



No-Code Indoor Air Quality Monitor with Separate Display

Created by Tyler Cooper



<https://learn.adafruit.com/no-code-indoor-air-quality-monitor-with-separate-display>

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Overview

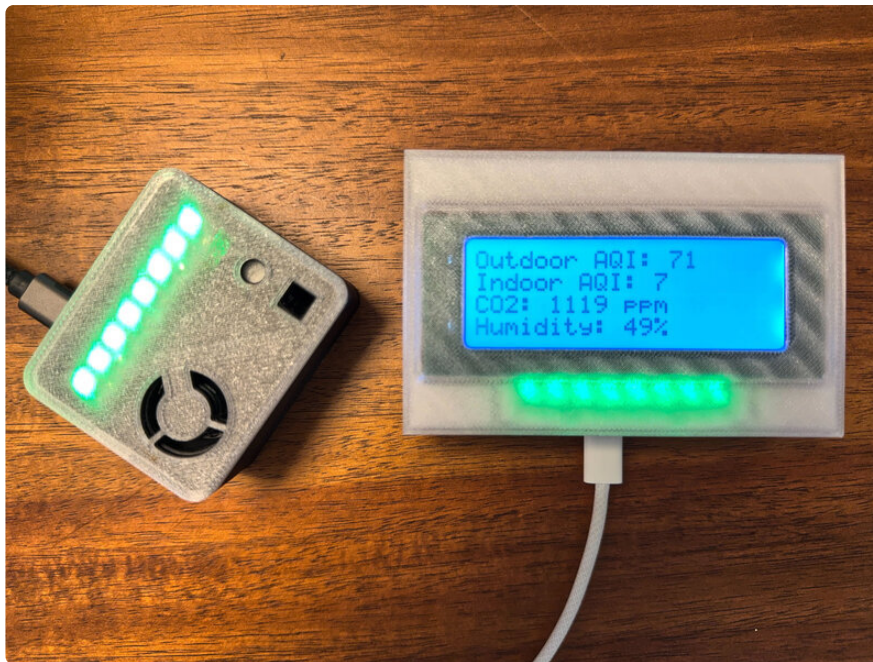


This step-by-step guide will walk you through building a fully functional indoor air quality monitor using the Sensirion SEN66 environmental sensor. You'll learn how to capture real-time measurements — such as temperature, humidity, and particulate matter — and automatically send that data to an external display for easy viewing.

The project leverages WipperSnapper firmware and Adafruit IO Actions, allowing you to set up powerful data collection, visualization, and automation features without writing a single line of code. By the end, you'll have a reliable, connected air quality monitor that can:

- Continuously track indoor environmental conditions
- Display live readings on a remote display, or view in a browser
- Trigger alerts or actions when air quality changes
- Log historical data for trend analysis

Whether you're a beginner looking for a no-code IoT project or an experienced maker wanting a quick, polished build, this guide will help you combine No-Code WipperSnapper firmware with Adafruit IO Actions to create a powerful little air quality monitor.



What is WipperSnapper?

WipperSnapper is a firmware designed to turn any WiFi-capable board into an Internet-of-Things (IoT) device without programming a single line of code.

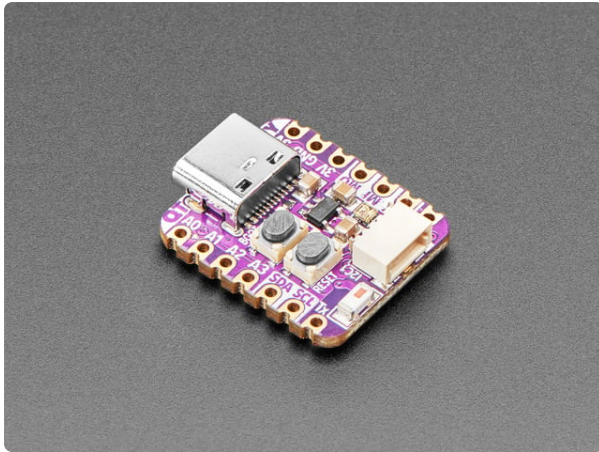
WipperSnapper connects to [Adafruit IO \(https://adafru.it/fsU\)](https://adafru.it/fsU), a web platform designed (by [Adafruit! \(https://adafru.it/Bo5\)](https://adafru.it/Bo5)) to display, respond, and interact with your project's data.

Simply load the WipperSnapper firmware onto your board, add credentials, and plug it into power. Your board will automatically register itself with your Adafruit IO account.

From there, you can add components to your board such as buttons, switches, potentiometers, sensors, and more! Components are dynamically added to hardware, so you can immediately start interacting, logging, and streaming the data your projects produce without writing code.

Parts

There are two projects within this one guide. You can easily just create the SEN66 part of the guide and view the data from a browser. Or you can create the external display to view the data right from your desk. If you want to create both, you will need 2x QT Py, 2x NeoPixel Sticks (optional).



Adafruit QT Py S3 with 2MB PSRAM WiFi Dev Board with STEMMA QT

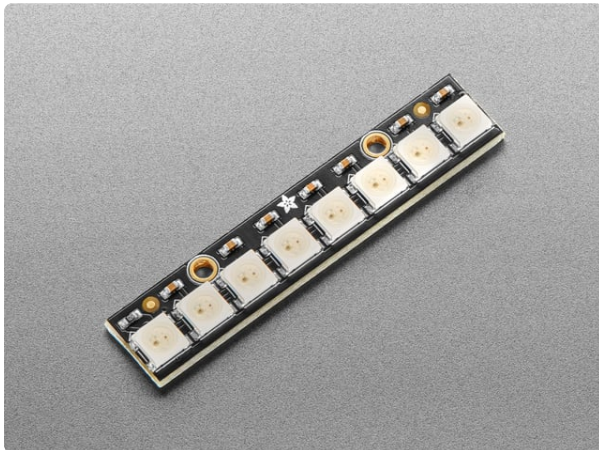
The ESP32-S3 has arrived in QT Py format - and what a great way to get started with this powerful new chip from Espressif! With dual 240 MHz cores, WiFi and BLE support, and native...

<https://www.adafruit.com/product/5700>

1 x Sensirion SEN66

A device packed with tons of environmental sensors. Will only work in this project with the Adafruit breakout board and special JST cable below.

