



SPECIALIST
SYNTHESIZERS



àradh
Transistor Ladder Filter
User Manual

Contents

3 —
Description / Features

4 —
Installation / Specifications

5 —
Overview

6 —
I/O - Filter & VCA

9 —
Control Voltage

10 —
Primary User-Defined Parameter

11 —
Secondary User-Defined Parameter

12 —
Envelope Follower & Comparator

14 —
Factory Reset

15 —
Patch Examples

- East Coast Synth Voice
- West Coast Synth Voice
- Impulse Envelope Extractor
- Compressor
- Expander
- Noise Gate

Description

By popular demand – an exciting new take on the legendary transistor ladder filter. Introducing the Instruō àradh, the long-awaited successor to the first Instruō low pass filter, tràigh. Expanding on tràigh's classic functionality, àradh adds a VCA with pre or post-filter routing options, an envelope follower, a comparator gate, a strike input with variable decay time, and a plethora of user-definable voltage-controlled parameter combinations.

Whether you're looking for voltage-controlled resonance, pre-gain filter saturation, noise gate functionality, dynamics processing, or even an envelope follower, àradh can get the job done – a true sound-shaping powerhouse in only 6 HP.

Features

- Low pass filter and VCA
- VCA pre/post-filter functionality
- Strike input and button
- User-defined CV input
- Envelope follower and comparator functionality
- Self-oscillating resonance

Installation

1. Confirm that the Eurorack synthesiser system is powered off.
2. Locate 6 HP of space in your Eurorack synthesiser 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 àradh in your Eurorack synthesiser case.
6. Power your Eurorack synthesiser system on.

Note:

This module has reverse polarity protection.

Inverted installation of the power cable will not damage the module.

Specifications

- Width: 6 HP
- Depth: 27mm
- +12V: 60mA
- -12V: 40mA

àradh | *La:rəxg* | noun (vestige) a range of operation, a marked effect, impression, or impact



Key

- | | |
|---------------------------------|------------------------|
| 1. Input (In) | 9. Strike Button |
| 2. Output (Out) | 10. Decay Knob |
| 3. Filter Cutoff (f_c) Knob | 11. CV Input |
| 4. Resonance (Q) Knob | 12. CV Attenuverter |
| 5. 1V/Oct Input | 13. CV Assign Button |
| 6. Bias Knob | 14. Gate/Follow Toggle |
| 7. Pre/Post Switch | 15. Gate/Follow Output |
| 8. Strike Input | |

I/O —

Input (In): The **Input** is an AC coupled audio input to the low pass filter and VCA.

Output (Out): The **Output** is an AC coupled audio output from the low pass filter and VCA.

Filter & VCA —

Filter Cutoff (f_c) Knob: The **Filter Cutoff Knob** controls the cutoff frequency of the low pass filter.

- Turning the knob clockwise will increase the cutoff frequency.
- Turning the knob anticlockwise will decrease the cutoff frequency.
- If $\text{\textcircled{A}}$ is used as a sine waveform oscillator, the knob controls the frequency of the oscillator.

Resonance (Q) Knob: The **Resonance Knob** determines the amount of emphasis applied to the cutoff frequency.

- Turning the knob clockwise will increase the resonance.
- Turning the knob anticlockwise will decrease the resonance.
- To battle the natural drop in level that usually occurs when the resonance of a low pass filter is increased, auto-gain compensation has been added to maintain a more consistent output level.
- If the knob is set to its fully clockwise position, $\text{\textcircled{A}}$ will self-oscillate and generate a sine waveform.
- The **Resonance Knob** can also set the attack time of the envelope follower (See the **Envelope Follower & Comparator** section for more information).

1V/Oct Input: The **1V/Oct Input** is a bipolar control voltage input that is calibrated for 1 volt per octave tracking. It is implemented to achieve traditional keyboard tracking, where higher notes will have an increased cutoff frequency.

- This is traditionally used with pitch-related control voltages sent from a sequencer or keyboard.
- Control voltage is summed with the value set by the **Filter Cutoff Knob**.

Bias Knob: The **Bias Knob** sets the level of the VCA.

