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Orbitals

dual bipolar voltage controlled step sequencer

USER MANUAL v1.04



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Introduction

Thank you for your interest in/purchase of a hexinverter.net Orbitals eurorack synthesizer module or DIY project! It is my hope that you find this sequencer a fun addition to your modular synthesizer.

This user manual exists to aid you in utilizing the Orbitals to its fullest potential as well as to explain the various features, functions and limitations of the design.

A huge thank you to **Hannes Pasqualini of papernoise.net** for his excellent graphics design and artwork used for this project! (<http://papernoise.net>).

As always, please email me with any questions you may need answered. I can be reached directly via email at [hex\[at\]hexinverter.net](mailto:hex@hexinverter.net)!

Please read on!

--Stacy Gaudreau
hexinverter.net Electronics

Module Features and Specifications

Module Description

Orbitals is an affordable 42HP eurorack analogue CV/Gate step sequencer that offers a lot of useful features in a package that does **not compromise on build quality**. It can operate as **two independent 8 step sequencers**, each with their own controls, or can be seamlessly switched into **16 step mode** and operate as a single 16 step sequencer.

Inspired by the linear step sequencers of the early modular years, it offers linear programmability and features like a **transpose input for plugging a keyboard** in and getting those "Tangerine Dream Style" sequences by playing the sequence with a keyboard attached.

Orbitals offers some more interesting modern features as well, including **bipolar CV output** and **voltage controlled step addressing** modes.

Each sequencer can operate in six different modes! Forward, reverse, pendulum, random, CV(clocked) and CV(not clocked).

Full Features List

- easily switch between 2x8 step sequences to single 16 step sequence mode
- bipolar CV output on/off switch
- two modes of voltage controlled step addressing
- forward, reverse, pendulum, random and voltage controlled modes
- each sequence has a reverse control input
- sequencer A transpose input for plugging a voltage source (ie: keyboard) into for classic style linear sequencing
- each sequencer offers its own internal clock source, or you can use an external source
- global gate length control (per sequence)
- sequence length control (per sequence)
- global reset button
- reset input per sequence
- run switch per sequence
- run input per sequence
- select the output voltage ranges with the jumpers on the back of the module

Technical Details

- 42HP width
- Requires approximately +90mA, -20mA @ 12V
- 30mm deep eurorack module design is skiff friendly (55mm depth for DIY kit)
- ~1V logic level inputs
- 0-5V step addressing
- Up to 10V CV/Gate levels output selectable via jumpers on the back
- Internal clock adjustable up to low audio range (~100Hz)

Controls and Features

Control and Feature Descriptions



UPPER SECTION

Sequencer CV Knobs: These knobs adjust the CV level at that step in the sequence. If in bipolar output mode, 0V is around the centre of the knob's position.

Sequencer Gate Switches: These switches allow you to select whether or not a gate happens at that step of the sequence. Toggle the switch IN to turn ON a gate for that step. These switches also have LEDs built into them that indicate the position of the sequence at any given time.

RATE Knobs: These control the speeds at which the internal sequencer clocks run at.

CV Outputs: The generated control voltage for each sequencer is available at the CV output. When in dual 8 step mode, each sequencer has its own outputs. When in single 16 step mode however, *sequencer B's outputs become the same 16 step sequence as sequencer A.*

Gate Outputs: The gate signal outputs at these jacks when the current step's gate switch is on.

RUN Switches: Toggling the RUN switch in turns the sequencer and activates its gate output. When the switch is toggled out, the sequencer stops running and ignores clock inputs; it also disables the gate output when not running.

LOWER SECTION

RUN inputs: These do the same thing as the switches, only they are active high logic inputs (the sequencer is ON if the voltage is HIGH [**above 1V**])

GATE Knobs: Each sequencer can have its gate duration adjusted from short triggers to longer gates with these controls. With faster sequences, you can actually tie adjacent steps' gates together, so, *if you're missing gates, check your gate duration setting as it may be set so that they tie together!*

LENGTH Knobs: These set the length of the sequence. *Orbitals automatically goes into 16 step mode when Sequencer A's LENGTH is set over 8 steps.*

MODE Knobs: These controls select the MODE the sequence steps in. There are six available modes of operation for each sequencer:

1. **FW – Forward mode.** The sequencer steps from *left to right* and then repeats
2. **REV – Reverse mode.** The sequencer steps from *right to left* and then repeats
3. **PND – Pendulum mode.** The sequencer steps from left to right, then bounces back to the left and repeats.
4. **RND – Random mode.** Each time a clock occurs, the sequencer picks a random step to land on.
5. **CV – Voltage Addressed mode.** Plug a CV signal into the RST/CV input and a 0 to 5V CV level will pick what step the sequencer is on. **A new gate is generated each time the step changes.**
6. **CLK – Voltage Addressed (CLOCKED) mode.** Like **CV Mode**, The CV level selects what step the sequencer is on, however, **a new gate is only ever generated when a new clock signal occurs.** This works a lot like a clocked *sample and hold*.

RST/CV Inputs: Applying a 1V or greater logic HIGH here will reset the sequencer to step 0 until the logic level goes back to LOW. **The next step will be step 1 of the sequence.** Step 0 doesn't actually exist. It's just an imaginary "nowhere" place.

When in either of the voltage-addressed modes (CV or CLK) this input jack is the CV input and reset functionality does not occur.

CLK IN: Apply a positive-logic clock here to use a different clock source than the internally generated clock. This input expects a 1V logic level for clock HIGH. **You can clock this input up to about 1KHz or so reliably,** so, low audio rate sequences can be achieved.

CLK OUT: The sequencers' internal clocks are output at these jacks for use elsewhere in your modular system. **The clocks are 0-5V level.**

REVERSE Inputs: The sequencer will run backwards so long as a logic HIGH is present at this input.

RESET Switch: Pressing this switch will reset both sequencers at once for syncing them up together.

TRANS A Input: Plug in a keyboard or other voltage source to *transpose Sequencer A's CV output by the given level*. This input simply adds the two CVs together, saving you using a DC mixer to get the same effect. Using a keyboard, you can set up a sequence and then transpose it up and down with your keyboard!

SLAVE B>A Switch: Activate this switch to make Sequencer B's transport control inputs (RUN, RST/CV In, CLK IN) sync up internally to whatever is controlling Sequencer A. *This saves a lot of patch cords if you're syncing the sequencers together!*

BIPOLAR Switch: Activating this switch turns on bipolar voltage output mode. The switch positions and output ranges are as follows:

BIPOLAR MODE	OUTPUT RANGES	
	5V Jumper Setting	10V Jumper Setting
ON	-2.5 to +2.5V	-5 to +5V
OFF	0 to +5V	0 to +10V

Output Level Jumpers

Because of the wide array of CV/Gate levels in eurorack systems, Orbitals offers jumpers on the back so the user can select what levels their sequencer operates at.

NEVER ADJUST THE JUMPERS WITH THE MODULE POWERED ON!

To change the output levels, **turn the power off** and remove Orbitals from your case. Move the jumper for the given output to the level you want it to operate at. Refer to the chart below for the output ranges possible:

BIPOLAR MODE	OUTPUT RANGES	
	5V Jumper Setting	10V Jumper Setting
ON	-2.5 to +2.5V	-5 to +5V
OFF	0 to +5V	0 to +10V