



**Sands of Time** Filtered Noise Source - User's Manual for Eurorack  
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Hello and thank you for using the Sands of Time Filtered Noise Source for Eurorack modular. We hope you will find it to be a useful and interesting source of noise for your patching enjoyment!

The Sands of Time contains two separate noise circuits: a transistor-based analog noise generator similar to those used in many classic modular synth systems of the '60s and '70s, and a CMOS logic-based fixed oscillator bank as found in some of the great drum machines of the '80s, particularly of the TR series.

Either or both of these noise sources may be routed to a sweepable active bandpass filter, perfect for shaping the noise into many different “flavors,” from low-frequency earthquake rumble, to chest-thumping midrange snare source, to hissing raw hi-hat noise and everything in between.

In a very small package, the Sands of Time provides a full palette of audio frequencies and Noise-like sounds which are useful in many popular patching techniques, especially analog drum patches and “Noise Walls” along with the generation of pseudo-random voltages for use with Sample & Holds, slew generators, and more.

### **Technical Specifications:**

Width: 10 hp (Intellijel 1U format)

Depth: 35 mm

Peak Current Draw: 25 mA @ +12V, 20mA @ -12V

#### 1. Installing the Sands of Time

The Sands of Time uses a standard 10-pin Eurorack power header which is mounted on the back of the module. When connecting the power cable, make sure that the -12V rail from your case's power supply aligns with that of the module. The stripe on the bottom of the power header and the “-12V” label indicate the location of this rail on the module. The Sands of Time has reverse diode protection so plugging it in backwards will probably not destroy the module or case; however, we strongly recommend taking the proper precautions to plug it in correctly before powering up your case.

The 1U format module will fit in any **Intellijel-format** 1U case. Once your power ribbon cable is connected to the rear of the module, place it in the case and mount it using either two diagonal rack screws or screws in each of the four corner holes.

#### 2. Theory of Operation

The Sands of Time is a Noise Source module. Noise is an essential component of many classic synthesizer patches and drum machine sounds, and with this module we aim to deliver a great-sounding Noise source which can be used in many ways despite its small footprint.

The SOT contains two different circuits which generate noise in very different ways. The “Analog” noise circuit uses an NPN transistor configured for avalanche breakdown, which creates a very pleasant white noise across the full audible spectrum. This is the type of noise source typically used as a random voltage source with a Sample and Hold, and will work effectively for this type of patch.

The “Logic” noise circuit contains six dissonant fixed-frequency square wave oscillators generated using the workhorse CD40106 Hex Schmitt Trigger Inverter and CD4070 XOR IC's. Versions of this circuit can be found in classic analog drum machines such as the TR-606 and TR-808.

For more information on these noise circuits, we suggest you refer to the [Mutable Instruments Kinks](#) and [Synbal](#) project documents, without which this project would have been impossible.

These two noise sources are available as full-spectrum outputs via their respective labeled output jacks, but they are also routed to the Sands of Time's onboard bandpass filter, which provides a great deal of sonic depth when applied to either or both noise sources, selectable via the module's three-position switch. The filter can be swept using the Filter Frequency pot, allowing for anything from a low rumble to a sizzling hiss. This output is ideal for generating hi-hat and snare noises, but can also sound very interesting when used for frequency modulation on a filter or oscillator.

### 3. Summary of Functions

**Filter Freq.** (knob): Controls the central frequency of the onboard bandpass filter.

**Analog:** Full-spectrum avalanche transistor noise output. Output range: +/-5V (10Vpp) (Note: this circuit takes about 5 seconds to saturate upon startup)

**Logic:** Full-spectrum CMOS oscillator noise output. Output range: +/-5V (10Vpp)

**Analog-Both-Logic:** Three-position switch which selects which noise sources are routed to the onboard bandpass filter. In the middle position both signals are mixed before the filter, while "Analog" and "Logic" positions will route those respective sources to the filter.

**Filtered:** Main audio output. Either or both noise sources are routed through an active, non-resonant bandpass filter whose frequency is controlled by the Filter Freq. knob. Output range: Variable, maximum +/-8.5V (17Vpp) with both noise sources active.

### 4. Calibration

Use an Oscilloscope to monitor the Sands of Time's **Analog** output jack. Adjust the rear trimmer until the output level's maximum and minimum are roughly +5V and -5V respectively.

If you don't have an Oscilloscope, use a speaker or headphones to monitor the **Filtered** output with the switch on the **Both** setting. Set the **Filter Freq** knob somewhere near the middle of its travel. Adjust the rear trimmer, which adjusts the level of the **Analog** noise, until the **Analog** and **Logic** noise sources are roughly equal in volume.

### 5. Patch Ideas

#### "Simple Hi Hat"

Patch the Sands of Time's **Filtered** output on any setting into a VCA such as Arcane Knowledge with the Initial level turned to 0. Patch a snappy variable-decay envelope such as the Ancient Scroll into the VCA's Level control input and feed a trigger sequence to the envelope. If your sequencer has a CV output, this can be used to control either the length of the envelope (if your envelope has a CV input) or the initial level of the VCA by mixing this sequenced voltage with that of the envelope using a CV mixer. While the sequence is running, sweep the **Filter Freq** knob to shape the sound of your hi hat.

#### "Resonator Violin"

Patch the Sands of Time's **Filtered** output with the switch set to "Analog" into a VCA, then patch the output of the VCA into a Resonator module such as Rings, SMR, or into a resonant filter such as the VCFQ, Filter 8, or our Marsupial with the Q turned to just below self-resonance. Use the VCA to control the amount of Noise sent to the resonator or filter, and adjust the SOT's **Filter Freq** knob to taste (high

mids will probably be the most useful range). Manual sweeps or slow-attack modulation of the VCA will create cool “bowed” violin-type sounds as the resonator is subtly excited by the noise.

#### “Stepped Random”

Patch the **Analog** noise output into the signal input of a Sample & Hold module. Use the S+H’s output to modulate the frequency of a VCO, cutoff of a filter, the Rise/Fall CV inputs of a Slope generator, you name it. Patch a gate or trigger generator to the S+H’s Trigger input to capture a unique semi-random voltage from the **Analog** noise each time the S+H is triggered.

#### “Tuned Stepped Semi-Random”

Follow the previous example but use the **Filtered** output on **Analog** setting instead. Use the **Filter Freq** knob to change the behavior of the stepping from the S+H.

#### “Morphing Electro Hats”

Patch the **Logic** or **Filtered** noise outputs (on **Logic** or **Both** setting) into a colorful low-pass or band-pass VCF such as the Marsupial, then patch the VCF output into an audio VCA such as the Solar Gravity or Arcane Knowledge. Use a snappy envelope to modulate both the VCF and VCA, while also modulating the same filter with an out-of-rhythm or differently-clocked LFO or secondary envelope. If you have voltage control over the envelope decay as with the Ancient Scroll, definitely modulate this as well!

#### “Disco Snare Drum”

Patch the **Filtered** noise output on **Analog** or **Both** setting into the Linear FM input of an analog VCO. Patch the VCO to a VCA, and patch an envelope such as the Ancient Scroll to both the Level CV input of the VCA, and to the Expo FM input of the VCO. The amount of Noise sent to the VCO’s Frequency input is your “Snappy” amount, with control over the drum’s fundamental pitch coming from the Frequency control of the VCO along with the amount of Envelope sent to its Expo FM input.