moog

# Mavis

Patching with Intention

Get started with patching techniques,
explore deeper synthesis concepts, and
understand full patchbay functionality

Patching with Intention

There are many ways to approach patching a synthesizer like Mavis. There's no "wrong" way to do it, and often randomly patching inputs to outputs can lead to wonderful, unexpected results.

Other times, however, you may want to patch with some intention. Perhaps you have a sound in mind that you would like Mavis to approximate, or an idea may strike you while falling asleep: "I wonder what would happen if I patched the VCO to the Filter Cutoff..."

We hope that this guide will help you better understand how to patch Mavis and learn interesting new techniques for patching it as you get to know the instrument.
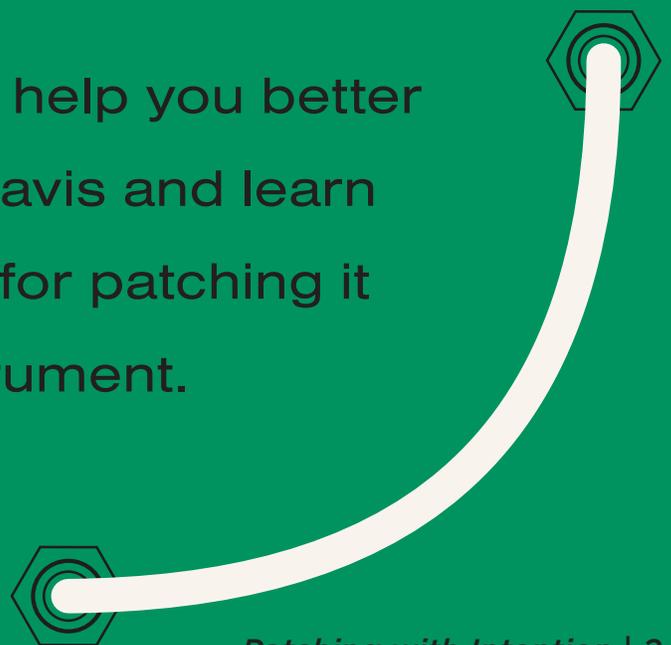
Initialized Patch
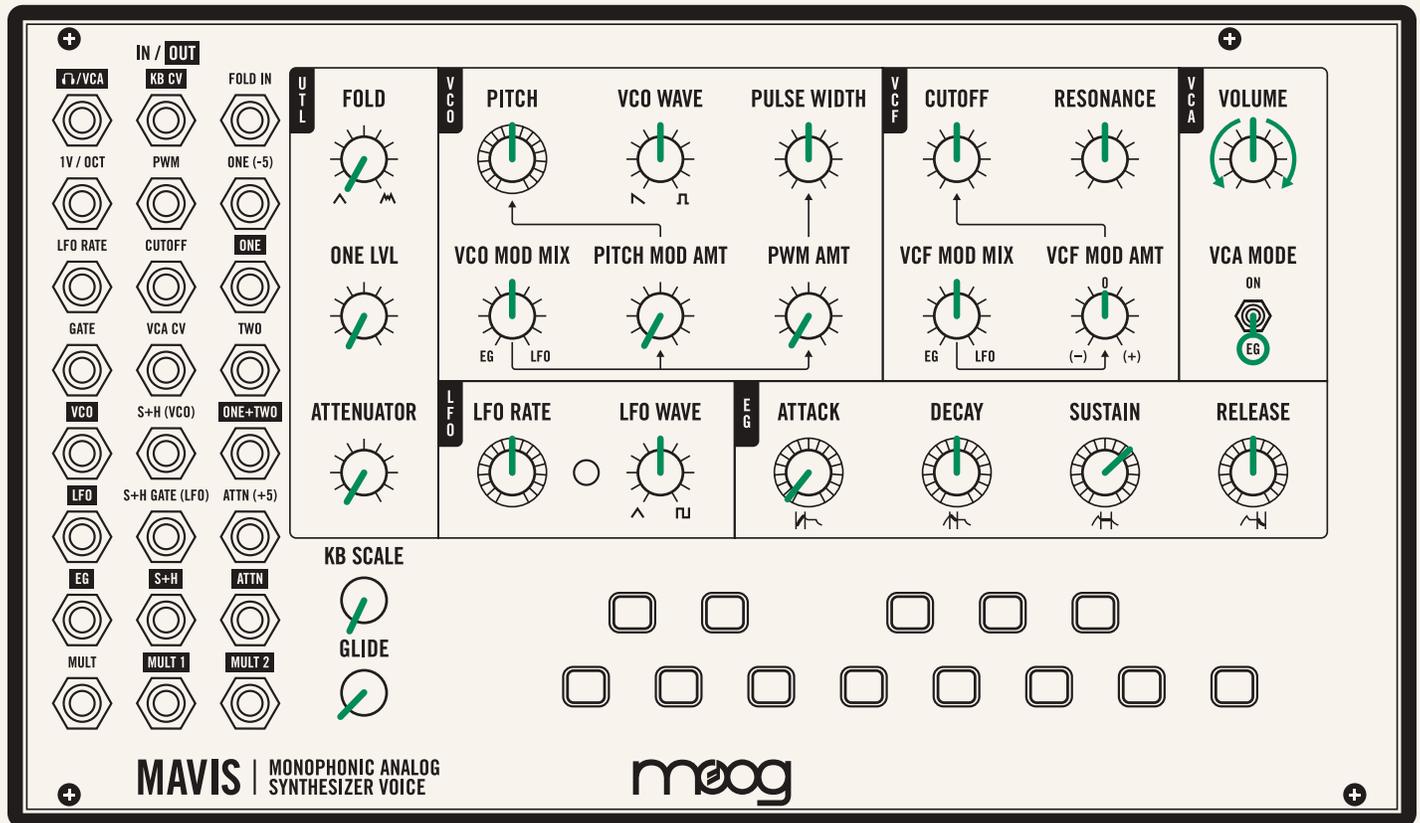
Before getting started, match your Mavis to the initialized patch settings above. You should be able to press one of the keyboard keys and hear a note.

