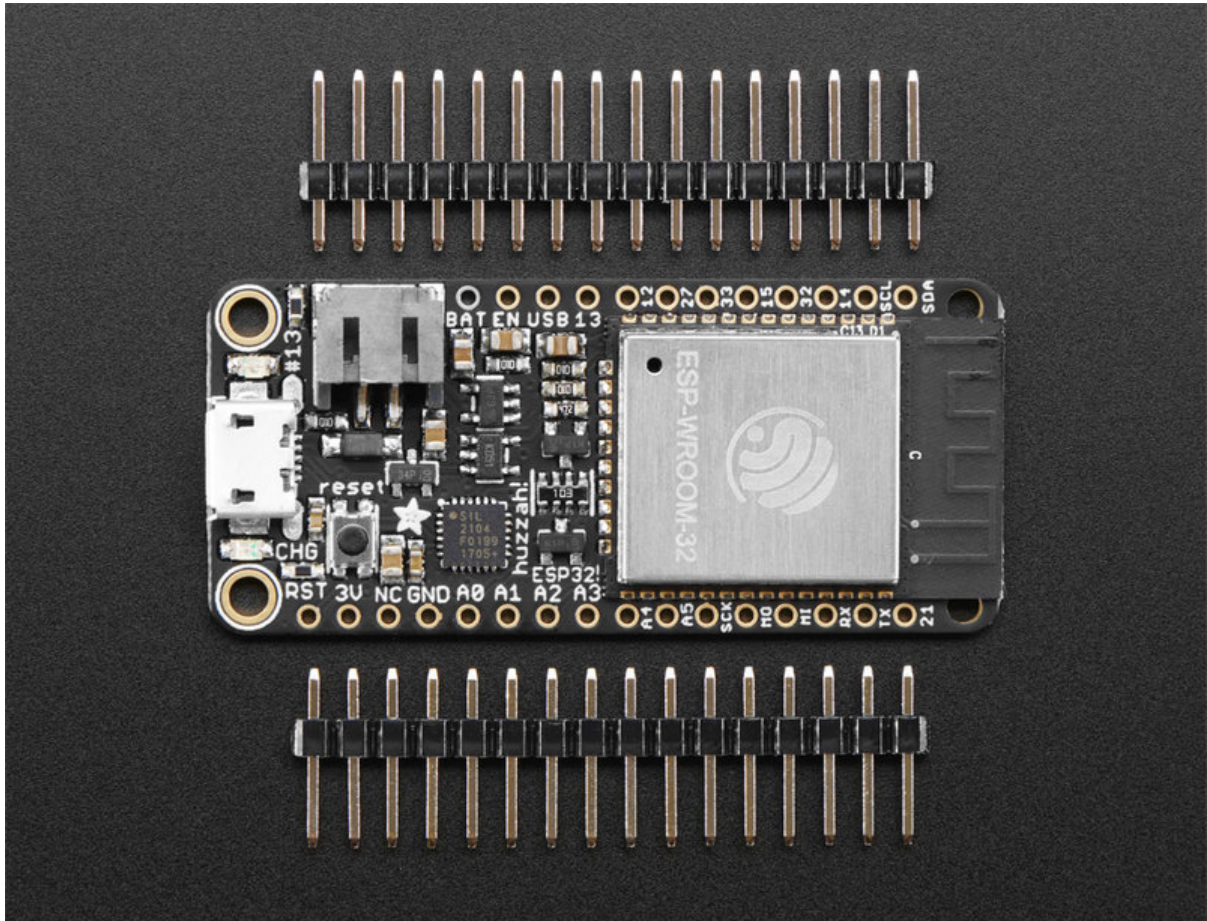




# Adafruit HUZZAH32 - ESP32 Feather

Created by lady ada



<https://learn.adafruit.com/adafruit-huzzah32-esp32-feather>

Last updated on 2024-11-13 12:40:31 PM EST

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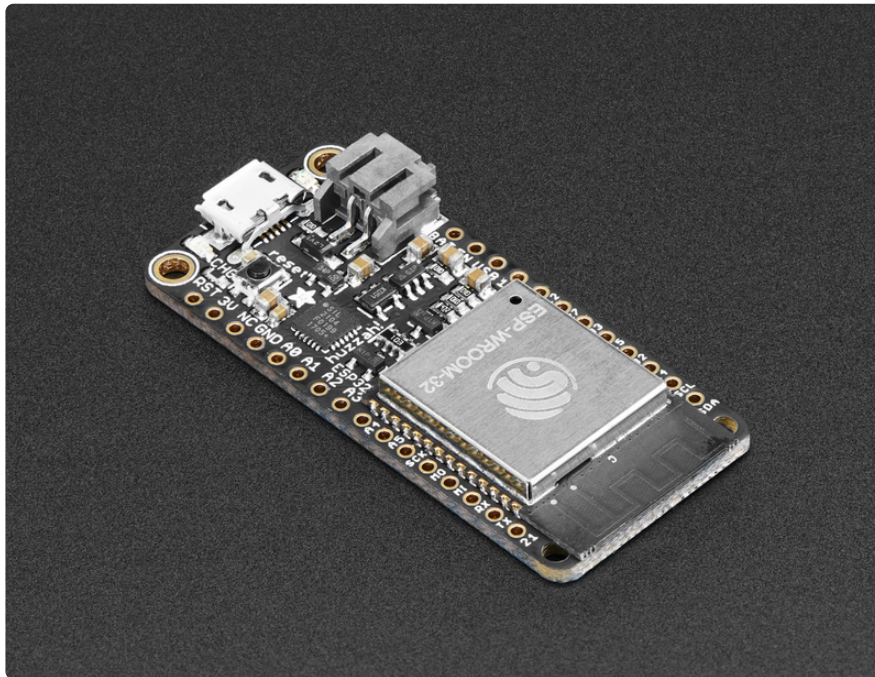
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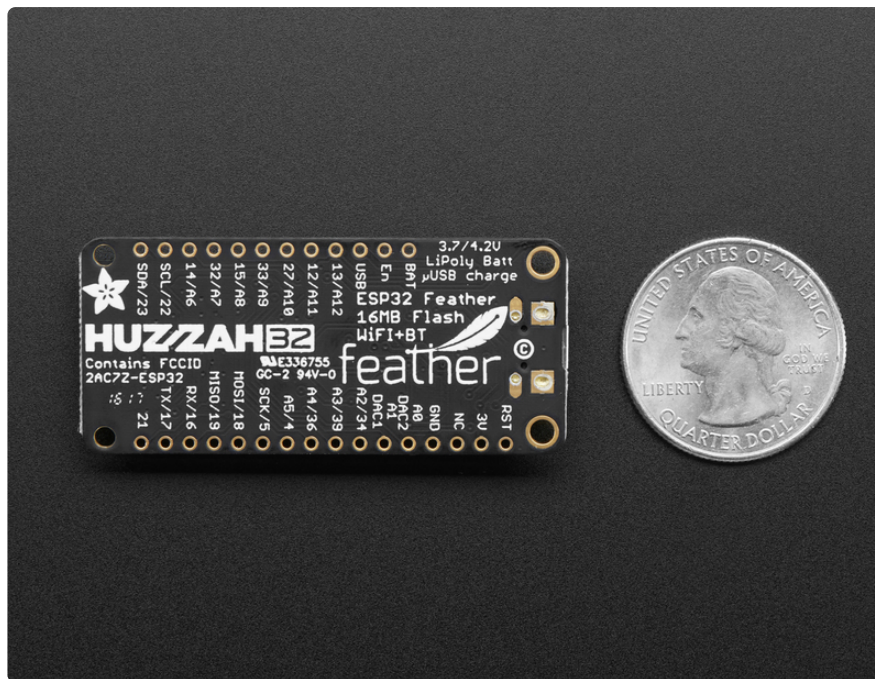
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# Overview



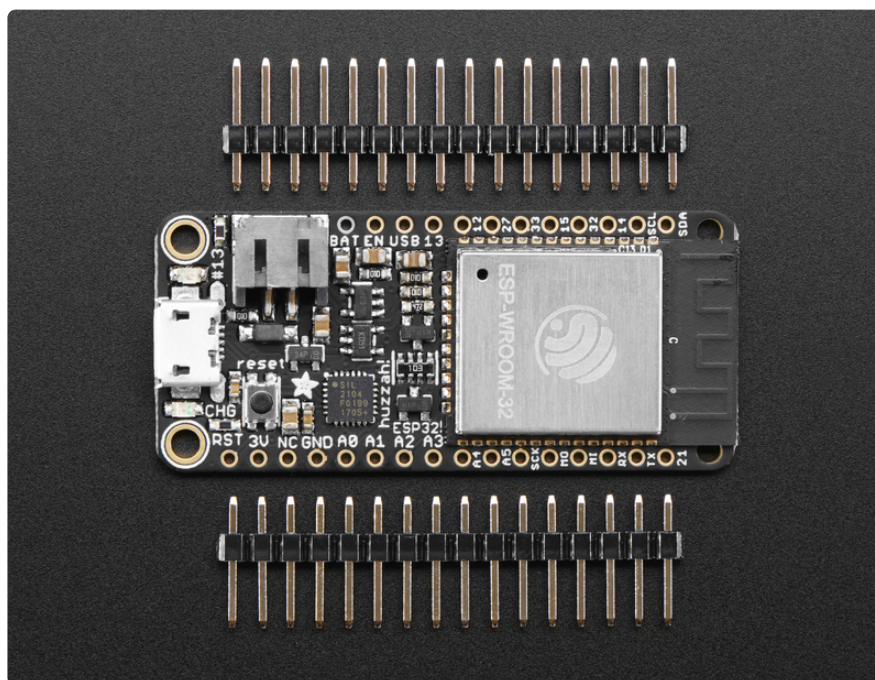
Aww yeah, it's the Feather you have been waiting for! The HUZZAH32 is our ESP32-based Feather, made with the official WROOM32 module. We packed everything you love about Feathers: built in USB-to-Serial converter, automatic bootloader reset, Lithium Ion/Polymer charger, and all the GPIO brought out so you can use it with any of our Feather Wings.

That module nestled in at the end of this Feather contains a dual-core ESP32 chip, 4 MB of SPI Flash, tuned antenna, and all the passives you need to take advantage of this powerful new processor. The ESP32 has both WiFi and Bluetooth Classic/LE support. That means it's perfect for just about any wireless or Internet-connected project.



Because it is part of our [Feather eco-system you can take advantage of the 50+ Wings](https://adafru.it/wev) (<https://adafru.it/wev>) that we've designed, to add all sorts of cool accessories

The ESP32 is a perfect upgrade from the ESP8266 that has been so popular. In comparison, the ESP32 has way more GPIO, plenty of analog inputs, two analog outputs, multiple extra peripherals (like a spare UART), two cores so you don't have to yield to the WiFi manager, much higher-speed processor, etc. etc! We think that as the ESP32 gets traction, we'll see more people move to this chip exclusively, as it is so full-featured.



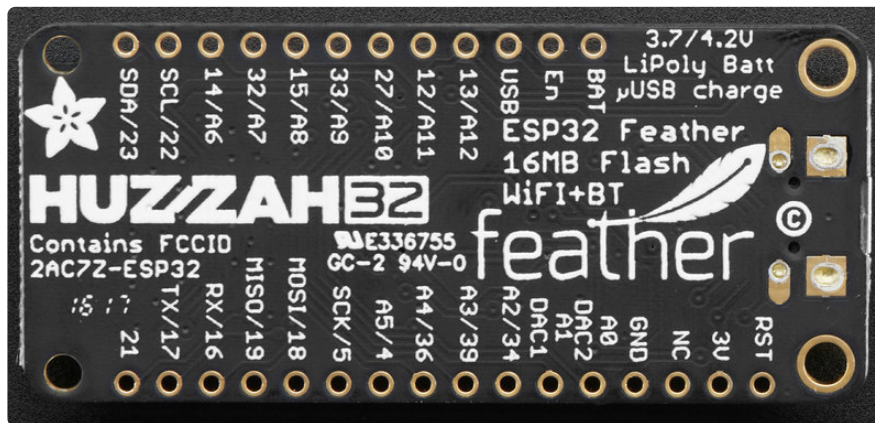
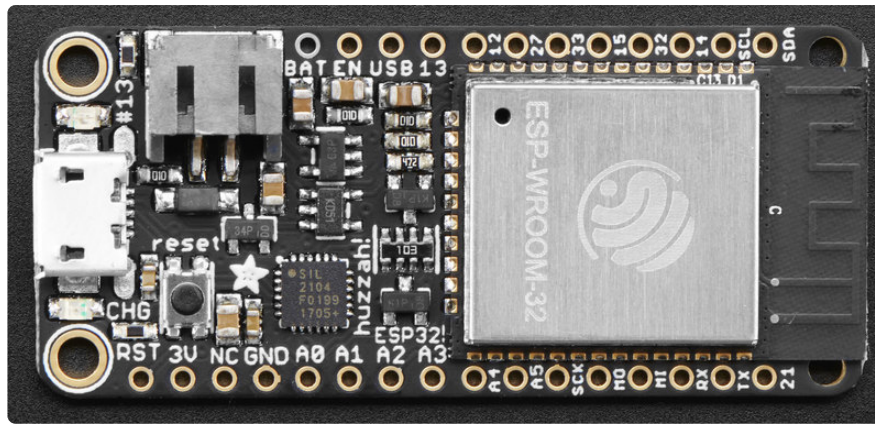
**Please note: The ESP32 is still targeted to developers.** Not all of the peripherals are fully documented with example code, and there are some bugs still being found and fixed. We got all of our Featherwings working under Arduino IDE, so you can expect things like I2C and SPI and analog reads to work. But other elements are still under development. For that reason, we recommend this Feather for makers who have some experience with microcontroller programming, and not as a first dev board.

Here are [specifications from Espressif about the ESP32 \(https://adafru.it/wew\)](https://adafru.it/wew)

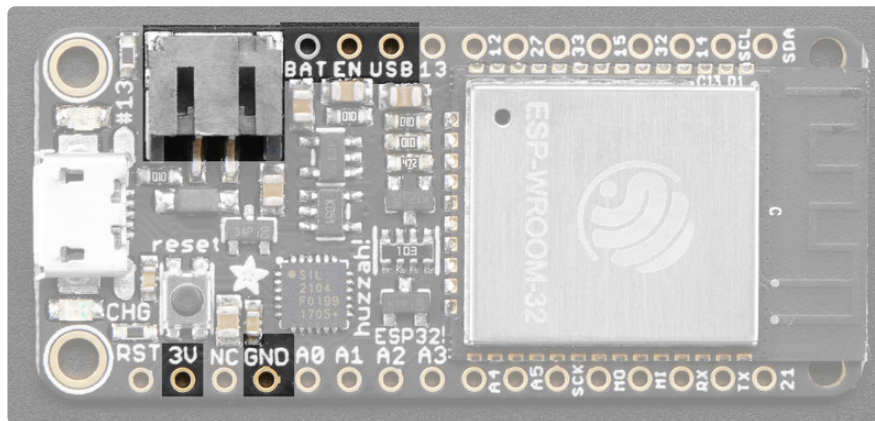
- 240 MHz dual core Tensilica LX6 microcontroller with 600 DMIPS
- Integrated 520 KB SRAM
- Integrated 802.11b/g/n HT40 Wi-Fi transceiver, baseband, stack and LWIP
- Integrated dual mode Bluetooth (classic and BLE)
- 4 MByte flash
- On-board PCB antenna
- Ultra-low noise analog amplifier
- Hall sensor
- 10x capacitive touch interface
- 32 kHz crystal oscillator
- 3 x UARTs (only two are configured by default in the Feather Arduino IDE support, one UART is used for bootloading/debug)
- 3 x SPI (only one is configured by default in the Feather Arduino IDE support)
- 2 x I2C (only one is configured by default in the Feather Arduino IDE support)
- 12 x ADC input channels
- 2 x I2S Audio
- 2 x DAC
- PWM/timer input/output available on every GPIO pin
- OpenOCD debug interface with 32 kB TRAX buffer
- SDIO main/secondary 50 MHz
- SD-card interface support







## Power Pins



- **GND** - this is the common ground for all power and logic
- **BAT** - this is the positive voltage to/from the JST jack for the optional Lipoly battery
- **USB** - this is the positive voltage to/from the micro USB jack if connected
- **EN** - this is the 3.3V regulator's enable pin. It's pulled up, so connect to ground to disable the 3.3V regulator
- **3V** - this is the output from the 3.3V regulator. The regulator can supply 500mA peak but half of that is drawn by the ESP32, and it's a fairly power-hungry chip.