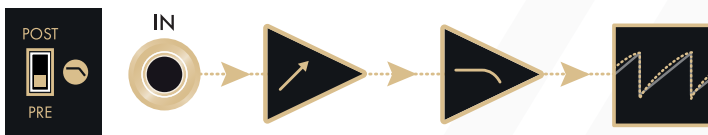
- If no control voltage is present, unity gain of the VCA is achieved when the **Bias Knob** is set to its centre position.
- The **Bias knob** can also set the threshold voltage of the comparator (See the **Envelope Follower & Comparator** section for more information).

Pre/Post Switch: The **Pre/Post Switch** configures the internal routing of the VCA in relation to the low pass filter.

- If the switch is in its upward position, the VCA is routed after the low pass filter, similar to a traditional east coast synth voice.



- If the switch is in its downward position, the VCA is routed before the low pass filter, allowing for saturation of the low pass filter .



- The **Pre/Post switch** can also determine where the envelope follower signal is derived from (See the **Envelope Follower & Comparator** section for more information).

Strike Input: The **Strike Input** is a gate/trigger input for the impulse envelope. Rising edge signals present at the Strike Input will trigger the impulse envelope which modulates both the cutoff frequency of the low pass filter and the amplitude of the VCA.

- Modulation will occur with a fixed modulation depth.
- The **Strike Input** can be triggered at audio rate.
- Signal present at the **Strike Input** is indicated by white illumination of the **Strike Button**.

Strike Button: The **Strike Button** is a manual control for triggering the impulse envelope

- Button presses are indicated by white illumination of the **Strike Button**.
- The **Strike Button** is also used to access additional functionality (See the **Secondary User-Defined Parameters, Envelope Follower & Comparator**, and **Factory Reset** sections for more information).

Decay Knob: The **Decay Knob** controls the decay time of the impulse envelope triggered by the **Strike Input** and **Strike Button**.

- Turning the knob anticlockwise will decrease the decay time of the impulse envelope.
- Turning the knob clockwise will increase the decay time of the impulse envelope.
- The **Decay Knob** can also set the decay time of the envelope follower (See the **Envelope Follower & Comparator** section for more information).



Control Voltage

CV Input ($\frac{CV}{FM}$): The **CV Input** is a bipolar control voltage input for the amplitude of the VCA, the cutoff frequency of the low pass filter, the resonance of the low pass filter, and/or the decay time of the impulse envelope, based on the targeted primary and/or secondary user-defined parameter(s).

- Control voltage is scaled by the **CV Attenuverter** and sums with the level set by the **Filter Cutoff Knob**, the **Bias Knob**, the **Resonance Knob** and/or the **Decay Knob**, based on the setting of the **CV Assign Button** (See the **Secondary User-Defined Parameters** section for more information).
- Unity gain of the VCA is achieved when the **CV Input** is assigned to control the amplitude of the VCA, the **CV Attenuverter** is set to its fully clockwise position, and approximately 3.6V is present at the **CV Input**. Voltage amplitudes higher than 3.6V will add gain to the signal.
- If $\text{\textcircled{A}}\text{radh}$ is self-oscillating, the **CV Input** can be used for frequency modulation of the generated sine waveform.
- If no signal is present at the **CV Input**, the envelope follower signal or gate signal is normalised to the **CV Input** and scaled by the **CV Attenuverter**.

CV Attenuverter: The **CV Attenuverter** determines the depth of modulation applied to the targeted primary and/or secondary user-defined parameter(s).

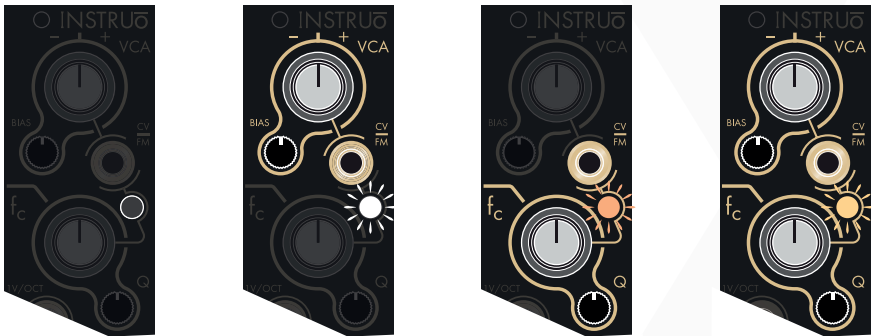
- Turning the knob clockwise will increase the depth of modulation in relation to the control voltage signal.
- Turning the knob anticlockwise will increase the depth of modulation with inverted polarity in relation to the control voltage signal.
- Centering the knob will fully attenuate the control voltage signal.