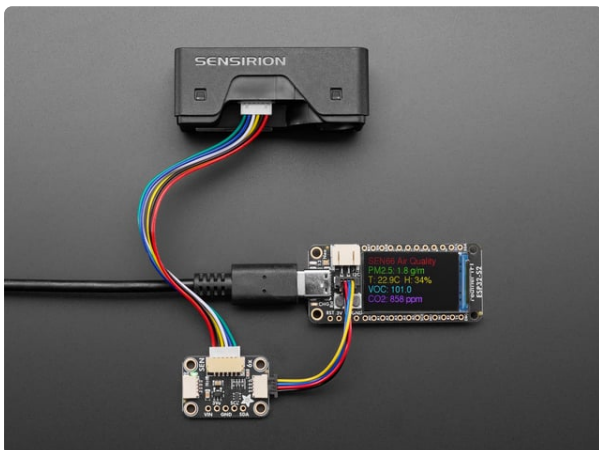
<https://www.digikey.com/en/products/detail/sensirion-ag/SEN66-SIN-T/25700945?s=N4lgTCBcDaIM4FMB2A2FIC6BfIA>



NeoPixel Stick - 8 x 5050 RGB LED with Integrated Drivers

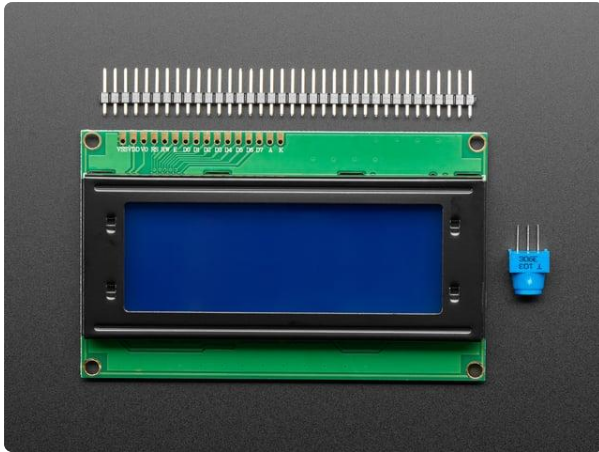
Make your own little LED strip arrangement with this stick of NeoPixel LEDs. We crammed 8 of the tiny 5050 (5mm x 5mm) smart RGB LEDs onto a PCB with mounting holes and a chainable...

<https://www.adafruit.com/product/1426>



Adafruit SEN6x Breakout for Sensirion SEN66 - STEMMA QT / Qwiic

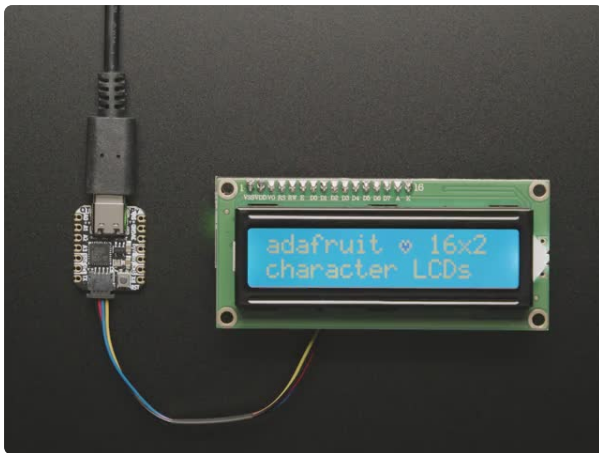
Now you can quickly integrate the <https://www.adafruit.com/product/6331>



Standard LCD 20x4 + extras

Standard HD44780 LCDs are useful for creating standalone projects. 20 characters wide, 4 rows. White text on blue background. Connection port is 0.1"...

<https://www.adafruit.com/product/198>



i2c / SPI character LCD backpack - STEMMA QT / Qwiic

Character LCDs are a fun and easy way to have your microcontroller project talk back to you. They are also common, and easy to get, available in tons of colors and sizes.

<https://www.adafruit.com/product/292>



STEMMA QT / Qwiic JST SH 4-pin Cable - 100mm Long

This 4-wire cable is a little over 100mm / 4" long and fitted with JST-SH female 4-pin connectors on both ends. Compared with the chunkier JST-PH these are 1mm pitch instead of...

<https://www.adafruit.com/product/4210>



Silicone Cover Stranded-Core Ribbon Cable - 4 Wires 1 Meter Long

For those who are fans of our silicone-covered wires, but are always looking to up their wiring game. We now have Silicone Cover Ribbon cables! These may look...

<https://www.adafruit.com/product/3889>



JST GH 1.25mm Pitch 6 Pin Cable - 100mm long

This cable is a little over 100mm / 4" long and fitted with JST-GH compatible 6-pin connectors on either end. We dig the solid and compact nature of these...

<https://www.adafruit.com/product/5754>

Wiring

Start by wiring your components so you can connect to Adafruit IO, install the WipperSnapper firmware, and run an initial test to confirm everything is functioning correctly. This ensures your hardware and cloud connection are solid before you move on to the full build.

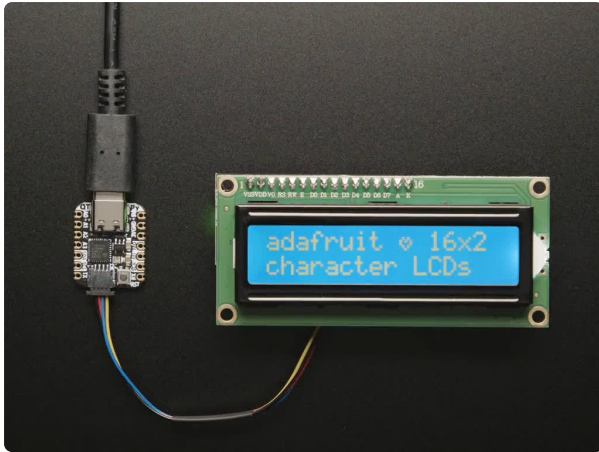
For both the air quality monitor and the display unit, you have the option to add a NeoPixel Stick. This extra feature provides a bright, at-a-glance visual indicator of air quality status that's visible from across the room — perfect for quick checks without looking at the LCD.

If you're building the LCD display unit, you'll first need to solder the Stemma LCD Backpack to your 20×4 LCD. Once that's done:

1. Connect the LCD to one **QT Py** using a **Stemma QT cable**.
2. Connect your **SEN66 breakout** to a second **QT Py** with another Stemma QT cable.
3. Use a **6-pin GST cable** to link the **SEN66 sensor** to the **SEN66 breakout** — this connection is essential for the sensor to function.

With these connections in place, you'll be ready to power up, link to Adafruit IO, and start streaming live air quality data.

Learn about the LCD Backpack and how to assemble it here:



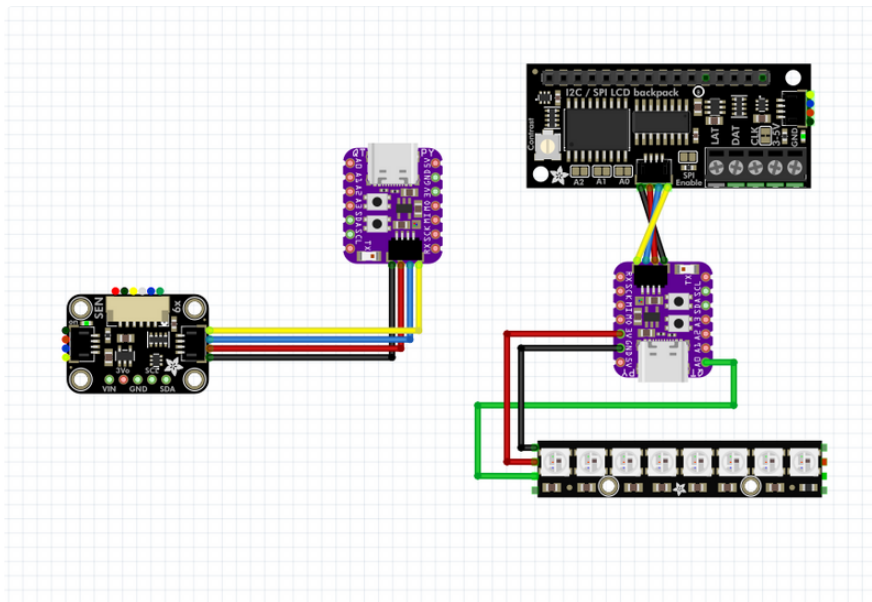
I2C/SPI LCD Backpack

By lady ada

[Overview](#)

<https://learn.adafruit.com/i2c-spi-lcd-backpack/overview>

If you want to connect up a NeoPixel stick to your SEN66 QT Py, just wire it up exactly like the LCD QT Py.



