

# Korg Volca FM Programming Guide

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## Introduction and Basics

This guide goes over the details of programming the Korg Volca FM. It does not cover the basics of performing with the volca (eg recording a sequence, using the arpeggiator, connecting via midi or sync, etc), but focuses instead on editing the actual sound patch on the Volca FM. The Volca FM is basically a scaled down Yamaha DX7 which gives you some extras that the DX7 didn't have in terms of performance options. To understand programming it, you must understand how the DX7 was programmed. To produce this guide, I read the DX7 documentation, and adapted it for the Volca FM, adding extra information as I went along. Therefore it contains some of the original text from that fine manual, along with a few images. Please note that you will need to upgrade your Volca FM to firmware version 1.02 or later, as it contains important bug fixes. Visit [korg.com](http://korg.com) for details.

The Volca FM has a current voice (or "Program") which can be edited and saved using the save button. The Program is saved independently of the recorded sequence. (To be precise, a sequence, as saved with the Memory button has a pointer to a Program that it uses when it's loaded). To edit the current program, you push the Edit button which takes you into edit mode. To save the program, you push the edit button again to exit edit mode, then push the save button, select the program slot to save the program into using the Program knob, and push the save button again which saves it into the selected slot. To edit the program, enter edit mode, use the Octave left and right buttons to select which sub-section of the program's parameters you want to work with, then use the program button to select which parameter in the current sub-section to edit, then use the Velocity slider to change that parameter's value. There are seven sub-sections (groups of parameters). The first six of them are the six operators. The parameters for these are notated in yellow on the Volca FM cheat card that comes with the instrument. The seventh set of parameters are other parameters that apply to the program as a whole (I call these "global voice settings" below) Note that if you have a sequence playing while editing, the new settings only take effect on the next note-on event (ie next note that plays in the sequence). Tweaking parameters at random usually leads to frustration, therefore it's advised to gain an understanding of them before attempting to program the device. I've found that it's best, when first starting out, to turn off all operators except one, and play around with parameters on that one operator so that you can hear your changes taking effect. There are a few other knobs that are hard-wired to editing parameters. These are the 6 knobs under the heading Modulator, Carrier, LFO along with the Algorithm knob, and they are explained in the sections below.

**Basics of FM on the Volca** - Each algorithm is a combination of carriers and modulators. Both carriers and modulators are oscillators that produce a sine wave. Carriers produce actual sound, and modulators feed their oscillations into the carrier(s) or modulator(s) below them to alter their sound (frequency modulation or FM). In the diagram below you might notice that some modulators have a line that loops back into itself or another box. This indicates a feedback loop where it feeds it's wave back into itself. This feedback can be adjusted. So to sum up, the green blocks in the diagram below produce sine waves, and the blue blocks modulate the sine waves below them. For example, algorithm 32 would be doing no FM but simply outputting 6 sine waves, whereas algorithms 16-18 would be doing complex FM where modulators are modulating other modulators and all affecting the single carrier signal. This becomes even more interesting when you start editing the envelope on each operator. The envelope affects the

amplitude of the sine wave over time after a key is pressed. Using this method, you are able to synthesize real world sounds, or create moving changing textures. In addition to the envelopes, there is a global LFO (low frequency oscillator) that can affect the overall pitch like most other synths, or can affect the amplitude on each operator selectively.