CV Assign Button: The **CV Assign Button** is used for assigning targeted primary and/or secondary user-defined parameter(s) controlled by the signal present at the **CV Input**.

Primary User-Defined Parameter

Multiple primary user-defined parameters can be set. Primary user-defined parameters can work simultaneously with the secondary user-defined parameters (See the [Secondary User-Defined Parameters](#) section for more information).

Press the **CV Assign Button** to set primary user-defined parameters.

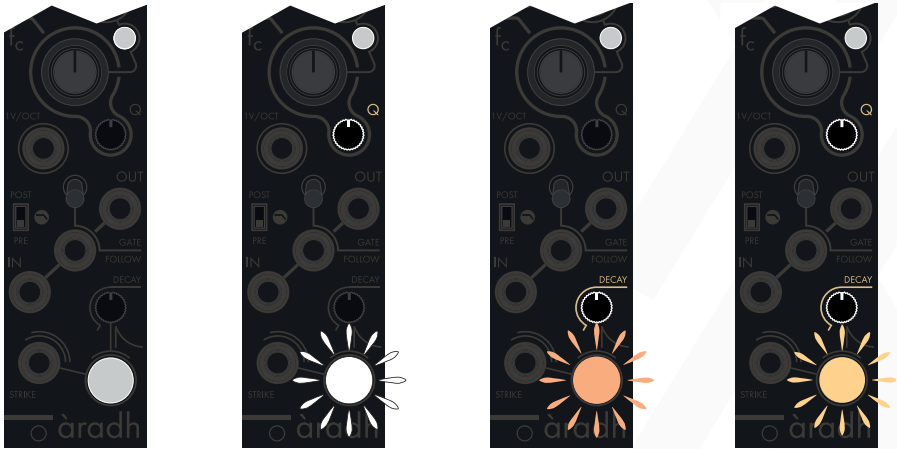


- If the button is unilluminated, the **CV Input** does not target a primary parameter.
- If the button is illuminated white, the **CV Input** targets the amplitude of the VCA.
- If the button is illuminated amber, the **CV Input** targets the cutoff frequency of the low pass filter.
- If the button is illuminated white/amber, the **CV Input** targets both the amplitude of the VCA and the cutoff frequency of the filter simultaneously.
- This setting is retained in between power cycles.
- The **CV Assign Button** is also used to assign several secondary features (See the [Secondary User-Defined Parameters](#), [Envelope Follower & Comparator](#), and [Factory Reset](#) sections for more information).

Secondary User-Defined Parameter

In addition to the primary user-defined parameters, secondary user-defined parameters can also be set. Secondary user-defined parameters can work simultaneously with the primary user-defined parameters (See the [Primary User-Defined Parameters](#) section for more information).

To set secondary user-defined parameters, press and hold the **CV Assign Button** and then press the **Strike Button** 4 times. With the **CV Assign Button** still held down, pressing the **Strike Button** will toggle through four available secondary-user defined parameters. The illumination of the **Strike Button** will display each secondary user-defined parameter, respectively.

