# *Quadigy* Quad Envelope Generator

## *7-stage envelopes, presets, cycling, morphing & CV matrix*

## Introduction

The Quadigy is a complex envelope generator focused on live play. The goal is to allow you setting up rich, interactive and dynamically evolving envelopes without the risk of breaking up a subtle and intricate patch once on stage. This is achieved by offering two main modes, one where full control is available, and a Live mode where only the settings that are sensible using on stage are accessible. The user interface offers an intuitive access for otherwise complex settings. Advanced features such as automatic time-stretching, multiphase clocking and full morphing between presets put the Quadigy in a category on its own.
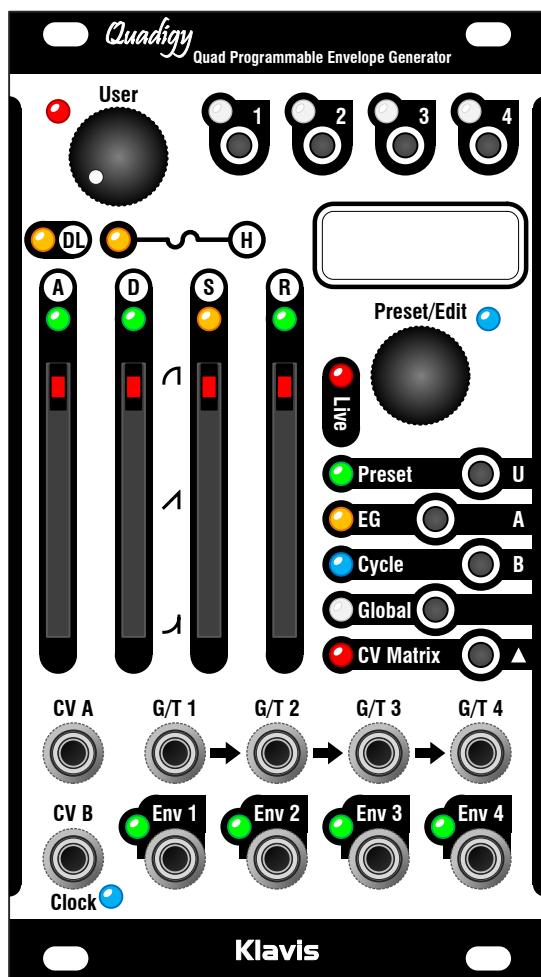


## Features at a glance

- Quad 7-stage envelopes
  - Pre-delay
  - Hold
  - Attack
  - Punch
  - Decay
  - Sustain
  - Release
- Continuous curve shape settings
- Inversion
- Independent output level
- Cycle capability with auto fit-to-clock
  - Elastic time stretching
  - 5 internal clocks with tap tempo
  - External clock control
  - Multiply/divide and offset
  - Individual cycle ext. control
- Manual gating for convenient editing
- 32 presets with naming
- External preset control via CV or Trig
- Simultaneous 156-point CV matrix
- Morphing on presets and CV Matrix
- Multi-editing for easy polyphonic uses
- Live mode for easier/safer control
- Graphical OLED display
- Real-time envelope stages LED indication
- Current state retained over power cycle
- Easy firmware update via an audio file
- Skiff-friendly and compact module

# 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! A Klavis NoDrain adapter can provide the missing 5V rail.

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 "Quadigy_1.00.wav".

**Check on Klavis.com that you have the latest firmware version for your product.**
If there is none to be found, there is none needed ;-)

## Procedure

- Connect a mono or stereo cable between your audio playing device headphone output and the Quadigy CV A input.
- Prepare to play the audio file
- Set the play level at two thirds
- While pressing the Preset and CV Matrix buttons, switch on your modular case supply
- The display provides instructions
- Start playing the audio file

### If everything goes fine

- The display tells "updating"
- As the update is progressing, a row is filling up
- When the row is full, all green LEDs flash; the firmware is updated successfully
- Press any button to restart the module

### If the sound level is too low

- Stop audio playback
- Slightly increase the audio playback level
- Start audio playback from the beginning

