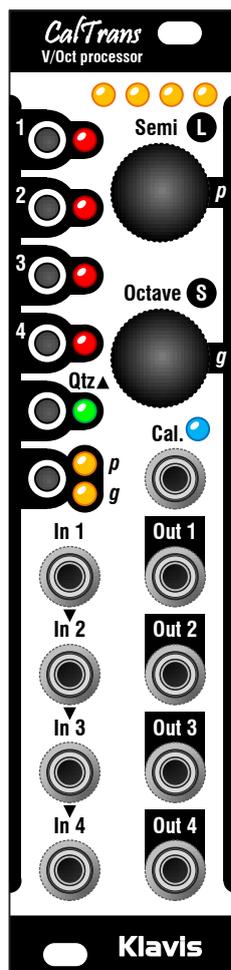


# CalTrans V/Oct processor

*Programmable Volt/Octave CV calibrator and transposer*

## Introduction

The CalTrans solves issues encountered when playing tonal music with a modular system: tracking problems, curves unrelated to Volt per octave ratio, limited octave range, cumbersome transpose, ... The Caltrans corrects and expands the range of troublesome VCOs and brings V/Oct tracking to anything that oscillates. Besides calibration, the CalTrans offers live play features. Each channel can be quantized and any combination of them transposed jointly. VCOs whose tracking doesn't go high enough to follow the leader will see their pitch repositioned in their highest possible octave so that the global harmony is unaffected. You can add a pinch of portamento and glissando to each channel and save the whole in user presets.



## Features at a glance

- Four V/Oct processing channels, each with
  - Curve correction and range expansion for any VCO, VCF or other oscillating circuit with a CV acting on pitch
  - 1 for 1 V/Oct mode for use without calibration
  - Switchable semitone quantizer
  - Adjustable portamento time
  - Adjustable glissando time
- Separate semitone and octave transpose encoders
- Inputs cascading with no added load for stable pitch control
- Four user presets storing transpose, portamento and glissando
- Storage of the calibration profile for each channel
- Maximum voltage range covering 10 octaves
- Presets, calibration and current state retained over power cycle
- Volt/Oct inputs factory-calibrated in flash memory
- Easy firmware update via a simple audio file
- High-quality push-encoders with metal shaft
- Skiff-friendly & compact module

New features described in this manual require firmware update 1.09

## Installation and security

### Purpose

This module is meant for installation in a Eurorack-compliant chassis. It adheres to Eurorack Doepfer mechanical and electrical specifications.

Do not attempt using this module in other mechanical or electrical contexts.

### Installation

Before the installation, disconnect the mains power supply from your modular system. Some power supplies are not safely isolated; there is a risk of injury!

See in the specifications if this module requires 5V from the supply rails. If 5V is needed and your rack is not providing 5V, do not attempt connection!

Check that the current consumption requirements of this module, when added to your installed set of modules do not exceed the available current from your supply. This is done by adding up the current draw of all modules (mA) separately for each of 5V, 12V and -12V rails. If any of these 3 sums exceeds the available current of your supply for that voltage, do not connect the module to your system; you need a stronger power supply.

The provided supply flat cable can only be inserted in the appropriate orientation at the back of the module, so there is no risk of error on that end. However, you should pay attention to the orientation of the cable in the socket of the supply PCB inside your chassis. Cheap sockets without shrouding may allow you to plug in the connector the wrong way!

The red stripe on the cable should match a stripe printed on the supply board. The stripe also indicates the -12V side. In case there is no stripe, a -12V marking is a safe indication of the orientation.

Double check that the connectors are fully inserted and correctly oriented before switching on the power supply. In case of an anomaly, switch off the power supply immediately and check everything again.

## Firmware update

If needed, the product can be updated by playing an audio file such as “CalTrans\_1.09.wav”.

