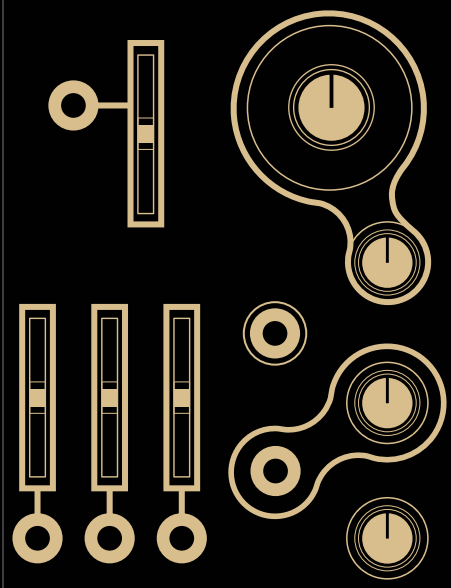
INSTRUŌ | SPECIALIST SYNTHESIZERS



tràigh

Discrete Transistor Ladder Lowpass Filter

User Manual

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Description

Nothing quite beats the comforting sound of multiple rich sawtooths softened by a warm, squishy filter. **tràigh** is a classic transistor ladder low pass filter with a -24dB/octave slope (4 pole). Derived from classic East Coast designs, **tràigh** is suited for creating fat, warm subtractive voices. With its built in three channel mixer, its optimised design allows for summing multiple audio signals and softening them into a warm, comforting cushion of sound.

Features

- Self-Oscillating resonance
- 1V/Oct tracking
- Three channel mixer with gain
- Linear FM

Installation

1. Confirm that the Eurorack synthesizer system is powered off.
2. Locate 18 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 **tràigh** in your Eurorack synthesizer case.
6. Power your Eurorack synthesizer system on.

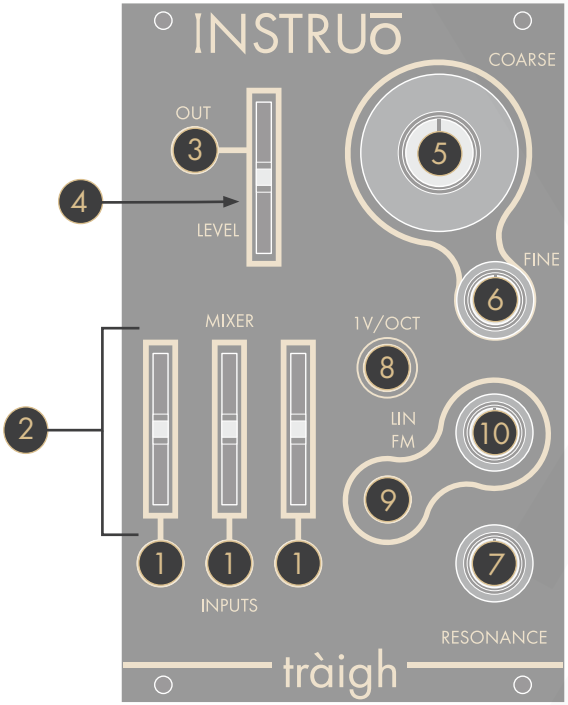
Note:

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

Specifications

- Width: 18 HP
- Depth: 27mm
- +12V: 40mA
- -12V: 20mA

tràigh | traːj | **noun** (coastal tide) the rising and falling of the sea due to the attraction of the moon, to ebb, recede, settle, empty



Key

1. Inputs
2. Mixer
3. Output
4. Level Fader
5. Coarse
6. Fine
7. Resonance
8. 1V/Oct Input
9. Linear FM Input
10. Linear FM Attenuator

Inputs/Outputs

Inputs: There are three audio **Input** channels that mix the incoming signals before reaching the low pass filter circuit.

Mixer: Each **Input** has a dedicated **Level** fader.

- Input signals will reach approximately unity gain when the corresponding **Level** fader is set at its centre point.
- Increasing the **Level** fader will add gain and introduce soft clipping overdrive to the incoming signal.

Output: The **Output** signal is the low pass filtered result of the mixed audio signals present at the **Inputs**.

