Raijū
User Manual

Raijū
User Manual – version 1.0

Table of Contents

Thanks

It's undoubtedly thanks to you if **Unknown Devices** has a chance to make itself know in the modular world. It has been a journey, with unexpected obstacles and opportunities to grow, both personal and as a brand, and the community (you!) has been of an unimaginable help.
Thanks to the beta users that believed in the project before anyone else.
A special thanks to my family and friends for the support, to *Lorenza*, for patiently listening to my rants, to *Antonio*, for lending his skills to the cause, to *Dave*, for sharing with me his determination.
A special, special thanks to *Lorenzo* (aka erekutoronikku) for the incredible help in both the module conceptual development, testing and for all the amazing art he made for the module.
Last but not least, thanks to *Paolo* (aka Shamisen Orchestra), for joining me in this ambitious journey and restoring my long lost enthusiasm.
Yours,
Ciro.

Overview

Raijū (雷獣) – the embodiment of lightning in animal form. Divine beasts, akin to the thunder gods (raijin), it is said that whenever a lightning strikes ground, a raijū has been sent to bring punishment.

Inspired by the Buchla modular environment, where often multiple different functions are often combined into a single module to extend their functionality and utility (1+1=3). Raijū is a 8HP analog **Low Pass Gate** + digital **Envelope Generator** combo module, with lots of tricks under his sleeve, thanks to this tight integration between the two submodules.

An "hidden" digital wavefolding oscillator is normalized to the LPG input, effectively rendering the module a capable standalone percussive voice.

The WiFi-enabled processor allows a powerful web configurator to run directly on the module, making it accessible without the need of a computer.
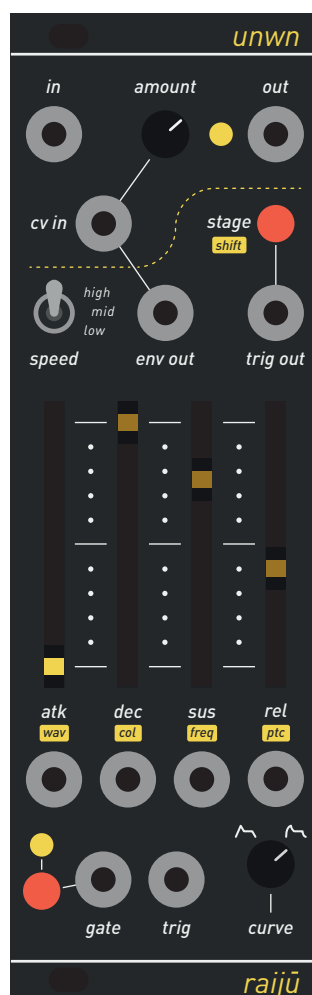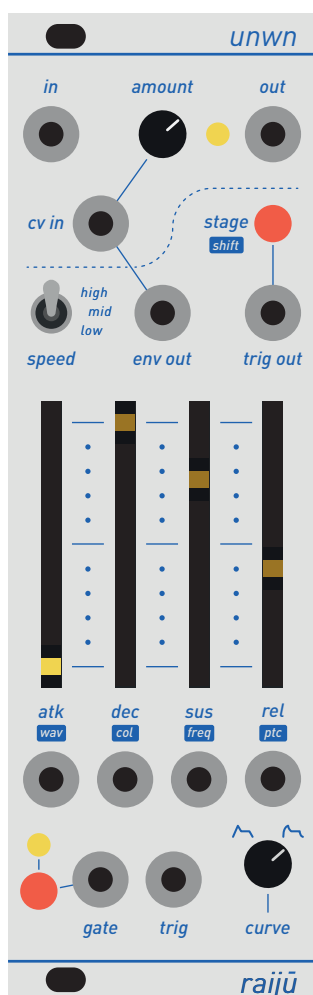
Specifications

- Analog, Vactrol-based Low Pass Gate
- ADSR Envelope Generator
- Gate and trigger inputs
- Range selection (from few millis to hundreds of seconds)
- Envelope shape control
- Configurable End-Of-Stage trigger output
- Triangle Core digital oscillator
- FM Waveshaping modulating oscillator
- 3-stage wavefolder
- Pitch decay envelope
- Integrated standalone Web Configurator

Installation

1. Ensure that the eurorack system is turned off.
2. Connect the 10-pin side of the power cable to the pin header on the back of the module, ensuring that the connector notch is aligned with the one on the backplate.
3. Connect the 16-pin side of the power cable to one of the empty power header on your Eurorack power supply, confirming that the red stripe on the power cable is connected to -12V.
4. Mount Raiju in your eurorack case.
5. Power your Eurorack system.