### Procedure

- Connect a mono or stereo cable between your audio playing device headphone output and the CalTrans calibration input.
- Prepare to play the audio file
- Set the play level at two thirds
- While pressing the channel 1 and Qtz buttons, switch on your modular case supply
- The six yellow LEDs will flash
- Start playing the audio file

### If everything goes fine

- After a while, the first yellow LED will go on steady
- As the update is progressing, the following yellow LEDs will also go on
- When the 4<sup>th</sup> yellow LED is on, the firmware is updated successfully
- Press the top encoder to restart the module

### If the sound level is too low

- Two red LEDs will blink alternately
- Stop audio playback
- Slightly increase the audio playback level
- Press the bottom encoder button
- Start audio playback from the beginning

### If there is an error during the playback

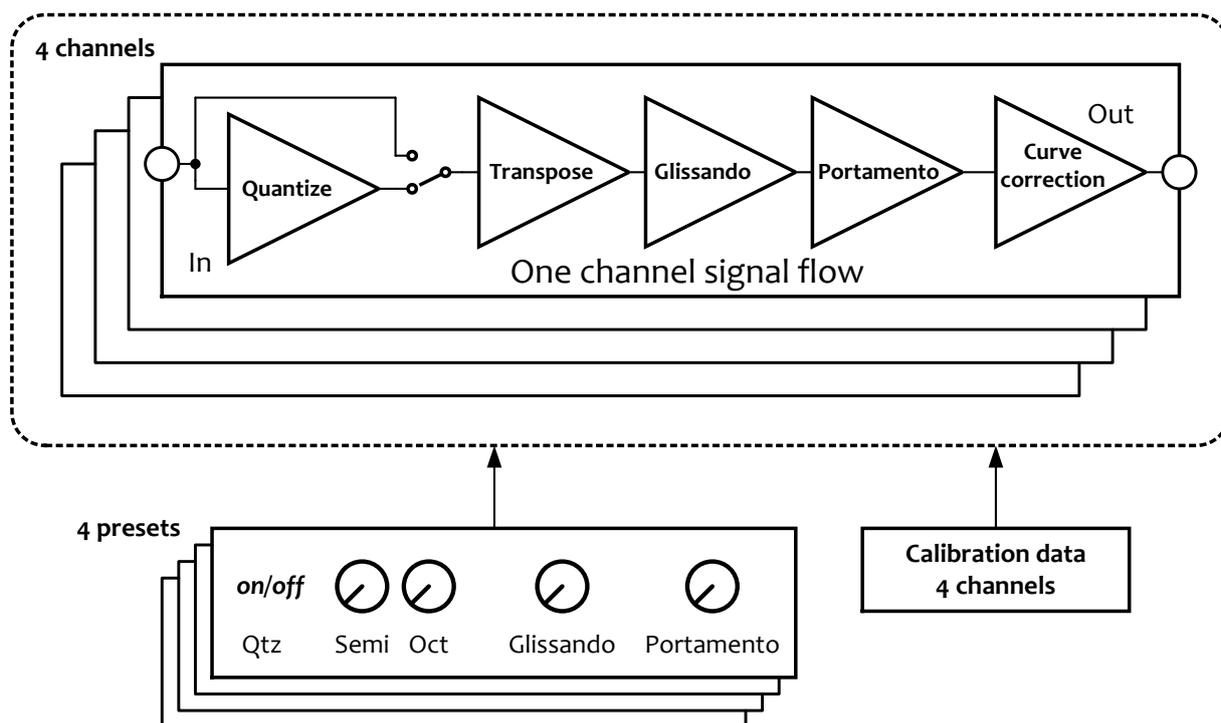
It is possible that the sound setting was too loud to begin with.

Diminish the sound level drastically and restart the procedure.

Playback error can also be due to various parasitic sound causes:

- Touching the cable
- Using sound-generating features of your phone or computer
- Some power saving feature affecting the audio playback
- Surrounding noisy modules, bad electrical grounding or modular supply noise

## Overview



The CalTrans fulfills two independent roles:

1. It corrects and usually expands the usable Volt/Octave range for up to four VCOs at once
2. It applies various musically-related voltage treatments independently for each of the four channels:
  - Switchable semitone quantization
  - Transposition per semitones and octaves
  - Portamento with adjustable duration
  - Glissando with adjustable duration

### Note:

The terms VCO and oscillator apply to any module capable of oscillation with pitch CV input.

## Calibration

There are two calibration modes:

1. V/Oct calibration for correcting VCOs whose tracking is not optimal.
2. Neutral calibration for VCOs that follow V/Oct nicely and need no curve correction.  
Neutral calibration is for benefitting of the transpose and other musical functions.

