

Expert Sleepers



lorelei

User Manual

Revision 1.0

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Introduction

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

Lorelei is a VCO (Voltage Controlled Oscillator) with quadrature sine outputs, waveshaping, and sync/cross-modulation options.

The module has three waveform outputs, all affected by the same waveshaping controls (a front panel knob and a CV input). The first offers a variable pulse width square wave. The remaining two offer waveforms based on quadrature (i.e. 90 degrees out of phase) sine waves. The waveshape control progressively turns the first sine output into a triangle-like waveform; the second sine output becomes a saw-like waveform.

The cross-modulation input is somewhat like the sync input found on more conventional VCOs, but it has more nuances of operation allowing for a wider choice of sounds.

The module is 100% analogue, using discrete transistor OTAs.



Installation

House the module in a Eurorack case of your choosing. The power connector is 16-pin [Doepfer standard](http://www.doepfer.de/a100_man/a100t_e.htm)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.

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

Power requirements

Lorelei draws up to 55mA on the +12V rail, and 54mA on the -12V rail.

It does not use the 5V rail.

Inputs and outputs

Lorelei'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, Lorelei's sockets are:

- Pitch CV input (1V/octave)
- Linear FM input
- Exponential FM input, with attenuator
- Cross-modulation/sync input
- Wave shape CV input, with attenuator
- Square/pulse output
- Sine/pseudo-triangle output
- Cosine/pseudo-saw output

Controls

In addition to the three attenuators, there is an eight-position octave selection switch (white), a Tune control (blue), and a Shape control (green).

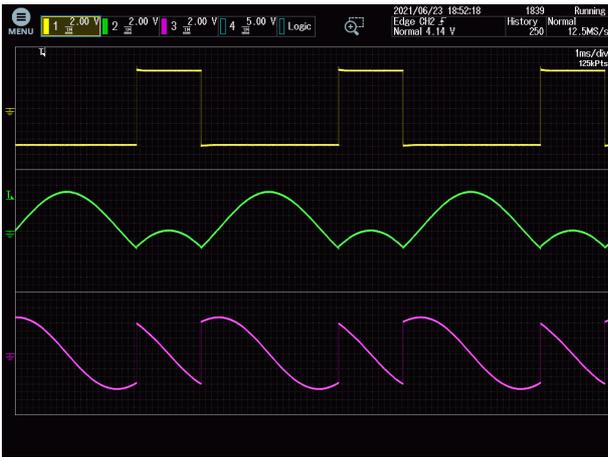
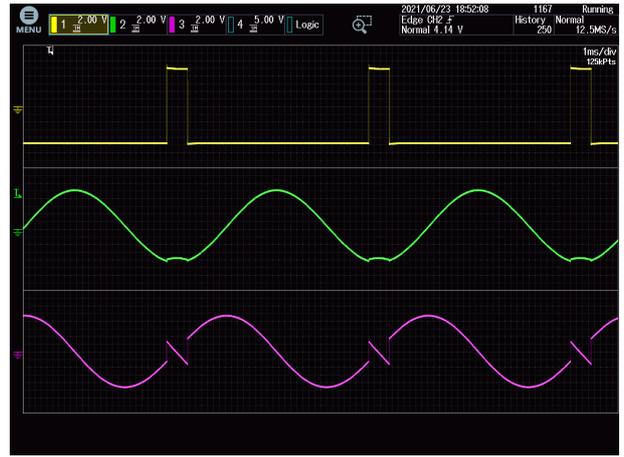
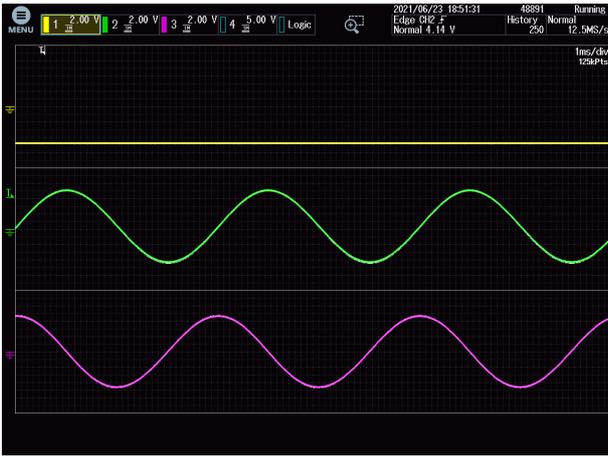
The Tune knob will adjust the oscillator pitch by approximately one octave up or down.

Wave shapes

The wave shape CV input and knob together simultaneously control the waveforms of Lorelei's three outputs.