### If there is an error during the playback

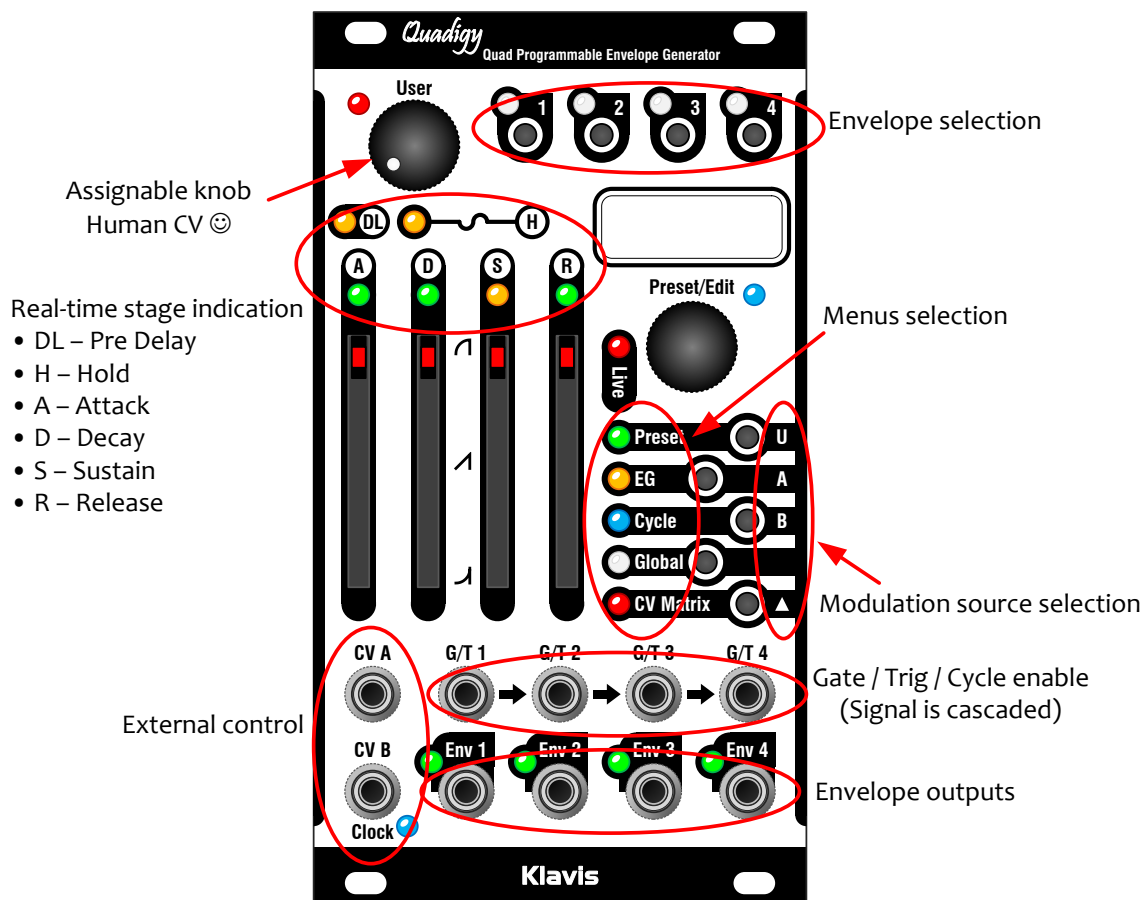The 7 red LEDs will flash and the display will indicate an error.

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
- Check that you have not created a ground loop (e.g. computer used as file player!)

# Panel presentation



Envelope selection

Assignable knob
Human CV ☺

Real-time stage indication
• DL – Pre Delay
• H – Hold
• A – Attack
• D – Decay
• S – Sustain
• R – Release

Preset/Edit

Menus selection

Live

Modulation source selection

External control

Gate / Trig / Cycle enable
(Signal is cascaded)

Envelope outputs

**For a quick hands-on discovery, go to the Run-through demo on page 15**

# Live mode vs Studio mode

### Hidden settings

The Quadigy offers many features whose editing is not required or sensible in a live context. In Live mode some editing pages are hidden or simplified.