Volt/Octave correction is done through a calibration procedure for each oscillator in turn. The calibration is per channel (and related VCO/oscillating gizmo), and normally done only once.

If you're not interested in the V/Oct calibration aspect and only want to use the other features, you can set one or more channels to Neutral calibration.

Note that only one calibration data set is stored.

- Once calibrated in V/Oct, the oscillators should not be swapped between channels.
- Channels set to Neutral calibration are interchangeable; their curve is neutral 1:1 between in and out.

## Presets

There are four preset locations.

Each preset stores the musical settings for all four channels.

**Storage of presets is independent from calibration data!**

## Input & outputs

### In 1, 2, 3, 4

These inputs are meant for V/Oct control voltages. They accept voltages between zero and seven volts.

### Normalization

When an input (from 2 to 4) is left unconnected, it receives its signal from the previous numbered input.

### Out 1, 2, 3, 4

These outputs correspond to the four inputs and drive the oscillator target.

### Calibration input

This input is only used during the V/Oct calibration procedure. It accepts typical levels generated by oscillators. This input is not used after calibration is done.

The Neutral calibration procedure (1:1 in/out) makes no use of the Calibration input.

## LEDs

### Red LED column

These four LEDs relate to the four processing channels. They tell on which channels changes are applied. Other uses of these LEDs are covered further down.

### Yellow LED row

These LEDs provide different visual clues depending on the context.

By default, they indicate the transpose setting for the currently selected channels. Transposition is indicated by lighting building up, away from the middle: to the left for lower and to the right for higher transpose values. When no LED is lit, there is no transposition.

Other uses of these LEDs are explained in the corresponding section.

### **Qtz = Quantize**

This LED blinks when there is at least one channel with active quantize

### **p/g = Portamento & Glissando**

One of these LEDs is on when editing portamento or glissando. It also tells if the yellow LED row currently relates to portamento or glissando.

### **Calibration**

This LED indicates an ongoing calibration operation.

## **Controls**

### **Channel buttons**

These correspond to in/out 1~4 and are used to select one or more channels. They also serve to select one of the 4 presets.

### **Encoders**

These are used to transpose the channels, adjust the portamento and glissando durations. When pressed, they activate the load and store operations.

### **Quantizer button**

This is used to edit the activation of the quantizer in each channel.

A long press on this button activates the Neutral calibration procedure.

### **p/g button**

This is used to enter the editing of portamento and glissando durations for each channel.

## **Module operation**

### **V/Oct Calibration**

This is for VCOs that need their tracking be corrected.

1. Connect a wave output from the VCO to the CalTrans calibration input.  
**Use preferably sine or square;** alternatively any simple wave will be fine. Complex waves with multiple zero-crossings or dynamically evolving shapes will NOT work.
2. **Disconnect or disable any modulation that may affect the pitch or phase** of the VCO. The CalTrans channel inputs are not needed and are disabled during V/Oct calibration.
3. On the VCO, set the fine tune to the middle and the coarse pitch setting around the lowest note you intend playing in tune. No need to be actually in tune at this point.

4. Connect one output channel of the CalTrans to the V/Oct or other pitch control input of your VCO (or oscillating module).  
The pitch may jump unexpectedly; ignore it.
5. Press the channel button corresponding to the output connected to the VCO.
6. Wait for the Calibration LED to end up full on. Calibration is done and saved automatically.
7. Start again with the next VCO using another CalTrans channel.

### **V/Oct Calibration troubleshooting**

Various problems can prevent or disrupt the calibration. A problem is indicated by the channel's red LED and the green calibration LED flashing alternatively. One of the yellow LEDs, from left to right indicates the cause of the trouble:

#### ***LED 1. Signal missing – error – calibration stops***

The audio signal coming from the VCO is too low or absent

- Check the cable and level from your VCO output
- You may possibly need to amplify the signal before bringing it to the Cal input

#### ***LED 2. Signal unstable – error – calibration stops***

The signal is inconsistent in frequency, phase or level, hampering the frequency measurement.

- Check both cables between the CalTrans and the VCO
- Ensure that there is no cabling or setting creating a modulation on your VCO

#### ***LED 3. Base frequency too low – error – calibration stops***

The CalTrans does not start calibration for notes under 20Hz

- Retune the coarse setting of your VCO above 20Hz

#### ***LED 4. Base frequency possibly too high – warning – calibration continues***

Your base frequency is above 80Hz. This warning draws your attention on the fact that you may miss some usable range at the bottom of the frequency span.