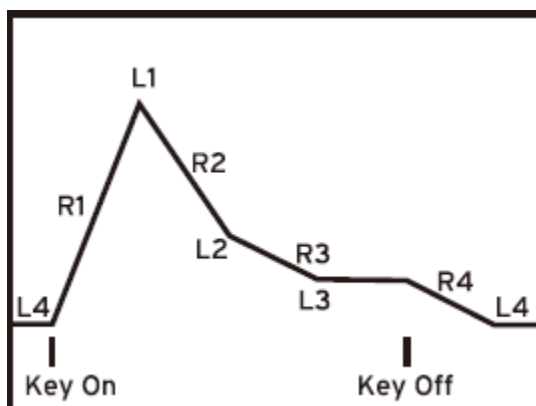
## LFO Information

There is a single LFO (low frequency oscillator). The LFO is applied to either pitch or amplitude (loudness) of the oscillators. If it is applied to pitch, then it affects all operators globally. If it is applied to amplitude it can be adjusted individually for each operator. The type of wave of the LFO can be selected (eg, triangle, sine, random, etc). The speed can be changed, and it's depth as it applies to either pitch or amplitude can be adjusted as well. You can also set a delay for the LFO so that it only starts affecting the pitch/amplitude after a given time after a note is pressed and held.

## Envelope Information

When a key is pressed and held, the envelopes start their movement from start to finish. These envelopes are more complex than a regular ADSR envelope on a synth, and can be somewhat confusing at first glance if you have not encountered them before. Each envelope is specified by four rates and four levels. The rate represents time, and a lower rate is a slower time to move to the next level. The level represents an amplitude level (loudness) of the oscillator at a specific point in time. Assuming that a key is pressed, held, then released some time later, here are the stages and corresponding points on the diagram:

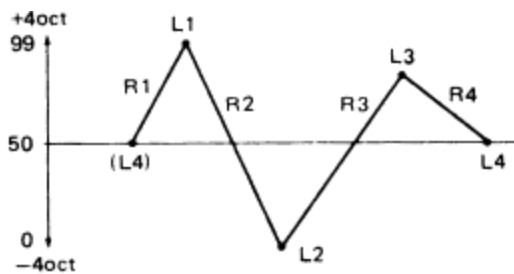
1. As soon as the key is pressed, the amplitude is specified by the L4 value
2. Over a period specified by R1, the amplitude moves to the value specified by L1.
3. The amplitude moves to L2 over a period R2.
4. The amplitude moves to L3 over a period R3. It will then stay at L3 as long as the key is held.
5. When the key is released, the amplitude moves to L4 over a period R4.
6. When it reaches L4 it stays at that level indefinitely.



Assuming you have L1 set to 99, L4 set to 0, L2 set to whatever L3 is set to, and R3 set to 0, you can mimic an ADSR envelope as follows:

Attack	R1
Decay	R2
Sustain	L3
Release	R4

The Volca FM has seven envelopes. The first six behave as described above and are assigned to the six operators. The seventh is similar in that it has the same rates and levels as the first six, however it applies to the pitch of the global voice. Since it applies to pitch, a value of 50 for one of the levels represents the pitch played on the keyboard. A value greater than 50 is a higher pitch and a value less than 50 is a lower pitch. Other than that, it behaves the same as the above.