A curious result of the exact nature of the wave shaping applied is that at the half-way point the perceived pitch of the sine and cosine outputs doubles.

Below are oscilloscope traces showing the three outputs as the Shape knob moves from 0 to 10.



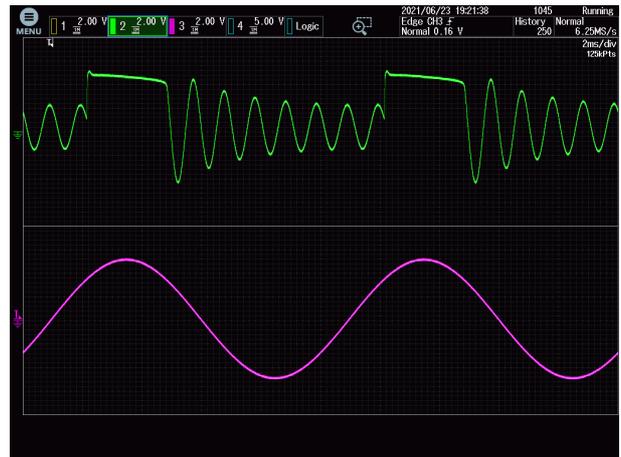
Waveforms shown for Shapes of approximately:

0	2
3.5	5
6.5	8
10	

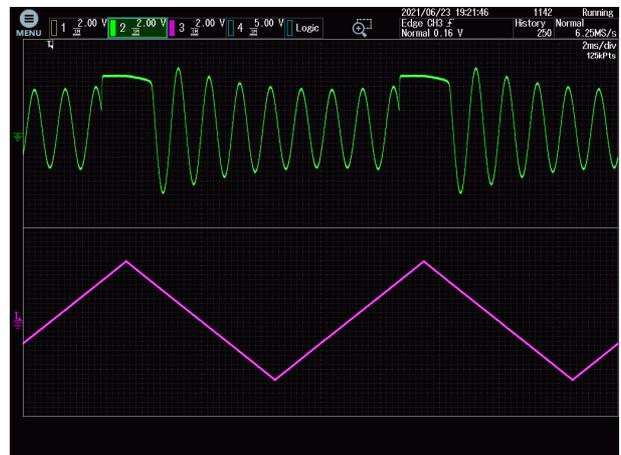
Cross-modulation/sync

In a common-or-garden ramp-based analogue VCO, oscillator sync works by resetting the ramp integrator based on the frequency of the syncing signal. Lorelei works quite differently, though similar effects can be obtained. In Lorelei, the sync input essentially prevents the oscillator from oscillating when the input is above a certain voltage (around 3.3V), but this is not an on-off thing – the effect gradually applies as the voltage increases. The upshot of this is that smooth waveforms (e.g. sine or triangle) for the syncing input produce a different effect to, say, square or pulse waveforms. Also, when using a pulse wave as the sync input, the pulsewidth of the signal also affects the result quite drastically. In the examples below, Lorelei's output is at the top (in green) and the sync input waveform is at the bottom (in magenta).

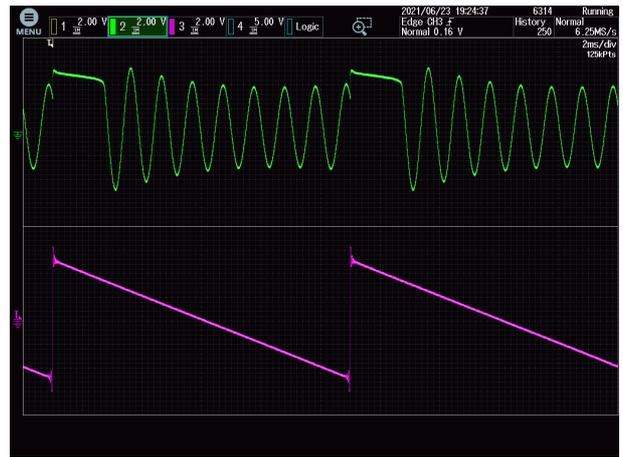
Sync from $\pm 5V$ sine wave:



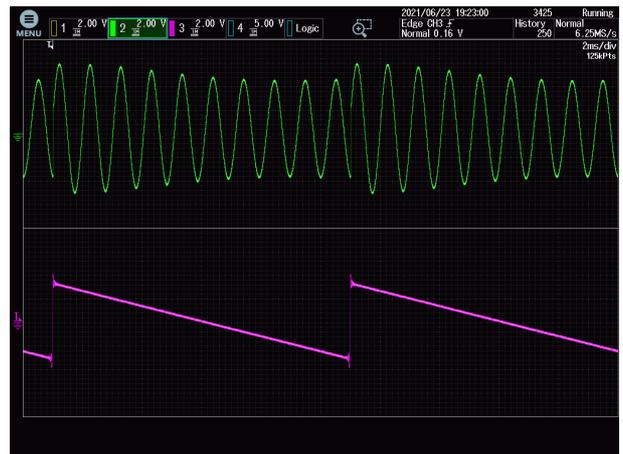
Sync from $\pm 5V$ triangle wave:



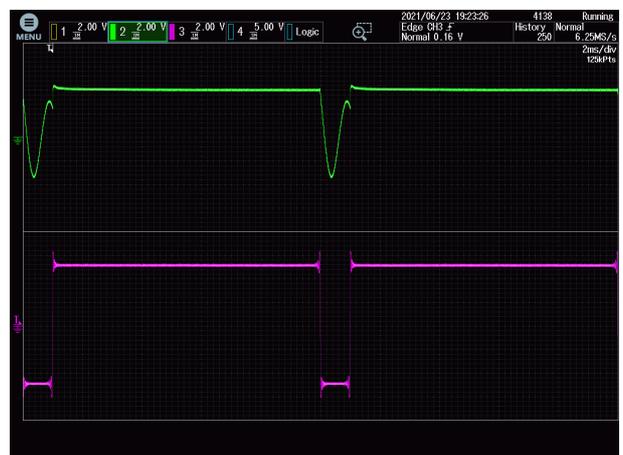
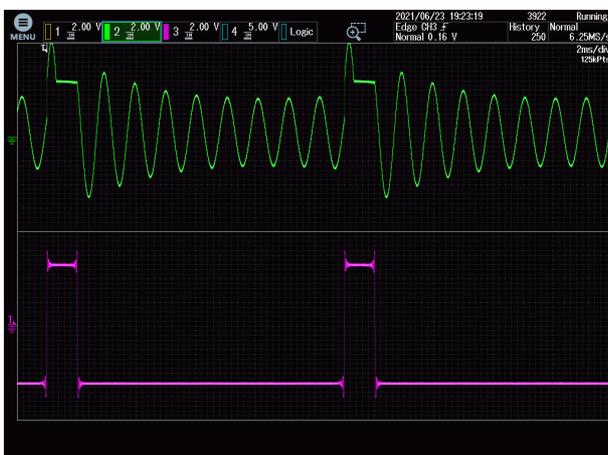
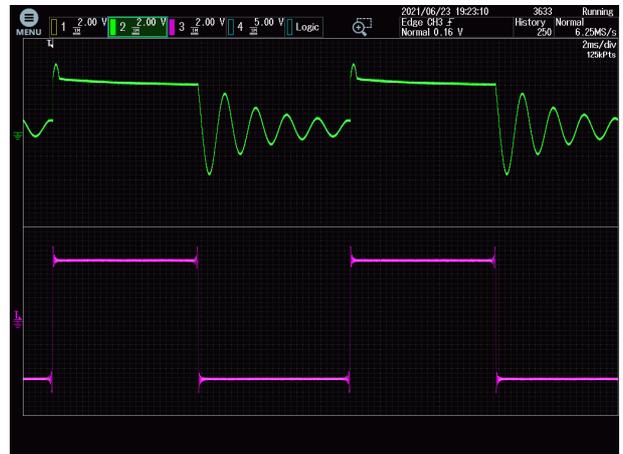
Sync from $\pm 5V$ ramp wave:



Ramp wave reduced in amplitude to just trigger the sync:

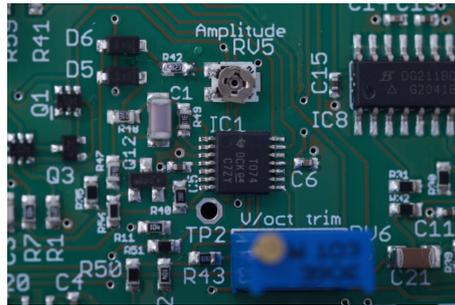


Sync from $\pm 5V$ pulse wave with various pulse widths:



Calibration

There are two trim pots on the Lorelei PCB, as shown below:



“RV5”, marked “Amplitude”, sets the internal level of the module and so the operating point of the wave shaping. It should be set so that the waveform observed at the test point “TP2” is 2 Volts peak-to-peak. You should not need to adjust this unless you find that the output waveforms cannot be set to completely clean sine waves at either end of the wave shape knob.

“RV6”, marked “V/oct trim”, controls the pitch tracking of the oscillator. This needs to be set carefully to obtain the best possible tracking. It is factory calibrated, but you may find you need to recalibrate if your environmental conditions are much different to those in the factory, or simply as the module ages.

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>