INSTRUō | SPECIALIST SYNTHESIZERS
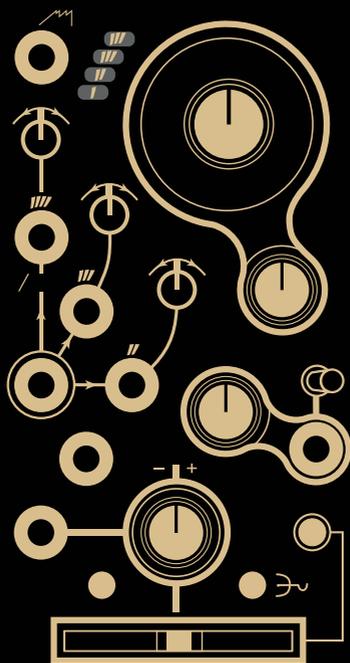
saïch

Quad Oscillator

User Manual

Contents

Description ▬

The Instruō **saïch** is a quad oscillator with super-saw functionality and built in "smart" VCA mixing. At its core are four fully analogue sawtooth waveforms that can be intervallically offset, individually and globally detuned, transformed and transposed, and mixed together in creative and interesting ways.

A perfect companion for the harmonàig quantiser, it can easily create harmonically structured chord voicings perfect for lush subtractive patching. Paraphonic patching in analogue with eurorack has now become considerably more convenient!

No quad quantiser in your system? Not to worry!
saïch includes beautifully simple diatonic modes allowing for the creation of Ionian and Aeolian chord scales with a single 1V/octave CV source.

Features ▬

- Quad analogue oscillators
- Smart VCA with 7 mix profiles
- Global and individual detuning
- Intervallic offsets
- Sub oscillator modes
- 1V/Oct tracking
- Linear and exponential FM
- Diatonic modes

Installation

1. Confirm that the Eurorack synthesizer system is powered off.
2. Locate 12 HP of space in your Eurorack synthesizer case.
3. Connect the 10 pin side of the IDC power cable to the 2x5 pin header on the back of the module, confirming that the red stripe on the power cable is connected to -12V.
4. Connect the 16 pin side of the IDC power cable to the 2x8 pin header on your Eurorack power supply, confirming that the red stripe on the power cable is connected to -12V.
5. Mount the Instruō **saïch** in your Eurorack synthesizer case.
6. Power your Eurorack synthesizer system on.

Note:
This module has reverse polarity protection.
Inverted installation of the power cable will not damage the module.

Specifications

- Width: 12HP
- Depth: 27mm
- +12V:110mA
- -12V: 90mA

saïch | saix | **noun** (natural sciences) a number of animate things massed together in motion

Key ▬

1. Output
2. Voice Indicators
3. Fader
4. CTRL Button
5. CTRL Input
6. CTRL Attenuverter
7. Global Coarse
8. Global Fine
9. Voice 2 Detune
10. Voice 3 Detune
11. Voice 4 Detune
12. Voice 1 or Global 1V/Oct
13. Voice 2 1V/Oct
14. Voice 3 1V/Oct
15. Voice 4 1V/Oct
16. FM Input
17. FM Attenuator
18. Lin/Exp Toggle
19. Sub Button
20. PWM Input
21. Mix Profile Button

Case Tuning ━━

Because **saïch** incorporates four fully analogue oscillator cores with definable intervallic offsets, it can require a little assistance to acclimatise to a new home. With today's endless possible combinations of power supply and module options in Eurorack, variations in -/+ 12V power rail balance is something that might need to be compensated for. In other words, the **saïch** can need tuned on a **case-by-case basis** (Pun intended!).

Once **saïch** is installed into the system, allow the system to warm up (10-15 min).

Once the system is warm, run through the following tuning procedure. This procedure sets the centre frequencies for all **Detune** controls, as well as octave references for the intervallic offsets. The procedure can be done by ear using a referencing of C5, but an electronic tuner can greatly aid the process.

Step 1

Centre all three **Detune** controls.
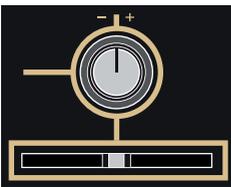
Step 2

Centre the **CTRL Attenuverter** and **Fader**. Ensure the **CTRL Button** is in its unlit state (press the **Mix Profile Button** to return from alternate controls)
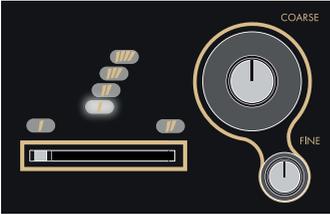
Step 3

Hold down the **CTRL Button** for 3 seconds until the **Voice Indicators** blink. The tuning procedure is now active and is indicated by a blinking amber/white **CTRL Button** and a flashing amber **Fader**.
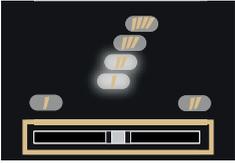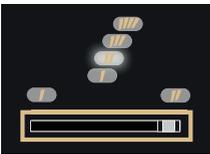
Step 4

Notice that the 1st and 2nd **Voice Indicators** are illuminated, and moving the **Fader** crossfades between voices 1 and 2.

