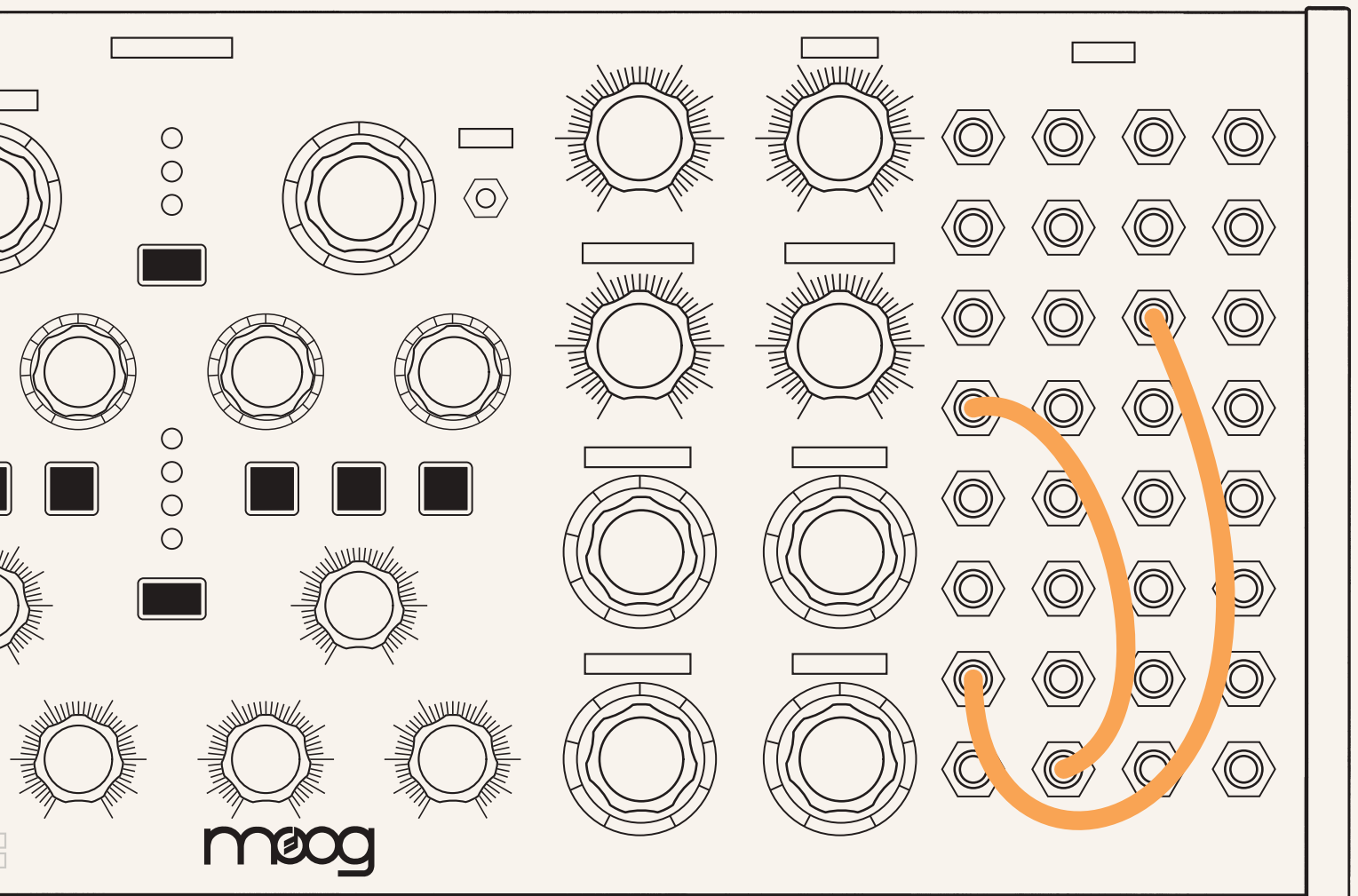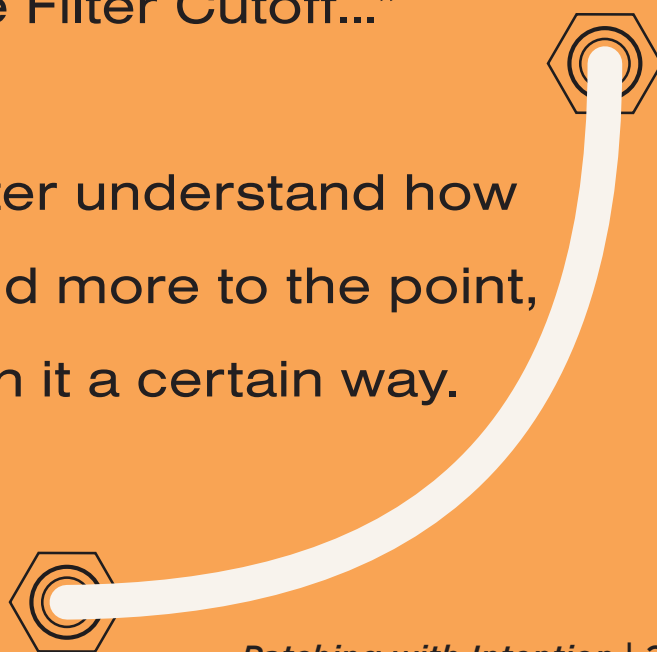# Subharmonicon

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 Subharmonicon. 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 Subharmonicon to approximate. Or an idea may strike you while falling asleep: "I wonder what would happen if I patched Sequencer 1 to the Filter Cutoff…"

This guide will help you better understand how to patch Subharmonicon and more to the point, why you might want to patch it a certain way.

