LARIX ELEKTRO

AUDIO
ORIGAMI DUO

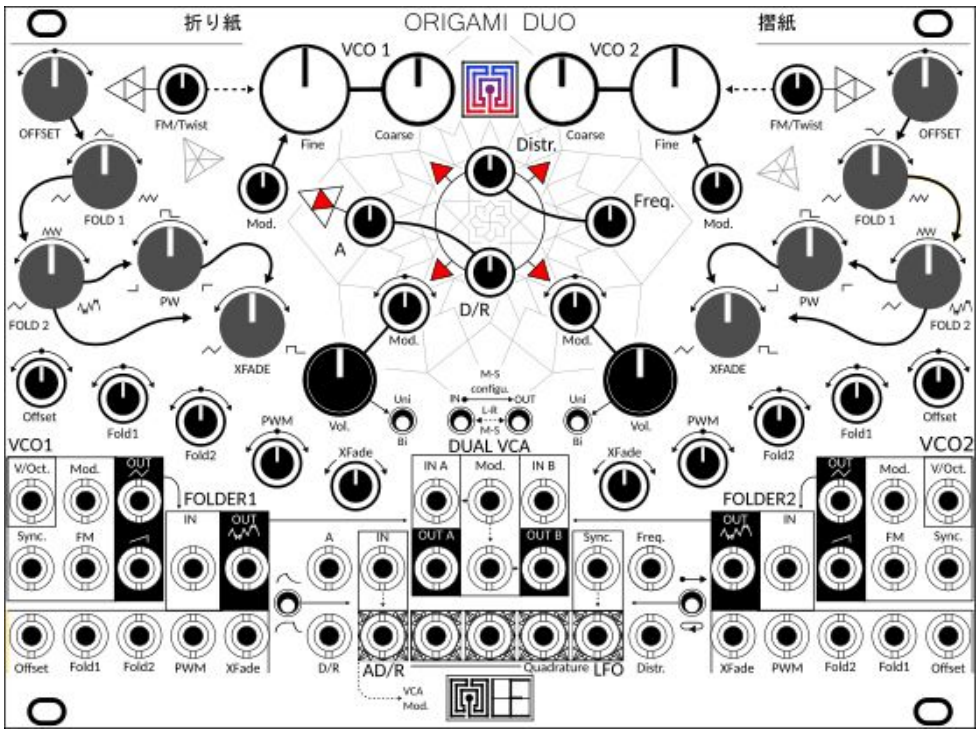
WHAT'S THAT THING ?

This is a dual complexe oscillator that has a lot of internal functionalities that allows a lot of various uses beyond a simple dual oscillator.
You can build a full autonomous synth voice, a Mid-Side processor, and more !

OK, so what's inside this module ?

To resum :

- 2 VCO with triangle & saw outputs.
  FM input (a bit dirty, but fun)
- 2 complex wave folders, one per oscillator, Fully controllable by CV.
- 2 VCA, uni or bipolar.
- Both VCA can be used inside a Mid-Side pocessor.
- 1 Quadrature LFO, the phase between outputs is adjustable.
- 1 Attack-Decay/Release envelope.
- LFO & Envelope fully controllable by CV.



Technical specifications:

+12V : 210 mA (max.)
-12V : 206 mA (max.)
+5V : 6 mA (max.)
34HP, 35mm deep (Approx.) with PSU connector

VCO Frequency: 1,2Hz to more than 20KHz.
LFO Frequency: 10 sec. to 3Hz (approx.)

Installation:

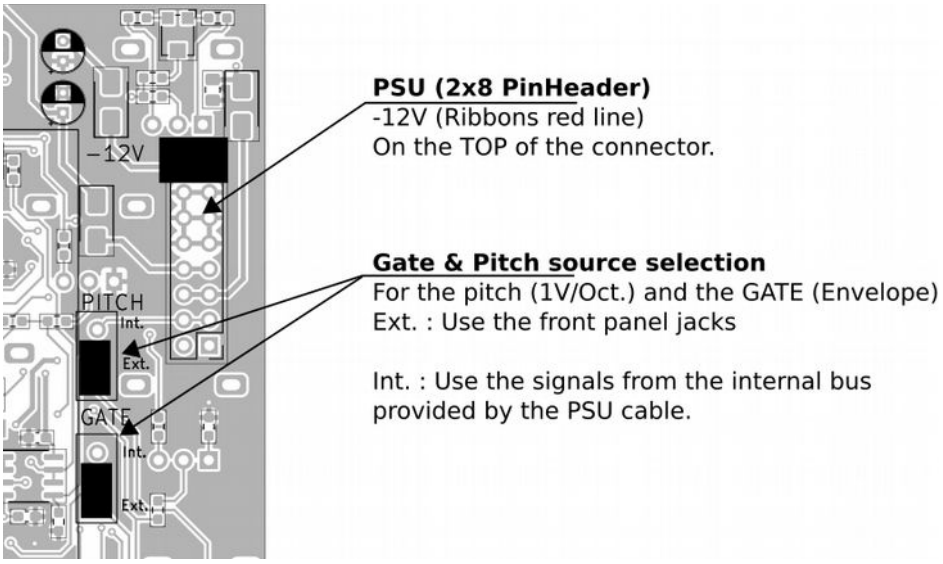
At first, ensure that there is enough power to supply the module.
Beware of the orientation: the red strip on the ribbon cable should match the white line on the module, and on the PSU board (-12V).