Find full patch point descriptions on to reference as you move through the patching exercises.

Each section in this guide builds upon the last, so explore them in sequential order for best results.

First Steps

Some typical patch configurations are already available to you through Mavis's internal routing. As a short exercise, let's recreate one of those using the patch bay.

Say you would like a nice little trill with each note. You can achieve this by patching the LFO to change the VCO's pitch.

MAKE THIS CONNECTION
Connect the **LFO** output to the **1V/OCT** input and then press a key on the keyboard to trigger a note.
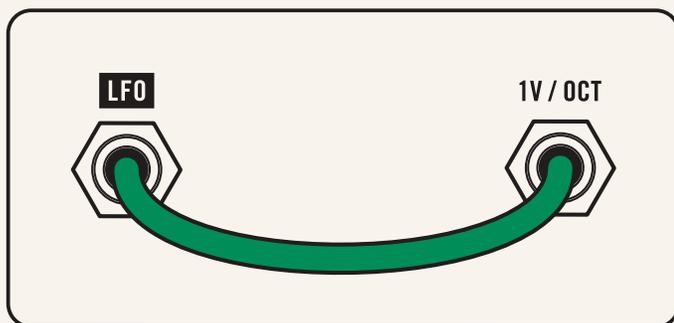
The LFO, however, swings from -5 volts to +5 volts—resulting in a trill spanning 10 octaves! Since that is likely too extreme for most uses, Mavis has an attenuator, which is like a volume knob for a control voltage.

MAKE THIS CONNECTION
Patch the **LFO** output to the **ATTN (+5)** (attenuator) input and then patch the **ATTN** (attenuator) output to the VCO's **1V/OCT** input.
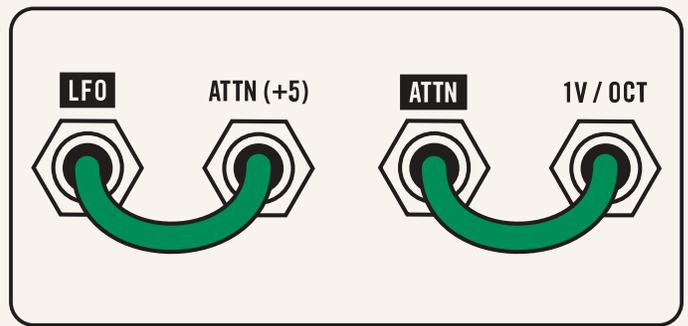
With the attenuator knob fully clockwise you will hear the same 10-octave trill, but as you lower the attenuator knob that range will diminish until there is almost no modulation.

NOW YOU HAVE 3 KNOBS THAT SHAPE THE TRILL/VIBRATO EFFECT:
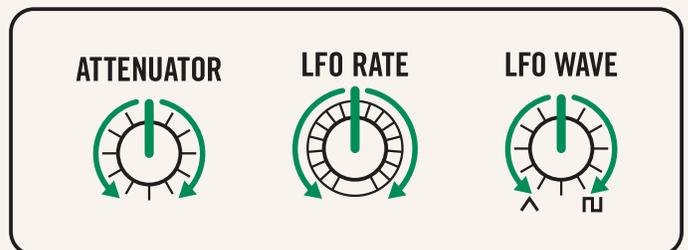
ATTENUATOR: Controls the interval of the trill (i.e. modulation depth)
LFO RATE: Controls the speed of the trill
LFO WAVE: Moves from a vibrato (triangle) effect to a trill (square)

This patch, however, is already present in Mavis's internal routing. After unpatching everything, all you need to do is set the **VCO MOD MIX** knob fully clockwise to **LFO** and the **PITCH MOD AMT** knob will set the depth of the modulation.

→**Let's now use the patch bay to do some things you can only do through patching.**

Tremolo and Vibrato

Unpatch any cables and match the settings to the initialized patch. Then raise the PITCH MOD AMT knob slightly so you hear a nice trill. It might be interesting now to hear what happens if the LFO gets faster as the pitch gets higher.

The **KB CV** output sends out a voltage based on the key pressed—the higher the key, the higher the voltage. Each key corresponds to a precise voltage to recreate a chromatic scale.

If we patch the keyboard output **KB CV** to the **LFO RATE** input, we can raise the frequency of the LFO at the same time that we raise the pitch.
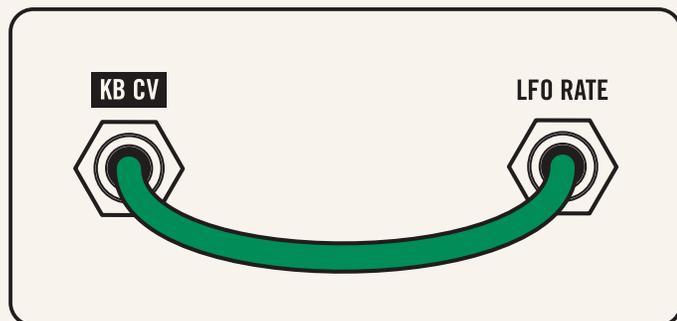
A related effect to vibrato (which moves the pitch up and down) is tremolo (which moves the volume up and down).

