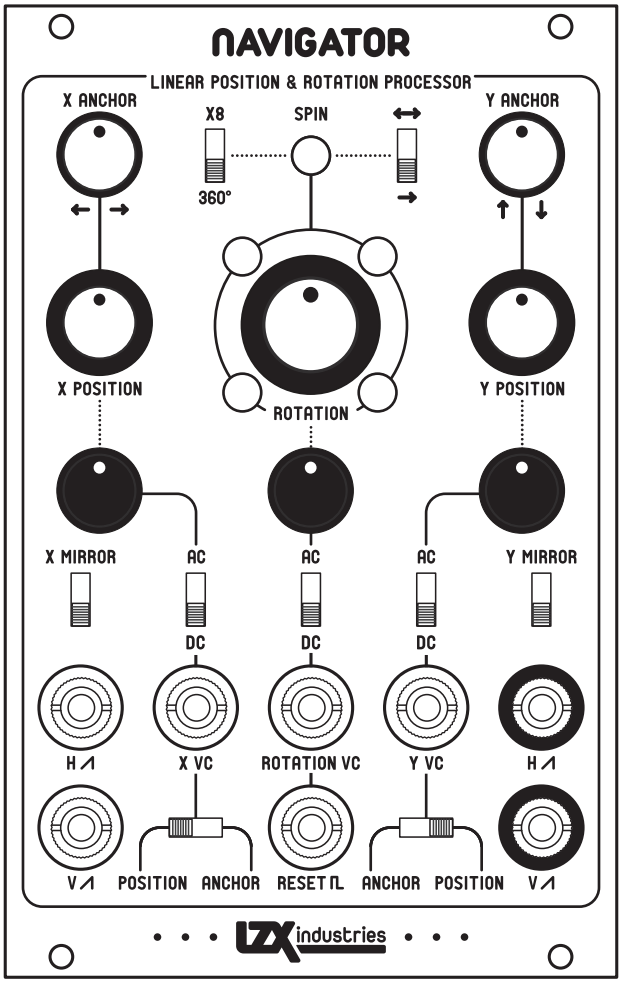
NAVIGATOR
OWNER'S MANUAL



LZX industries

UNCHARTED WATERS, NEW HORIZONS

Making shapes spin and move is notoriously difficult for pattern synthesis based only on oscillators synchronized to horizontal and vertical frequency ranges. Navigator is a large piece of a new method of video synthesis technique that I have been researching, simulating, and developing for the past few years since the initial release of our video synthesizer modules. Rather than using VCOs as a primary signal generator, this method uses horizontal and vertical ramp waveforms as a method to convert voltage to screen position. For example, with horizontal and vertical ramps that go from black-to-white across the screen, we can identify an X,Y position on the screen with two voltages. The point at which each ramp is at 0.5 volts (medium gray) is the center of the display.

Once a screen position can be identified in X/Y points, we can use analog computing techniques to perform operations such as position modulation and the 2D rotation transform (involving four 4-quadrant multipliers and 2 summing blocks, it's a big circuit!) Navigator maintains video rate signal path from input to output.

We get lots of requests about using our modules for vector rescanning techniques using oscilloscopes and XY displays. Due to some careful consideration on signal paths, Navigator is perfectly at home in this environment as well.

Lars Larsen
December, 2016

NAVIGATOR
OWNER'S MANUAL

Written by Lars Larsen

Published December, 2016.

LZX-NV-OM-V1.0

LZX Industries
814 SE 14th Ave.
Portland, OR 97214
USA

www.lzxindustries.net
lzx@lzxindustries.net
Creative tools for video synthesis
and analog image processing.