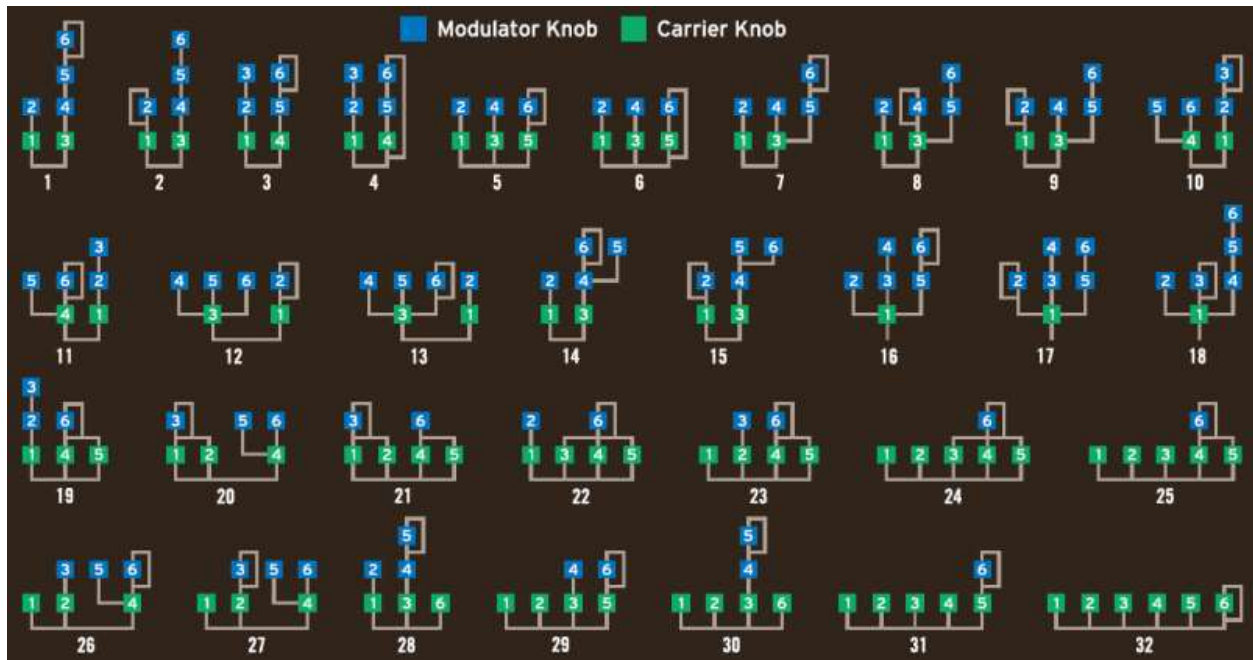
## Knob, slider and button settings

**Octave buttons (left and right)** – In edit mode, these switch between operators 1-6 or enter global voice editing (after operator 6). On the cheat card that comes with the Volca FM, the yellow settings are the per-operator settings (ie each operator has all these settings), and the blue settings are the global voice parameters (ie there is one setting for the program you are editing).

**Program** – In edit mode, this switches between the various parameters for the currently selected operator, or, if the global voice settings are selected, switches between parameters for the global voice.

**Velocity Slider** – . In edit mode, this slider changes the value of the currently selected parameter in increments of 1. Slide it all the way up for maximum and all the way down for minimum. Most settings range from 1-99, but others have a narrower range. When not in edit mode, this specifies the velocity of recorded as well as played notes. Volca FM is not velocity sensitive to MIDI notes played, so this is the only way to adjust velocity of notes – in realtime. In order to hear a change when this slider is used, the “Key Velocity Sense” for one or more operators needs to be set to a value greater than zero.

**ALGRM** (Algorithm Select) - This knob permits selection of one of the 32 algorithms as shown in the following chart. Changing algorithms can drastically alter the sound.



**LFO Rate** - The speed (frequency) of the LFO can be set from 0 to 99. 0 is the slowest LFO speed while 99 is the fastest. See the LFO section above for more information.

**P.Depth** (pitch modulation depth) - Varies, over a 0 to 99 range, the depth of LFO modulation applied to pitch. A 0 setting produces no pitch modulation and a setting of 99 produces maximum modulation. See the LFO section above for more information.

**Transpose Slider** - Transposes pitch over a  $\pm 3$  octave range in octave steps. Note that this differs from the Octave buttons in that it actually transposes the sound engine (not the keyboard) and therefore affects the sound of already recorded notes as well as played notes. Note also that there is a global transpose setting discussed later which lets you transpose in semitone increments.

**Modulator Attack knob** – This will adjust the attack rate of all the operators that are designated as Modulators (blue in above image) for the current algorithm. The attack value for these is specified on a per operator setting via “EG Rate 1” on each operator. This knob will offset that value for each of these operators either negatively or positively as you turn it left or right. Ie. If the operator has a value of 99 (fastest attack) then turning this counter-clockwise will have no effect as it’s already as fast as it’s going to get, however turning it clockwise will slow down the attack speed. See Envelope section below for more info.

