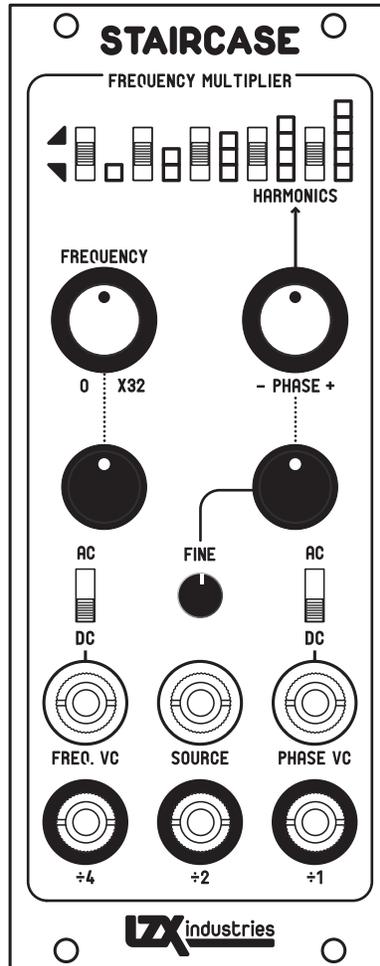# STAIRCASE
OWNER'S MANUAL

FLIGHT OF STAIRS

Staircase is the result of a few years of thought put into the subject of abstract pattern generation using analog computing techniques. It is a component of several modules designed for the purpose of processing horizontal and vertical ramp waveforms as the core source of a complex 2D figure or pattern. Staircase can be used in much the same way as a synced horizontal or vertical oscillator when fed a horizontal or vertical ramp as its source, but its applications are much more open ended.

In video synthesis patches using our first generation of modules, it was often difficult to break away from the restriction of horizontal and vertical elements and motions. This was largely due to VCOs being the primary pattern generation source, and VCOs being able to lock to either horizontal or vertical directions only. To generate a 2D pattern, a vertically locked oscillator would modulate a horizontally locked oscillator. Staircase breaks out of this paradigm entirely, since its frequency modulation function is achieved through nonlinear waveshaping. This makes it possible to multiply the frequency of a 2D plane rather than a unidimensional one. By this methodology, one pattern can create another, in endless configurations.

This method of using chained full wave rectifiers as frequency doublers was first used by us in the original Video Waveform Generator module, to double the frequency of the triangle oscillator core and enable the generation of a sawtooth/ramp waveshape output. It was used again in the polar-to-cartesian waveshaping portion of the Mapper module. Doorway expands on the concept and grants access to its inner workings in a creatively potent manner.

The artistic implications of this module go beyond the limits of my imagination, and I am beyond thrilled to see what you make with it.

Lars Larsen
November, 2016

STAIRCASE
OWNER'S MANUAL

Written by Lars Larsen

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LZX-SC-OM-V1.0

TABLE OF CONTENTS

FEATURES

Staircase is a wideband analog frequency multiplier for video processing and pattern generation. It allows the video synthesist to instantly add greater visual complexity to their patches. It can split an elliptical gradient into a series of concentric rings, solarize an input camera source until the brightness of the signal has wrapped around many times, or perform the simple functions of a VCA, mixer, and sawtooth-to-triangle waveshaper.
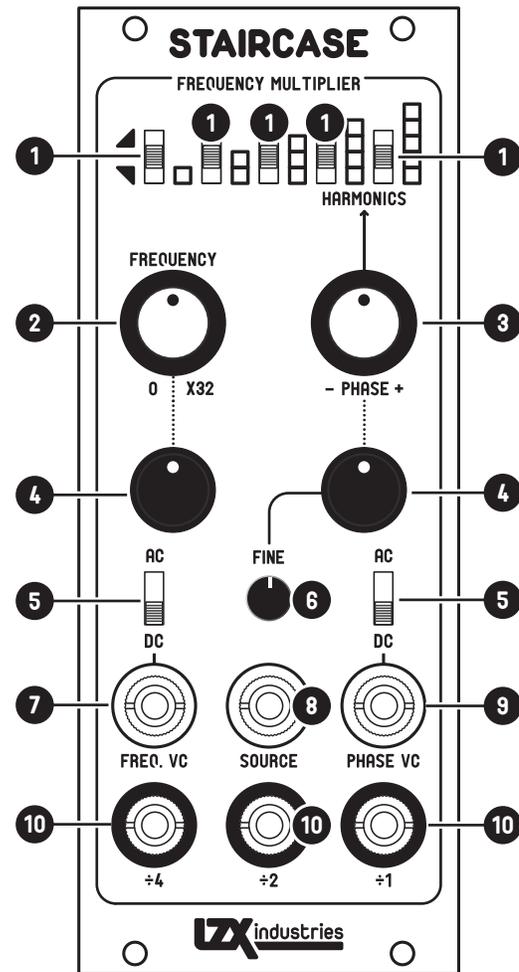
▶   Voltage controlled multiplication of the input frequency up to 32 times.