So if you need a ton of power for stuff like LEDs, motors, etc. Use the **USB** or **BAT** pins, and an additional regulator

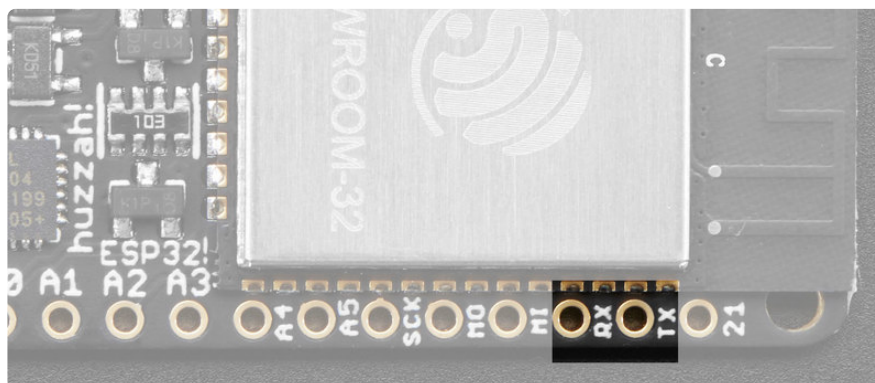
## Logic pins

This is the general purpose I/O pin set for the microcontroller. All logic is 3.3V

The ESP32 runs on 3.3V power and logic, and unless otherwise specified, GPIO pins are not 5V safe!

## Serial pins

**RX** and **TX** are the additional Serial1 pins, and are not connected to the USB/Serial converter. That means you can use them to connect to UART-devices like GPS's, fingerprint sensors, etc.

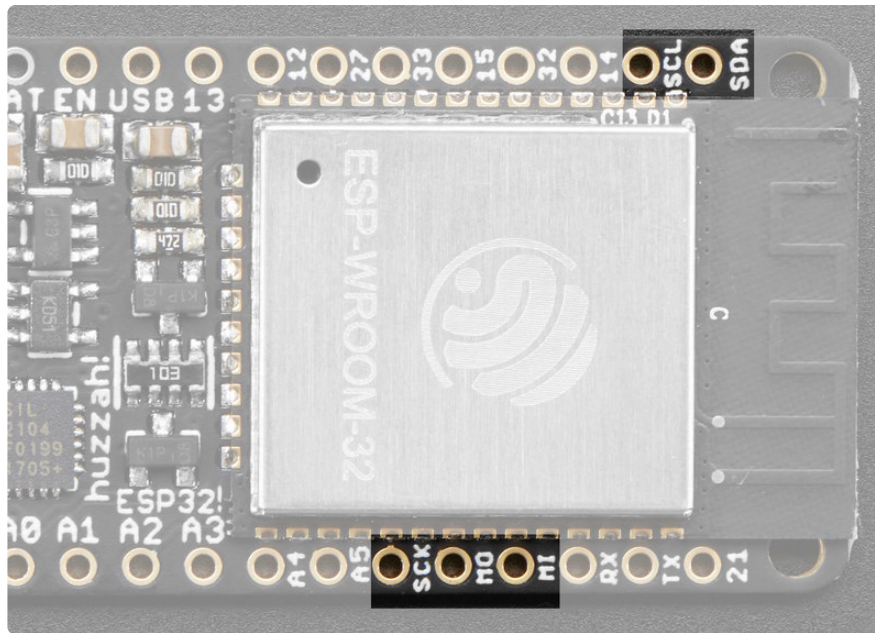


The **TX** pin is the output from the module. The **RX** pin is the input into the module. Both are 3.3V logic

## I2C & SPI pins

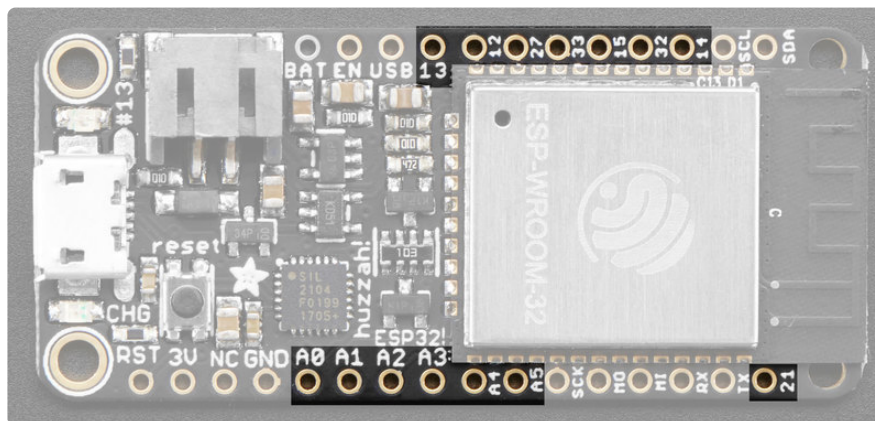
You can use the ESP32 to control I2C and SPI devices, sensors, outputs, etc. If using with Arduino, the standard **Wire** and **SPI** devices work as you'd expect!





Note that the I2C pins **do not have pullup resistors** already! You must add them if you want to communicate with an I2C device

## GPIO & Analog Pins



There are tons of GPIO and analog inputs available to you for connecting LEDs, buttons, switches, sensors, etc. Here's the remaining pins available.

Bottom row:

- **A0** - this is an analog input A0 and also an analog output DAC2. It can also be used as a GPIO #26. It uses ADC #2
- **A1** - this is an analog input A1 and also an analog output DAC1. It can also be used as a GPIO #25. It uses ADC #2
- **A2** - this is an analog input A2 and also GPIO #34. Note it is not an output-capable pin! It uses ADC #1
- **A3** - this is an analog input A3 and also GPIO #39. Note it is not an output-capable pin! It uses ADC #1

- **A4** - this is an analog input A4 and also GPIO #36. Note it is not an output-capable pin! It uses ADC #1
- **A5** - this is an analog input A5 and also GPIO #4. It uses ADC #2
- **21** - General purpose IO pin #21

Top row:

- **13** - This is GPIO #13 and also an analog input A12 on ADC #2. It's also connected to the red LED next to the USB port
- **12** - This is GPIO #12 and also an analog input A11 on ADC #2. This pin has a pull-down resistor built into it, we recommend using it as an output only, or making sure that the pull-down is not affected during boot.
- **27** - This is GPIO #27 and also an analog input A10 on ADC #2
- **33** - This is GPIO #33 and also an analog input A9 on ADC #1. It can also be used to connect a 32 KHz crystal.
- **15** - This is GPIO #15 and also an analog input A8 on ADC #2
- **32** - This is GPIO #32 and also an analog input A7 on ADC #1. It can also be used to connect a 32 KHz crystal.
- **14** - This is GPIO #14 and also an analog input A6 on ADC #2

There's also an external analog input

- **A13** - This is general purpose input #35 and also an analog input A13, which is a resistor divider connected to the **VBAT** line

Note you cannot read analog inputs on **ADC #2** once WiFi has started as it is shared with the WiFi module.

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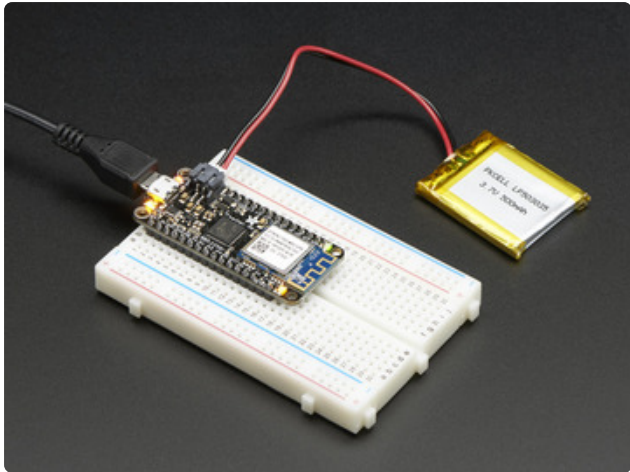
## Assembly

We ship Feathers fully tested but without headers attached - this gives you the most flexibility on choosing how to use and configure your Feather

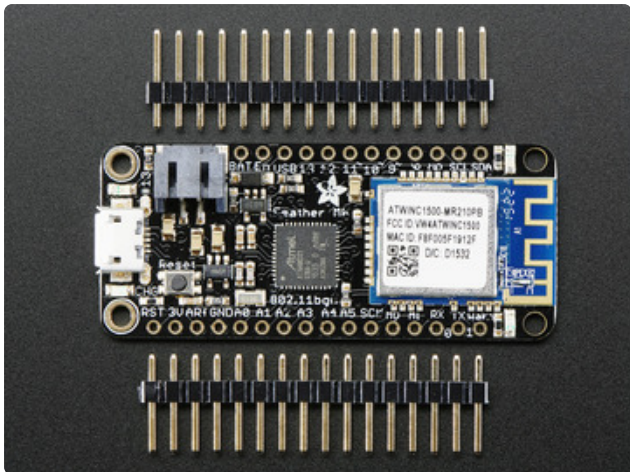
## Header Options!

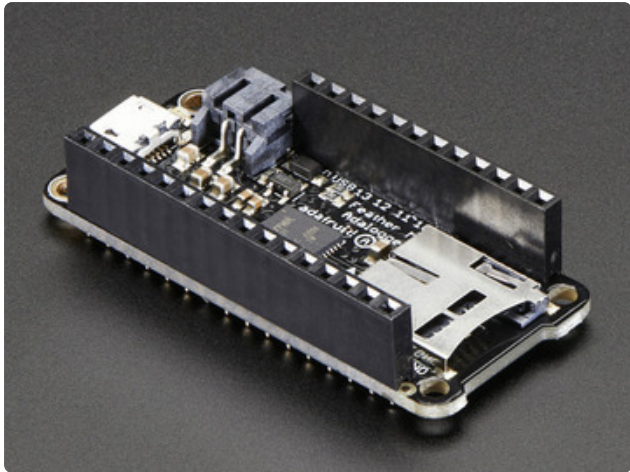
Before you go gung-ho on soldering, there's a few options to consider!



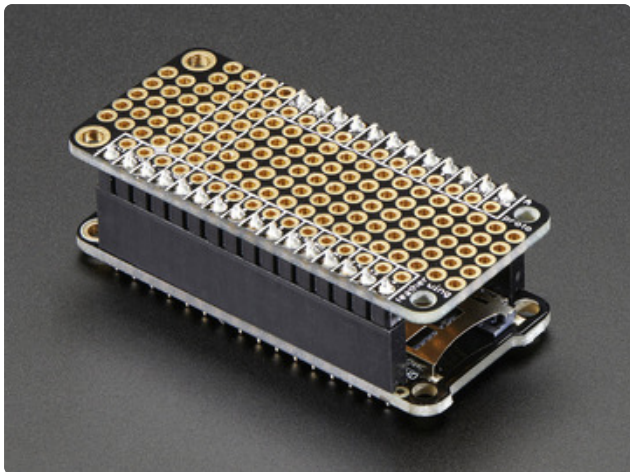


The first option is soldering in plain male headers, this lets you plug in the Feather into a solderless breadboard

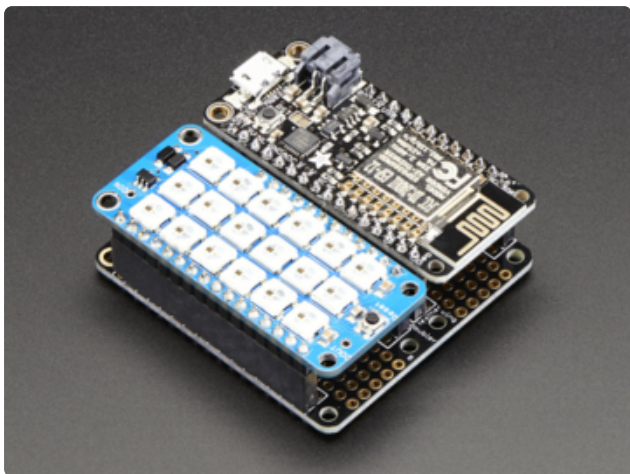


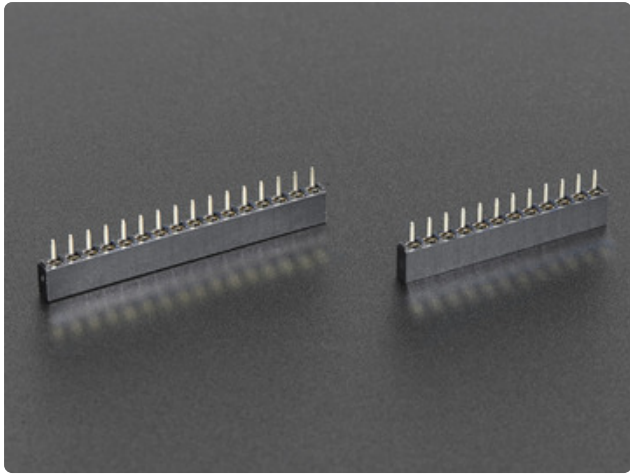


Another option is to go with socket female headers. This won't let you plug the Feather into a breadboard but it will let you attach featherwings very easily

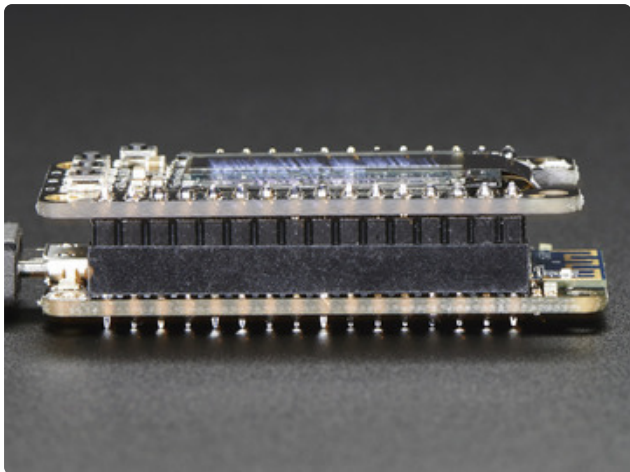


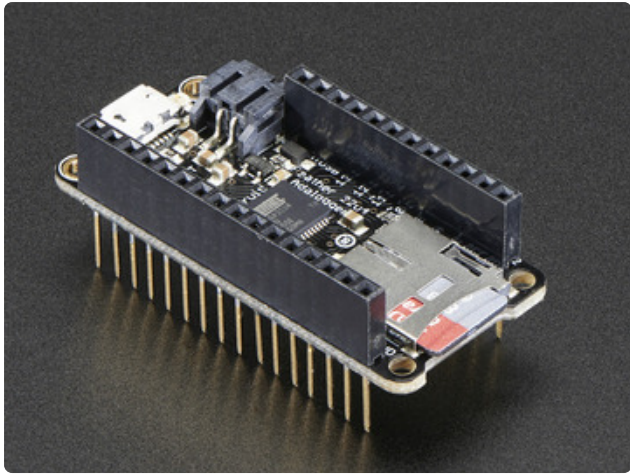
A few Feather boards require access to top-side components like buttons or connectors, making stacking impractical. Sometimes you can stack in the opposite order—FeatherWing underneath—or, if both Feather and Wing require top-side access, place the boards side-by-side with a [FeatherWing Doubler](http://adafru.it/2890) (<http://adafru.it/2890>) or [Tripler](http://adafru.it/3417) (<http://adafru.it/3417>).