Note: The module power input is protected from inverse polarity, plugging the connector wrong won't damage the module nor the system.
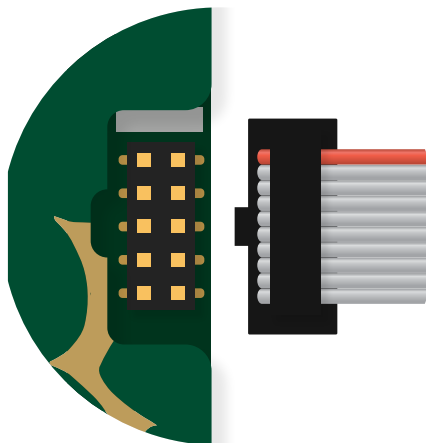
Front panel

Controls

a. LPG amount. linear attenuator for the LPG CV signal.

b. EG manual trig. click for triggers, keep pressed for gates.

c. Parameters sliders and multi-purpose status leds. the slides are used to edit the 8 main parameters, divided in two pages, EG and oscillator. The current page is indicated by the leds, off for EG and 50% brightness for the oscillator.

page 1	attack	decay	sustain	release
page 2	waveform	colour	frequency	pitch env.
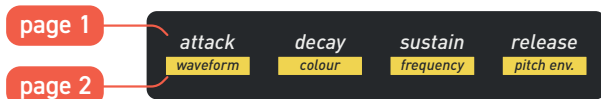
The active page can be changed using the shift modifier (see d).

d. Trig out stage select and shift button. Clicking it cycles through the EOS output options (All stages, Attack, Decay, Sustain and Release) the selected option is represented by the flashing status leds. Holding it down engages the shift modifier, switching the active parameters page. Releasing the button returns the sliders to the previous page, this is useful when you only need to quickly change parameters. To lock in the oscillator page press the trig button (b) while holding.

e. EG Speed selector. Toggles between the envelope speed ranges, high (250ms), mid (1s) and low (100s).

Toggling also saves the current configuration into memory.

f. EG Shape potentiometer. Shape of the EG stages curve, from linear to exponential.
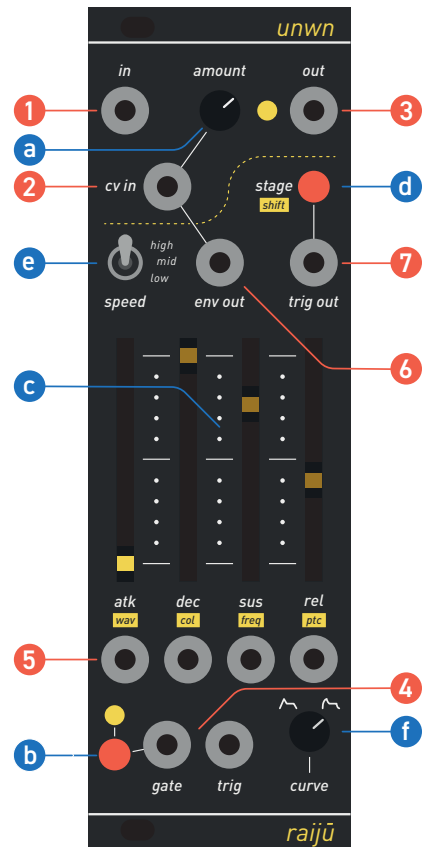
INs & OUTs

1. LPG audio input. When unplugged the internal oscillator is internally connected to the LPG.

2. LPG CV input. Internally connected to the envelope generator output.

3. LPG audio output.

4. EG gate & trig input. Triggers (and holds, in case of the gate input) the envelope generator as well as the oscillator pitch envelope.

