

Mental Noise

Axon

MIDI to CV Eurorack Module

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# Description

Axon is an Open Source MIDI to CV Eurorack module.

Connect it to your modular synth using a regular MIDI cable (DIN 5 pins) to convert MIDI signals to CV signals, gates and triggers you can use in Eurorack.

This module outputs all these signals:

- **Note:** 88 keys, 1V/octave using a 12-bit DAC
- **Velocity:** 0 to 4V
- **Control Change:** 0 to 4V
- **Pitch Bend:** 0.5 +/-0.5V
- **Gate:** 5V for the duration of the key press
- **Trigger:** 5V for 20ms for each key press
- **Clock:** 5V for 20ms each quarter note

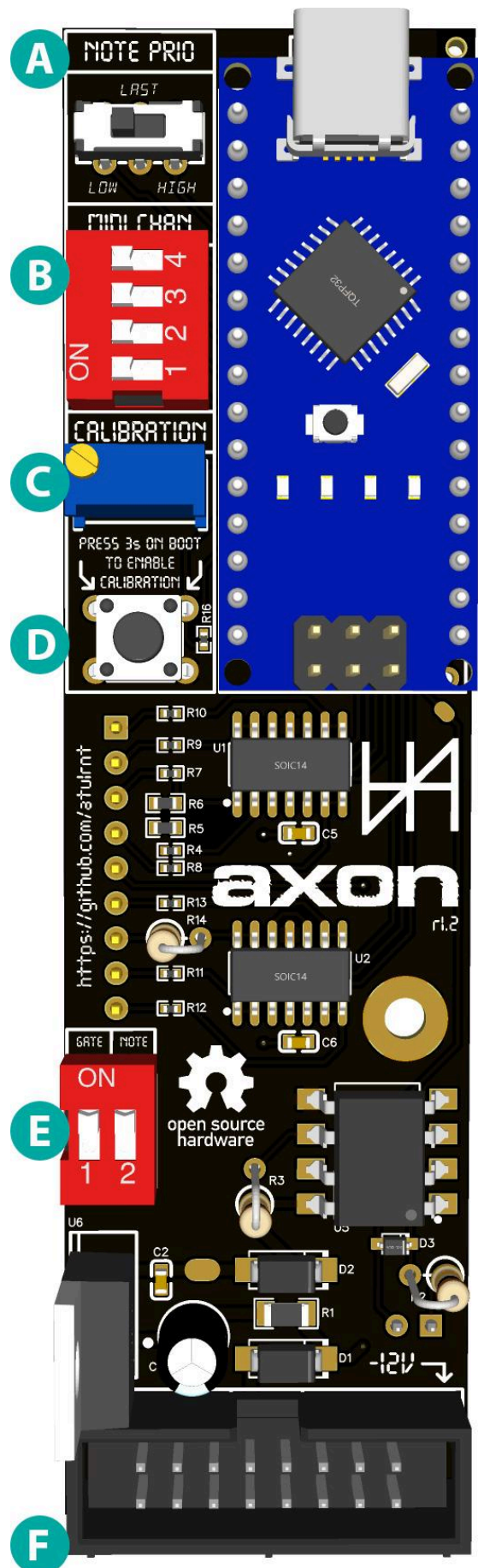
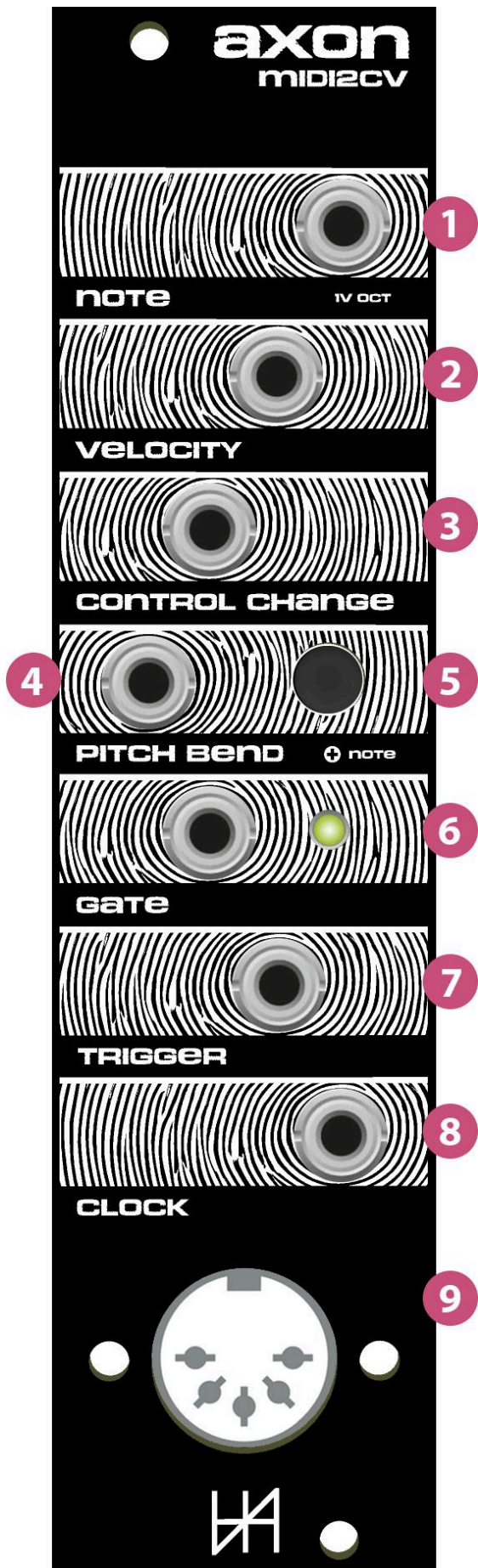
Configurable settings:

- Pitch bend can be applied directly to the note output via a switch on the front panel
- Note priority can be switched between latest, lowest and highest via a switch on the back
- Note and gate can be sent to your power bus if compatible (only on 16 pins to 16 pins Eurorack cable)
- MIDI channel can be chosen between 1 and 16 via a dip switch on the back
- The module can be calibrated to accurately output 1V/oct

This allows you to have complete control of your Modular synth with a MIDI controller!

If you need any help adapting the firmware to your specific needs, feel free to contact me on reddit ( <https://www.reddit.com/user/atulrnt/> ) or open an issue on github ( <https://github.com/Mental-Noise/Axon> ).

I hope you will have as much fun using it as I had building it, enjoy!



# Front panel

## 1. Note output

This is the CV / note output, it can handle up to 88 keys, 1V/octave.

## 2. Velocity

This output the velocity as a CV signal between 0 and 4V.

## 3. Control Change

This output the control change as a CV signal between 0 and 4V.

## 4. Pitch Bend

This output the pitch bend as a CV signal between 0 and 1V centered around 0.5V.

## 5. Apply Pitch Bend

When pushed, this button applies the pitch bend directly to the note output **(1)**.  
This removes the need for a CV mixer to use the pitch bend on the note.

## 6. Gate

Each time a key is pressed, 5V is output from the gate for the duration of the key press.

## 7. Trigger

Each time a key is pressed, 5V is output from the trigger for 20ms.

## 8. Clock

This output the clock as a 20ms trigger based on the MIDI clock signal converted to a clock usable in Eurorack.

## 9. MIDI Input

Connect your MIDI cable here to control your modular synth.

# Back board

## A. Note Priority

This switch allows you to choose the note priority when multiple notes are played at once.

**Left:** The lowest note is played

**Center:** The latest note is played

**Right:** The highest note is played

The center position can be more difficult to switch to than the other two, if you end-up on the lowest or highest note instead, try to very slowly move the switch to the center position.

The note priority is selected at the boot of the module, changing it once the module is powered will have no effect.

## B. MIDI Channel

You can select the channel Axon listens to between 16 MIDI channels by toggling this DIP switch to the right order / position:

1 - 0000	2 - 0001	3 - 0010	4 - 0011
5 - 0100	6 - 0101	7 - 0110	8 - 0111
9 - 1000	10 - 1001	11 - 1010	12 - 1011
13 - 1100	14 - 1101	15 - 1110	16 - 1111

0 = switch positioned to the bottom

1 = switch positioned to the top

The MIDI channel is selected at the boot of the module, changing it once the module is powered will have no effect.

