INTRODUCTION

In everyday usage, 'chaos' means 'disorder, randomness'. In mathematics however, chaos has a very specific meaning. Chaos theory deals with systems exhibiting highly irregular behaviour, seemingly random yet completely deterministic.

Applying this to the world of modular synths opens up a whole new world of modulation opportunities, introducing a natural irregularity to otherwise purely 'mechanical' music, yet with much more control and repeatability than just simple randomness.

In chaos theory, the combination of all possible oscillations at a specific set of parameters is known as the 'attractor'. Orbit 3 incorporates a modified electronic analogue of the classic double-scroll attractor. Since it contains some (bi)stable regions in addition to chaotic ones, this type is known as a 'strange' attractor.

The voltages at each of the module's outputs can be thought to describe the orbit of a particle through 3D space around two equilibrium points. The positions of these points, as well as the distribution of the orbits and rate of movement can all be adjusted under manual or voltage control.

Not just limited to low frequency modulation use, Orbit 3 can operate in the audio frequency domain as well, yielding a variety of waveforms from its three complementary output pairs. These span a wide range, from near-sine waves to white noise. The addition of temperature compensation and calibrated pitch tracking makes for an unconventional and lively, yet also accurate audio oscillator.

And when you need a break from all that musical chaos, simply connecting any pair of outputs to the XY inputs of an oscilloscope will surely not disappoint!

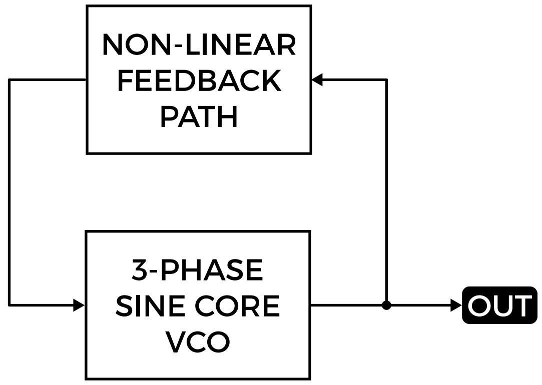
CONTENTS

In the Orbit 3 box, you'll find:

- Product card, stating serial number and production batch.
- 16-to-10-pin Eurorack power cable.
- Mounting hardware: four black M3 x 6 mm hex screws, four black nylon washers and a hex key.
- The Orbit 3 module itself, in a protective cotton bag.

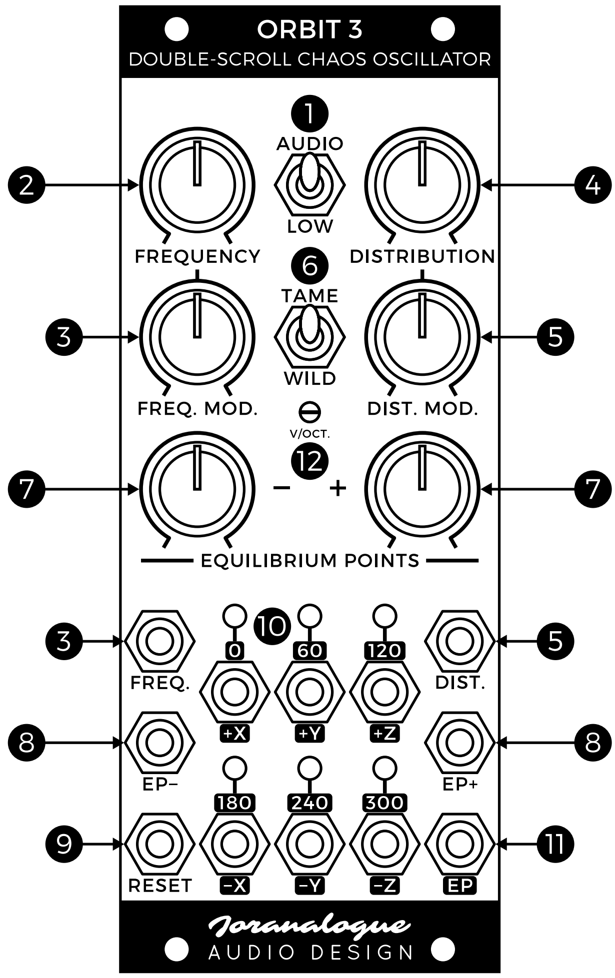
If any of these items are missing, please contact your dealer or support@joranalogue.com.

SIGNAL FLOW



Input | Output | Connection | Normalised connection | Mixer

CONTROLS & CONNECTIONS



1 FREQUENCY RANGE SWITCH

This switch determines over which frequency range Orbit 3 will operate: low frequency (VCLFO) or audio frequency (VCO).