5. CV inputs. Configurable -/+5V modulation inputs, can be individually routed to one of the two respective parameters

6. Envelope output.

7. Envelope EOS Output. End Of Stage output for the envelope.

Normalization Map
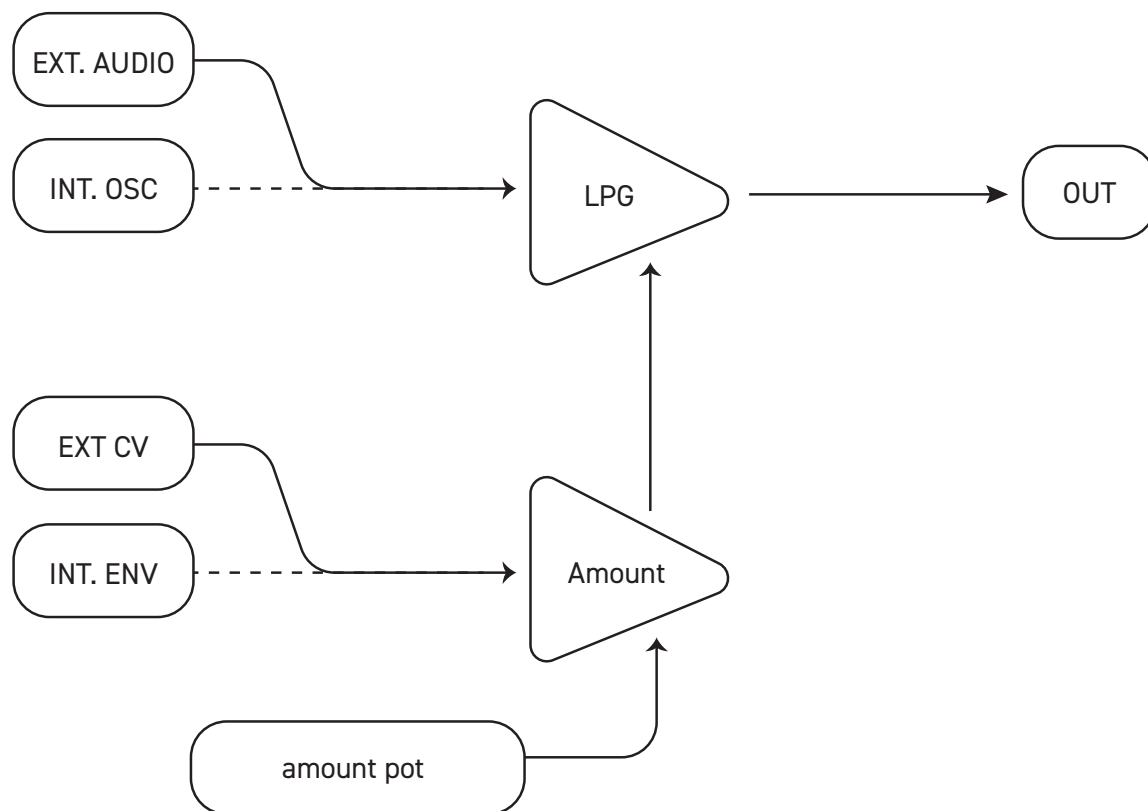
Shift button & pages navigation

This small panel its packed with features, let's see how to navigate them.

Raiju's page navigation is toggled by using the **SHIFT** button and the sliders. Don't be afraid: there's only 2 pages.
Raiju boots on the Envelope page by default, this means that the sliders will control the envelope parameters from start. To change the internal oscillator parameters you can enter the **OSC** page by holding the **SHIFT** (stage) button.
(You can also press the TRIGGER/GATE button once, while holding the SHIFT button to remain in the chosen page.)
All the sliders LEDs will blink and remain dim indicating that we are in the **OSC** page. In this page is possible to tweak the parameters shown in "blue" background (*more on this at page 11*).
To return to the Envelope page, simply release the **SHIFT** button.
The LEDs will blink and remain off, indicating that we're back on the Envelope page.
To remain in the **OSC** page, press the **GATE** button once while holding the **STAGE** button.
You can use this function to return back to the envelope page.
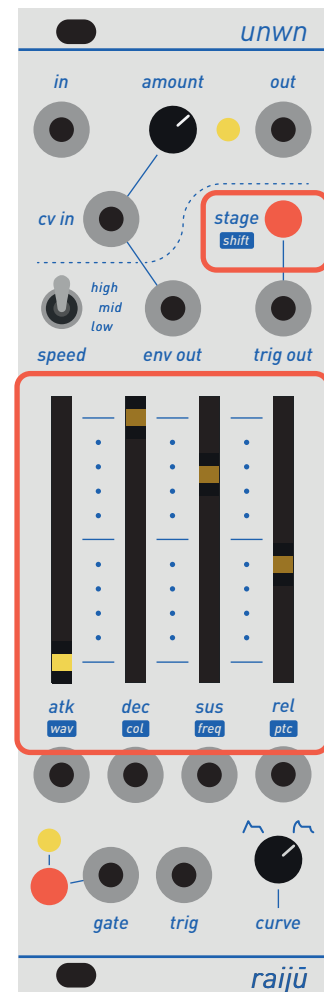
Slider value catcher
To avoid parameters jumping to the current slider value everytime you switch between the two pages, parameters are locked until you move the sliders to the current values for the active parameter, with the slider led blinking when reaching the current setting (i.e. if the attack/shape slider is at 0 but the shape parameter is set to 0.5, moving the slider won't have any effect until you move it to the 0.5 position)

Saving state
To save into permanent memory (kept after reboot) the current envelope and oscillator parameters quickly flick the **SPEED** lever to the **Low** setting. (this will be substituted by a key combo in future updates).