## C. Calibration Trim Potentiometer

In calibration mode, use this trim potentiometer to calibrate the note output.

Turn CCW to decrease the output voltage and CW to increase the output voltage.

## D. Calibration Switch

Push this button for 3s while powering the module to enter the calibration mode.

In calibration mode, push this button to move to the next step.

Clicking the calibration switch once the module is powered will have no effect.

## E. Bus Switches

If you have a compatible bus and module, you might want to send the note and gate directly via the bus.

The left switch is for the gate, the right one is for the note.

To enable any or both of these, put the switches in their top position.

## F. Power Connector

Standard 16 pins Eurorack power connector.

If you want to send the gate and/or the note to your bus, you need to use 16 to 16 pins cable, otherwise you can use a 16 to 10 pins cable (the side with 16 pins connected to the module).

# Calibration

The module is calibrated when built but each system is different and it might need to be recalibrated to fit your specific system if you feel the 1V / octave tracking is not accurate.

## Enter calibration mode

Before calibrating the module, make sure it is powered off.

Disconnect everything from its front panel and **disable** the pitch bend switch (5).

To enter calibration mode, push the calibration switch (D) for 3 seconds while powering up the module.

The gate (6) LED will blink 10 times rapidly signifying that you successfully entered calibration mode.

Wait 3 seconds, the gate (6) LED will blink 1x slowly signifying the module is outputting 1V to the note output (1).

Connect a patch cable to the note output (1), use a voltmeter to measure its voltage and turn the calibration trim potentiometer (C) if the voltage is not exactly 1V.

Turn CCW to decrease the output voltage and CW to increase the output voltage.

It can take a few turns to see the voltage change.

Once the voltage is set to exactly 1V, press the calibration switch (D) once, the gate (6) LED will blink 3x slowly signifying the module is now outputting 3V to the note output (1).

Repeat the previous measurement and adjustment step, when done, press the calibration switch (D) once, the gate (6) LED will blink 5x slowly signifying the module is now outputting 5V to the note output (1).

Repeat the previous measurement and adjustment step, when done, press the calibration switch (D) once, the gate (6) LED will blink 7x slowly signifying the module is now outputting 7V to the note output (1).

Repeat the previous measurement and adjustment step, when done, press the calibration switch (D) once, the gate (6) LED will blink 10x rapidly signifying the calibration procedure is done.

Restart the module by disconnecting and reconnecting the power connector (F).



## Restore default calibration values

If you feel like your calibration negatively affected the note output (1), you can restore the default values.

Before starting the restoration procedure, make sure the module is powered off. Disconnect everything from its front panel and **enable** the pitch bend switch (5).

The gate (6) LED will blink 10 times signifying that you successfully entered calibration mode.

Wait 3 seconds, the gate (6) LED will again blink 10 times rapidly signifying that you successfully restored the default calibration values.

Restart the module by disconnecting and reconnecting the power connector (F).

# Firmware update

The firmware is maintained on github (<https://github.com/Mental-Noise/Axon/releases>) and might receive new updates containing improvements, new features or bug fixes.

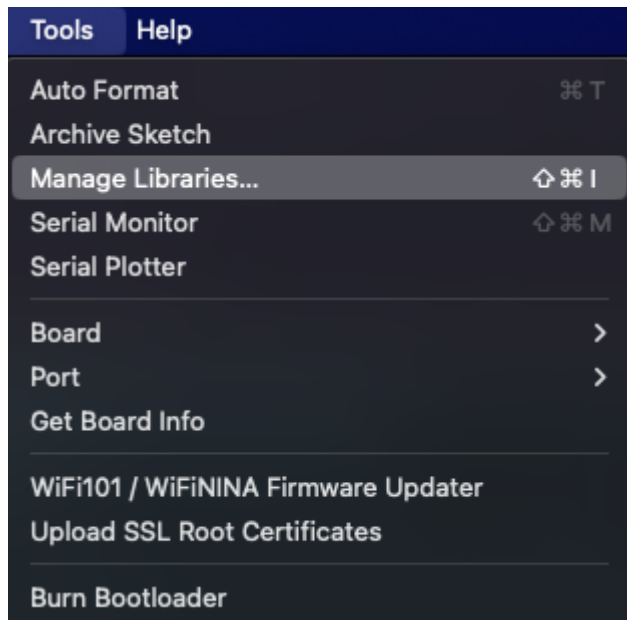
Follow these steps to upload the firmware on the Arduino.

