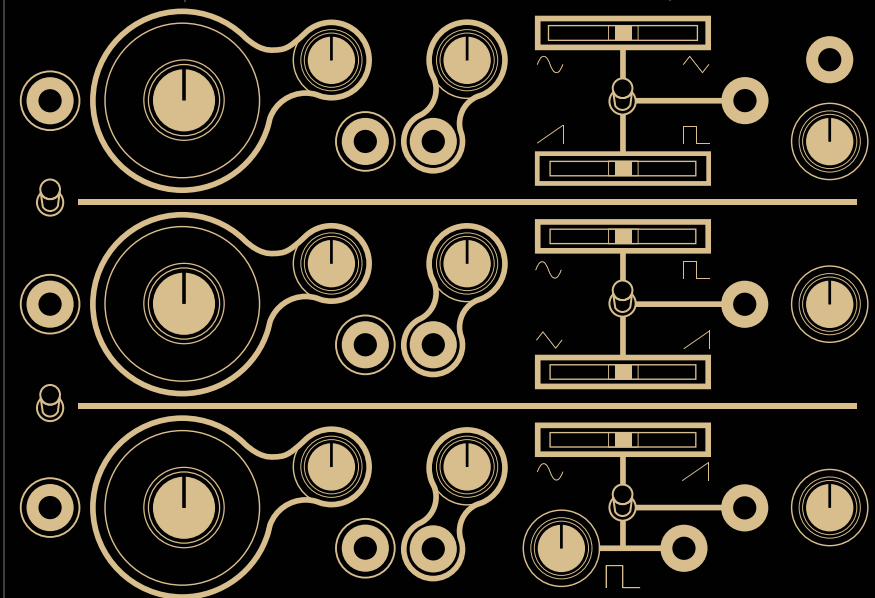
INSTRUO | SPECIALIST SYNTHESIZERS



troika

Triple Oscillator

User Manual

Contents

3
Description / Features

4
Installation / Specifications

5
Overview

6
Oscillators
Frequency/Pitch

7
Frequency Modulation

8
Waveform Crossfade

9
Mixer

10
Patch Examples

- Detuned East Coast Synth Voice
- Triple FM Synth Voice
- Polyphonic East Coast Synth Voice

Description

troika is a set of 3, all analogue, voltage controlled oscillators in a single module.

They can be used individually or summed with a built-in mixer.
Each voice generates the classic waveforms and uses a unique control set of switches and crossfaders for truly analogue crossfading between waveshapes.

Between the three voices, crossfading between any combination of classic waveshapes can be achieved. In addition, the third voice has PWM capabilities.

Features

- Three oscillators
- 1V/Oct tracking
- Linear FM
- Hard synchronisation
- Waveshape crossfade
- Pulse Width Modulation

Installation

1. Confirm that the Eurorack synthesizer system is powered off.
2. Locate 32 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 **troika** in your Eurorack synthesizer case.
6. Power your Eurorack synthesizer system on.

