*flight of harmony*
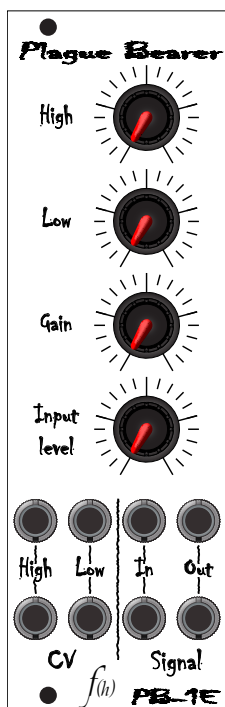
# Plague Bearer

## Eurorack and Fractional-rack Modules
## ~rev3.1~

## Components

| 1 | Assembled Plague Bearer filter module |
|---|---|
| 1 | DC power cable – (euro) 9" Ribbon cable w/10-&16-pin 0.1" connectors<br>(frac)18" 4-wire cable w/ 4-pin 0.156" connectors |

## Specifications

(see text for detailed description.)

| Supply Voltage (min –> max) | ±9V –> ±15V |
|---|---|
| Supply Current (max draw @ ±12V) | +12V: 6.5mA          –12V: 4.0mA |
| Input Voltage (@ ±12V) | $0V_{pp}$ —> $10V_{pp}$ |
| Max Output Voltage | ±5V |
| Input & Ouput (I/O) coupling | Capacitive (AC) |
| Output Impedance | 2.2µF in series with 1kΩ |
| Control Voltage (CV) inputs | 0V –> V+ |
| CV input coupling | Direct (DC) |
| CV input impedance | 100kΩ |

## 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 mangler, a crusher, and – my favorite – as an "FSU module"[1].

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 called 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 <u>sound</u>, 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 3.1

- Added voltage-controlled gain OPTION– yes, it works somewhat like a VCA, except that the fc and Q are affected by the gain. Due to the overwhelming requests to keep the PB format as it is, the VC gain input will not be brought out to the panel this run. The header is on the PCB for those that wish to do so themselves.

- Boosted low-end output – can go much deeper/richer than previously.

- Increased signal input attenuation – handles stronger signals much better now.

- Increased high-gain distortion – Nastier!

- Improved self-oscillation – Self-osc. on earlier versions was widely different for each unit, not any more. This version is *touchy.*

- Easter eggs! – Not the edible ones, nothing to do with anything cute, furry, pagan, or fertile in any way, actually, just (barely) hidden goodies. Nothing too special, so don't get all drippy-excited or anything.

- MUCH more touchy and weird. You'll see.

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1.   F*ck Sh*t Up

## Specification Details

The Plague Bearer filter module rev3.1 is designed to be as versatile as possible. Details:

Supply: This design has been tested from ±9V up to ±15V and works well in this range, although performance specifics will vary with supply voltage. All measurements, unless stated otherwise, assume $V_{supply}$ = ±12V.

Output: Maximum $V_{out}$ = ±5V. 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., < ±15+ volts) 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.

## 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...[2] 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. The gain also directly controls the amount of internally-generated noise fed through while the input is at or near minimum. And, hey – it has a CV input now too!

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

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

## Connections



— fig. 1 —
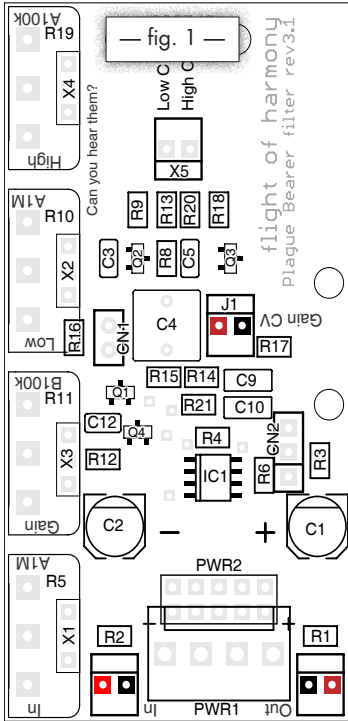
flight of harmony
Plague Bearer filter rev3.1

Figure 1 is an outline drawing of the board and it's components. As you may have noticed, all the horizontal text was accidentally inverted. Cope, I had to.