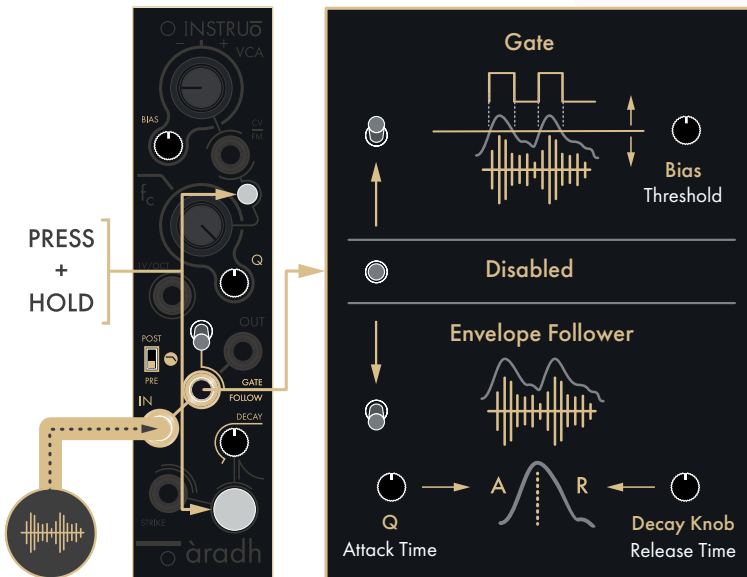


- If the **Strike Button** is unilluminated, the **CV Input** will not target a secondary parameter.
- If the **Strike Button** is blinking white, the **CV Input** targets the resonance of the low pass filter.
- If the **Strike Button** is blinking amber, the **CV Input** targets the decay of the impulse envelope.
- If the **Strike Button** is blinking white/amber, the **CV Input** targets both the resonance of the low pass filter and the decay of the impulse envelope simultaneously.

Envelope Follower & Comparator

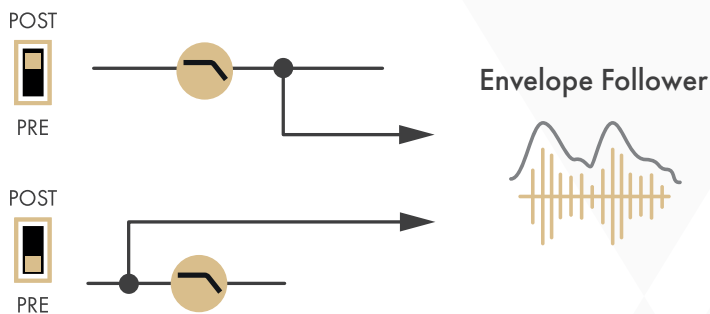
Gate/Follow Output: Based on the position of the **Gate/Follow Toggle**, the **Gate/Follow Output** will output either the comparator-based gate signal, the envelope follower signal, or no signal at all.

Gate/Follow Toggle: The **Gate/Follow Toggle** sets the behaviour of the **Gate/Follow Output**.



- If the toggle is in its centre position, the **Gate/Follow Output** is disabled.
- If the toggle is in its downward position, the **Gate/Follow Output** is set to output an envelope follower signal.
 - By default, the envelope follower signal is derived from the input signal post-filter .
 - Changing the location of where the envelope follower signal is derived from (pre or post-filter) is possible by pressing and holding the **CV Assign Button** and the **Strike Button** and then setting the **Pre/Post Switch**.

- Performing this action and setting the **Pre/Post Switch** to its downward position will pull the envelope signal from the pre-filter input signal.
- Performing this action and setting the **Pre/Post Switch** to its upward position will pull the envelope signal from the post-filter input signal.



- Pressing and holding the **CV Assign Button** and the **Strike Button** and moving the **Q knob** will set the **Attack Time** of the envelope follower signal.
- Pressing and holding the **CV Assign Button** and the **Strike Button** and moving the **Decay knob** will set the release time of the envelope follower signal.
- The envelope follower signal is indicated by amber illumination of the **Strike Button**.
- Range: $\approx 0V$ to $+8V$
- If the toggle is in the upward position, the **Gate/Follow Output** is set to output a gate signal based on a comparator.
 - The gate signal will be held HIGH for as long as the envelope is above the designated threshold voltage.
 - Pressing and holding the **CV Assign Button** and the **Strike Button** and moving the **Bias knob** will set the threshold voltage of the comparator.
 - Range: $0V$ to $+5V$