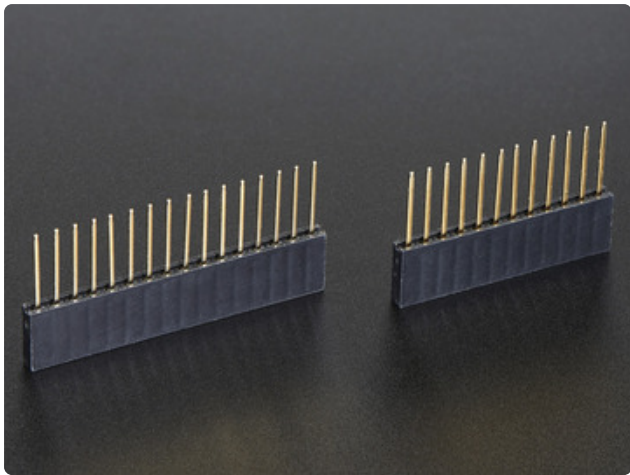


We also have 'slim' versions of the female headers, that are a little shorter and give a more compact shape

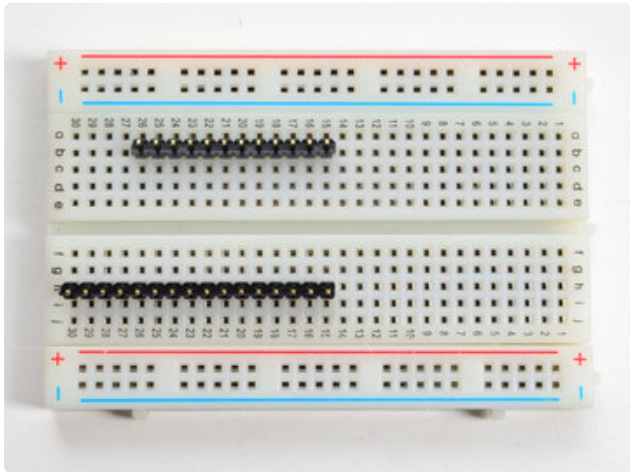




Finally, there's the "Stacking Header" option. This one is sort of the best-of-both-worlds. You get the ability to plug into a solderless breadboard and plug a featherwing on top. But its a little bulky

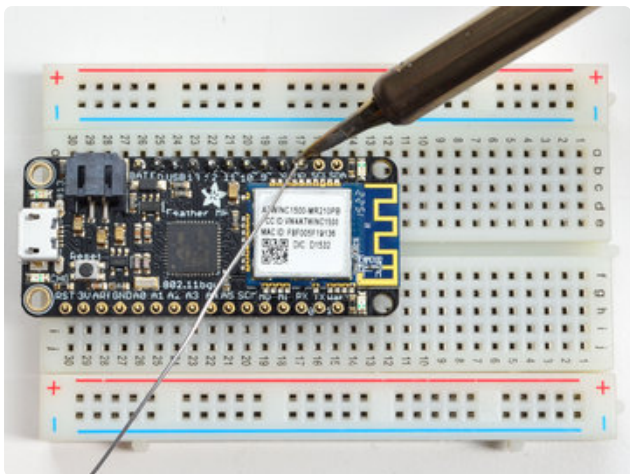
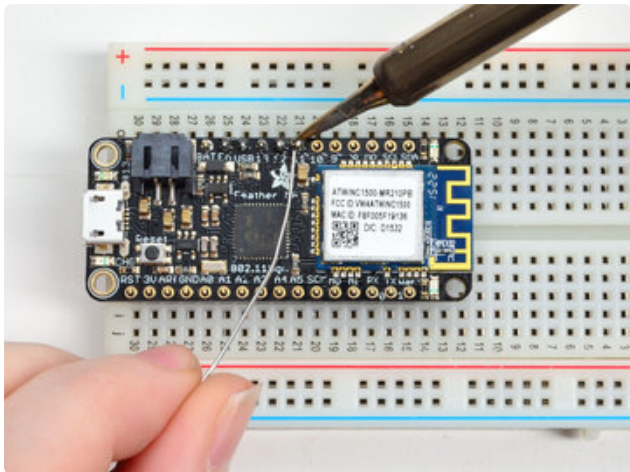
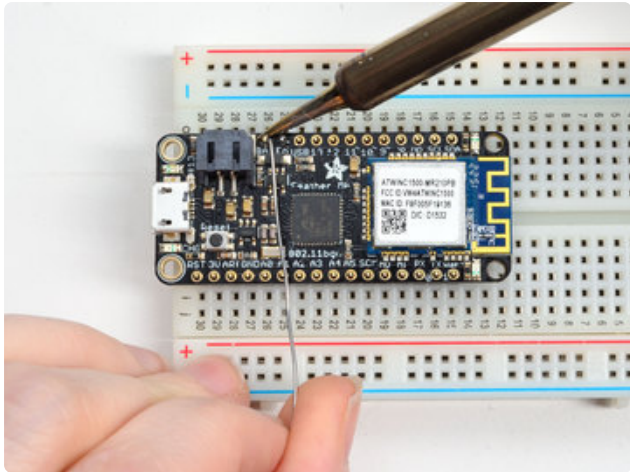


## Soldering in Plain Headers



**Prepare the header strip:**  
Cut the strip to length if necessary. It will be easier to solder if you insert it into a breadboard - **long pins down**





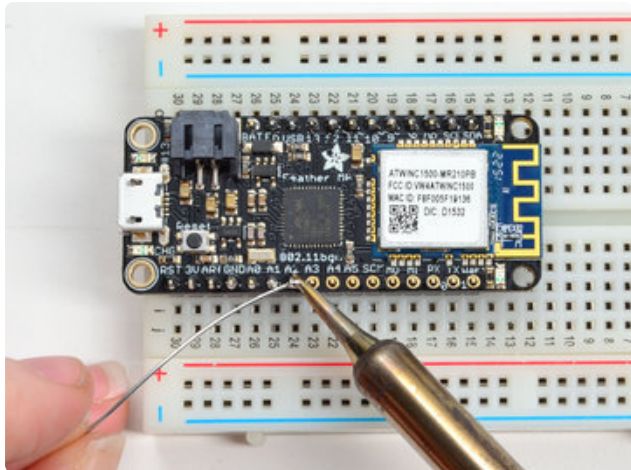
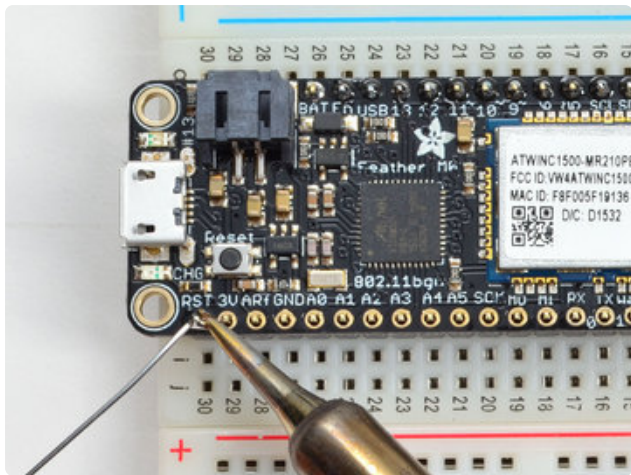
## Add the breakout board:

Place the breakout board over the pins so that the short pins poke through the breakout pads

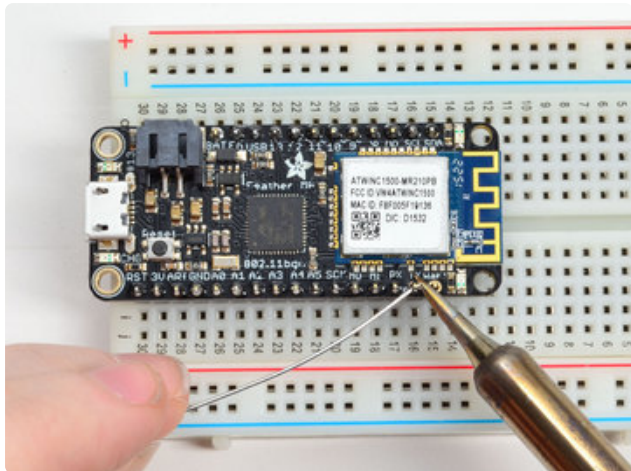
## And Solder!

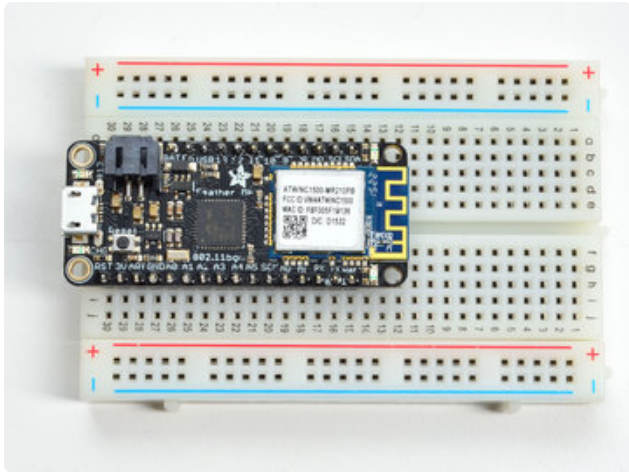
Be sure to solder all pins for reliable electrical contact.

(For tips on soldering, be sure to check out our [Guide to Excellent Soldering](https://adafruit.it/aTk) (<https://adafruit.it/aTk>)).



Solder the other strip as well.





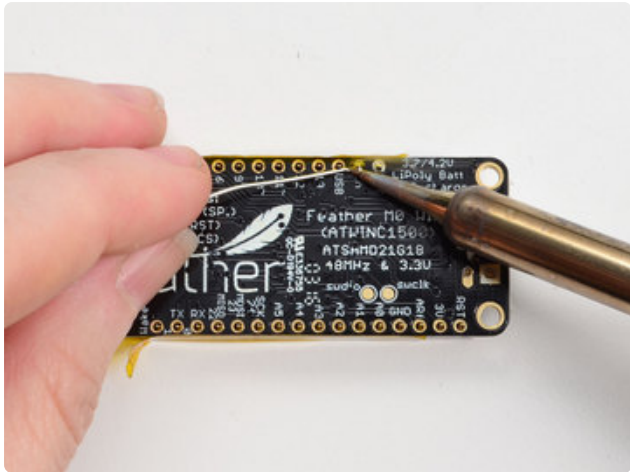
You're done! Check your solder joints visually and continue onto the next steps

## Soldering on Female Header



### Tape In Place

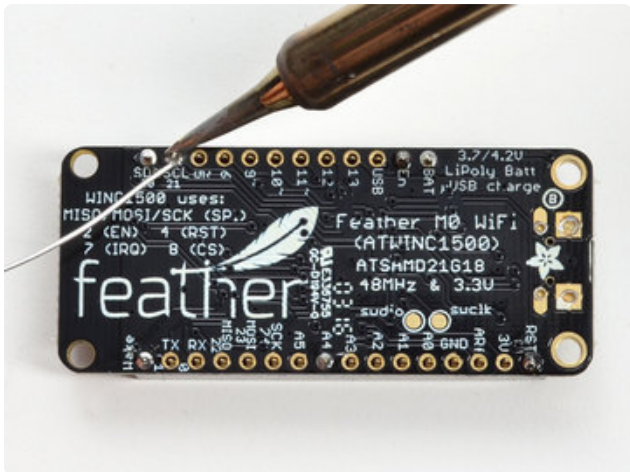
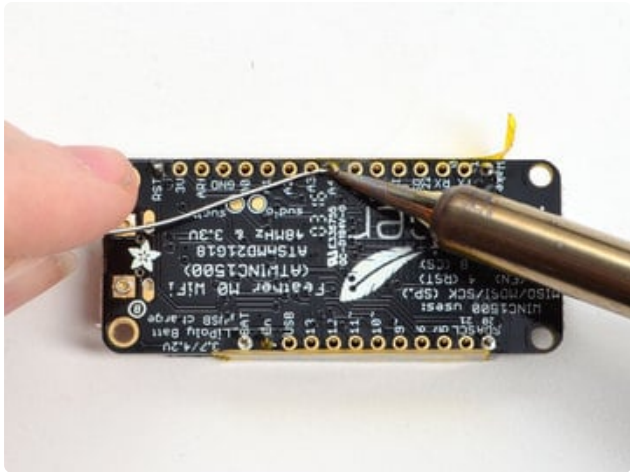
For sockets you'll want to tape them in place so when you flip over the board they don't fall out



## Flip & Tack Solder

After flipping over, solder one or two points on each strip, to 'tack' the header in place

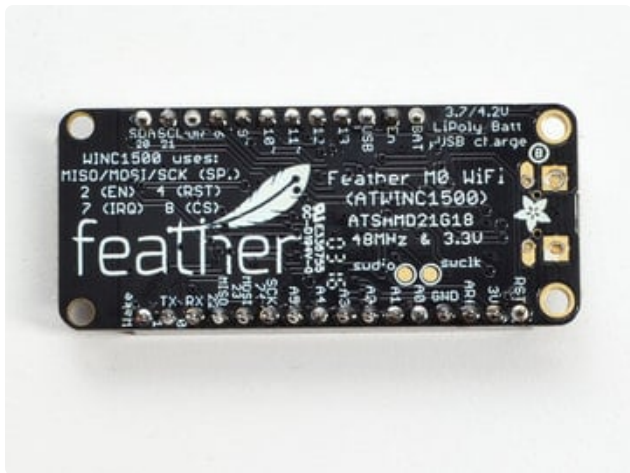




## And Solder!

Be sure to solder all pins for reliable electrical contact.

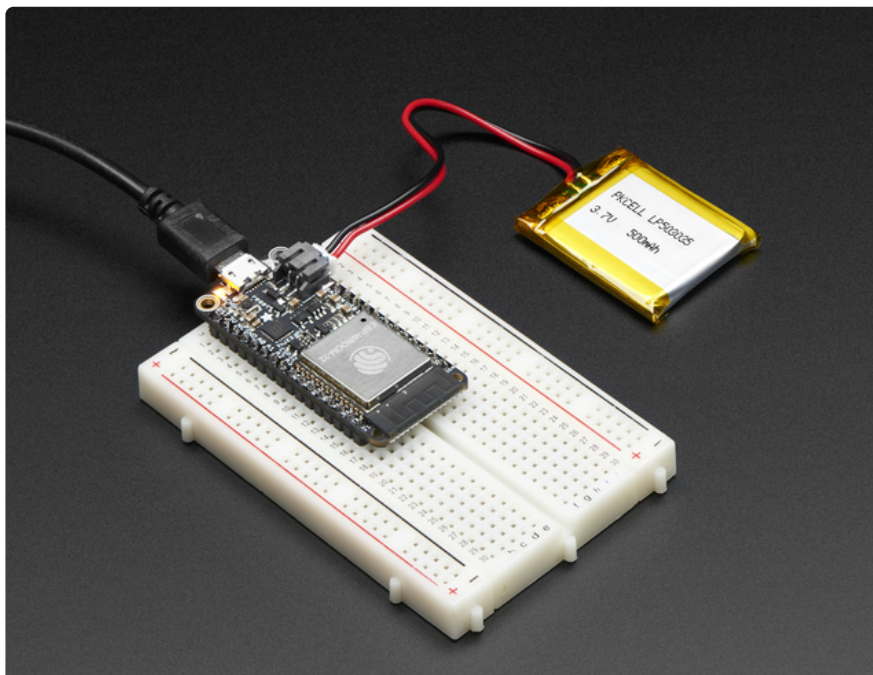
(For tips on soldering, be sure to check out our [Guide to Excellent Soldering \(https://adafruit.it/aTk\)](https://adafruit.it/aTk)).



