

*flight of harmony*

# Plague Bearer

Voltage-Controlled Bandpass Filter  
Eurorack Module  
~rev4.0~





## Components

|   |  |
|---|--|
| 1 | Assembled Plague Bearer filter module                                |
| 1 | DC power cable – (euro) 9" Ribbon cable w/10-&16-pin 0.1" connectors |
| 2 | M3x6 Mounting screws   |
| 2 | Nylon washers  |

## Specifications

(see text for detailed description.)

|  |                                      |
|--|--------------------------------------|
| Supply Voltage (min -> max)            | $\pm 9V \rightarrow \pm 15V$         |
| Supply Current (max draw @ $\pm 12V$ ) | +12V: 6.5mA      -12V: 4.0mA         |
| Input Voltage (@ $\pm 12V$ )           | $0V_{pp} \rightarrow 10V_{pp}$       |
| Max Output Voltage                     | $\pm 5V$                             |
| Input & Output (I/O) coupling          | Capacitive (AC)                      |
| Output Impedance                       | $3.3\mu F$ in series with $1k\Omega$ |
| Control Voltage (CV) inputs            | $0V \rightarrow V+$                  |
| CV input coupling                      | Direct (DC)                          |
| CV input impedance                     | $100k\Omega$                         |

## Philosophy/What is it?

The Plague Bearer is called a filter, but that is just a description of the circuit topology, what it can actually *do* goes way beyond that. It has been described as a filter, a waveshaper, a mangler, a crusher, and – my favorite – as an "FSU module".

I think calling it a filter may be a bit misleading, but I have no idea what else to call it. It *is* a filter, but it does more (all at the same time, really) excessive phase shifting, waveforming, ringing, formant generation, and so on. I guess it could be called a waveform modifier or enhancer, but those don't sound good either. I named it the Plague Bearer for a reason.

If you are looking for technical synthophile specs you are out of luck here. All f(h) devices are designed in accordance with how they sound, not to achieve mathematical perfection.

The most common question I receive is, "what is the filter slope?" Honestly, I never measured that. I specifically avoided the conventional approach while I was designing this circuit, so it's very problematic to try to describe this filter in the normal terms. The slope is directly tied to the gain of the circuit, making it variable, and the Q is affected by all three filter controls. The setup is actually a combined High- and Low-pass. The corner frequencies are adjusted by the controls and can be overlapped completely, which gives a comb-filtering effect.

The rest is for you to discover.

## Changes in Rev 4

Most changes in the r4 were for ease of assembly purposes, but two new features were added:

Input Attenuator: Earlier versions often required use of an external VCA to reduce input signal levels and prevent overdriving the input. This is now handled by the input attenuator.

Output limiting: The output levels of earlier versions could spike well beyond  $\pm 5V_{P-P}$ , so an output limiter was added. The limiter has a soft to medium curve and can be disabled by moving the two jumpers as shown on the PCB.

## Specification Details

The Plague Bearer filter module rev4 is designed to be as versatile as possible. Details:

Supply: This design has been tested from  $\pm 9V$  up to  $\pm 15V$  and

works well in this range, although performance specifics will vary with supply voltage. All measurements, unless stated otherwise, assume  $V_{\text{supply}} = \pm 12\text{V}$ .

Output: Maximum  $V_{\text{out}} \approx \pm 5\text{V}$ . The modules are intended for use in modular synthesizers, so the output is set to the standard level.

Input: This can physically handle pretty much any reasonable (e.g.,  $< \pm 15\text{V}$ ) signal you might throw at it. This is why there is an input attenuator. Lower signal levels will give a much wider range of signal coloration/alteration, while overdriving the input of the filter will give a very harsh distortion and destroy most of the filtering subtleties.

If you find that the filter seems too "touchy", and overdrives too easily for you, try attenuating the signal before the module. Another symptom of too-high input levels is if the controls seem to not do much at all - this is the most common question I receive.

## Controls

High: Okay, a confession: The controls are technically labelled incorrectly. *High* actually controls the cutoff frequency ( $f_c$ ) of the lowpass portion (how much of the high end is let through), while *Low* controls the  $f_c$  of the highpass section (how much of the low end is let through).

Having said that, clockwise rotation of the High control increases the high end of the signal. This also increases the resonance of the filter. Applying an increasing CV to the High CV input will act the same as clockwise rotation.

Low: This one is rather weird. Clockwise rotation of the Low control will increase the amount of the low end passed through the filter (i.e., it lowers the highpass  $f_c$ ), and dramatically boosts the resonance. Applying an increasing voltage to the Low CV input also acts as clockwise rotation, which is the weird part: Increasing the Low CV lowers the highpass  $f_c$ , allowing more low end through.

Gain: Controls the gain of the filter. Clockwise to increase, yadda yadda yadda...<sup>2</sup> The part to keep in mind is that increasing the gain increases the resonance, and the PB was designed to go absolutely nertz from this. The filter will easily oscillate and scream at you. This usually occurs when processing an audio signal and can be heard as an additional voice.

The gain also directly controls the amount of internally-generated noise fed through while the input is at or near minimum.

See page 4 for further details on self-oscillation and noise.

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2. Equivalent to "blah, blah, blah..."

The VC Gain has inverted behavior - 0V is maximum gain, +12V is minimum gain. Several inversion circuits were tried to change the behavior to "standard" action, but the most reliable designs added too many components and assembly time to keep the price below USD\$100.00, and keeping the price low is a major design goal with the Plague Bearer.

Input: This is the input attenuation control as mentioned above.

## Making Noise

The PB filter can also act as a noise generator, and quite a variable one at that. To do so, just turn the input all the way down (CCW), turn the gain up a bit, and then adjust the High and Low controls to get the desired tone of noise. You can get some interesting percussion sounds by applying an impulse or saw wave to the High CV input, or some nice wind/whooshing sounds with a slow sweep. Daisy-chaining (series-connecting) a couple filters makes some nicely creepy ambient effects.

Caveat: *The noise feature is very quiet!* I'm talking millivolts here. It works, trust me, that is the first and last function I test before shipping. If you can't hear any noise, crank up your output amplifier. If you still can't hear it, use a preamp as well. It is worth it!



## Self-Oscillation

The PB can be made to self-oscillate, turning it into an independent oscillator. I get a lot of questions about this, so here is the quickest way to get it working:

- 1) Nothing plugged into "Input"
- 2) Turn "High" all the way down.
- 3) Turn "Gain" all the way up.
- 4) Turn "Low" all the way up.
- 5) Slowly turn up "High"

As you can see in the image to the left, the usable range tends to be between 8:00 and 10:00. It will start out as a low moaning, then go up in pitch. The best way to get fine control over the pitch is by CV control - in the High to start, but the others will affect it as well. Once you've figured out how to start the oscillation, experiment. There are many variations

and ways to obtain them. The high, low, and gain all interact, so there's a lot of possible combinations.

Don't even ask me about volts/octave, that's not the point of this thing. It's a filter, the self-osc is just an added bonus.

### Stuff

There is a lot of discussion about the Plague Bearer on the Muffwiggler forums, come check it out! People have posted some excellent demos on there. I haunt the forums as well, and new things are posted there long before they hit the f(h) website.

<http://www.muffwiggler.com/forum/index.php>

A big thank you to those who have sent in suggestions and comments, keep them coming!

Send samples to: [samples@flightofharmony.com](mailto:samples@flightofharmony.com)

Comments, suggestions, complaints to: [flight@flightofharmony.com](mailto:flight@flightofharmony.com)

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Can you hear them?

$f(h)$