform</i>	6	waveform ( <i>Triangle, Sawtooth, Square, Rectangle, Pulse, Pulse Width Modulation</i> )
<i>SG PWM Intensity</i>	7	intensity of the Pulse Width Modulation
<i>SG Fine Tune</i>	8	frequency fine tuning
<i>SG Coarse Tune</i>	9	frequency coarse tuning
<i>SG Octave</i>	10	Octave ( <i>16', 8', 4', 2'</i> )
<i>SG Frequency Mod Enable</i>	11	activates the Frequency Modulation
<i>SG Frequency Mod Reverse</i>	12	polarity of the Frequency Modulation
<i>SG Frequency Mod by MG1</i>	13	Frequency Modulation amount of MG1
<i>SG Frequency Mod by GEG/Ext</i>	14	Frequency Modulation amount of GEG or external/patched source
<i>SG Frequency Mod Source</i>	15	external/patched modulation source for Frequency Modulation
<i>SG Pulse Width Mod Source</i>	16	external/patched modulation source for Pulse Width Modulation



## Lowpass Filter

<b>parameter</b>	<b>ID</b>	<b>description</b>
<i>LP Cutoff Frequency</i>	17	cutoff frequency
<i>LP Peak</i>	18	peak (resonance)
<i>LP Balance</i>	19	keyboard balance (tracking)
<i>LP Expand</i>	20	intensity of modulation by Envelope Modifier
<i>LP Frequency Mod Enable</i>	21	activates the Cutoff Frequency Modulation
<i>LP Frequency Mod by MG1</i>	22	Cutoff Frequency Modulation amount of MG1
<i>LP Frequency Mod by GEG/Ext</i>	23	Cutoff Frequency Modulation amount of GEG or external/patched source
<i>LP Frequency Mod Source</i>	24	external/patched modulation source for Cutoff Frequency Modulation

## Envelope Modifier

<b>parameter</b>	<b>ID</b>	<b>description</b>
<i>EM Attack</i>	25	Attack time
<i>EM Decay</i>	26	Decay time
<i>EM Sustain</i>	27	Sustain level
<i>EM Release</i>	28	Release time ( <i>Damp, Half Damp, Release</i> )
<i>EM Hold</i>	29	activates the Hold function
<i>EM Attack Time Mod Source</i>	30	external/patched modulation source for Attack time
<i>EM Release Trigger Source</i>	31	external/patched trigger source for Release phase

## Resonators

<b>parameter</b>	<b>ID</b>	<b>description</b>
<i>Resonators Intensity</i>	32	mix between original and Resonators effect signal
<i>Resonator 1 Frequency</i>	33	peak frequency of first resonator
<i>Resonator 2 Frequency</i>	34	peak frequency of second resonator
<i>Resonator 3 Frequency</i>	35	peak frequency of third resonator
<i>Resonators Frequency Mod by MG2</i>	36	activates the Peak Frequency Modulation by MG2
<i>Resonators Frequency Ext Mod Intensity</i>	37	amount of Peak Frequency Modulation by external/patched modulation source
<i>Resonator Peak Frequencies Mod Source</i>	38	external/patched modulation source for Peak Frequency Modulation

## Total Signal Modifiers

<b>parameter</b>	<b>ID</b>	<b>description</b>
<i>Amplitude Mod Intensity</i>	39	intensity of the Amplitude Modulation
<i>Amplitude Mod by MG1</i>	40	activates the Amplitude Modulation
<i>Ensemble</i>	41	activates the Ensemble effect
<i>VCA1 Mod by GEG</i>	42	activates the modulation of VCA1 by GEG
<i>VCA1 Amplitude Mod Source</i>	43	external/patched modulation source for VCA1
<i>VCA2 Mod by VP1</i>	44	activates the modulation of VCA2 by VP1
<i>VCA2 Amplitude Mod Source</i>	45	external/patched modulation source for VCA2

### Modulation Generators 1/2 and Sample & Hold

parameter	ID	description
<i>MG1 Waveform</i>	46	Waveform ( <i>Triangle, Falling Sawtooth, Rising Sawtooth, Square, Pink Noise, White Noise</i> )
<i>MG1 Frequency</i>	47	frequency
<i>MG1 Frequency Mod Source</i>	48	external/patched source for frequency modulation
<i>MG Signal Selector</i>	49	MG Signal selector ( <i>S/H or MG1</i> )
<i>MG Signal Mod Source</i>	50	external/patched source for MG Signal modulation
<i>MG1 Sync to Host</i>	51	sync to host tempo rate
<i>MG2 Frequency</i>	52	47
<i>MG2 Sync to Host</i>	53	sync to host tempo rate
<i>S/H Clock Frequency</i>	54	sample clock rate
<i>S/H Synchro</i>	55	Activates the Synchro function
<i>S/H Input Source</i>	56	sample input source
<i>S/H Sync to Host</i>	57	sync to host tempo rate

