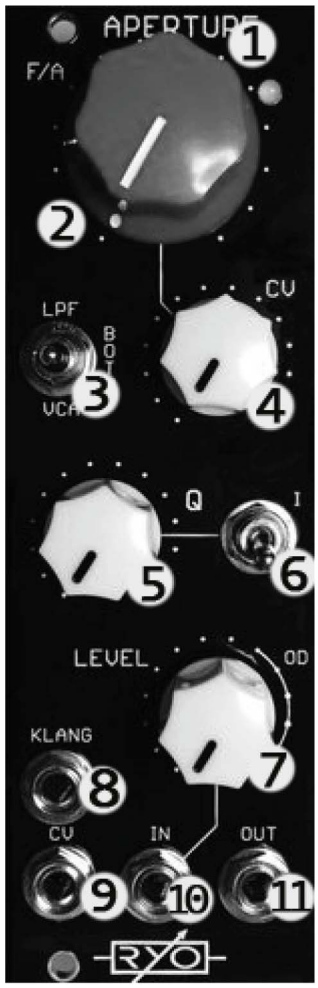
LjunggrenAudio RYO Aperture
a Resonant vactrol VCF/LPG/VCA

Quickstart – what is the Aperture and how do I get going?

The RYO Aperture is a vactrol lowpass filter and VCA module inspired by the much beloved 292 Lowpass Gate from the Buchla 200 series modular system of the 1970s. However, rather than being a straight up clone, the Aperture is a newly developed and reworked design for eurorack modular synths. The module is based on a pair of Silonex/Advanced Photonix optocouplers that allow a plucky dynamic response to CV to be dialled in as desired, along with the option of some characterful overdrive.

RYO Aperture



1. Cutoff/Gain lvl indicator.
2. Cutoff Frequency/VCA Inital Knob.
3. Three position mode switch [when res off]:
   - LPF: Non resonant lowpass filter.
   - Both: Non resonant lowpass gate.
   - VCA: Standard Expo VCA.
4. CV attenuator for Cutoff Freq/VCA CV
5. Resonance Manual Lvl Knob.
6. Resonance on/off switch [when res on, mode switch gives]:
   - LPF: Resonant lowpass filter.
   - Both: Resonant lowpass gate.
   - VCA: 6dB variety of resonant lowpass gate.
7. Input Signal Lvl - will overdrive in range marked.
8. Klang Input (feed it a trig or other control voltage!).
9. Cutoff Freq/VCA CV input.
10. Signal Input.
11. Signal Output.

Width: 8 hp

I**nstallation**

To begin installation, please make sure that:
- you have a standard pinout eurorack bus board
- you have +12V and -12V power rails on that bus board [no +5V supply is required]
- the power rails are not overloaded

!!!Before installing this module disconnect the power from your system!!!

- Double check the polarity of the ribbon cable - The red stripe should be aligned with the -12V rail, on both the module and on the bus board

[we use shrouded headers but it's still possible a cable has been assembled with the stripe on the wrong side of the shroud so always double check!].

Also make sure when using busboards without shrouded headers that the pins aren't transposed a row vertically or horizontally – all pins should insert into holes on the cable.

Although we use both PTC fuses and schottky diodes to provide reverse polarity and excess current protection, we do not take any responsibility for damages caused by wrong power supply connection!

After you have connected everything, double checked it and ensured your case is closed such that no power lines can be touched by your hand or any stray cables drop into holes, turn on your system and test the module

The Aperture is a quite an advanced skill-level project and is a medium part count, multi-PCB build that requires a higher degree of experience in PCB soldering and module assembly:

Aperture can be used as a 12dB lowpass filter, a VCA or a combination of the two similar to the 292 but also adds a new switchable resonance circuit. This solution gives you no less than 6 different characteristics!

* **Non resonant lowpass filter**
* **Resonant lowpass filter**
* **Both: Non resonant lowpass gate**
* **Both: Resonant lowpass gate**
* **VCA**
* **6dB variety of resonant lowpass gate in the VCA mode with resonance on.**

The resonance goes from smooth and twangy to increasingly bubbly and acidic to wild and untamed howling towards the end of the pots range. The self-oscillation also lends itself well to creating kickdrums, toms and other percussive sounds.

The result is a very wide range of sound shaping possibilities, from the classic resonant filter sweeps of east coast to the plucky acoustic timbres of west coast synthesis and everything in between.