TABLE OF CONTENTS

FEATURES

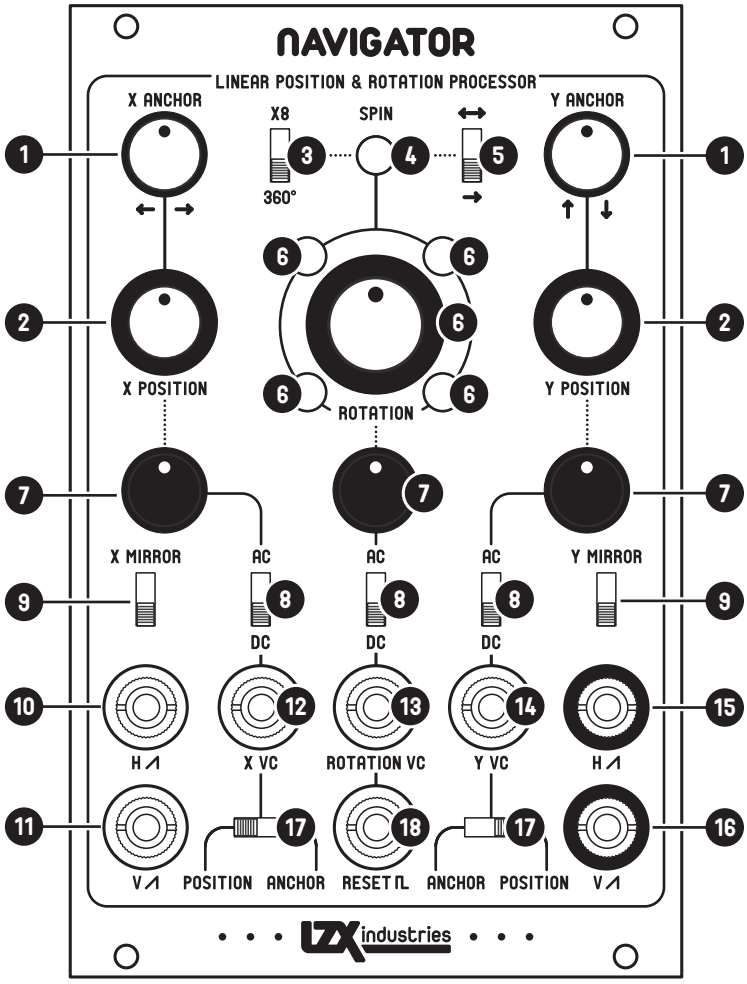
Navigator is a functional block of a 2D analog graphics engine. Designed to take two input voltages representing X and Y points on a display, it can perform adjustment and modulation of their position, anchor point, and continuous rotation in 360 degrees. A typical use case is to process the horizontal and vertical ramp waveforms generated by Visual Cortex, before passing them to a shape or pattern generator. In this case, Navigator repositions and rotates the resulting shape. Since the entire signal path performs at video rates from input to output, the processing opportunities are limitless: cycle color components of external video, rotate objects inside of rotating objects with series processing, or patch your outputs into an XY display, laser projector interface or oscilloscope to open a whole new world of possibilities.

- Voltage controlled XY position and anchor point channels allow summing of a modulating voltage before and after rotation processes.
- Analog rotation processor with digital control allows modulation of the hue angle directly, or of the rotation spin speed in clockwise or counterlockwise directions.
- Dual full wave rectifiers allow for ramp-to-triangle shaping of the input signal. This enables quadrilateral and bilateral symmetrical mirroring of the resulting transformations.
- Signal path performs at high frequency, video rate speeds from input to output.
- AC/DC input coupling switches and inverting level attenuators on voltage control inputs.

SPECIFICATIONS

Format	EuroRack Synthesizer Module
EuroRack Width	16HP
Mounting Depth	1.25 inches (31.75 mm)
Frontpanel Dimensions	3.185 inches (80.9 mm) * 5.059 inches (128.5 mm)
+12V Power Consumption	130mA
-12V Power Consumption	100mA
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 X & Y Anchor point controls. These control a variable bias from -1V to +1V to the X & Y signal paths. Centered position is 0. The location of the anchor offset in the signal path is determined by the Position & Anchor mode switches (17.)

2 X & Y Position controls. These control a variable bias from -1V to +1V to the X & Y signal paths. Centered position is 0. The location of the position offset in the signal path is determined by the Position & Anchor mode switches (17.)

3 Rotation scaling switch. In its downward position, the rotation control (6) will control the angle of rotation from 0 to 360 degrees. In its upward position, the rotation control will control the angle of rotation from 0 2880 degrees (8 full rotations.) When spin mode (4) is engaged, this switch has no effect.

4 Spin mode switch. When disengaged (pushed out) the rotation control (6) controls the angle of rotation directly. When engaged (pushed in) the rotation control (6) controls the speed of continuous rotation in either clockwise or counter-clockwise directions (center point is 0.)

5 Rotation direction switch. In its downward position, both H & V outs (15, 16) will rotate clockwise. In its upward position, H will rotate clockwise and V will rotate counter-clockwise.