## Install the Arduino IDE

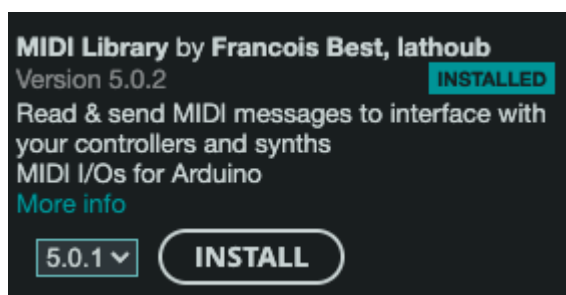
Go to <https://www.arduino.cc/en/software> and install the latest version of the Arduino IDE

## Install the MIDI library

In the “Tools” menu, click on “Manage Libraries...”.



Install the MIDI Library by searching for “MIDI I/Os for Arduino” and click “Install” on the one by “Francois Best, lathoub”.



## Download the source code

The source code is available in github under the “mental-noise-axon” folder:

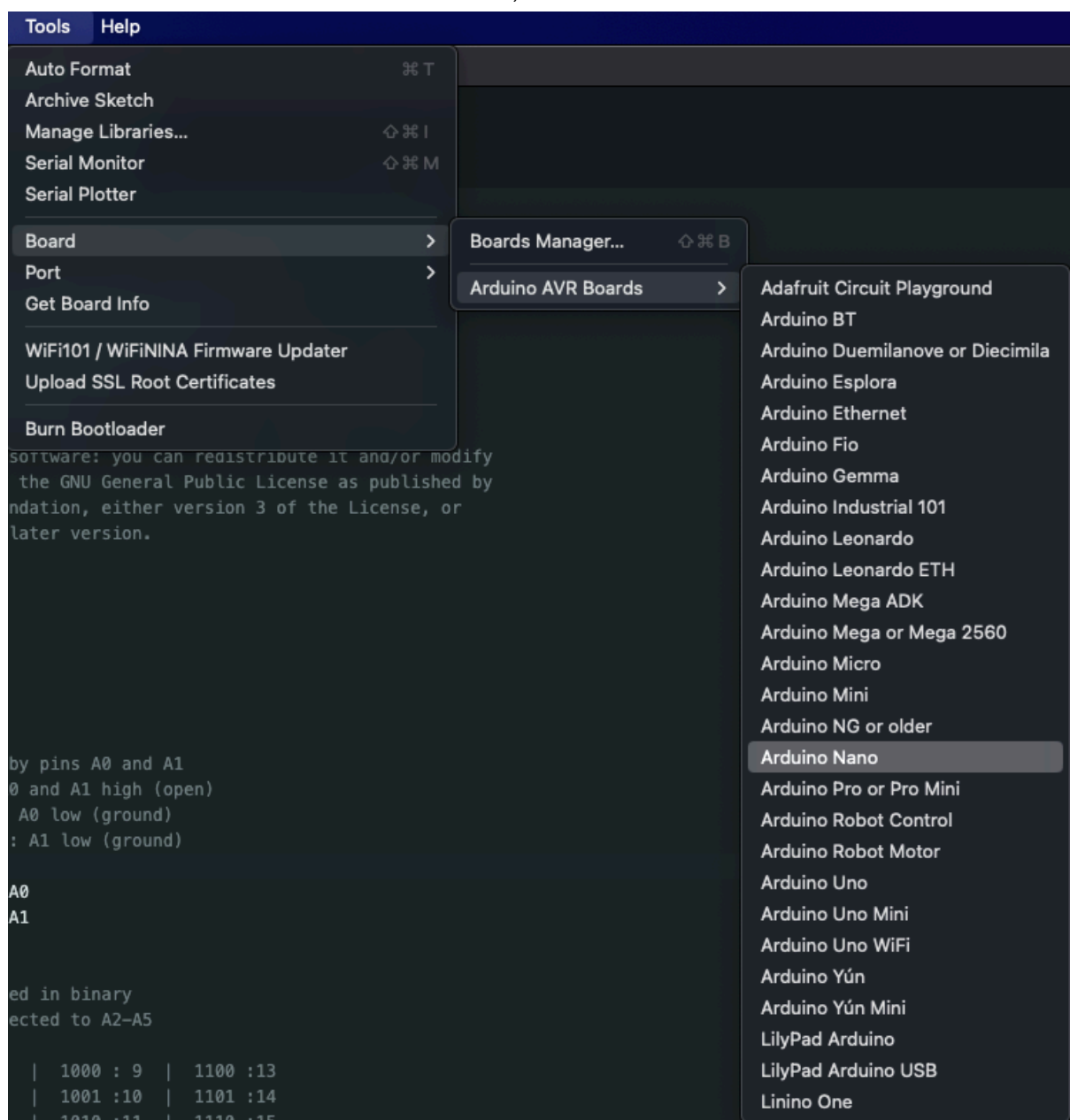
<https://github.com/Mental-Noise/Axon/blob/master/mental-noise-axon/mental-noise-axon.ino>