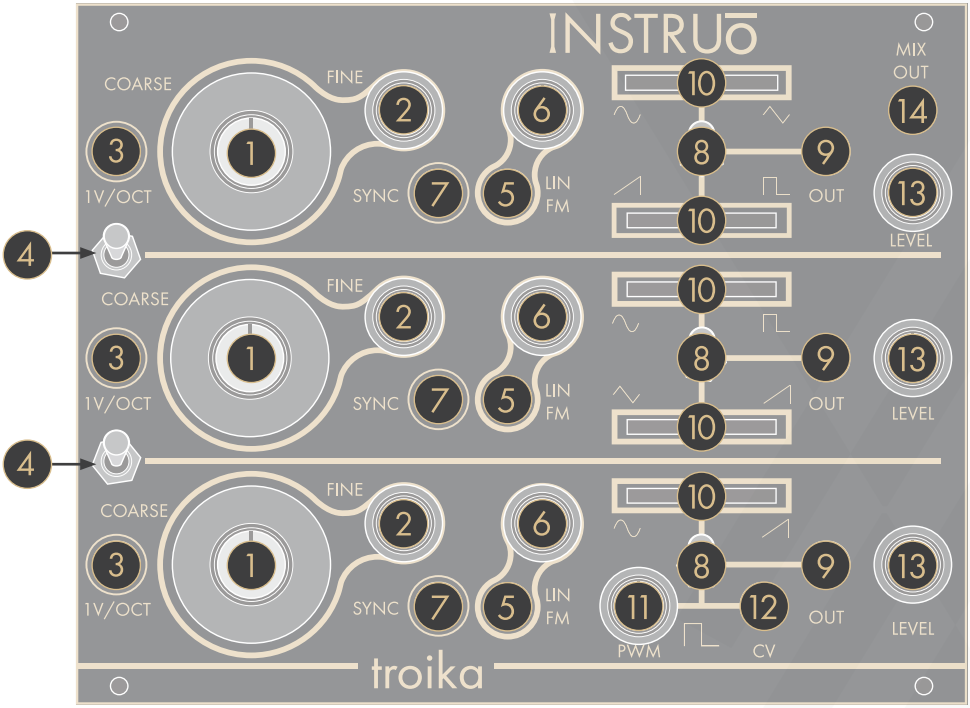
Note:

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

Specifications

- Width: 32 HP
- Depth: 27mm
- +12V: 110mA
- -12V: 110mA

Troika | ˈtrɔikə | **noun** (group of three) three horses harnessed side-by-side, working together often in ruling or administrative function, iconic symbol of Russia



Key

1. Coarse Frequency Controls
2. Fine Frequency Controls
3. 1V/Oct Inputs
4. 1V/Oct Link Toggles
5. Linear FM Inputs
6. Linear FM Attenuators
7. Sync Inputs
8. Waveform Selection Toggles
9. Waveform Outputs
10. Waveform Crossfaders
11. PWM
12. PWM CV Input
13. Level Controls
14. Mix Ouput

Oscillators

Each oscillator of **troika** has similar controls. The only difference between each oscillator is the **Waveform Crossfade** controls and the **1V/Oct Link Toggle** normalisations.

Frequency/Pitch

Coarse: The **Coarse** knobs control the fundamental frequency of the corresponding oscillator, effectively changing the pitch of all waveforms.

- Turning the knob clockwise will increase the frequency.
- Turning the knob anticlockwise will decrease the frequency.

Fine: The **Fine** knobs are used for minute control of the corresponding oscillator's fundamental frequency and is relative to the frequency defined by the **Coarse** knob. This will also effectively change the pitch of all waveforms.

- Turning the knob clockwise will increase the frequency.
- Turning the knob anticlockwise will decrease the frequency.

1V/Oct Input: The **1V/Oct Inputs** are bipolar control voltage inputs that are calibrated to 1V per Octave.

- This is traditionally used for frequency control (musical pitch) sent from a sequencer or keyboard.
- Control voltage is summed with the values set by the **Coarse** and **Fine** knobs.

1V/Oct Link Toggle: The **1V/Oct Link Toggles** will set **1V/Oct Input** normalisations between each oscillator. If a toggle is in the down position, the signal present at the uppermost oscillator's **1V/Oct Input** is normalised to the next oscillator's **1V/Oct Input**. If a toggle is in the up position, normalisation will be broken. Inserting a secondary signal to the normalised **1V/Oct Input** will also break the normalisation. If a toggle is in the up position, no normalisation is configured.

Frequency Modulation

Linear FM Input: The **Linear FM Inputs** are bipolar control voltage inputs for the frequency parameter of the corresponding oscillator.

- A signal present at the **Linear FM Input** will affect the corresponding oscillator's frequency.
- Control voltage is summed with the values set by the **Coarse** and **Fine** knobs and scaled by the **Linear FM Attenuator**.
- Audio rate signals will add non-harmonic side bands to the original waveform.