Step 5

With the **Fader** fully left, allowing only voice 1 to be monitored, tune voice 1 to C5 (~523.25Hz / the octave above middle C) using the **Coarse** and **Fine** knobs.

Step 6

Now move the **Fader** fully right to monitor voice 2.

Step 7

Use the **CTRL Attenuverter** to tune voice 2 to middle C5 (~523.25Hz / the octave above middle C).

Step 8

Move the **Fader** to its centre position to confirm the tuning between voices 1 and 2. There should be little to no beating.

Step 9

When satisfied with the tuning between voices 1 and 2, press the **Sub Button** and **Mix Profile Button** at the same time to save the tuning.

Note: **Voice indicators** will pulse confirming the save.

Step 10

Press the **CTRL Button** to go to the next step - tuning the octave reference of voice 2.

Step 11

Repeat steps 5-9 but instead of tuning voice 2 to C5, tune it to C6 (~1046.50 Hz).

Step 12

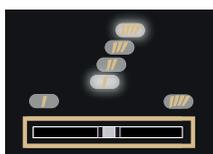When satisfied with the tuning between voices 1 and 2, press the **Sub Button** and **Mix Profile Button** at the same time to save the tuning.

Step 13

Now press the **CTRL Button** again to repeat this process tuning voice 3 to voice 1 and voice 4 to voice 1 at both unisons and octaves.

Step 14

Once you've saved the final tuning (the octave of voice 4), press the **CTRL Button** to exit the tuning procedure.

Waveforms ▬

Output: Mixed output of up to four analogue waveforms. Voice 1 can be set to ramp, sawtooth, or pulse waveforms, while voices 2 through 4 only generate ramp waveforms (See the Sub Modes section for more information). The mix of amplitudes between voices is defined by the currently selected mix profile (see the Mix Profile Scan and Sub Modes sections of the manual for more information).

VOICE WAVEFORM VCA

OUT
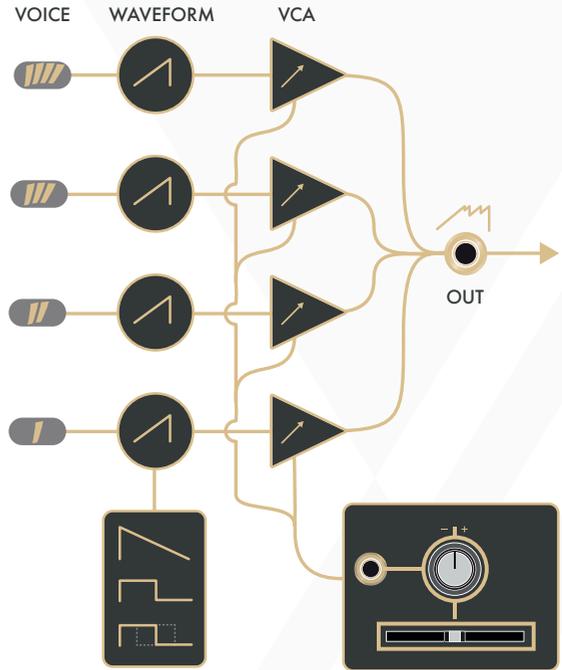
Voice Indicators: The **Voice Indicators** depict the amplitude of each voice as brightness. They will also temporarily indicate which mix profile is active (see the Mix Profile Scan section of the manual for more information).

CTRL ━━━

Fader: The **Fader** can be used to control one of three different parameters.

1. Mix Profile Scan (primary function)
2. Intervallic Offset (secondary function)
3. Global Detune (secondary function)

CTRL Button: The **CTRL Button** is used to change the behaviour of the **Fader**.

 If the **CTRL Button** is unilluminated, the **Fader** sets the **Mix Profile Scan** position. (Pressing the **Mix Profile Button** will return to this primary function)

 If the **CTRL Button** is illuminated white, the **Fader** selects the **Intervallic Offset** of voices 2, 3, and 4.

 If the **CTRL Button** is illuminated amber, and an **Intervallic Offset** has been selected, moving the **Fader** from left to right controls the **Global Detune** of each voice from unisons, to the defined **Intervallic Offset**.

