INSTRUŌ | SPECIALIST SYNTHESIZERS

# Tš-L
# Oscillator
# User Manual

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## Description

The Instruō **Tš-L** is a fully analogue voltage controlled oscillator with a plethora of features in a very small footprint.

Its triangle core circuitry allows for extremely consistent waveforms over a wide frequency range. The triangle foundation is used to generate its sine waveform which holds consistent shape and amplitude across **Tš-L's** wide range. The outputs consist of simultaneous Square/Sub, Triangle, and Sine waveforms, with an additional voltage controllable wavefolder and a complex PWM waveshaper.

**Tš-L** includes every feature needed to powerfully perform as a rich, ultra-compact audio source, as well as functioning equally as a versatile modulation source.

## Features

- 1V/Oct tracking
- Linear and exponential frequency modulation
- Pulse width modulation
- Wavefolding
- Soft synchronisation
- Sub-square mode

## Installation

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

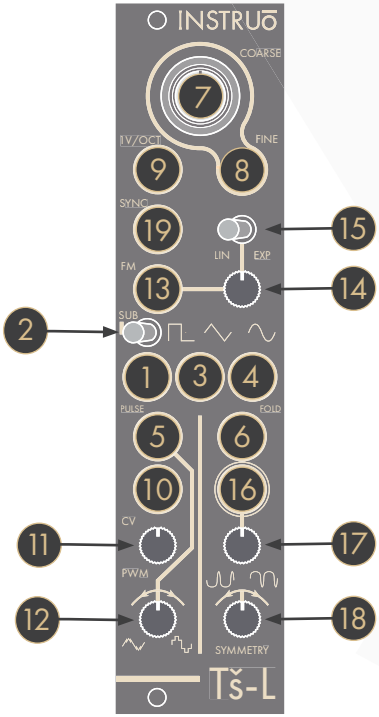
### Note:

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

## Specifications

- Width: 6 HP
- Depth: 35mm
- +12V: 60mA
- -12V: 40mA

**Tš-L** | tiː-əz-ɛl | **proverb** (siri) "this sauce later rocks"




## Key

1. Square Output
2. Sub Toggle
3. Triangle Output
4. Sine Output
5. PWM Output
6. Wavefold Output
7. Coarse
8. Fine
9. 1V/Oct Input
10. PWM CV Input
11. PWM CV Attenuverter
12. PWM Waveform Crossfade
13. FM Input
14. FM Attenuator
15. Lin/Exp Toggle
16. Wavefold CV Input
17. Wavefold Depth / CV Attenuater
18. Symmetry Bias Attenuverter
19. Soft Sync Input

## Waveforms

**Square Output:** Square waveform output.

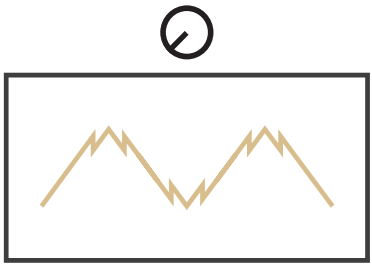
**Sub Toggle:** The **Sub Toggle** determines the octave of the square waveform.

- If the toggle is set to the right position, the frequency of the square waveform is set to one octave below the fundamental frequency of the oscillator.
- If the toggle is set to the left position, the frequency of the square waveform is set to two octaves below the fundamental frequency of the oscillator.

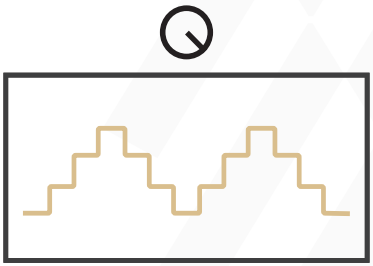
**Triangle Output:** Triangle waveform output.

**Sine Output:** Sine waveform output.

**Pulse Output:** Pulse width modulation waveform output.



SPLIT TRIANGLE



STEPPED TRIANGLE

- This waveform is unlike any other. It smoothly morphs from a split triangle waveform to a slightly softened stepped triangle waveform.

**Wavefold Output:** Final waveform output.



- The waveform is determined by the **Wavefold Attenuator** and the **Symmetry Bias** parameter.

## Frequency/Pitch

**Coarse:** The **Coarse** knob controls the fundamental frequency of the oscillator. It determines the pitch of all waveforms.

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

**Fine:** The **Fine** knob is used for minute control of the oscillator's fundamental frequency and is relative to the frequency value set by the **Coarse** knob. This will also determine the pitch of all waveforms.