Connect the PSU ribbon into the PSU connector.
WARNING ! The module needs +5V, use a case that provide this 5V (almos all cases and PSU offer this 5V)

It is better to have a **well-insulated box** because parasites can be added to the signal of the modules. If you are not familiar with electronics, prefer commercial boxes. This is especially true for power supplies: a poorly designed power supply can damage the modules.

To avoid various problems, electromagnetic, but not only, **complete the empty spaces with blind front panels** (Blank panels).

The VCO have a good stability, but for more accuracy, it's better to wait for 15min, the time for the module to warm, and to stabilize the frequency.
Yes, **The module produces heat.** This is partly due to the choice of the value of certain components, to have a lower noise at the audio output. The « flip side » is higher power consumption and a bit of heating.



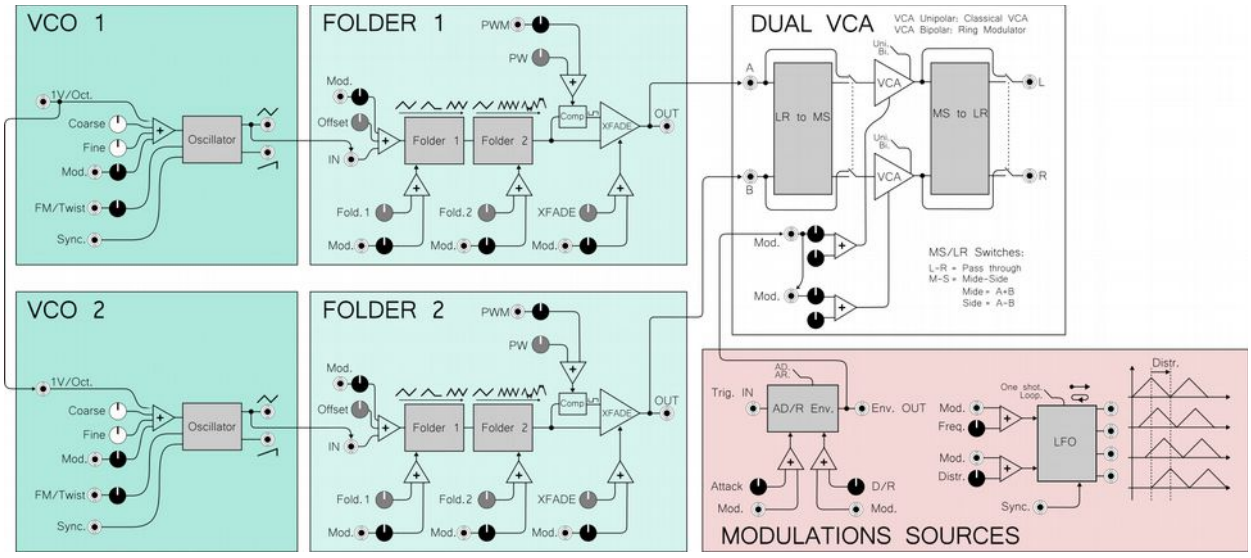
Pitch & GATE configuration:

By default, to control the VCO pitch and trigger the envelope, the module uses the jack inputs available on the front panel.
But in the Eurorack system, the power cable also carries these two signals in addition to the various required voltages.
This allows to remove cables on the front, and there are modules to access these 2 signals.
If this doesn't mean anything to you, don't change anything and skip the rest of this chapter!

If you want to use the internal signals instead of the front panel jacks, change the jumper settings as shown in the diagram above.

WARNING: In this case, the pitch input (V/Oct) of VCO 1 is no longer connected.
However, since the V/Oct input of VCO 2 is normalized (connected by default) to the corresponding signal from VCO 1, it's still possible to plug another signal into the VCO2 input.

BLOCK DIAGRAM:



This diagram shows the different blocks of the module.
Don't panic, each one will be explained one by one.

You can already see that they are connected to each other. So, just like that, without trying to understand the module, you can start having fun with the module.

But also, we can notice that each module has inputs and outputs. Which means that the pre-wiring can be bypassed. All these blocks can be rearranged in a different order, or used with other modules.

More information, and some 'tips', are available in the next chapter: **How to use the ORIGAMI**

MODULE EXPLANATIONS

GENERALITIES:

Visually, the front panel is divided into two parts: all the controls are on the top part, and all the connections, the jacks, are located on the bottom of the module.

All the settings can be controlled by an external CV, even the envelope and the LFO.

