

# PONY VCO

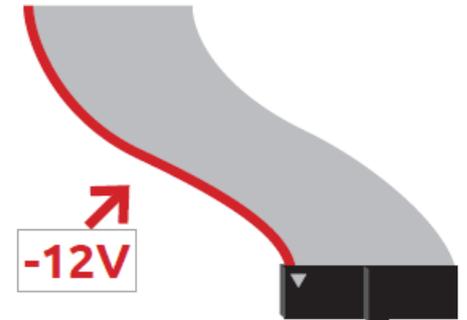
## USER MANUAL



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POWERING THE MODULE | THANKS FOR PURCHASING A MODULE FROM BEFACO!  
MODULE | BEFORE YOU PLUG THIS MODULE IN...

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1. Disconnect your cabinet from the mains.
  2. Triple check the power cord polarity. The coloured line on the cable (pin number one) is the -12V rail.
  3. If you plug the module backwards you might burn it out and unfortunately this is not covered by the warranty.
  4. If you have any questions about this product feel free to contact us [support@befaco.org](mailto:support@befaco.org)



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### | WHAT IS PONY VCO?

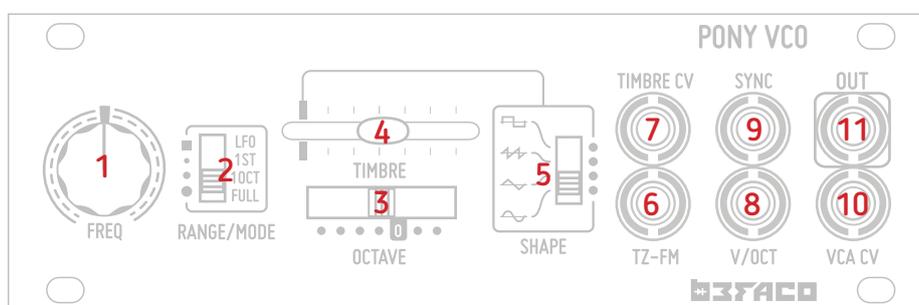
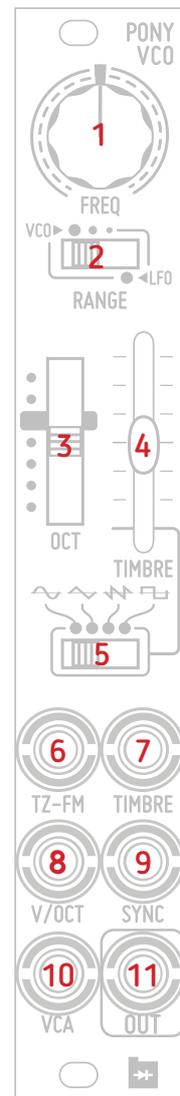
**Pony VCO** is a fully analog Thru-Zero oscillator with wavefolder and dedicated VCA in only 4HP. The module offers great stability and tuning capabilities thanks to its powerful core, based on Sound Semiconductors IC. It comes with range selector, that allows it to go down to LFO range, as well as octave and waveform selectors.

**Pony VCO** is also available in 1U format keeping the same functionality and control layout.

PANEL OVERVIEW



1. **Freq:** Manual tuning control of the VCO. Its behavior is affected by the Range switch below.
2. **Range:** Sets the frequency range of the Freq control. There are four range settings available. From left to right: Full, Octave, Semitone and LFO.
3. **Oct:** Sets the frequency of the VCO in octave jumps. The selector covers a range of seven entire octaves from C1 to C7 with Freq control at the centre. 0 position marks the fifth octave.
4. **Timbre:** This slider controls the amount of wave folding applied to the signal. Its behaviour is directly affected by the Shape selector below. With the Square wave selected it turns into a bipolar PWM control.
5. **Shape:** Selects between the four available waveforms: Sine, Triangle, Ramp and Square.
6. **TZ-FM:** Through Zero Frequency Modulation Input. 10Vp-p bipolar voltage range.
7. **Timbre CV Input:** Voltage control over Timbre. The voltage applied to this input is summed to the current position of the Timbre control. 10Vp-p voltage range.
8. **1V/OCT:** Calibrated frequency CV Input with 8 octave range accuracy. The voltage applied here is summed to the current value set by the Oct selector and Freq control and also to the signal present at TZ-FM Input. 10Vp-p voltage range.
9. **SYNC:** Hard Sync Input. 10Vp-p bipolar voltage range.
10. **VCA:** Input over the amplitude of the internal VCA circuit. Unipolar control Input. 0-8V voltage range.
11. **OUT:** VCO main signal output. Voltage range 10Vp-p (bipolar).



Warming Up our VCO

As **Pony VCO** is fully analog oscillator, is highly recommended to leave the module warming up for at least 15 minutes before use it. That will allow the core to reach its ideal temperature and ensure full tracking stability.

## MODULE STRUCTURE

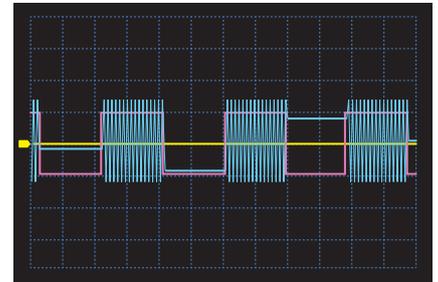
### Through Zero Frequency Modulation

In Through Zero oscillators, frequency is controlled by either positive and negative voltage. The main difference between a regular VCO and a Through Zero one is that if the voltage at the FM Input goes below zero, the core will continue oscillating inverting its phase.

