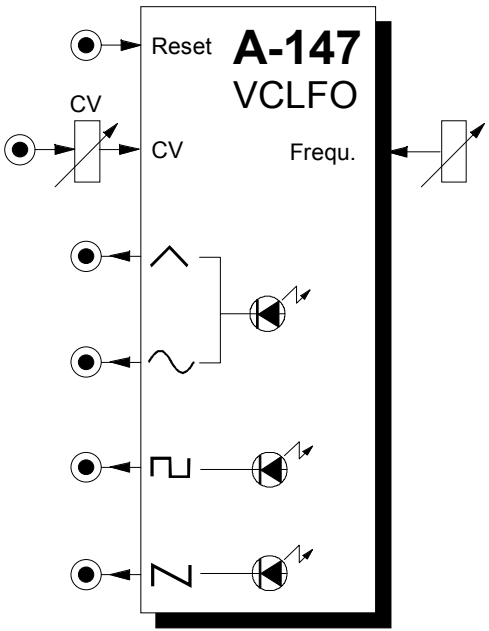


1. Introduction

Module **A-147 (VCLFO)** is a **voltage controlled low frequency oscillator,** which can produce cyclical control voltages over a 0.01Hz to 50Hz frequency range.

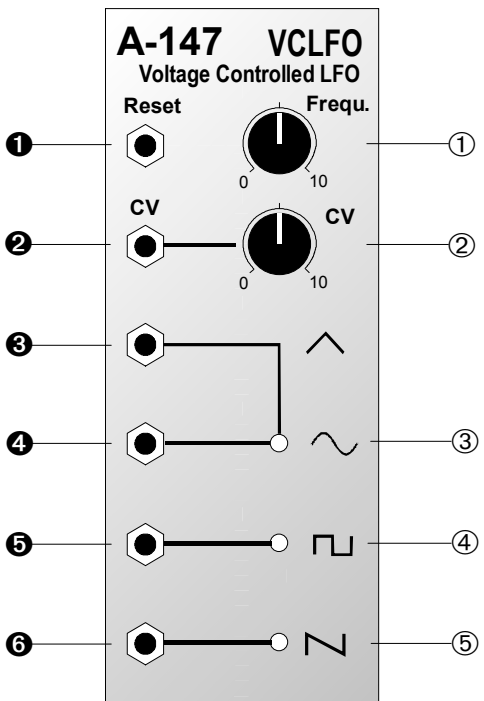
The VCLFO can be patched as a **modulation source** for a wide range of modules (for instance, modulation of VCO pulse-width or frequency, VCF cut-off frequency, VCA amplitude modulation) and as a provider of repetitive or clock voltages (for instance to drive the A-161 clock sequencer).

Four waveforms are available: **triangle, sine, square,** and **falling sawtooth waves**.

The VCLFO's frequency can be controlled by hand, but also by voltage control.

You can sync the VCLFO to another waveform by connecting the other waveform (eg another LFO) to the VCLFO's reset input.

2. Overview



Controls and indicators:

①	**Frequ.** :	Manual frequency control
②	**CV** :	Attenuator for the voltage at input ❷
③	**LED** :	Frequency indicator for the triangle and sine waves at outputs ❸ and/or ❹
④	**LED** :	Frequency indicator for the square wave at output ❺
⑤	**LED** :	Frequency indicator for the sawtooth wave at output ❻

In- / Outputs:

❶	**Reset** :	Reset input for syncing the VCLFO
❷	**CV** :	Control voltage input
❸	:	Triangle wave output socket
❹	:	Sine wave output socket
❺	:	Square wave output socket
❻	:	Sawtooth wave output socket

3. Controls and indicators

① Frequ.

This control sets the **frequency** of the VCLFO in a range from 0.01 Hz (one cycle every 100 seconds) to 50 Hz (50 cycles a second).

☞ The actual LFO frequency is determined by a combination of manual control and any voltage patched into CV input ❷ .

② CV

Use **Attenuator** ② to set the level of the voltage at CV input ❷ affecting the VCLFO frequency.

③ LED ... ⑤ LED

LEDs ③ to ⑤ indicate the frequency and voltage state of the LFO signals at their respective outputs.