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

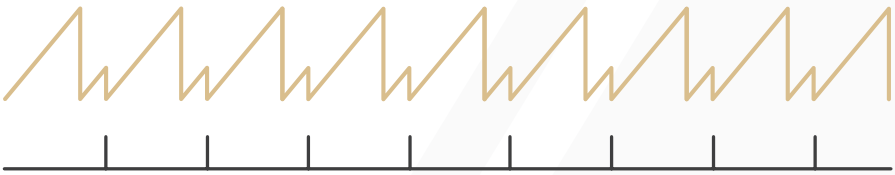
- Turning the knob clockwise will increase the depth of frequency modulation.
- Turning the knob anticlockwise will decrease the depth of frequency modulation.

Oscillator Synchronisation

Sync Input: The **Sync Inputs** are hard synchronisation inputs.

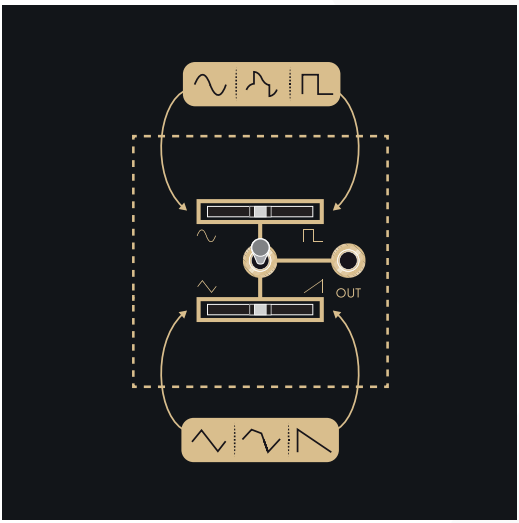
- The corresponding oscillator's cycle will reset with rising edge signals.
- Hard edged signals such as sawtooth/ramp and square waveforms work best for the **Sync Input**.
- Voltage threshold: 2.5V.

Hard Sync



Waveform Crossfade

The **Waveform Crossfade** section of each oscillator includes a **Waveform Output**, two **Waveform Crossfaders**, and a **Waveform Selection Toggle**.



Oscillator 1: If the **Waveform Selection Toggle** is in the up position, the signal present at the **Waveform Output** will smoothly morph between a sine waveform and a triangle waveform as the **Waveform Crossfader** moves from left to right. If the **Waveform Selection Toggle** is in the down position, the signal present at the **Waveform Output** will smoothly morph between a ramp waveform and a square waveform as the **Waveform Crossfader** moves from left to right.

Oscillator 2: If the **Waveform Selection Toggle** is in the up position, the signal present at the **Waveform Output** will smoothly morph between a sine waveform and a square waveform as the **Waveform Crossfader** moves from left to right. If the **Waveform Selection Toggle** is in the down position, the signal present at the **Waveform Output** will smoothly morph between a triangle waveform and a ramp waveform as the **Waveform Crossfader** moves from left to right.

Oscillator 3: If the **Waveform Selection Toggle** is in the up position, the signal present at the **Waveform Output** will smoothly morph between a sine waveform and a ramp waveform as the **Waveform Crossfader** moves from left to right. If the **Waveform Selection Toggle** is in the down position, the signal present at the **Waveform Output** will be a pulse waveform with a dedicated **PWM** control.

The **PWM** knob controls the duty cycle ratio of the pulse waveform.

- Turning the knob clockwise will increase the +/– ratio of the pulse wave.
- Turning the knob anticlockwise will decrease the +/– ratio of the pulse wave.
- The range of the **PWM** knob was chosen to always result in a signal with an audible duty cycle when used without external control voltage.