You possibly forgot setting your VCO to a lower frequency before starting the calibration.

- Tune the coarse setting of your VCO to a lower frequency
- If your VCO requires negative voltages to reach low frequencies, ignore the warning

After correcting an error, unplug and reinsert the calibration jack to restart the procedure.

### **Visual feedback of the calibration**

During calibration, the yellow LEDs tell the currently covered range. Illumination from left to right represents contiguous frequency ranges from low to high. Each LED can have different illumination behavior telling the extent of its covering:

- Full on: the range is completely covered
- Almost permanently on (black blips): the range is almost covered
- Blinking: the range is covered halfway
- Flashes: the range is barely covered

- Off: the range is not covered at all

Ideally, the more LEDs are fully on, the best.

For example, all you have are two yellow LEDs on the right being full on; your coarse setting was set too high. Lowering the coarse setting of your VCO and redo calibration might extend the range to lower notes.

### Play recommendations after V/Oct calibration

These recommendations do not apply for Neutral calibrated channels

- Do not touch the coarse setting of your VCOs anymore!  
When using the Klavis Twin Waves dual VCO, you can lock the tuning pots.
- All transpose must be done via the CalTrans encoders
- Only a subtle pitch retuning (smaller than a quartertone) is allowed on your VCOs; bigger changes must be done via the CalTrans transpose.  
Doing otherwise will break the calibration relationship!  
However, any CV pitch modulation of any amplitude to your VCO is perfectly OK. (e.g. vibrato, pitch trill, ...)
- Some oscillators change their pitch response when changing the wave shape. For these oscillators to play in tune, the sound settings should be adjusted before calibration and not modified thereafter.

### Neutral calibration (requires firmware 1.09)

This is for VCOs that track well and don't need curve correction.

1. For each channel that should be Neutral calibrated, connect a cable between the output and the corresponding input of the Caltrans. The other channels should have their inputs free from jacks.
2. Press the Qtz (Quantize) button until the blue Cal LED starts flashing.
3. If successful:
  - the Cal blue LED goes steady on
  - the Qtz green LED flashes
  - the calibrated channel(s) LED goes on
  - Neutral calibration is stored automatically; the other channels calibration (V/Oct or Neutral) is unaffected.
4. Remove all input jacks; the calibration procedure is over

### Neutral calibration issues

When jacks in the inputs are not coming from their related output, the Qtz green LED will not go on. Those channels will have their LED flashing.

However, channels whose calibration succeeded will have their LED steady on. The calibration for those channels is successful and is saved. It is OK to work that way to avoid unpatching the channels that need no Neutral calibration.

## Notes about Neutral calibration

Neutral calibration does not “know” what VCO is connected at the output. Therefore, some niceties of V/Oct calibration are missing:

- The end of range – up and down – will not be handled
- All curve/tracking errors of the target remain present as if directly connected without the CalTrans
- There is no “intelligent” transpose that keeps the VCO in harmony when going over/below its musical limits.

It can make sense using V/Oct calibration instead of Neutral calibration for VCOs that track well. This will offer all the musical niceties otherwise lost.

## Channel selection for transpose & p/g editing

- Press the button of the channel you intend transposing or editing  
To select more than one channel, hold one of them while pressing the other(s)
- Release all buttons; the channel selection is valid until being changed again

## Transpose

Transposition works independently of the quantizer being active or not.

- Turn the top encoder for semitones
- Turn the bottom encoder for octaves
- Press both encoders simultaneously to reset the transpose

## Apply a quantizer

- Press the Qtz button; the channel LEDs tell if the related quantizer is active
- Press a channel button to toggle its quantizer on/off
- Press the Qtz button to exit quantizer editing

The Qtz LED and channels with quantize active have their LED blinking

## Change the portamento and glissando time

- Press the p/g button; the p LED will flash
- Turning the top encoder changes the portamento duration (zero to 20 sec) for the selected channels. The yellow LEDs give an indication of the duration applied.
- Turning the bottom encoder works the same but for glissando.
- The p and g LEDs follow whichever from portamento or glissando was tweaked last. This is useful to know what the duration indication relates to.
- Pressing an encoder brings the LED focus to that setting without changing its value.
- When done, press the p/g button to exit p/g editing.