WipperSnapper Setup

The WipperSnapper firmware and ecosystem are in BETA and are actively being developed to add functionality, more boards, more sensors, and fix bugs. We encourage you to try out WipperSnapper with the understanding that it is not final release software and is still in development. If you encounter any bugs, glitches, or difficulties during the beta period, or with this guide, please contact us via <http://io.adafruit.com/support>

What is WipperSnapper

WipperSnapper is a firmware designed to turn any WiFi-capable board into an Internet-of-Things device without programming a single line of code. WipperSnapper connects to [Adafruit IO \(https://adafru.it/fsU\)](https://adafru.it/fsU), a web platform designed ([by Adafruit! \(https://adafru.it/Bo5\)](https://adafru.it/Bo5)) to display, respond, and interact with your project's data.

Simply load the WipperSnapper firmware onto your board, add credentials, and plug it into power. Your board will automatically register itself with your Adafruit IO account.

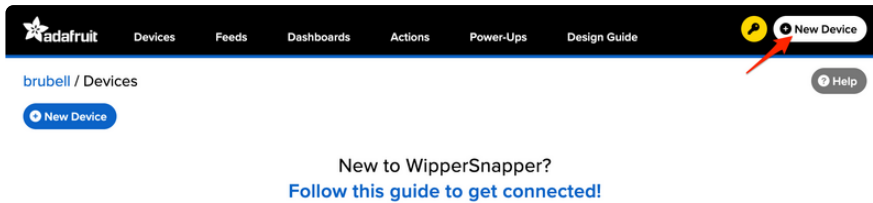
From there, you can add components to your board such as buttons, switches, potentiometers, sensors, and more! Components are dynamically added to hardware, so you can immediately start interacting, logging, and streaming the data your projects produce without writing code.

Sign up for Adafruit.io

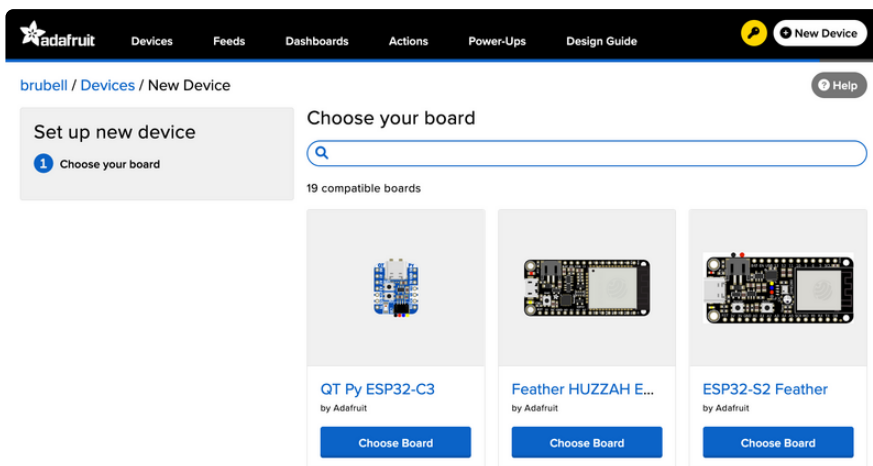
You will need an Adafruit IO account to use WipperSnapper on your board. If you do not already have one, head over to [io.adafruit.com \(https://adafru.it/fsU\)](https://adafru.it/fsU) to create a free account.

Add a New Device to Adafruit IO

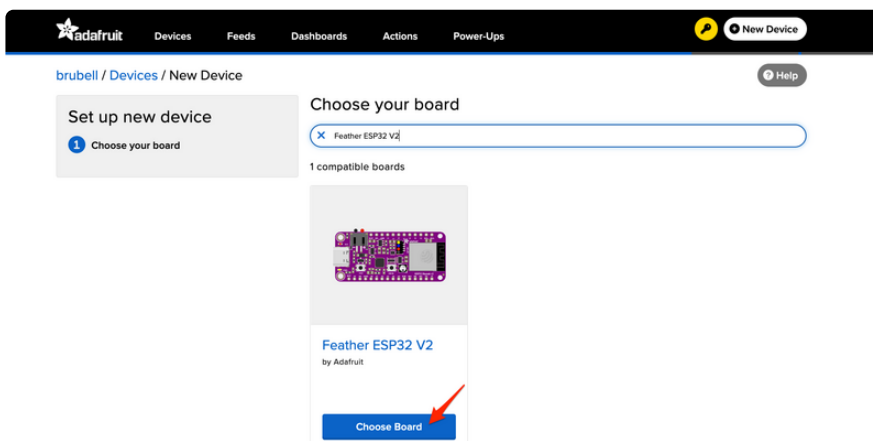
Log into your [Adafruit IO \(https://adafru.it/fsU\)](https://adafru.it/fsU) account. Click the New Device button at the top of the page.



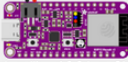
After clicking New Device, you should be on the board selector page. This page displays every board that is compatible with the WipperSnapper firmware.



In the board selector page's search bar, search for the Feather ESP32 V2. Once you've located the board you'd like to install WipperSnapper on, click the Choose Board button to bring you to the self-guided installation wizard.



Follow the step-by-step instructions on the page to install Wippersnapper on your device and connect it to Adafruit IO.



Installing: 1.0.0-beta.61

Set up a new Adafruit Feather ESP32 V2

- ✓ Choose board
- 2 Set up Secrets file**
- 3 Install via WebSerial
- 4 Connect!

Set up Secrets File

Next, we will generate a configuration file, named `secrets.json`, for your board. It will contain:

- Your Adafruit IO credentials
- Your WiFi settings
- (Optional) various advanced settings

⚠ Your WiFi network **MUST** have an available 2.4GHz frequency. Most modern WiFi routers have both 5GHz and 2.4GHz, but please confirm before moving forward. [Click here to learn more.](#)

🔒 Your WiFi SSID and Password never leave this browser, except to be downloaded by you or sent directly to your device. This sensitive information will not be saved anywhere else.

WiFi SSID

WiFi Password

Status LED Brightness

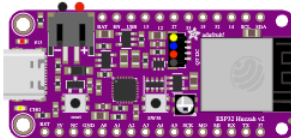
[← Back to Step 1](#)
Next Step

If the installation was successful, a popover should appear displaying that your board has successfully been detected by Adafruit IO.