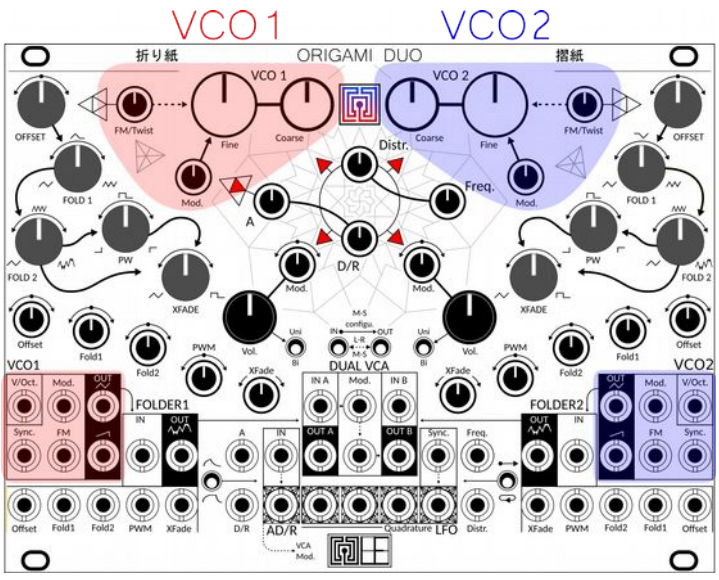
The module is built in 3 parts:

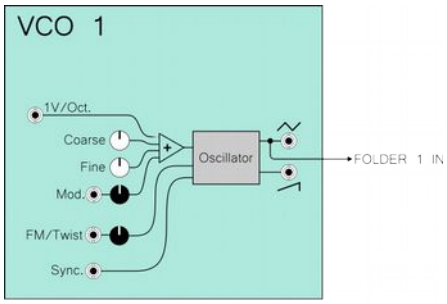
- 2 symmetrically arranged parts, each including a circuit going from a VCO to a wave folder, ending with a VCA and the main output.
- And in the center, there's a section with 4 potentiometers adding 2 modulation sources: an AD/R envelope and an LFO with 4 phase-shifted outputs.

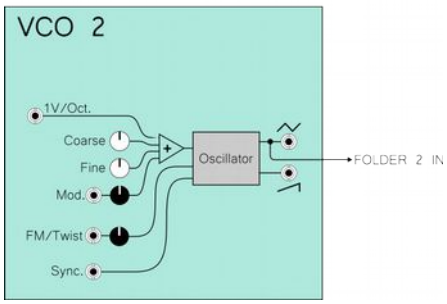
Each parameter can be controlled by a potentiometer and has its own CV input.
All CVs have an amplitude setting (Ok, except for the enveloppe and the LFO...)
Additionally, for the FOLDERs and VCAs, this setting consists of an attenuverter.

VCO

The VCO is very classic. It's built around an AS3340 chip.
It has a 1V/Octave pitch input as well as a modulation input.
The available outputs are triangle and SAW.
Note that the triangle output is connected by default to the input of the wavefolder.
The SQUARE isn't available because it's built using the Folder block.







The SYNC input works with all types of signals, even a triangle.

The FM input (Pitch modulation in a linear way, unlike the Mod. input which is exponential). It's labeled FM/Twist because it's a bit special: The classic way of implementing FM on this component isn't very satisfying.

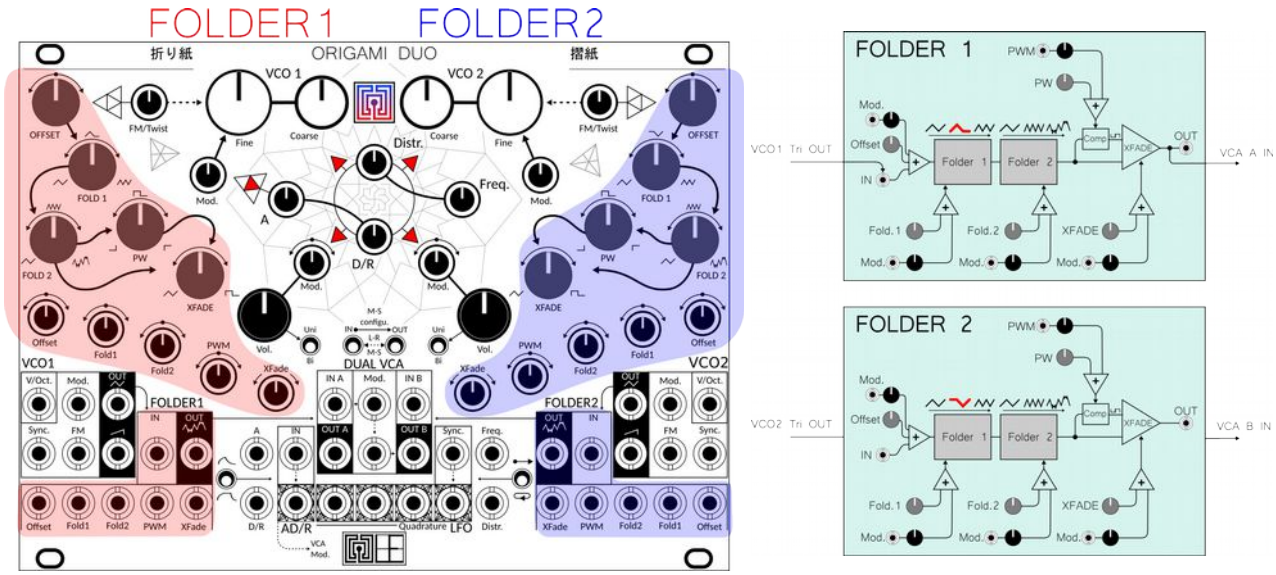
Fortunately, there is a way to increase the effect of this input. The electronics are more complicated and require the use of the sync input. You can get a True Zero FM VCO.
During the tests, results came out that weren't very 'FM'. More like a mix of FM and sync. The sound, especially once it went through the wavefolder, was so interesting that it was decided to keep this kind of result instead of having a real True Zero FM.
It's not a clean FM, but for lovers of dirty and rough sounds, here's something original!
Part of the knob's range gives you FM as expected from a VCO, then towards the end of the knob's range, the sound gets less clean and weird.