### Different behavior

Studio mode offers full control on all settings. However, some features can be perturbing while elaborating the stages of your live set. This is why some features are only active when in Live mode.

| Feature / setting | Studio mode | Live mode |
|---|---|---|
| Preset load, save & clear | Full featured | Simpler menu with Load only |
| External preset control | Editable but disabled | Hidden but enabled |
| Morphing between presets | Editable but disabled | Editable and enabled |
| Various advanced parameters | All available | Hidden |

Switching between Studio and Live modes is done by a **long press of the Global button**. Live mode is reflected by the Live red LED. An "L" or "S" also appears in the top left corner of the display.

Note that if you don't use preset control or morphing you can stay in Studio mode during live situations. You can also switch from Live mode to Studio mode at any time to save a tweak.

## Envelope selection and multi-editing

The 4 buttons + white LED row at the top select the envelopes under editing.

It is allowed to select/edit more than one envelope at once. This is done by maintaining any of the 4 buttons as a shift and adding/removing the others by individual press.

When more than one envelope is selected for editing:

- The settings in the display and the 6 stage LEDS reflect the leftmost envelope
- Changes are simultaneously applied as absolute values to all envelopes selected

## Faders and User knob behavior

Changes are applied after the physical position crosses the current value. This is shown by the fader's red LED going solid on.

A current setting of zero is indicated by double pulses (or reverse).

## Menus and editing

There are 4 base menus with the CV Matrix button leading to 3 derived menus.

| Base menus | | When adding the [CV Matrix] button |
|---|---|---|
| Preset control | → | CV-clearing functions in current preset |
| EG – Envelope generator settings | → | EG – CV control settings |
| Cycle related settings | → | Tempo CV control settings |
| Global settings | | - none - |

Once in a menu, selecting the pages is done by turning the encoder.
Each menu contains a number of pages, possibly of two types:

1. Fader pages where four settings are controlled by the four faders
2. Parameter/option pages showing a single setting, changed via the encoder:
   - Press the encoder to access editing; the Blue Edit LED goes on
   - Turn to edit the setting
   - Press the encoder to validate the change and exit editing

You can always press another menu button to leave a page/setting you have entered.

Note that some pages are hidden depending on the context of other settings; for example the Gate/Trigger mode selection is hidden when the envelope is in cycle mode because that setting is meaningless in such case.

To protect the settings against user mistakes, there is a timeout that terminates editing after 20 seconds of inactivity.

## Manual gate

While in any of the 3 multi-fader pages of the EG menu, pressing the encoder button acts as a manual gate on the sections currently selected.

## CV Matrix

There are 3 sources of modulation that can be freely assigned in amplitude and polarity to any of the 13 destinations in any of the four envelopes. This gives a modulation matrix where all 156 modulation links can be active simultaneously if you wish so (we think not, but who are we to judge?).

The 3 sources are CV A, CV B and the User knob acting as CV U.

### Assigning a CV modulation

Every page whose setting allows CV control is accessed by pressing the CV Matrix button.
Once the CV Matrix red LED is flashing:

- Select a source by holding the CV Matrix button as a shift key and select one of the 3 top menu buttons for source U, A or B. This is reflected on the screen.
- Change the modulation by moving the related fader (fader pages) or entering editing via the encoder (parameter pages).
- Press CV Matrix to exit the CV editing

When CV Matrix is active, pages without CV settings are hidden.

## 1. Preset menu

### Studio mode

Here you can load, save and clear presets.

Pressing any other menu button cancels the current operation.

When saving, the 4 faders allow you naming the preset

### Live mode

The only option is load preset which offers direct preset selection.

## 2. Preset + CV = Clear CV menu

### Studio mode only

Here you can clear the CV modulations for the current preset, separately by source (A, B, U) or globally for all sources.