Envelope

The envelope block is a classic ADSR. It's Raiju's core.
This submodule can work symbiotically with the LPG sub-module or can be completely independent.

TRIG/GATE inputs

In order to work, an envelope needs a trigger or a gate.
Raiju offers a manual trigger/gate button, a GATE input and a TRIG input (very useful for retriggering or for producing percussive sounds).

Envelope duration

The envelope has 3 main speed modes: **HIGH**(300ms per stage), **MID**(1s) and **LOW**(10s)
Each Envelope stage duration can be controlled with its relative slider, except for the sustain stage whose slider sets the level of the sustain while the duration is related to the incoming gate length.
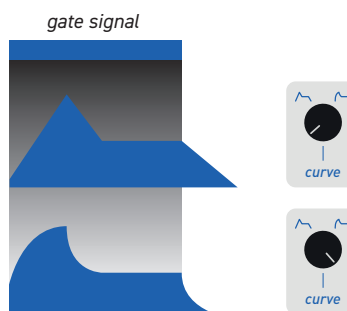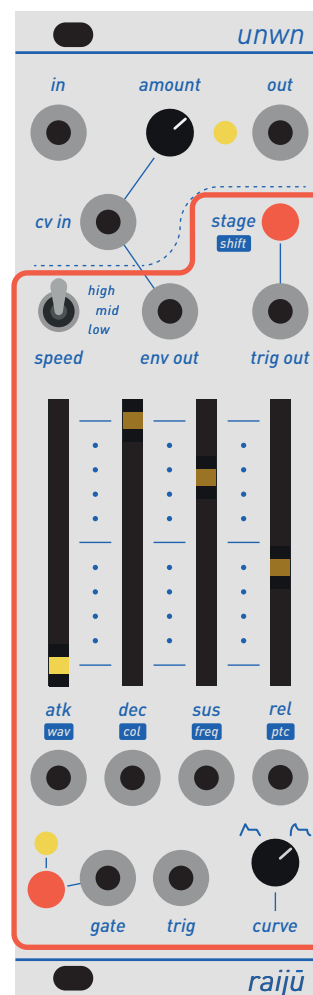
CV inputs

Each stage parameter can also be controlled by a CV source, in this case the slider position works as the offset of the value.

Curve

At the end of the path there's CURVE, a parameter that controls the envelope response, from linear to exponential.
Linear is ideal for controlling parameters and Exponential is perfect for sounds envelopes.

End of Stage trig output

The **STAGE** button sets the trig out jack's output. Click the button to rotate between the output options. the LEDs on the sliders will show which stages will output the trigger (End of Stage - EOS).

5 configurations are currently available:
1. **Attack EOS** - only atk led lights up
2. **Decay EOS** - only dec led lights up
3. **Sustain EOS** - only sus led lights up
4. **Release EOS** - only rel led lights up
5. **ALL EOS** - all four leds lights up

(try triggering raiju with itself, it's fun)

Envelope Offset

The envelope can be sightly offset (up or down) to tune the lpg reactivity. To do so, hold **SHIFT/STAGE** and rotate the **CURVE** knob to change the offset. Add offset to increase the dynamic range and the decay length at the expense of more audio bleed, decrease it to completely close the gate.

Low Pass Gate

The LPG block is a straight forward Buchla-style Low Pass Gate.
This submodule can work symbiotically with the Envelope submodule or can be completely independent.