Patch the **LFO** output to the **VCA CV** input.
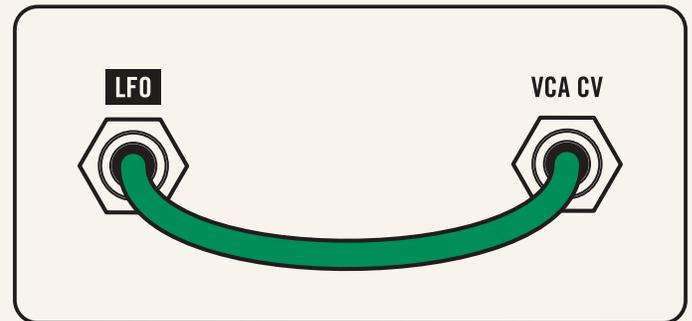
Now you can hear the volume move up and down in time with the LFO—even when no key is pressed. This is because now the LFO signal is controlling the volume instead of the envelope generator.

By turning the filter **CUTOFF** knob completely counterclockwise we can then silence Mavis when no key is pressed.
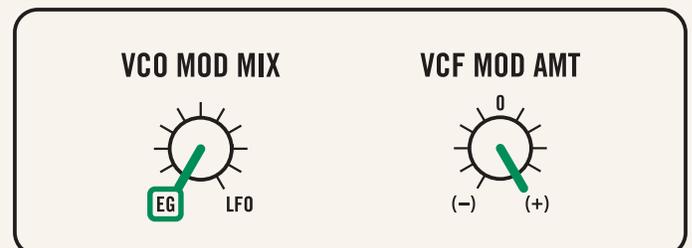
With the **VCF MOD MIX** knob set to **EG** and **VCF MOD AMT** fully clockwise, the filter now acts as something similar to a low pass gate, with the envelope shaping both the filter and the amplitude of the signal, while the LFO adds a tremolo effect with the VCA.

→ **Play with the envelope parameters and LFO RATE to explore this sound!**

# Exploring the Sample & Hold Circuit

For a more advanced exercise, let's investigate the Sample and Hold (S+H) section. Unpatch any cables and match the panel settings to the initialized patch.
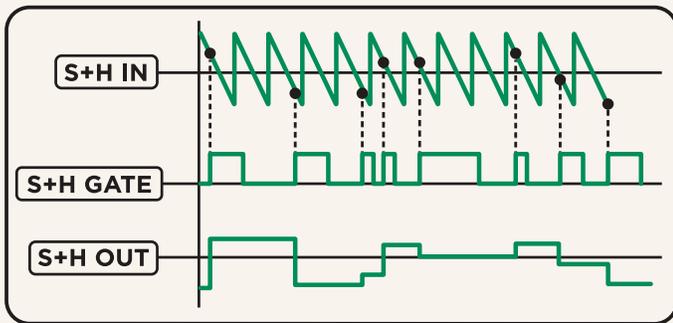

A sample and hold circuit takes two inputs: an input to be sampled (**S+H**) and a gate (**S+H GATE**). Whenever the **GATE** input receives a gate pulse, the voltage in the **S+H** input is held at the **S+H** output until a new gate comes in.

On Mavis, the **S+H** input is normalled to the **VCO**, meaning that the VCO is already connected to the **S+H** input without the need for a patch cable. If anything else (say, the **EG** output) is connected to the **S+H** input, the normalled connection is overridden. Normalled connections are indicated by parentheses on the Mavis patch bay: the **VCO** is normalled to the **S+H** (VCO) input and the **LFO** is normalled to the **S+H GATE** (LFO) input.

MAKE THIS CONNECTION

Connect the **S+H** output to the **1V/OCT** input and press and hold a key down.
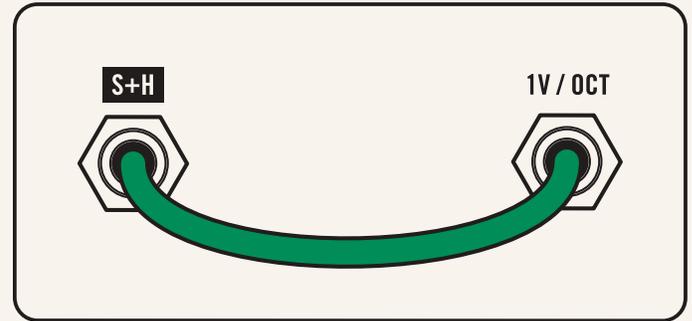
You will hear a new pitch in time with the LFO. If the **VCO WAVE** knob is rotated to the square wave you will hear only two pitches since the square wave being sampled only oscillates between two voltages. If the **VCO WAVE** knob is turned to sawtooth you will hear random voltages, as the sawtooth wave sweeps continuously between +5 and -5 volts and (typically) at a rate much faster than the LFO.