## 3. EG Envelope Generator

This menu offers:

- 3 Quad-fader pages (with encoder press = manual gate)
    - ADSR
    - Additional timings: Pre-delay, Hold, Punch, and Global Time
    - Curves for A, D, R, and output level
- 5 Parameter pages
    - Trigger mode (Gate/Trigger)
    - Full attack (Yes/No)
    - Transition (Join/Restart)
    - Inverted output (Yes/No)
    - Morph Time (0 – 120 seconds)

### Envelope stages
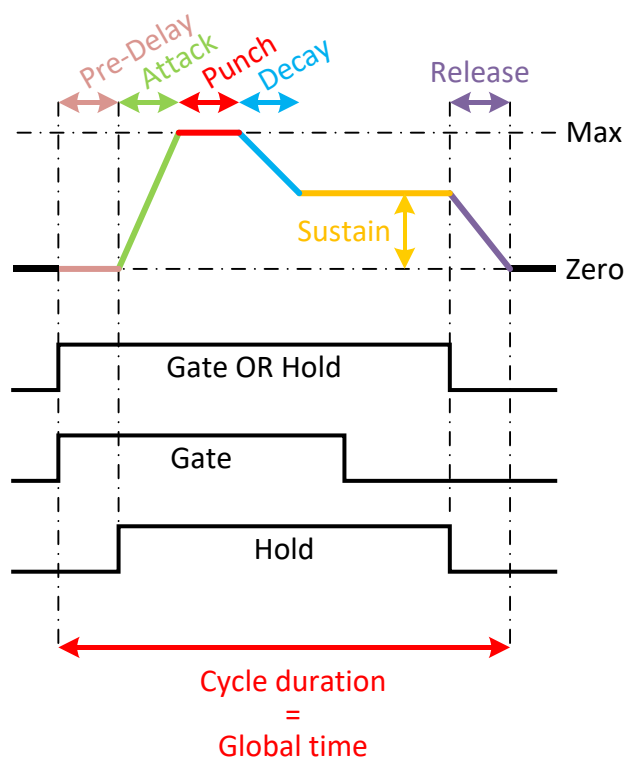
## Pre-Delay - time

This setting allows delaying the entire envelope as if the gating was coming later. Note however that the end of gate is not delayed. If the Pre-Delay is longer that the Gate, there is no envelope.

## Hold – time

Hold is a virtual gating signal that can extend the actual gate duration.  The Hold time begins with the Attack. If the Gate is longer that the Hold time, Hold is "useless". When Hold extends the gating, a further Gate signal could "extend the Hold". With regularly time-spaced gates, this may result in a continuous Sustain-only envelope.

When the Pre-Delay time is longer than the Gate signal, the Hold will be applied after the incoming Gate is over. This makes the envelope seem to be independent from the Gate!

## Attack - time

This is the time the envelope takes to reach its maximum level. If the gate or hold is not long enough, the maximum level may not be attained. In that case, the envelope goes immediately to Release from the level currently reached.

## Punch - time

If Attack has the time to reach the maximum level, the Punch phase begins. Punch is a hold time before the Decay begins. The Punch level is always to maximum. If the gate or hold durations are not long enough, the end of Punch time may not be attained, in which case the envelope goes immediately to Release.

## Decay - time

The Decay is the time needed to go from maximum level to sustain level, after the Punch duration is over. When Punch is set at zero duration, the Decay follows the Attack.

If Gate or Hold is not long enough for the Decay to reach the sustain level, the envelope goes immediately into Release.

## Sustain - level

The Sustain is the level attained after Attack, Punch and Decay are over IF the gate or Hold is long enough to go over the end of these 3 phases.

## Release - time

Release is the time needed to go from the current level to zero. The Release occurs immediately when the Gate and the Hold durations are both over.

## Global time

This parameter is a timing factor acting simultaneously on all time parameters of the envelope. It can be seen as a continuous range setting.

At mid-fader setting, the GT is 100% which corresponds to a maximum duration of 30 seconds for any given time setting of the envelope. Going down tends towards 0%, going up, to 800%. Therefore, the longest duration for each envelope stage is 30 seconds x 8 = 4 minutes.

The durations displayed take into account the multiplication factor of the Global Time setting.