Initialized Patch
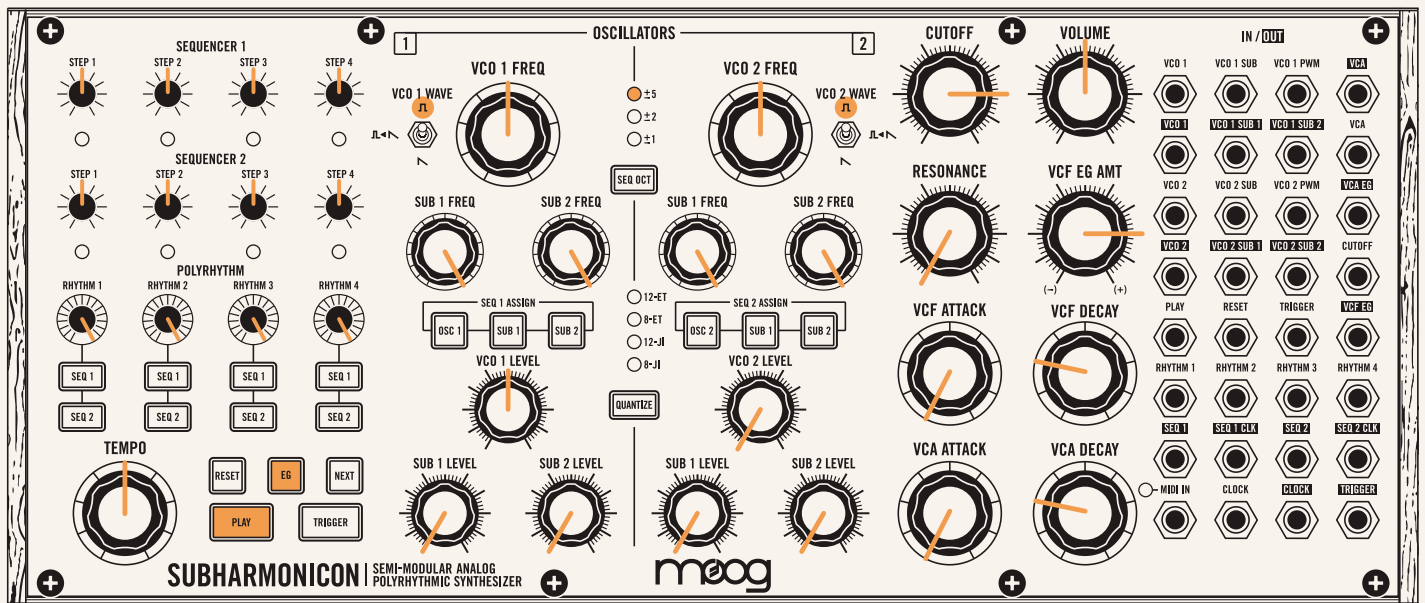
Before getting started, match your Subharmonicon to the initialized patch settings above. Each section builds upon the last, so explore them in sequential order for the best results.

Find full patch point descriptions on pages 12-15 to reference as you move through the patching exercises.

First Steps

Let's start by exploring how to patch a sequencer to an oscillator, allowing us to get more familiar with the process of patching.

First let's route **RHYTHM 1** to **Sequencer 1** by pressing the **SEQ 1** button under **RHYTHM 1**. Let's route **RHYTHM 2** to **Sequencer 2** by pressing the **SEQ 2** button under **RHYTHM 2**. Make sure the **EG** button is illuminated, and press **PLAY**.

Raise the volume and turn the **TEMPO** knob down to around 9 o'clock to hear Subharmonicon's sequencer in action. You will hear a procession of notes all at the same pitch—this is because although the sequencers are running, they are not currently connected to anything.

MAKE THIS CONNECTION

Let's change that by patching the **Sequencer 1** output to the **VCO 1** input with a patch cable.
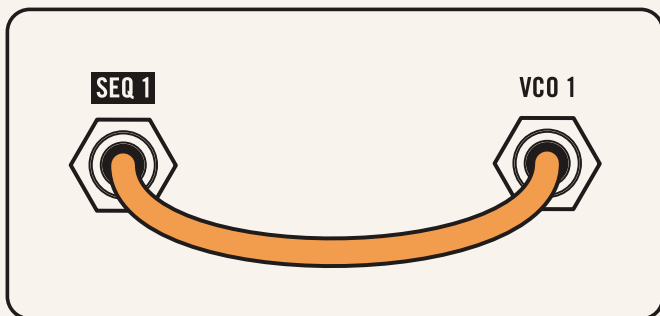
Now you will hear four distinct notes, each corresponding to the setting of the four different knobs of **Sequencer 1**.

→ **Play with those knob settings while the sequencer is running and listen to how the notes change as you rotate them up and down.**

You will notice the sequencer knobs cover an incredibly wide range of notes—this is because the **SEQ OCT** toggle (in between Oscillators 1 and 2) is currently set at **±5** volts. When each sequencer knob is at precisely 12 o'clock it is set to 0 volts, leaving the VCO at whatever frequency is set by the large **VCO 1 FREQ** knob (i.e., the frequency of VCO 1 when there is nothing patched to it).

Rotating a sequencer knob fully clockwise sets it to +5 volts or 5 octaves above the **VCO 1 FREQ** knob while rotating fully counterclockwise sets them to -5 volts or 5 octaves below the **VCO 1 FREQ** knob.

