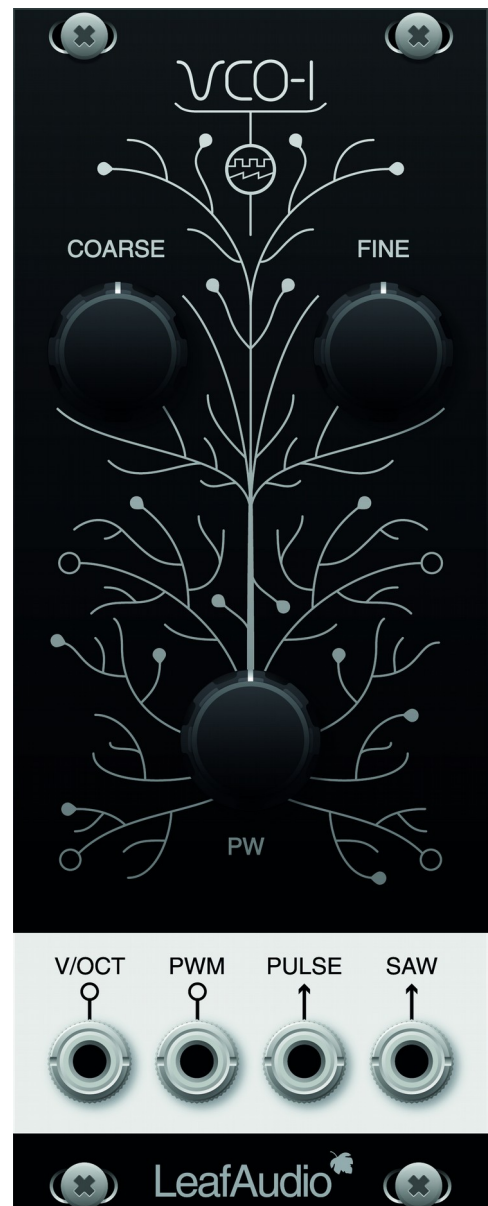


VCO-1

Voltage Controlled Oscillator

Manual

Version 1.4 - KW52'2018



First things first

RTFM

Please do yourself and us a favor and read the manual! If you only spend a tenth of the time we invested in writing, you will be able to operate the device perfectly. In case you are sitting in front of many tiny components: Please read the instructions for the DIY kit first!

Intended Use / Basic Function

The VCO-1 is designed to operate within a modular synthesizer (Eurorack standard). The VCO-1 is a purely analogue oscillator for audio frequencies.

Safety Instructions

The VCO-1 module is not intended for operation in or under water or at high humidity. Conductive and/or corrosive liquids, gases, aerosols or vapours may damage or destroy the equipment, regardless of its operating condition. The same applies to fires or temperatures above 85°C/185°F. The VCO-1 is also designed to operate on a symmetrical DC voltage of +/- 12V.

A suitable power supply unit is absolutely necessary for operation, which provides a safe extra-low voltage that is galvanically isolated from the mains supply.

Avoid mechanical stress, shocks or strong vibrations.

Always use signal sources and destinations for the VCO-1 that meet the levels and requirements of the Eurorack standard. Never connect headphones or consumer hi-fi devices to the module!

Contact / Responsible

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Disposal

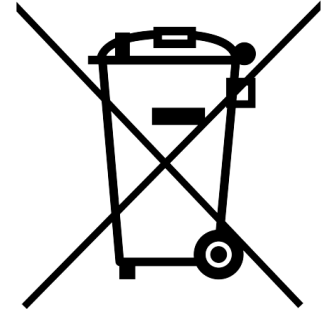
For private households: Information on Disposal for Users of WEEE

This symbol (figure on the right) on the product(s) and / or accompanying documents means that used electrical and electronic equipment (WEEE) should not be mixed with general household waste. For proper treatment, recovery and recycling, please take this product(s) to designated collection points where it will be accepted free of charge. Alternatively, in some countries, you may be able to return your products to your local retailer upon purchase of an equivalent new product.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point.