You're done! Check your solder joints visually and continue onto the next steps



## Power Management



# Battery + USB Power

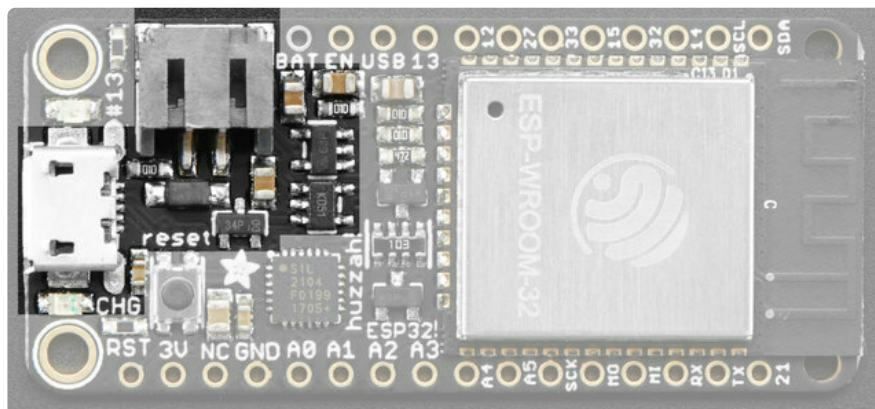
We wanted to make our Feather boards easy to power both when connected to a computer as well as via battery.

There's **two ways to power** a Feather:

1. You can connect with a USB cable (just plug into the jack) and the Feather will regulate the 5V USB down to 3.3V.
2. You can also connect a 4.2/3.7V Lithium Polymer (LiPo/LiPoly) or Lithium Ion (Lilon) battery to the JST jack. This will let the Feather run on a rechargeable battery.

When the **USB power is powered**, it will automatically switch over to **USB for power**, as well as **start charging the battery (if attached)**. This happens 'hot-swap' style so you can always keep the LiPoly connected as a 'backup' power that will only get used when USB power is lost.

The JST connector polarity is matched to Adafruit LiPoly batteries. Using wrong polarity batteries can destroy your Feather. Many customers try to save money by purchasing Lipoly batteries from Amazon only to find that they plug them in and the Feather is destroyed!



The above shows the Micro USB jack (left), LiPoly JST jack (top left), as well as the 3.3V regulator (to the right of the JST jack), changeover diode+transistor (below the JST jack) and the LiPoly charging circuitry (right below the regulator).

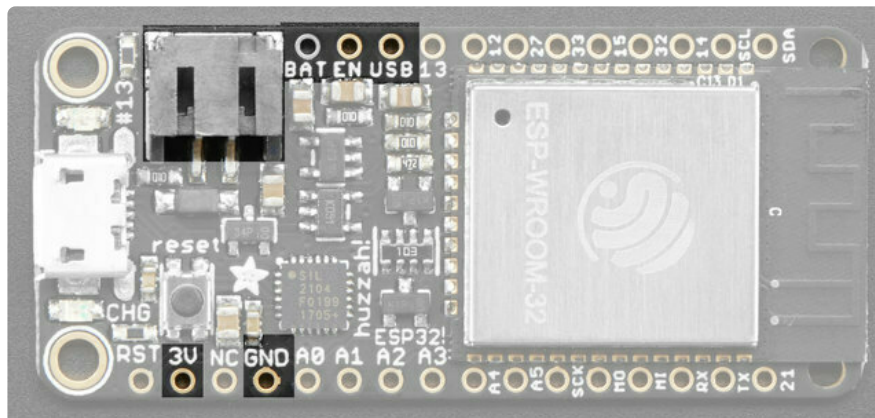
There's also a **CHG** LED next to the USB jack, which will light up while the battery is charging. This LED might also flicker if the battery is not connected, it's normal.

The charge LED is automatically driven by the LiPoly charger circuit. It will try to detect a battery and is expecting one to be attached. If there isn't one it may flicker once in a while when you use power because it's trying to charge a (non-existent) battery. It's not harmful, and it's totally normal!

## Power Supplies

You have a lot of power supply options here! We bring out the **BAT** pin, which is tied to the LiPoly JST connector, as well as **USB** which is the +5V from USB if connected. We also have the **3V** pin which has the output from the 3.3V regulator. We use a 500mA peak regulator. While you can get 500mA from it, you can't do it continuously from 5V as it will overheat the regulator.

Please budget 250mA for the WROOM32 module. We use this to power the ESP32 which draws about 200mA continuous. The good news is you can put the ESP32 into sleep and low-power modes much easier.



## Measuring Battery

If you're running off of a battery, chances are you wanna know what the voltage is at! That way you can tell when the battery needs recharging. LiPoly batteries are 'maxed out' at 4.2V and stick around 3.7V for much of the battery life, then slowly sink down to 3.2V or so before the protection circuitry cuts it off. By measuring the voltage you can quickly tell when you're heading below 3.7V.

Since the ESP32 has tons of ADC pins, we 'sacrifice' one for Lipoly battery monitoring. You can read half of the battery voltage off of **A13 also known as GPIO 35**. Don't forget to double the voltage you read, since there is a divider.

Note this pin is not the same as the D13 available as a pin on the header: the ADC is 'internal' to the board and not exposed.





- **Do not use 7.4V RC batteries on the battery port** - this will destroy the board

The Feather is not designed for external power supplies - this is a design decision to make the board compact and low cost. It is not recommended, but technically possible:

- **Connect an external 3.3V power supply to the 3V and GND pins.** Not recommended, this may cause unexpected behavior and the **EN** pin will no longer work. Also this doesn't provide power on **BAT** or **USB** and some Feathers/Wings use those pins for high current usages. You may end up damaging your Feather.
- **Connect an external 5V power supply to the USB and GND pins.** Not recommended, this may cause unexpected behavior when plugging in the USB port because you will be back-powering the USB port, which could confuse or damage your computer.

---

## CircuitPython

[CircuitPython \(https://adafru.it/tB7\)](https://adafru.it/tB7) is a derivative of [MicroPython \(https://adafru.it/BeZ\)](https://adafru.it/BeZ) designed to simplify experimentation and education on low-cost microcontrollers. It makes it easier than ever to get prototyping by requiring no upfront desktop software downloads. ESP32 CircuitPython firmware is uploaded to the board via the USB serial port.

Follow this step-by-step to get CircuitPython running on your board.

### Driver Install

If this is your first time using an ESP32 board on Windows or MacOS, you may need to install the USB to serial drivers. There are two options for the USB to serial chipset on your board. If you are unsure which one you have, install both drivers.

For instructions and more information regarding the CH9102F chip and driver install, please visit the [How To Install Drivers for WCH USB to Serial Chips guide \(https://adafru.it/-f8\)](https://adafru.it/-f8).

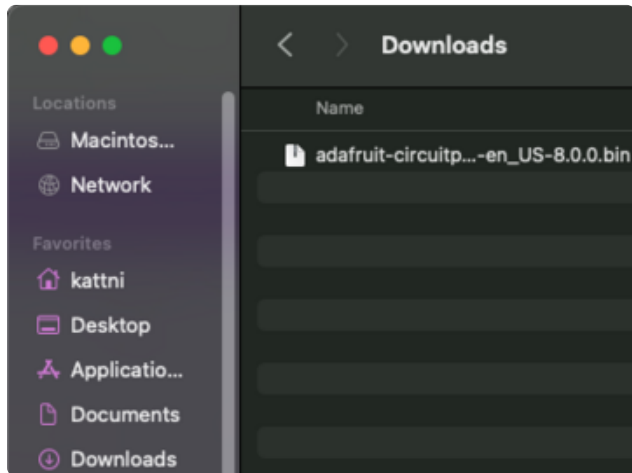
For driver downloads for the CP2104 and CP2012N, please visit the [Silicon Labs Downloads page \(https://adafru.it/11em\)](https://adafru.it/11em).

For those running Linux, the drivers are already included.

## CircuitPython Download

Download the latest version of  
CircuitPython for this board via  
circuitpython.org

<https://adafru.it/1a6k>



Click the link above to download the  
latest CircuitPython .bin file.

Save it wherever is convenient for you.

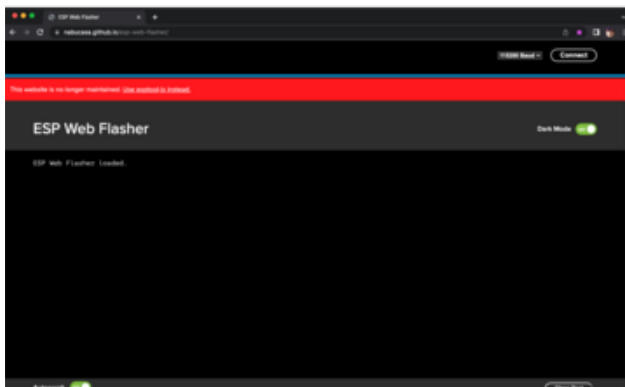
## Connecting to the Web Flasher

To begin, **plug your board into your computer via USB**, using a known-good data-sync cable, directly, or via an adapter if needed.

You will have to use the Chrome or a Chromium-based browser to install CircuitPython. For example, Edge and Opera are Chromium based (<https://adafru.it/10BL>).

Safari and Firefox, etc are not supported - they have not implemented Web Serial (<https://adafru.it/10BM>)!

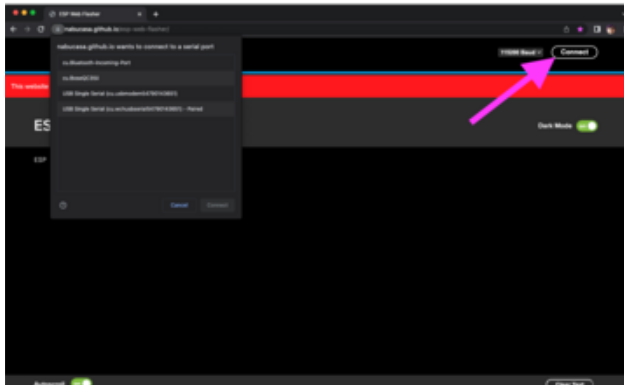
In the **Chrome browser** visit [https://adafruit.github.io/Adafruit\\_WebSerial\\_ESPTool/](https://adafruit.github.io/Adafruit_WebSerial_ESPTool/) (<https://adafru.it/PMB>)



The main page of the ESP Web Flasher  
should look something like this.

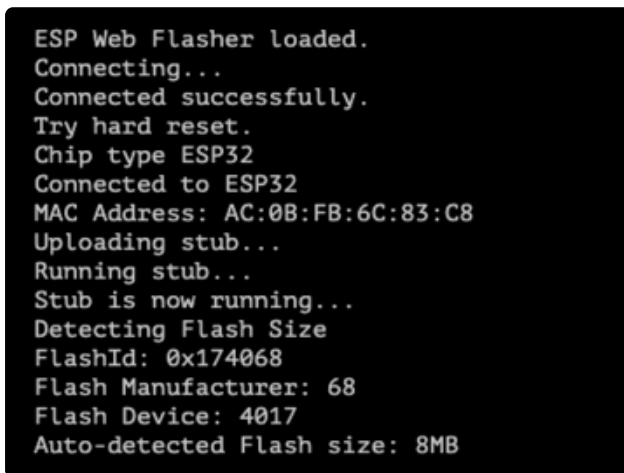
Note: The site now displays an alert that it is no longer maintained, and suggests using a different option. The ESP Web Flasher has still proven to be more consistent and easier to use, so it is highly suggested that you continue with this version.

You should remove all other USB devices so only the target board is attached. This eliminates confusion over multiple ports!

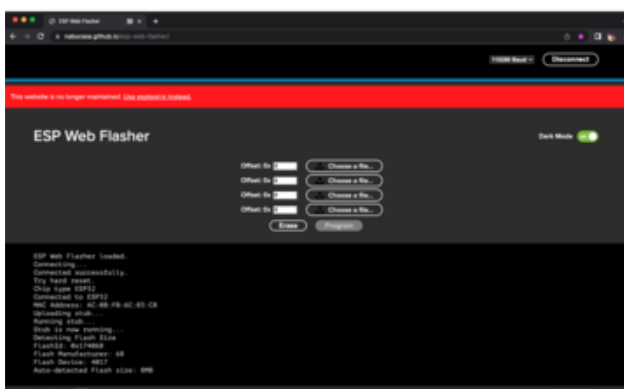


Press the **Connect** button in the top right of the web browser. You will get a pop up asking you to select the COM or Serial port. Look for **USB Single Serial**.

On some systems, such as MacOS, there may be additional system ports that appear in the list (as shown in the image).



The Javascript code will now try to connect to the board. It may timeout for a bit until it succeeds. On success, you will see that it is **Connected** and will print out a unique **MAC address** identifying the board along with other information that was detected.

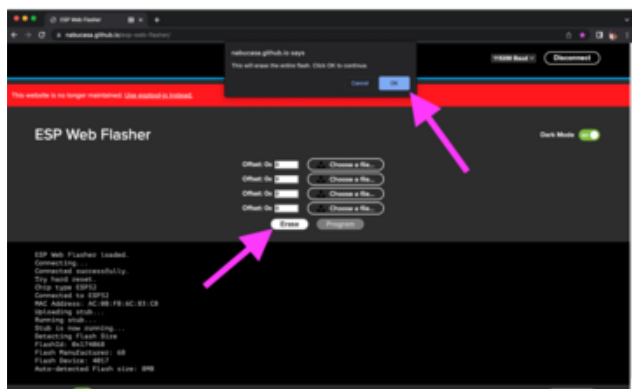


Once you have successfully connected, the command toolbar will appear.

## Erasing the Board Contents

If you would like to erase the entire flash area so that you can start with a clean slate, you can use the erase feature. We recommend doing this every time before installing or updating CircuitPython.





To erase the contents, click the **Erase** button. You will be prompted as to whether you want to continue. Click **OK** to continue. If you do not wish to continue, click Cancel.

```

MAC Address: AC:0B:FB:6C:83:C8
Uploading stub...
Running stub...
Stub is now running...
Detecting Flash Size
FlashId: 0x174068
Flash Manufacturer: 68
Flash Device: 4017
Auto-detected Flash size: 8MB
Erasing flash memory. Please wait...
Finished. Took 5965ms to erase.

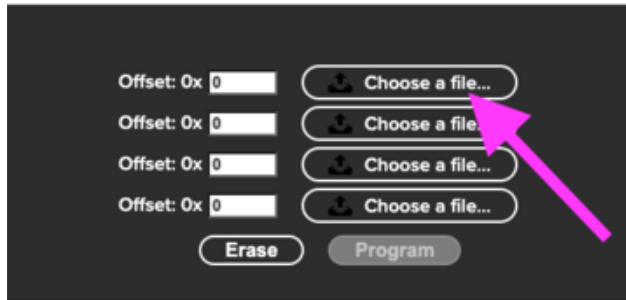
```

You'll see "Erasing flash memory. Please wait..." This will eventually be followed by "Finished." and the amount of time it took to erase.

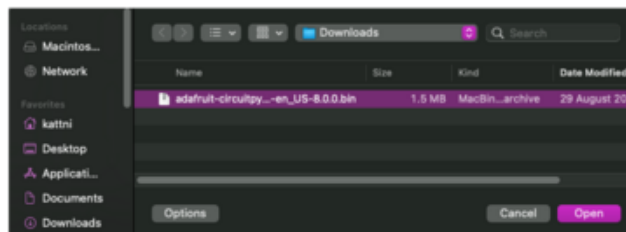
**Do not disconnect!** Immediately continue on to Programming the Board.

Do not disconnect after erasing! You should immediately continue on to programming your board. If you do not, you may end up with your board in a bad state that makes it more difficult to continue. You can avoid this!