Inputs

An LPG works pretty much like a VCA for Audio rate, dynamically scaling the amplitude of the incoming signal while
also applying a smooth non resonant low pass filter.
This creates a very natural sounding response.
In order to work an LPG needs 2 signals: Audio, which goes into the LPG ("in") and CV signal to open/close the LPG ("cv in"). The "cv in" also features an attenuator to scale the incoming cv.
The attenuator also acts as gain stage, so after 2 o'clock it will actually start distorting the cv signal (pretty useful in a live scenario to quickly change dynamic response of a Kick or any Percussion in general).
If nothing is plugged into the cv input, the LPG will receive the cv signal from the Envelope Block.
If nothing is plugged into the lpg input the internal voice will be active (*read about the internal voice at pag 11*).
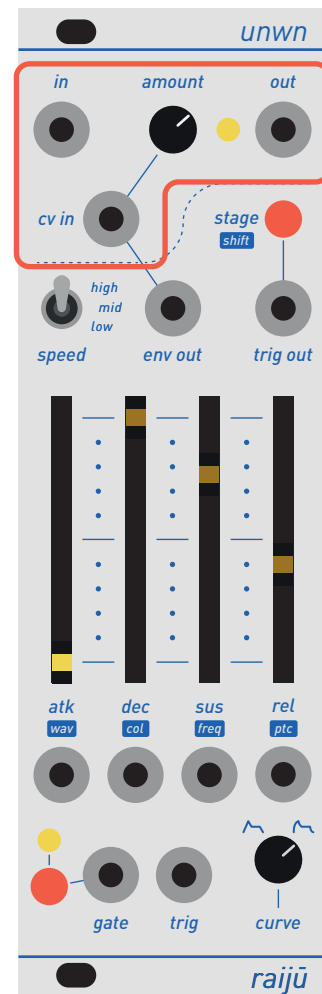
Internal voice

Note: Raiju's internal voice is only available when nothing is plugged into the LGP IN!
Raiju's internal voice is a gritty west-coast oriented oscillator.

Principal oscillator
The oscillator is a 16 bit digital triangle core oscillator with many wave shaping options.
Note: the sliders range is represented with a minimum of 0 to a maximum of 1.

Shape
From 0 to 0.5 a gentle wave shaping from sine to triangle is applied. From 0.5 to 1 a second internal noise/sine modulation oscillator is engaged and the slider works as a "modulation index" on the frequency of the principal oscillator. The ratio of the modulation oscillator is fixed but can be modified via the web configurator *(more on this topic at pag 12)*.

band-pass filter   triangle core   FM modulation

.0   0.5   1.(
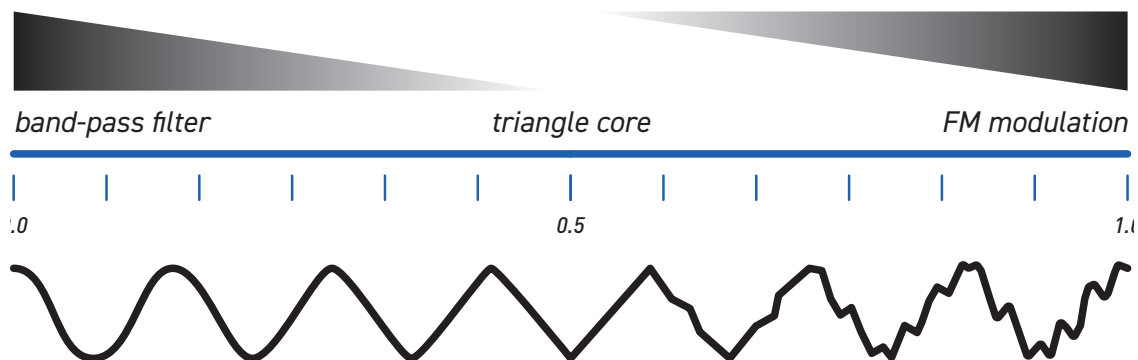
Color
This is a Buchla Easel inspired digital wavefolder. It bends and folds the internal oscillator after the shaping stage.
The cv in signal control is exponential, giving you a wider range of control on lower values.

Frequency
This slider sets the center frequency of the main oscillator while the cv input is your trustworthy 1v/oct input.

Pitch Bend (or Punch)
This slider sets the amount of modulation of the dedicated internal envelope which is a modified shorter version of the envelope in the Envelope page.

CV inputs
All CV inputs are by default set to control the envelope parameters, but can be routed differently via the web configurator.

Web configurator

Raijū's web configurator lives inside the module itself, and it can be accessed with a smartphone, tablet or pc to the automatically generated wifi access point (named Raiju). The configurator accessible at the address raiju.local (or 192.168.1.1 if your browser doesn't support mDNS names).
SSID: **Raiju**
Password: **unknowndevices**
Configurator address : **raiju.local** (or *192.168.1.1*)

Connection to Raiju's access point

Follow these simple steps to connect to the module via WiFi.
Step 1: Connect to the WiFi Access Point

For Android Devices:
1. Open your device's Settings app.
2. Tap on "Network & Internet" or "Connections", then "WiFi".
3. Turn on WiFi.
4. Search for Raiju's WiFi network (it will be listed under 'Available Networks'). Tap on it to connect.
5. When prompted, enter the password.