Note that manual transpose goes through P & G processing

## Load a preset

- Press briefly the top encoder; the current preset yellow LED and all red LEDs flash.

- Press one of the channel buttons (1~4) to load the corresponding preset (1~4).  
The corresponding yellow LED briefly flashes to indicate the preset loaded.

### **Store a preset**

- Press briefly the bottom encoder; the current preset yellow LED and all red LEDs flash
- Press one of the channel buttons (1~4) to store into the corresponding preset (1~4).  
The corresponding yellow LED briefly flashes to indicate the destination preset

### **Clear a preset**

There is no single operation to clear a preset. What you should do is writing default settings in a preset.

Here are the steps to follow:

- Select all 4 channels (red LEDs)
- Press both encoders at once (this will reset all transposes)
- Press the p/g button then turn each encoder counter-clockwise until all yellow LEDs are fully off; press p/g to exit
- Press the Qtz button and switch off all red LEDs  
Press Qtz to exit
- Store those settings in one or more preset you want to clear.

## Background on portamento and glissando

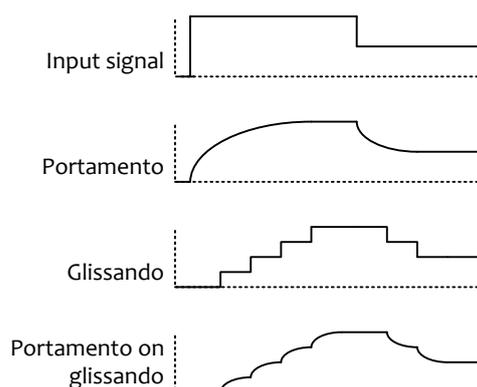
Portamento is a well-known voltage processing where a pitch changes to another one in a smooth way. When done with an analog circuit, called an integrator, it follows a curvature called exponential decay. In the modular world, this function is also called slew.

Glissando is the change from one pitch to another by consecutive steps. This effect is approximately emulated by sliding the back of your hand on a keyboard, moving from note to note. With glissando, the step change is usually linear. When done with analog electronics, it implies that until the before-last step, all steps present an equal voltage increase; the last step being of variable size.

In the CalTrans, the processing being done by computation allows all steps to be equal up to the last one.

When combining both portamento and glissando, the portamento will typically be set faster than the glissando for the glissando steps to be noticeable. When the portamento is then set a bit longer, the end result is close to linear portamento, which sound strikingly different from the usual portamento effect.

Hereafter is the representation of the voltage changes.



## V/Oct Calibrating VCOs with voltage range going negative

To benefit from the full extent of their octave covering, some VCOs also need being driven below zero volt. Therefore, when doing their V/Oct calibration, the base pitch should be set one to three octaves higher than the lowest note to be played.

The CalTrans will make the best of the available range. If for example the VCO has a range from minus 1V to +4V (covering 5 octaves), after calibration, it will be possible to play these 5 octaves only using positive voltages; a simple transpose will reposition the VCO's pitch range in the voltage range you find practical on the controlling side.

## Specifications

### Mechanical

Dimensions	mm	inches	Eurorack compliance
Height	128.40	5.06	3HE
Width	30.00	1.18	6HP
Depth behind panel (with supply cable inserted)	36.00	1.41	

### Supply

The supply socket is protected against reverse insertion.

Supply rail	Current draw
+12V	39 mA
-12V	8 mA
+5V	0 mA

### Input/output

All inputs and outputs can withstand signals between -12V and +12V without harm.

Jack	Effective voltage range received or generated
V/Oct input	0 to 7V
V/Oct output	-3 to +7V
Calibration input	1V p/p minimum, rising edge detection

### Signals

Parameter	Values
V/Oct Calibration Frequency range	20 Hz to 10 KHz
Neutral calibration voltage range	1:1 in/out +/- transpose

### Packing list

The box contains:

- CalTrans module
- 2x M3 black mounting screws + washers
- Eurorack-compliant supply cable
- Quick setup notice

**Klavís** products, including PCB and metalwork, are designed and manufactured in Europe.