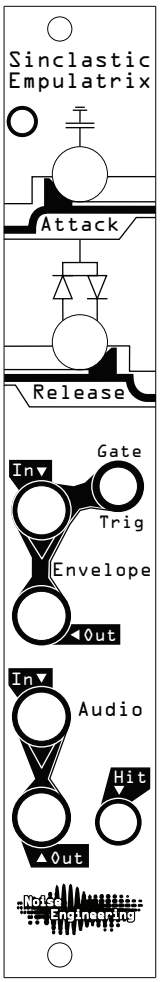
Noise Engineering

Sinclastic Empulatrix

Simple Attack-Release Envelope with Voltage Controlled Clamp



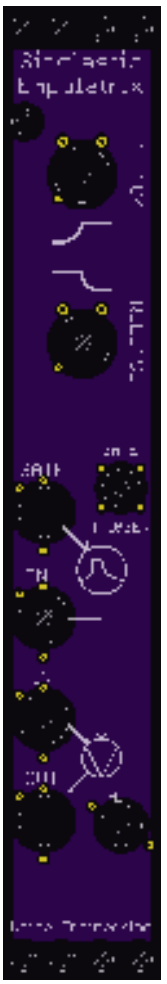
Overview

Type	Envelope/VCA
Size	4HP Eurorack
Depth	.8 inches
Power	2x5 Eurorack
+12 mA	15
-12 mA	25

Sinclastic Empulatrix is a 4HP envelope generator with a voltage controlled clamp. The envelope generator is an exponential curve with controllable attack and release. The time ranges for both attack and release vary from 50 microseconds to 5 seconds. This is normaled to a voltage controlled clamp which acts much like a VCA but with subtle distortion added on the release.

The envelope in Sinclastic Empulatrix is a simple asymmetric voltage controlled slew so the ENVELOPE IN input need not be a gate. The attack controls the rate of voltage increase and release controls the rate of decrease. If ENVELOPE IN is a square wave it acts much like a traditional envelope generator.

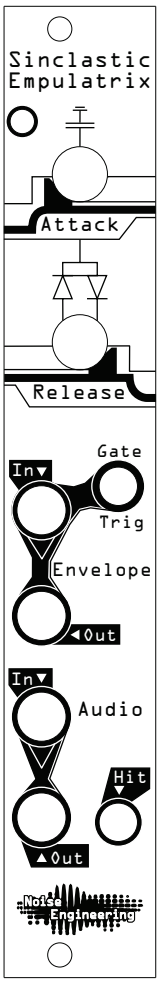
The inspiration of the Sinclastic Empulatrix is the brilliant minimal design of the envelopes in the Roland TR-808 which use both simple capacitor charging for envelope generation and minimum voltage circuits for VCA like behavior.



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Patching Suggestions

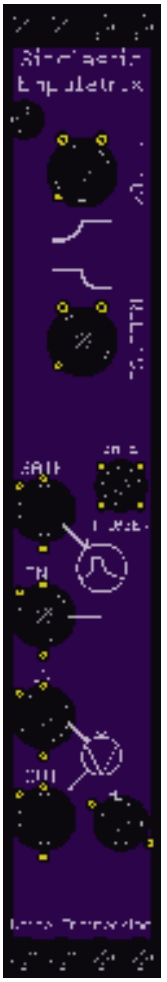
The most basic patch with Sinclastic Empulatrix is to send a gate from a clock or rhythm generator into the GATE input. At this point the led should be displaying the envelope and the ATTACK/RELEASE knobs should be affecting the LED. At first put the GATE/TRIG switch into the GATE position.

At this point you can use the generated envelope for CV control of another module by connecting ENVELOPE OUT to the other module.

Next connect an audio source, say a basic oscillator into AUDIO IN. To get the maximum effect from the clamping choose a waveform with low harmonic content like a sinusoid. You should be able to distinctly hear the clipping that occurs when listening to AUDIO OUT.

Next turn the ATTACK knob fully CCW and flip the GATE/TRIG switch to TRIG. This pings the envelope rather than driving it directly from ENVELOPE IN. The main use for this is when one wants to synchronize a release envelope with a rising gate or trigger. RELEASE will be the main useful control in this configuration.