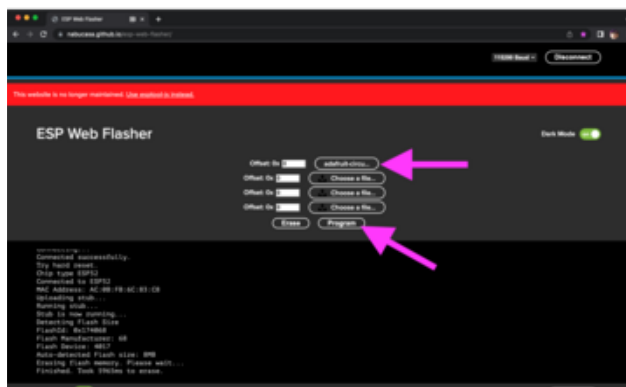
# Programming the Board



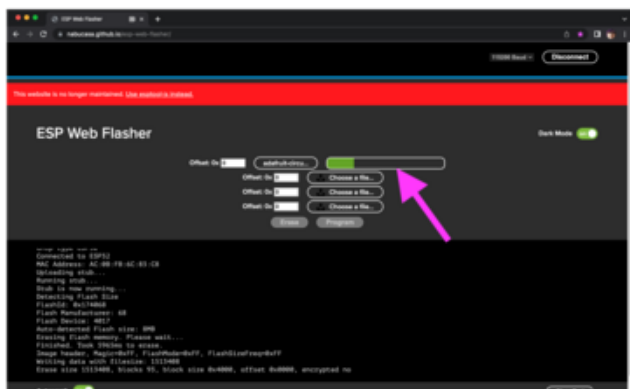
You can click on **Choose a file...** from any of the available buttons. It will only attempt to program buttons with a file and a unique location. Select the **.bin** file you downloaded at the beginning of this page from the file chooser dialogue.



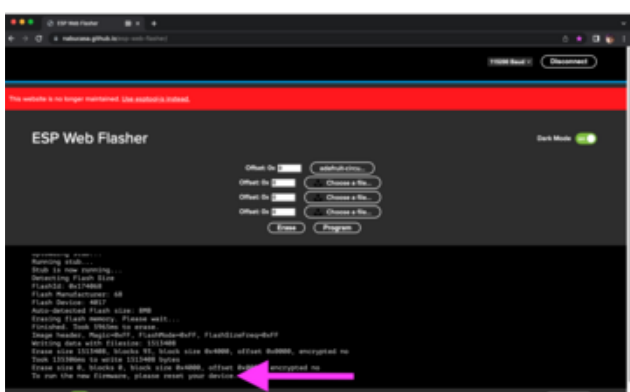
Verify that the **Offset** box next to the file location you used is 0x0. The offset defaults to 0x0, so unless you changed it manually, it should be good to go.



Once you choose a file, the button text will change to match your filename. You can then click the **Program** button to start flashing.



A progress bar will appear and after a minute or two, you will have written the firmware.



You've now successfully programmed CircuitPython onto your board! As suggested in the output, press reset to run the new firmware.

As the ESP32 does not have native USB, no USB drive will show up on your computer when you reset. With CircuitPython firmware loaded, the REPL can be accessed over a serial/COM port.

For more details on installation, how to configure your ESP32, and info on getting started with CircuitPython on your ESP32 using the Web Workflow, check out the [CircuitPython on ESP32 Quick Start guide](https://adafru.it/10JF) (<https://adafru.it/10JF>).

## Using with Arduino IDE

We primarily recommend using the ESP32 Feather with Arduino.

[Check out the Espressif Arduino repository for details on how to install it](https://adafru.it/weF) (<https://adafru.it/weF>)

Don't forget you will also need to install the SiLabs CP2104 Driver on Windows. Linux, and macOS 10.15 and later [include a built-in](https://adafru.it/19Ob) (<https://adafru.it/19Ob>) CP2104 driver.

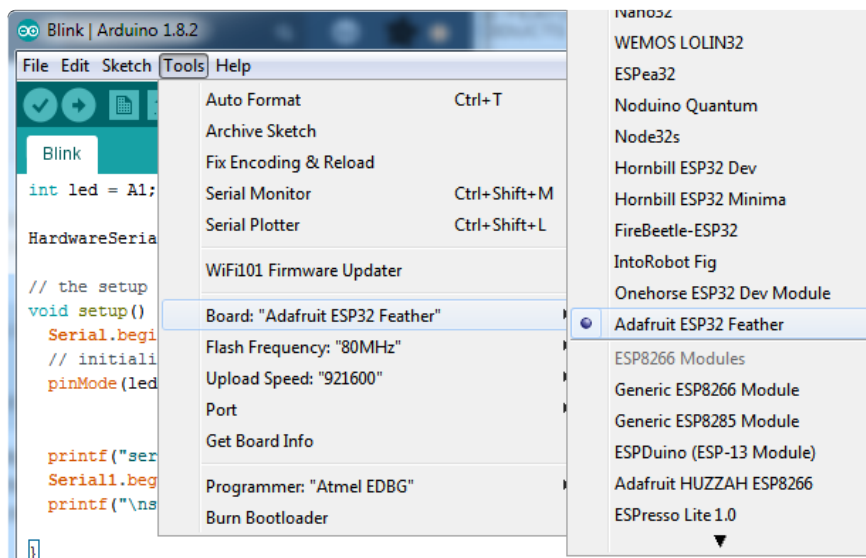
[Click here to download the CP2104 USB Driver](#)

<https://adafru.it/vrf>

Once installed, use the **Adafruit ESP32 Feather** board in the dropdown

For **Upload speed** we've found **921600** baud works great.

The ESP32 uses a fair amount of current, so if you're getting flakey behavior make sure you are plugging your console cable into either a motherboard USB port or a powered USB hub. Don't use the 'extra' USB port on your monitor or keyboard.



## 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.

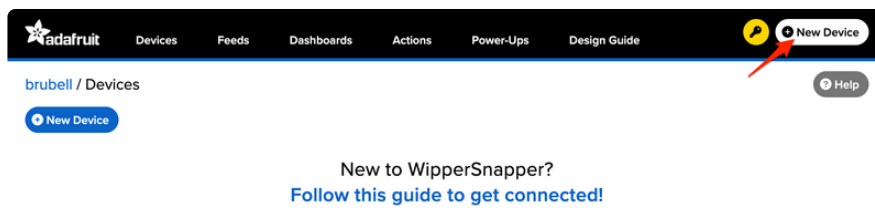
From there, you can add components to your board such as buttons, switches, potentiometers, sensors, and more! Components are dynamically added to hardware, so you can immediately start interacting, logging, and streaming the data your projects produce without writing code.

## Sign up for Adafruit.io

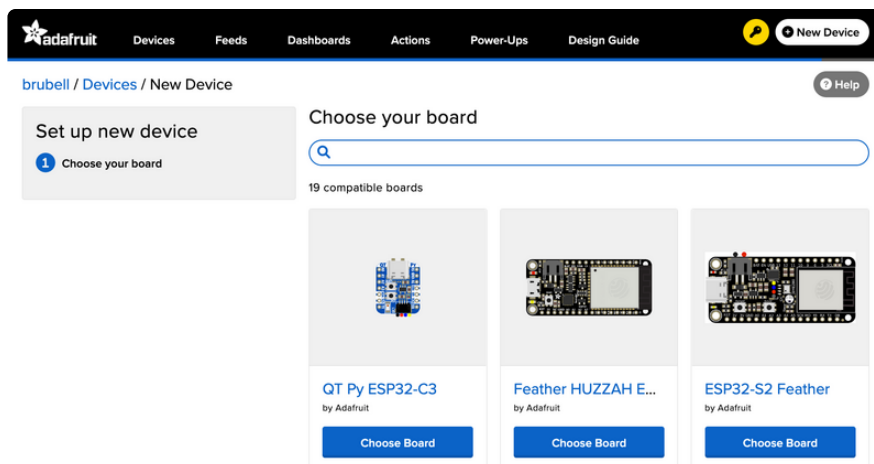
You will need an Adafruit IO account to use WipperSnapper on your board. If you do not already have one, head over to [io.adafruit.com](https://adafru.it/fsU) (<https://adafru.it/fsU>) to create a free account.

## Add a New Device to Adafruit IO

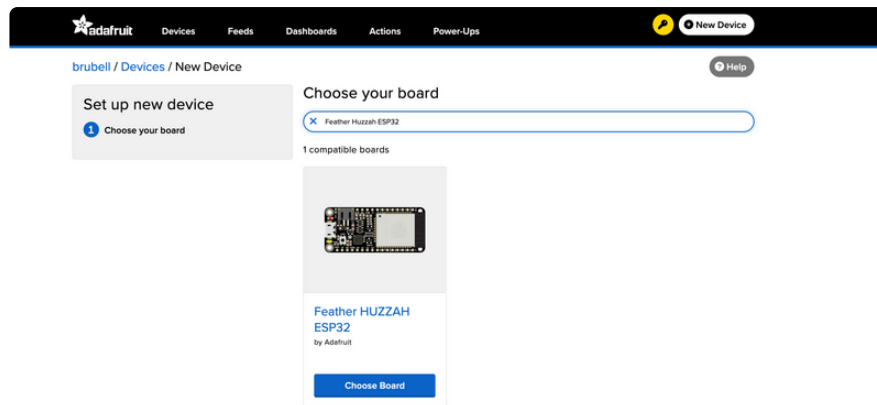
Log into your [Adafruit IO](https://adafru.it/fsU) (<https://adafru.it/fsU>) account. Click the New Device button at the top of the page.



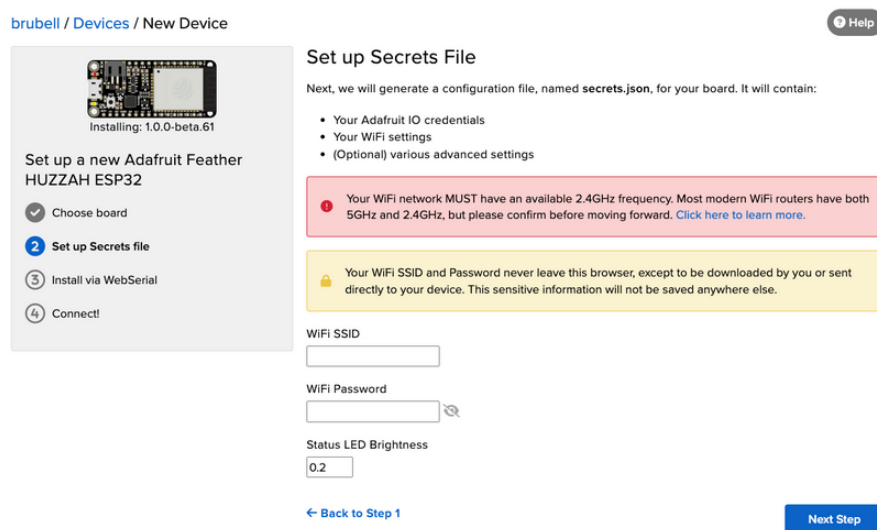
After clicking New Device, you should be on the board selector page. This page displays every board that is compatible with the WipperSnapper firmware.



In the board selector page's search bar, search for the ESP32-S2 Feather. 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.



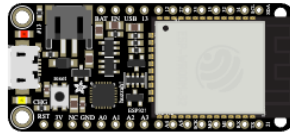
If the installation was successful, a popover should appear displaying that your board has successfully been detected by Adafruit IO.

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

## New Device Detected!




You have successfully connected a new **feather-esp32** 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

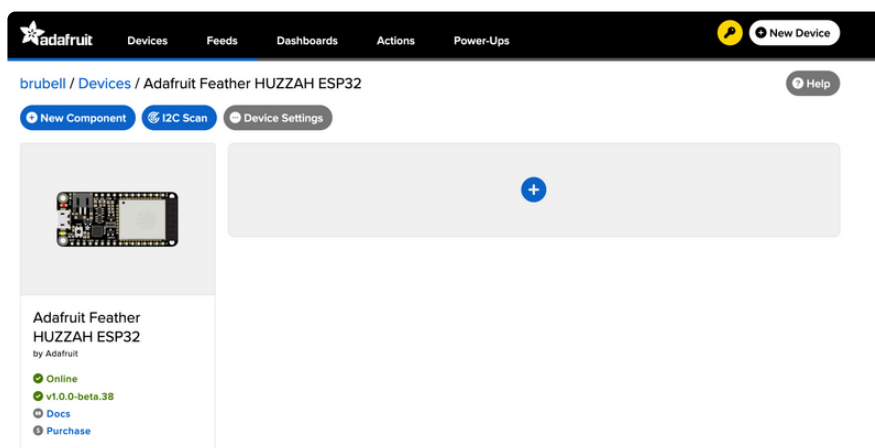
Adafruit Feather HUZZAH ESP32

Firmware Version:  **v1.0.0-beta.38**

[Continue to Device Page >](#)

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

Next, Visit this guide's **WipperSnapper Essentials** pages to learn how to interact with your board using Adafruit IO.



## 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/AKr>

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

Upload Arduino "Blink" Sketch

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

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

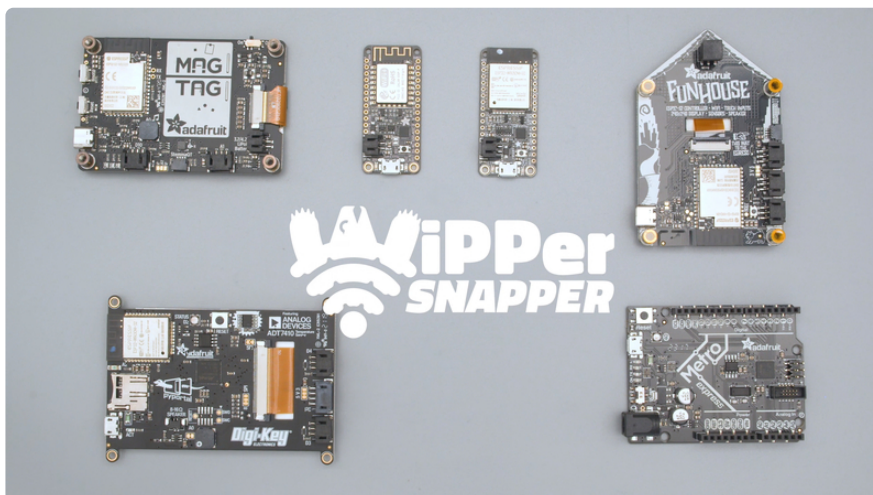
### Factory Resetting a WipperSnapper Board

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.

**Note:** There is no "Factory Reset" binary file available for this board. You will need to upload the "Blink" sketch to your board per the instructions above.

---

# WipperSnapper Essentials



You've installed WipperSnapper firmware on your board and connected it to Adafruit IO. Next, let's learn how to use Adafruit IO!

The Adafruit IO supports a large number of components. Components are physical parts such as buttons, switches, sensors, servos, LEDs, RGB LEDs, and more.

The following pages will get you up and running with WipperSnapper as you interact with your board's LED, read the value of a push button, send the value of an I2C sensor to the internet, and wirelessly control colorful LEDs.