6 Rotation offset control. Its operational mode is determined by the Spin mode switch (4). The accompanying LED indicators show the current angle of rotation.

7 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.

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

9 X & Y Mirror mode switches. In their downward positions, there is no effect on the input signals. In their upward positions, the input signal is full wave rectifed around 0.5V as a center point. If the input signal is a sawtooth ramp, this has the effect of sawtooth - to - triangle wave shaping.

10 Horizontal ramp input. 0-1V DC expected. While the intended use case here is to patch in a horizontal ramp waveform generated by Visual Cortex, any signal can be used.

11 Vertical ramp input. 0-1V DC expected.

12 X position voltage control input. 0-1V DC full scale. The depth of modulation is set by the associated inverting level control.

13 Rotation voltage control input. 0-1V DC full scale. The depth of modulation is set by the associated inverting level control.

14 Y position voltage control input. 0-1V DC full scale. The depth of modulation is set by the associated inverting level control.

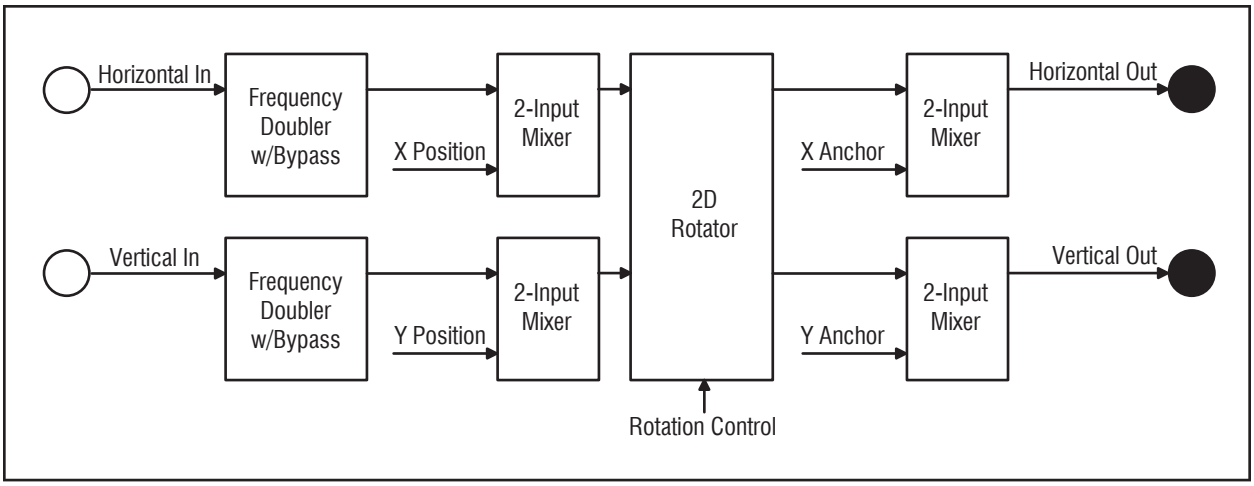
15 Horizontal ramp output. 0-1V DC typical.

16 Vertical ramp output. 0-1V DC typical.

17 X & Y Position & Anchor mode switches. Set to Position (default operation), the position controls will be applied to the signal path pre-rotation, and the anchor controls will be applied to the signal path post-rotation. Set to Anchor, and this relationship is reversed. Anchor mode is useful in a case where this module is being used to process vector graphics rather than direct video synthesis.

18 Rotation reset trigger input. 0.5V threshold voltage. Only applies when Spin mode (4) is engaged. Useful for synchronizing spinning with external modulation sources.