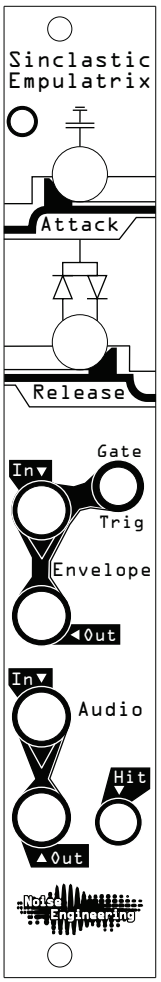
It is possible to drive the Sinclastic Emplatrix with non-digital signals such as an LFO. In this configuration ATTACK/RELEASE become up/down slew controls. If ATTACK/RELEASE are both fully CCW than the ENVELOPE IN can be used as an amplitude control for the clamp section.



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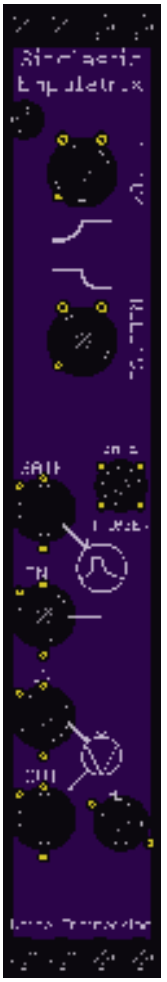
Simple Attack-Release Envelope with Voltage Controlled Clamp



Design Notes

The first version of Sinclastic Empulatrix was a very straightforward adaption of the high hat envelope/VCA in the Roland TR-808. This circuit has a lot of minor issues when generalized to a flexible system like Eurorack. The first big revision was to replace a lot of the discrete transistors with op amps to reduce the voltage offsets that occur in a signal path with emitter followers. The TR-808 VCA was a one quadrant multiplier so these offsets would just get clamped at zero in the original circuit.

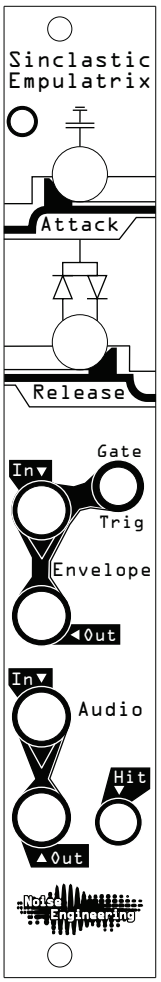
The second big change in design was to reduce the minimum attack/release time. The limiting factor in the original design was the op amp buffer used to drive the RC circuit that generates the envelope. Most op amps do not have the current needed to charge a reasonable value of capacitor as fast as desired. After some searching an op amp typically used for motor control (TCA0372) was found that fit the bill perfectly.



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Interface

ATTACK

ATTACK controls the time constant for the envelope when GATE is high. With the knob fully CCW it takes about 20 microseconds to go from zero to ten volts.

RELEASE

RELEASE controls the time constant for the envelope when GATE is low. With the knob fully CCW it takes about 20 microseconds to go from ten to zero volts.

ENVELOPE IN

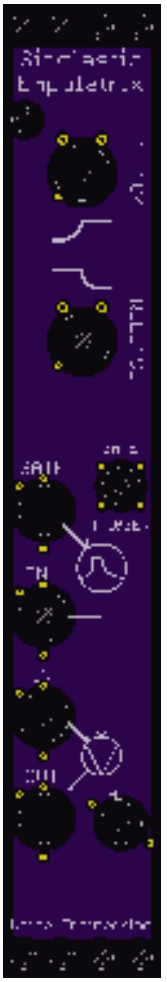
ENVELOPE IN is the input voltage to the envelope generator. When driven by a square wave this produces a typical AR envelope output. The precise behavior is if the input voltage is a higher voltage than the current ENVELOPE OUT than a rising envelope with a time constant from ATTACK is generated. When ENVELOPE IN is less than ENVELOPE OUT than a falling envelope with a time constant from RELEASE is generated. This can allow behavior similar to an envelope follower as well as envelope generation.

GATE/TRIG

The GATE/TRIG switch changes the input to an edge triggered ping when in the TRIG position. In this position one usually wants ATTACK fully CCW. This will synchronize the RELEASE with the rising of the signal on ENVELOPE IN.