You can limit this range by toggling the **SEQ OCT** to **±2** to change the sequencer range to ±2 volts. You can limit it further by changing it to **±1**. Let's set it to **±1** volt for now. Toggle the **QUANTIZE** selector to **12-ET**—this will quantize the voltages coming out of the sequencer so that they 'lock' into semitones.

Now disconnect the patch cable and instead press the OSC 1 button under SEQ 1 ASSIGN. This button will have the same effect, but without the need for patching.

Intertwining Sequencers

We have two methods of connecting a Subharmonicon sequencer to an oscillator: either via a patch cable, or with the buttons under SEQ 1/2 ASSIGN. This opens up a handful of possibilities because it allows us to, for example, route both sequencers to a single oscillator.

Keep the OSC 1 button under SEQ 1 ASSIGN illuminated from the previous section.

MAKE THIS CONNECTION
Now connect a patch cable from the SEQ 2 output to the VCO 1 input.
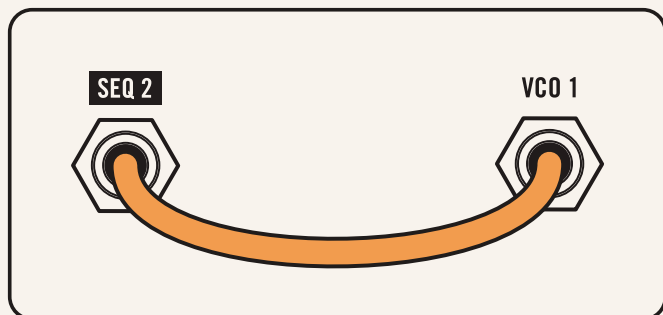
If the SEQUENCER 2 knobs are all precisely at 12 o'clock you probably won't hear much of a difference since each step in Sequencer 2 is adding 0 volts to the voltages coming from Sequencer 1, but

as you play with the sequencer knobs you will notice that the settings of both sequencers affect the melody.

Using two knobs per step as opposed to one may seem silly until you begin to use the POLYRHYTHM section to get Sequencers 1 and 2 moving at different rates. Leave RHYTHM 1 fully clockwise and turn RHYTHM 2 fully counterclockwise.

→ Now you will hear Sequencer 1 complete four phrases before Sequencer 2 moves to a new step. Sequencer 2 now is able to transpose Sequencer 1.

The voltage coming from Sequencer 2 is added to the voltages coming from Sequencer 1, and by playing with the RHYTHM 2 setting you can create sequences much longer than four steps by intertwining both sequencers.

By having two sequencers interact with each other, we can break free of repetitive four-note patterns, extending our musical vocabulary and allowing us to create phrases on much longer timescales.

From Melody to Rhythm

Using a combination of the SEQ ASSIGN buttons, patch cables, and the Polyrhythm section we can start to create interesting pitched sequences. But using Sequencers for pitch alone, while the most common use case, is just the beginning.

MAKE THIS CONNECTION

Disconnect the patch cable **VCO 1** input from the last lesson and instead patch the **SEQ 2** output to the filter **CUTOFF** input.
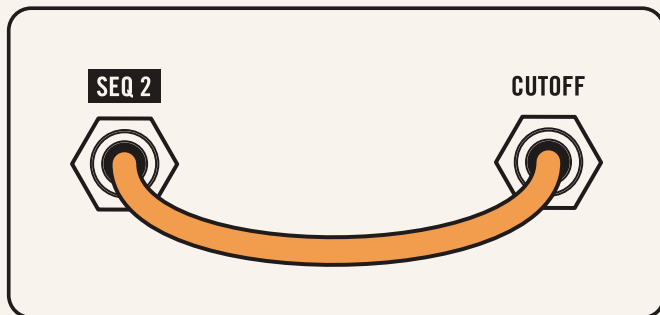
At first this may not sound like too much, but begin to rotate the **CUTOFF** knob down to around 9 o'clock. You should hear Sequencer 2 opening and closing the filter rhythmically.

→ Exaggerate this effect by increasing the RESONANCE and reducing the VCF DECAY. Do this slowly and listen to how it changes as you approach max RESONANCE.

Now you will start to get very percussive sounds, completely changing the character of our tones and starting to sound more like a drum machine.

Play with the RHYTHM 1 knob, the RHYTHM 2 knob, and both sequencer knobs to explore drum patterns.

→ Keep this patch cable connected for the next step.

Intermingled Drum Machine

We can push these rhythms even further with some more patching. Start with the panel settings from the end of the last section.

Each **POLYRHYTHM** subsection divides the master tempo by a certain amount, which you have explored by simply playing with **RHYTHM 2** and **RHYTHM 1**. By modulating these **RHYTHM** settings, we will begin to generate complex rhythms—always in some subdivision of the master tempo.

While Subharmonicon does not have any LFOs, it does have sub-oscillators that can function in much the same way.

MAKE THIS CONNECTION
Begin by patching the **VCO 1 SUB 1** output to the **RHYTHM 2** input.
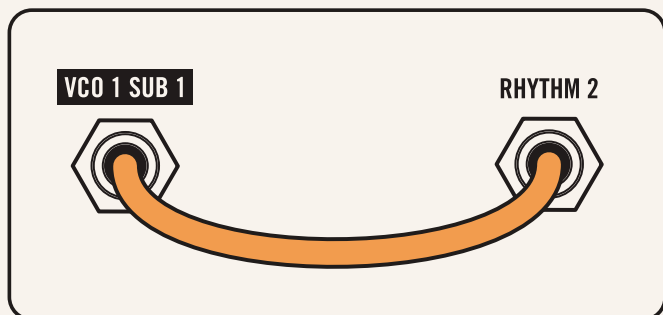
With the **RHYTHM 2** knob set roughly in the middle, you will now hear a more intricate rhythm as the first sub-oscillator

of **VCO 1** moves the **RHYTHM 2** knob up and down via control voltage.