2 FREQUENCY KNOB

Although it may not always be apparent with highly irregular chaotic signals, there is a constant underlying oscillation frequency. This drives the chaos and sets the rate at which the signals evolve. It is controlled by this knob, with a range of 22 Hz to 22 kHz in the audio frequency mode.

In low frequency mode, the total range is 2.4 mHz (a period of 7 minutes) to 180 Hz, with 1 Hz when the knob is centred.

3 FREQUENCY MODULATION INPUT AND KNOB

This input is used to modulate the frequency in an exponential fashion. It includes a polariser knob to set the modulation depth, with 0 in the centre, standard +1 volt per octave maximum and –1 volt per octave minimum in audio mode.

In low mode, the sensitivity is increased to approximately 0.6 volt per octave.

4 DISTRIBUTION KNOB

The distribution knob manipulates Orbit 3's internal feedback path to change the nature of the chaos generated by 'widening' the orbits. When configured with a large distribution, the oscillator will typically orbit closer to each of the equilibrium points and spend more time around it before switching to the other point.

5 DISTRIBUTION MODULATION INPUT AND KNOB

The distribution parameter can be modulated using this input, which also includes a polariser knob. A modulation value of +5 V results in maximum distribution.

6 TAME/WILD SWITCH

This switch presents another way to affect the kind of chaotic signals that are generated. In tame mode, the orbits take the form of two distinct scrolls. In wild mode, changing scrolls becomes much easier, usually resulting in more irregular orbits.

7 EQUILIBRIUM POINT KNOBS

Rotating either of these knobs clockwise moves the corresponding equilibrium point further away from the origin (0 V). As such, these parameters affect the output amplitudes as well as the nature of the chaotic signals. Additionally, setting both points in different positions results in asymmetric attractors, and changing one point affects both scrolls.

Any combination of the system parameters may result in stable oscillation (much like a standard VCO), bistable operation (cycling between two different orbits) or full chaos, which is typical of chaotic systems.

8 EQUILIBRIUM POINT CV INPUTS

Both equilibrium points can be voltage modulated using these inputs, with 0 V and +5 V corresponding to the minimum and maximum values for each scroll.

9 RESET INPUT

Orbit 3's core can be instantly reset by a rising edge on this input, much like the 'hard sync' on a conventional oscillator. Depending on the chaos parameter values, the oscillation direction may also flip during each reset pulse, leading to octave down effects at audio frequencies.

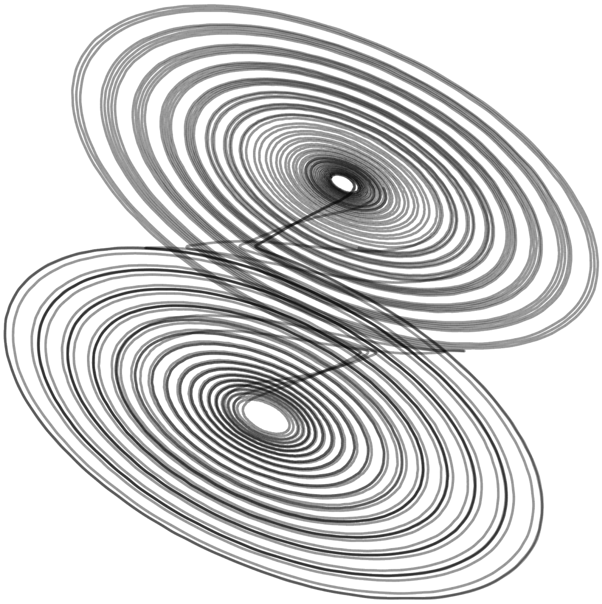
This input is uniquely designed to be driven reliably even from weak, slow, bipolar signals. It features Schmitt action, with a +2 V low and +3 V high logic threshold.