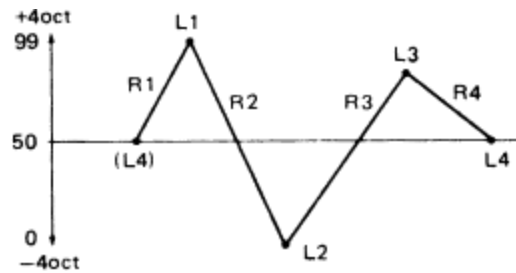
**Carrier Attack knob** – Same as modulator attack knob (above) but applies to all the operators that are designated as Carriers (green in above image).

**Modulator Decay knob** – This will adjust the decay rate of all the operators that are designated as Modulators (green in above image) for the current algorithm. The decay value is classified as EG Rates 2, 3 and 4 on each operator. This knob will offset all three of these values for each of these operators either negatively or positively as you turn it left or right. See Envelope section below for more info.

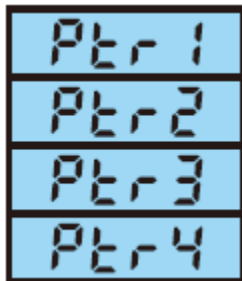
**Carrier Decay knob** – Same as Modulator decay knob (above) but applies to all the operators that are designated as Carriers (green in above image)

## Global settings

### Pitch EG

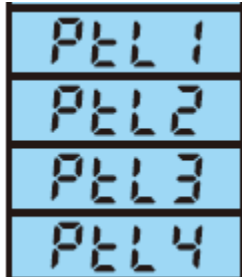


PITCH EG permits variation of pitch by  $\pm 4$  octaves either side of standard pitch (50). The RATE and LEVEL parameters of the PITCH EG can be set just as in the other envelope generators. See the envelope section above for more details.



Rate (0-99)

A 0 setting produces the longest (slowest) RATE, and a 99 setting produces the fastest RATE.



LEVEL (0-99)

With a setting of 50 as standard, a setting of 99 permits +4 octaves pitch variation while a setting of 0 permits -4 octaves pitch variation. Set LEVEL 1 through LEVEL 4 to 50 to defeat the PITCH EG function.



Feedback (00-07)

One operator in each of the 32 algorithms has its output fed back to its input. This is the feedback operator. The amount of feedback applied can be adjusted over a range of 0 to 7. By increasing the FEEDBACK level the harmonics are increased, resulting in the generation of noise-like sounds.

0FS

Osc Key Sync (00=off, 01=on)

When the SYNC function is ON, all oscillator begin operation from the same phase angle (0 degrees). With SYNC OFF the phase angle at which an operator begins oscillation is carried over smoothly from the preceding note. In the polyphonic mode, for example, maximum simultaneous output is 3 notes. If a 4th key is pressed the first note makes a smooth transition to the 4th note.

LF0d

LFO Delay (00-99)

This creates a delay between initial key closure and application of LFO modulation. A setting of 0 results in no delay--LFO modulation begins the instant a key is pressed--and a setting of 99 creates the longest delay.

LANd

LFO Amp Mod Depth (00-99)

Varies, over a 0 to 99 range, the depth of LFO modulation applied to amplitude. A 0 setting produces no amplitude modulation, and a setting of 99 produces maximum modulation. Note that to hear amplitude modulation, you need to also adjust Amp Mod Sense on a per operator basis. For pitch depth, see dedicated knob above.

LF0S

LFO Key Sync (00=off, 01=on)







When SYNC is ON, LFO modulation begins at the same point in the LFO waveform when a key is pressed. When SYNC is OFF, LFO modulation starts at the current phase of the LFO, since the LFO is free running in this mode.



LFO8

LFO Wave (00=Triangle, 01=Saw Down, 02=Saw Up, 03=Square, 04=Sine, 05=S/Hold)

The Low Frequency Oscillator produces low-frequency sine, saw-tooth or square waves, or a SAMPLE/HOLD waveform. The LFO waveform can be used to apply vibrato, tremolo or "wow" effects to the voices. This selects the waveform output by the LFO. Any of the six waveforms shown below can be selected.