▶   Voltage controlled phase with harmonics selection allows 243 different visually rich modulation routings.

▶   Simultaneous output of three different multiplication frequencies enables the rapid generation of full color patterns.

▶   All signal and control paths perform at high frequency, video rate modulation speeds.

▶   AC/DC input coupling switches and inverting level attenuators on voltage control inputs.

▶   Fine tune control of phase modulation channel allows precise tuning of modulation input amplitudes for use cases in which visually continuous phase scrolling is desired.
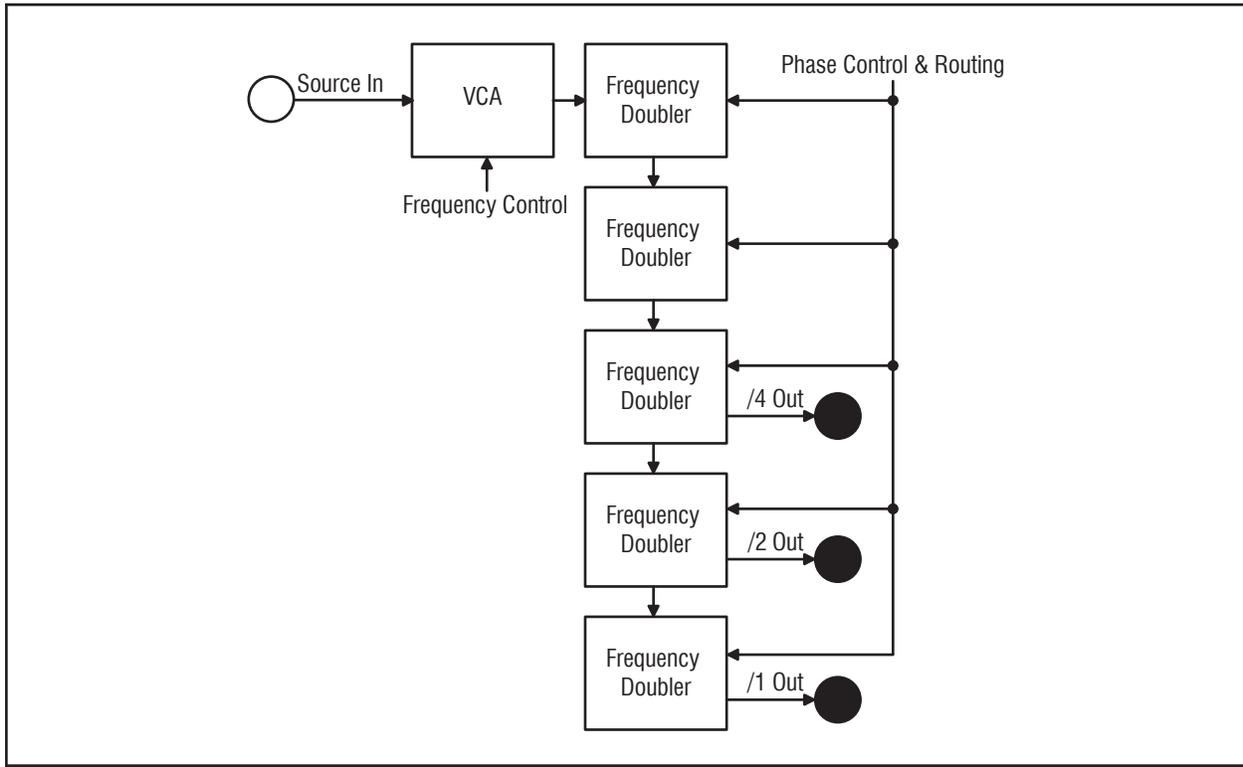
SPECIFICATIONS