Give your board a name and click "Continue to Device Page".

New Device Detected! ✕

You have successfully connected a new **feather-esp32-v2** device to Adafruit IO. It is already set up and submitting data. You can name the device here, and set up components on the device page.

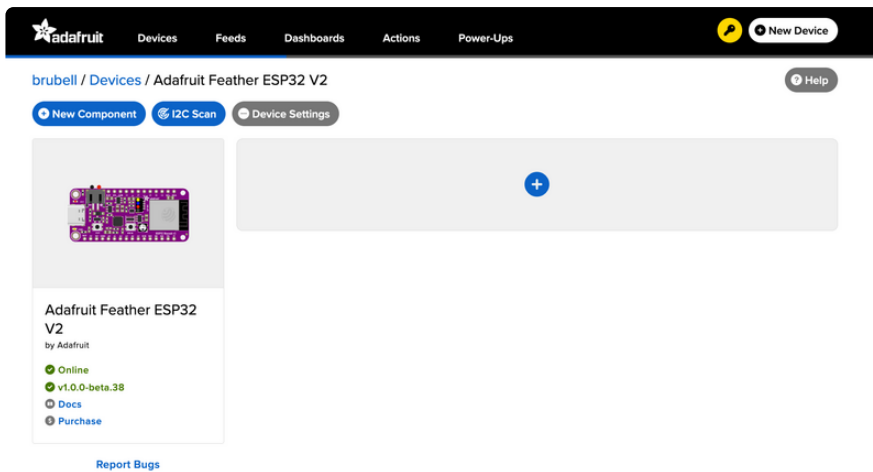


Device Name

Firmware Version: ✔ v1.0.0-beta.38

Continue to Device Page >

You should be brought to your board's device page.



Feedback

Adafruit.io WipperSnapper is in **beta** and you can help improve it!

If you have suggestions or general feedback about the installation process - visit <https://io.adafruit.com/support> (<https://adafru.it/Sgb>), click "Contact Adafruit IO Support" and select "I have feedback or suggestions for the WipperSnapper Beta".

Troubleshooting

If you encountered an issue during installation, please try the steps below first.

If you're still unable to resolve the issue, or if your issue is not listed below, get in touch with us directly at <https://io.adafruit.com/support> (<https://adafru.it/Sgb>). Make sure to click "Contact Adafruit IO Support" and select "There is an issue with WipperSnapper. Something is broken!"



I don't see my board on Adafruit IO, it is stuck connecting to WiFi

First, make sure that you selected the correct board on the board selector.

Next, please make sure that you entered your WiFi credentials properly, there are no spaces/special characters in either your network name (SSID) or password, and that you are connected to a 2.4GHz wireless network.

If you're still unable to connect your board to WiFi, please [make a new post on the WipperSnapper technical support forum](#) with the error you're experiencing, the LED colors which are blinking, and the board you're using. (<https://adafru.it/V6a>)



I don't see my board on Adafruit IO, it is stuck "Registering with Adafruit IO"

Try hard-resetting your board by unplugging it from USB power and plugging it back in.

If the error is still occurring, please [make a new post on the WipperSnapper technical support forum](#) with information about what you're experiencing, the LED colors which are blinking (if applicable), and the board you're using. (<https://adafru.it/V6a>)

"Uninstalling" WipperSnapper

WipperSnapper firmware is an application that is loaded onto your board. There is nothing to "uninstall". However, you may want to "move" your board from running WipperSnapper to running Arduino or CircuitPython. You also may need to restore your board to the state it was shipped to you from the Adafruit factory.

Moving from WipperSnapper to CircuitPython

Follow the steps on the [Installing CircuitPython page](https://adafru.it/Amd) (<https://adafru.it/Amd>) to install CircuitPython on your board running WipperSnapper.

- If you are unable to double-tap the RST button to enter the UF2 bootloader, follow the "Factory Resetting a WipperSnapper Board" instructions below.

Uploading this sketch will overwrite WipperSnapper. If you want to re-install WipperSnapper, follow the instructions at the top of this page.

Moving from WipperSnapper to Arduino

If you want to use your board with Arduino, you will use the Arduino IDE to load any sketch onto your board.

First, follow the page below to set up your Arduino IDE environment for use with your board.

Setup Arduino IDE

<https://adafru.it/YYC>

Then, follow the page below to upload the "Arduino Blink" sketch to your board.

Upload Arduino "Blink" Sketch

<https://adafru.it/10aN>

Uploading this sketch will overwrite WipperSnapper. If you want to re-install WipperSnapper, follow the instructions at the top of this page.

Factory Resetting a WipperSnapper Board

Sometimes, hardware gets into a state that requires it to be "restored" to the original state it shipped in. If you'd like to get your board back to its original factory state, follow the guide below.

**Factory Reset your Adafruit Feather
HUZZAH ESP32-V2**

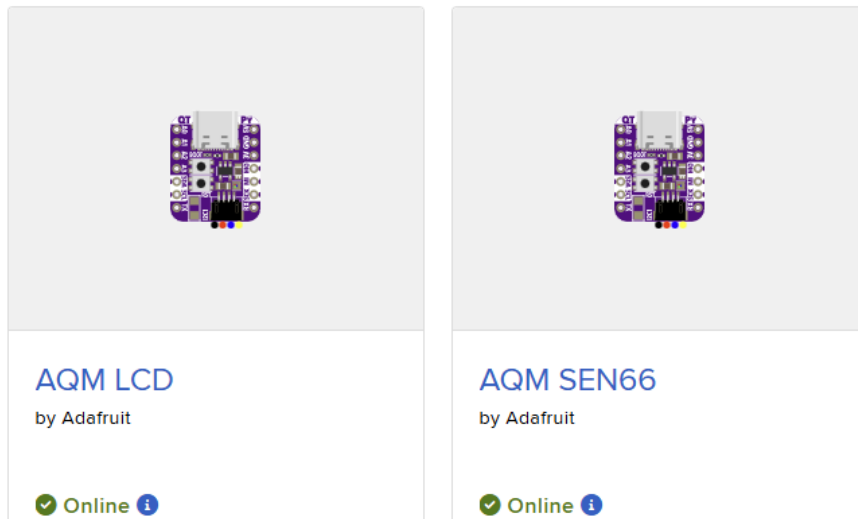
<https://adafru.it/10aO>

Adafruit IO Configuration

Assuming you have already gone through the WipperSnapper Setup page and connected your board(s) to WipperSnapper, [navigate to the WipperSnapper board list \(https://adafru.it/TAu\)](https://adafru.it/TAu). You likely will want to see two boards in your list, both QT Py boards. In my case, I named one of them AQM LCD, and one of them AQM SEN66.

On this page, start by setting up the SEN66 board by clicking on it.