ENVELOPE OUT

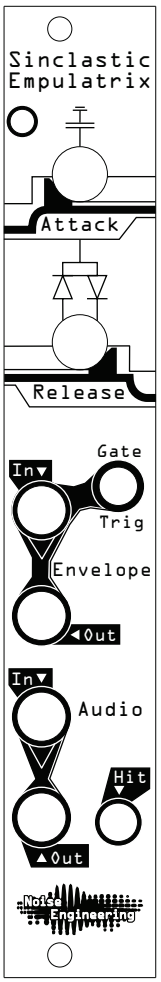
ENV is the envelope output. This is a CV between 0 and 2x the voltage applied to ENVELOPE IN. A typical 5v gate will generate a 10v envelope.



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Interface

IN

IN is an audio input signal into the voltage controlled clamp.

OUT

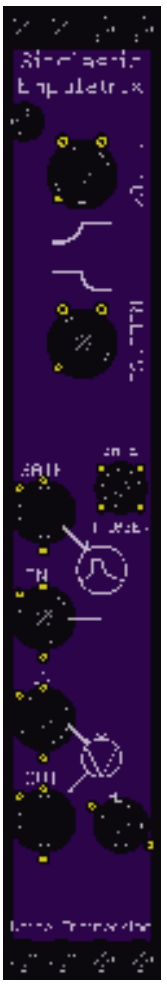
OUT is the audio output from the voltage controlled clamp.

HIT

The HIT button allows the manual triggering of ENVELOPE IN. It always works in GATE mode no matter the position of GATE/TRIGGER.

JUMPER

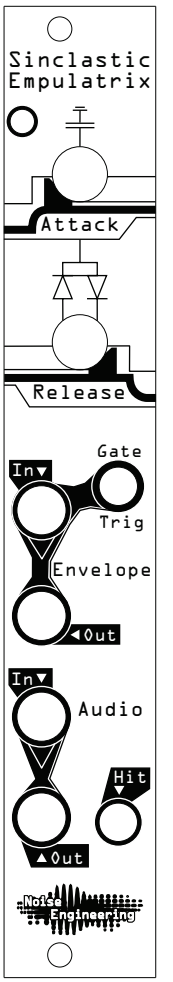
On the rear there is a two pin header that if a shunt is applied will increase the charge/discharge time by a factor of 3.5 for those that desire extra long envelopes. This cuts down on the precision at high speeds and can make it hard to dial in fast attacks.



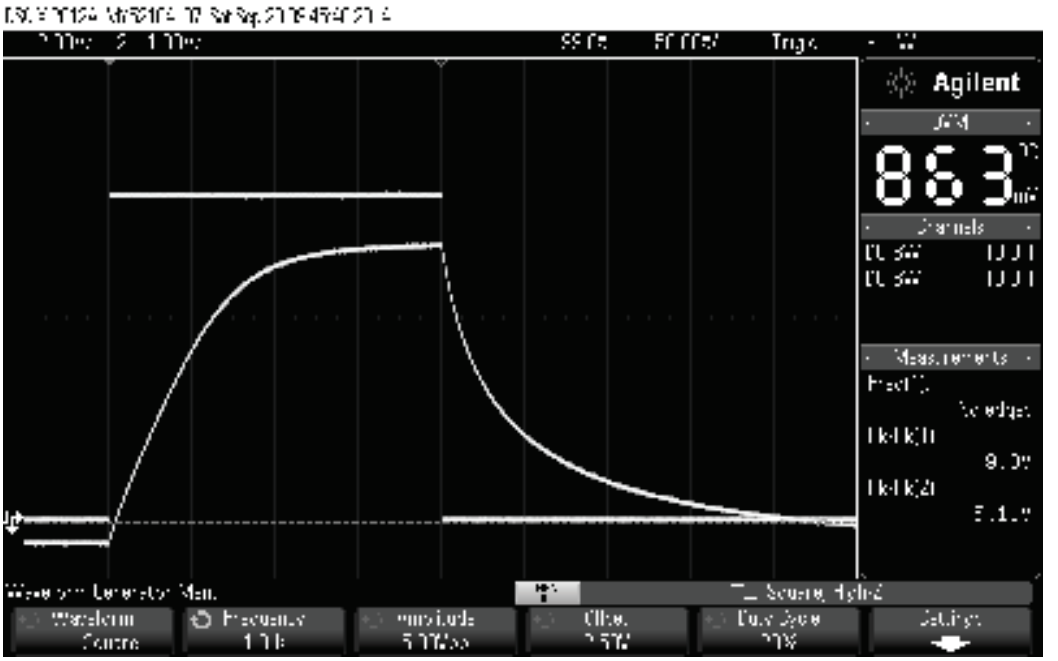
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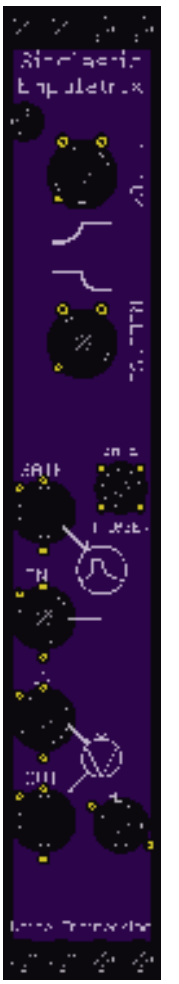
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Typical Performance