Format	EuroRack Synthesizer Module
EuroRack Width	10HP
Mounting Depth	1.25 inches (31.75 mm)
Frontpanel Dimensions	1.9882 inches (50.5 mm) * 5.059 inches (128.5 mm)
+12V Power Consumption	70mA
-12V Power Consumption	70mA
Series Output Resistance	499 ohms
Input Termination Resistance	100K ohms
Voltage Levels (Expected)	0-1V DC
Voltage Levels (Absolute Maximum)	+/-12V DC

USER CONTROLS & CONNECTIONS

1 Phase control routing switches. In the upward positions, the phase voltage adds to the signal going into the associated frequency doubling block (first, second, third, fourth, or fifth.) In the downward positions, it subtracts. The combination of settings between these five switches determines the overall visual effect phase modulation will have on the output signals.

2 Frequency offset control. Counter-clockwise, the input source is fully attenuated. Adjusted clockwise, the frequency multiplication of the input signal increases from 1 to 32 repetitions.

3 Phase offset control. In its center position, the output is 0. Adjusted counter-clockwise, voltage is subtracted from the phase modulation channel. Adjusted clockwise, voltage is added. Modulation destinations are determined by the routing switches (1).

4 Inverting level controls. These controls set the depth of external voltage control modulation applied to the associated parameter. In their center positions, the output is 0. Adjusted clockwise from center, the signal is added to the associated parameter. Adjusted counter-clockwise, the signal is subtracted.

5 Voltage control AC/DC coupling switches. In AC mode, slow moving voltages are removed from the input signal and only high frequency content remains.

6 Phase fine tune control. This control adjusts the overall level of phase modulation by +/-10%. It is useful when attempting to match the level of an input voltage to the exact scale of the source amplitude for continuous scrolling.

7 Frequency external voltage control input. 0-1V DC full scale. The depth of modulation is set by the associated inverting level control (4).

8 Primary source signal input for frequency multiplier. 0-1V DC expected.

9 Phase external voltage control input. 0-1V DC full scale. The depth of modulation is set by the associated inverting level control (4).

10 Frequency multiplier outputs, 0-1V DC levels. The /1 jack is the primary output. The /2 and /4 outputs are direct outputs from the third and fourth frequency doublers in the chain, and will output frequences half and one fourth the frequency of the primary output.

BLOCK DIAGRAM

Source In · VCA · Frequency Doubler · Phase Control & Routing

Frequency Control

Frequency Doubler

Frequency Doubler · /4 Out

Frequency Doubler · /2 Out

Frequency Doubler · /1 Out

INSTALLATION

Power down your EuroRack case and disconnect it from AC power outlet while installing new modules.