Level: The **Level** fader is a global attenuator of the final mixed **Output** amplitude.

- If the fader is in the down position, the **Output** will be silent.
- If the fader is in the up position, the **Output** will be at its full scale amplitude.

Filter

Coarse: The **Coarse** knob controls the cutoff frequency of the low pass filter.

- The cutoff frequency is the point at which the filtered signal is reduced by 3dB in amplitude.
- Turning the knob anticlockwise will decrease the cutoff frequency.
- Turning the knob clockwise will increase the cutoff frequency.
- If **tràigh** is used as an oscillator, the knob controls the fundamental frequency of the oscillator.
- Range: ~250Hz - 13KHz.

Fine: The **Fine** knob is used for minute control of the cutoff frequency and is relative to the cutoff frequency value set by the **Coarse** knob.

- Turning the knob anticlockwise will decrease the cutoff frequency.
- Turning the knob clockwise will increase the cutoff frequency.
- If **tràigh** is used as an oscillator, the knob controls the fundamental frequency of the oscillator.

Resonance: The **Resonance** knob determines the level of inverted feedback from the filter's output to its input.

- This is also known as the **Q**, **Emphasis**, or **Feedback**.
- With **Resonance** introduced, the cutoff frequency will be accentuated while the passband will inversely scale in amplitude.
- Turning the knob anticlockwise will decrease the resonance.
- Turning the knob clockwise will increase the resonance.
- If the **Resonance** knob is at its maximum value and there is no input signal, **tràigh** will self-oscillate as a stable sine waveform.

Frequency Modulation

1V/Oct Input: The **1V/Oct Input** is a bipolar control voltage input for the cutoff frequency.

- This can also be thought of as an **Exponential CV Input**.
- If **tràigh** is self-oscillating, the **1V/Oct Input** can be used for consistent pitch tracking of the sine waveform, effectively making **tràigh** a fully functional sine waveform oscillator.
- Control voltage is added to the summed values set by the **Coarse** and **Fine** knobs.

Linear FM Input: The **Linear FM Input** is a bipolar control voltage input for the cutoff frequency.

- Control voltage is summed with the values set by the **Coarse** and **Fine** knobs.
- If **tràigh** is self-oscillating, the **Linear FM Input** can be used to add non-harmonic sidebands to the sine waveform.

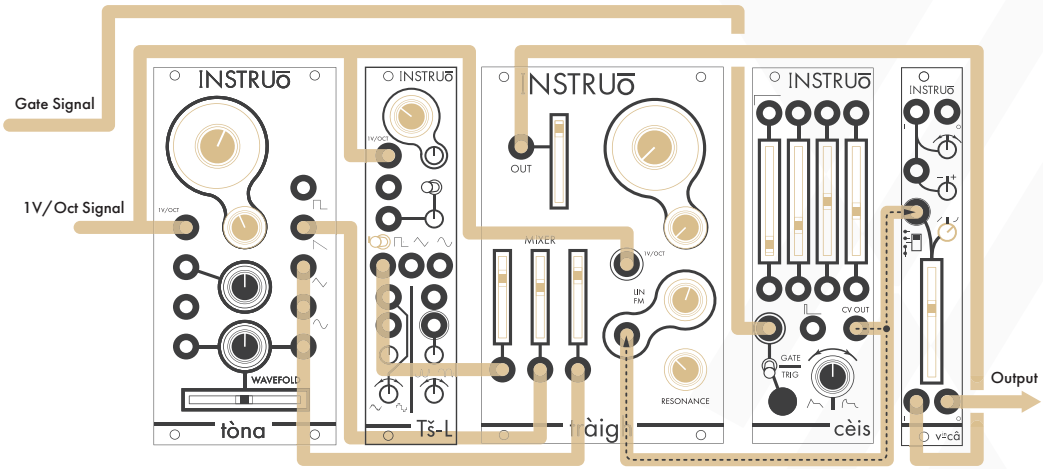
Linear FM Attenuator: The **Linear FM Attenuator** determines the depth of frequency modulation applied to the cutoff frequency.