Penalties may be applicable for incorrect disposal of this waste, in accordance with your national legislation.



For professional users in the European Union

If you wish to discard electrical and electronic equipment (EEE), please contact your dealer or supplier for further information.

For disposal in countries outside of the European Union

This symbol is only valid in the European Union (EU). If you wish to discard this product please contact your local authorities or dealer and ask for the correct method of disposal.

Please think of our planet! Repair, resale or
upcycling are always better than final disposal.

Specifications

Width:	10 HP/TE, w/4 Schroff-Holes
Depth:	30mm (1,37"), single PCB
Weight:	120g (4,2oz)
Power demand:	+12V rail: 21mA -12V rail: 19mA
Frequency range:	20Hz – 20kHz, adjustable via 2 Potentiometers coarse and fine
Tracking linearity:	Minimum 4 octaves or even more
Waveforms:	Saw and pulse Triangle and morph via additional EXP-1 module
I/Os:	Pitch input (V/oct), pulsewidth ratio input, saw, pulse audio output

Thanks

THANKS for purchasing the VCO-1 and supporting us!

A few words about our philosophy: In contrast to many other DIY manufacturers, we produce our front panels and printed circuit boards in Germany. Local companies pay local people salaries and comply with the high local environmental regulations. We see this as a contribution to the environment and the economy - locally and globally. Furthermore, we only use high-quality materials and durable parts. Practices such as planned obsolescence are absolutely out of the question for us. We hope that our customers will appreciate this and support us in doing so, even if it costs us and them slightly more.

Installation

For connecting VCO-1 to EXP-1 via link cable, please make sure you read the note at the very end of the manual! Right polarity is extremely important here!

But before we start: Safety first! Please disconnect your Modular System from mains power.

Secondly, ensure your bus board complies with the Eurorack standard (connector pinout and voltage) and the power supply has sufficient power.

Double check the polarity of the ribbon cable and its proper connection (direction and offset). The red stripe must be attached to the -12V rail, both on the bus board and on the module side!

The module has a protective circuit (crowbar) which protects the module from polarity reversal for a short time.

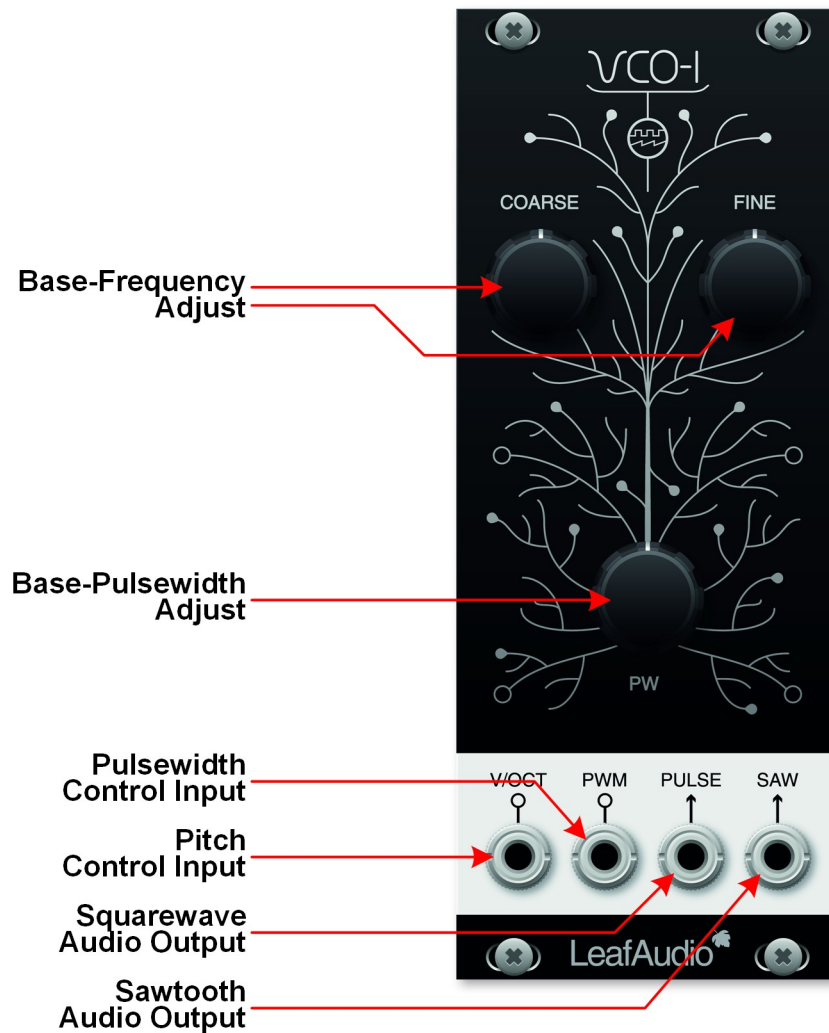
After you connected everything, double checked it and closed your system so no power lines can be touched by your hand, turn on your system and test the module.