For iOS Devices (iPhone/iPad):
1. From your Home screen, go to Settings.
2. Tap on "WiFi".
3. Switch on WiFi if it's not already on.
4. Under 'Choose a Network', select Raiju's WiFi network.
5. When prompted, enter the password.

For Windows Devices:
1. Click the Network icon on the lower right corner of your screen.
2. Click on Raiju's WiFi network from the WiFi menu.
3. Click "Connect".
4. When prompted, enter the password.

For Mac Devices:
1. Click on the WiFi icon on the upper right corner of your screen.
2. From the drop-down list, select Raiju's WiFi network.
3. When prompted, enter the password.

Step 2: Open a Browser and Input the IP or mDNS Name

After successfully connecting to the WiFi network, proceed to open a web browser (like Google Chrome, Safari, Mozilla Firefox, Microsoft Edge) on your device.

In the address bar at the top of your browser window, type in the IP address or mDNS name of the module,, and then press "Enter".
If the device is properly connected, you should be able to see Raiju's Setting page.

# Connect Raiju to your WiFi network

Raijū can also be configured to connect directly to your home WiFi network.
To do so, input your access point name and password into the dedicated section in the configurator and reboot the device. If, for whatever reason, the access point isn't available or the name or password aren't correct, Raijū will restore its access point.

Settings

This is the first and the main tab Raiju's web configurator. The inferface is divided in various sections, organized by purpose.
Each section has a [?] button next to the title, click it to open the info tooltip, that contains details about what every single option does.
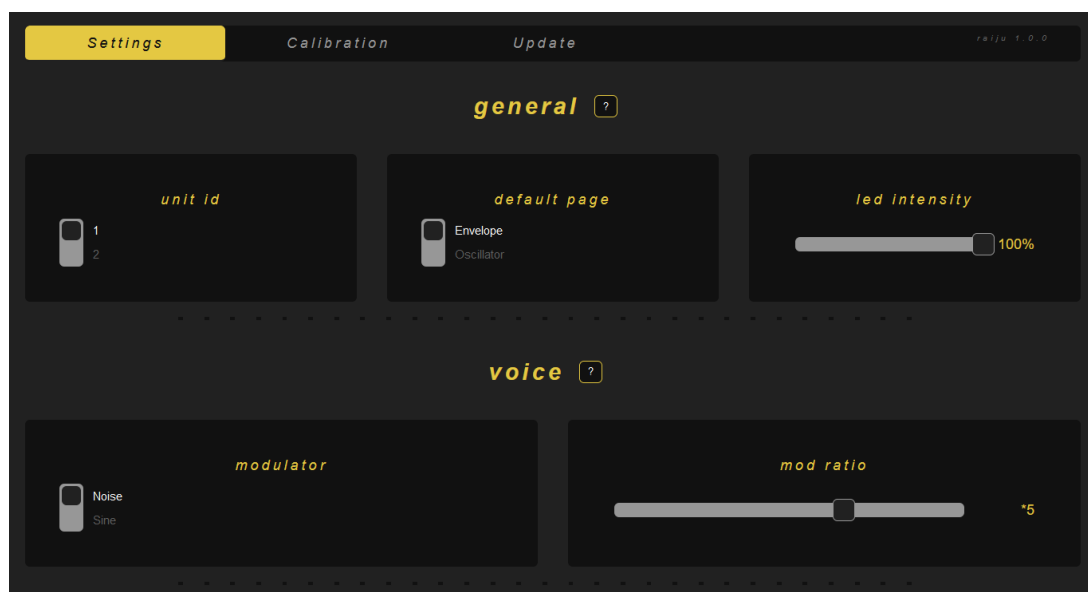
Calibration

Raiju's calibration procedure is done during the firmware initialization and shouldn't be needed to be done by the end user. If for some reason the 1V/Oct tuning feels off it is possible to fine tune the saved calibration values.

