Expert Sleepers

User Manual

Revision 1.0

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Introduction

Congratulations on your purchase of an Expert Sleepers “Persephone”. Please read this user manual before operating your new module.

Persephone is a VCA (Voltage Controlled Amplifier) using a discrete JFET as the gain element. The JFET can be tastefully (or violently) overdriven for saturation/distortion effects.

Persephone also includes a zero-crossing detector, which can be used to restrict gain changes to zeros in the audio waveform, preventing clicks and pops that can occur with very fast envelopes, especially on lower pitched sounds. In fact, with the zero-crossing circuit engaged, you can use a simple gate as the CV input without clicks.

The module's signal and CV paths are 100% analogue (there is a little discrete logic involved in the zero-cross circuitry).

Installation

House the module in a Eurorack case of your choosing. The power connector is 16-pin Doepfer standard[1]. If using the power cable supplied with the module, the red edge of the cable is closest to the bottom edge of the PCB, and carries -12V. ("-12V" is marked on the PCB itself next to this end of the connector.) Be sure to connect the other end of the power cable correctly, again so -12V corresponds to the red stripe on the cable.

Power requirements

Persephone draws up to 33mA on the +12V rail, and 26mA on the -12V rail.

It does not use the 5V rail.

1 http://www.doepfer.de/a100_man/a100t_e.htm

Inputs and outputs

Persephone's input and output jack sockets are illuminated, lighting red for positive voltage and blue for negative voltage. (Audio appears purple, since it is a rapid alternation of positive and negative.)

Inputs with attenuators are indicated by a dotted line linking the socket to its corresponding attenuator knob.

From top to bottom, Persephone's sockets are:

- CV input with attenuator
- Secondary CV input
- CV output
- Audio input
- Secondary audio input
- Audio output

The two CV inputs are summed; similarly the two audio inputs are summed (mixed).

The “Clip” LED in the centre of the panel lights when the output exceeds ±10V, indicating that you've most likely left the realm of soft saturation and are heading into harsh clipping.

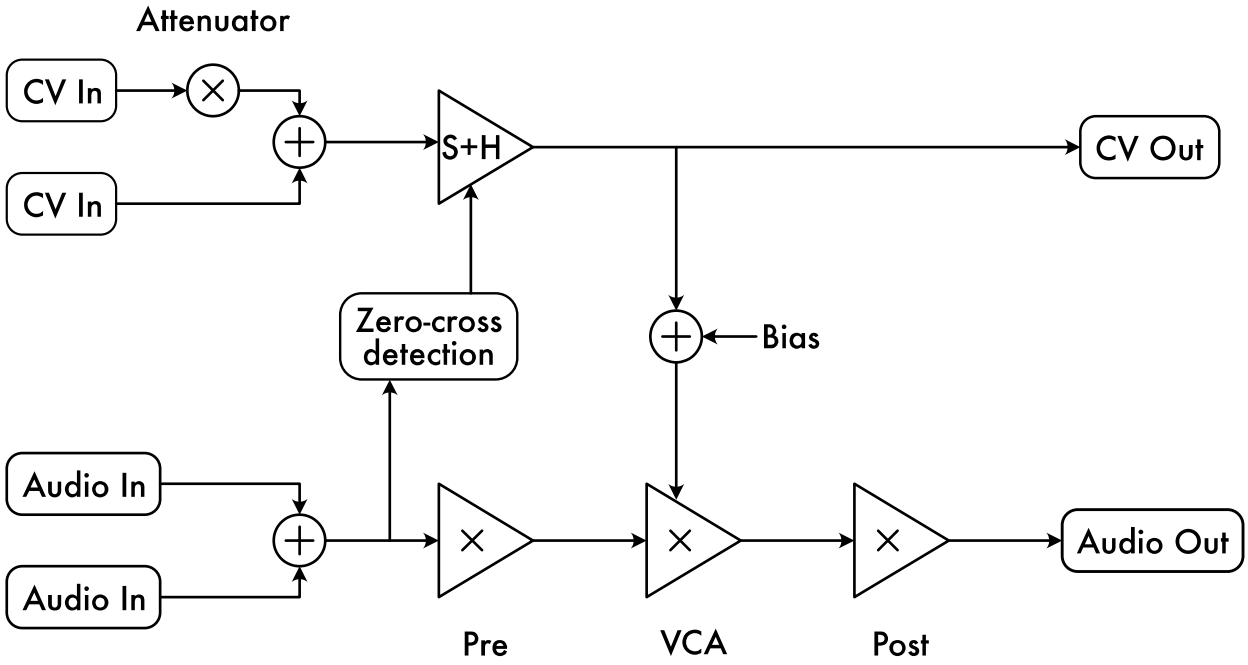
Controls

In addition to the CV attenuator, there is a knob for the CV Bias (explained below), and knobs for the audio Pre-VCA and Post-VCA gains (again, explained below).

There are two switches – one to enable the zero-crossing detection feature, and the other to switch the VCA to “asymmetric” mode.