- If you do not see your boards listed - go back to the WipperSnapper Setup Page and make sure they both register with Adafruit.io



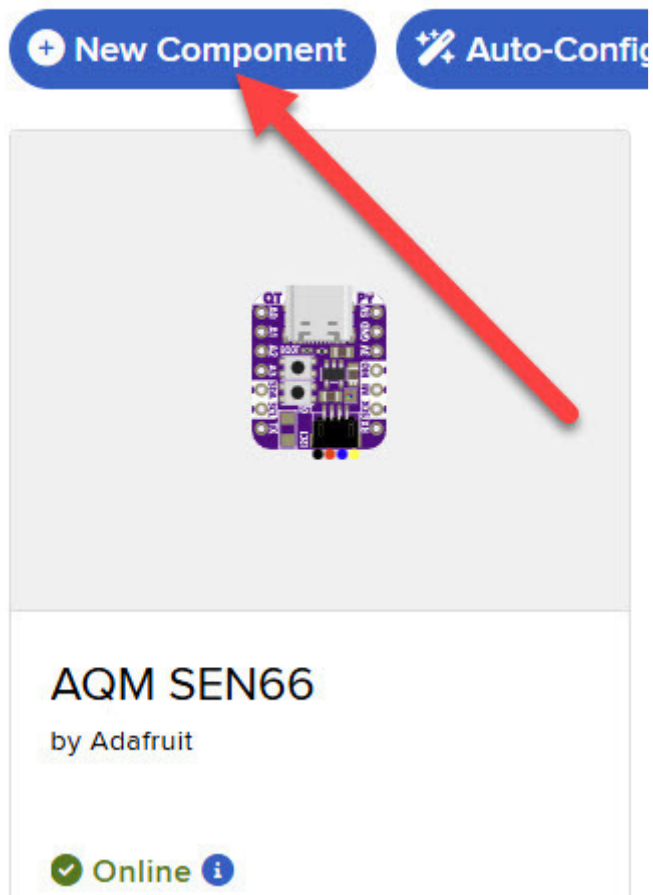
On the device page, quickly check that your device is online and is running the latest version of the WipperSnapper firmware.

The device tile on the left indicates the version number of the firmware running on the connected board.

- If the firmware version is green with a checkmark - continue with this guide.
- If the firmware version is red with an "X" - [update to the latest WipperSnapper firmware \(https://adafru.it/Vfd\)](https://adafru.it/Vfd) on your board before continuing.

Adding Components

From the SEN66 device page, start by setting up all of the components included in the SEN66 (there are a lot of them). Click on either the New Component Button, or the big + icon in the middle of the page.



In the pop-up, search for SEN66 and click on the SEN66 option to get to the set-up screen.

New Component

Which component would you like to set up?

✕ sen66

Displaying 1 matching Components.



i2c

SEN66

This little sensor contains temperature, humidity, pm10, pm25, pm100, voc-index, nox-index, and co2 sensing

[Product Page](#) 

[Documentation](#) 

On the Create SEN66 Component screen, you can see all of the data this little sensor provides. The only change I made is to uncheck the Temperature C, as I prefer to see the Temperature F. Other than that, you can speed up how often it reads data by switching all the Send Data dropdowns. But be careful if you are using a free account as this can cause you to hit your limit pretty fast. 15 minutes should be plenty fast here.

Create SEN66 Component ✕

Select I2C Address:

Enable SEN66: Temperature Sensor (°C)?

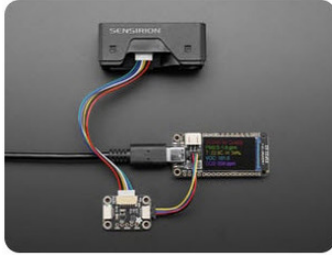
Enable SEN66: Temperature Sensor (°F)?
 Name:
 Send Data:

Enable SEN66: Humidity Sensor?
 Name:
 Send Data:

Enable SEN66: PM1.0 Standard?
 Name:
 Send Data:

Enable SEN66: PM2.5 Standard?
 Name:
 Send Data:

[← Back to Component Type](#)
Create Component




Your device page should now be populated with all of the different sensors included in the SEN66 (it may take 15 minutes for data to populate).

tcooper / Devices / AQM SEN66

Help

New Component
Auto-Config
I2C Scan
Settings



AQM SEN66
by Adafruit

SEN66: CO2 sen66.co2

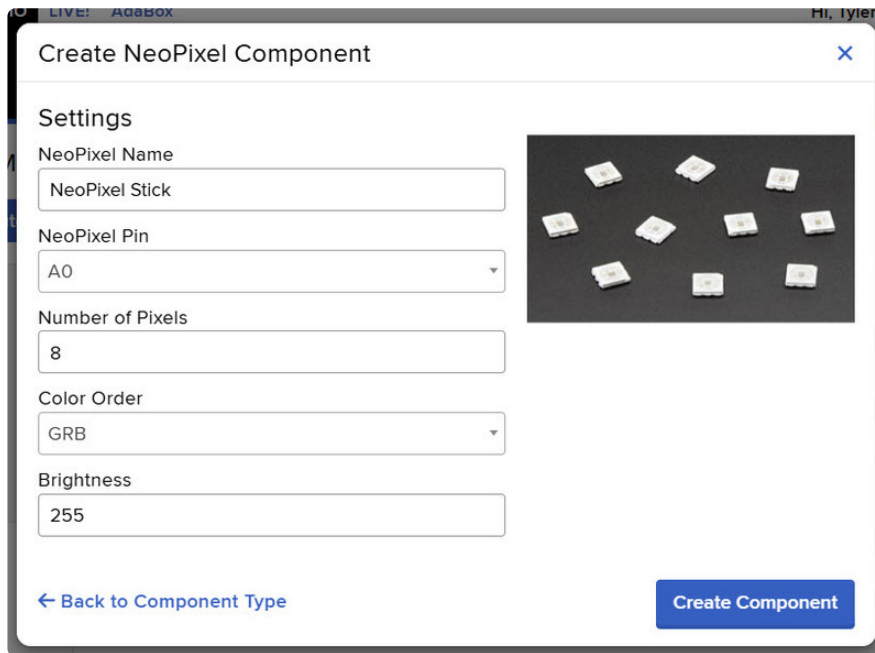
- ppm

SEN66: Humidity Sensor sen66.humidity

41.97%

If you soldered up a NeoPixel stick to your project, you will need to add that as well. Just like above, click the New Component button, then search for NeoPixel. Then in