- Turning the **Linear FM Attenuator** clockwise will increase the depth of linear frequency modulation.
- Turning the **Linear FM Attenuator** anticlockwise will decrease the depth of linear frequency modulation.

Patch Examples

East Coast Synth Voice

Summary: The sequencer or keyboard sends voltages to the oscillator while simultaneously triggering the envelope generator. The CV output of the envelope generator opens **tràigh** and the VCA, allowing the mixed oscillator signals to pass through. More traditional East Coast patches would incorporate separate envelope generators for **tràigh** and the VCA.



Audio Path:

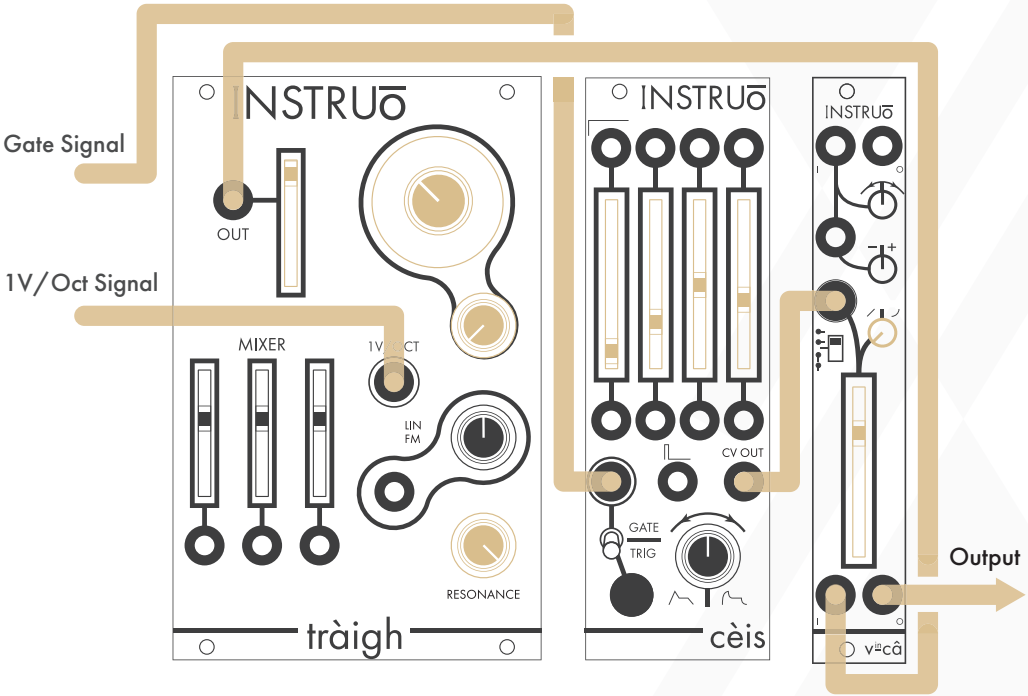
- Connect the desired waveforms of three oscillator to the three **Inputs** of **tràigh**.
- Connect the **Output** of **tràigh** to the audio input of a VCA.
- Monitor the audio output of the VCA.
- Set two of the oscillators to unison (some detuning is aloud).
- Set the third oscillator to one octave below the other two oscillators.
- Set the **Mixer** faders to a desired position.
- Set the **Level** fader to its maximum setting.
- Set the **Coarse** knob to a desired position.
- Set the **Resonance** knob 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 a buffered multiple.
- A buffered multiple will keep the signal from dropping voltage when split.
- Connect four copies of the 1V/Oct CV signal to the 1V/Oct inputs of all three oscillators and the **1V/Oct Input** of **tràigh**. This is known as **Keyboard Tracking** and allows **tràigh** to track the sequencer or keyboard voltage. As higher voltages are generated, the cutoff frequency increases.
- 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 **Linear FM Input** of **tràigh** and set the **Linear FM 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.

Sine Waveform Generator

Summary: Peaking the resonance of a **tràigh** forces it to self-oscillate at a pure sine waveform. Once the waveform is generated, it can then be patched through a VCA as a simple synth voice patch. This was often the technique to create sine waveforms in the early days of electronic synthesiser music. In the simplest of contexts, a second filter in the audio path is not needed, because a sine waveform only loses amplitude when patched through a filter. This is because there are no other harmonics to attenuate, only the fundamental.