Capture showing typical envelope.

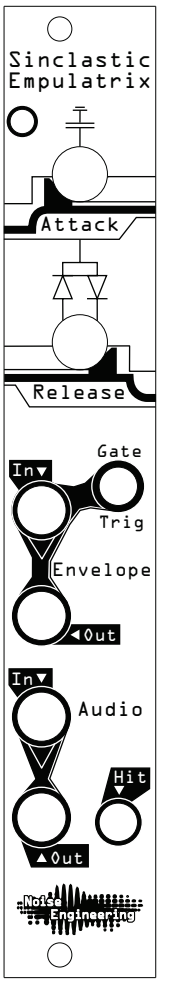


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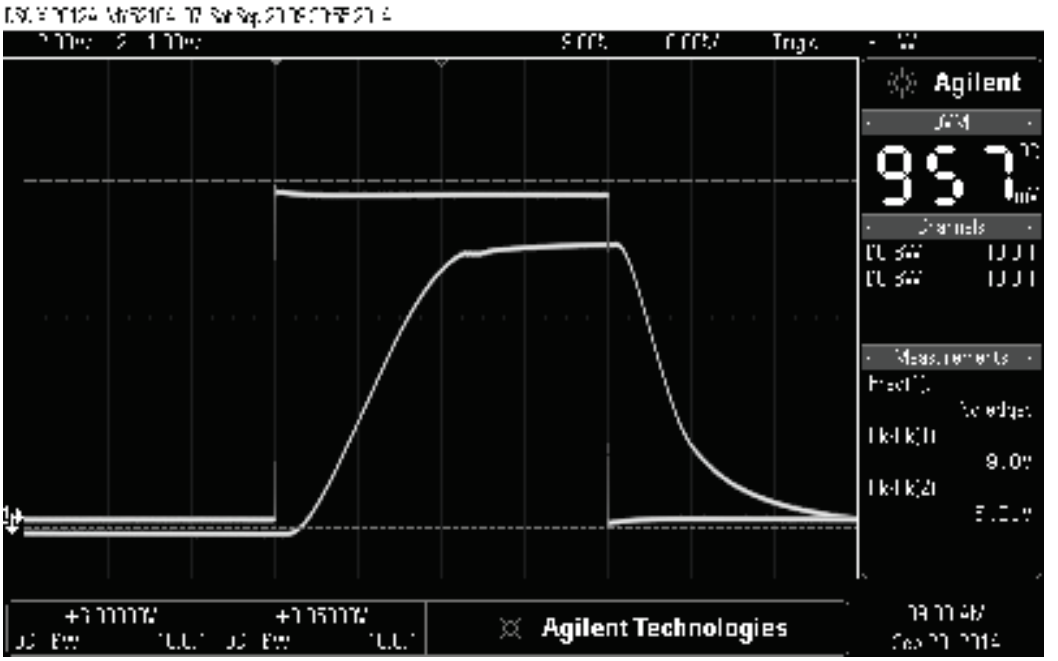
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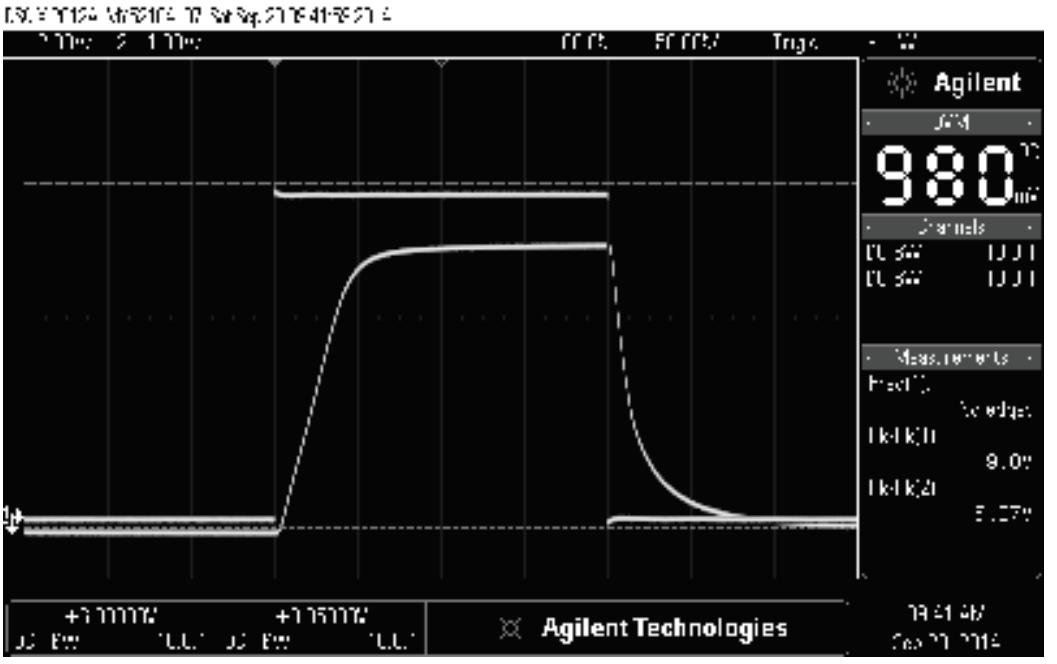