- All previous parameter values are retained when new parameters are assigned to the **Fader**.
- Once a parameter selection has been changed moving the **Fader** will activate control over the parameter.
- It is important to note that pressing the **CTRL Button** only switches to the secondary functions parameters (**Intervallic Offset** and **Global**

Detune). If one of these modes are selected and the **CTRL Button** is illuminated either white or amber, press the **Mix Profile Button** to return to the **Mix Profile Scan** parameter control. This is indicated by an unilluminated **CTRL Button**.

Mix Profiles Scan ━━

The **Mix Profile Scan** parameter is a macro control which influences an automation styled audio mixer featured within the **saïch**. It uses digitally controlled analogue VCAs to mix amplitudes between the four oscillator voices. There are seven mix profiles that determine the manner in which voices are combined at the **Output**. Once a mix profile is selected (and the **CTRL Button** is unilluminated) the **Fader** scans through the mix profile. Amplitude levels of the voices are depicted in brightness by the **Voice Indicators**.

Mix Profile Button: Pressing the **Mix Profile Button** cycles through the seven mixing profiles. Mix profile selection is temporarily depicted in binary by the **Voice Indicators**.

Mix Profiles ━━

1) Cascade Crossfade: As the **Fader** is moved from left to right, all voices crossfade to single voices (1 through 4), which then crossfades to silence.
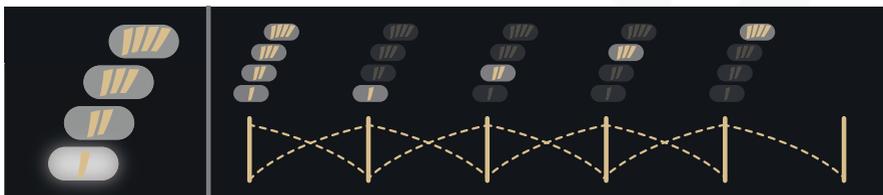
2) Basic VCA: As the **Fader** is moved from left to right, all voices fade in. With the **Fader** in its far left position, applying positive control voltage will fade from silence to all voices at full amplitude.
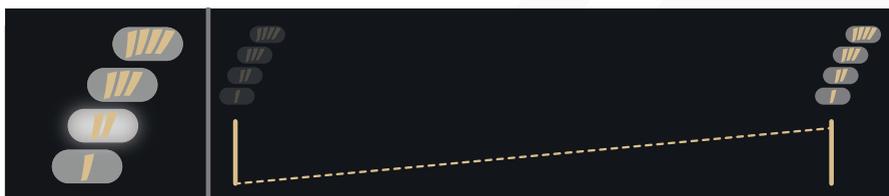
3) Voice Arpeggiator: As the **Fader** is moved from left to right, the voices are isolated one after the other. Voice 1 switches to voice 2, voice 2 switches to voice 3, and voice 3 switches to voice 4.
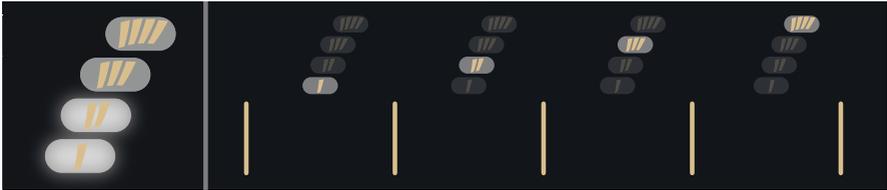