→ **Begin to play with the SUB 1 FREQ knob under VCO 1 and you will start to hear new rhythms emerge as the RHYTHM 2 divisions change dynamically.**

MAKE THIS CONNECTION
Push this further by patching the **VCO 1 SUB 2** output to the **RHYTHM 1** input.
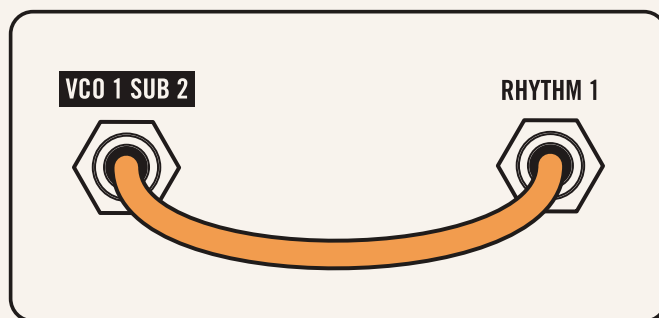
Now you have an even more expressive drum machine! The settings of **RHYTHMS 1 + 2** as well as the frequency of both of **VCO 1's** sub-oscillators control the intricate rhythms, while very slight adjustments of **VCF DECAY**, **VCF EG AMT**, **RESONANCE**, and the settings of both sequencers affect the tonal characteristics of each drum hit.

→ **You can continue the intermodulation with RHYTHM 3 and RHYTHM 4 (routing them to either SEQ 1 or SEQ 2 with their associated buttons) and using the two sub-oscillators of VCO 2 to modulate those extra rhythms. From here, you can begin to explore a world of fascinating intermodulated rhythms that could never be made on a typical drum machine.**

Fun with Envelopes

Being a modular synthesizer, Subharmonicon can play with time by harnessing the power of voltage control over clocks, allowing us to accelerate and modulate time.

→ To explore this, let's return the settings to the initialized patch at the beginning of this guide.

As we've done before, route **RHYTHM 1** to Sequencer 1 by pressing to illuminate the **SEQ 1** button under **RHYTHM 1** and route **RHYTHM 2** to Sequencer 2 by pressing to illuminate the **SEQ 2** button under **RHYTHM 2**.
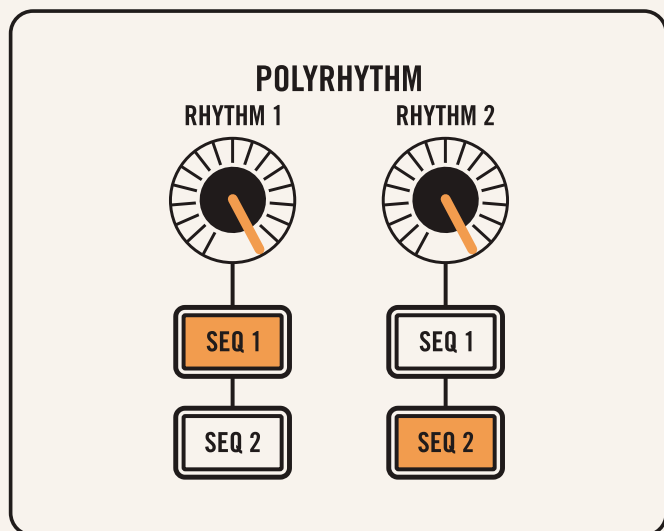
Make sure the **EG** button is illuminated, press **PLAY**, and turn the **TEMPO** down to roughly 9 o'clock.
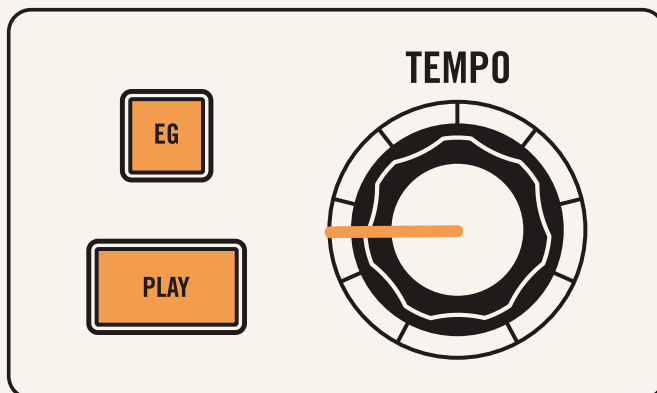
Route **SEQ 1** to **VCO 1** with the corresponding **SEQ 1 ASSIGN** button and play with the **SEQUENCER 1** knobs to get a nice, basic sequence going.
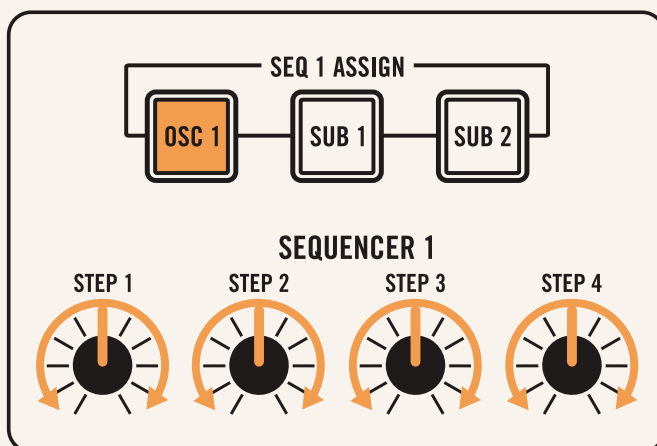
MAKE THIS CONNECTION

Continuing in our use of the sub-oscillators as modulators, patch **VCO 2**'s **SUB 1** output to the **CLOCK** input.

