

## Oscillator 2

Version b, Build #4, 2023-06-01



This module is an oscillator with various functions.

- Hybrid analog-digital oscillator
- Fixed frequency adjustable matching note names without pitch CV
- Pitch output for use as pitch CV source or transposer
- Switchable fixed pitch offset for *Voltage/Moog* mode
- Unlimited pitch input voltage
- Huge frequency range from almost 0 Hz up to 20 kHz.
- CV input for frequency modulation
- CV input for pulse width modulation
- Unlimited envelope CV input with ring modulator capability
- Output signal bipolar or unipolar
- Inbuilt meters for voltage, frequency, cycle time

## Function

In audio range 10 to 20,000 Hz an analog-style oscillator produces naturally sounding signals. Below 1 Hz a pure digital oscillator provides clean wave forms. Between 1 and 10 Hz both oscillator signals are smoothly blended from one to the other.

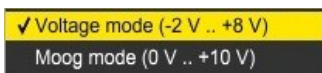
## Controls and connectors



A voltage at the **pitch** input jack controls oscillator frequency with 1 V/octave. Basically any control voltage can be sent to this input jack. There is no limitation of value and frequency.

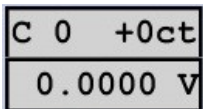


When mouse cursor is on pitch label, a red frame appears. It indicates a hidden function.

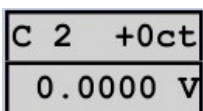


After a right click on the label a drop down menu lets you select a **pitch mode**. Actual pitch mode is marked with a hook sign. You can switch to the other mode by clicking on it. A click to anywhere will keep actual mode.

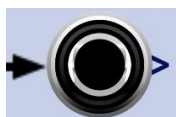
Within *Voltage Modular* pitch range is from -2 volts (tone "C0") up to +8 volts (tone "C10") while traditional hardware *Moog* synthesizer modules mostly work within a range from 0 volts ("C0") to +10 volts ("C10"). This means, that in *Voltage mode* all tones are two octaves higher than in *Moog mode*.



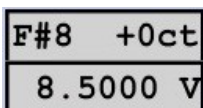
Above pitch input jack there are two displays. Lower one shows actual input voltage, upper one the resulting note according selected pitch mode.



In *Moog mode* tone C0 is at 0V (upper display image), while in *Voltage mode* tones are transposed two octaves higher (lower display image).



This is **pitch output** jack. It provides total pitch voltage that is used to set internal oscillators' frequency and includes *Voltage* pitch offset, *fm* modulation as well as all settings of **octave**, **tune** and **fine tune**.



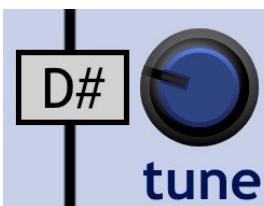
Above pitch output jack there are two displays. Lower one shows total pitch voltage, upper one the resulting note.

Following table shows displays depending on pitch input voltage and selected pitch mode:

input	Voltage mode	Moog mode
<= -10.0 V	cv<min	cv<min
	cv<min	cv<min
-9.9989 V	cv<min	cv<min
	-9.9989 V	-9.9989 V
-2.5 V	cv<min	cv<min
	-2.5000 V	-2.5000 V
-1.5 V	F#0 +0ct	cv<min
	-1.5000 V	-1.5000 V
0.0 V	C 2 +0ct	C 0 +0ct
	0.0000 V	0.0000 V
8.0 V	C 10 +0ct	C 8 +0ct
	8.0000 V	8.0000 V
8.5 V	cv>max	F#8 +0ct
	8.5000 V	8.5000 V
10.0 V	cv>max	C 10 +0ct
	cv>max	cv>max
> 10.0 V	cv>max	cv>max
	cv>max	cv>max

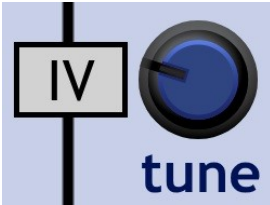


With **octave** knob oscillator pitch can be transposed from -15 to +5 octaves. Default is 0.



**tune** knob allows to transpose oscillator pitch from 0 to 13 half tone steps. When no cable is connected to pitch input or pitch input voltage is an integer value, **tune** will set frequency according to displayed note names.

tune



When oscillator pitch is controlled by CV, it might be better to see step numbers instead of notes. A click on the tune label with left mouse buttons changes step label format.



This knob can be used to adjust pitch with with very fine “cent” steps (1 cent = 1/100 halftone).

Fine tuning is possible from -99 to +99 cent.



A voltage at **fm** input jack can influence oscillator pitch. Attenuverter knob allows to adjust CV amount with a factor from -2 to +2. At a 1.0 knob value **fm** CV acts with 1 octave/volt. Maximum **fm** value (product of CV and knob value) is +/- 10 volts.



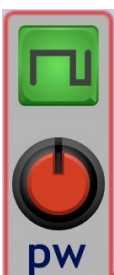
A trigger pulse at **restart** input jack or a click on the button lets oscillators restart a wave. This is especially useful, when **Oscillator 2** is used at very low frequency in order to control other devices.

The restart appears, when rising restart input CV exceeds 2.5 volt.



With these toggle buttons you can select one of five output signal wave forms:

- ramp
- triangle
- sine
- pulse



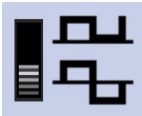
When pulse wave is selected, pulse width can be adjusted with the **width** knob within a range from 0.005 to 0.995.

Knob default value is 0.5 (square wave).



When a cable is connected to **pwm** input jack, pulse width may be controlled by a CV. Attenuverter knob allows to adjust CV amount with a factor from -2 to +2.

The adjusted CV amount will be added to **pw** knob value. Resulting sum gets clipped, when it exceeds range 0.005 to 0.995.



Audio signals are usually bipolar, that means, they do not contain a DC value.

Against with audio signals control voltages can also be unipolar, that means they are either only positive or negative. This slider switch lets you set output signal according to your needs.



CV at **env** input jack controls output signal level. For example this CV can be an envelope signal. It gets normalized by a factor of  $1/5$ . That means, at 5 volts the output level will be multiplied by 1.

Negative CV will change signal polarity. So with this control voltage a real amplitude modulation is possible. (“Ring Modulator”)

Because CV value is not limited, absolute values higher than 5 volts can increase absolute output level without any limitation.

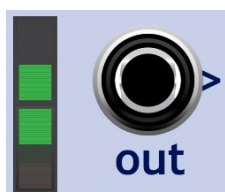
When no cable is connected to **env** input, output signal level will be multiplied by 1 and depends only from volume knob setting.



With **vol** knob you can attenuate output signal level. Knob value overrides input CV.

Default volume is 0.5 (50 %).

Volume meter bar shows total volume factor, which is the product of **env** voltage, **env attenuator** value and **volume** knob value. That volume factor will set absolute signal output level.



**out** jack provides oscillator output signal. When no cable is connected to **env** input jack, output signal voltage level is within -5 to +5 volts range.

2.5737 Hz

Above out jack a “multi meter” displays one of three measurements:

- Oscillator frequency
- Signal cycle time
- Momentary signal voltage

Frequency is measured in Hz and will be displayed with five digits and a decimal sign.

2.5737 Hz

When mouse cursor is on the display field, it's frame becomes red. A left click on the display switches to next kind of measurement.

388. msec

For cycle time measurement display format depends on actual value.

49.73 sec

29d16h55m

-1.4697 V

Voltage measurement is only useful at very low frequency, for instance when cycle time is higher than some seconds.

## Schematic Block Diagram