Copy this file in the Arduino IDE.

## Select your board

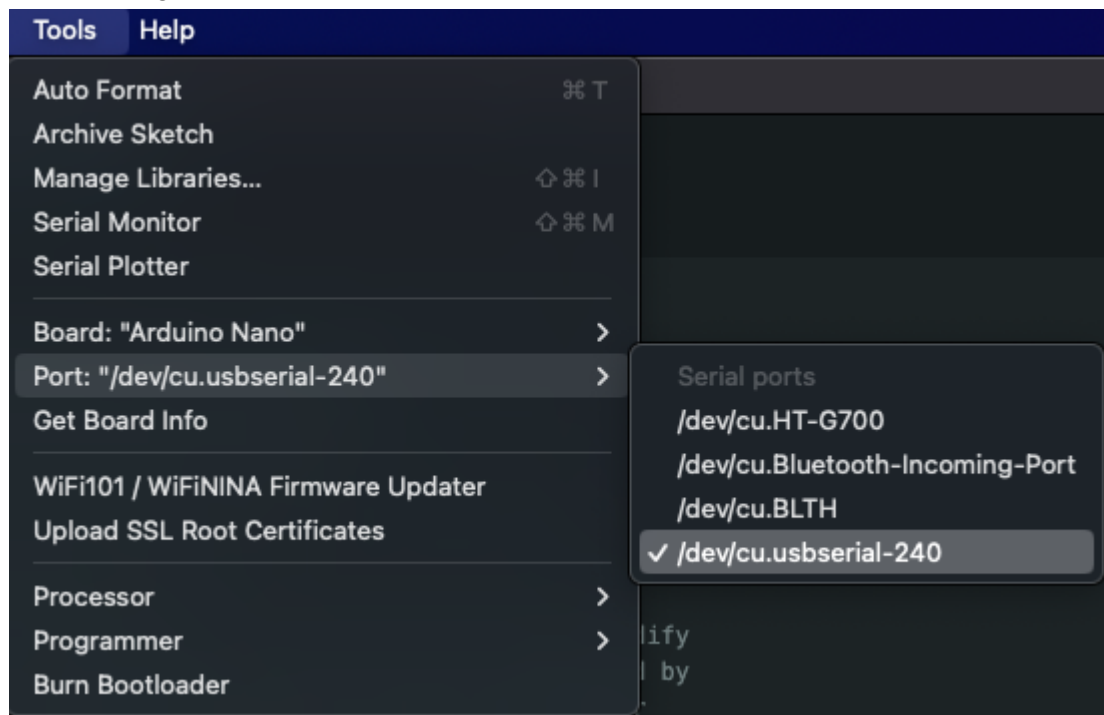
Connect the Arduino to your computer.