MAKE THIS CONNECTION

Rather than having to press a key, we can instead use the **LFO** to trigger a new note each time the **S+H** circuit is triggered by connecting the **LFO** to the **GATE**.
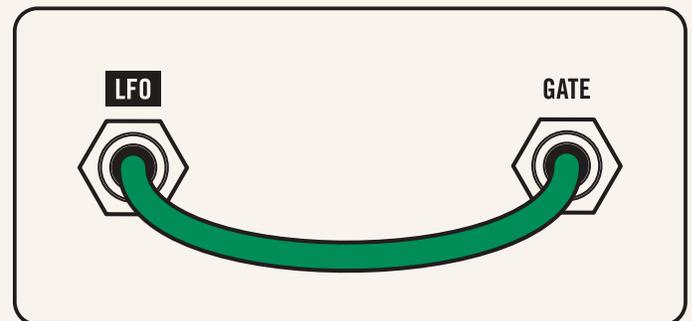
Now the **LFO** is connected to the **GATE** triggering a new note with each LFO pulse via a patch cable, and the **LFO** is also connected to the **S+H GATE** through normalization.

Now you will hear a procession of distinct random notes. Remembering back to our first patch, you will probably note that, again, the range of notes is quite wide–far too wide for some musical purposes.

MAKE THIS CONNECTION

Use the attenuator to narrow that range. Patch the **S+H** output to the **ATTN (+5)** input. And the **ATTN** output to the **1V/OCT** input.
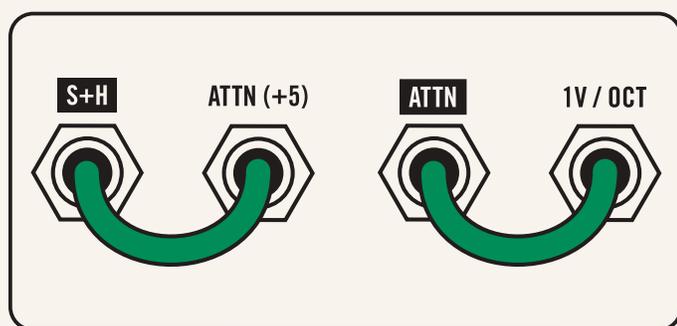
Finally, we may want to break up the rhythm a bit and get some more motion in our patch. By patching the **S+H** output to the **LFO RATE**, the S+H will change the rate of the LFO. Higher S+H values will turn the LFO rate up while lower values will turn it down.

MAKE THIS CONNECTION

We can use the **MULT** to patch the **S+H** output to two places at once.
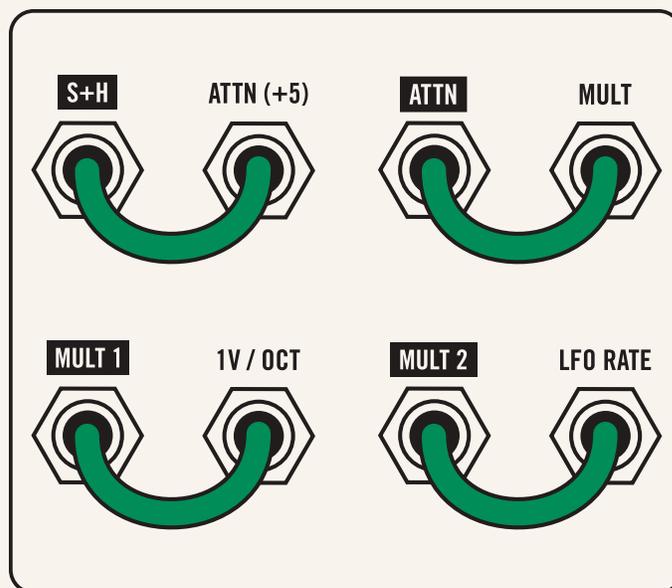
The **MULT** is a simple utility allowing you to patch one output to multiple inputs. Patch the **S+H** output (post attenuator) to the **MULT** input, and then patch **MULT 1** to the **1V/OCT** and **MULT 2** to the **LFO RATE**.

→Now you will hear that as the pitch of the oscillator goes up, so does the rate of the LFO–resulting in quicker notes as the pitch increases!

Expanded Wave Folding

Mavis is the first of the Moog synthesizers to include a wave folder. A typical component of the "West Coast" synthesis approach, the wave folder uses distortion to add harmonics to a signal where a filter removes harmonics from a signal. Unpatch cables and match the panel settings to the initialized patch.
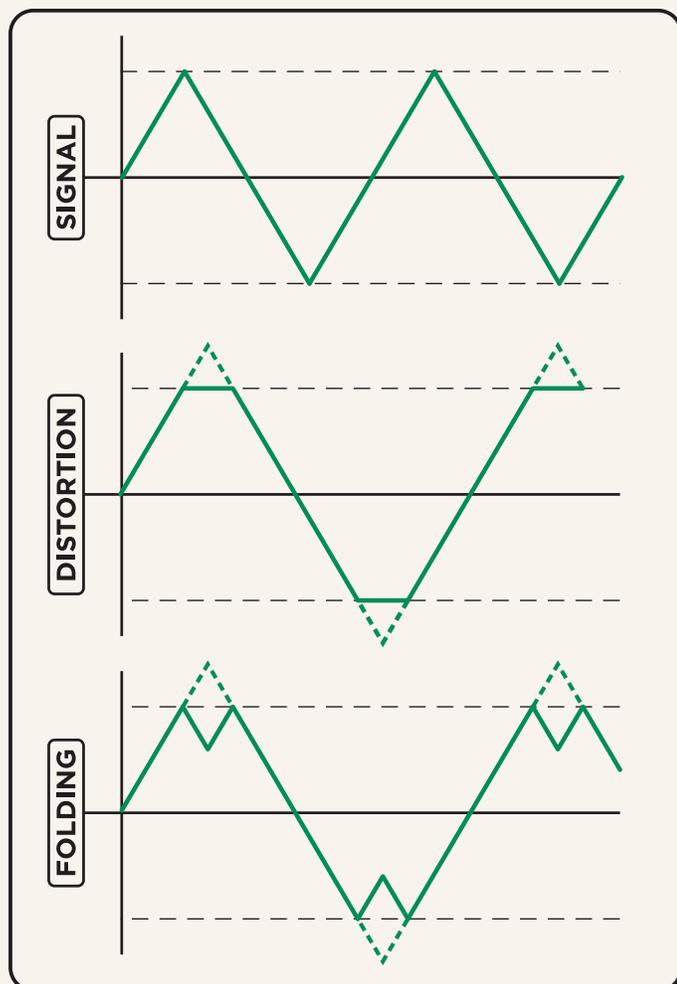
When a signal gets distorted, it gets amplified past a threshold whereby the tops and bottoms of the wave or any parts of the signal above (or below) stay at that