We do not accept any responsibility for damage to the module or system caused by improper installation.

Usage

The operation of VCO-1 is quite simple. The two controls COARSE and FINE are used to set the base frequency, whereby a range of 8 halftones is tuned with the FINE control and the entire frequency range of 20Hz... 20kHz with the COARSE control. The pitch can be externally controlled by the pitch input (V/OCT), beginning from the base frequency, set by COARSE.

The base pulse width of the square wave signal (PULSE) can be adjusted at the PW controller and, similar to the pitch, can be controlled via the PWM input by means of an external signal (CV, LFO, ADSR...). When you add the EXP-1 module to the VCO-1, PWM and pitch can also be controlled by LFO.



Adjusting the Low Limit / Hi Limit

By the trimmers R40 and R41 you can adjust the lowest and highest frequency of VCO-1, when COARSE is set fully left / fully right. Do this before you adjust the 1V/oct tracking. Turn COARSE fully left and listen to the audio out of VCO-1. Now adjust R41 Low Limit to your taste. Then turn COARSE fully right (or as you are no chicken or bat maybe a bit lower so you can actually still hear the audio) and adjust R40 High Limit to your taste. As both parameters influence each other, you might have to repeat the process until the full range matches your taste. If you have got this, go on with 1V/oct tracking, please.

Adjustment of the V/OCT tracking

Via the corresponding pitch input, VCO-1 can be played by other synths, sequencers or Midi-to-Gate/CV interfaces. Before you do so, you need to manually adjust the 1V/octave tracking. If you have no experiences with that, it might be a little challenging, like on any other analogue VCO. Please have a couple of beers first, or whatever might calm you down. But with our guide it should be quite easy.

- Before you calibrate the module, please mount it behind the panel.
- Power it up and let it warm up at least 30 minutes, so it has its final working temperature.
- Do not touch the PCB while calibrating, hold it on the panel!

We were able to calibrate our test units to ~1,5 cents detuning between octave 1 and octave 5, which is pretty accurate.

Example: You play a note C1 and want to hear for example 100Hz (depending on the positions of coarse and fine tuning of your VCO), then one octave higher C2 should be 200Hz, C3 = 400Hz, C4 = 800Hz, C5 = 1,6kHz. If the 1V/oct scale is not adjusted correctly, this might not be the case and notes appear out of tune. It's your job now to correct this!

The easiest way is using Midi notes coming from a computer via a Midi-to-Gate/CV interface. Program a series of 2 quarter notes: C1 and C2. Use the CV signal of your Midi-to-Gate/CV interface and feed it into the CV input of VCO-1. Connect the sawtooth output to your monitoring system, so you are able to hear it.