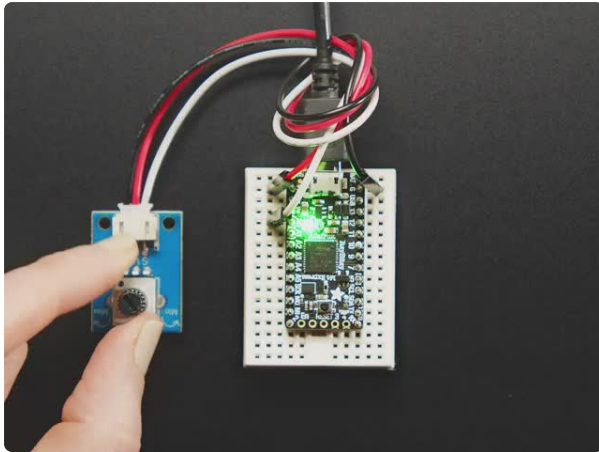
## Parts

The following parts are **required** to complete the WipperSnapper essentials pages for this board:



[Tactile Switch Buttons \(12mm square, 6mm tall\) x 10 pack](https://www.adafruit.com/product/1119)

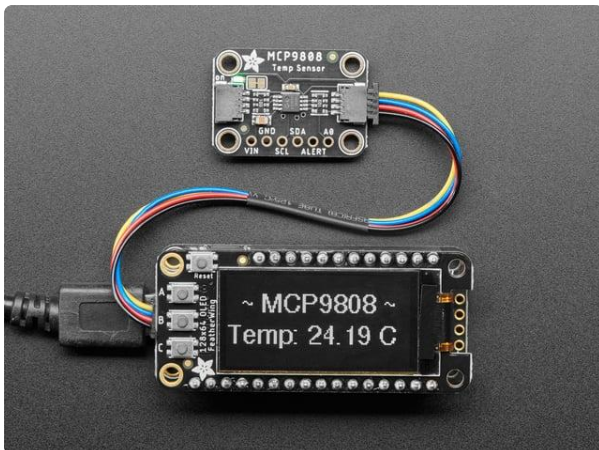
Medium-sized clicky momentary switches are standard input "buttons" on electronic projects. These work best in a PCB but <https://www.adafruit.com/product/1119>



### STEMMA Wired Potentiometer Breakout Board - 10K ohm Linear

For the easiest way possible to measure twists, turn to this STEMMA potentiometer breakout (ha!). This plug-n-play pot comes with a JST-PH 2mm connector and a matching

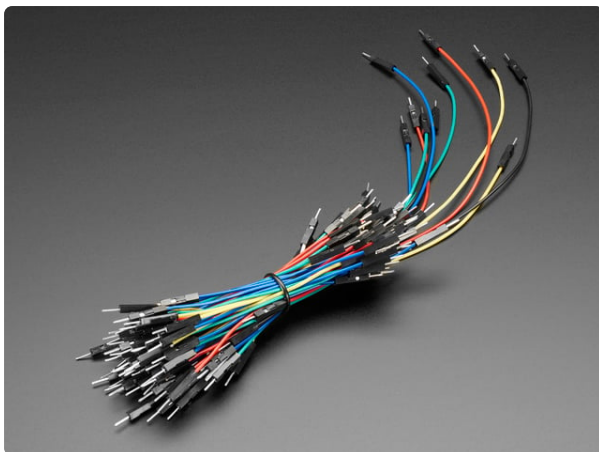
<https://www.adafruit.com/product/4493>



### Adafruit MCP9808 High Accuracy I2C Temperature Sensor Breakout

The MCP9808 digital temperature sensor is one of the more accurate/precise we've ever seen, with a typical accuracy of  $\pm 0.25^{\circ}\text{C}$  over the sensor's  $-40^{\circ}\text{C}$  to...

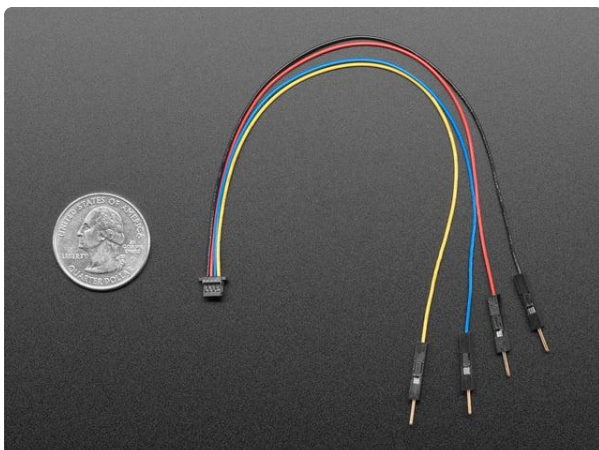
<https://www.adafruit.com/product/5027>



### Breadboarding wire bundle

75 flexible stranded core wires with stiff ends molded on in red, orange, yellow, green, blue, brown, black and white. These are a major improvement over the "box of bent..."

<https://www.adafruit.com/product/153>

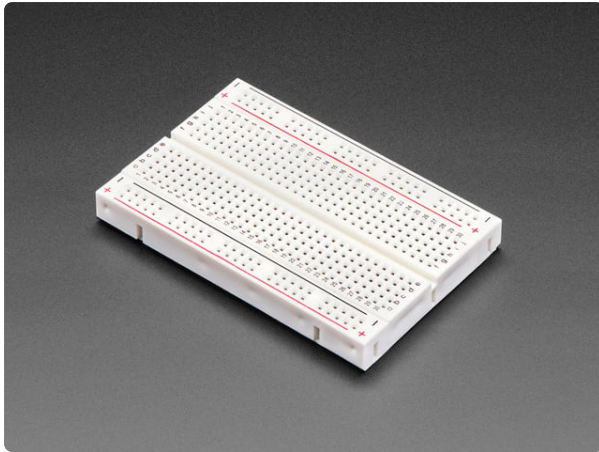


### STEMMA QT / Qwiic JST SH 4-pin to Premium Male Headers Cable

This 4-wire cable is a little over 150mm / 6" long and fitted with JST-SH female 4-pin connectors on one end and premium Dupont male headers on the other.

Compared with the...

<https://www.adafruit.com/product/4209>



### Half Sized Premium Breadboard - 400 Tie Points

This is a cute, half-size breadboard with 400 tie points, good for small projects. It's 3.25" x 2.2" / 8.3cm x 5.5cm with a standard double-strip in the...

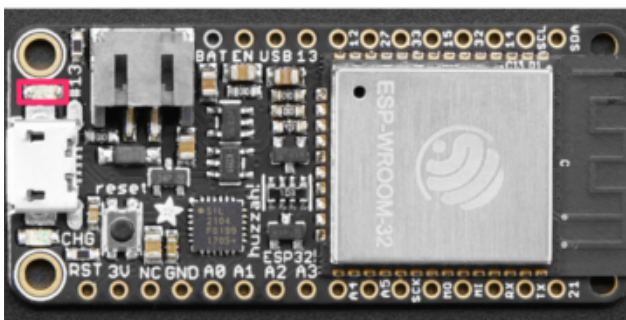
<https://www.adafruit.com/product/64>

## LED Blink

This demo shows controlling an LED from Adafruit IO. The same kind of control can be used for relays, lights, motors, or solenoids.

One of the first programs you typically write to get used to embedded programming is a sketch that repeatably blinks an LED. IoT projects are wireless, so after completing this section, you'll be able to turn on (or off) the LED built into your board from anywhere in the world.

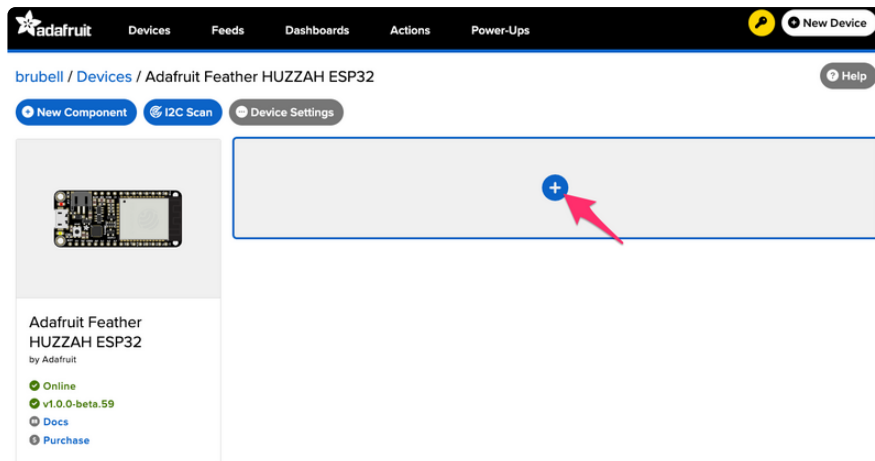
### Where is the LED on my board?



The Adafruit HUZZAH 32's LED (highlighted in red) is located next to the micro-USB connector.

## Create a LED Component on Adafruit IO

On the device page, click the New Component (or "+") button to open the component picker.



## New Component

Which component would you like to set up?

Displaying 3 matching Components.



Search for the component name by entering **LED** into the text box on the component picker, the list of components should update as soon as you stop typing.



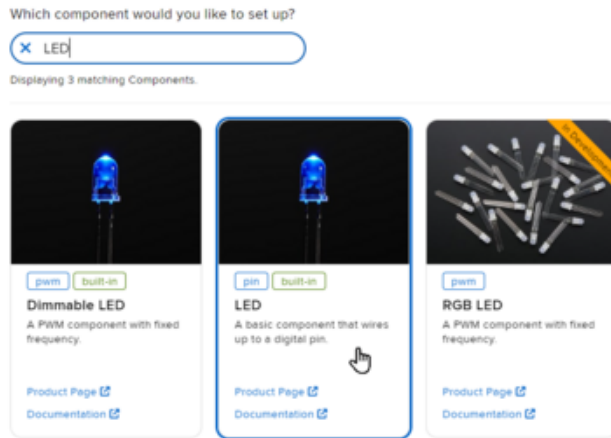
## Filtering and searching for components

Since WipperSnapper supports such a large number of components, there is keyword filtering. Try searching for various keywords, like:

- component names: **aht20**, **servo**, **buzzer**, **button**, **led**, etc
- sensor types: **light**, **temperature**, **pressure**, **humidity**, etc
- interface: **i2c**, **uart**, **ds18x20**, **pin**, etc (also I2C addresses e.g. **0x44**)
- vendor: **Adafruit**, **ASAIR**, **Infineon**, **Bosch**, **Honeywell**, **Sensirion**, etc

There are also product and documentation links to every component. Follow the links beneath the component descriptions to be taken to the appropriate product page or Learn Guide





Select the **LED** from the list of components.

On the Create LED Component form, the board's LED pin is pre-selected.

Click Create Component.

Create LED Component

Settings

LED Name

LED

LED Pin

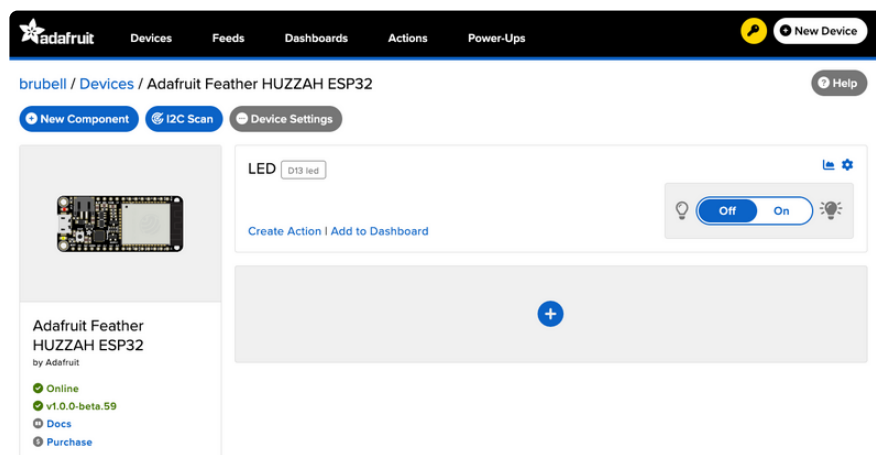
D13 (LED BUILT-IN)

← Back to Component Type

Create Component

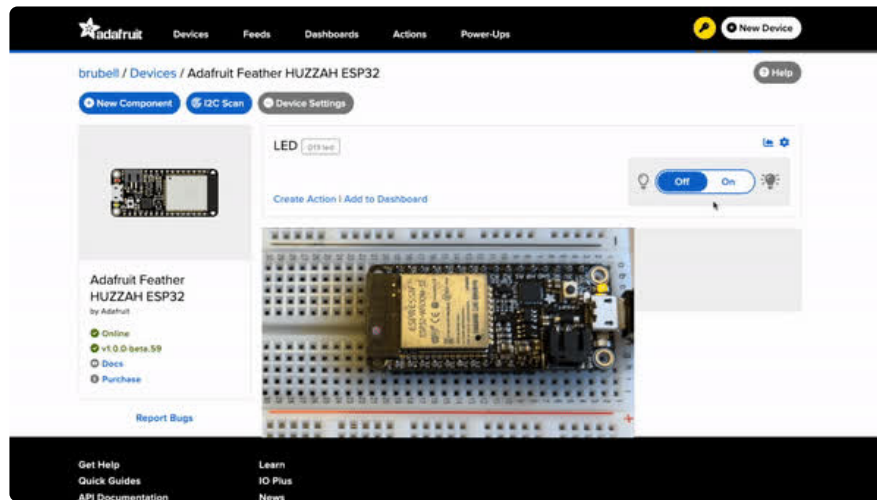
Behind the scenes, Adafruit IO sends a command to your board running WipperSnapper telling it to configure "LED Pin" as a digital output.

Your board's page on Adafruit IO shows a new LED component.



## Usage

On the board page, toggle the LED component by clicking the toggle switch. This should turn your board's built-in LED on or off.



## Read a Push-button

In this demo, we show reading the state of a push-button from WipperSnapper. But the same kind of control can be used for reading switches, break beam sensors, and other digital sensors.

You can configure a board running WipperSnapper to read data from standard input buttons, switches, or digital sensors, and send the value to Adafruit IO.

From Adafruit IO, you will configure one of the pushbuttons on your board as a push button component. Then, when the button is pressed (or released), a value will be published to Adafruit IO.

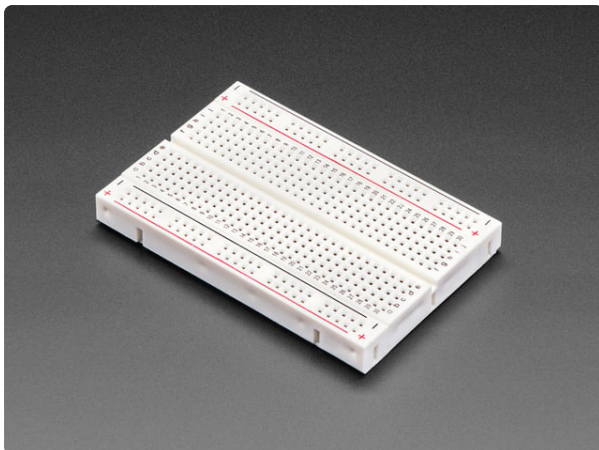
## Parts

The following parts are required to complete this page.



### Tactile Switch Buttons (12mm square, 6mm tall) x 10 pack

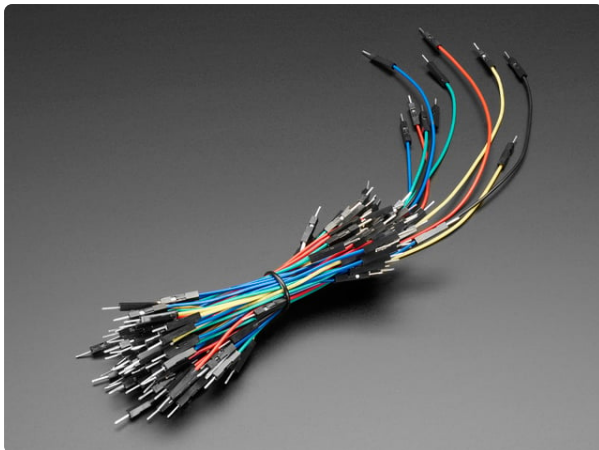
Medium-sized clicky momentary switches are standard input "buttons" on electronic projects. These work best in a PCB but <https://www.adafruit.com/product/1119>



### Half Sized Premium Breadboard - 400 Tie Points

This is a cute, half-size breadboard with 400 tie points, good for small projects. It's 3.25" x 2.2" / 8.3cm x 5.5cm with a standard double-strip in the...