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

**1V/Oct Input:** The **1V/Oct Input** is a bipolar control voltage input that is calibrated to 1 volt 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

## Pulse Width Modulation

**PWM**: The **PWM** parameter controls the width of the pulses for the PWM waveform.

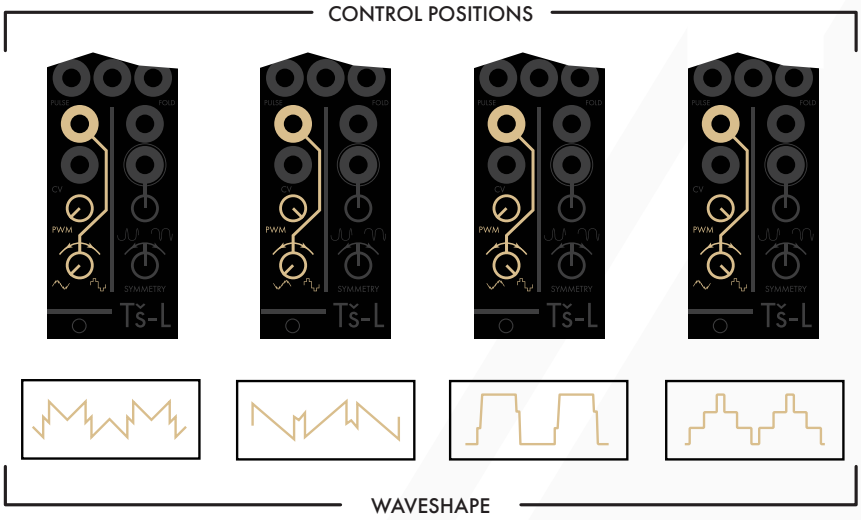
- Turning the knob anticlockwise will decrease the width of the pulses.
- Turning the knob clockwise will increase the width of the pulses.

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

- Control voltage is summed with to the **PWM** knob position.
- Input range: –/+5V.

**PWM Waveform Crossfade:** The **PWM Waveform Crossfade** knob controls the blend between two parallel PWM controlled waveforms produced by **Tš-L**.

- Turning the knob anticlockwise will blend towards the split triangle waveform.
- Turning the knob clockwise will blend towards the stepped triangle waveform.

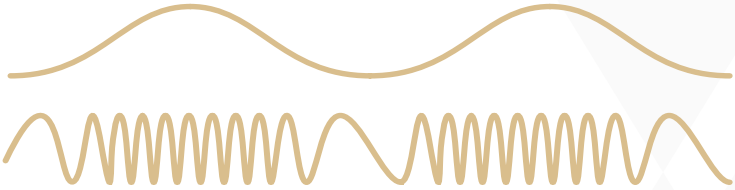


## Frequency Modulation

**FM Input:** The **FM Input** is a bipolar control voltage input for the frequency parameter of the oscillator.

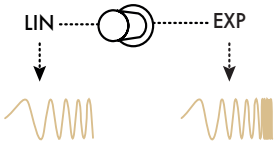
- Control voltage is summed with the values set by the **Coarse** and **Fine** knobs and scaled by the **FM Attenuator**.

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



- 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 Input**).

## Wavefolding

**Wavefold:** The **Wavefold** knob controls the amount of wavefolding applied to the waveform produced at the **Wavefold Output**.

- A parallel sine waveform is used by the wavefolder.
- Turning the knob fully anticlockwise results in a waveform that resembles a sine waveform.
- Turning the knob fully clockwise results in a rich, harmonic timbre (Adjusting the **Symmetry Bias** knob will further affect the harmonic makeup).

**Wavefold CV Input:** The **Wavefold CV Input** is a unipolar positive control voltage input that can be scaled by the **Wavefold** knob.

- When external control voltage is used to control the wavefolder, the **Wavefold** knob becomes an attenuator over the external control voltage signal.

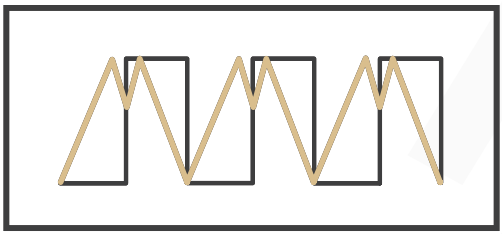
**Symmetry Bias:** The **Symmetry Bias** knob controls a DC offset amount that shapes the sine waveform used by the wavefolder. The amount of DC offset is applied before the wavefolding stage.