Remove the module from its packaging and connect the 16-pin power cable to the keyed power entry header on the rear of the module as shown. Connect the other end of the power cable to an empty connector on your EuroRack power distribution busboard. Ensure pin 1 (-12V, with the red stripe) is oriented as indicated on your power distribution busboard.
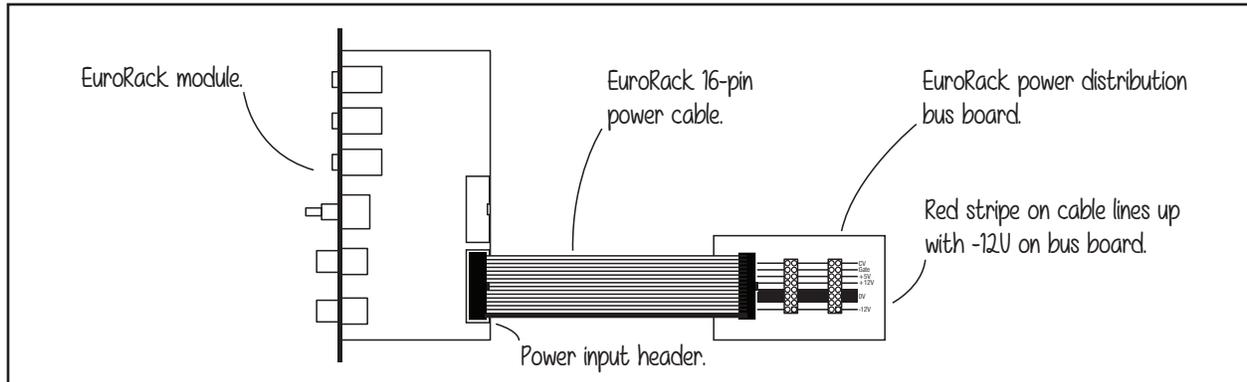

After connecting the power cable, mount the module frontpanel flush to your enclosure's EuroRack mounting rails and secure the module with the mounting screws provided by your enclosure's manufacturer.
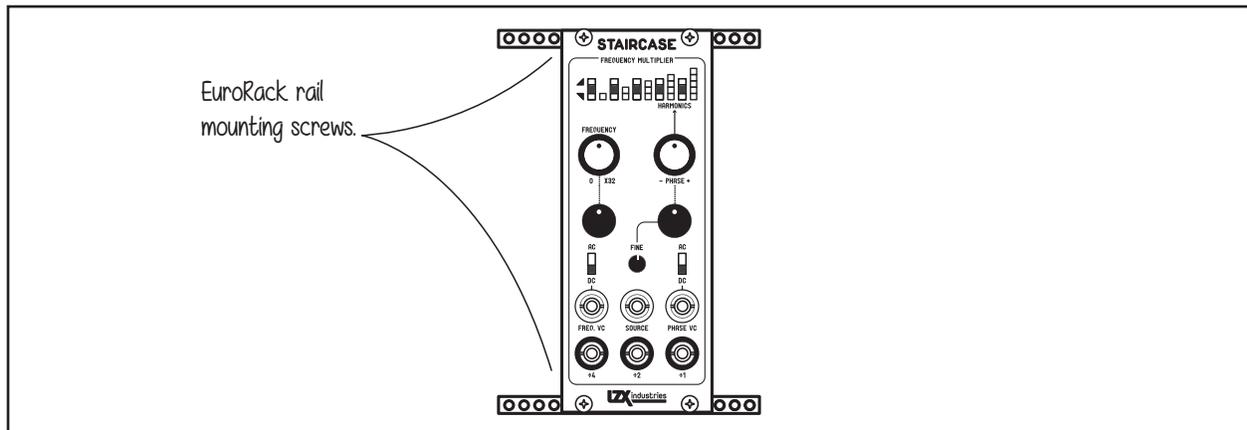
EXAMPLE PATCHES