### General Envelope Generator

parameter	ID	description
<i>GEG Trigger</i>	58	number of keys to be pressed for triggering the GEG
<i>GEG Delay</i>	59	Delay time
<i>GEG Attack</i>	60	Attack time
<i>GEG Release</i>	61	Release time
<i>GEG Auto</i>	62	activates the Auto function
<i>GEG Polarity</i>	63	sets the output polarity
<i>GEG Trigger Source</i>	64	external/patched trigger source

## Voltage Processors 1 and 2

parameter	ID	description
<i>VP1 Limiter A</i>	65	Limiter A of VP1
<i>VP1 Limiter B</i>	66	Limiter B of VP1
<i>VP1 Input Source</i>	67	input source of VP1
<i>VP2 Limiter A</i>	68	Limiter A of VP2
<i>VP2 Limiter B</i>	69	Limiter B of VP2
<i>VP2 Source Select</i>	70	sets the input source of VP2 ( <i>VP1</i> or <i>VP2</i> )
<i>VP2 Input Source</i>	71	input source of VP2

## Temperament (Micro-Tuning)

parameter	ID	description
<i>Tune C to B</i>	72 – 83	individual tuning for keys C to B

## External Modulation and Trigger Sources

parameter	ID	description
<i>Clock1 Source</i>	84	sync to host rate for Clk1
<i>Clock2 Source</i>	85	sync to host rate for Clk2
<i>Trigger1 Source</i>	86	MIDI CC assignment for Trg1
<i>Trigger2 Source</i>	87	MIDI CC assignment for Trg2
<i>VC1 Source</i>	88	MIDI CC assignment for VC1
<i>VC2 Source</i>	89	MIDI CC assignment for VC2
<i>VC3 Source</i>	90	MIDI CC assignment for VC3
<i>VC4 Source</i>	91	MIDI CC assignment for VC4

## Tweaks

parameter	ID	description
<i>Use PS3100 Hold Function Mode</i>	92	activates the PS-3100 Hold function mode behaviour
<i>Override EM Release switch</i>	93	activates the EM Release time override
<i>EM Override Release Time</i>	94	override for EM Release time
<i>Resonator Input Mix</i>	95	mix between internal and external input signal

## Frequently Asked Questions

Before you read on here, please make sure that you also have read my statements regarding the FB-3100's capabilities and limitations at the beginning of this manual (see section *Digital Transformation*).

### ***How do I install the FB-3100 (Windows VST2 32 bit version)?***

Just copy the files `fb3100.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST2 plug-in folder. Your DAW should automatically register the FB-3100 VST2 plug-in the next time you start it.

### ***How do I install the FB-3100 (Windows VST2 64 bit version)?***

Just copy the file `fb310064.dll` from the ZIP archive you have downloaded to your system's or favorite DAW's VST2 plug-in folder. Your DAW should automatically register the FB-3100 VST2 plug-in the next time you start it.

Note: You may have to remove any existing (32 bit) `fb3100.dll` from your VST2 plug-in folder or else your DAW may screw the versions up...

### ***How do I install the FB-3100 (Windows VST3 64 bit version)?***

Just copy the files `fb3100.vst3` from the ZIP archive you have downloaded to your system's or favorite DAW's VST3 plug-in folder. Your DAW should automatically register the FB-3300 VST3 plug-in the next time you start it.

### ***How do I install the FB-3100 (Mac VST2/VST3/AU 64 bit)?***

Locate the downloaded PKG package file `fb3100_1_2_1_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 FB-3100?***

The ID is FB31.

### ***Will you support the FB-3100?***

Yes. If you have problems, found a bug, or have some suggestions about the FB-3100 please send me a mail: [full.bucket@gmx.net](mailto:full.bucket@gmx.net) .

### ***Does the PS-3100 have a status LED for the GEG?***

Nope, I added that to the FB-3100 for convenience.

### ***How do I know if a new version of the FB-3100 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 FB-3100 is available on [fullbucket.de](http://fullbucket.de) the respective information will be shown in a message box.