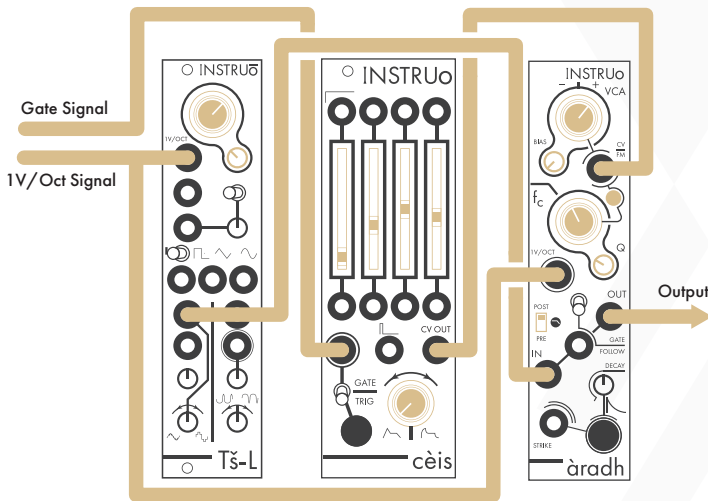
Factory Reset

Press and hold both the **CV Assign Button** and the **Strike Button** and switch the **Gate/Follow Toggle** up and down 3 times. This will set no target for both the primary user-defined parameter and the secondary user-defined parameter. It will also initialise the attack time and release time of the envelope follower and set it to post-filter. Lastly, it will initialise the threshold voltage of the comparator.

Patch Examples

East Coast Synth Voice:

Summary: The sequencer or keyboard controls the pitch of an oscillator while simultaneously triggering an envelope generator. The CV output of the envelope generator simultaneously opens àradh's low pass filter and VCA, allowing the oscillator signal to pass through. Keyboard tracking is also implemented in this patch



Audio Path:

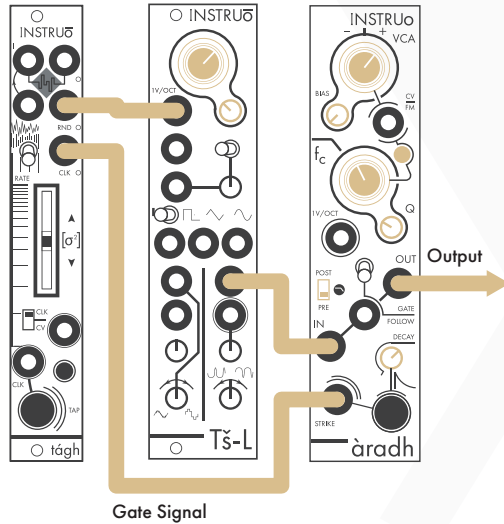
- Connect a harmonically rich waveform of an oscillator to the **Input** of àradh.
- Monitor the **Output** of àradh.
- Set the **Bias Knob** fully anticlockwise to keep the oscillator from droning.
- Set the **Filter Cutoff Knob** to a desired position.
- Set the **Resonance Knob** to a desired position.
- Set the **Pre/Post Switch** to its upward position, so that the VCA is routed post-filter.

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 one copy of the 1V/Oct signal to the 1V/Oct input of the oscillator and connect another copy of the 1V/Oct signal to the **1V/Oct Input** of àradh.
 - This is known as keyboard tracking and allows àradh to increase the cutoff frequency as higher-pitched notes are played.
- Set the **CV Assign Button** to its white/amber primary user-defined parameter.
 - This allows the cutoff frequency of the low pass filter and the level of the VCA to be controlled by a single control voltage signal.
- Connect the gate output of the sequencer or keyboard to the gate input of an envelope generator.
 - An ADSR is preferred for an East Coast Synth Voice.
- Connect the CV output of the envelope generator to the **CV Input** of àradh and set the **CV Attenuverter** to a desired positive position.
- Set the envelope stages to desired positions.

West Coast Synth Voice:

Summary: A random voltage generator controls the pitch of an oscillator while simultaneously striking àradh's low pass filter and VCA, allowing the oscillator signal to pass through.



Audio Path:

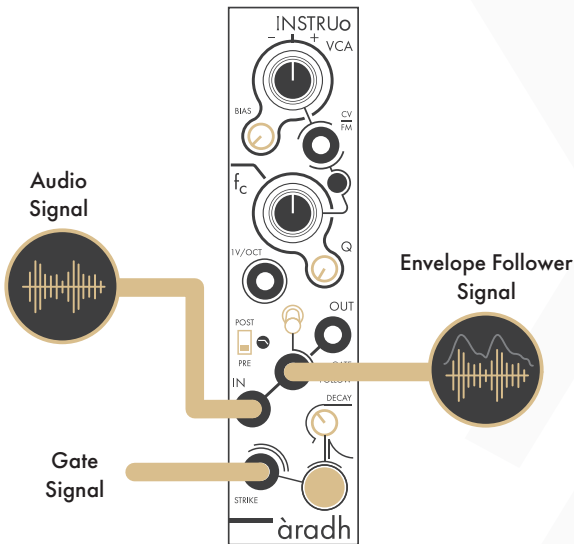
- Connect a harmonically rich waveform of an oscillator to the **Input** of àradh.
- Monitor the **Output** of àradh.
- Set the **Bias Knob** fully anticlockwise to keep the oscillator from droning.
- Set the **Filter Cutoff Knob** to a desired position.
- Set the **Resonance Knob** to a desired position.
- Set the **Pre/Post Switch** to its downward position, so that the VCA is routed pre-filter.