COMPLEX COLORIZED PATTERN GENERATION

Part of what makes Staircase such a powerful component of a video synthesis system is its ability to achieve modulation over the density of a pattern. This patches takes the H+V ramp mix from Visual Cortex and multiplies its frequency to create a diamond texture with 32 diamonds, each nested inside the other. The Staircase's three outputs are patched to Red, Green and Blue to create a colorized version of the pattern.
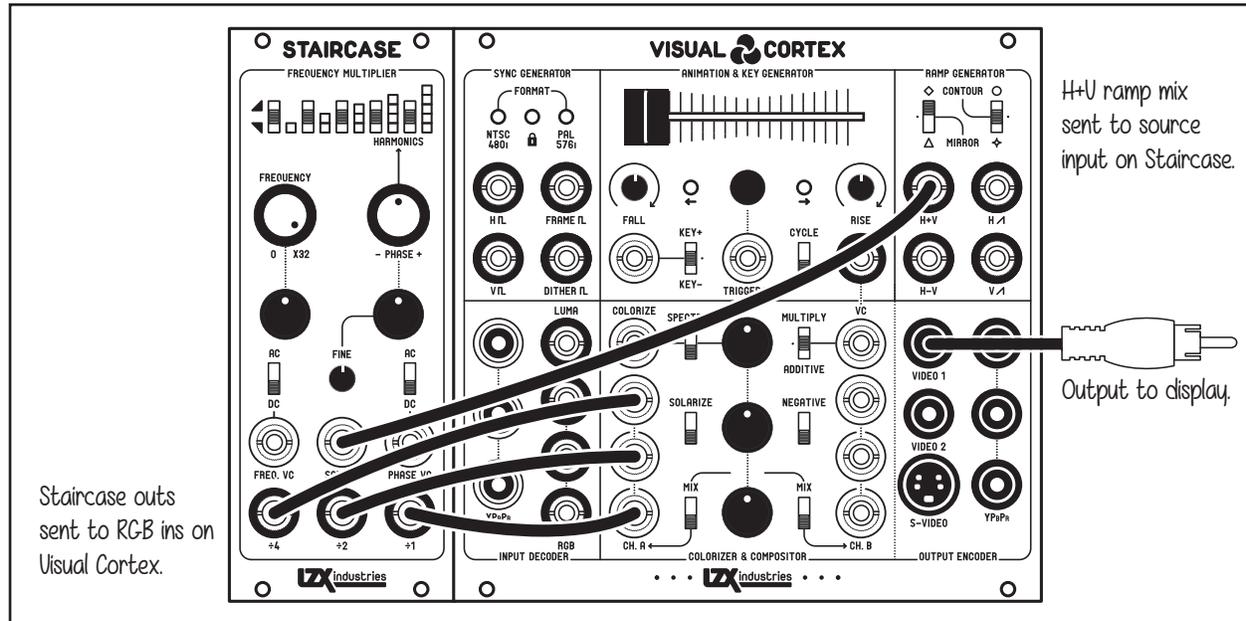
Further exercises and experiments to explore using this patch as a starting point:

▶ Patch the RGB connections in different orders to achieve variant color palettes.

▶ Instead of the H+V ramp mix, use external video as the input source to Staircase.

▶ Apply voltage control to frequency. Alternate ramp generator outputs (from Cortex) and external VCOs make great sources.

▶ Apply voltage control to phase. Flip the first harmonics switch up as a start point (others centered.) Play with switch settings.

▶ In a more complex patch, insert Staircase into the signal path before a voltage control input, and use it as a weird VCA (with extra effects!)

▶ With two Staircase modules, insert another processor in a processing chain between the two. Navigator's rotation feature is especially interesting in this use-case.

▶ By patching an output of Staircase to the Pedestal CV input of Prismatic Ray, you can gain access to all of its output waveshape slopes as well as mixing with its internal VCO as a modulator.

MANUFACTURER'S WARRANTY

Fully assembled versions of this product are covered by our manufacturer warranty for one year following the date of manufacture. This warranty covers any defect in the manufacturing of this product., such as assembly errors or faulty components. This warranty does not cover any damage or malfunction caused by incorrect use – such as, but not limited to, power cables connected backwards, excessive voltage levels, or exposure to extreme temperature or moisture levels. The warranty covers replacement or repair, as decided by the manufacturer. Please contact customer service via our website at www.lzxindustries.net for instructions on returning the product. The cost of returning a product for repair or replacement is paid for by the customer.

DIY kits and bare printed circuit boards are not covered under any warranty and come with no guarantee of assembly troubleshooting or customer support. However, we are nice and will help you when possible. Please contact us if you have questions about or problems with your build.