4) Voice Subtraction: As the **Fader** is moved from left to right, voices are subtracted from top to bottom. At full left, all voices are present. At full right, no voices are present.
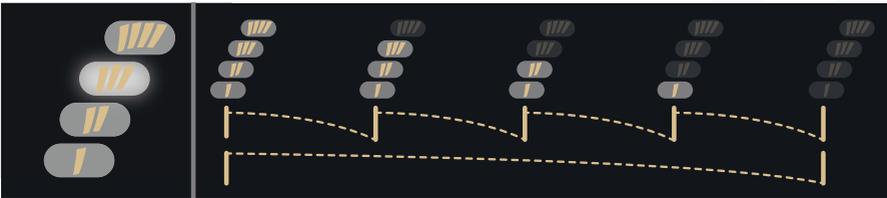
5) Odds to Evens: As the **Fader** is moved from left to right, odd voices (voices 1 and 3) crossfade to even voices (voices 2 and 4).
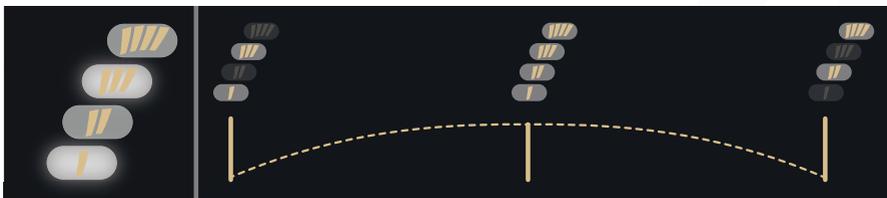
6) Smart Pairs: All four voices are present at the **Fader**'s centre position. As the **Fader** is moved to the left, voices 1 and 2 crossfade to voices 1 and 4 before completely fading out to silence. As the **Fader** is moved to the right from its centre position, voices 2 and 4 crossfade to voices 2 and 3 before completely fading out to silence.
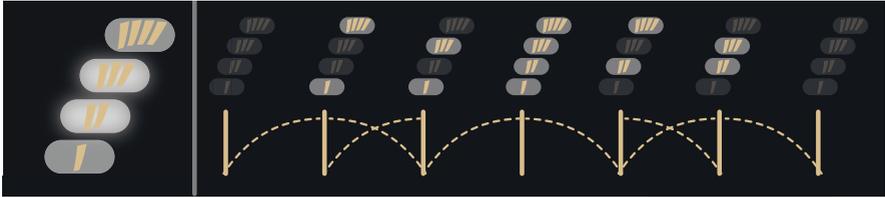
7) Constant Root: As the **Fader** is moved from left to right, the mix profile crossfades between voices 1 and 2, voices 1 and 3, voices 1 and 4, and back to voices 1 and 2.
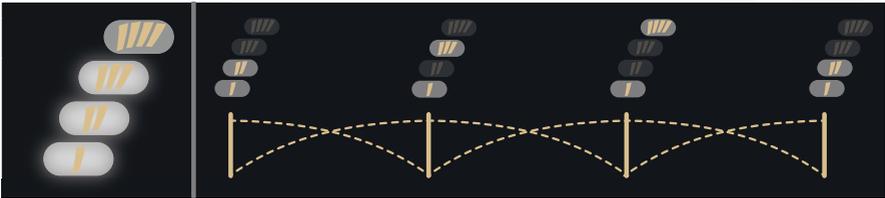
To quickly return to the **Cascade Crossfade** mix profile, press and hold the **Mix Profile Button** and then press the **Sub Button**.
If the **Mix Profile Button** remains held and the **Sub Button** is pressed multiple times, the **Mix Profiles** can be cycled through in reverse order.

Intervallic Offsets ━━

When the **CTRL Button** is illuminated white, the **Fader** sets the **Intervallic Offset** of voices 2, 3 and 4. Setting the **Fader** to its fully left position sets all four voices to unison. Moving the **Fader** to the right introduces combinations of intervallic unisons, octaves, perfect fourths, and perfect fifths between each voice. The **Fader's** LED will blink off when the **Intervallic Offset** changes.

The **Intervallic Offset** variations are divided into three groups.

- The furthest left **Intervallic Offset** setting sets all voices to unison (no offsets).
- Moving the **Fader** right switches through 6 **Intervallic Offset** variants.
- These 6 variants repeat twice more as the intervallic pattern rotates around voices 4, 3, and 2.
- It is important to note that the three groups of variants will sound the same when there are no differing **1V/Oct** signals at the **1V/Oct Inputs** of voices 2, 3, and 4.
- When harmonàig is used, the intervallic offsets become diatonic tensions as the three groups of variants rotate across all **Intervallic Offset** variations at perfect intervals (4ths, 5th and octaves).

The table below shows how each voice is changed as the **Fader** is moved from left to right.

- 8va = 1 octave above unison
- P5+ = perfect 5th above unison
- P4- = perfect 4th below unison
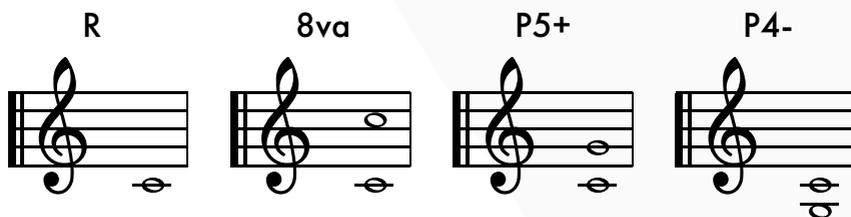
R   8va   P5+   P4-

Interval Fader Notches

Oscillators	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	R	8va	P5+	P4-	P4-	P4-	P4-	R	R	R	R	R	P5+	R	R	R	8va	P5+	8va
	R	R	R	R	8va	P5+	8va	8va	P5+	P4-	P4-	P4-	P4-	R	R	R	R	R	P5+
	R	R	R	R	R	R	P5+	R	R	R	8va	P5+	8va	8va	P5+	P4-	P4-	P4-	P4-
	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R

Global Detune

When the **CTRL Button** is illuminated amber, and an **Intervallic Offset** has been set, moving the **Fader** from left to right controls the **Global Detune** of each voice from unison to their fully spread position.

It's important to note that the **Global Detune** must be set to a value higher than 0 for the **Intervallic Offset** to be applied.