The 2 VCOs are identical.
If nothing is connected to the V/Oct input of VCO 2, it will use the pitch from VCO 1 (the signal received at the V/Oct input of VCO 1).

FOLDER

This block itself is made up of 3 blocks. On the front, the circuit is shown by the arrows going from one potentiometer to another : Follow the arrows!

Actually, the signal goes through 2 wavefolders, then through a crossfade between the signal and its transformed, squared version.
By default, the triangle signal is connected to the input, but by plugging a jack into the input, you can use this module for something else. You can use the other VCO, or the SAW instead of the Triangle.
Note that there are no capacitors in the signal path, so it's also possible to process a signal coming from an LFO, for example.



At the start of the chain, an offset adjustment lets you mess with how the 2 wavefolders work by making the folding asymmetrical. It's just a simple summing stage, so the offset modulation input can be used to add another signal (the other VCO?).

The first wavefolder is a module that lets you fold the signal with respect to 0V. By default, since the input signal is a triangle, at the output of this block you get the same triangle but at double the frequency.
If you input a SAW, a triangle comes out.

The setting allows you to switch from the unmodified input signal to the signal that has gone through folding.
Note that in the middle of the adjustment range, the signal is kind of 'clipped': only half of it ends up at the output.
On FOLDER 1, it's the signal below 0 that's removed (you're left with the upper part), and on FOLDER 2, it's the opposite: the positive part is cut and only the negative part remains.
In other words, FOLDER 1 folds the negative part toward the positive part, and FOLDER 2 folds the positive part toward the negative part. (*The difference is **shown in red** on the diagram above*)

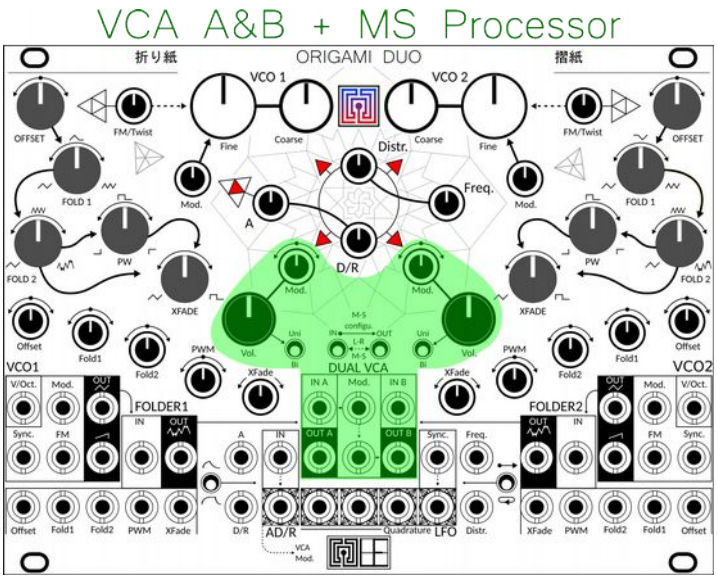
And of course, by playing with the offset, all the folding is messed up! And so the timbre changes.

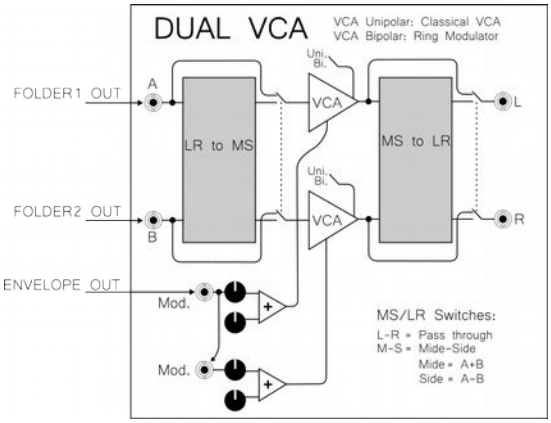
The next wavefolder stage is more complex: by default, with a triangle wave as input, it outputs the triangle wave at triple the frequency. The circuit was modified so that beyond that, other foldings appear.

Finally, the signal goes through a comparator, allowing it to go from the input triangle to a square signal. The PW setting (at its PM modulation input)
If the signal is more complex than a triangle, the output signal will be more complex than a square or a single pulse.