When activating the editing on multiple envelopes and changing the GT, the percentage applied will be the same, but the resulting timings in each envelope will be different if their initial values were not the same.

It might be convenient to set GT according to the kind of envelopes you intend doing. For example, when doing percussions not exceeding a few seconds, setting the GT at 20% will restrict the longest stage duration to 6 seconds. This will give you a better control of that maximum duration over the entire fader length for attack, decay, etc.

Note: When Global Time is at 0%, any envelope is reduced to a pulse !

## Output Level

This sets the voltage span of the envelope signal. At maximum, the envelope goes up to 8 Volts.

Note that CV control of this setting offers a virtual VCA on each envelope.

## Curve shape

The Attack, Decay and Release can each be shaped individually from logarithmic to exponential curves via linear when set halfway. The typical analog 'exponential decay' curve is obtained with the setting at around 70%.

## Trigger Mode – Gate/Trigger

Envelopes are usually controlled with a gate: their duration is related to the duration of the incoming gate signal.

### Gate

Without hold being active, the end of gate is the start of the release phase; this may occur at any time, even during the Attack, Punch or Decay phase.

### Trigger

When triggered, the whole envelope duration is defined by the addition of each phase: pre-delay, attack, punch, decay and release. The envelope develops automatically through these phases till the end.

Without hold (long enough), the release immediately follows the decay. This creates an ADSR envelope where the sustain level is reached but its duration is zero.

When hold is long enough to go beyond the end of the decay phase, a sustain phase is obtained.

## Full Attack (FA) – on/off setting

With FA on, an attack already started will always complete, even if there is no more active gate or hold. Punch is always included in FA. The Punch phase is included in the Attack phase LED.

When in Trigger mode, the Attack is always full.

## Transition – Join/Restart

This setting tells if the attack level takes on from the current envelope level (join), or if it cuts down the current level in order to start from zero (restart).
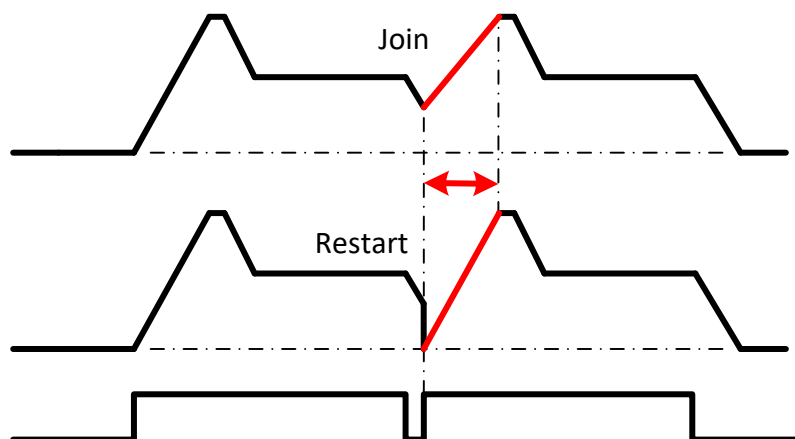


The J/R setting has no effect on the attack duration; only the attack slope will vary as needed.

## Invert Output – on/off setting

By default this setting is off. When set to on, the polarity of the envelope is flipped.

Note that the signal remains unipolar positive; there are no negative voltages generated.

## Morph Time – duration

This - per preset - setting is only effective if Global Morph Time is set to Off (in Global menu).

For the morphing to be active you should also be in Live mode.

Morphing is the progressive transition of all continuous settings plus all the CV settings of the current preset to the ones of the preset newly called. The time can be set from zero (instant) to 120 seconds. Morph Time is read from the target preset.

# 4. EG + CV = Envelope CV control menu

CV control is offered on each setting of the 3 fader pages in the EG menu.

# 5. Cycle and clock menu

Each envelope can run independently or jointly in cycle mode.

When cycle is active, the Cycle LED blips according to the clock source.