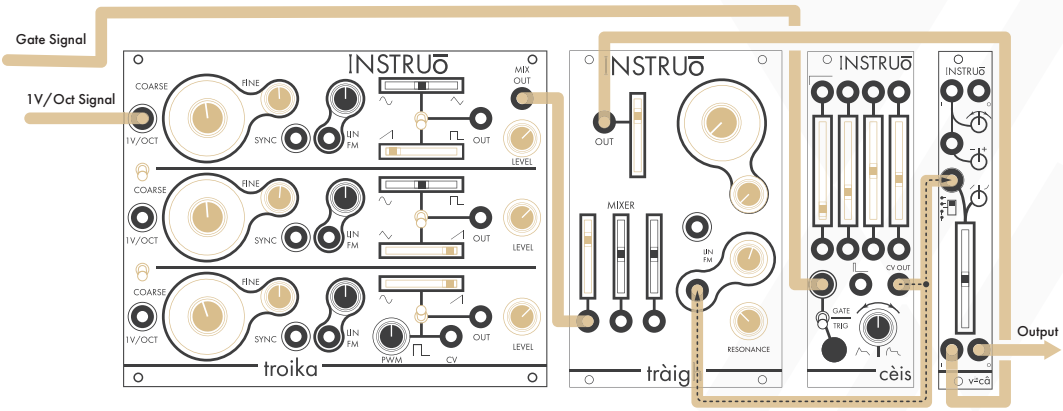
Mixer

The selected waveforms of each oscillator can be mixed with a dedicated **Level** control and output at the **Mix Output**. It is important to note that the selected waveforms of each oscillator will output from the **Mix Output** at unity gain, so clipping can occur with extreme **Level** settings.

Patch Examples

Detuned East Coast Synth Voice:

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



Audio Path:

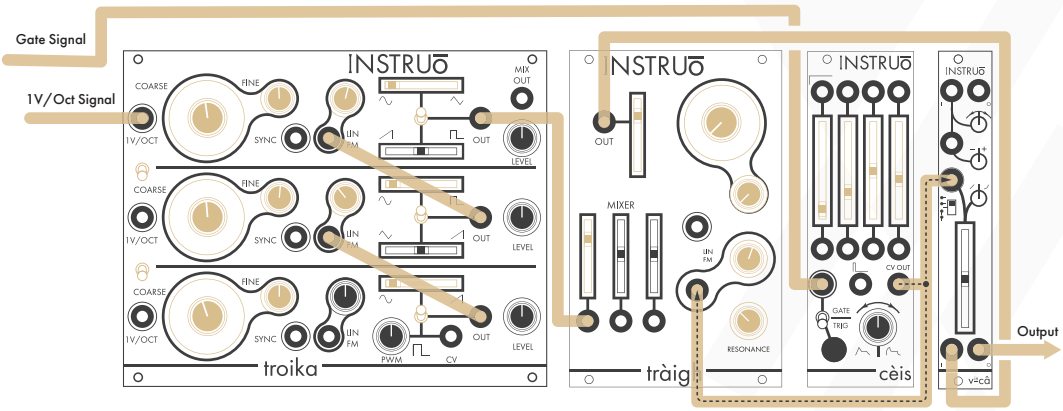
- Set all oscillators to ramp waveforms
- Connect the **Mix Output** to the audio input of a filter.
- Connect the audio output of the filter to the audio input of a VCA.
- Monitor the audio output of the VCA.
- Set the fundamental frequency of oscillator 1 to a desired position.
- Set the fundamental frequency of oscillator 2 and oscillator 3 to similar positions, but keep them slightly detuned for a chorusing effect.
- Set the **Level** knobs to desired positions.
- 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 **1V/Oct Input** of Oscillator 1.
- Set all 1V/Oct Link Toggles to the down position.
- 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.