Audio Path:

- Connect the **Output** of **tràigh** to the audio input of a VCA.
- Set the **Resonance** knob fully clockwise.
- Without an input signal, **tràigh** resonantes as a pure sine waveform.
- Set the **Coarse** knob to the desired fundamental frequency.

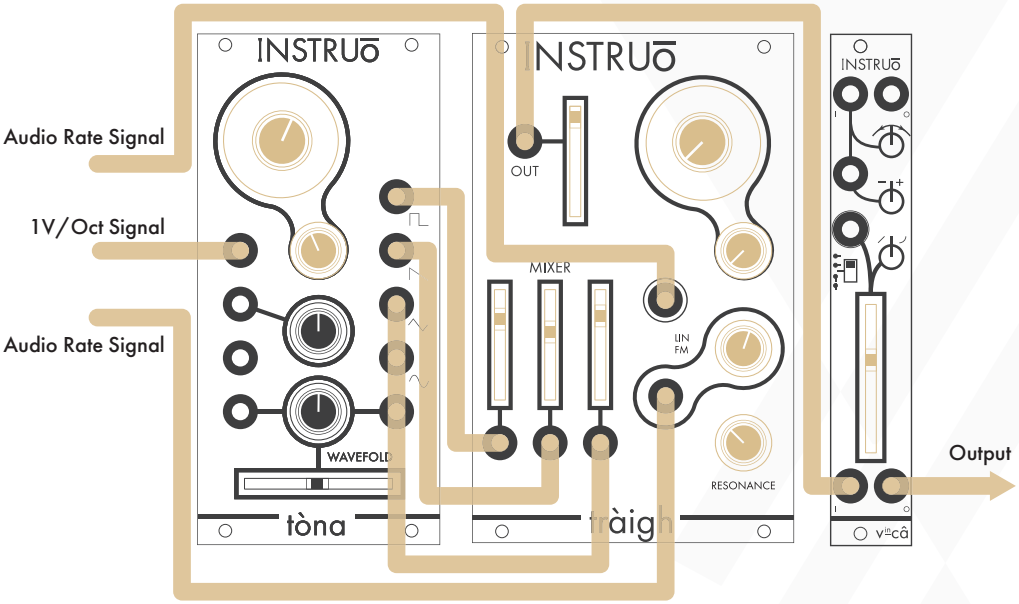
- Set the **Level** fader to its maximum setting.
- Set the level of the VCA to a desired position.
- In this patch the **Coarse** and **Fine** knobs are frequency (pitch) controls.

Control Path:

- Connect the 1V/Oct output of a sequencer or keyboard to the **1V/Oct Input** of **tràigh**.
- Connect the gate output of the sequencer or keyboard to the trigger input of an envelope generator.
- Connect the envelope generator CV output to the CV input of VCA and set the corresponding CV attenuator to a desired position.
- Set the envelope stages to desired positions.

Audio Rate Filter

Summary: The three oscillators present at the three **Inputs** of **tràigh** are mixed while being modulated by the audio rate signal at the **1V/Oct Input** and the **Linear FM Input**. Self-oscillating **Resonance** of **tràigh** adds further audio rate modulation.



Audio Path:

- Create an **East Coast Synth Voice** audio path.
- Connect the desired waveforms of three oscillator to the three **Inputs** of **tràigh**.
- Connect the **Output** of **tràigh** to the audio input of a VCA.
- Monitor the audio output of the VCA.
- Set the **Mixer** faders to a desired position.
- Set the **Level** fader to its maximum setting.
- Set the **Coarse** knob to a desired position.
- Set the **Resonance** knob to a desired position.
- Set the level of the VCA to a desired position.

Control Path:

- Connect an audio rate signal of a separate oscillator to the **1V/Oct Input** of **tràigh**.
- Connect another audio rate signal from a second separate oscillator to the **Linear FM Input** of **tràigh**.
- Turn the **Linear FM Attenuator** fully clockwise.

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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.