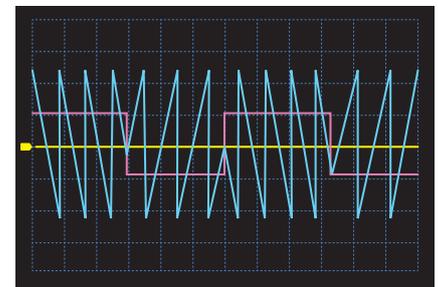
In Pony VCO, the application of the Through Zero FM is asymmetrical. The core continues oscillating with its phase inverted when the FM Input goes below zero but the frequency obtained is slightly different than the one at the positive part of the cycle.

This “little” change of behavior allows the core to create a whole new range of timbres that are just impossible to achieve with regular VCOs.

In order to keep the tune when a V/Oct and TZ signals are applied at the same time, the TZFM Input is AC Coupled which marks the minimum signal frequency expected at this input to 15mHz.



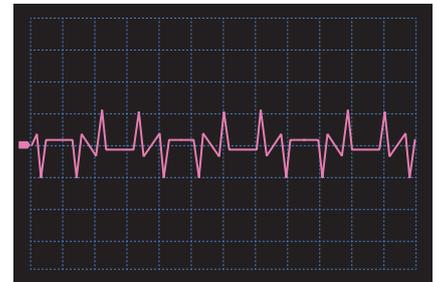
FM RAMP EVEN VCO



THRU ZERO RAMP

### Wavefolding (Timbre)

**Pony VCO** includes a wave folding circuit for the Sine, Triangle and Ramp waves. On wave folders, once an input reaches a certain threshold, the circuit inverts the direction the wave is travelling, “folding” it. Generally, it’ll do this multiple times, creating a very complex sound from even a simple input. As we increase the folding amount (Timbre), it’ll lower that threshold, increasing the number of times our wave gets folded. Timbre folds the waveform entirely two times adding several new harmonics during the process, pairing very well with the previously mentioned TZ-FM.



WAVEFOLDED SINE WAVE

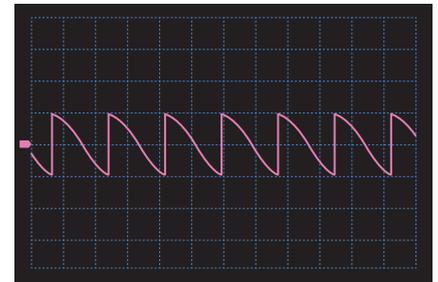
## | MODULE STRUCTURE

## Pulsewidth Modulation (PWM)

When the Square waveform is selected, the Timbre parameter turns into a bipolar pulse-width modulation control (PWM). It controls the amount of time the Square will be at its maximum level on each cycle. It is normally measured in percentage of a duty cycle, being 50% duty cycle (the middle position of Timbre control) the initial position where the time that the Square is at its maximum and minimum level is the same. Pony VCO counts with a vast PWM range, being able to achieve very tight pulse widths. This is very useful to make monophonic “string” and “chorus” like sounds using external signals to modulate them. Be aware that to achieve these tight pulse widths, the PWM circuit covers the whole range of the duty cycle. This means that at the minimum and maximum position of Timbre (0 and 100% duty cycle) the oscillation will stop.

## SYNC

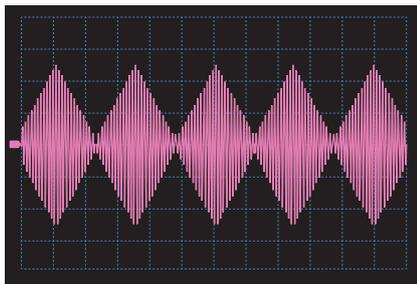
The signal applied to this input will force the core to reset its cycle (Hard Sync). It works best with waveforms that have sharp rising edges like a Pulse or Sawtooth. If the signal used to sync the core doesn't have an octave relationship with the core's frequency, the shape of the waveform will be distorted creating some interesting “ripping” tones.



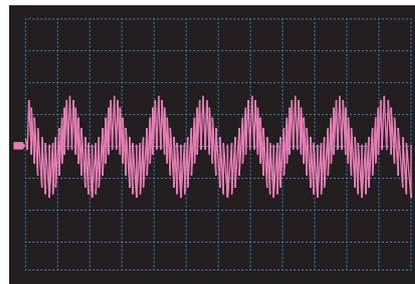
HARD SYNCED SINE WAVE

## VCA

**Pony VCO** includes a dedicated VCA circuit to modulate the oscillator's amplitude with external signals. The linear response of the circuit makes it ideal either for Subtractive and AM-type patches as the shape of the external signal is not affected by the VCA.



VCA WITH ENVELOPE (RAMPAGE)



VCA WITH AM (SINE FROM EVEN VCO)

## | SPECS AND CREDITS



**Size:** 4HP  
**Deeth:** 30 mm  
**+12v:** 32 mA  
**-12v:** 25 mA

This module is the result of loads of hours of work, love, and care. We would like to thank everybody that took the time to provide opinions, warned about technical issues (Thanks Alex!!) and encouraged us to keep going!! And of course THANK YOU! for the continuous support and trust in Befaco! <3

Hardware, layout and documentation design by Befaco Team

Beta testing by José Ángel Cabrera, Miguel Eedl, and the Befaco team.