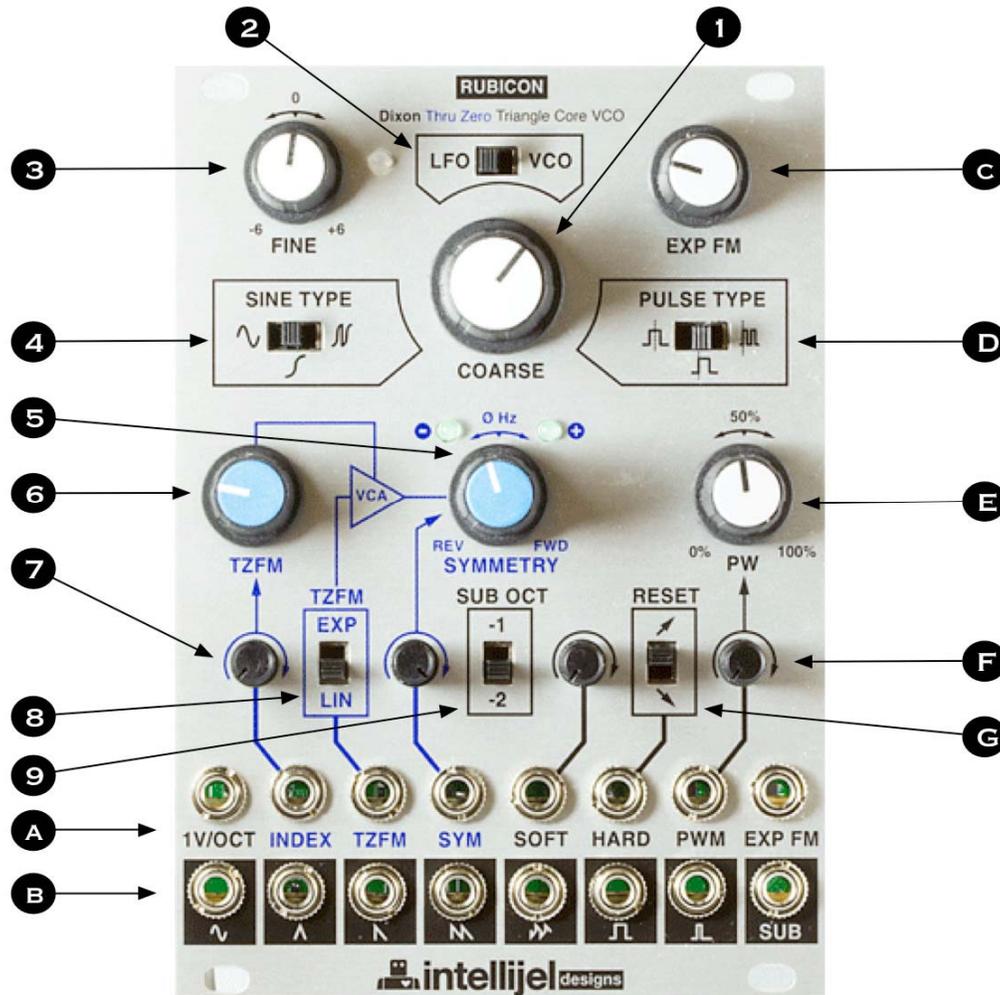The Rubicon is an analogue triangle core VCO that is capable of through zero frequency modulation. It is a feature packed VCO with multiple simultaneous waveform outputs including waves that are multiples or divisions of the base frequency.

Front Panel details

1- COARSE knob- Sets the frequency of the oscillator.