DUAL VCA & MS Processor

Each VCA is inserted into an MS processor. So this block is not just a simple VCA. Because of the presence of this MS processor, the two VCAs work together. And the explanation of this part will be given as a complete block of 2 VCAs with its MS processor.
The inputs and outputs are no longer called 1 and 2, but A and B. Even though by default, the output of FOLDER 1 is connected to input IN A, and FOLDER B to input IN B.
The outputs are also the main outputs of the module: OUT A and OUTB.





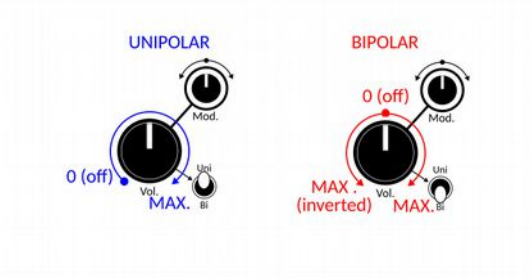
Each VCA can be set to operate in either unipolar or bipolar mode.

- **Unipolar** is the standard way a VCA works: when the CV input is zero or less, there's no output signal. Then, the more you increase the CV, the stronger the output signal gets.
- In **Bipolar** mode, when the CV is negative, the signal is amplified as if the CV were positive, but the output is inverted. In other words, it's like having a CV-controlled attenuverter. Or, put another way, having a Ring Modulator!

A switch allows you to configure each VCA.

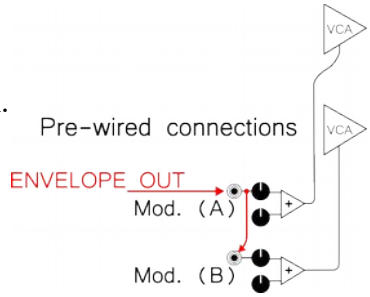
The Volum knob works differently depending on the setting, unipolar or bipolar :

- With unipolar mode, the minimal is fully left (and maximum, full right)
- With bipolar mode, the minimal is on the center (12 o'clock).
  Maximal is fully right
  Maximal, inverted is fully left.



By default, the CV input of VCA A is connected to the CV input of VCA B if nothing is connected to the CV input of VCA B. And also, the envelope output is connected to the CV input of VCA A. That way, the envelope can control both VCAs without adding extra cables.

Yes, by default, the module is a full synth voice!



The MS processor is divided into 2 parts:
The conversion from LR to MS, then the return from MS to LR.
The VCAs are placed between the two. And each part has its own switch to turn the conversion on or off.
An MS processor, or MS encoder/decoder, allows you to control a signal not in left/right, but in center/side. Hence the name...

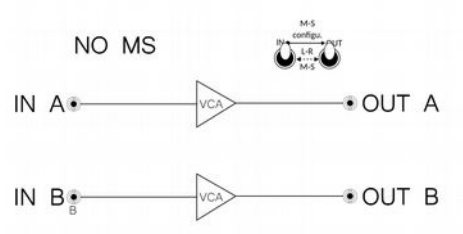
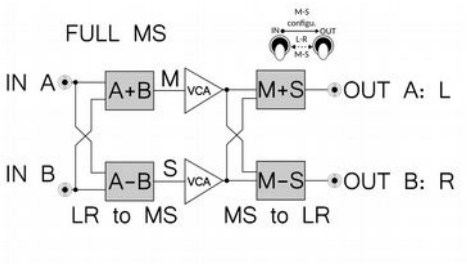
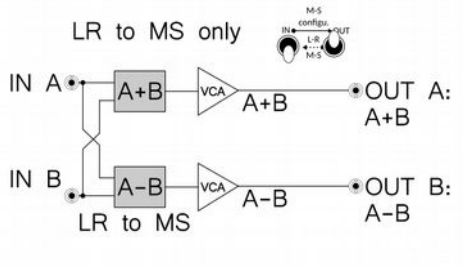
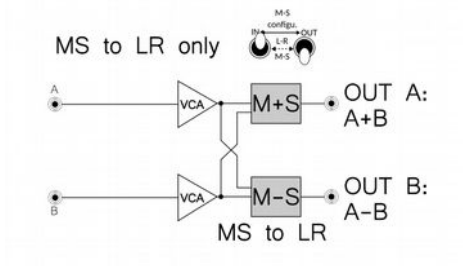
The **MID** is the sum of the 2 inputs, that is **A+B**.
The **SIDE** is the difference, that is **A-B**.

To go back to Right/Left, the operation is the same:

Left (OUT A) = **M+S**
Right (OUT B) = **M-S**

Rather than thinking in MS or LR, you can think in terms of summing or subtracting signals. The VCAs control the signals either before or after summing/subtracting.

Here's a table explaining the 4 possibilities with the 2 switches:

	Each VCA are independent. If nothing is connected, Both side of the module are independent (VCO+Folder+VCA).
	VCA A controles what is identical between A & B. VCA B controles what is different. In Stereo, you can controle the amount of difference between A and B, and keep A Left and B right.
	VCA A controles what is identical between A & B. VCA B controles what is different (as above). The Sum and difference is made **BEFORE** the VCA. Direct output of sum & difference of A & B.
	VCA A controles only the A signal, and VCA the B signal. The Sum and difference is mad **AFTER** the VCA. It outputs the sum & difference of A & B (as above).