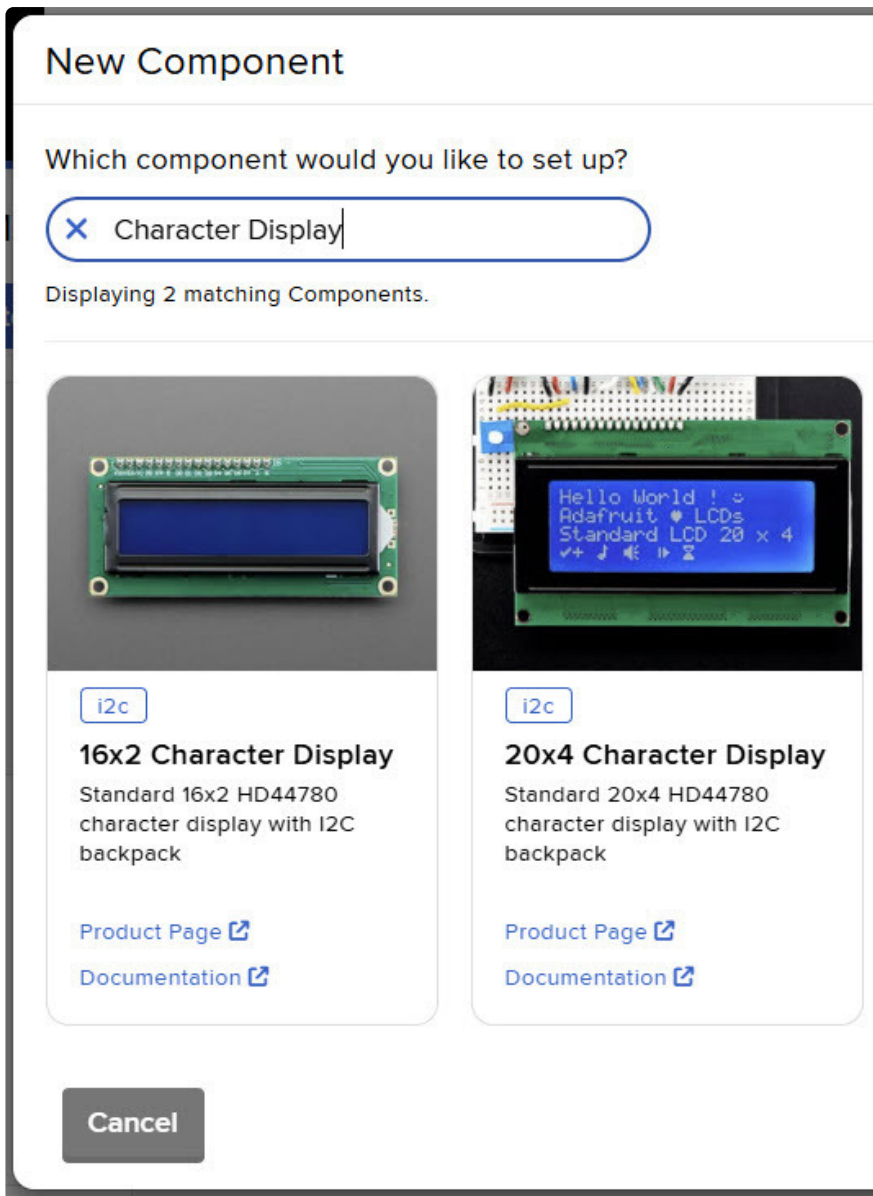
the settings, you can adjust the name if you want, change the pin to A0 (or whatever you soldered the data pin of the NeoPixel stick to), and set the number of pixels to 8.



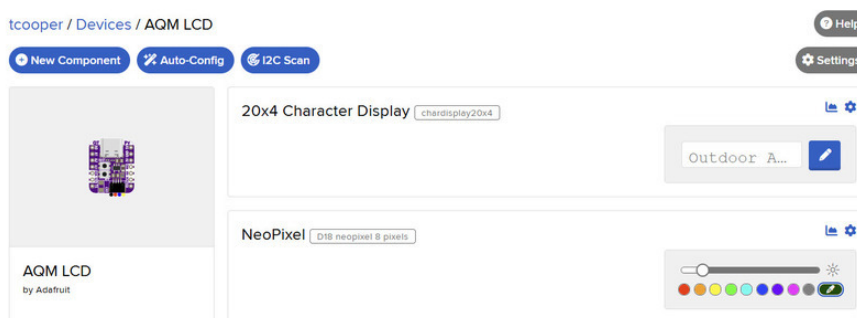
You should now see the NeoPixel Stick component at the top of your list. Feel free to mess around with the colors and make sure the changes show up on your device.



Just like with the AQM SEN66 device, do the same for the AQM LCD device. Make sure this device is connected and updated with the latest firmware like above, then click New Component, and search for Character Display.



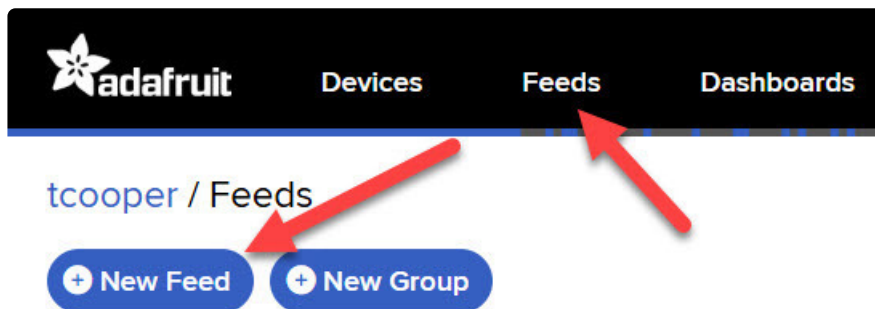
For my project, I am using the 20x4 Character Display, so I will choose that one. But you could use either display here. Then you can change the name if you want and click the Create Component button. Do the same with the NeoPixel stick if you are adding that to your project as well (exactly like we did above).



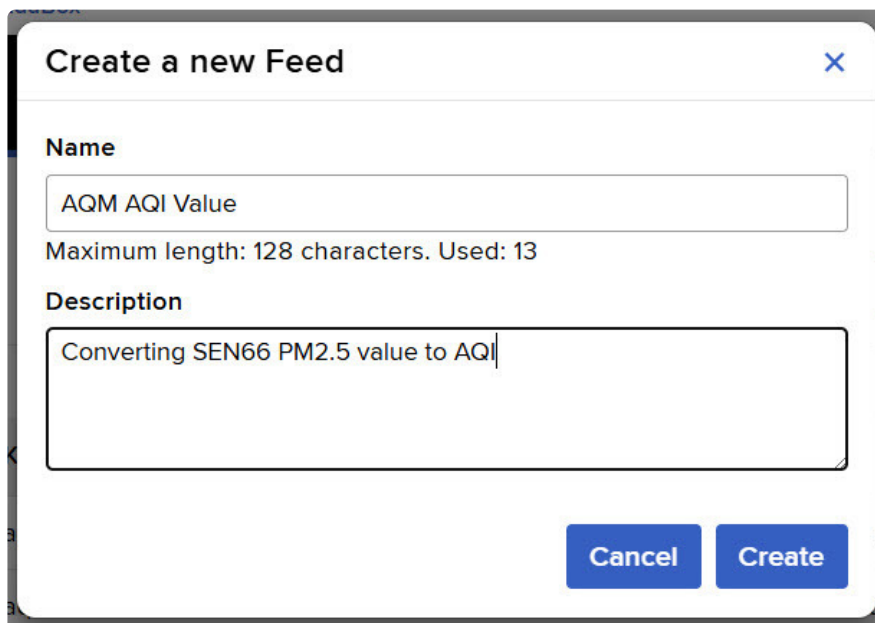
The next step sets up the Adafruit IO Actions to get all of this to work.