### Clock sources

Each envelope can follow different clock sources:

| Clock source | Behavior | Cycle LED blips |
|---|---|---|
| None; cycle is off | The envelope follows gates/triggers | none |
| Internal individual | The envelope uses its dedicated clock | single |
| Internal global | The envelope shares the global clock | double |
| External | The envelope follows the external clock | triple |

The tempo range of clocks (internal or external) goes from 1 to 300BpM.

## Cycle

The metric onto which the envelope develops is a Cycle. When using Global or External clock, a Cycle is defined by multiplying or dividing that (master) clock.

When using the Individual clock, since there is no (need for) multiply/division, the cycle is equal to the tempo.

When cycle is active:

- The envelope self-loops endlessly. When a preset with Cycle active is called, the envelope starts at the beginning of its next start point, and then loops
- The duration of the envelope is not defined by absolute durations; instead, time settings of the phases (A, P, D, H, R) are shown as percentages of the overall envelope duration. This is what allows automatic time stretching. If for example, you augment the attack time, all other duration will be proportionally reduced. This way the whole envelope development time is unchanged. Note that the Pre-Delay value is not part of the envelope percentage; its percentage is independent and comes in addition.
- All envelope phases develop without relating to a gate signal.
- The sustain phase only exists if there is a sufficient Hold time beyond the decay phase.
- The Gate signal is not used as a gate; it can be enabled as an on/off switch for cycling (see Gated cycle)

### Subdiv

It may happen that the envelope cycle, while of the appropriate length, does not start at the right time (in relation to other equipment). This is why there is a Subdiv setting. This subdivision adjustment is only needed (and thus visible) when an external clock is used and divided.

### Offset

Offset positions the envelope start within the cycle. The Cycle is divided in 12 equal steps according to a musical metric and terminology.

### Playing multiple envelopes to a Global or External clock

After division and Subdiv are defined, it might be needed to adjust the position of multiple cycling envelopes in relation to each other. This is done with the Offset setting.

While both Subdiv and Offset move the position of the envelope starting point, they have a different purpose:

- Subdiv repositions the whole group of related envelopes according to their common clock downbeat (to agree with the external equipment's start/loop/downbeat point)
- Offset defines the start point of the envelopes amongst themselves.

## Filling

A filling of 100% makes the addition of envelope stage durations fit within the duration of one cycle.
The filling can be reduced so that there is a blank after the envelopes ends, or conversely, be extended beyond 100% to make consecutive envelopes overlap, and thus being truncated by the next envelope cycle.

Filling does not change the duration of the cycle, but how much the envelope fills the cycle.
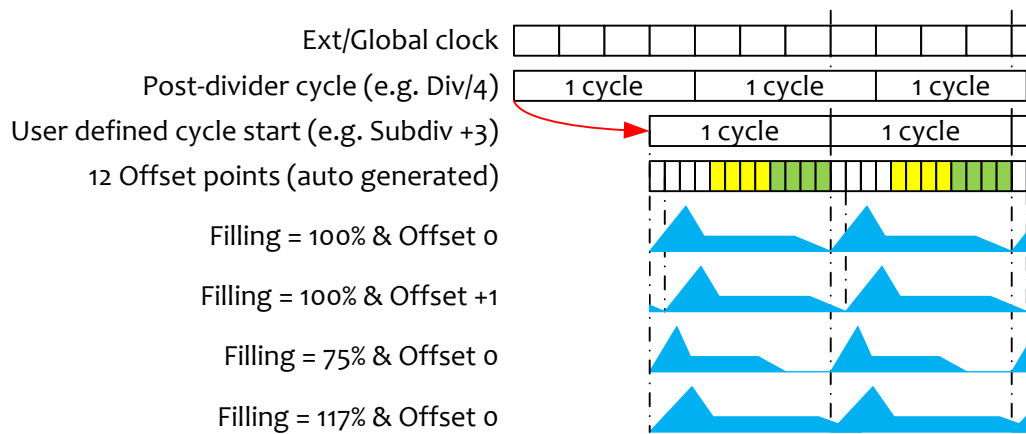


### Filling set to "Env Timing"

Setting the filling lower than 1% enters to the Envelope Timing mode of filling

When set to Env Timing, the way the envelope durations are applied is changed:

- There is no more stretching/compacting of the envelope phases to fit the cycle
- The phase duration settings are applied as shown in milliseconds/seconds whatever the tempo or tempo change
- It is possible to set envelopes that are longer than a cycle

This allows maintaining the overall shape and timings of an envelope when the tempo changes as with an "ordinary" envelope generator.