- The **Symmetry Bias** parameter offsets the curvature of the raw sine waveform that becomes further shaped by the wavefolder.
- Applied **Symmetry Bias** will affect the harmonic makeup of the final waveform.

## Soft Synchronisation/Phase Locking

- **Soft Sync Input: Tš-L** implements **Soft Synchronisation**.
- This is also known as **Frequency Lock** or **X-Lock**.
- The oscillator's core triangle waveform changes its charge direction when clocked.
- When tuning the oscillator to an external signal, the **Soft Sync Input** can be used to phase lock the signals to remove beat frequencies in unison and perfect interval tunings.
- **Tš-L** will lock to integer multiples of the external signal.
- Musical intervals such as perfect octaves, perfect 4ths, and perfect 5ths work best for the **Soft Sync Input**.
- Voltage threshold: 2V.

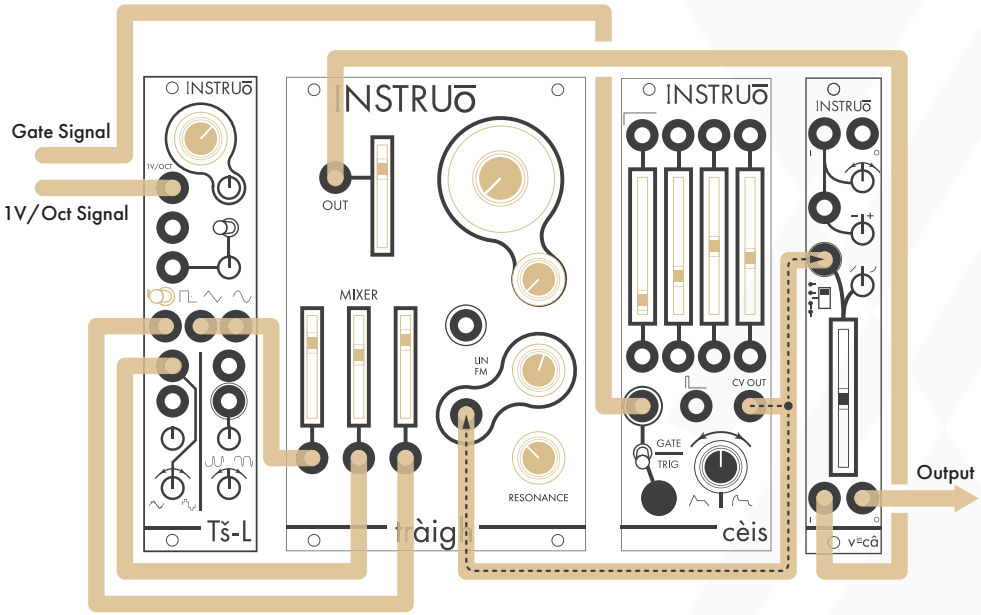
SOFT SYNC



# Patch Examples

## East Coast Synth Voice:

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




## Audio Path:

- Connect the **Square**, **Pulse**, and **Triangle** waveforms of **Tš-L** to three inputs of a mixer.
- Set the **Sub Toggle** to its left position, dropping the square waveform by one octave.
- Connect the output of the mixer to the audio input of a filter.
- Connect the audio output of the filter to the audio input of a VCA.
- Monitor the output of the VCA.

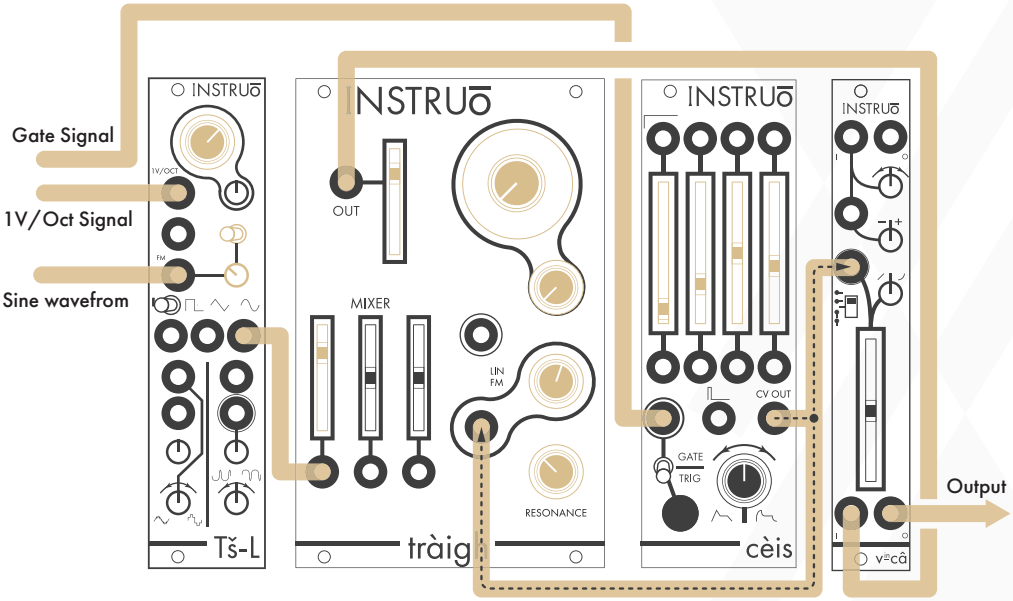
- Set the fundamental frequency of **Tš-L** to a desired position.
- Set the individual levels of the mixer to desired positions.
- Set the cutoff frequency of the filter to a desired position.
- Set the resonance of the filter to a desired position.
- Set the level of the VCA to a desired position.