<https://www.adafruit.com/product/64>

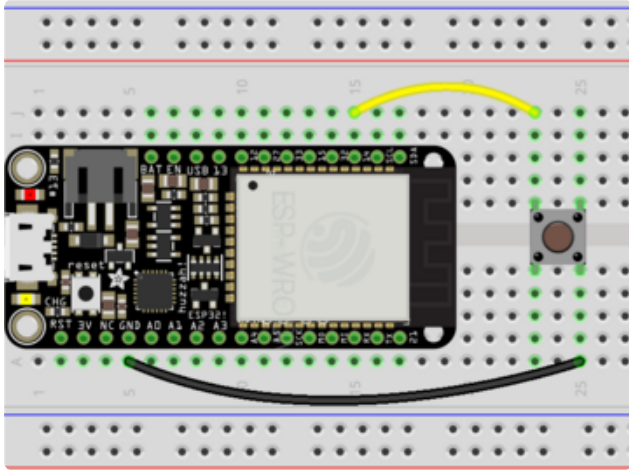


### Breadboarding wire bundle

75 flexible stranded core wires with stiff ends molded on in red, orange, yellow, green, blue, brown, black and white. These are a major improvement over the "box of bent..."

<https://www.adafruit.com/product/153>

## Wiring

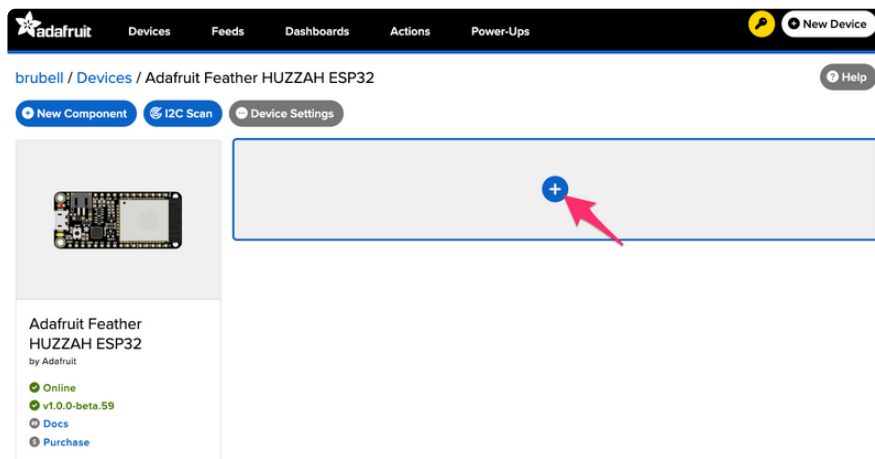


Feather GND to Push Button  
Feather GPIO D14 to Push Button

**Note** - we are not using a resistor part! We will be configuring the Feather ESP32 to use its internal resistor instead.

## Create a Push-button Component on Adafruit IO

On the device page, click the New Component (or "+") button to open the component picker.



### New Component

Which component would you like to set up?

Displaying 1 matching Components.



Search for the component name by entering **push** into the text box on the component picker, the list of components should update as soon as you stop typing.



# Filtering and searching for components

WipperSnapper supports such a large number of components we added filtering!

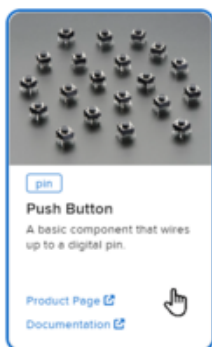
Try searching for various keywords, like:

- component names: `aht20`, `servo`, `buzzer`, `button`, `relay`, etc
- sensor types: `light`, `temperature`, `pressure`, `humidity`, etc
- interface: `i2c`, `uart`, `ds18x20`, `pin`, etc (also I2C addresses e.g. `0x44`)
- vendor: `Adafruit`, `ASAIR`, `Infineon`, `Bosch`, `Honeywell`, `Sensirion`, etc

We've also added product and documentation links to every component, follow the links beneath the component descriptions to be taken to the appropriate product page or Learn-Guide.

Which component would you like to set up?

Displaying 1 matching Components.



Select the **Push Button** from the list of results to go to the component configuration page.

There will be a back button if you select the wrong component, and you can use the Edit component icon (⚙️) on the device page to update the component configuration in the future.

The "Create Push Button Component" form presents you with options for configuring the push button.

Start by selecting the board's pin connected to the push button.

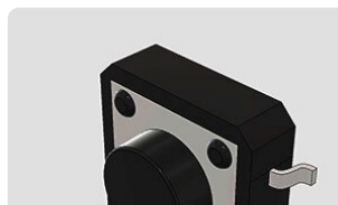
## Create Push Button Component



### Settings

Push Button Name

Push Button Pin





The Return Interval dictates how frequently the value of the push-button will be sent from the board to Adafruit IO.

For this example, you will configure the push button value to be only sent when the value changes (i.e.: when it's either pressed or depressed).

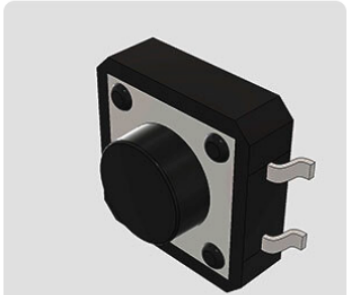
Create Push Button Component

Settings

Push Button Name

Push Button Pin

Return Interval  
☒ On Change  
☐ Periodically



Check the **Specify Pin Pull Direction** checkbox.

Select **Pull Up** to turn on the internal pull-up resistor.

Create Push Button Component


Settings

Push Button Name

Push Button Pin

Return Interval  
☒ On Change  
☐ Periodically

☒ Specify Pin Pull Direction?  
☒ Pull Up  
☐ Pull Down



[← Back to Component Type](#)

Create Component

Make sure the form settings look like the following screenshot. Then, click **Create Component**.

## Create Push Button Component



### Settings

Push Button Name

Push Button

Push Button Pin

D14

Return Interval

☒ On Change

☐ Periodically

☒ Specify Pin Pull Direction?

☒ Pull Up

☐ Pull Down

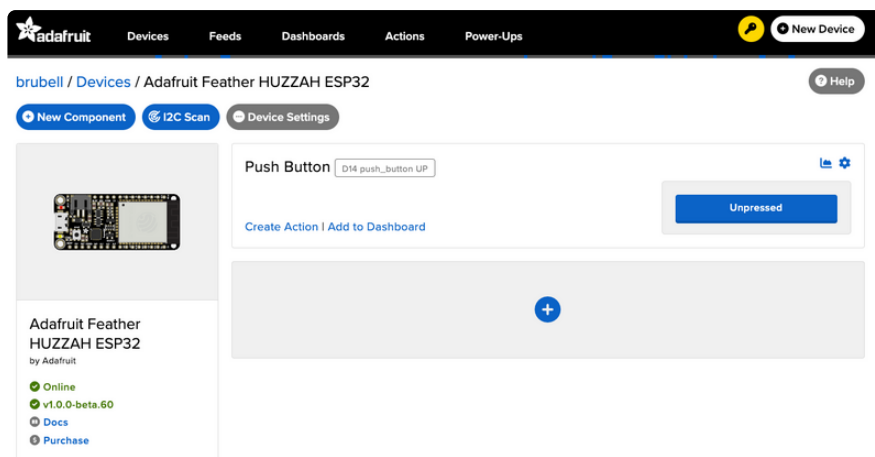


[← Back to Component Type](#)

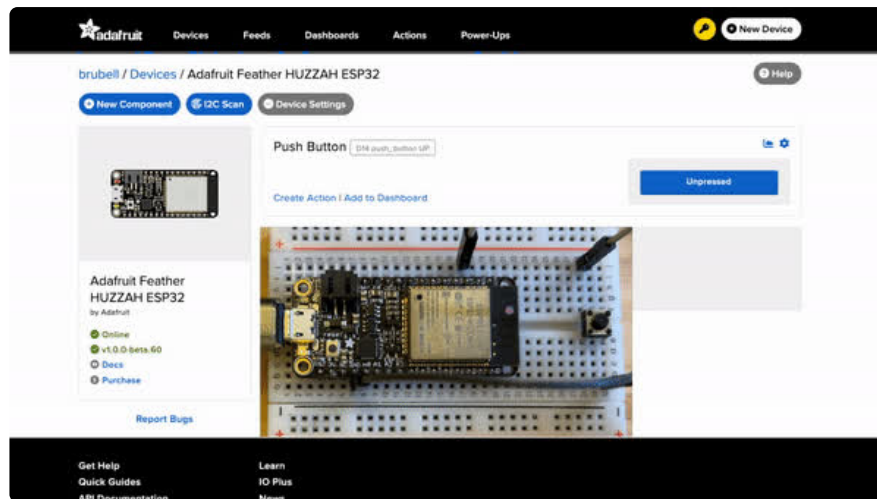
[Create Component](#)

Adafruit IO sends a command to your WipperSnapper board, telling it to configure the GPIO pin you selected to behave as a digital input pin and to enable it to pull up the internal resistor.

Your board page should also show the new push-button component.



Push the button on your board to change the value of the push-button component on Adafruit IO.



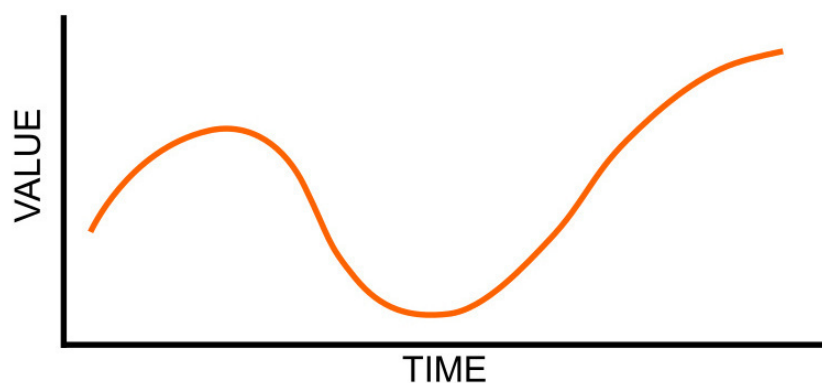
## Analog Input

Your microcontroller board has both digital and analog signal capabilities. Some pins are analog, some are digital, and some are capable of both. Check the **Pinouts** page in this guide for details about your board.

Analog signals are different from digital signals in that they can be any voltage and can vary continuously and smoothly between voltages. An analog signal is like a dimmer switch on a light, whereas a digital signal is like a simple on/off switch.

Digital signals only can ever have two states, they are either are **on** (high logic level voltage like 3.3V) or **off** (low logic level voltage like 0V / ground).

By contrast, analog signals can be any voltage in-between on and off, such as 1.8V or 0.001V or 2.98V and so on.



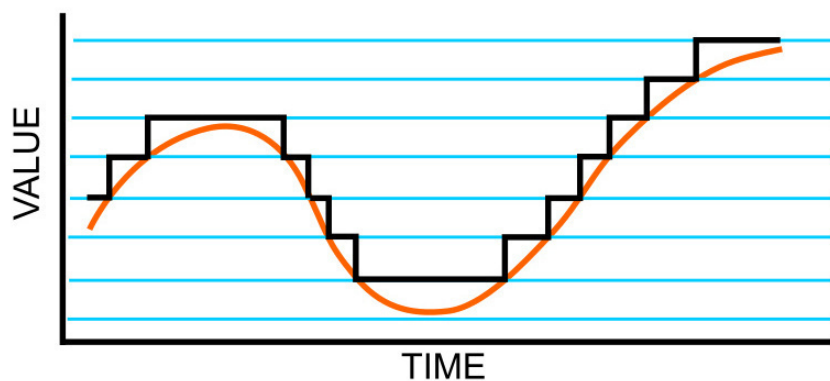
Analog signals are continuous values which means they can be an infinite number of different voltages. Think of analog signals like a floating point or fractional number, they can smoothly transiting to any in-between value like 1.8V, 1.81V, 1.801V, 1.8001V, 1.80001V and so forth to infinity.

Many devices use analog signals, in particular sensors typically output an analog signal or voltage that varies based on something being sensed like light, heat, humidity, etc.

## Analog to Digital Converter (ADC)

An analog-to-digital-converter, or ADC, is the key to reading analog signals and voltages with a microcontroller. An ADC is a device that reads the voltage of an analog signal and converts it into a digital, or numeric, value. The microcontroller can't read analog signals directly, so the analog signal is first converted into a numeric value by the ADC.

The black line below shows a digital signal over time, and the red line shows the converted analog signal over the same amount of time.

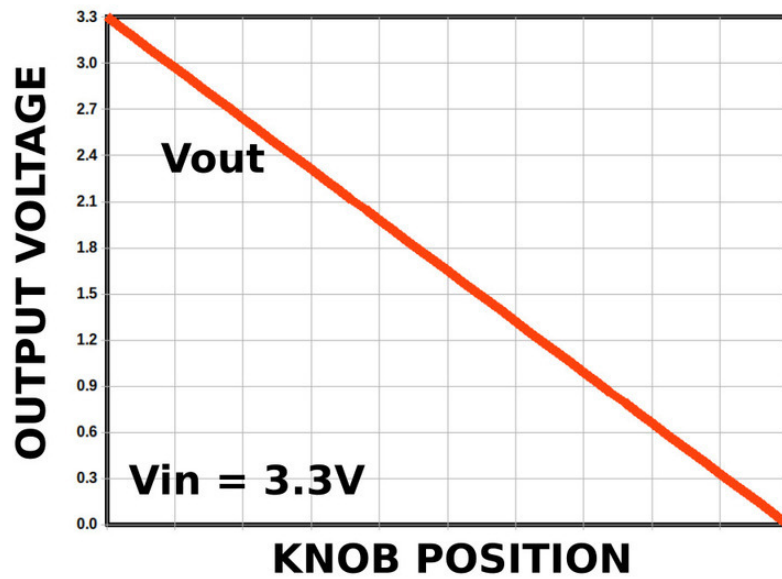


Once that analog signal has been converted by the ADC, the microcontroller can use those digital values any way you like!

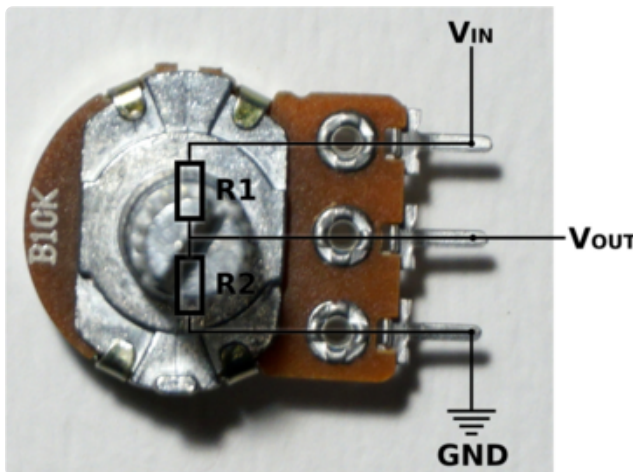
## Potentiometers

A potentiometer is a small variable resistor that you can twist a knob or shaft to change its resistance. It has three pins. By twisting the knob on the potentiometer you can change the resistance of the middle pin (called the wiper) to be anywhere within the range of resistance of the potentiometer.

By wiring the potentiometer to your board in a special way (called a voltage divider) you can turn the change in resistance into a change in voltage that your board's analog to digital converter can read.



To wire up a potentiometer as a voltage divider:



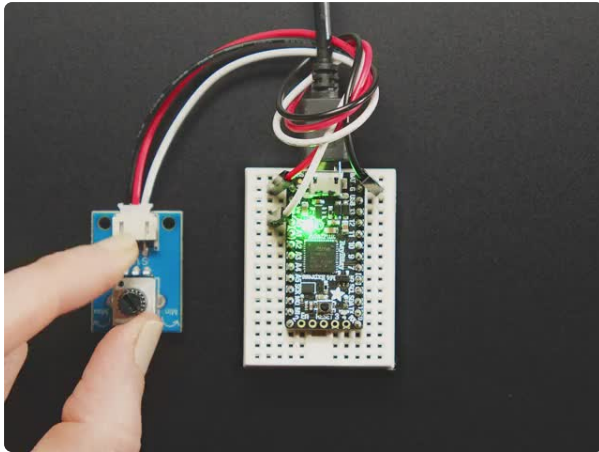
Connect one outside pin to ground  
 Connect the other outside pin to voltage in (e.g. 3.3V)  
 Connect the middle pin to an analog pin (e.g. A0)

## Hardware

In addition to your microcontroller board, you will need the following hardware to follow along with this example.