Set Up Adafruit IO Actions

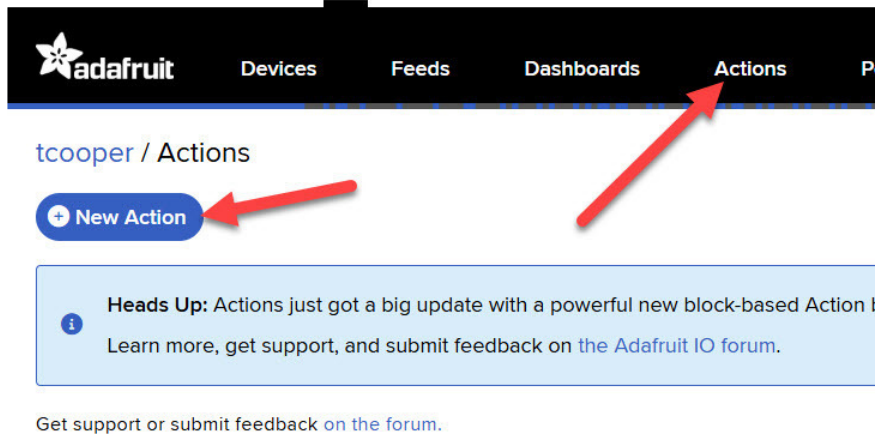
I really like being able to see an air quality index (AQI) value, as I find it more readable than just reading a PM2.5 value. So to start with, you will convert the SEN66's PM2.5 value to AQI. But in order to do that, you need to create a new feed. You need this new blank feed to store the AQI value to it. In the top navigation, click on the Feeds link. Then, on this page, click the New Feed button.



Then create a feed called AQM AQI Value, give it a description, and click the Create button.

A screenshot of a modal dialog box titled 'Create a new Feed'. The dialog has a close button (X) in the top right corner. It contains two input fields. The first is labeled 'Name' and contains the text 'AQM AQI Value'. Below this field, it says 'Maximum length: 128 characters. Used: 13'. The second field is labeled 'Description' and contains the text 'Converting SEN66 PM2.5 value to AQI'. At the bottom right of the dialog, there are two buttons: 'Cancel' and 'Create'.

Now create this first Action. Go to Actions in the top navigation, and click the New Action button.



Then give this action a title of AQM AQI Calculator, and an optional description.

This first action is mostly just mapping the PM2.5 value to spit out the correct AQI value. The action looks a lot more complicated than it really is. A lot of copying and pasting of blocks will make quick work of setting this one up.

This action will trigger any time there is new PM2.5 data from the SEN66, convert it to AQI, and store it in the feed we just created.

Triggers:

When AQM SEN66: SEN66: PM2.5 Standard gets any data

Actions:

Set variable pm_reading = Get AQM SEN66: SEN66: PM2.5 Standard

if Get variable pm_reading \geq 0 and Get variable pm_reading $<$ 12

do Set My Feeds: AQM AQI Value to: Round Map Value: Get variable pm_reading From: (0 , 12) To: (0 , 50)

- else if Get variable pm_reading \geq 12 and Get variable pm_reading $<$ 35.5

do Set My Feeds: AQM AQI Value to: Round Map Value: Get variable pm_reading From: (12 , 35) To: (51 , 100)

- else if Get variable pm_reading \geq 35.5 and Get variable pm_reading $<$ 55.5

do Set My Feeds: AQM AQI Value to: Round Map Value: Get variable pm_reading From: (36 , 55) To: (101 , 150)

- else if Get variable pm_reading \geq 55.5 and Get variable pm_reading $<$ 150.5

do Set My Feeds: AQM AQI Value to: Round Map Value: Get variable pm_reading From: (56 , 150) To: (151 , 200)

- else if true

do

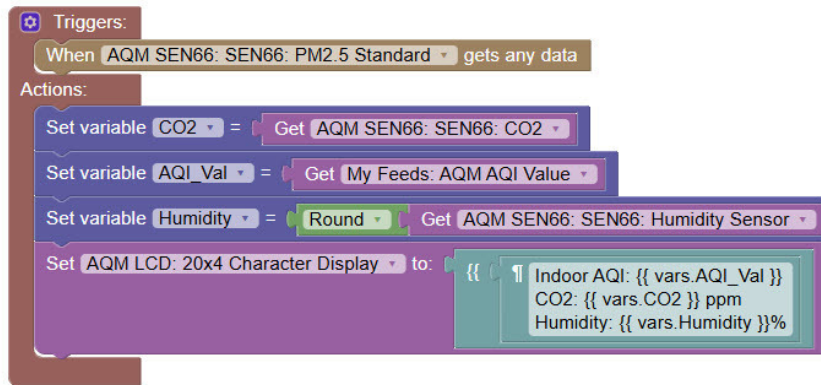
+ else if

+ else

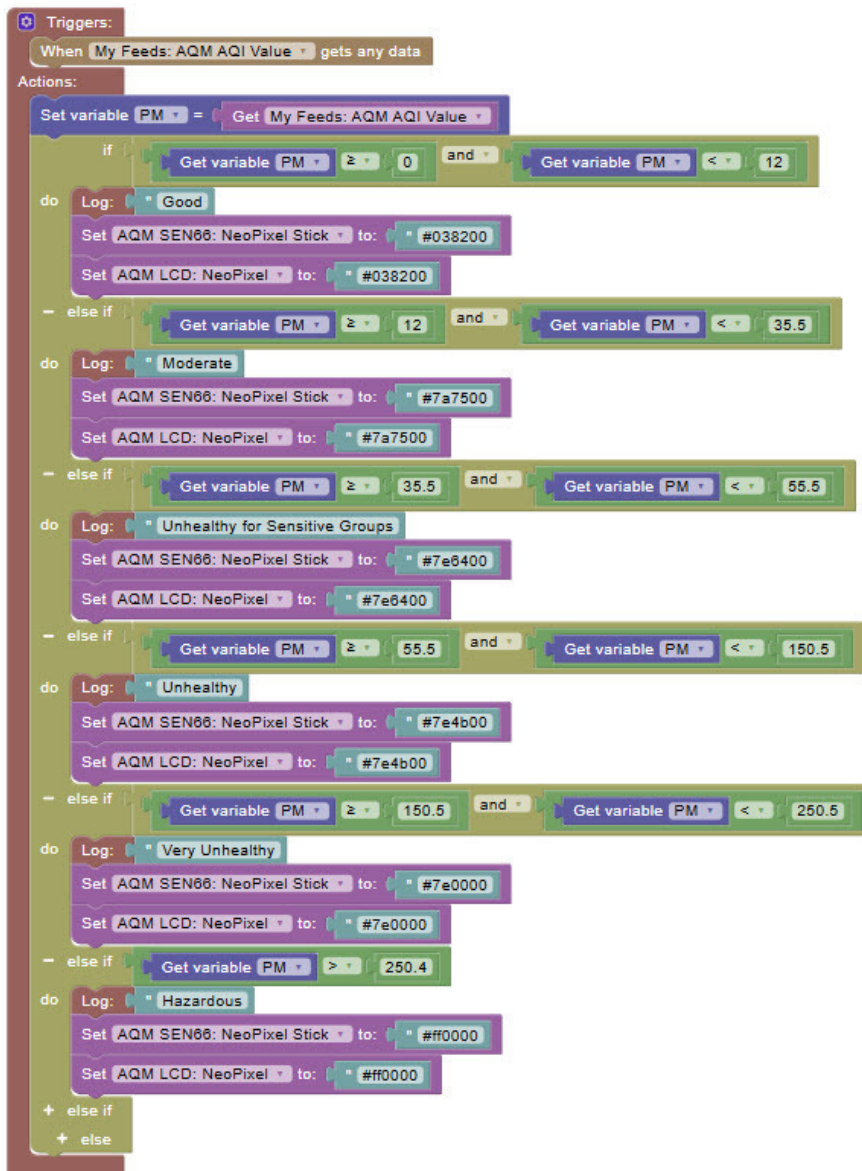
If you aren't sure how to use Adafruit IO Actions, please check out this guide: <https://learn.adafruit.com/how-to-use-blockly-for-actions-on-adafruit-io>