At first you will hear a whole bunch of noise as this will cause the sequencers to run at audio rate. Play around with the **SEQUENCER 1** knobs and the **VCO 2 FREQ** knob to explor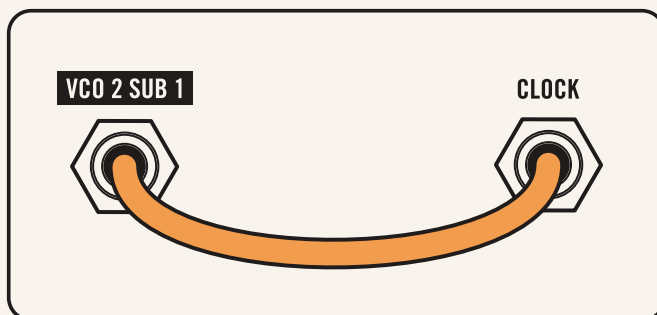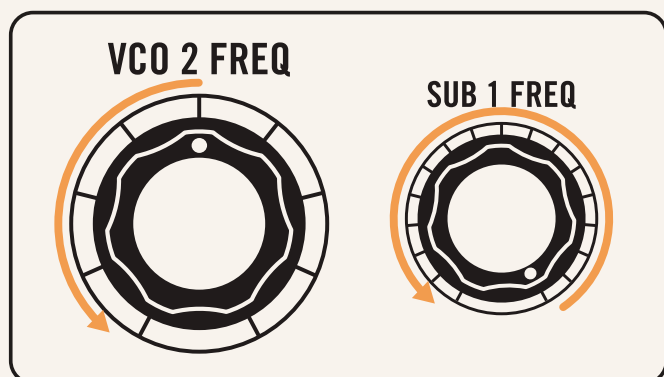e some of the wild, broadband tones that audio-rate clock modulation can achieve. Running sequencers at audio-rate speeds can be a very powerful method for creating complex tones.

Once you're done exploring some of these tones with the **SEQUENCER 1** knobs and **VCO 2 FREQ**, rotate the **VCO 2 FREQ** knob all the way down as well as **VCO 2**'s **SUB 1 FREQ** knob.

With **VCO 2** at a low frequency and its first sub-oscillator at an even lower one, you will hear the sequencer is now driven by **VCO 2 SUB 1** instead of the Subharmonicon internal clock.

The benefit of using one of the oscillators as a clock is that the VCOs are voltage controllable—we can change the speed of the clock with voltages from elsewhere in Subharmonicon.

Subharmonicon features two independent envelopes: one routed to the VCA controlled by the **VCA ATTACK/DECAY** knobs, and one routed to the filter controlled by the **VCF ATTACK/DECAY** knobs. Each has an output on the patch bay so you can route them to other Subharmonicon locations.

→ **You can use an envelope to modulate the pulse width for thicker sounds, for example, or to modulate a rhythm for more sporadic movement.**

MAKE THIS CONNECTION
For this experiment, with **VCO 2 SUB 1** driving the sequencers, let's use the **VCF EG** to modulate time. Patch the **VCF EG** output to the **VCO 2 SUB** input.
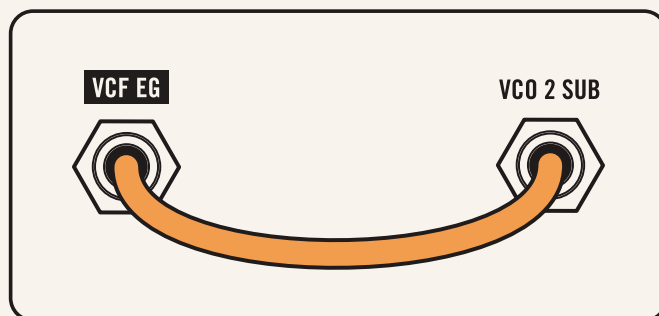
Adjust the **VCF DECAY** all the way down (completely counterclockwise), and begin to raise the **VCF ATTACK** until roughly 12 o'clock.
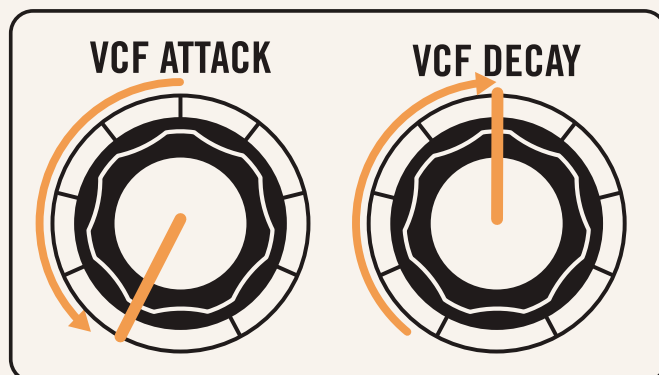
You will hear a longer attack on the filter envelope, slowly opening the filter up, but at the same time you'll notice that it is raising the **SUB 1 FREQ** of **VCO 2**, increasing the rate of the sequencers. As you lengthen the **VCF ATTACK** the clock will accelerate more slowly.