2 - LFO/VCO switch - Changes the base frequency range from very slow (LFO) to audio (VCO)

3 - FINE knob – Allows finer adjustment of the coarse frequency over a range of +/-6 semitones

4- SINE TYPE switch - SINE on the left, SIGMOID in the middle, SIGMOID at double the base frequency on the right (*sine is what you get when you push a triangle wave to a sine shaper, and sigmoid is what you get when you push a sawtooth wave through a sine shaper -- it sounds a lot like a saw, but a bit warmer and can be great for creating metallic sounds.*

5- SYMMETRY knob - Determines the direction and magnitude of the waveform through the linear FM circuit -- fully CW gives output at the positive base frequency, fully CCW gives output at the negative

base frequency, and in the centre the VCO stops oscillating (zero frequency). If fully CW, then a signal into TZFM gives conventional Linear FM. Ditto for fully CCW, but the output frequencies are negative (which simply means that all of the waveforms are backwards -- except the zigzag, strangely enough). For normal VCO sounds set this at full CW.

NOTE: Symmetry affects 1V/Oct tracking! For the best tracking put SYMMETRY in full CW position.

6 - TZFM knob - Sets the Bias of the TZFM VCA. As the knob is turned CW more of the signal patched into the TZFM input will modulate the VCO frequency. (Remember, the SYMMETRY setting determines whether the FM is conventional linear, partially through-zero , or balanced through-zero)

7 - mini knob for TZFM attenuation - This attenuates the audio/cv signal coming into the INDEX input below. This is the attenuated modulation input for a linear VCA which virtually turns the TZFM knob. This is the "dynamic" modulation of through-zero FM. In other words, it modulates the modulation. It's the "adverb" to TZFM's "adjective" so to speak. That's why it is shown as the control input to a VCA on the panel. The INDEX input is like the CV input of a VCA, and the TZFM knob is like the Bias of that VCA, where that VCA controls the degree of through-zero (or just linear) FM.

8 - TZFM EXP/LIN switch - Selects the type of FM modulation the TZFM input will be.

This switch determines whether the response of TZFM is linear or exponential. The exponential setting is not really 1V/oct, and really just gives a more extreme response to the modulation signal

9 - SUB OCT switch - Selects if the SUB output is down one octave or two octaves from the VCO base frequency.

A - Input jacks - CV and audio signals are patched into here.

B - Output jacks   - As will all Intellijel modules the outputs have filled boxes around them.

C - EXP FM knob - Sets the attenuation of the signal patched into the EXP FM input, modulates the conventional expo FM circuit (gives 1V/octave response when the attenuator knob is turned fully CW)

D- Pulse Type switch - Centered pulse on the left, edge aligned pulse in the centre, edge aligned pulse at double the base frequency on the right (centre pulse is what you get when you send the triangle wave to the pulse comparator, and edge pulse is what you get when you send the sawtooth wave to the pulse comparator -- they are the same, but they have a different phase relationship to each other, so they do different things when blended with the other waveforms)

E – PW knob - This knob offsets the pulse width of the Pulse waveform out.

F - mini knob - Attenuates the signal going into the PWM input.

G - RESET switch - Selects whether the HARD sync input will reset the VCO to a rising or falling direction.

IO Section Details
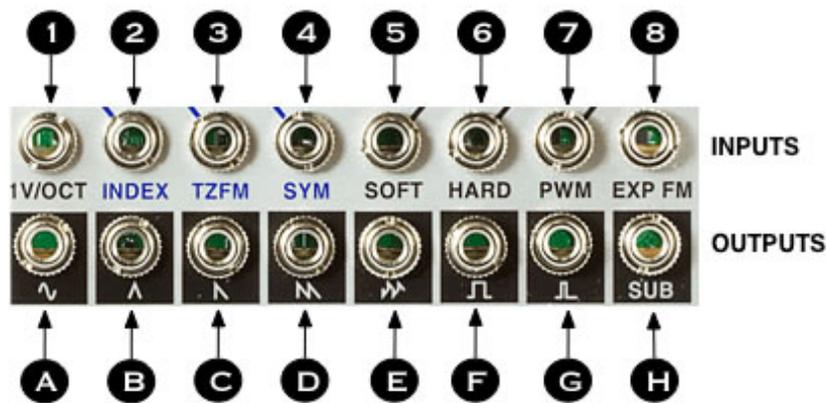
INPUTS

1 - 1V/OCT - Controls the frequency of the VCO. 1 volt increments double the frequency of the VCO.