When the CV input is presented with a control voltage between 0V and 8V, in the VCA setup, the module will behave as a traditional relatively clean sounding VCA *albeit with some character and limitations as dictated by the optocouplers.*

Also added is a unique "Klang" function. The Klang input generates a decay slope from a trigger, *the shape is very steep in the beginning and quickly smooths out to a nice prolonged ring, resulting in a very natural acoustic sounding tone. The circuit was specifically tailored for this purpose and does not give the same result as just using a decay envelope with the regular CV input. Experimenting with different trigger voltage and length will affect the response of the decay and overall shape. It will also work with other control voltages but will add a falling slew to the signal. Trigger the CV as well as the Klang input at different intervals for simulating the impression of striking a drum or string instrument in different ways.*

Finally, the input is AC coupled and has a dedicated attenuator with clipping overdrive towards the end of the pot range for adding a bit of extra bite to the incoming signal. *The signal input is scaled for 10Vpp audio signals. The AC coupling comes after the overdrive circuit so you can add offsets to your audio with RYO Ampmix and many other modules to get an asymmetric clipping.*

Although the module has an exponential response to control voltages at the CV in *and accepts both DC and AC signals it should be noted that due to the slew rate of the optocouplers audio rate modulation of the cutoff/gain CV is limited in frequency to a degree dictated by the optocouplers.*

We designed the Aperture using NSL32 SR3 optocouplers; *the SR3's give a tight, snappy CV response and have low bleed through of the signal when CV is fully off (CCW, i.e. to the left) and when 'level' is set to below overdrive settings for a clean signal. SR2 optocouplers may also work but will have a slightly different CV response and may need different trimmer settings to get the LPG/VCA to have low/zero bleed at fully off/low signal in – DIY builders may therefore have fun experimenting with different optocouplers, but not all will work or have fully successful results.* ***(Please note that due to the nature of the vactrol-style optocouplers, response behaviour may vary between different factory batches.)***

The module can be used as a basic attenuator; *by disconnecting cv/keeping the CV and Q knobs fully CCW, and adjusting the level control between minimum and start of overdriven settings as desired.*

The Aperture can be used as a basic overdrive effect: *using the attenuator setup described above, opening the 'VC' knob into the marked overdrive range will introduce distortion - from a bit past 50% up to max gain (full CW) the Aperture will overdrive the signal with increasing distortion - this distortion will vary in character depending on the settings.*

Dimensions	
Height:	**3U** [128.5mm],
Width:	**8HP** [40.30mm],
Depth:	**27mm** (with power cable attached)
Weight:	125g (approx w/cable)

Current consumption	
+12V rail	Min 25mA to **max 50mA**
-12V rail	Min 45mA to **max 75mA**
+5V rail	**no +5V** supply required

(Minimum with no self oscillation, maximum with self oscillation at high pitch).
(There are small power variations between different vactrol varieties. The power stats shown here are for the SR3 optocouplers.)

Basic specifications	
total frequency controllable range	DC to 50kHz
max input/output audio signal	10Vpp
CV input range	-10V to +10V
Max gain	n/a

Nominal impedances	
Audio signal input:	100k ohm
Audio Signal output:	1k ohm
CV input:	100k ohm

Patch ideas:

Although uses of VCAs and filters in patch examples and ideas are found readily online and in some books, and similarly there are those familiar with using distortion effects perhaps from the guitar pedal cultural background, there are many other less obvious ways to use the Aperture in patches in your modular rig:

below i've included some inspiring words showing some patching ideas to try out; and, as ever, experiment – RYO modules are designed with all necessary protection and fail-safes so you can just start plugging in patch cables and see what happens!

ping it:
many modules with vactrols in the CV-path can be 'pinged' – excited by a short spike of CV such as a trigger or by a few ms pulse of noise, the vactrols will ring with a very natural, organic sounding, woody decay – different from the klang input but in the same way varying with different amplitudes, durations and shapes of input, this is great for drums or percussive tonal instruments.

Distort or filter a CV signal:
try something different - such as distorting or slewing a CV modulator wave so that the resulting sound output from an affected signal through a processing module is different.

Phase shifters:
try combining the different outputs as either unusual phase shifters, using the all pass as a phase shifter or using the self oscillating outputs combined too get unusual phase shift combinations.

Weird control voltages:
try inserting the many different types of filtering in the feedback path of a delay.

Drums:
setting the resonance just past so near self-oscillation and sending a trigger or decay envelope to the filter audio or CV inputs will initiate a decaying oscillation akin to the 808 kick drum.

Complex VCO:
sending the output of the filter in self oscillation to the CV input of a VCO or another filter in self oscillation will create complex FM timbres on the output of the VCO or second filter.

Taming complex patches:
frequency shifters, Karplus-Strong resonators, and complex feedback patches can use filters to remove DC offsets that may occur or smooth out harsh frequencies. Adding resonance can add more zaniness though!