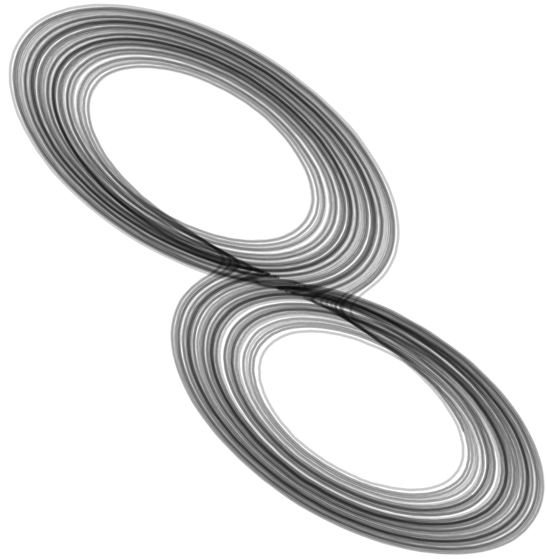
10 CHAOS OUTPUTS

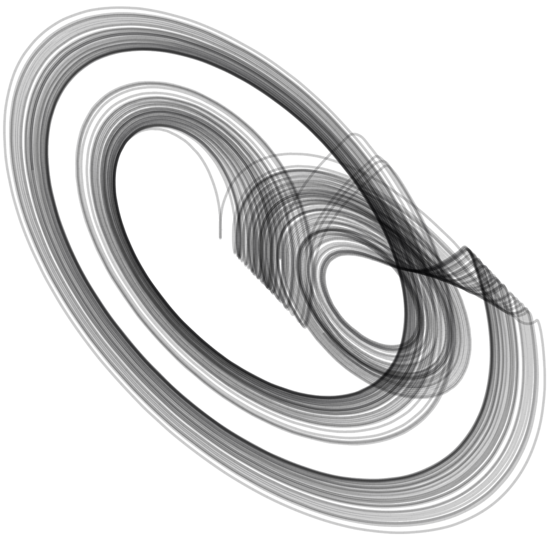
These are the outputs from the different stages inside the chaotic oscillator's core. They represent a three-dimensional orbit on axes X, Y and Z around two adjustable equilibrium points. The output signal of each successive stage will be phase shifted by 60°, as shown on the front panel, although the irregular nature of chaos means this is not always apparent. For patching convenience, inverted outputs are included as well, yielding a full set of 6-phase outputs.

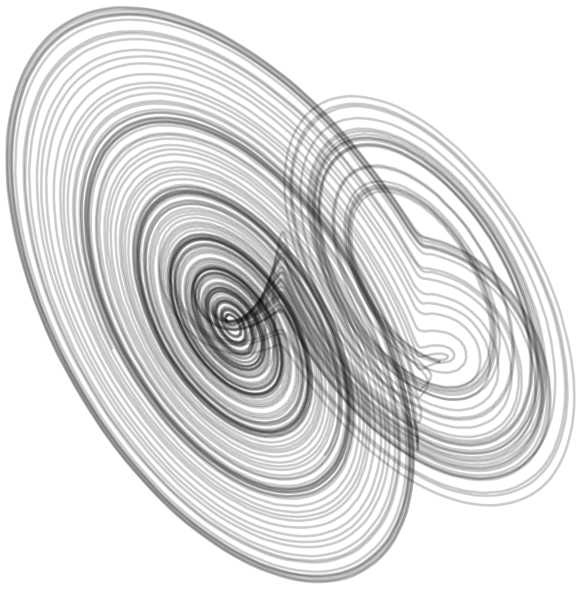
The output amplitudes typically range between 3 and 12 Vpp, as determined by the tame/wild switch and the distribution and scroll position parameters.

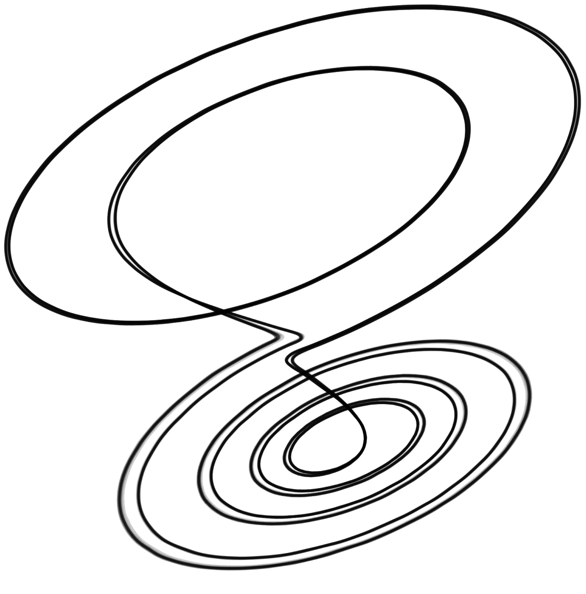
The images on the following page illustrate the typical figures that arise when projecting the 3D orbits onto two dimensions, with a variety of parameter values and in each case using only two out of six outputs. They are based on true output captures of the module in operation.