TRIANGL	: 	(Triangular wave)
SAW DWN	: 	(Number 1 sawtooth waveform)
SAW UP	: 	(Number 2 sawtooth waveform)
SQUARE	: 	Square wave
SINE	: 	Sine wave
S/HOLD	: 	Sample and hold

MSP

Mod Sense Pitch (00-07)

This adjusts the sensitivity (depth) of pitch modulation. This parameter must be greater than 0 before any pitch modulation can be applied. Sensitivity to pitch modulation is variable from 0 to 7. This value sets the modulation sensitivity for all operators. Pitch modulation is applied via the LFO, and results in vibrato type effects.

TrSP

Transpose (00-48)

Transposes pitch over a  $\pm 2$  octave range in semitone steps with C3 as standard.

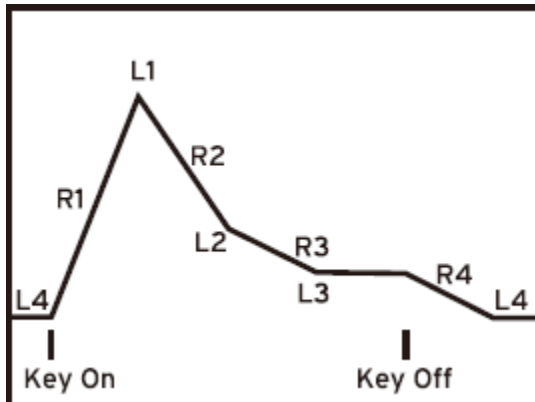
## Operator Specific settings

On

Operator On/Off (00 = off, 01 = on)

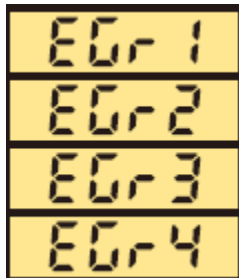
Results in the corresponding operator being turned OFF or ON. This setting IS saved with the Volca program, unlike the DX7 according to it's manual.

## Envelope Generator



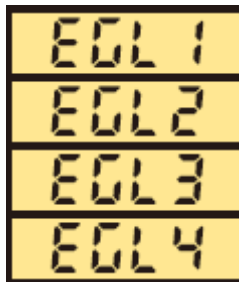
The envelope generator determines how the amplitude (volume) or timbre (tone) of a note will vary over time. Envelope modulation of a modulator results in time-based timbre variations, while envelope modulation of a carrier produces amplitude variations.

The parameters which determine the "shape" of the envelope are RATE 1 through RATE 4 and LEVEL 1 through LEVEL 4. The RATE parameters determine how long it takes the envelope to reach one LEVEL from another. The envelope applied to each operator can be set individually, permitting an essentially infinite range of envelope combinations.



EG Rate x (00-99)

Each RATE parameter can be set from 0 to 99. A 0 setting produces the longest (slowest) RATE and a 99 setting produces the fastest RATE.



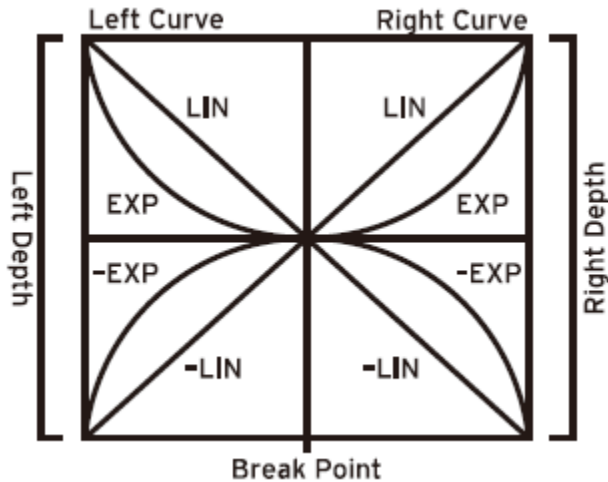
EG Level x (00-99)

Each LEVEL parameter can be set from 0 to 99. 0 is no output, while 99 is maximum level. Normally LEVEL 4 will be set at "0". In this case LEVEL 1 should be greater than "50" to ensure proper EG operation.