In “Tools” > “Board” > “Arduino AVR Boards”, select the “Arduino Nano”.

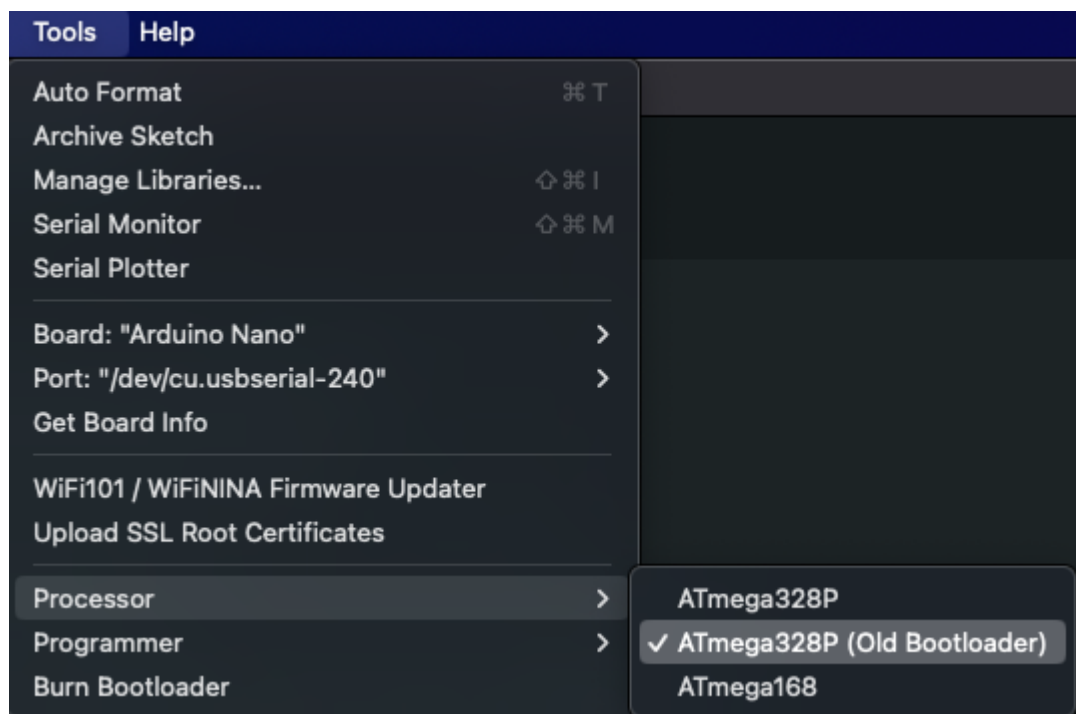


In “Tools” > “Port” > select the right serial port, yours might be different than mine.

If you are not sure which one to select, disconnect the Arduino, check the available ports, connect it again and select the port that wasn't there before.

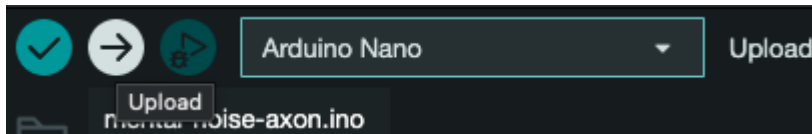


In "Tools" > "Board" > "Processor", select "ATmega328P (Old Bootloader)".  
If you are using a genuine Arduino, you might want to select "ATmega328P".



## Upload the firmware

Click on the upload button.



If everything went well, you should see a success message in the monitor at the bottom of the IDE.

You can now disconnect the Arduino from your computer and put it back in the module. Make sure you are installing it in the right position (USB connector pointing to the top of the module).

## Known limitations

- Axon is a monophonic MIDI module and therefore cannot handle multiple notes played together, some weird triggers can appear when playing a recorded sequence containing multiple notes played together.

## Firmware versions

### 1.0 - 27/06/2024

First fully working version.

<https://github.com/Mental-Noise/Axon/releases/tag/1.0.0>

## Hardware revisions

### 1.2 - 17/06/2024

First release of the module performing as expected.