threshold instead. This adds the pleasing harmonic overtones characteristic of distortion.

Wave folding pushes the same concept a little further. Instead of the tops and bottoms simply staying at the threshold, they are folded back–the threshold acts a little like a mirror, reflecting those peaks and troughs back on themselves. This technique also adds harmonic overtones, but of a different timbral quality than distortion. Increasing the folding amount simply amplifies the signal even more, causing deeper reflections of the peaks and troughs.

MAKE THIS CONNECTION
Let's play a little bit with wave folding by patching the **VCO** into the **FOLD IN** input.
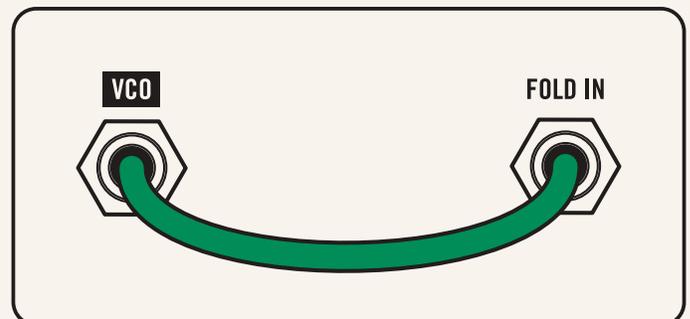
Open the **VCF CUTOFF** knob fully clockwise so you can hear the folding more clearly. Now by rotating the **FOLD** knob you will hear the oscillator begin to distort and fold over on itself. Try changing the **VCO WAVE** between saw and square and listening to how that affects the **FOLD**.

You'll notice using a square wave that the wave folding has a much more subtle effect.

Looking at our wave folding diagram, you'll notice that the square wave is already fully "squared off" and distorted. Sending this to a wave folder yields more subtle effects than with saw or triangle waves, whose linear shapes result in more "teeth."

While there is no voltage control of Mavis's wave folder, you can use the LFO and the **ONE+TWO** mixing section to achieve something similar.

Typically, audio oscillators are centered around zero volts. Therefore, since the ceiling and floor thresholds are always symmetric, the waves distort or fold symmetrically.
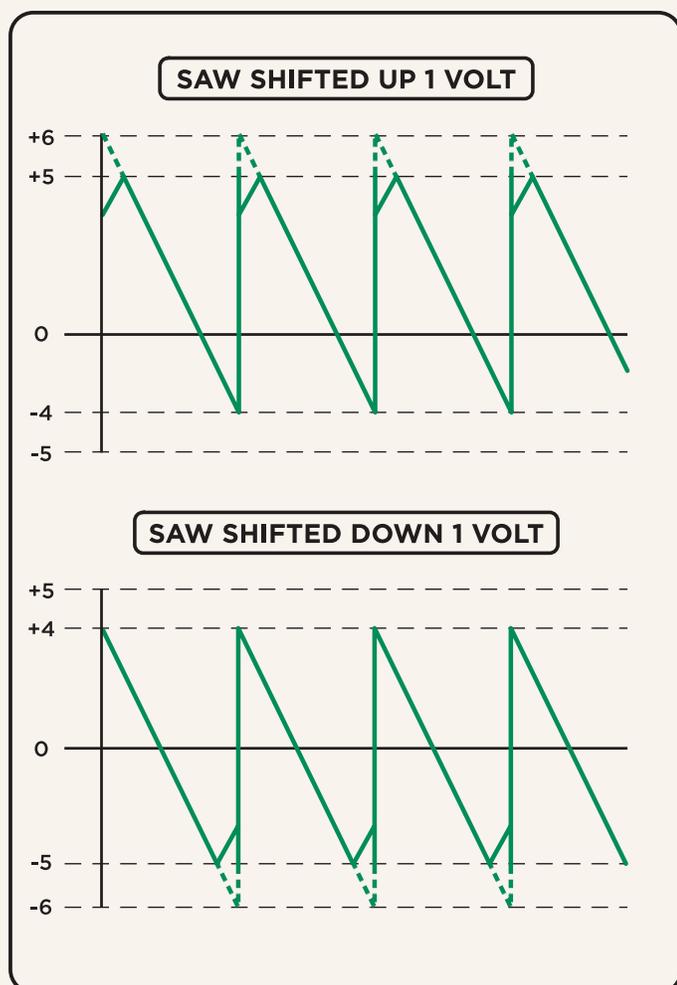
However, if we shift the entire wave up or down, the wave folder will now distort the top and bottom of the waves differently.