Similarly, the **Intervallic Offset** must be set to something other than Unison for the **Global Detune** to have any effect. For instance, if the **Intervallic Offset** is set to Unison, then the **Global Detune** doesn't have a voicing to spread.

CTRL CV Mapping

CTRL CV Input: The **CTRL CV Input** can be mapped to one of three parameters. This mapping can function independent of the **Fader** parameter mapping.

1. **Mix Profile Scan:** Press and hold the **Mix Profile Button** and then press the **CTRL Button** to map the **CTRL CV Input** to the **Mix Profile Scan** parameter. (The **CTRL CV Input** is mapped to the **Mix Profile Scan** parameter by default)
2. **Intervallic Offset:** With the **CTRL Button** illuminated white and the **Intervallic Offset** parameter active to the **Fader**, press and hold the **CTRL Button** and then press the **Sub Button** to map the **CTRL CV Input** to the **Intervallic Offset** parameter.
3. **Global Detune:** With the **CTRL Button** illuminated amber and the **Global Detune** parameter active to the **Fader**, press and hold the **CTRL Button** and then press the **Sub Button** to map the **CTRL Input** to the **Global Detune** parameter.

Note: When pressing and holding the **CTRL Button** before pressing the **Sub Button** to define **CTRL CV Input** mapping, the **CTRL Button** LED will flip colour as if it switched between **Intervallic Offset** and **Global Detune**. When the **Sub Button** is pressed this will flip back as the button press was intended for **CTRL CV Input** mapping and not a parameter change.

CTRL CV Attenuverter: The **CTRL CV Attenuverter** will scale and/or invert the control voltage signal present at the **CTRL CV Input**.

- Control voltage is scaled and/or inverted by the **CTRL CV Attenuverter** and summed with the parameter's **Fader** position.

Frequency & Pitch ━━

Coarse: The **Coarse** knob controls the fundamental frequency of all voices. It determines the pitch of all four voices simultaneously.

- Turning the knob anticlockwise will decrease the frequency of all voices.
- Turning the knob clockwise will increase the frequency of all voices.

Fine: The **Fine** knob is used for minute control of the voices' fundamental frequency and is relative to the value set by the **Coarse** knob. It also determines the pitch of all voices simultaneously.

- Turning the knob anticlockwise will decrease the frequency of all voices.
- Turning the knob clockwise will increase the frequency of all voices.

Detune: Voices 2, 3, and 4 have dedicated **Detune** controls that can be used for subtle deviation from the fundamental frequency defined by the **Coarse** and **Fine** knobs. These can be used to match unison tunings and produce chorusing effects, and chordal dissonances.

1V/Oct Inputs: The **1V/Oct Inputs** are bipolar control voltage inputs that are calibrated to 1 volt per Octave. There is an independent **1V/Oct Input** per voice.

- The **1V/Oct Input** of voice 1 normals to the other three **1V/Oct Inputs** in parallel. Inserting a cable to any of the other **1V/Oct Inputs** breaks this normal.
- This is traditionally used for frequency control (musical pitch) sent from a sequencer or keyboard.
- Control voltage is summed to the values set by the **Coarse** and **Fine** knobs.

Frequency Modulation ▬

FM Input: The **FM Input** is a bipolar control voltage input for the frequency parameters of all voices.

- Control voltage is summed with the values set by the **Coarse** and **Fine** knobs and scaled by the **FM Attenuator**.

FM Attenuator: The **FM Attenuator** determines the depth of frequency modulation applied to the fundamental frequency of all voices.

- Turning the knob anticlockwise will decrease the depth of frequency modulation.
- Turning the knob clockwise will increase the depth of frequency modulation.

Lin/Exp Toggle: The **FM Input** can be set to have a linear or exponential FM response curve.

- If the toggle is set to the left position, the FM signal will apply with linear scaling.
- If the toggle is set to the right position, the FM signal will apply with exponential scaling.
- If the toggle is set to exponential FM and the **FM Attenuator** is fully clockwise, the **FM Input** will essentially track at 1V/Octave. (Its tracking may differ slightly from the calibrated **1V/Oct Inputs**.)

Sub Modes

Sub Button: The **Sub Button** cycles through four **Sub Modes** that affect voice 1.

By default, **Sub Mode 1** is active and voice 1 will produce an ascending sawtooth wave at the fundamental frequency. When selected the **CTRL Button** LED will indicate **Sub Mode 1** with a fast white upward pulse.

When **Sub Mode 2** is active, the **CTRL Button** illuminates with a slow white downward pulse, indicating that the waveform of voice 1 has inverted to a descending sawtooth waveform one octave lower than its default fundamental frequency.