Since we're using **VCO 2 SUB 1** as our clock, our patterns are moving much quicker than with the internal clock of Subharmonicon (which is much slower than the VCOs).

Since the **POLYRHYTHM** section is comprised of four clock dividers, which slow down clock signals, we can turn down the overall clock rate simply by rotating **RHYTHM 1** counterclockwise. This gives us a slower clock rate that still accelerates based on the acceleration time set by **VCF ATTACK**.

MAKE THIS CONNECTION

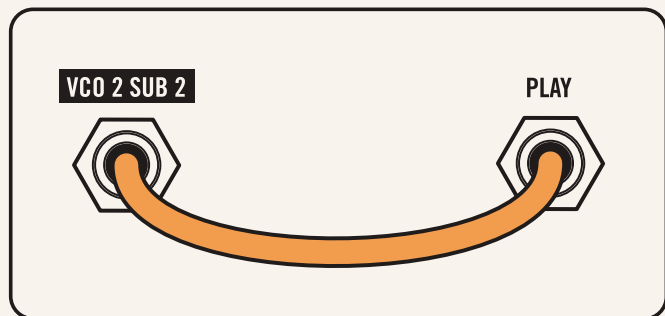We can exaggerate this effect even further by using the second sub-oscillator of **VCO 2** to stop and start the sequencer. Patch the **VCO 2 SUB 2** output to the **PLAY** input.

Turn down **VCO 2**'s **SUB 2 FREQ** knob to around noon and you'll start to hear this stopping and starting motion in action, creating very off-kilter rhythms that are being accelerated by **VCO 2 SUB 1** while at the same time being turned off and on by **VCO 2 SUB 2**!

This creates a very complex system, and you can start to perceive that Subharmonicon sounds like it almost has a mind of its own.

Click the **QUANTIZE** button (setting it to **8-ET**) to quantize the voltages coming from **SEQUENCER 1** into a diatonic scale. Play around with the **SEQUENCER 1** knobs and you'll be able to find melodies that move in very strange patterns.

→ **The ability of Subharmonicon to stretch out time, manipulate clocks with its envelopes, and even stop and start itself with its own oscillators makes Subharmonicon a powerful instrument for generating tangled melodies and strange sequences.**

Further Exploration

Now that you have some intuition for how Subharmonicon'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 Subharmonicon'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

VCO 1   VCO 1 SUB   VCO 1 PWM   VCA

VCO 1   VCO 1 SUB 1   VCO 1 SUB 2   VCA

VCO 2   VCO 2 SUB   VCO 2 PWM   VCA EG

VCO 2   VCO 2 SUB 1   VCO 2 SUB 2   CUTOFF

PLAY   RESET   TRIGGER   VCF EG

RHYTHM 1   RHYTHM 2   RHYTHM 3   RHYTHM 4

SEQ 1   SEQ 1 CLK   SEQ 2   SEQ 2 CLK

MIDI IN   CLOCK   CLOCK   TRIGGER
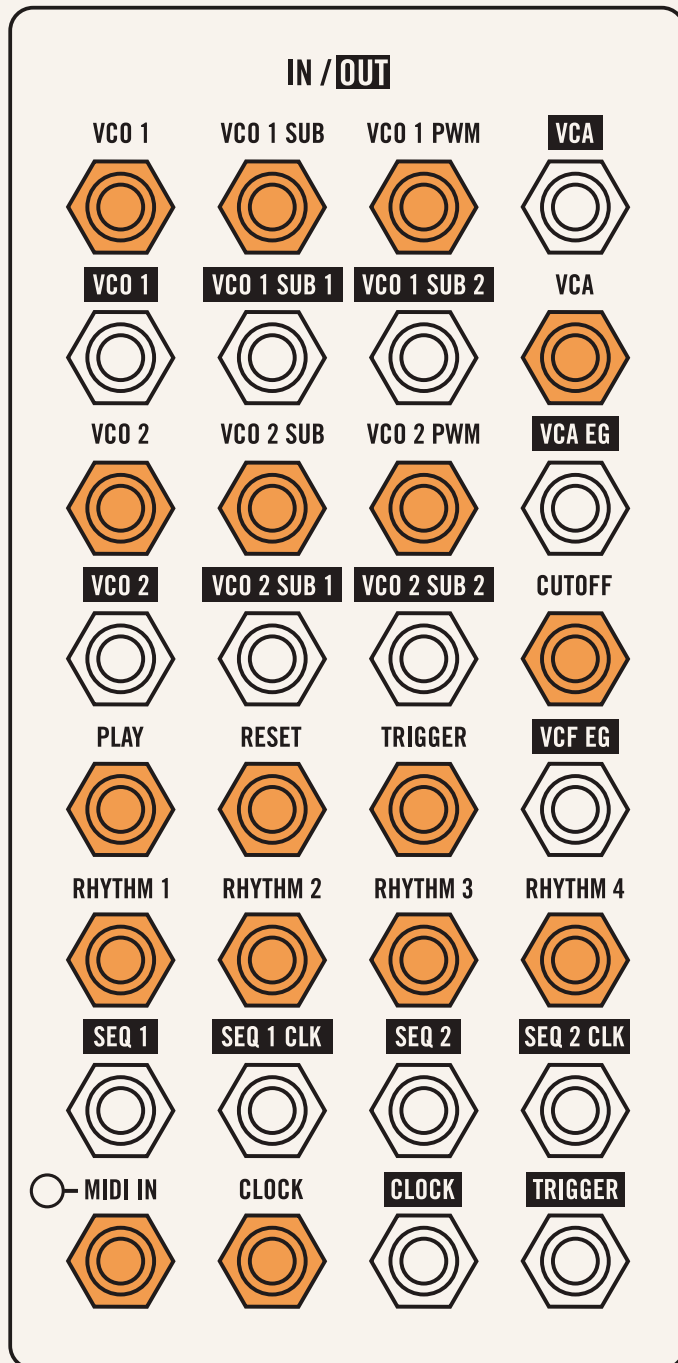
VCO 1 *(R1, C1)*
Controls the frequency of VCO 1

SEQ 1 can be patched to this input with the SEQ 1 ASSIGN buttons, but you can also connect SEQ 2 here, the VCA/VCF EG here for envelope modulation, or VCO 2 for frequency modulation.