WARNING! The output signal amplitudes have been adjusted for an MS processor configuration that is either fully on or off.
If only one of the two parts of the processor is activated (either LR to MS or MS to LR), then **the signal might be too high and get clipped at the output**.

This makes sense because in this case, the output contains the sum of the signals, which can result in a very high signal. If that's the case nd if you don't like this clipped sound, **turn down the volume accordingly**.

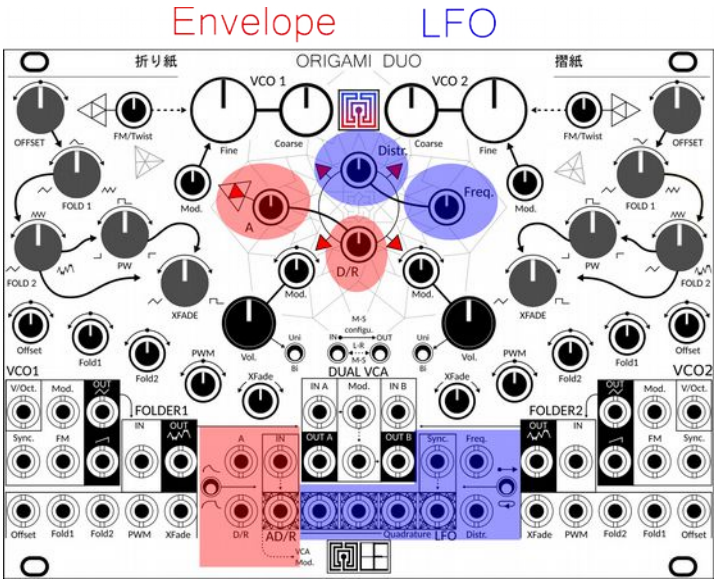
NOTE: The LEDs behind the logo between the 2 VCOs show the signal coming out of the 2 outputs OUT A and OUT B.

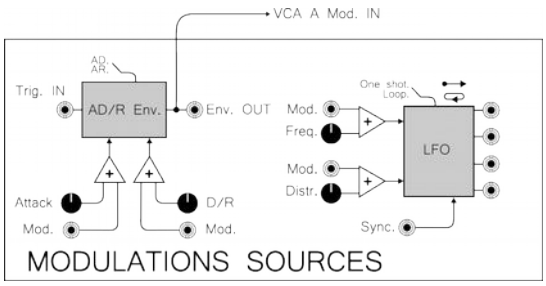
MODULATIONS :

The ORIGAMI is not just a complex double oscillator. But on its own, that would already be pretty good! To provide a full synth voice, you at least need an envelope to control the output VCAs.

The module, having a large number of modulation inputs, needed an LFO, and to satisfy this large number of CVs, the LFO has 4 outputs.

These modulation sources are finally pretty simple, but they save you from taking up even more space in your rack, and they're still really useful. Plus, they're still available for other modules from your setup!





The envelope

The envelope can be configured as **Attack/Decay (AD)** or **Attack/Release (AR)**.
Simply put, in AD, a pulse triggers the Attack then Release cycle.
In AR, the attack is triggered at the start of the GATE, stays at maximum, and only goes down (Release) when the GATE returns to zero.

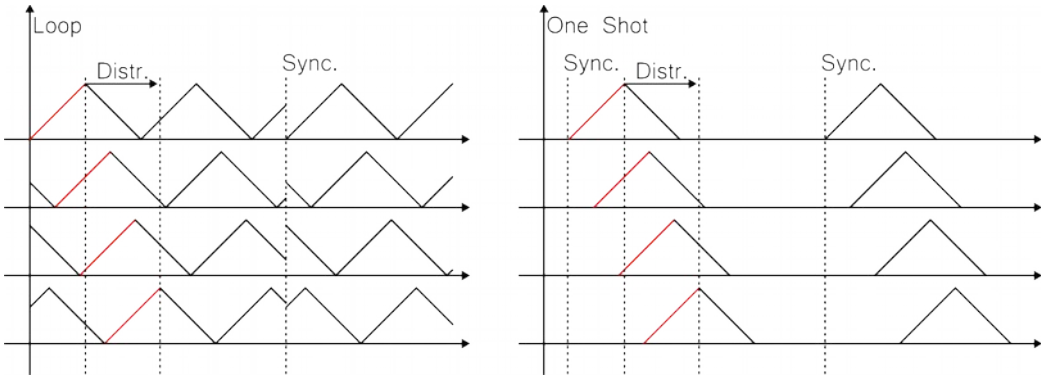
The 2 parameters A and D/R can be controlled by an external CV.

The envelope output has its own output jack, but it's already connected to the 2 VCA. This makes using the module as a standalone synth voice easier.

The Quadrature LFO (Quadratic LFO)

This LFO sends out a triangular signal, roughly between 0 and 10V. It has **4 outputs**.
The phase shift can be controlled using the Distr. (Distribution) parameter.
A Sync input allows you to reset (RESET) the LFO.
A switch lets you choose whether the LFO runs in a loop or in 'one shot' mode.