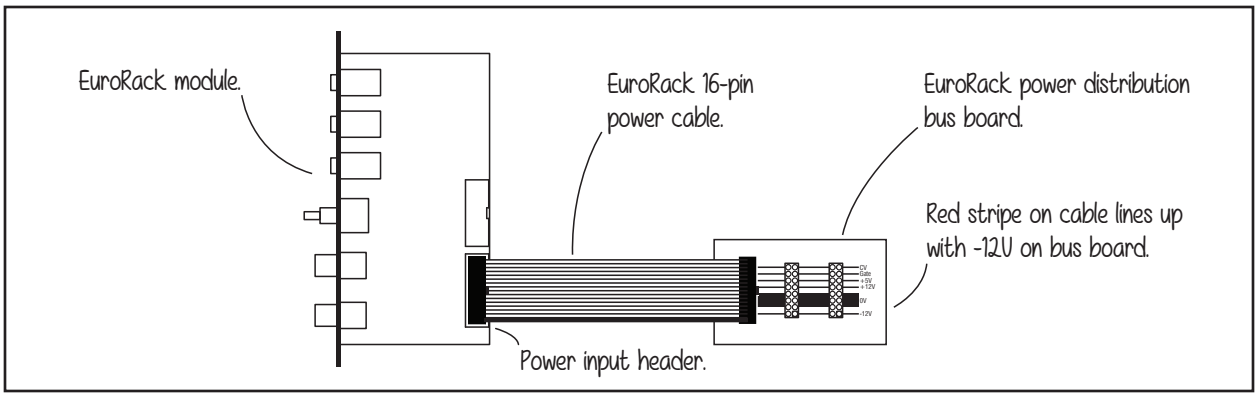
BLOCK DIAGRAM



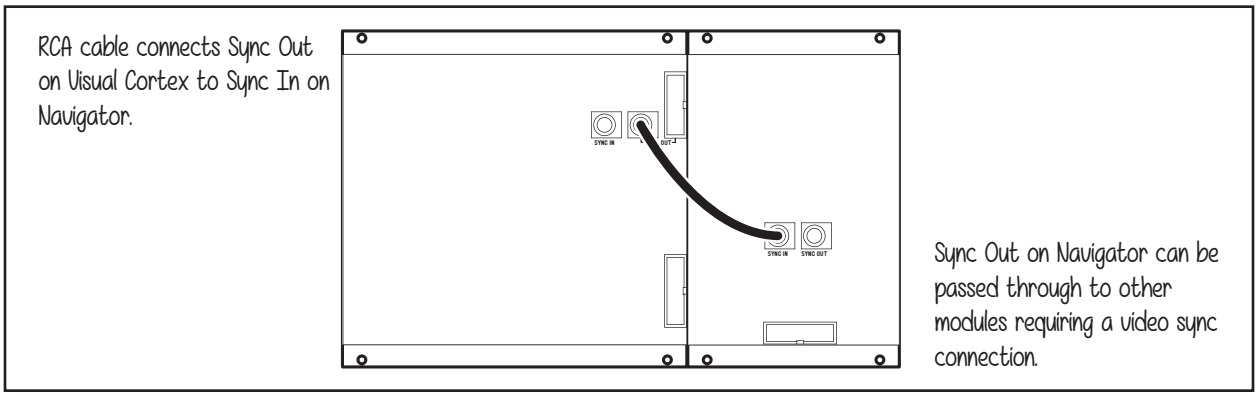
INSTALLATION

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

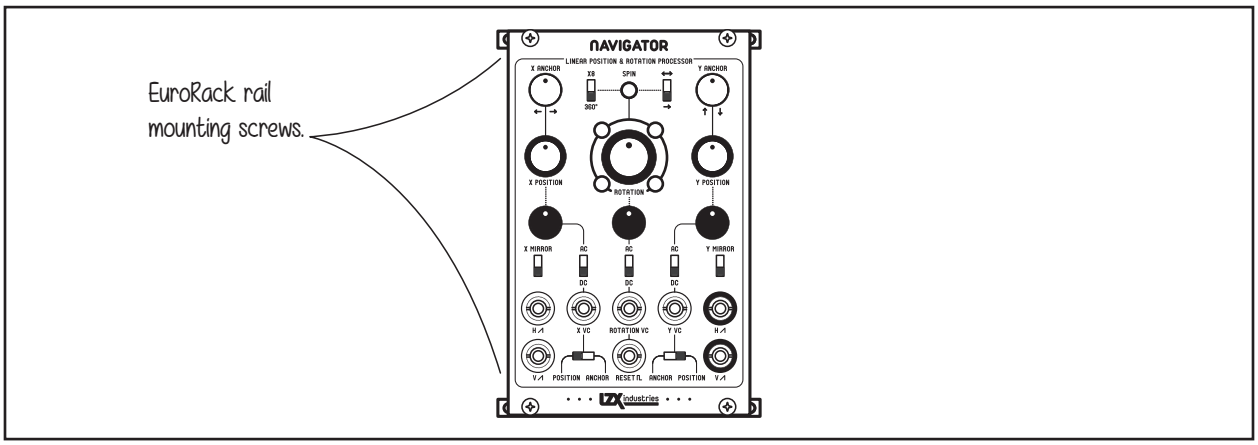
Remove the module from its packaging and connect the 16-pin power cable to the keyed power entry header on the rear of the module as shown. Connect the other end of the power cable to an empty connector on your EuroRack power distribution busboard. Ensure pin 1 (-12V, with the red stripe) is oriented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



This module requires connection to a video sync (or any video signal) via its rear Sync Input RCA jack in order to operate. There is also a Sync Out jack that will buffer and pass the sync signal to another module in a daisy chain. Sync output typically comes from Visual Cortex.