To do so, access the Web Configurator (As described in the previous chapter), and go to the **Calibration** tab, where you can find all the tools to edit, backup and restore your calibration data.
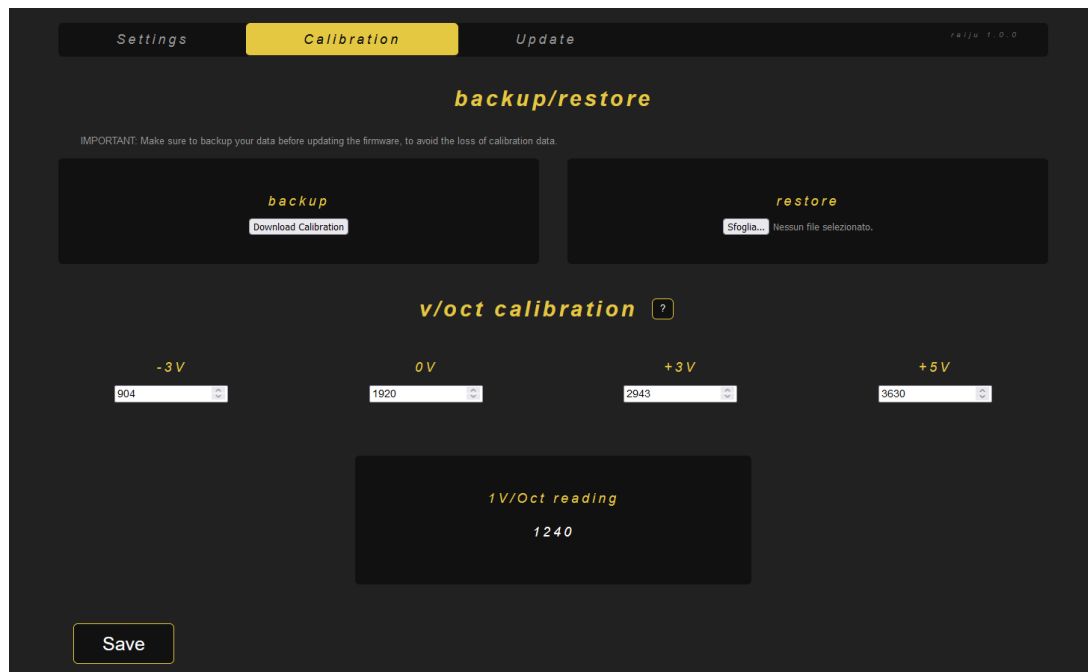
the procedure to quickly tune the 1V/Oct input is pretty simple:

1.   Plug a Precision voltage source to into the **sustain/frequency CV input.**
2.   Set the voltage source to the target voltage (for example 3V)
3.   the 1V/Oct reading at the bottom will show the value to set into the calibration voltage input above.
4.   Click the **Save button** and reboot the module to apply the changes.
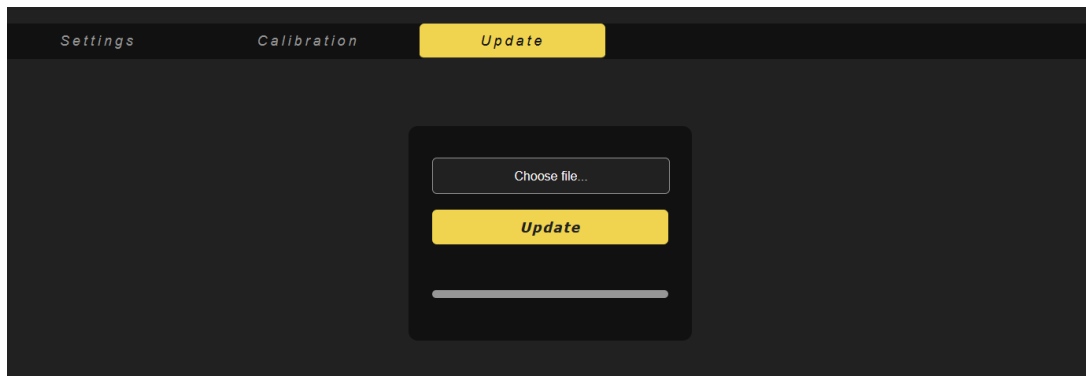
Firmware Update

Firmware updates can be installed using two different methods: the on board wifi configurator or a dedicated PC/Mac tool.
The first one can be used for most of the updates (unless specified in the update release notes).

Using the Web Configurator

Before starting the update procedure, download the latest firmware update from Raiju's github release page on the device (Computer or smartphone) you're going to use to access the Raiju's internal server. If multiple versions are present, download the one with the **_web** suffix.
then it's time to update! access the Web Configurator (As described in the Web Configurato chapter), and go to the **Update** tab.