When **Sub Mode 3** is active, the **CTRL Button** slowly blinks white, indicating that the waveform of voice 1 has changed to a square waveform one octave lower than its default fundamental frequency. (In this mode the **PWM CV Input** will affect the square wave's pulse width. See the Pulse Width Modulation section of the manual for more information).

When **Sub Mode 4** is active, the **CTRL Button** slowly blinks between white and amber illumination. This indicates the waveform of voice 1 has changed to a pulse waveform one octave lower than its default fundamental frequency with automatic pulse width modulation applied via an internal fixed-rate triangle waveform LFO. The **PWM CV Input** can also be utilised in this mode. External modulation will sum with the internal modulation (See the Pulse Width Modulation section of the manual for more information).

Pulse Width Modulation ▬

When **Sub Mode 3** or **4** are active, setting voice 1 to be either a square or pulse waveform, external control voltage can be used to modulate the pulse width. In **Sub Mode 4** the **PWM** parameter is automatically modulated by an internal bipolar triangle waveform LFO.

PWM Input: The **PWM Input** is a bipolar control voltage input for the **PWM** parameter.

- In **Sub Mode 4** external control voltage will sum with the internal modulation applied to the waveform.

Diatonic Mode

Diatonic Mode is a bit of an "easter egg" feature of the saïch. When active it will automatically tune the internal intervallic offsets of each voice to create harmonic 7th chords.

The capabilities are similar to those of the harmonàig quantiser when set to fully chromatic Ionian or Aeolian modes.

When the CTRL Button is illuminated white indicating that the Intervallic Offset parameter is active at the Fader, press and hold the CTRL Button then press the Mix Profile Button. The CTRL Button will now illuminate a mix of white and amber, indicating that Diatonic Mode is active.

Once Diatonic Mode is active:

- The signal present at the 1V/Oct Input of voice 1 determines the root of the chord.
- Voltage applied at the 1V/Oct Inputs of voices 2, 3, and 4 will sum with the diatonic intervallic offsets.
- The signal present at the CTRL CV Input determines the quality of the chord.
- If the CTRL Attenuverter is fully clockwise, the CTRL CV Input will track 1V/octave and the available chord qualities will be diatonic to Ionian mode (major scale).
- If the CTRL Attenuverter is fully anti-clockwise, the CTRL CV Input will track 1V/octave and the available chord qualities will be diatonic to Aeolian mode (natural minor scale).
- The Fader controls the chord voicing spread.
- Moving the Fader from left to right switches voicings between Close, Drop 2, Drop 3, and Open voicings.

C $^{\Delta 7}$

close   drop 2   drop 3   open

Patch Examples ━━

East Coast Synth Voice:

Summary: The sequencer or keyboard sends voltages to **saïch** while simultaneously triggering the envelope generator. The CV output of the envelope generator opens the filter and VCA, allowing **saïch**'s voices to pass through. More traditional East Coast patches would incorporate separate envelope generators for the filter and VCA.
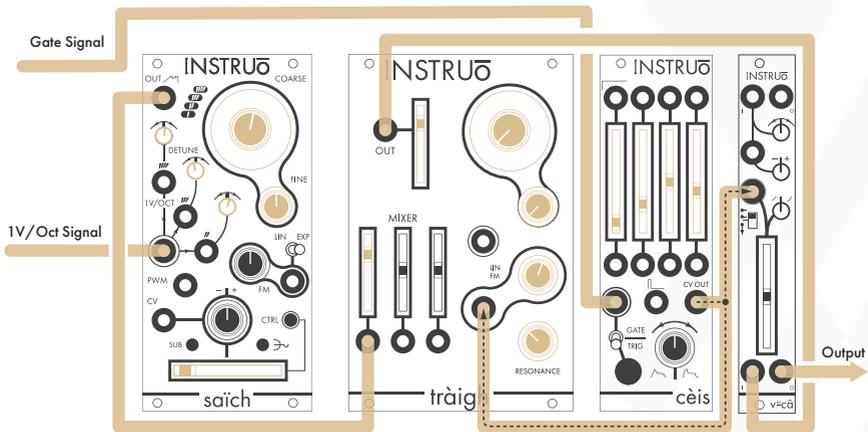
Audio Path:

- Connect the **Out** of **saïch** to the audio input of a filter.
- Connect the audio output of the filter to the audio input of a VCA.
- Monitor the audio output of the VCA.
- Set the mix profile to **Cascade Crossfade** and set the **Fader** to its fully left position, ensuring that all voices are equally present at the **Out**.
- Set the fundamental frequency of **saïch** to a desired position using the **Coarse** and **Fine** knobs.
- Set the **Detune** controls of voices 2, 3, and 4 to slightly chorus against voice 1.

- Set the cutoff frequency of the filter to a desired position.
- Set the resonance of the filter to a desired position.
- Set the level of the VCA to a desired position.