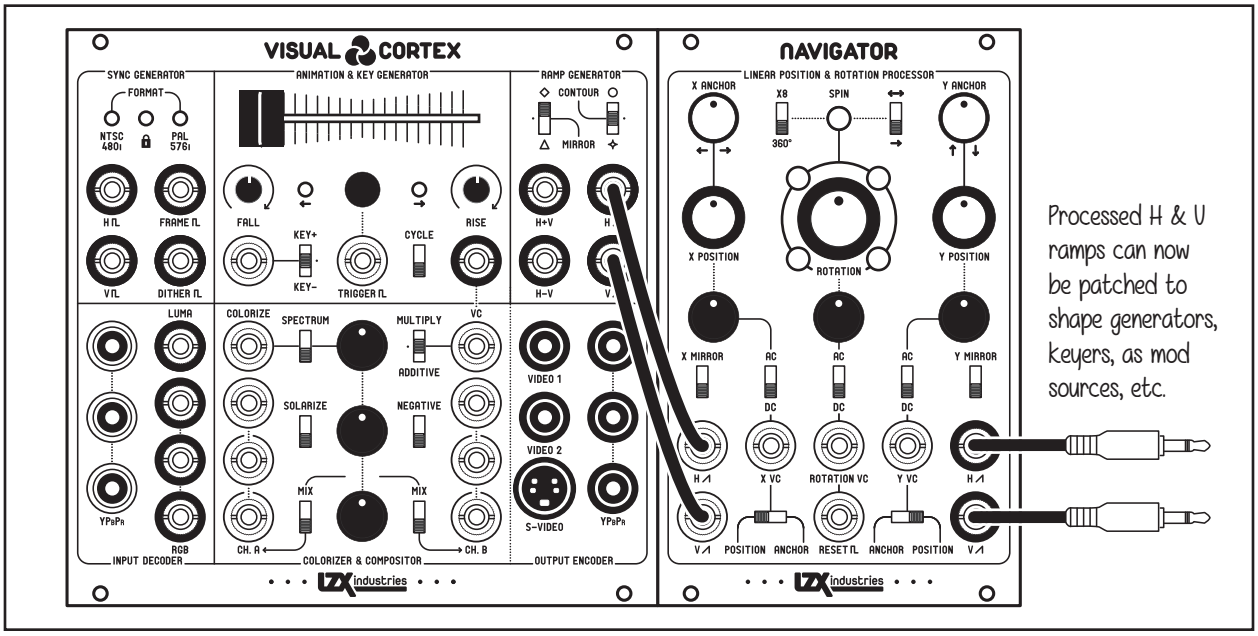
After connecting the power cable, mount the module frontpanel flush to your enclosure's EuroRack mounting rails and secure the module with the mounting screws provided by your enclosure's manufacturer.



EXAMPLE PATCHES

HORIZONTAL & VERTICAL RAMP WAVEFORM PROCESSING

Navigator is a complex analog processor with endless possibility, but the basic intended usage is quite simple. Horizontal and vertical ramp waveforms generated by Visual Cortex are sent to Navigator's inputs, and then the outputs are passed along to use as inputs to shape generators, keyers, or as modulation sources.



Further exercises and experiments to explore using this patch as a starting point:

- Modulate X/Y position and rotation using external oscillators (or video) to get a good handle on what happens under modulation.
- Play with all of the various rotation modes and switches to see how they effect the output signal.
- View the difference between "Position" and "Anchor" modes on the selection switches at the bottom, while X & Y position are being modulated.
- Try feeding H & V with 2 color channels from an RGB video source to achieve colorspace rotation.
- Use only one input (H or V) and use the H & V outputs as a cyclical signal panner.
- View the difference of rotation and position with the X & Y mirror switches both on and off.

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.