2 - INDEX - CV input of the VCA in the TZFM path. There is a mini attenuator on this input.

3 - TZFM - FM input that can be switched LINear or EXPonential with the switch above it. The amount of this input is controlled by the VCA. The VCA is controlled by the TZFM knob and INDEX input.

4 - SYM - This modulates the symmetry setting, and is equivalent to turning the symmetry knob back and forth. This is the "non-dynamic" modulation of through-zero FM. There is a mini attenuator on this input.

5 - SOFT – Soft sync, the triangle wave reverses on the incoming sync pulse, and the attenuator sets the probability that a pulse will cause reversing. Requires edge-y waveforms like square or sawtooth (sawtooth is best). There is a mini attenuator on this input.

6 - HARD - hard sync input. Traditional VCO sync that resets the Rubicon when the input VCO or Master crosses zero. Use the RESET switch above it to select if the waves will reset rising or falling.

7 - PWM - Pulse Width Modulation CV input for modulating the pulse with of the Pulse wave.
There is a mini attenuator on this input.

8 - EXP FM - input for traditional exponential FM. Does not go through zero. use for pitch bend and FM sounds that do not have to track the 1v/oct input such as percussion. The EXP FM knob attenuates this input. Gives 1V/octave response when the attenuator knob is turned fully CW

OUTPUTS

A - Sine wave - Waveform selected by the SINE TYPE switch. Wave types: Sine, Sigmoid, Double Frequency Sigmoid.

B - Triangle wave.

C - Saw wave

D - Double Saw wave -   A saw one octave above the VCO frequency

**E - Zig Zag wave**

F - Square wave

G - Pulse wave - Pulse type selected by the PULSE TYPE switch. Wave types: pulse (center modulated), pulse (edge modulated), double frequency pulse

H - SUB - Sends a square wave either one or two octaves below the base frequency to the SUB output. SUB OCT switch selects -1 octave or -2 octave below the VCO frequency.
This circuit is very similar to the SUB control on a classic Roland SH-101 synthesizer.

The TZFM Section in depth

On the Rubicon panel, the "Index" input is the CV input for dynamic control of the TZFM CV input. This TZFM input goes through a linear VCA, and the Index input controls this VCA. (The Symmetry input does not go through a VCA, and therefore cannot be put under dynamic control -- that is the only difference between those two inputs.) Like the other modulation indices, it is 20% per volt.
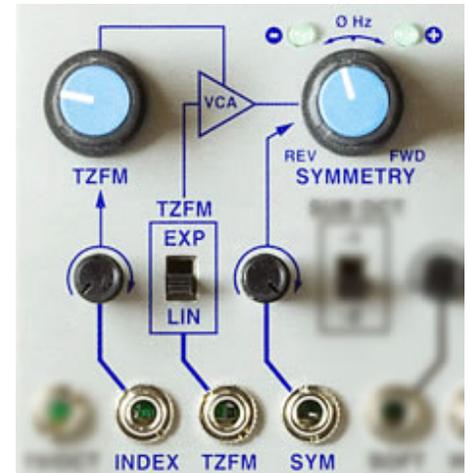
On using TZFM from the designer himself:

"About using the TZFM, the best (i.e., most musical) results will be obtained when the TZFM modulation signal has a lower frequency than the base frequency of the Rubicon (i.e., the frequency of the unmodulated VCO with the SYMMETRY pot cranked fully CW). If the TZFM modulation signal is faster than the Rubicon's base frequency, then all you'll get is little wiggles on the waveform which aren't that interesting.

If you want balanced TZFM (where the frequency is modulated through zero in a symmetrical fashion, going up to the same frequency in both the positive and negative directions), then set the SYMMETRY pot in the centre. However, you must be aware that the unmodulated frequency of the VCO at this setting is actually zero, and even with the COARSE knob cranked way up, the frequency range you hear will still be relatively low. This is simply the nature of the beast. Hence, if you want high frequencies with balanced TZFM, you'll really have to crank the COARSE pot up pretty high (which would give "base" frequencies well above the audio range under "normal" operating conditions).