Triple FM Synth Voice:

Summary: troika's oscillator 2, called the **Modulator** in an FM patch, is modulating the frequency of **troika's** oscillator 1, called the **Carrier** in an FM patch. **troika's** oscillator 3, which is a secondary **Modulator** in an FM patch, is modulating the frequency of **troika's** oscillator 2. The sequencer or keyboard sends voltages to **troika** while simultaneously triggering the envelope generator. The CV output of the envelope generator opens the filter and VCA, allowing **troika's** signal to pass through. More traditional East Coast patches would incorporate separate envelope generators for the filter and VCA.



Audio Path:

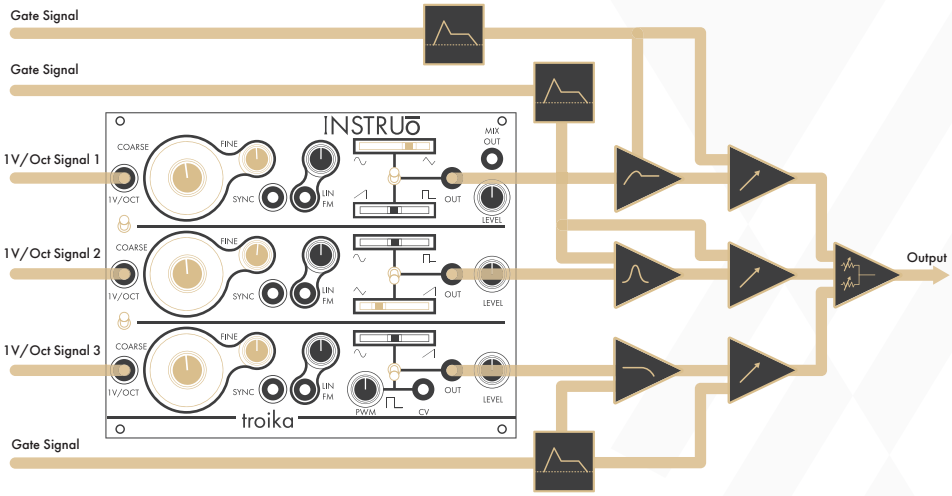
- Create an **East Coast Synth Voice** audio path using the sine waveform of **troika's** oscillator 1.

Control Path:

- Create an **East Coast Synth Voice** control path.
- Connect the sine waveform of **troika's** oscillator 2 to the **Linear FM Input** of oscillator 1.
- Connect the sine waveform of **troika's** oscillator 3 to the **Linear FM Input** of oscillator 2.
- Set the **Linear FM Attenuators** of **troika's** oscillator 1 and oscillator 2 to desired positions.

Polyphonic East Coast Synth Voice:

Summary: Three sequencers or keyboards send voltages to **troika's** three separate oscillators while simultaneously triggering envelope generators. The CV output of the envelope generators open the filters and VCAs, allowing **troika's** signals to pass through. More traditional East Coast patches would incorporate separate envelope generators for the filters and VCAs.



Audio Path:

- Set all oscillators to desired waveforms
- Connect each **Waveform Output** to the audio inputs of separate filters.
- Connect the audio output of the filters to the audio inputs of separate VCAs.
- Connect the audio outputs of the VCAs to a mixer.
- Monitor the audio output of the mixer.
- Set the fundamental frequency of all oscillators to unison.
- Set the cutoff frequency of the filters to desired positions.
- Set the resonance of the filters to desired positions.
- Set the level of the VCAs to desired positions.

Control Path:

- Connect the 1V/Oct output of three separate sequencers or keyboards to the individual **1V/Oct Inputs** of **troika**.
- Connect the gate outputs of the sequencers or keyboards to the trigger inputs of three separate envelope generators.
- Connect the CV outputs of the envelope generators to three separate multiples.
- Connect one copy of the envelope generator CV signals to the CV inputs of the filters and set the corresponding CV attenuators to desired positions.
- Connect a second copy of the envelope generator CV signals to the CV inputs of the VCAs and set the corresponding CV attenuators to desired positions.
- Set the envelope stages of each envelope to desired positions.

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.