VCO 1 SUB *(R1, C2)*
Controls the subdivision frequency of both sub-oscillators of VCO 1

SEQ 1 can be patched to either SUB with the SEQ 1 ASSIGN buttons. Try patching VCO 2 or any of its sub-oscillators in here for frequency modulation, or slow down the VCA and VCF envelopes and connect them here to run up and down the subharmonic scale.

VCO 1 PWM *(R1, C3)*
Controls the pulse-width of VCO 1

Connect either envelope here for traditional envelope pulse-width modulation, a sequencer here for different timbres on each step, or the VCA output for feedback-like harsher timbres.

VCA *(R2, C4)*
Controls voltage input for the VCA

The VCA EG is normalled here, but by patching either SEQ in here you can get per-step velocity changes, or patch a VCO here for amplitude modulation.

VCO 2 *(R3, C1)*
Controls the frequency of VCO 2
See VCO 1.

VCO 2 SUB *(R3, C2)*
Controls the subdivision frequency of both sub-oscillators of VCO 2
See VCO 1 SUB.

VCO 2 PWM *(R3, C3)*
Controls the pulse-width of VCO 2
See VCO 1 PWM.

CUTOFF *(R4, C4)*
Controls the cutoff frequency of the filter

Connect a SEQ here for timbral changes per-step, or a VCO or VCO SUB here for filter FM.

PLAY *(R5, C1)*
A rising gate signal here will be akin to toggling PLAY On—a falling gate signal akin to toggling PLAY Off.

Use the VCOs and VCO SUBs for audio rate sequencer stopping and starting, or connect external gear here to engage PLAY.

RESET *(R5, C2)*
A rising gate signal here will reset the sequencers and hold them until the gate goes down.

This is mostly useful with external gear and sequencers, but play around with plugging the SEQ 1/2 CLKs in here.

TRIGGER *(R5, C3)*
A rising gate signal here will trigger both the VCF and VCA envelope generators— akin to pressing the TRIGGER button.

Trigger continued...
Motion in either SEQ 1 or SEQ 2 will trigger this input, but you can patch the CLOCK here to get faster triggers with SEQ 1 and SEQ 2 running at subdivisions of the clock.

RHYTHM 1 *(R6, C1)*
Controls the subdivision of RHYTHM 1, which is a division of the master TEMPO and routed to either SEQ 1 or SEQ 2 via its corresponding buttons

Patch the VCOs (and especially the SUBs at low rates) here to get interesting rhythmic movement, or patch SEQ 1 or SEQ 2 here for further intricate rhythms.

RHYTHM 2 *(R6, C2)*
Controls the subdivision of RHYTHM 2
See RHYTHM 1.

RHYTHM 3 *(R6, C3)*
Controls the subdivision of RHYTHM 3
See RHYTHM 1.

RHYTHM 4 *(R6, C4)*
Controls the subdivision of RHYTHM 4
See RHYTHM 1.

MIDI IN *(R8, C1)*
A MIDI input to be used with the included 5-pin MIDI to 3.5mm adapter. For more MIDI interfacing information, see manual.
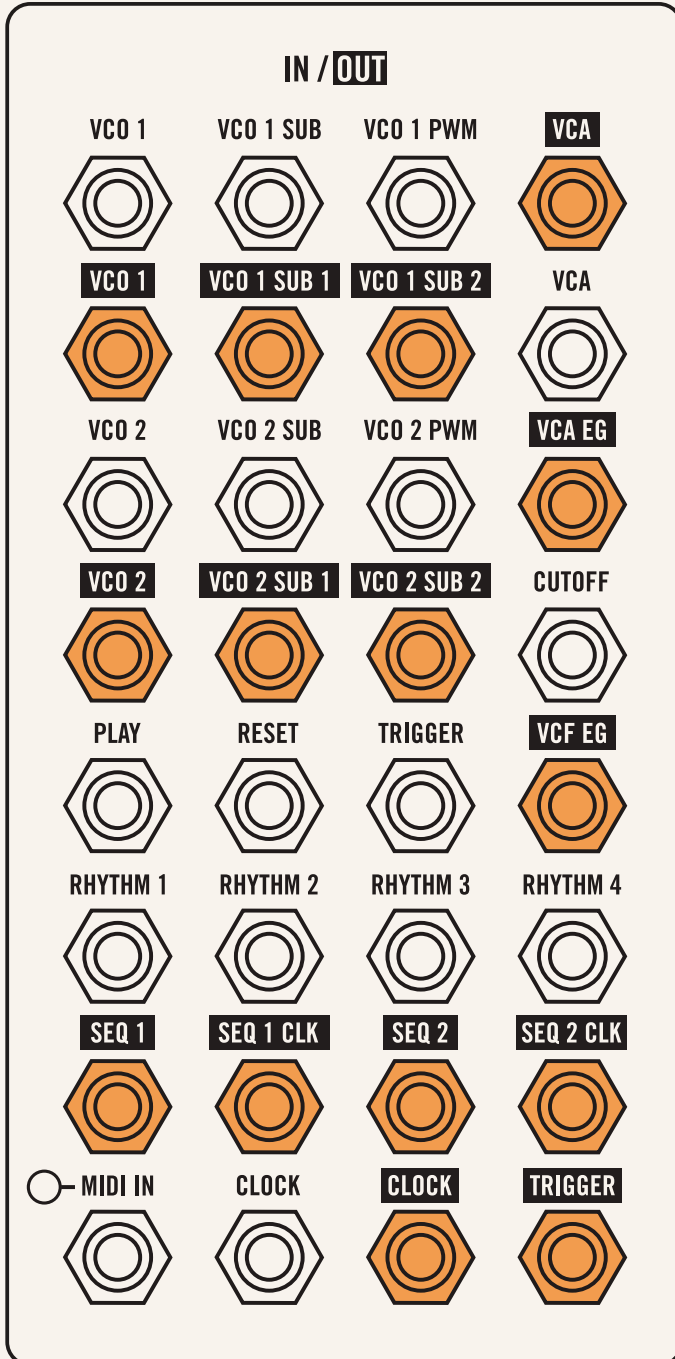
CLOCK *(R8, C2)*
A clock signal input here will override the master clock set with the TEMPO knob.