## Tap tempo

Tapping the encoder knob defines the tempo. It can be also be readjusted via the Tempo page.

A new tempo is updated after 3 taps, no more, no less.

## Gated cycle

- When Gated cycle is On, a gate signal (= enable) must be On for the cycling to occur
- When gate goes On, the envelope starts at the beginning of its next offset point, then cycles as long as the gate stays on.
- When the gate ends, the envelope goes immediately to release phase then stays off
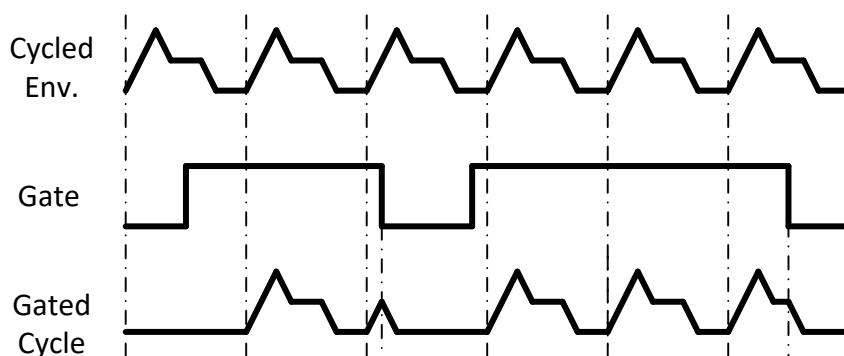


## 6. Cycle & Clock + CV = Tempo control

The only CV controllable parameter is the tempo of internal clocks.

## 7. Global menu

### Quad control page

This page is the only one in the Quadigy where the 4 faders are acting on the 4 envelopes.
For each fader/section, the parameter under control depends on the Cycle mode in that section.

| Cycle setting in the section | Icon | Parameter on the fader |
|---|---|---|
| Off | GT | Global stretch/squeeze |
| Internal clock | Metronome | Tempo for the section |
| Internal global clock | Metronome + G | Tempo for all sections in Global clock |
| External clock | Sweeping clock | Mult/divide clock ratio |

QCT fader set halfway corresponds to the original values (100% of the current timings).
Beware that this setting is independent from the Global Time setting in each envelope. Since they are both percentages, they simply multiply the durations in cascade. (e.g. GT at 50% with QCT at 200% = 100%; Time x 0.5 x 2 = 1).

### Preset control

The settings shown here are only available in Studio mode and active only in Live mode.

Calling the presets by external control can be done in two ways: clock/triggers and CV. Preset control points to a user-defined list of presets part of a continuous range within the 32 available.

### Clock/trigger-based preset control

When preset control = trigger, the CV A input is used to input a trigger signal.
Presets are called sequentially in a loop. It remains possible to select presets manually. This is useful to "synchronize" the preset selection in relation with the external equipment requests.

### CV-based preset control

When preset control = CV-A, presets are called according to a voltage offset.

- When CV=zero, the pointed preset is the first preset in the defined range
- Every 150mV step up from zero Volts points to the next preset in the defined range

### First and Last preset range definition

These settings define the first and last preset in the range accessible by external preset control.

## Morph mode page

Defines where the Morph duration will be read from when calling a new preset:

- As defined in each preset
- Globally for all presets

## Global Morph time page

The setting goes from instant (0) to 120 seconds. This setting is useful only when Morph mode is set to Global

## Brightness

This setting affects the LEDs and the display brightness jointly.

Note that the 4 output LED's brightness is not controlled by this setting.

## Screen Saver

To preserve the Quadigy display's longevity, it switches off automatically after a predefined time.

You can switch between short, mid and long.

## Factory Reset page

This page allows clearing the entire module and reinstates the factory demo presets.
Beware that all your presets will be lost!