MAKE THIS CONNECTION
Patch the **LFO** to input **ONE (-5)** of the mixer and the **VCO** to input **TWO** of the mixer. Finally, patch the **ONE+TWO** mixer output to the **FOLD IN** input.
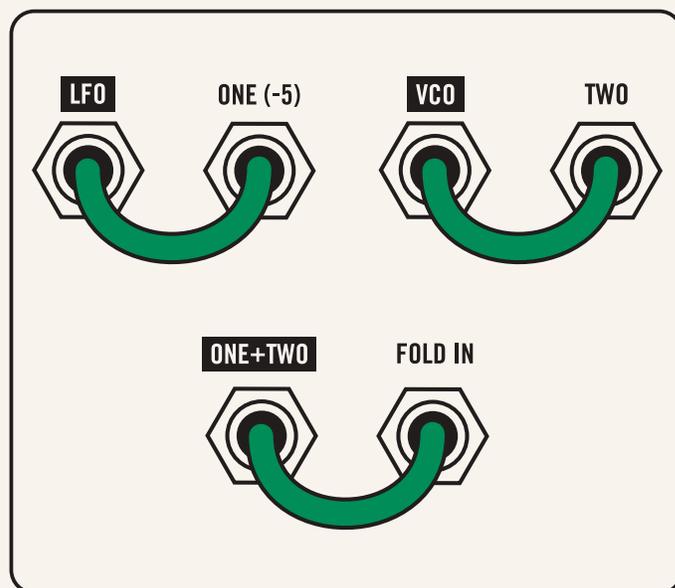
With this configuration, you can explore wave folding even further—playing with the **VCO WAVE** and **LFO WAVE** shapes, the **ONE LVL** (which scales the LFO shifting amount), and the **FOLD** knob.

By adding the LFO to the VCO, we are actually shifting the VCO signal up and down in time with the LFO. When the LFO rises positively, the VCO signal is shifted in the positive direction and hits the top mirror of the wave folder, folding the positive peaks. When the LFO falls negative, the VCO signal is shifted in the negative direction and hits the bottom mirror of the wave folder, folding the negative troughs.

Further Exploration

Now that you have some intuition for how Mavis's patch bay can be used, feel free to start exploring it on your own. Remember: there is no wrong way to patch—it's all music at the end of the day.

Either begin from a sound that grabbed you while working through this guide (this being an analog semi-modular synthesizer, it will never be quite the same), or just start making connections and see what happens.

Over the next few pages is a list of Mavis's inputs and outputs (organized left to right by row) and some beginning ideas for how they can be used. Let your imagination and your ears be your guide.

Inputs

Listed in order left to right by row;
R (Row) and C (Column)

IN / **OUT**

🎧/VCA | KB CV | FOLD IN

1V / OCT | PWM | ONE (-5)

LFO RATE | CUTOFF | **ONE**

GATE | VCA CV | TWO

VCO | S+H (VCO) | **ONE+TWO**

LFO | S+H GATE (LFO) | ATTN (+5)

EG | **S+H** | **ATTN**

MULT | **MULT 1** | **MULT 2**
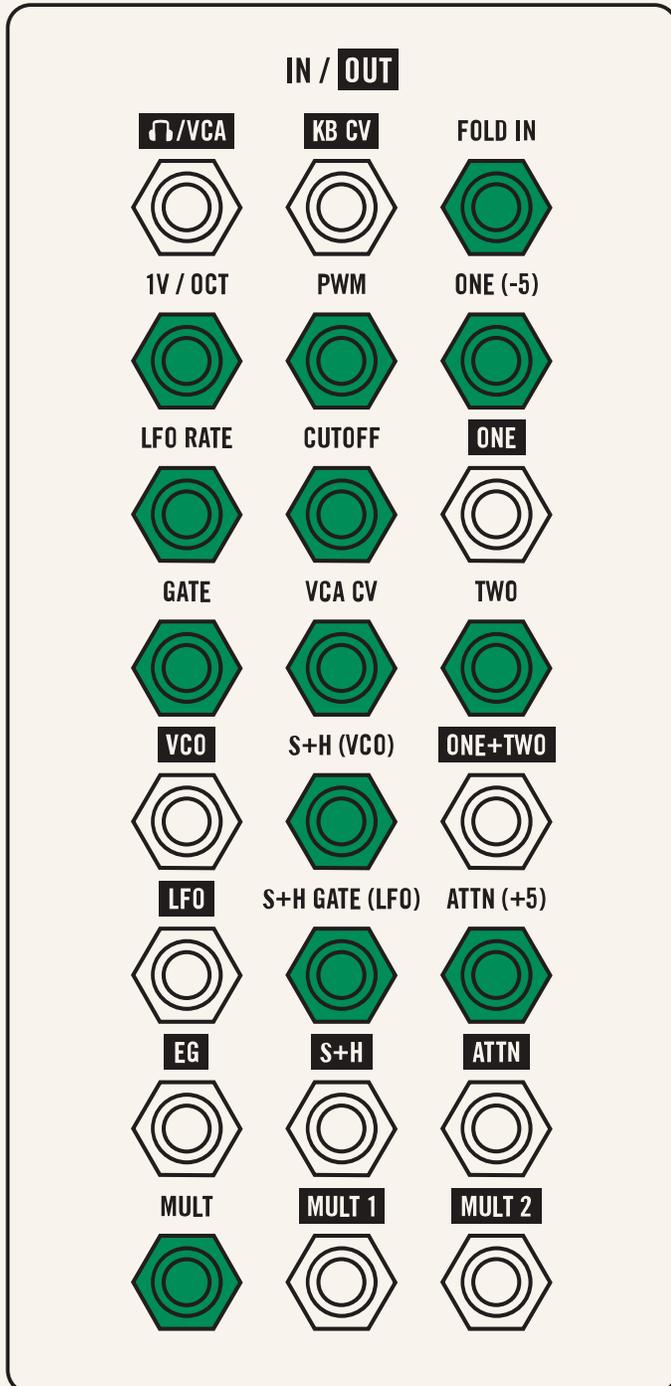
FOLD IN *(R1, C1)*