☞ If the LFO frequency is higher than about 15 to 20 Hz, our persistence of vision means that the LEDs look permanently on.

4. In- / Outputs

❶ Reset

A gate pulse entering the **reset input socket** ❶ enables the VCLFO to be **synchronised** with another oscillator.

This means that the waveforms instantly go to their zero-point, and start from there (see Fig. 1). In the case of the triangle and sine waves, that's 0 V; with the square wave it's about +5 V and the sawtooth it's at half its maximum (about +3.5 V).

❷ CV

Socket ❷ is the **voltage control input** for LFO frequency. The voltage at this input is added to whatever voltage is set on the manual control ①. The level of CV input ❷ can be adjusted with the Attenuator ②.

❸ ⋀

This socket outputs a triangle wave, whose frequency is indicated by LED ③ (amplitude roughly ± 5 V).

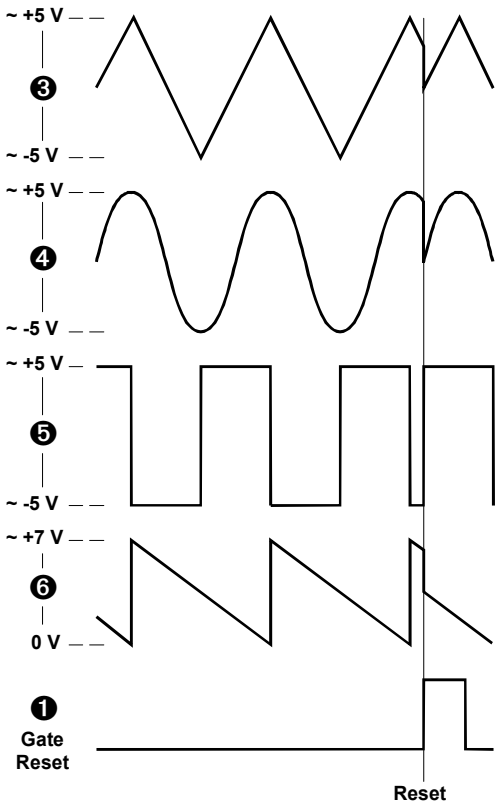


Fig. 1: How sync affects the waveforms

❹ ∿

This socket outputs a **sine wave** (amplitude range roughly ± 5 V), whose frequency / voltage state is indicated by LED ③ .

❺ ⊓

This socket outputs a **square wave** (amplitude roughly ± 5 V), whose frequency / voltage state is indicated by LED ④.

❻ ⋀

This socket outputs a **falling sawtooth wave** (amplitude roughly +7 V) whose frequency / voltage state is indicated by LED ⑤.

☞ In contrast to the A-145 standard LFO, the sawtooth is the identical frequency to the other waveforms (while the A-145 sawtooth is double the others' frequency).

5. User examples

An LFO can be used for all sorts of different modulations:

- **VCLFO - VCA**
  Modulation of the VCA gain produces **tremolo.**
- **VCLFO - VCF**
  Modulation of the cut off frequency produces cyclical changes in tone colour **(wah-wah).**
- **VCLFO - VCO (PWM)**
  Pulse width modulation causes cyclical changes in **tone colour.**
- **VCLFO - VCO (FM)**
  Pitch modulation produces **Vibrato**.

All the above refers to modulation in the **sub-audio range**. With modulation at audio frequencies (the low end of which the VCLFO can just get to), further changes occur in the sound spectrum. Look at the examples and suggestions in the manuals of the respective modules.

Simulating string vibrato

The patch in Fig. 2 shows a **string vibrato simulation**, copying the common guitar or violin playing technique, in which the finger applying the vibrato moves parallel to the fingerboard, in an oscillation of varying speed, to produce a pleasing and natural frequency modulation.

In this patch, the VCO is modulated by the VCLFO (with the VCO's CV input attenuator set to a low level).

While the key is held down on the keyboard, the VCLFO's frequency increases thanks to the control voltage from ADSR 1; at the same time, the volume decreases, thanks to the control voltage patched from ADSR 2 to the VCA.