## Version page

This page is displaying the current firmware version.

# Run-trough demo

Discover some features of the Quadigy without relying on any other module.

This demo is available from firmware version 1.14 – Check the version in Global menu.
If you have to upgrade from version 1.13 or lower, you must also perform a Factory reset.

The preset demonstrates the following:

- Envelopes 1 and 2 work jointly with different settings (e.g. feeding a VCF and a VCA).
  There's a global control on their timing aspects
- Envelope 3 acting as an LFO with wave shaping
- Envelope 4 acting as a clock generator with tempo control

The User knob is acting as a "manual" CV that is applied to various parameters for the purpose of the demonstration.

### Let's retrieve the demonstration preset

- Press the [Preset] button; its green LED goes on
- Press the encoder and turn it to bring preset 8; then press again to load it.

### Manual gating

- Press the [EG] (envelope generator) button
- Press simultaneously buttons [1] and [2] in the top row; their white LEDs stay lit.
  You have access to parallel editing and manual gating of these two envelopes
- Every press on the encoder is a manual gate on the selected envelopes

### Global timing

- Turn the User knob until its red LED goes on; then set it halfway
  With the LED on, the knob visual cue is now reflecting its actual setting.
- When pressing the encoder and keeping it pressed for various gate durations, one can see the resulting signals on the green LEDs at outs 1 and 2
- Now, try varying the User knob and check its effect by gating the envelopes.
  Not only the decay and release times are made shorter or longer depending on the knob position, but the pre-delay on the second envelope is also affected.

The User knob is a bipolar virtual CV (negative to zero to positive). When halfway (= zero), its LED shows double off-blips as do the faders when presenting bipolar settings.

This knob and the external CV inputs can modify any combination of settings in any envelope, each with their own polarity and amplitude.

In this case, the knob controls the global time parameter of the two envelopes. It could have been sent to any other parameter (curves, attack, hold, out level, etc.) at the same time.

### LFO with waveshaping

- Set the User knob halfway (double off-blips)

- Press button [3] in the top row to access the settings of the third envelope
  The envelope 3 is configured in cycle mode; this is why the blue Cycle LED blips regularly
- You can see the Attack and Release green LEDs slowly balancing in equal durations; they show the up and down phases of the triangle wave that the envelope 3 creates.
- To get a perfect triangle, the A and R curves were set to linear.
  Turn the encoder twice to the right to see those curves.
- Now tweak the User knob and see the resulting curves in the display and the signal on the output 3 green LED. The knob changes the A & R settings in opposite polarities.
  The change in shape is not affecting the tempo.

The knob could have also varied the tempo, the level or created other LFO shapes such as saw, trapezoid or fancy ones that ordinary LFOs never do ☺

### Clock and pulse generator

- Press button [4] in the top row
- Envelope 4 is cycled and configured as a full-on/full-off signal generator with instant rise and fall times and a cycle filling of 50%.
- Here the User knob acts on the tempo.
  Since you can define the base tempo and the depth of control of the User knob, it is possible to tailor a rate range that exactly fits your needs.

Note that when A & R are zero as in envelope 4, the shape of the curves is irrelevant.

# Specifications

## Mechanical

| Dimensions | mm | inches | Eurorack compliance |
|---|---|---|---|
| Height | 128.40 | 5.06 | 3HE |
| Width | 71.00 | 2.8 | 14HP |
| Depth behind panel (without supply cable) | 21.00 | 0.83 | |

## Supply

The supply socket is protected against reverse insertion.

| Supply rail | Current draw |
|---|---|
| +12V | 24 mA |
| -12V | 10 mA |
| +5V | 40 mA |

## Input/output

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

| Jack | Effective voltage range received or generated |
|---|---|
| Gate/Trigger input | Minimum 1.8V |
| CV control input | +/- 5V |
| Clock input | Minimum 2.8V |
| Outputs | 0 to 8V |

## Packing list

The box contains:

- Quadigy module
- 4x M3 black mounting screws + washers
- Eurorack-compliant 16-pin supply cable
- Quick setup notice

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