Control Path:

- Connect the 1V/Oct output of a sequencer or keyboard to the **1V/Oct input** of **Tš-L**.
- 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.

## FM Synth Voice:

**Summary:** The secondary oscillator, called the **Modulator** in an FM patch, is modulating the frequency of **Tš-L**, called the **Carrier** in an FM patch. The sequencer or keyboard sends voltages to **Tš-L** while simultaneously triggering the envelope generator. The CV output of the envelope generator opens the filter and VCA, allowing **Tš-L**'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 **Tš-L**.

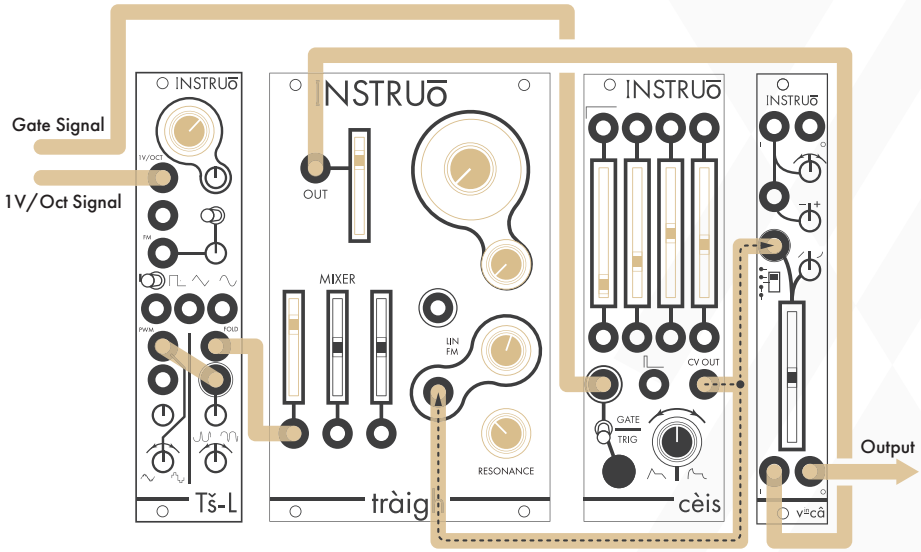
### Control Path:

- Create an **East Coast Synth Voice** control path.
- Connect the sine waveform of a separate oscillator to the **FM Input** of **Tš-L**.

- Set the **FM Attenuator** to a desired position.
- Set the **Lin/Exp Toggle** to a desired position.
- Most East Coast synthesizers were traditionally limited to linear frequency modulation only.

## Folded PWM Synth Voice:

**Summary:** Connecting the **PWM Output** to the **Wavefold CV Input** allows for four levels of timbre control via the **PWM** knob/**PWM CV Input**, the **PWM Waveform Crossfade** knob, the **Wavefold** knob, and the **Symmetry Bias** knob. The sequencer or keyboard sends voltages to **Tš-L** while simultaneously triggering the envelope generator. The CV output of the envelope generator opens the filter and VCA, allowing **Tš-L**'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 **Wavefold Output** of **Tš-L**.
- Set the **Wavefold** knob to a desired position.
- Set the **Symmetry Bias** knob to a desired position.

Control Path:

- Create an **East Coast Synth Voice** control path.
- Connect the **Pulse Output** to the **Wavefold CV Input**.
- Set the **PWM** knob to a desired position.
- Set the **PWM Waveform Crossfade** knob to a desired position.

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.