Instead of ADSR 1, whose control voltage is raising the frequency of the VCLFO, and thus the speed of the vibrato, it's possible to use a MIDI interface (for instance an A-190 or A-191) and use aftertouch to provide the control voltage to the VCLFO.

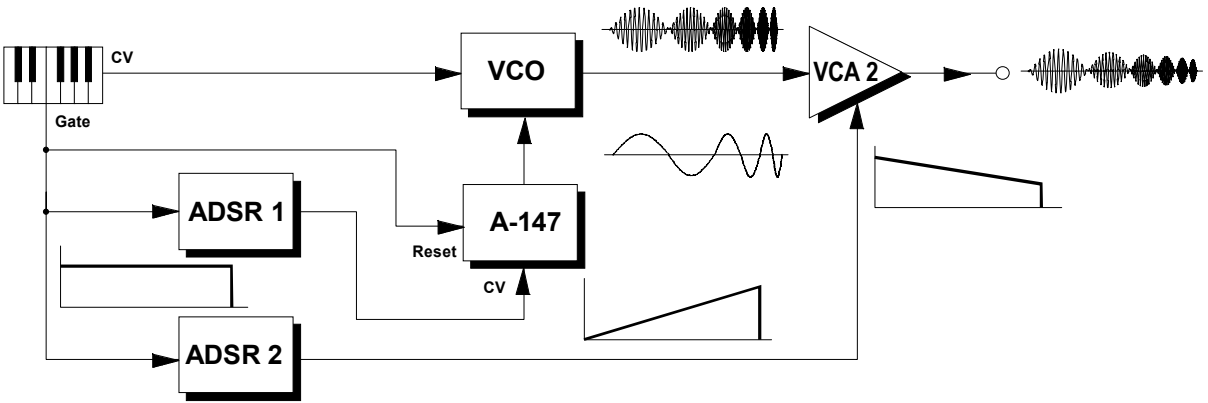


Fig. 2: Simulation of string vibrato

Integrating the VCLFO into a MIDI system

Unlike the A-145 and A-146 LFOs, the A-147's frequency can be voltage controlled.

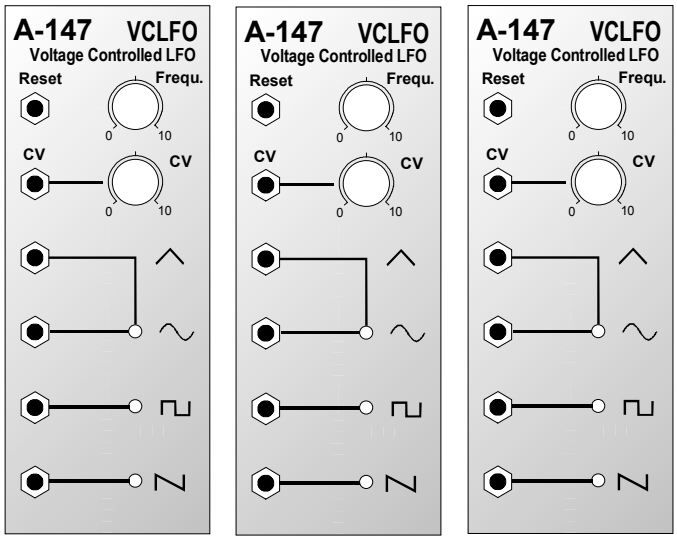
This above all gives you the chance to use a MIDI-CV interface (such as the A-190 or A-191) and use your chosen controller to **adjust the VCLFO frequency via MIDI**.

That makes the LFO frequency in effect programmable, and also naturally means that you can control it while playing in real time.

6. Patch-Sheet

The following diagrams of the module can help you recall your own **Patches**. They're designed so that a complete 19" rack of modules will fit onto an A4 sheet of paper.

Photocopy this page, and cut out the pictures of this and your other modules. You can then stick them onto another piece of paper, and create a diagram of your own system.

Make multiple copies of your composite diagram, and use them for remembering good patches and set-ups.

- Draw in patchleads with colored pens.
- Draw or write control settings in the little white circles.