<u>Signal Input & Gain CV:</u> In – LEFT pin is signal/tip, RIGHT pin is ground/sleeve

<u>Signal Output:</u> Out – RIGHT pin is signal/tip, LEFT pin is ground/sleeve

## Power Cable

<u>PB-1E:</u> 9" Doepfer-style ribbon cable. The shrouded header removes all mystery

<u>PB-1F:</u> 18" 4-wire cable with identical red AMP connectors at either end. Just plug it in.

## Jacks

There are eight jacks per filter, two for each input and output. The pairs of jacks are wired directly together (called "multiples"), to allow you to pass the signal on to some other module ("daisy-chain") as well, making the unit transparent in regard to the number of connections used up.

The jacks are very closely placed, yet it is possible to use all of them at once if you are using narrow-bodied plugs. When not using the secondary connections, it is recommended that you stagger the placement of your plugs as in figure 2 for ease of access.



— fig. 2 —

High   Low   In   Out

CV        Signal
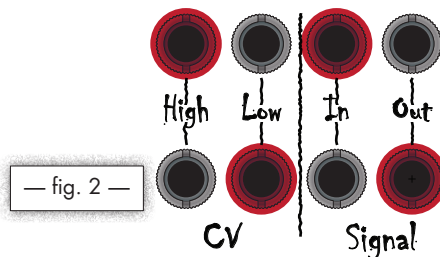
## Making Noise

The PB filter can also act as a noise generator[3], 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.

## Self-Oscillation

The PB can be made to self-oscillate, turning it into an independent oscillator. The following procedure is the simplest approach to this:
1.  Turn the input all the way down.
2.  Turn the gain all the way up.
3.  Set the high control around the middle.
4.  Now slowly start turning up the low control.

You may have to play around for a bit, it's another one of those "sweet spots", but it will start to make a moaning/howling sound. It can quickly overload and start screaming if you turn up the low too far, so go slowly. The high, low, and gain all interact, so there's a lot of possible combinations.

Once you've gotten the hang of making it oscillate, try using the CV inputs to control the oscillating frequency. Don't even ask me about volts/octave, that's not the point of this thing.

## Easter eggs?

Rev3.1 has some hidden goodies/capabilities. Aside from the Gain CV input (which isn't actually hidden), utilizing any of these will require soldering in connections, while most also require the removal of existing components. In case you had not noticed, most of these are SMD[4], so bear that in mind. If you want to do this, keep in mind: NO WARRANTY OR RETURNS, YOU BREAK IT, IT'S YOUR FAULT. Subtle eh?

Variable Output Level: Header CN2 is for a potentiometer > 5k, remove R6.

Gain CV slew rate: If the gain CV slew rate is too "poppy", add a 0.1μF 0805 capacitor at C12.

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3.  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!
4.  Surface Mount Device
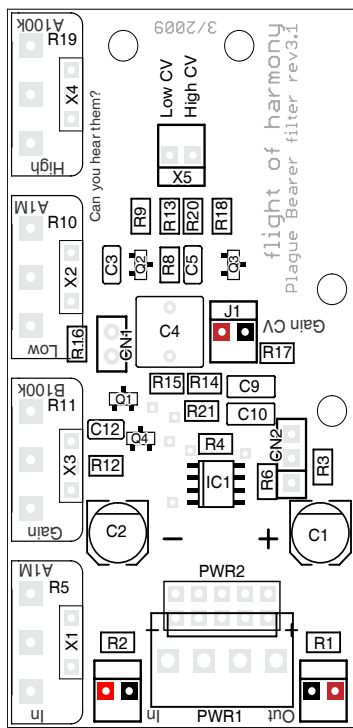
Gain CV Sensitivity: The Gain CV input is set for a wider range of control, but the side effect is a slower slew rate. To increase the response, put a resistor (or potentiometer!) in CN1, which is parallel to the 200kΩ current limiting resistor.

Revert Circuit: The circuit can be converted to the r2.3 version, should you desire that character. I'm not telling you how to do it though, so contact me if you want this. A switchable conversion kit is in development as well.

## 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

Comments, suggestions, complaints to: flight@flightofharmony.com

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http://www.flightofharmony.com

revised 3/09

Can you hear them?

$f(h)$