Signal flow

The diagram below shows the module's operation in outline:



Audio path

The two audio inputs are summed (mixed), and then pass through three gain stages: the Pre stage (i.e. pre-VCA), the VCA itself, and the Post stage. The purpose of the Pre stage is primarily to reduce the input level to one that the VCA can handle with reasonable linearity; likewise the main purpose of the Post stage is to boost the signal back to normal levels. Conversely, by deliberately raising the gain of the Pre stage we can deliberately operate the VCA in its non-linear (saturating) region; then the purpose of the Post stage becomes that of reducing the level so it doesn't clip at the output.

The Asymmetry switch disables part of the circuit that linearises the behaviour of the VCA, resulting in positive and negative sections of the input waveform being processed quite differently, increasing the even harmonic distortion.

The whole audio path is DC coupled.

CV path

The two CV inputs are summed, one via the attenuator, and passed to a Sample-And-Hold circuit. If the zero-cross detection is not enabled, this simply passes the CV straight through. If the zero-cross detection is enabled, the CV is sampled whenever the audio signal passes through zero, and that CV value is held in between zero-crosses.

The CV output is the output of the S+H circuit.

The Bias is added to the CV from the S+H and the result is used as the controlling voltage of the VCA.

Use as a "regular" VCA

To use Persephone as a common-or-garden VCA, with minimal distortion, we suggest the following:

- Set Pre to 0, and Post to 10.
- Disable Asymmetry.
- Adjust Bias until the sound is just cut off with no CV applied.
- Apply your CV. Set the CV attenuator to 10, and then lower the attenuator until the sound follows the envelope shape faithfully.

Zero-cross detection

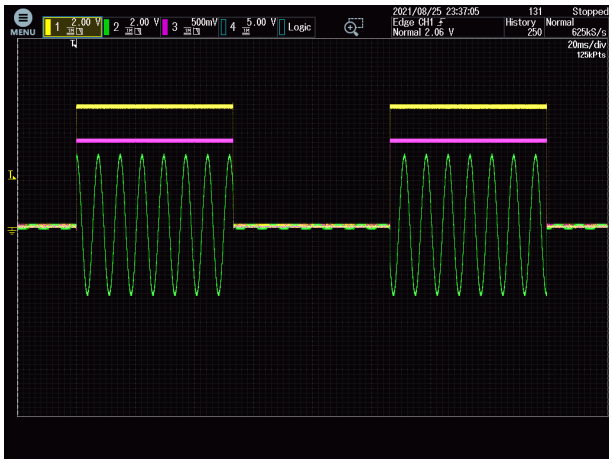
To illustrate the value of the zero-cross feature, consider the following, in which an envelope with a very fast attack is being applied to a fairly low frequency sine wave:

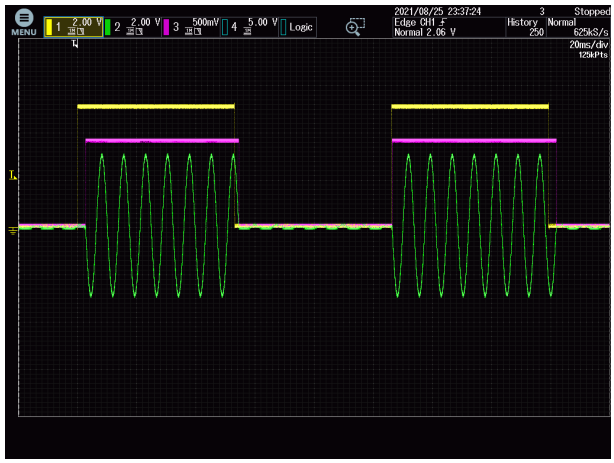
The yellow trace is the CV input; the magenta is the CV output. The green trace shows the module's audio output. In this image, the zero-cross feature is not enabled. Notice how the audio waveform rises extremely abruptly as the envelope opens. This would be audible as a nasty click. Worse, as the relative timings of the envelope and the sine wave change from note to note, the click will come and go randomly.

Now let's enable the zero-cross detection:

Notice how the output CV (magenta) is now stepped, and only changes when the audio passes through zero. Also, the output waveform no longer has the click at the start, since it remains at zero until the first zero-crossing.

For an even more example consider the images below, now using a simple gate pulse as the CV input:

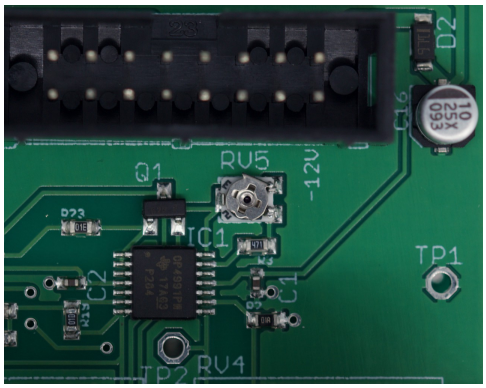




On the left (without zero-cross detection), note the random clicks that will occur at the start and end of each burst. On the right (with zero-cross detection), note how each burst begins and ends cleanly at zero.

Calibration

A trim pot (marked RV5) on the PCB allows for adjusting the VCA gain. Persephone is factory-calibrated so that the module gives unity gain with Bias set to 10, Pre set to 0, and Post set to 10.



Where to get help

Email, forum, and social media links can be found at the bottom of every page on our website[2].

Acknowledgments

Black and white photography by Israel Denadai[3].

2 https://www.expert-sleepers.co.uk
3 http://israeldenadai.com.br/bw