Control Path:

- Connect the random voltage output of the random voltage generator to the 1V/Oct input of the oscillator
- Connect the gate output of the random voltage generator or keyboard to the **Strike Input** of àradh.
- Set the **Decay Knob** to a desired position

Impulse Envelope Extractor:

Summary: The impulse envelope simultaneously modulates the cutoff frequency of the low pass filter and the level of the VCA. With an audio signal present at the **Input** as a signal reference, the impulse envelope will generate an audio impulse which produces an envelope from the **Gate/Follow Output**. The envelope generated will closely match the raw envelope produced from the impulse envelope.



Audio Path:

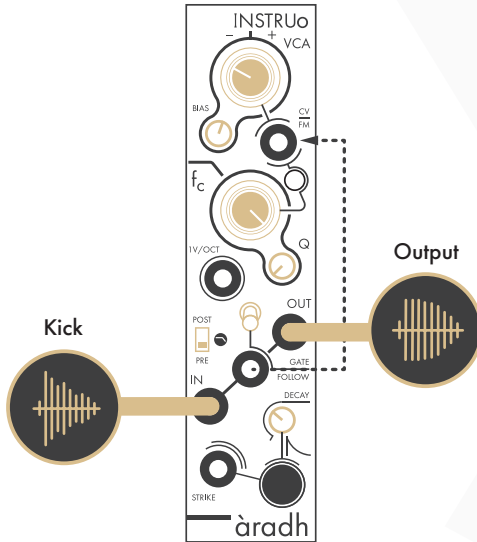
- Connect an audio signal to the **Input** of àradh.
 - The extracted envelope is dependent on the frequency content of the audio signal.
- Set the **Bias Knob** fully anticlockwise to keep the audio signal from droning.
- Set the **Resonance Knob** fully anticlockwise to maintain a high amplitude envelope extraction.
- Set the **Pre/Post Switch** to its downward position, so that the VCA is routed pre-filter.

Control Path:

- Set the **Gate/Follow Toggle** to its downward position to access the envelope follower.
- Set the **Decay Knob** to a desired position
- Trigger the **Strike Input** with a gate or trigger signal or manually press the **Strike Button** to trigger the impulse envelope.
- Set the attack time and decay time of the envelope follower to desired positions.
- Output from the **Gate/Follow Output** and connect the envelope follower signal to any CV input in the patch.

Compressor:

Summary: àradh is patched to work as a traditional downward compressor, where the **CV Attenuverter** acts as the threshold parameter, the **Bias Knob** acts as the make-up gain parameter, and the envelope follower sets the attack and release times.



Audio Path:

- Connect an audio signal (a kick drum sound transient, for example) to the **Input** of àradh.
- Set the **Filter Cutoff Knob** fully clockwise.
- Set the **Resonance Knob** fully anticlockwise.
- Set the **CV Attenuverter** to a desired negative position.
 - This acts as a threshold parameter for compression.
- Set the **Bias Knob** to a desired position.
 - This acts as a make-up gain parameter for compression.
- The ratio parameter for compression is defined by a combination of the threshold and make-up gain parameters.

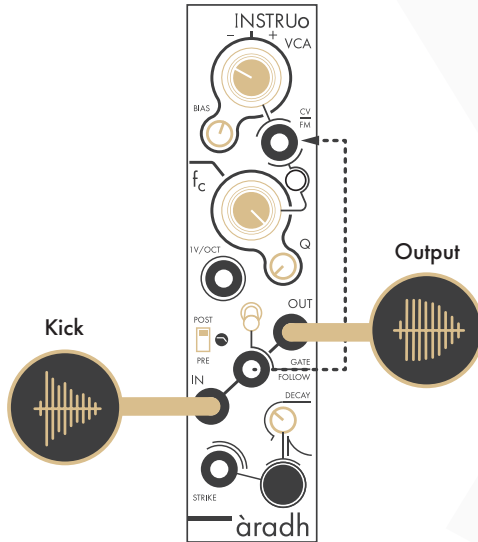
- Set the **Pre/Post Switch** to its downward position, so that the VCA is routed pre-filter.
- Monitor the **Output** of àradh.