- In loop mode, it works like a classic LFO.
- In 'one shot', only one cycle is played. And it is triggered when a trig is received at the Sync input. This way, we have 4 envelopes offset in time by the Distr parameter.



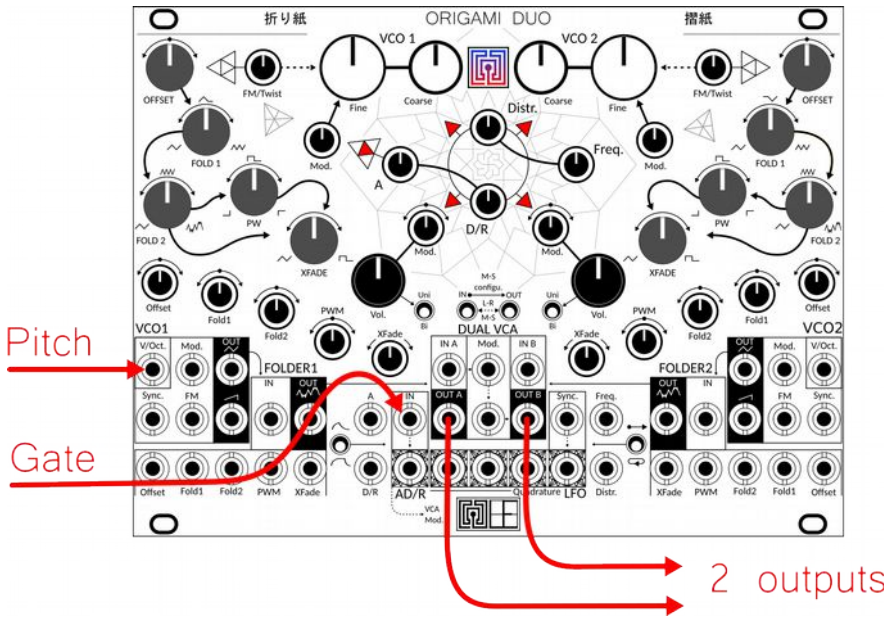
The 2 parameters, Frequency and Distribution, each have an external CV input.
The LFO isn't pre-wired like the envelope.

The envelope's status is visible thanks to the LED located at the attack setting point.
The LFO's status, on the other hand, is visible through the 4 LEDs connected by the golden circle.

How to use the ORIGAMI DUO ?

SIMPLE USE :

In its simplest form, the module can work as a full synthesizer voice.
Without wiring anything more than a pitch into the V/Oct input of VCO1, and a GATE signal into the envelope's IN input, you already have a very powerful monophonic 'west coast' synth in your hands.
Depending on the configuration of the MS processor switches, you can have different behavior of the circuits between them. And produce a stereo or mono signal.



The LFO with its 4 outputs being free, you can add modulations to the parameters, according to your tastes.

INTERNAL CONNECTIONS:

The ORIGAMI DUO is packed with enough features and connection options to be interesting on its own without any external modules.
Here are a few ideas:

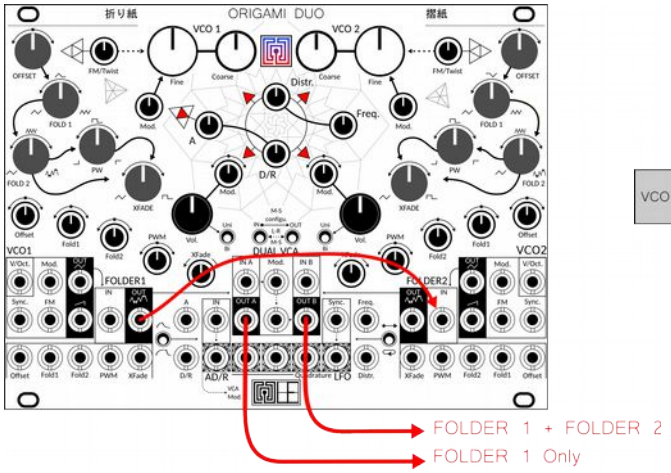
SYNCHRO :
Don't hesitate to try synchronization, the sound palette is much richer once it goes through the FOLDER. In this case, one of the VCOs will serve as the master oscillator and synchronize the second one.
For the master VCO, try using the output after the FOLDER, rather than the direct signal from the VCO. (and add some modulation!)

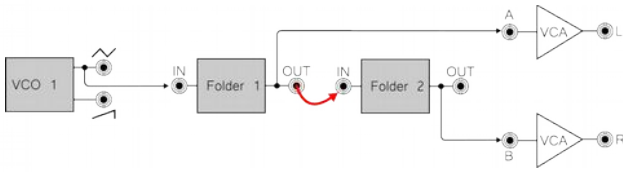
FM :
The logic is the same for the FM input of the VCOs. As explained in the VCO description, this input is a bit 'twisted' (hence the name!) But with subtle adjustments, the waveform is distorted enough to mess with the FOLDER's operation, without affecting the VCO's tuning, the result is for fans of strange sounds!
Try modulating each VCO with its neighbor: cross-modulation!

