

## 1. Introduction

Module **A-143-3 Quad LFO** is a low-cost four-fold modulation oscillator and includes four independent **low frequency oscillators (LFO's)**, which produce cyclical control voltages in a wide frequency range.

Three waveforms are available for each LFO: **triangle, square and sawtooth**. The frequency of the sawtooth output is twice the frequency of the other outputs.

The LFO's can be used as **modulation sources** for any control voltage input of other modules - for instance modulating the pulse width or frequency of a VCO, modulating the cut-off frequency of a VCF or the phase-shift of a VCP, amplitude modulation with a VCA, delay time of a BBD module, parameters of a voltage controlled wave shaper/multiplier, or any other control voltage input.

A three-way switch let's you select three frequency ranges, spanning from about two cycles per minute at the lowest, to moderate audio frequency at the highest.

The module includes four identical units.

Fig. 1: A-143-3 Controls and Outputs

## 2. Overview

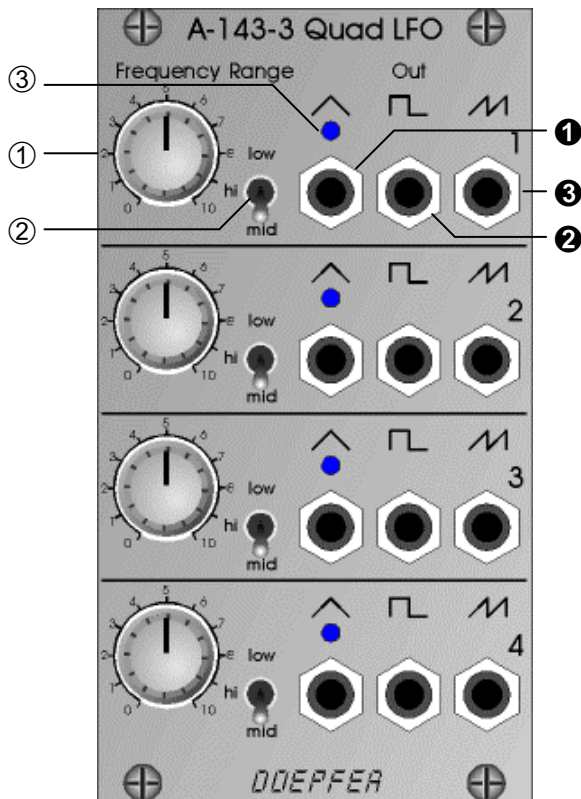


Fig. 2: A-143-3 front panel

### Controls:

- ① Frequ. : frequency control
- ② Range: frequency range switch
- ③ : LED control

### Outputs:

- ① : triangle output
- ② : rectangle output
- ③ : sawtooth output

The controls and outputs are the same for all four sub-units.

Module width: 14 HP / 70.8 mm

Module current: 70 mA

### 3. Controls and Outputs

#### ① Frequency

This control adjusts the frequency of the LFO within the frequency range set by the range switch ②.

#### ② Range

Use switch ② to select a suitable frequency range:

- **L** (low): minimum about 2 cycles per minute
- **M** (medium): normal LFO range
- **H** (high): moderate audio range

Pay attention that the high range is in the middle position due to technical reasons.

#### ③ LED

LED ③ displays the triangle signal that appears at socket ①.

If the LFO frequency goes above about 25 Hz, our persistence of vision means that the LEDs look permanently on.

#### ①

This is the output for the **triangle** wave, whose frequency is displayed by LED ③. The output is symmetrical around 0V, the level is about  $\pm 7$  V.

#### ②

This is the output for the **square** wave. The output is symmetrical around 0V, the level is about  $\pm 6$  V.

#### ③

This is the output for the **sawtooth** wave. The output is symmetrical around 0V, the level is about  $\pm 7$  V. To obtain an inverted sawtooth the voltage inverter module A-175 may be used.

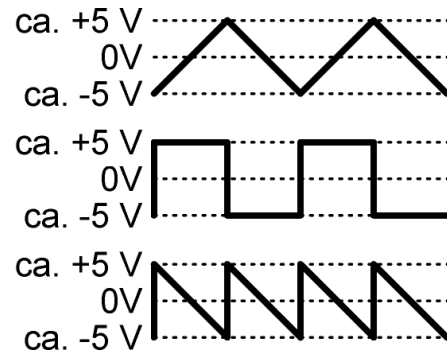


Fig. 3: A-143-3 waveforms and levels

## 4. User Examples

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

- **VCO Pitch/Frequency Modulation**  
Pitch/frequency modulation of a VCO produces **vibrato**.
- **VCO Pulse Width Modulation**  
Pulse width modulation of a VCO produces cyclical variation in tone colour (sounds similar to phasing)
- **VCA Loudness Modulation**  
Modulation of the gain of a VCA produces **Tremolo**
- **VCF Frequency or Resonance Modulation**  
Modulation of the cut-off frequency of a VCF produces cyclical variation in tone colour. For some filters even the resonance can be modulated.
- **VCP Phase Shift Modulation**  
Phase shift modulation of a phaser (e.g. A-101-3 or A-125) produces cyclic phasings or phase vibrato

Please refer to the user's manual of other LFOs or modulation sources for detail (A-145, A-146, A-147, A-149-1, A-118 random output).

By means of the universal vactrol module A-101-9 the frequency can be **voltage controlled**. Please refer to the A-101-9 manual for details.

In principle any control voltage input can be controlled by an LFO to modulate the parameter in question.

A special application of the quad LFO is the simultaneous modulation of several parameters of the same module.

### Example #1: **Wave Multiplier A-137**

- LFO 1 controls Multiplication
- LFO 2 controls Folding Level
- LFO 3 controls Folding Symmetry
- LFO 4 controls Harmonics

### Example #2: **VC Mixer A-135**

- LFO 1 controls VCA1
- LFO 2 controls VCA2
- LFO 3 controls VCA3
- LFO 4 controls VCA4