Play your programmed C1 and stop. VCO-1 now got the control voltage for the lowest note on its CV input. Set the finetune knob to middle position and coarse tuning to a low note, which you can clearly identify as a note (and not so low, that it appears as a series of clicks).

Tip: Run and monitor the audio through your DAW (Ableton, Cubase...) and throw a tuner plugin into your monitoring channel. In a minute this will be useful.

When you now playback the sequence of 2 notes in octaves C1- C2, VCO-1 will generate some audible notes which hopefully are close to octaves, but they might be not.

Trimmer R24, labelled as 'Tune' sets the scale for the lower octaves. Trimmer R12, labelled as 'HiComp' corrects the scale for the higher range. You will possibly have to use both, but start with the 'Tune' one and work on the lower octaves first until they are absolutely tight.

While playing back the 2 notes, you use a small screw driver to carefully adjust the 'Tune' trimmer to the right or the left very carefully, listen what happens and try to find the position where the notes seem to be octaves or 'in tune'.

You have 2 possibilities at this point: a) doing it by ear or b) using a tuner. The problem is, that when you turn the trimmer, the base note always drifts. So if you already adjusted the lowest note to a C on your tuner, it will be something different in the next moment. The best thing is to have a musical ear and adjust it roughly by ear.

Once you managed to adjust the scaling for the lowest octave and they seem to be in tune, the higher octaves still might not be in tune. Use the 'HiComp' trimmer now to adjust this. Program a series of notes C1 - C2 - C3 - C4 - C5 and use that now.

In some cases you might have to alter between the two trimmers, change very very little things, hear the results, try different things. When the rough part is done, it makes sense to use the tuner plugin for finetuning.

Finally, once this is done, VCO-1 should be stable over a range of minimum 4 octaves, mostly even 5.

The Expander EXP-1

The EXP-1 increases the versatility of VCO-1 a lot! It is connected to VCO-1 with an additional ribbon cable. It adds an LFO with selectable triangle and square waveforms, which can be routed to various targets, such as pitch or pulsewidth of VCO-1, or you can use the LFO for external things, as it has an output connector.

Furthermore, inputs for linear FM and Sync as well as outputs for triangle and morph waveforms are added to the VCO-1. The morphing circuit seamlessly fades between triangle and square or triangle and sawtooth of VCO-1. This function can also be performed by the LFO or by external control voltages (CV).

EXP-1 v1.3 is released at the same time as VCO v1.4, but also works with older VCO-1 versions.

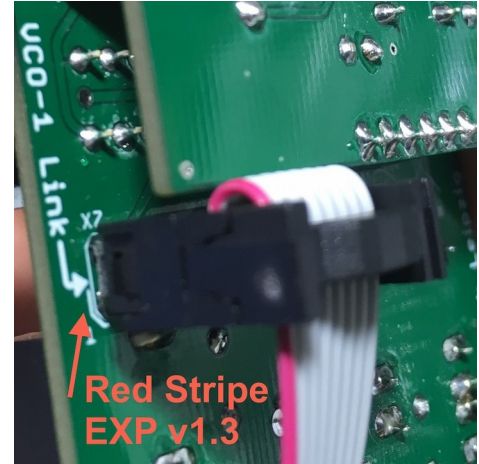


**For connecting your VCO-1 to EXP-1, please read
the info on the next side!**

Please read the following info for connecting your VCO-1 to EXP-1:

If the connection is reversed, some components might blow up. But even that can be repaired quite easily then.

VCO-1 v1.4 and EXP-1 v1.3: The link connectors on both PCBs show a mark on the silk screen print at one corner of the connector. It is kind of a bracket around one corner. This is where the red stripe of the link cable sits on both modules. See the pictures on the right, please.



VCO-1 lower than v1.4 with an EXP-1: On the EXP side it's the same as above. On VCO-1 v1.0a and v1.1 red stripe faces south- or downwards, regardless which signs or numbers are written there! Check the compass rose to identify „south“.