High Speed Performance

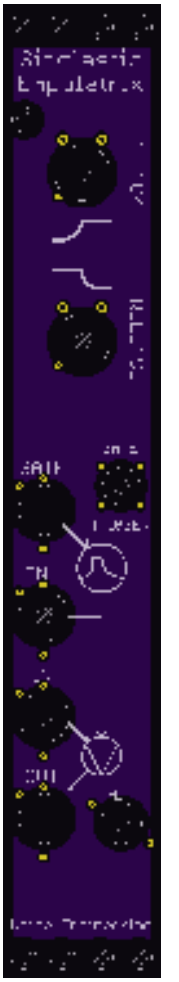
Can you say overkill?



Capture showing 20 microsecond response time. This is with the rear jumper open.



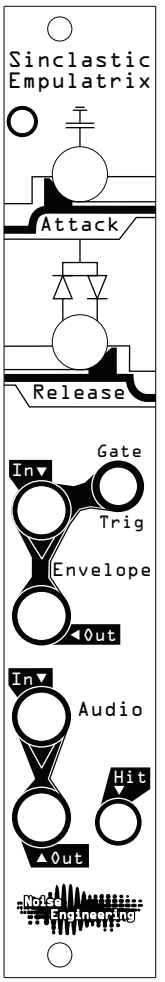
Capture showing 50 microsecond response time. This is with the rear jumper shunted.



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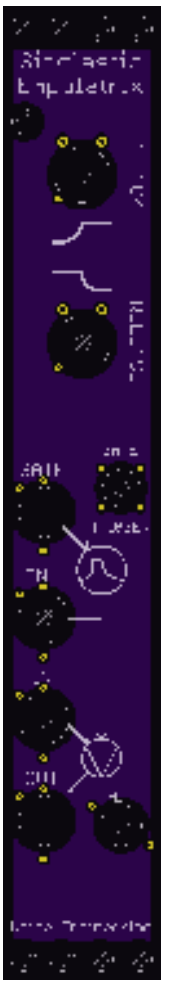
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Alex Anderson



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