Input to the wave folder. Plugging any signal in here will patch it through the wave folder (**FOLD** knob) and then directly to the filter. Experiment with both the VCO and LFO (at audio rate) patched here, and play with their respective waveshapes and the **FOLD** knob to explore the timbral possibilities of wave folding.

1V/OCT *(R2, C1)*

Controls the frequency of the VCO. **1V/OCT** means this input is scaled such that every volt will correspond to a doubling of the frequency (i.e. a change of one octave). Patch an **LFO** (through an attenuator) here for vibrato or the **S+H** for random pitch changes.

PWM *(R2, C2)*

Controls the pulse width of the VCO's pulse wave. Patch the **S+H** here for random pulse wave fluctuations.

ONE (-5) *(R2, C3)*

Input one for the mixer. The signal patched here will be attenuated by the **ONE LVL** knob and available at the **ONE** output and mixed with **TWO** at the **ONE+TWO** output. Patch any audio or control signals here and another to **TWO** to add those signals together. You can add the **VCO** + **LFO** for a two-oscillator synth, the **EG** + **LFO** for wobbly envelopes, or the **S+H** + **EG** for random note strengths! The (-5) indicates that a negative five volt offset is normalled to this input, allowing you to shift the signal in **TWO** down five volts with nothing patched to **ONE**.

LFO RATE *(R3, C1)*

Controls the frequency of the LFO. Patch the **KB CV** here to control the LFO rate with the keyboard or the **S+H** to get random LFO rate changes.

CUTOFF *(R3, C2)*

Controls the filter's cutoff frequency. As with **PITCH MOD** and **PWM**, the **EG** and **LFO** are already available for modulation, but patch the **S+H** here for random cutoff fluctuations or the **VCO** for audio rate filter modulation.

GATE *(R4, C1)*

Triggers the **EG** with a rising edge gate signal. Patch the **LFO** here to cyclically trigger the **EG**, or the **S+H** to sporadically trigger the **EG**. You can also use this input with an external keyboard to trigger the **EG**.

VCA CV *(R4, C2)*

Controls the VCA. The **EG** is pre-patched here (and can be removed with the **VCA MODE** switch), but patch the LFO through an attenuator here for tremolo or the **S+H** for notes of random velocity.

TWO *(R4, C3)*

Input two for the mixer–added to input one at full strength.

S+H (VCO) *(R5, C2)*

The signal to be sampled by the Sample + Hold circuit when a gate is registered at the **S+H GATE** input. The **VCO** output is normalled to this input. The saw wave VCO is a good choice since, at audio rate, it can provide an even range of voltages to be sampled, while the pulse wave can restrict the sampled voltages to either the high or low voltage values of the VCO signal. You can replace the **VCO** with the **VCA** output for more flavors of randomness, while replacing with the **LFO** or **EG** will provide slower signals to sample.

S+H GATE (LFO) *(R6, C2)*

A gate high here will sample the signal in the **S+H** input and hold that sampled value available at the **S+H** output. The **LFO** is normalled to this input, but a short attack envelope can also be used as a gate here.

ATTN (+5) *(R6, C3)*

Input for the attenuator module. The signal patched here will be attenuated by the **ATTENUATOR** knob and available at the **ATTN** output. Use this to scale LFOs or **S+H** signals, or to give channel two of the mixer its own attenuator knob. The (+5) indicates that a positive five volt offset is normalled to this input, allowing you to shift the **ONE** input up five volts by patching the **ATTN** output to **TWO** when nothing is patched to the **ATTN** input.

MULT *(R8, C1)*

Input for the **MULTIPLE** utility. Patch any signal here to get two copies of that signal at **MULT 1** and **MULT 2** outputs.