Make sure to click the Save and Run button at the top, then go back to the Actions page. Now to create a new action to show all of this data on the 20x4 Character Display.

Create a new action called AQM 20x4, and give it a description (optional).



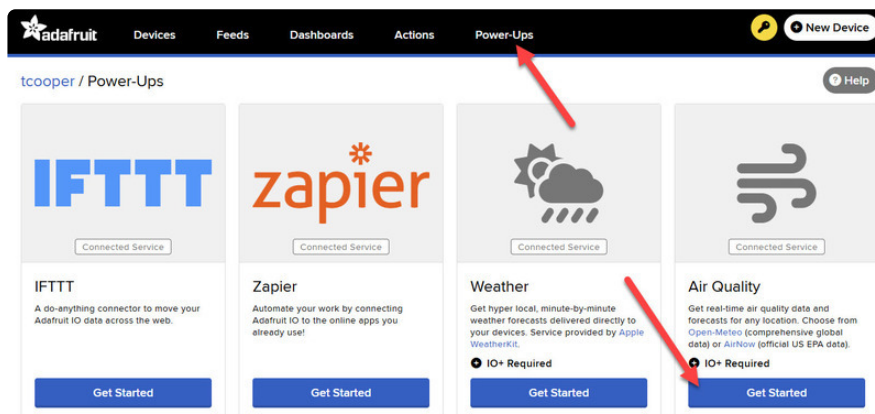
This action will trigger it anytime the SEN66 PM2.5 feed gets new data. Set variables within the action to whichever of the SEN66 you would like displayed. In my case, I want to see the CO2, the new AQI feed we just created, and humidity.



If you chose to add NeoPixel Sticks to your builds, you will need to create another action to set these colors. I called this action AQI Categories, to break down the AQI numbers into their respective categories, then it will set the NeoPixel Stick colors based on these categories.

AIO+ Bonus: Outside AQI

If you have Adafruit IO+, you can utilize the new Air Quality Power-Up. In the top navigation, click on Power-Ups, then click Get Started on the Air Quality Power-Up.



From here, you will need to add a location to track, and choose which Data Provider to use. If you are in the US, choose AirNow, and if you are outside of the US, choose Open-Meteo. Once you have created the new location, you should see it in the left side of the Power-Up.

Current Locations

[+ Add Location](#)

ID	Name	Location	Last Updated	
5	Minneapolis	44.977753,-93.265015	2 days ago	View

Now, go back to the 20x4 Action previously worked on, and make the following updates:

Triggers:

- When AQM SEN66: SEN66: PM2.5 Standard gets any data

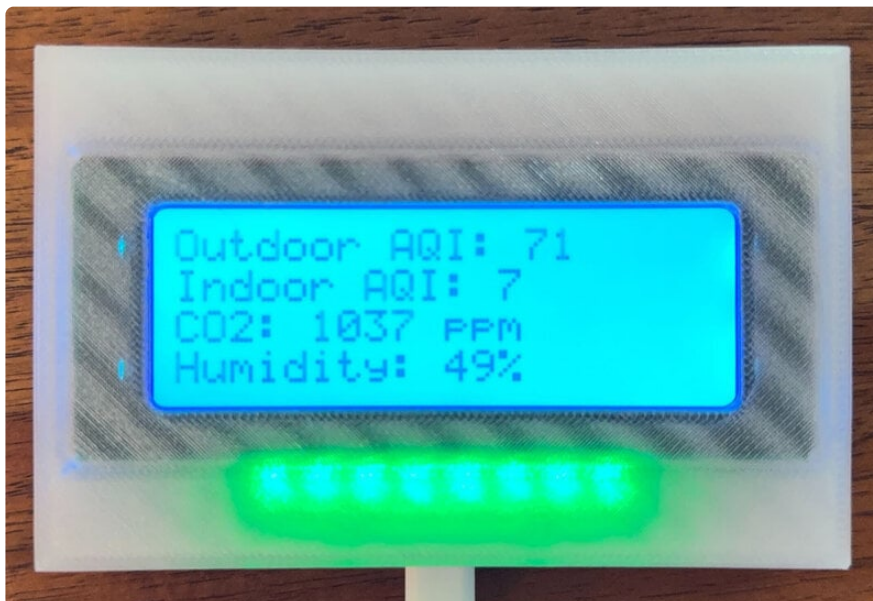
Actions:

- Set variable Outside_AQI = Air Quality
 - At: Minneapolis
 - When: Now
 - Metric: AQI (Now: 60)
 - Now: 60
- Set variable CO2 = Get AQM SEN66: SEN66: CO2
- Set variable AQI_Val = Get My Feeds: AQM AQI Value
- Set variable Humidity = Round Get AQM SEN66: SEN66: Humidity Sensor
- Set AQM LCD: 20x4 Character Display to:


```

      {{
      | Outdoor AQI: {{ vars.Outside_AQI }}
      | Indoor AQI: {{ vars.AQI_Val }}
      | CO2: {{ vars.CO2 }} ppm
      | Humidity: {{ vars.Humidity }}%
      }}
      
```

You should now see indoor and outdoor AQI on your display!



3D Prints and Assembly (optional)



If you have access to a 3D printer, you can download the files below and print the custom enclosures. I printed the case tops in transparent filament (clear PETG) so I could see the NeoPixel Stick through the print. But if you aren't using the NeoPixel sticks, you could print all in black. Or print the entire thing in clear PETG.

Everything is snap fit, except for the M2x4mm screws I used to secure the NeoPixel Sticks.



The LCD display can be slid into the optional dock once assembled.



AQM_SEN66_Body.stl

<https://adafru.it/1ary>

AQM_SEN66_Cover.stl

<https://adafru.it/1arz>

AQM_LCD_Body.stl

<https://adafru.it/1arA>

AQM_LCD_Cover.stl

<https://adafru.it/1arB>

AQM_LCD_Dock.stl

<https://adafru.it/1arC>