Control Path:

- Connect the 1V/Oct output of a sequencer or keyboard to the primary **1V/Oct Input** of **saïch**.
- Connect the gate output of the sequencer or keyboard to the trigger input of an envelope generator.
- Connect the CV output of the envelope generator to a multiple.
- Connect one copy of the envelope generator CV signal to the CV input of the filter and set the corresponding CV attenuator to a desired position.
- Connect a second copy of the envelope generator CV signal to the CV input of the VCA and set the corresponding CV attenuator to a desired position.
- Set the envelope stages to desired positions.

East Coast Bass Voice:

Summary: The sequencer or keyboard sends voltages to **saïch** while simultaneously triggering the envelope generator. The CV output of the envelope generator opens the filter and VCA, allowing **saïch**'s voices to pass through. **Intervallic Offsets** and **Global Detune** are set to create perfect 4th and perfect 5th intervals, thickening out the sound. A **Sub Mode** is set to create a low fundamental frequency. More traditional East Coast patches would incorporate separate envelope generators for the filter and VCA.

Audio Path:

- Create an **East Coast Synth Voice** audio path using the **Out** of **saïch.** Set to the **Cascade Crossfade** mix profile with the **Fader** in its fully left position, ensuring that all voices are equally present at the **Out.**
- Press the **CTRL Button** so that it is illuminated white and move the **Fader** to select the desired **Intervallic Offset**.
- Press the **CTRL Button** so that it is illuminated amber and move the **Fader** to its fully right position to ensure that the voicing is in its fully
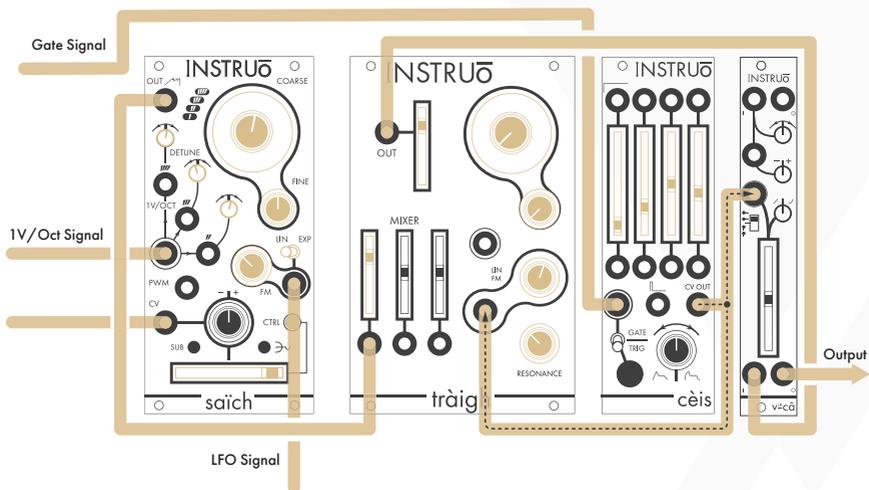
spread position.

- Press the **Sub Button** to select the desired **Sub Mode** waveform.
- Set the **Detune** controls of voices 2, 3, and 4 to slightly chorus against voice 1.

Control Path:

- Create an **East Coast Synth Voice** control path.

Chord Vibrato:

Summary: A bipolar triangle waveform LFO modulates the frequency of all voices when tuned to a chord.
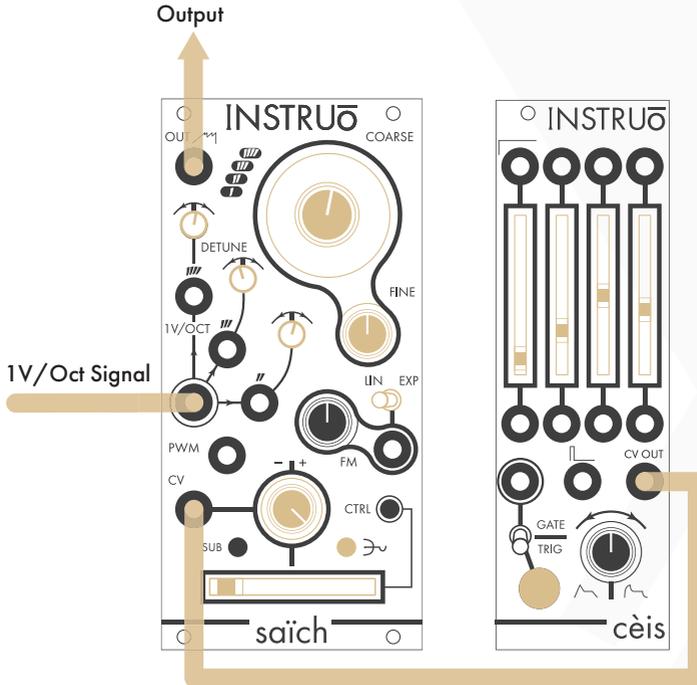

Audio Path:

- Monitor the **Out** of **saïch**.
- Set to the **Cascade Crossfade** mix profile with the **Fader** in its fully left position, ensuring that all voices are equally present at the **Out**.
- Press the **CTRL Button** so that it is illuminated white and move the **Fader** to select the desired intervallic offset.
- Press the **CTRL Button** so that it is illuminated amber and move the **Fader** to its fully right position to ensure that the voicing is in its fully spread position.