Control Path:

- Set the **CV Assign Button** to its white primary user-defined parameter.
 - This allows modulation to be applied to the level of the VCA.
- Set the **Gate/Follow Toggle** to its downward position to access the envelope follower.
- The envelope follower signal is normalised to the **CV Input**.
- Set the attack time and release time of the envelope follower to desired positions.

Expander:

Summary: àradh is patched to work as a traditional upward expander, where the **CV Attenuverter** acts as the threshold parameter, the **Bias Knob** acts as the starting gain parameter, and the envelope follower sets the attack and release times.



Audio Path:

- Connect an audio signal (a kick drum sound transient, for example) to the Input of àradh.
- Set the **Filter Cutoff Knob** fully clockwise.
- Set the **Resonance Knob** fully anticlockwise.
- Set the **CV Attenuverter** to a desired clockwise position.
 - This acts as a threshold parameter for expansion.
- Set the **Bias Knob** fully anticlockwise.
 - This acts as a starting amplitude gain parameter for expansion.
- The ratio parameter for compression is defined by a combination of the threshold and gain parameters.

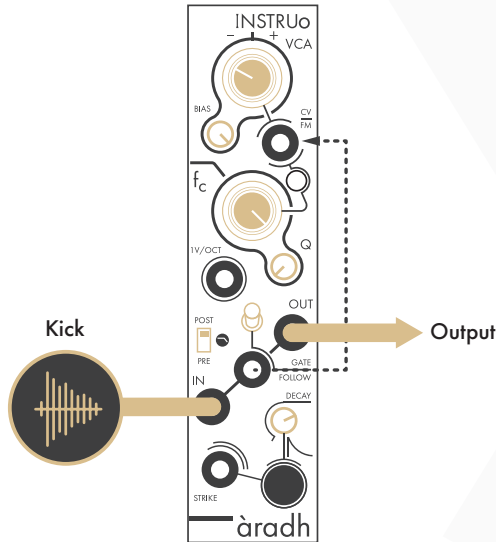
- Set the **Pre/Post Switch** to its upward position, so that the VCA is routed post-filter.
Monitor the **Output** of àradh.

Control Path:

- Set the **CV Assign Button** to its white primary user-defined parameter.
 - This allows modulation to be applied to the level of the VCA.
- Set the **Gate/Follow Toggle** to its downward position to access the envelope follower.
- The envelope follower signal is normalled to the **CV Input**.
- Set the attack time and release time of the envelope follower to desired positions.

Noise Gate:

Summary: àradh is patched to work as a traditional noise gate, where the **CV Attenuverter** acts as the threshold parameter, the **Bias Knob** acts as the starting gain/minimum amplitude parameter, and the envelope follower sets the attack and release times.



Audio Path:

- Connect an audio signal (a kick drum sound transient, for example) to the Input of àradh.
- Set the **Filter Cutoff Knob** fully clockwise.
- Set the **Resonance Knob** fully anticlockwise.
- Set the **CV Attenuverter** fully clockwise .
 - This acts as an “on” amplitude parameter for noise-gating.
- Set the **Bias Knob** fully anticlockwise.
 - This acts as a starting gain parameter for noise-gating.
- Set the **Pre/Post Switch** to its upward position, so that the VCA is routed post-filter.
- Monitor the **Output** of àradh.

Control Path:

- Set the location of where the envelope follower signal is derived from to pre-filter.
- Set the **CV Assign Button** to its white primary user-defined parameter.
 - This allows modulation to be applied to the level of the VCA.
- Set the **Gate/Follow Toggle** to its upward position to access the comparator.
- The envelope follower signal is normalised to the **CV Input**.
- Set the threshold of the comparator.
- Set the attack time and release times of the envelope follower to have a quick attack and a long release.
 - This affects the duration of the gate signal derived by the comparator.

Manual Author: Collin Russell

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.