Ring Modulator :
VCAs can work like ring modulators. Like with sync or FM, plug both VCOs into one of the VCAs in Bipolar mode. For example, plug VCO 2 into VCA A mod. input. For a true ring modulation setup, set the volume knob to the middle.
Since there are 2 VCAs, each independently configurable, it's still possible to stick with the configuration of a full synth voice.

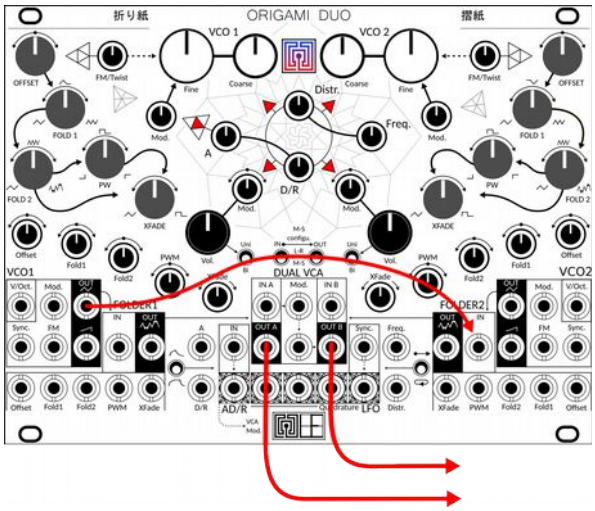
Remember to try signals before or after the wavefolder!

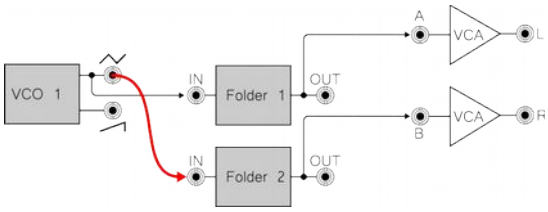
Chain the wavefolders :
Connect the output of FOLDER 1 to the input of FOLDER 2.
The full signal is available at OUT B, but the intermediate signal that only went through FOLDER 1 is available at OUT A.
VCO 2 isn't used and can be used as a modulation source: Sync, FM, or Ring Modulation.





Wavefolders in parallel :
Connect the triangle output of VCO 1 to the input of FOLDER 2. This way, the signal from VCO 1 goes into both wavefolders. Using the two VCAs, you can adjust the output mix of the two FOLDERS. Try to create a stereo signal. In mono, use the output of one of the LFOs to switch from one signal to the other.
VCO 2 isn't used and can be used as a modulation source: Sync, FM, or Ring Modulation.

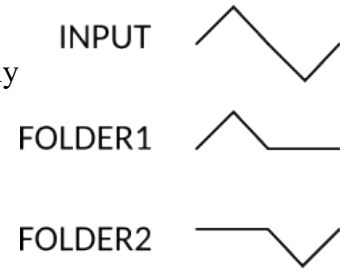




SOME IDEAS, a bit of math...

The MS processor is actually on one side a sum and on the other a difference. Then the FOLDER works by folding. It seems interesting to work while keeping this logic in mind. Because in the end, running a signal through a Folder, then subtracting the original afterwards, for example, that could be interesting, right?
Not to mention that in the other output we have the sum of the two. I think math and combinatorics fans are going to find lots of uses for it!

Similarly, it's not without reason that the choice was made to make the 2 FOLDERS differently. In the explanation of the FOLDER, the first circuit, it says that for FOLDER 1, the signal below 0 is removed (you keep the upper part) and for FOLDER 2, it's the opposite: the positive part is cut and only the negative part remains.
So, if you insert the same signal into both FOLDERS, and set the first circuit's parameter correctly, on one side you'll be able to work on the positive part of the input signal, and on the other, on the negative part.



MORE TWISTED ? (Random ideas)

Use the wave folder to modify the LFO or the envelope:
The circuit can handle all kinds of signals.

By the way, the VCOs are also very (very slow) and can turn into LFOs...
that can always come in handy!

A VCO in the FOLDER settings: First, the Offset is a simple input with a volume control, added to the signal input. So it's a mixer! This means that the 2 VCOs will go into the same circuit at the same time! The other FOLDER settings can also accept an audio signal.

The FOLDERS to transform an external signal? Some drums, a recorded sound?
Access to the circuit is open, so the FOLDERS are available for external signals.
This external signal can be stereo. And it can even take advantage of the MS processor.

"Break up" the module into several modules:
Each function of the module is indeed pre-wired, but can operate independently.
It’s possible to see ORIGAMI as a collection of modules freely usable.
A VCO somewhere, a FOLDER for a percussion signal, another for an external VCO. The VCAs, the MS processor to control the stereo image of another signal in your setup, etc.

If you don't like the internal VCA, remember that you have access to the signal after the FOLDER block. This is a good solution if you want to build a more complete synth voice, by adding a filter for example. Because removing all not necessary elements (means electronics, means noise) is always a good practice.

And in this case, the VCA are available for other tasks, modulating the LFO ?
The VAC can works with all kind of signals.

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