I personally find that the TZFM sounds are the most interesting when the SYMMETRY is adjusted to around 1:00 or 2:00 o'clock (or 10:00 to 11:00 o'clock). However, YMMV. I also find the sound to be quite invigourating when the symmetry is modulated (by feeding a waveform, preferably sine, into the SYM input) and the symmetry knob is then slowly turned. As Martha used to say, "It's a good thing!"

Try relatively fast modulation to the TZFM input, modest TZFM attenuator setting, maybe some INDEX (maybe not), and a slow modulation to the SYM input. Then, send something else to HARD or SOFT

sync, etc.

You can also self modulate to interesting effect. Try sending the SUB output to HARD or SOFT at various attenuator settings, or the double sigmoid to TZFM, or whatever -- it may be total shite, or it may be the most amazing thing you've ever heard. Experiment!"   **- David G. Dixon**

Tuning Procedure

WARNING – Do not do this unless instructed by Intellijel

While the Rubicon ships from the factory with its tuning professionally calibrated it may drift out of optimum tuning after several years of use. If that happens the below procedure may be necessary. Please note this is a lengthy process and should only be undertaken by an experienced user.

0- Before Tuning have Symmetry set to full CCW
1- plug in and warm up for 5 min.
2- voltage offset gen at 0V
3- patch 1v/oct offset generator to 1v/oct in. You can also use a 1v/oct source such as a CV keyboard. You will need to generate voltages that are precisely 1V increments (ie 1V, 2V, 3V etc)
4- connect ext fine tune to 3 pin header
5- frequency counter patched to tri out, mode to measure Hz
6- Set offset generator to 0V, set fine to 12 o'clock set coarse and extra fine so Rubicon is at 8hz
7- tune 8hz to 16hz range by using the offset gen to 1V. Then adjust CV gain so that freq is 16hz. Go back to 6 and repeat 7 until 0V =8Hz and 1V = 16Hz perfectly.
8- set offset so it reads 64hz - Adjust xtra fine so you get exactly 64Hz on meter
9- set offset so you get 512Hz
10- 10 - adjust HFGAIN trimmer until the meter reads 512Hz
11- 11 - set offset so you get 4096Hz
12- 12 - adjust HFBIAS so you get 4096Hz.
13- 13 - now go back to 64Hz and repeat steps 8 to 12 until no more changes are needed
14- (about 2-3 passes total)