## Level Scaling

Permits raising or lowering the EG levels for keys to the left and right of any key specified as the "Break Point". This is basically a highly advanced version of the keyboard follower function found on some conventional synthesizers, permitting much finer scaling control. See diagram below.



LSbP

Level Scale Breakpoint (0-99)

The BREAK POINT key--the reference for the scaling function--can be specified anywhere between A1 and C8. Keys to the left of this key will correspond with the Left depth and curve, while keys to the right will correspond with the right depth and curve.

LSLd

LSrd

Level Scale Left Depth/Right Depth (0-99)

Varies the depth of each curve over a 0 to 99 range. A 0 setting results in a flat (no variation) curve, and a 99 setting produces maximum scaling depth.

LSLc

LSrc

LSrc

Level Scale Left/Right Curve (00=-LIN, 01=-EXP, 02=EXP, 03=LIN)

Permits variation of the scaling curve to the left and right of the BREAK POINT key. Four different curves are available, as shown in the figure.



OSC Rate Scale (00-07)

The EG for each operator can be set for a long bass decay and short treble decay--as in an acoustic piano. RATE can be set from 0 to 7. The higher the rate, the shorter the decay on the EG becomes.



Amp Mod Sense (00-03)

This adjusts the sensitivity (depth) of amplitude modulation. This parameter must be greater than 0 before any amplitude modulation can be applied. Sensitivity to amplitude modulation is variable from 0 to 3. Amplitude modulation sensitivity is set independently for each operator. Applying amplitude modulation to a modulator creates "wow" effects, while applied to a carrier it results in tremolo effects. On the Volca FM, this setting determines how much the LFO affects this operator's amplitude.



Key Velocity Sense (00-07)

Permits adjustment of key touch response. That is, how the velocity with which the keys are played affects the sound. Since touch response can be applied to carriers or modulators, variations in timbre as well as level can be produced. Sensitivity can be set from 0 to 7. No touch response will be produced with a 0 setting, while a setting of 7 produces maximum response. On the Volca FM, there is no velocity information recognized with each key. The velocity slider determines the current velocity setting at any given time.



Output Level (00-99)

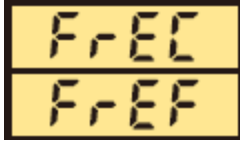
Controls overall EG level, like the EG DEPTH controls in conventional synthesizers. Note that setting a large DEPTH value for Level Scale depth and either the +LIN or +EXP curve will result in output from the operator even if the operator's output level is set to "0".



Osc Mode (00=Freq Ratio, 01=Fixed Freq)

FREQUENCY (RATIO) mode - operator pitch is scaled to the keyboard as normal.

FIXED FREQ (HZ) mode - a fixed frequency is produced no matter what key is pressed.



Freq Coarse (00-31), Freq Fine (00-99)

If Osc Mode is set to FREQUENCY (RATIO) the operators are set to a standard frequency of 1.00 (8 feet) when the PITCH COARSE key is pressed. The frequency can then be varied from by one half (0.5 times) to 32 times. FINE adjustment is possible over a range of from 1 to 1.99 times. If the frequency is increased by 2 times, for example, the pitch will increase by one octave.

If Osc Mode is set to FIXED FREQ (HZ), COARSE adjustment is possible in four steps--1, 10, 100 and 1000. FINE adjustment is possible from 1 to 9.772 times.



Detune (00-14)

The operator frequencies as determined by the FREQUENCY COARSE and FREQUENCY FINE controls can be detuned over a -7 to +7 range.

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