

## VCO Instructions:



1. Tune: This knob is a coarse tune which allows you to sweep to a specific frequency
2. Fine tune: This knob is a fine tune which allows you to better dial in the frequency the coarse tune is on
3. PWLVL: this knob attenuates the signal that is patched into the “PWIN” input which modulates the pulse width modulation
4. PWM: this knob controls the pulse width modulation on the square wave
5. Sync: this is a sync input which when patched
6. PWIN: this is a pulse width input which modulates the pulse width and the signal can be attenuated with the “PWLVL” knob
7. SAW: this outputs a sawtooth wave form
8. SINE: this outputs a sine wave
9. TRI: this outputs a triangle signal

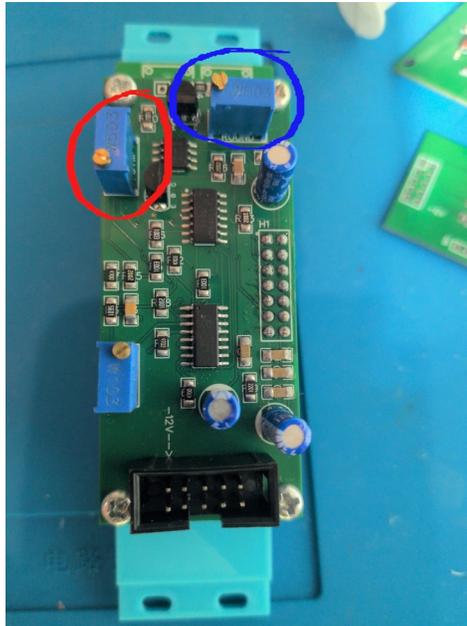
10. SQU: this outputs a square wave, with the pulse width can be changed with the “PWM” knob as well as modulated when a cv signal is patched into the “PWIN” input

11. FM: this is a FM (frequency modulation) input

12. 1/V: this is a 1/v input which allows you to play specific notes using a cv keyboard, midi to cv converter, sequencer, or any other cv signal.

Dialing in the sine wave:

On the rear of the module are two blue trim pots. One labeled SYM (for symmetry circled in red) and the other labeled ROUND (circled in blue). With a precision flat head screwdriver, you are able to adjust the shape of the sine wave to your liking. It is highly recommended to use an oscilloscope for this part to be able to see what the wave forms look like.



Adjusting the “round” trimpot affects how round/smooth the peaks of the sine wave are. Adjusting the “symmetry” trimpot affects how wide/narrow the sine waves can be. Note that depending on how much you adjust the round and symmetry, you may end up with a triangle wave. To fix this, simply try adjusting the round trimpot first to round out the peaks then the symmetry. This is why it is suggested to have an oscilloscope handy.

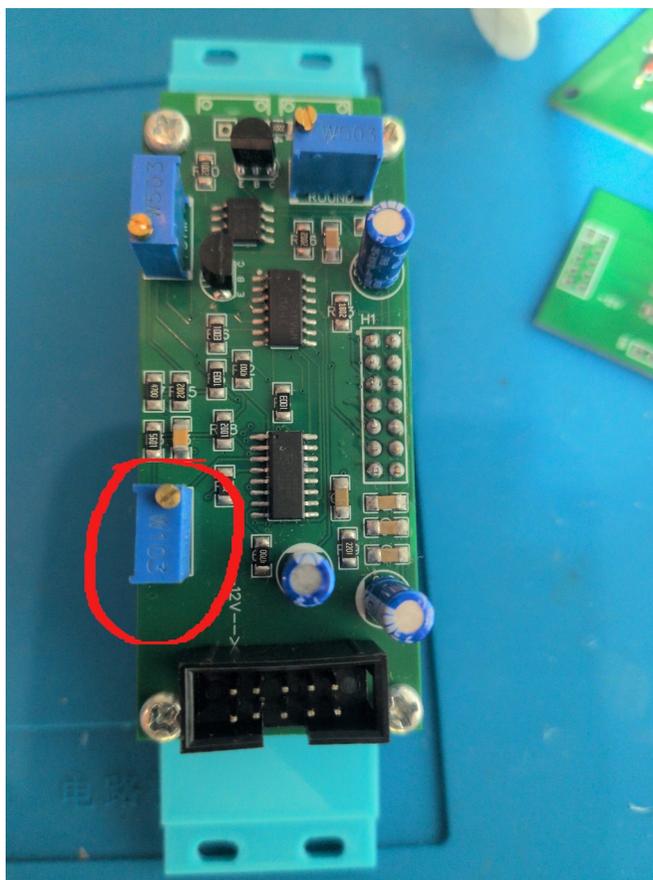
## VCO calibration:

Since this is an analog AS3340 based vco, it would need to be calibrated. I tend to calibrate the vcOs to “C” prior to shipping so when plugged to a 1/v source (cv keyboard, midi to cv converter, etc), it is already in tune. But due to temperatures, user power supplies, components, and other variables, analog vcOs can fall out of calibration.

It is HIGHLY recommended when wanting to calibrate these vcOs to have an oscilloscope handy to be able to see the exact frequencies you are getting, and while there are alternatives such as maybe using a tuner, this one tends to be the most accurate. To calibrate, you will need some tools. As mentioned, an oscilloscope is highly recommended, a midi to cv converter with a midi keyboard connected or a cv keyboard (either or would have to be patched to the 1/v input on the vco), a precision flat head screwdriver, 1 or 2 patch cables, and possibly a calculator. I would also refer to the guide: “Calibrating and tuning a vco” by Analog Output as it goes into better detail of calibrating the analog vcOs and explaining the process than I can. I do detail some steps of what I personally do and have found easy, especially if you are first starting out with

The first step would be to have the vco powered on to your eurorack power supply for at least 30 minutes to warm up the AS3340 chip. After about 30 minutes I would set the fine tune knob at 12 o'clock and patch a cv keyboard or midi to cv converter to the 1/v input of the vco. I do want to note that it is ok to leave the PWLVL and PWM knobs at whatever position, however the “TUNE” knob would be used a little later.

The second step is either from the sawtooth or sine wave output, use your oscilloscope to attach onto a patch cable and patch into one of those two outputs. After adjusting your oscilloscope to be able to see the waveform of your choosing, I personally play C1 on a keyboard and then refer to the guide I use and reference, as they better explain the procedure in depth. Also, as part of the calibration process, it would be important to know which trimpot is the track trimpot, which is the one circled in red in the photo below



The guide I personally use is the article “Calibrating and tuning a vco” by Analog Output. All credit goes to Analog Output for the calibration guide and has been super helpful in the calibration process. The guide can also be found [here](#) and it states:

“Start with the lower voltage and adjust the center frequency pot, if necessary, to get a frequency of around 100–200 Hz. (Your oscilloscope may be able to measure frequency, or you may be able to find a tuner device or app that will read out frequency.)...

With the lower voltage, make a note of the frequency, call it  $f_1$ .

- Go up 2 V and make a note of the new frequency, call it  $g_1$ .
- Use a calculator to get the frequency ratio  $R_1 = g_1/f_1$ . Now forget about  $g_1$  and  $f_1$ , it's this ratio that's important. What you want is for it to be 4.000. Let's just say for example you get  $R_1 = 3.923$ .
- Now turn the Tracking pot by some amount — let's say 1 turn clockwise.
- Go back to the lower voltage, make a note of the frequency, call it

$f_2$ .

- Go up 2 V and make a note of the new frequency, call it  $g_2$ .
- Calculate the frequency ratio  $R_2 = g_2/f_2$ . Let's suppose you get  $R_2 = 3.964$ . That's closer to 4.000 so clockwise was the right direction but you didn't go far enough. So turn Tracking another turn clockwise. If on the other hand you got  $R_2 = 3.896$ , that would be further from 4.000, so clockwise was the wrong direction. So turn Tracking two turns counterclockwise.
- Go back to the lower voltage, make a note of the frequency, call it

$f_3$ .

- Go up 2 V and make a note of the new frequency, call it  $g_3$ .
- Calculate the frequency ratio  $R_3 = g_3/f_3$ . If you haven't reached 4.000 yet, turn Tracking some more the same way. If you've passed 4.000, turn Tracking half a turn back the other way.
- Keep repeating measuring two frequencies, calculating their ratio, and adjusting Tracking one way if the ratio is too low, the other way if it is too high, until the ratio is 4.000."