Patch Examples

Patch 1: Basic 2 Operator TZFM
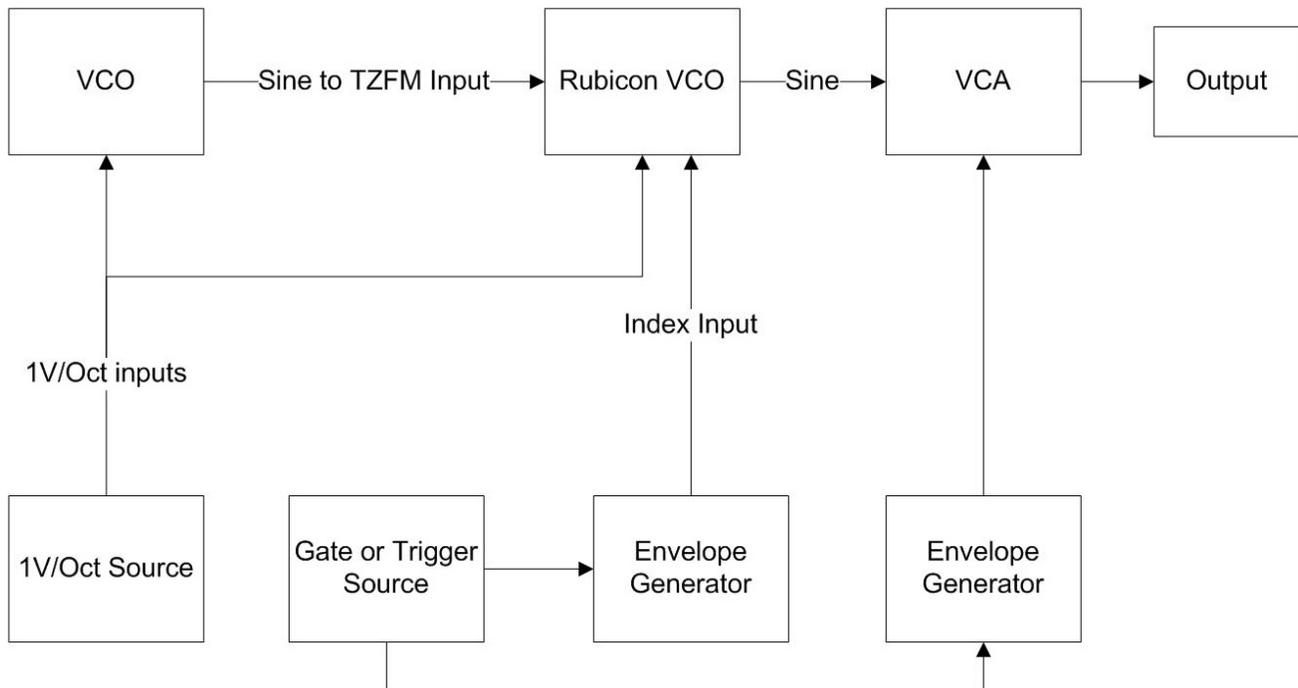
This is the most basic FM patch and is known as "Two Operator FM". It uses The Rubicon, another VCO, two Envelope Generators and a VCA. In FM terminology the Rubicon becomes the Carrier and the second VCO is the Modulator. Because they have similar pitch tracking we recommend the second VCO be a Intellijel Dixie or another Rubicon. You will need a 1V/oct and gate source such as a CV keyboard or MIDI to CV converter.

Connect your CV/Gate source to the 1V/oct inputs of both VCOs. Connect the gate out to both gate inputs of your envelope generators. Arrange other connections as shown in the diagram above. Turn the Symmetry of the Rubicon to full CW, place the TZFM switch in LIN mode and turn the TZFM knob all the way down.

Tune both VCOs to the same octave using their coarse and fine tune controls. Now tune the second VCO, or Modulator one octave above the Rubicon. This is the classic 2:1 FM ratio. Use the Index mini knob to control the depth of FM that is applied to the Rubicon via the first envelope generator. The TZFM knob acts as a offset to the FM depth so you should experiment with it as well. It is usually best to set the envelope generator controlling FM to be shorter than the envelope controlling the output VCA.