1.   Click on the **Choose file...** button
2.   Select the previously downloaded firmware file (ending with the *.bin extension)
3.   Click the **Update button** and wait for the update to end: the progress bar at the bottom will be filled and the module will automatically reboot.

Using the desktop tool

Sometimes bigger updates have to be installed using Raiju tools, a software available for Windows and Mac devices that provides tools for uploading firmwares and debugging Raiju using the usb C port in the back of the module.
[Download the latest version of the tool and the usb drivers from here.](#)
WARNING: this procedure completely overwrites the calibration file, so make sure you got a backup first.
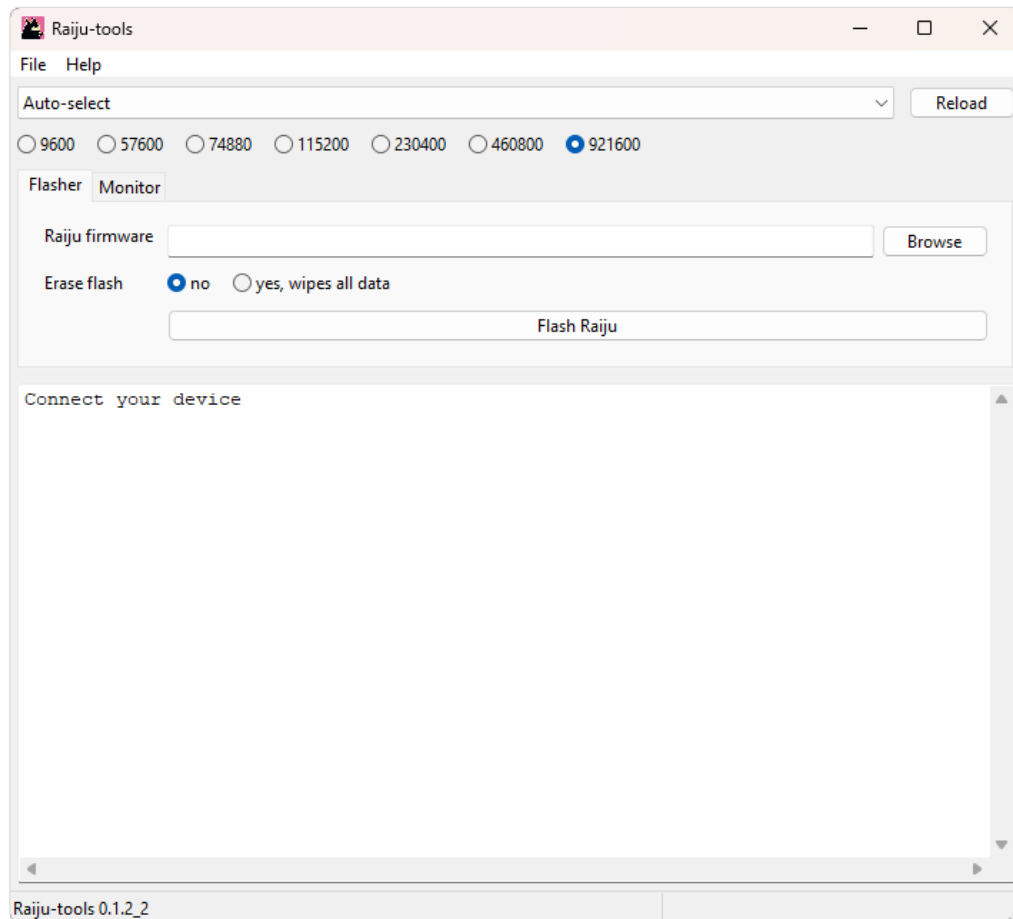
1.   Install the usb drivers, then restart the Computer.
2.   Download the latest firmware update from [Raiju's github release page](#). If multiple versions are present, download the one with the **_full** suffix.
3.   Power your module and connect an usb C to usb B cable from the module to the PC.
4.   Launch the Raiju-tools executable.
5.   (optional) Select Raiju's com port from the first dropdown.
        the software should auto detect the device when you press Flash Raiju
Click the browse button and select the previously downladed firmware file.
6.   Ensure Erase flash is set to **NO**
7.   Click Flash Raiju to start the update, the output on the lower part of the window will say Completed when the update is done, and the module will be automatically rebooted.
8.   Connect to the Web Configurator and restore the calibration.json file *(page 13)*.

16