Control Path:

- Set the **Lin/Exp Toggle** to its left position to set linear frequency modulation scaling.
- Connect a bipolar triangle waveform LFO to the **FM Input** of **saïch** and slightly increase the **FM Attenuator**.
- Set the frequency of LFO between 3Hz and 7Hz.

Basic VCA:

Summary: An envelope modulates through the **Basic VCA** mix profile, allowing all voices of saïch to pass to the **Out**.
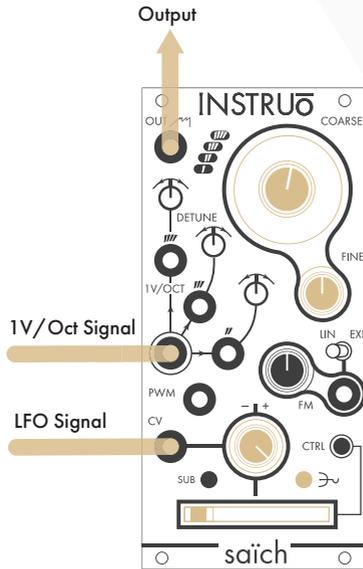

Audio Path:

- Monitor the **Out** of **saïch**.
- Press the **Mix Profile Button** to select the **Basic VCA** mix profile.
- Set the **Fader** to its fully left position so that all voices are fully attenuated at the **Out**.

Control Path:

- Connect an envelope generator to the **CTRL Input** and set the **CTRL Attunuverter** to its fully right position.
- Trigger the envelope generator manually or by an external source.

Arpeggiator:

Summary: A unipolar positive triangle waveform LFO modulates through the **Arpeggiator** mix profile, allowing each voice to pass independently in up-down order.
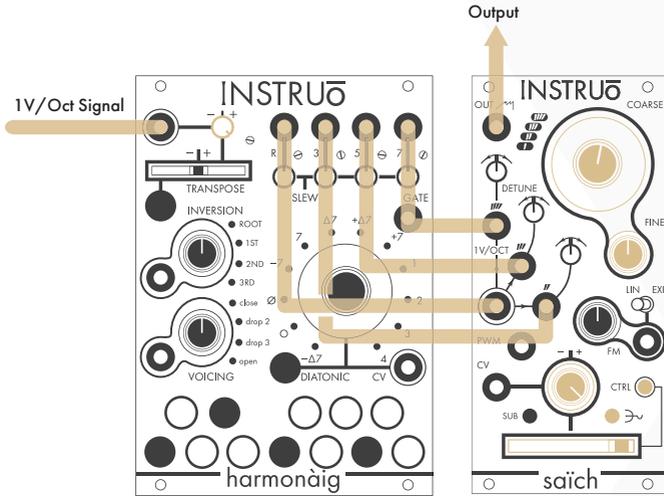

Audio Path:

- Monitor the **Out** of **saïch**.
- Press the **Mix Profile Button** to select the **Arpeggiator** mix profile.
- Set the **Fader** to its fully left position so that all voice 1 is present at the **Out**.

Control Path:

- Connect a unipolar positive triangle waveform LFO to the **CTRL Input** and set the **CTRL Attenuverter** to its fully right position.
- Use a unipolar positive ramp waveform LFO for up direction arpeggios.
- Use a unipolar positive sawtooth waveform LFO for down direction arpeggios.

Tensions:

Summary: Intervallic Offsets in conjunction with external control voltage is used to make chords with diatonic tensions.

Audio Path:

- Monitor the **Out** of **saïch**.
- Set to the **Cascade Crossfade** mix profile with the **Fader** in its fully left position, ensuring that all voices are equally present at the **Out**.
- Press the **CTRL Button** so that it is illuminated white and move the **Fader** to select the desired intervallic offset.
- Press the **CTRL Button** so that it is illuminated amber and move the **Fader** to its fully right position to ensure that the voicing is in its fully spread position.

Control Path:

- Use a quad quantizer like harmonàig to add tuned external control voltage to all four **1V/Oct Inputs** of **saïch**. This biases the intervallic offsets to be diatonic tensions of the original chord.

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Manual Design: Dominic D'Sylva

CE This device meets the requirements of the following standards: EN55032, EN55103-2, EN61000-3-2, EN61000-3-3, EN62311.