The amount of harmonics is controlled by the Index amount and TZFM knob while the timbre of the harmonics is controlled by the Modulator VCO pitch relative to the carrier VCO as well as the waveforms used. It is recommended to use simple waveforms such as sine or triangle.
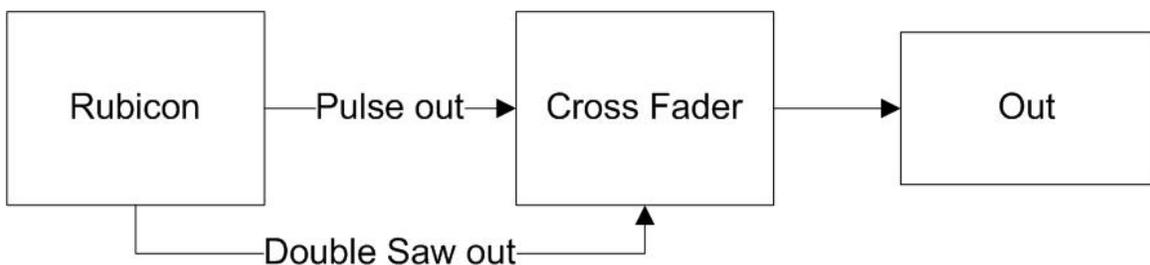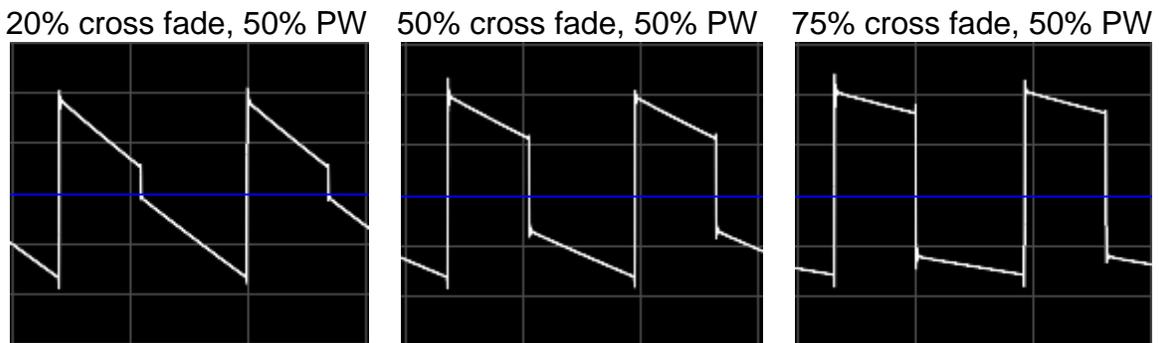
Patch 2: Classic DCO style PWM Saw Strings

One of the special features of the Rubicon is the double frequency waveform outputs. These waves can be used for FM modulation or combined with the other waves to give a richer sound. PWM saws can be created by using the Double Saw and Pulse outputs into a cross fader creates a saw wave that can be pulse modulated.

By setting the cross fader to the center so that both waves are equal the below waveform is generated.

20% PW   50% PW   80% PW
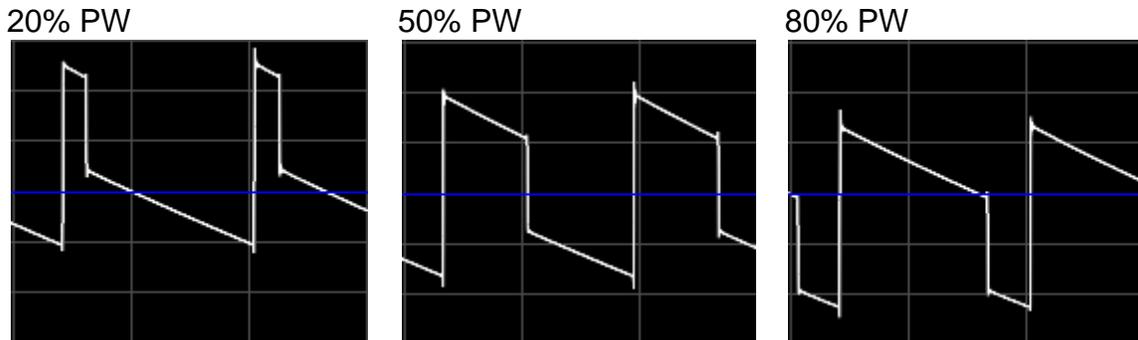
Changing the cross fader position will change the height of the pulse

20% cross fade, 50% PW   50% cross fade, 50% PW   75% cross fade, 50% PW

Support

Web: http://intellijel.com/

email: support@intellijel.com

Technical Specifications

Width: 18 HP

Depth: 45mm

Power: 95mA @ -12V, 107mA @ +12V

Expected input: 5v peak to peak

This modular device is intended to be used in the Eurorack standard modular system and its associated enclosures and power supply specifications.

Credits

Original Rubicon design: David Dixon

Eurorack conversion, PCB design and realization: Danjel van Tjin

Design consulting and beta testing: Haven Siguenza

Manual written by: Haven Siguenza, Danjel van Tjin, David Dixon

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