Outputs

Listed in order left to right by row;
R (Row) and C (Column)

IN / **OUT**

🎧/VCA	KB CV	FOLD IN
1V / OCT	PWM	ONE (-5)
LFO RATE	CUTOFF	ONE
GATE	VCA CV	TWO
VCO	S+H (VCO)	ONE+TWO
LFO	S+H GATE (LFO)	ATTN (+5)
EG	S+H	ATTN
MULT	MULT 1	MULT 2
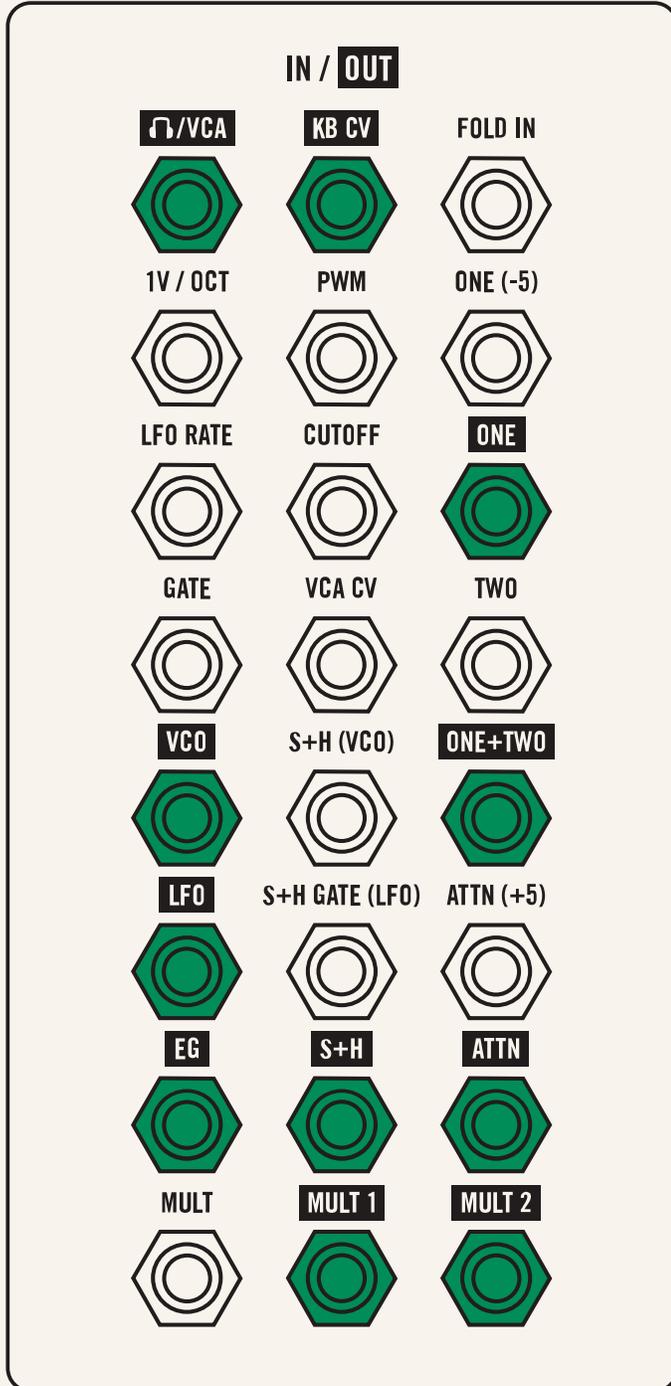
🎧/VCA *(R1, C1)*

Output of the VCA scaled by the **VOLUME** knob. Mavis's main output, which can be sent to mixers, audio interfaces, or headphones. Be sure to turn the **VOLUME** knob down before connecting this output to anything!

KB CV *(R1, C2)*

Outputs a voltage corresponding to the key pressed on the keyboard, scaled by the **KB SCALE** knob, and slewed by the **GLIDE** knob. This output is already patched to the VCO pitch, but you can also use it to control the LFO rate (faster LFOs with higher pitches), the filter cutoff (higher pitches open the filter further), or VCA (higher notes are louder).

ONE *(R3, C3)*

Signal at **ONE** input scaled by **ONE LVL** knob. Use to attenuate any signal and patch to any destination.

VCO *(R5, C1)*

VCO signal, oscillating from –5 volts to +5 volts (10V peak to peak), at a frequency and shape determined by **PITCH**, **VCO WAVE**, **PULSE WIDTH**, and any modulation. You can use the VCO to do audio rate modulation of any of Mavis's parameters, or patch it to **FOLD IN** to explore wave folding.

ONE+TWO *(R5, C3)*

Mixed output of **ONE** input scaled by **ONE LVL** and **TWO** input at full strength. Use to add two signals and create interesting, compound audio or modulation signals.

LFO *(R6, C1)*

LFO signal, oscillating from –5 volts to +5 volts (10V peak to peak), at a frequency and shape determined by **LFO RATE**, **LFO WAVE**, and any modulation. The LFO is internally routed to many parts of Mavis, but you can also use it as an **S+H** input, patch it to the **VCA** for tremolo effects, or patch it to the **GATE** to continually trigger Mavis's EG.

EG *(R7, C1)*

Envelope signal triggered by **GATE** and with a shape determined by the **EG** parameters (Attack, Decay, Sustain, Release). Like the LFO, it is internally routed to many parts of Mavis, but you can also use it as an **S+H** input or patch it to the **LFO RATE** to increase and decrease the LFO rate over the course of the envelope.

S+H *(R7, C2)*

Output of Sample + Hold circuit. With normalled signals and VCO set to **SAW WAVE**, this will output pseudorandom voltages at the rate of the LFO. You can use this to inject randomness anywhere in Mavis, from the VCO (**1V/OCT**) to the filter (**CUTOFF**), **VCA**, or the **LFO RATE** itself.

ATTN *(R7, C3)*

Attenuator output. Outputs signal at **ATTN** input scaled by **ATTENUATOR** knob.

MULT 1 *(R8, C2)*

First output of **MULT**. Exact copy of signal input to **MULT** input.

MULT 2 *(R8, C3)*

Second output of **MULT**. Exact copy of signal input to **MULT** input.