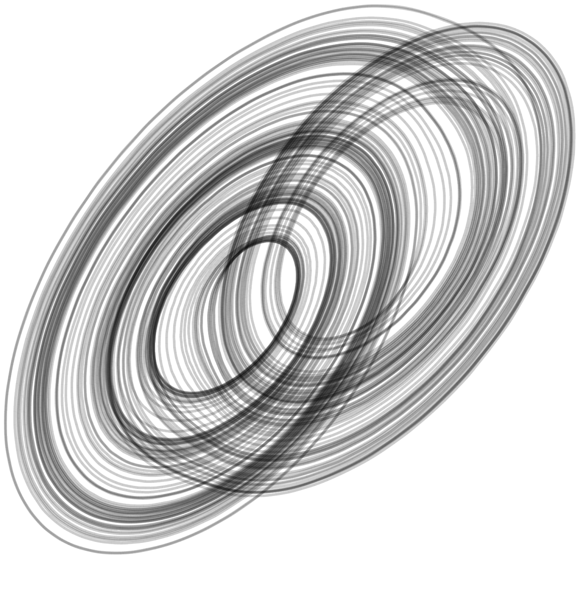












11 EQUILIBRIUM POINT OUTPUT

At each instance, this output represents the equilibrium point that is currently being orbited. The output voltage will alternate between +5 V for the positive scroll, and 0 V for the negative. The resulting signal may be used as a pseudo-random gate stream in low frequency mode, or as a sound source at audio frequencies.

12 VOLT PER OCTAVE TRIMMER

This trim potentiometer is used to calibrate the module's pitch tracking. Since it is accessible from the front panel, calibration can be easily performed without removing the module from the system. Each module is individually calibrated during production; do not adjust this trimmer if not needed.

Should you find your Orbit 3 to be out of tune, set it to the audio frequency range and in wild mode, with the coarse frequency knob to about 30 % of its range (10 o'clock), the distribution knob to 9 o'clock, and the frequency modulation and both equilibrium point position knobs fully clockwise. There should now be a steady, regular oscillation on all outputs. If not, you may need to adjust the distribution or equilibrium point knobs slightly.

Make sure Orbit 3 has been powered for at least 20 minutes at a stable ambient temperature. Now connect the equilibrium point output to a calibrated digital tuner.

During the tuning process, the frequency modulation input should be continually switched between 0 V and a precision +4 V source, toggled automatically or by hand. Leave all other inputs unpatched.

Using a dedicated trimming tool or standard 2.5 mm flat screwdriver, adjust the trimmer until the interval between both states is exactly 4 octaves. For example, if 0 V corresponds to a pitch of C1 + 23 cents, +4 V should yield C5 + 23 cents.

PATCH IDEAS

CHAOTIC DUET

You can create two alternated, chaotically modulated voices using Orbit 3, a gated signal switch and a single oscillator. Patch two different waveform outputs through the selector switch.

Set Orbit 3 in low mode and use one of the Z chaos outputs to frequency modulate the oscillator. Next, send the EP output to the gate input of the switch.

The switch will cycle between the two waveforms, each of them modulated around a different centre pitch. Each scroll is now given its own voice, resulting in a chaotic duet.

SAW WAVE CHAOS

There are many useful applications for feedback patching within Orbit 3. For example, patch any of the X outputs into the frequency modulation input and turn the modulation amount up to the maximum setting.

The waveforms at the Z outputs will now be saw-like, rather than sinusoidal. Experiment with different feedback path and output combinations of to achieve a wide variety of timbres.

STEPPED TONE GENERATOR

While stable points can be readily found by experimenting with the chaos parameters in normal operation, Orbit 3 can also be forced into stable oscillation by patching the EP output into the reset input.

While the oscillation frequency can still be controlled normally, adjusting the distribution and equilibrium point parameters will cause stepped changes in perceived pitch when the module is set in the audio frequency range. Use tame mode for the best results.

SPECIFICATIONS

Module format
Doepfer A-100 'Eurorack' compatible module
3 U, 10 HP, 30 mm deep (inc. power cable)
Milled 2 mm aluminium front panel with non-erasable graphics

Maximum current draw
+12 V: 70 mA
–12 V: 65 mA

Power protection
Reverse polarity (MOSFET)

I/O impedance
All inputs: 100 kΩ
Analogue outputs: 0 Ω (impedance comp.)
Gate output: 1 kΩ

Outer dimensions (H x W x D)
128.5 x 50.5 x 43 mm

Mass
Module: 140 g
Including packaging and accessories: 215 g

SUPPORT

As all Joranalogue Audio Design products, Orbit 3 is designed, manufactured and tested with the highest standards, to provide the performance and reliability music professionals expect.

In case your module isn't functioning as it should, make sure to check your Eurorack power supply and all connections first.

If the problem persists, contact your dealer or send an email to support@joranalogue.com. Please mention your serial number, which can be found on the product card or on the module's rear side.

With compliments to the following fine people,
who helped to make Orbit 3 a reality!

Björn Jauss   Boris Uytterhaegen

Daniel Miller   Frits Jacobs

Gregory Delabelle   Jan D'Hooghe

Janus Coorevits   Jérémy Bocquet

Jeroen De Pessemier   Lieven Stockx

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21st Century Analogue Synthesis—Made in Belgium

Joranalogue
AUDIO DESIGN

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