Experiment with routing the VCOs in here and modulating them for wild audio-rate rhythmic possibilities.

Outputs

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

IN / OUT

VCO 1	VCO 1 SUB	VCO 1 PWM	VCA
VCO 1	VCO 1 SUB 1	VCO 1 SUB 2	VCA
VCO 2	VCO 2 SUB	VCO 2 PWM	VCA EG
VCO 2	VCO 2 SUB 1	VCO 2 SUB 2	CUTOFF
PLAY	RESET	TRIGGER	VCF EG
RHYTHM 1	RHYTHM 2	RHYTHM 3	RHYTHM 4
SEQ 1	SEQ 1 CLK	SEQ 2	SEQ 2 CLK
MIDI IN	CLOCK	CLOCK	TRIGGER

VCA *(R1, C4)*
Output of the final VCA

This can be used to integrate Subharmonicon with Eurorack gear for further processing, or routed back into Subharmonicon for feedback patches. Try routing it to either VCO or the CUTOFF for noisy modulation.

VCO 1 *(R2, C1)*
Audio output of VCO 1

Try routing to VCO 2 for frequency modulation, VCA for amplitude modulation, or route to CLOCK for audio rate clocking. You can also use this output to take VCO 1 direct to external gear, bypassing the VCF and VCA.

VCO 1 SUB 1 *(R2, C2)*
Audio output of VCO 1 Sub-oscillator 1

Try routing to any of the RHYTHMS for rhythm modulation, the VCA for amplitude modulation, or CLOCK for a clock with voltage control.

VCO 1 SUB 2 *(R2, C3)*
Audio output of VCO 1 Sub-oscillator 2
See VCO 1 SUB 1.

VCA EG *(R3, C4)*
Envelope output of the VCA envelope generator

This is normalled to the VCA input, but try routing to any VCO for enveloping FM or a RHYTHM for complex sequencer motion.

VCO 2 *(R4, C1)*
Audio output of VCO 2
See VCO 1.

VCO 2 SUB 1 *(R4, C2)*
Audio output of VCO 2 Sub-oscillator 1
See VCO 1 SUB 1.

VCO 2 SUB 2 *(R4, C3)*
Audio output of VCO 2 Sub-oscillator 2
See VCO 1 SUB 1.

VCF EG *(R5, C4)*
Envelope output of the VCF envelope generator

This is normalled to the CUTOFF input, but try routing to any VCO for enveloping FM or a RHYTHM for complex sequencer motion.

SEQ 1 *(R7, C1)*
Sequencer 1 output

This can be routed to VCO 1 with SEQ 1 ASSIGN buttons, or use a patch cable to route it to any VCO 2 parameters, the CUTOFF for sequenced filter motion, the VCA for sequenced accents, or any RHYTHM for per-step rhythmic changes.

SEQ 1 CLK *(R7, C2)*
The clock output of SEQ 1—generates a clock whenever SEQ 1 moves.

Useful for synchronizing with external instruments, play with patching it to the CUTOFF or any VCO for very fast punchy attack transients.

SEQ 2 *(R7, C3)*
Sequencer 2 output

This can be routed to VCO 2 with SEQ 2 ASSIGN buttons, or use a patch cable to route it to any VCO 1 parameters, the CUTOFF for sequenced filter motion, the VCA for sequenced accents, or any RHYTHM for per-step rhythmic changes.

SEQ 2 CLK *(R7, C4)*
The clock output of SEQ 2

This generates a clock whenever SEQ 2 moves. See SEQ 1 CLK.

CLOCK *(R8, C3)*
Master clock of Subharmonicon

Patch to TRIGGER input to trigger notes on every clock pulse regardless of RHYTHM settings, or connect to external instruments for synchronization.

TRIGGER *(R8, C4)*
A trigger output which is sent to the VCF and VCA EGs

This differs from the CLOCK output in that it only fires whenever SEQ 1 or SEQ 2 moves—which will be very different from the CLOCK output depending on the POLYRHYTHM settings. Connect to external instruments, or try connecting to VCO inputs, CUTOFF, or VCA for a sharper attack transient.