### Potentiometer





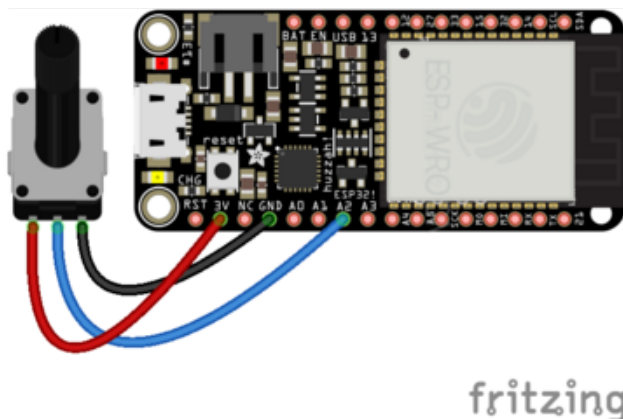
## STEMMA Wired Potentiometer Breakout Board - 10K ohm Linear

For the easiest way possible to measure twists, turn to this STEMMA potentiometer breakout (ha!). This plug-n-play pot comes with a JST-PH 2mm connector and a matching

<https://www.adafruit.com/product/4493>

## Wire Up the Potentiometer

Connect the potentiometer to your board as follows.



Make the following connections between your ESP32 Feather and the Potentiometer:

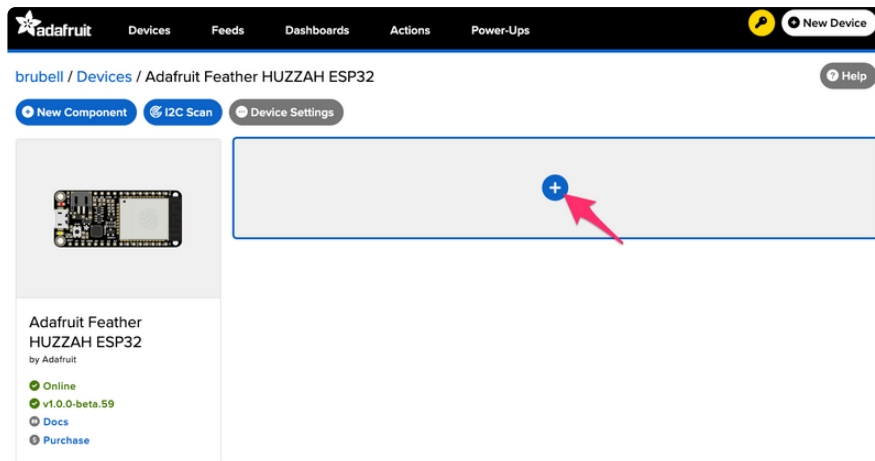
- Feather 3.3V to potentiometer left pin
- Feather A2 to potentiometer middle pin
- Feather GND to potentiometer right pin

**Note:** On WipperSnapper, the ESP32's ADC1 pins are unusable for analog input since WiFi is constantly running.

[For information on what Analog Input pins can \(and can't\) be used on this board, click here >>> \(https://adafru.it/18eQ\)](https://adafru.it/18eQ)

## Create a Potentiometer Component on Adafruit IO

On the device page, click the New Component (or "+") button to open the component picker.



## New Component

Which component would you like to set up?



Displaying 1 matching Components.



Search for the component name by entering **potentiometer** into the text box on the component picker, the list of components should update as soon as you stop typing.

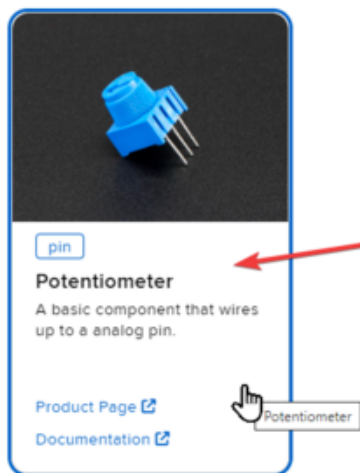


## Filtering and searching for components

Since WipperSnapper supports such a large number of components, there is keyword filtering. Try searching for various keywords, like:

- component names: **aht20**, **servo**, **buzzer**, **button**, **potentiometer**, etc
- sensor types: **light**, **temperature**, **pressure**, **humidity**, etc
- interface: **i2c**, **uart**, **ds18x20**, **pin**, etc (also I2C addresses e.g. **0x44**)
- vendor: **Adafruit**, **ASAIR**, **Infineon**, **Bosch**, **Honeywell**, **Sensirion**, etc

There are also added product and documentation links for every component, follow the links beneath the component descriptions to be taken to the appropriate product page or Learn Guide.



Select the **Potentiometer** from the list of results to go to the component configuration page.

There will be a back button if you select the wrong component, and you can use the Edit component icon (⚙️) on the device page to update the component configuration in the future.

On the Create Potentiometer Component form:

- Set **Potentiometer Pin** to **A2**
- Select **"On Change"** as the **Return Interval**
- Select **Raw Analog Value** as the **Return Type**

Then, click Create Component

Create Potentiometer Component

Settings

Potentiometer Name

Potentiometer

Potentiometer Pin

A2

Return Interval

☒ On Change
 ☐ Periodically

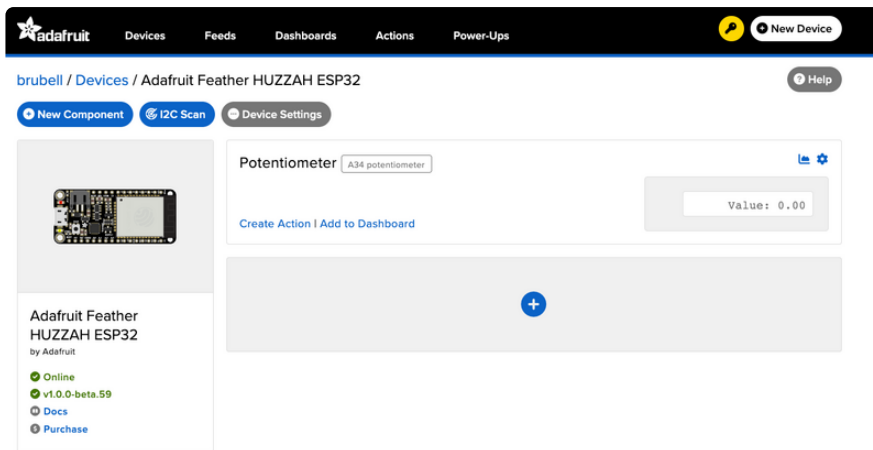
Return Type

☒ Raw Analog Value
 ☐ Voltage

[← Back to Component Type](#)

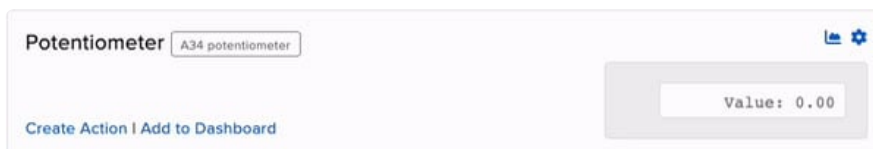
Create Component

The potentiometer component appears on your board page! Next, learning to read values from it.



## Read Analog Pin Values

Rotate the potentiometer to see the value change.

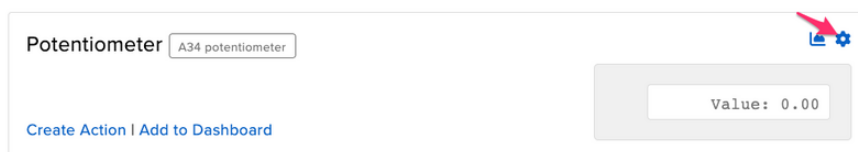


What do these values mean?

WipperSnapper reports ADC "raw values" as 16-bit unsigned integer values. Your potentiometer will read between 0 (twisting the pot to the leftmost position) and 65535 (twisting the pot to the rightmost position).

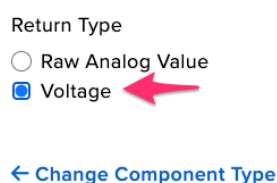
## Read Analog Pin Voltage Values

You can update the potentiometer component (or any analog pin component in WipperSnapper) to report values in Volts. To do this, on the right-hand side of the potentiometer component, click the cog button.

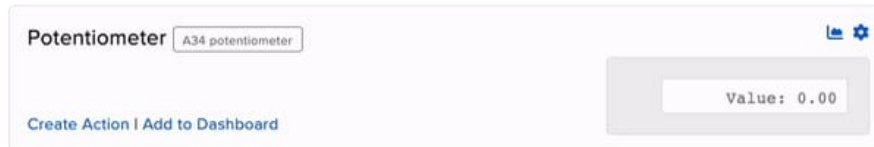


Under **Return Type**, click Voltage.

Click Update Component to send the updated component settings to your board running WipperSnapper.



Now, twist the potentiometer to see the value reported to Adafruit IO in Volts!



## I2C Sensor

While this page uses the "MCP9808 High Accuracy I2C Temperature Sensor Breakout", the process for adding an I2C sensor to your board running WipperSnapper is similar for all I2C sensors.

Inter-Integrated Circuit, aka **I2C**, is a two-wire protocol for connecting sensors and "devices" to a microcontroller. A large number of sensors, including the ones sold by Adafruit, use I2C to communicate.

Typically, using I2C with a microcontroller involves programming. Adafruit IO and WipperSnapper let you configure a microcontroller to read data from an I2C sensor and publish that data to the internet without writing code.

The WipperSnapper firmware supports a number of I2C sensors, [viewable in list format here \(https://adafru.it/Zbq\)](https://adafru.it/Zbq).

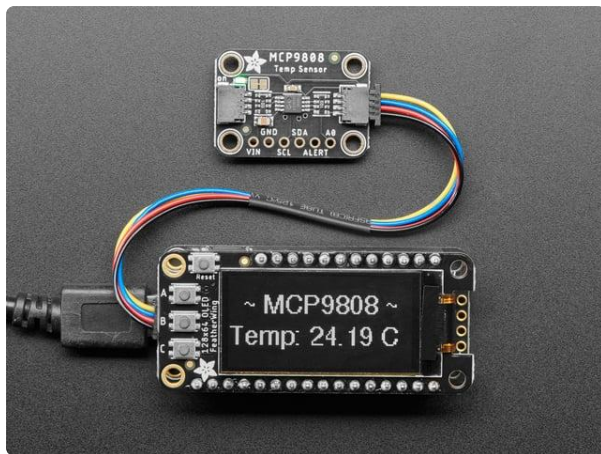
- If you do not see the I2C sensor you're attempting to use with WipperSnapper, [Adafruit has a guide on adding a component to Adafruit IO WipperSnapper here \(https://adafru.it/Zbr\)](https://adafru.it/Zbr).

On this page, you'll learn how to wire up an I2C sensor to your board. Then, you'll create a new component on Adafruit IO for your I2C sensor and send the sensor values to Adafruit IO. Finally, you'll learn how to locate, interpret, and download the data produced by your sensors.

## Parts

You will need the following parts to complete this page:

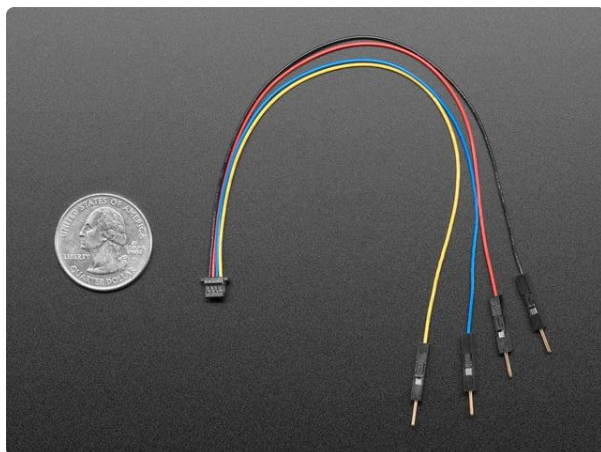




### Adafruit MCP9808 High Accuracy I2C Temperature Sensor Breakout

The MCP9808 digital temperature sensor is one of the more accurate/precise we've ever seen, with a typical accuracy of  $\pm 0.25^{\circ}\text{C}$  over the sensor's  $-40^{\circ}\text{C}$  to...

<https://www.adafruit.com/product/5027>

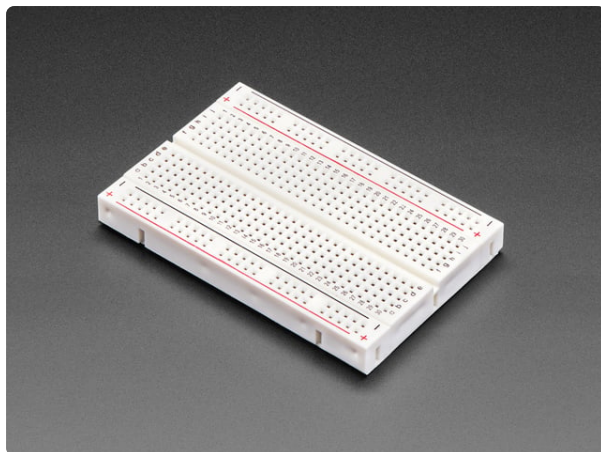


### STEMMA QT / Qwiic JST SH 4-pin to Premium Male Headers Cable

This 4-wire cable is a little over 150mm / 6" long and fitted with JST-SH female 4-pin connectors on one end and premium Dupont male headers on the other.

Compared with the...

<https://www.adafruit.com/product/4209>

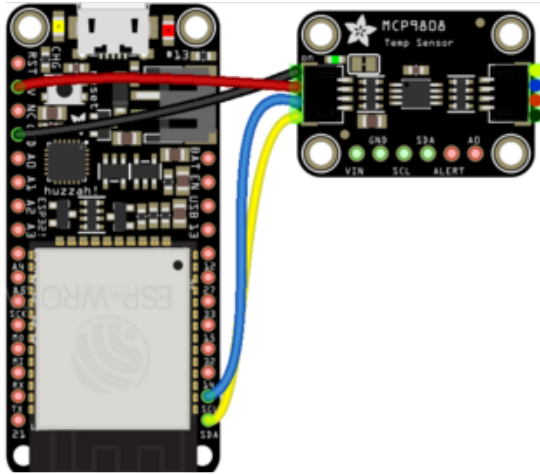


### Half Sized Premium Breadboard - 400 Tie Points

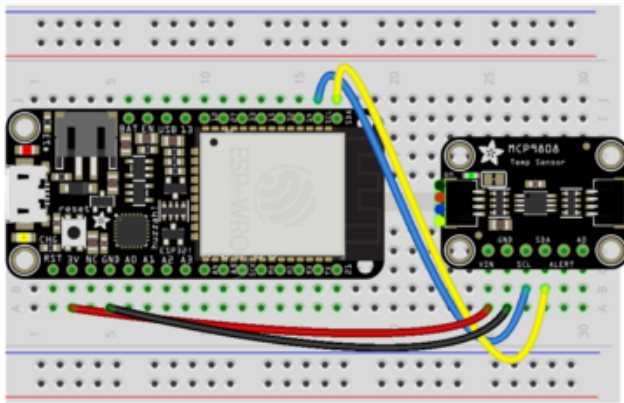
This is a cute, half-size breadboard with 400 tie points, good for small projects. It's 3.25" x 2.2" / 8.3cm x 5.5cm with a standard double-strip in the...

<https://www.adafruit.com/product/64>

## Wiring



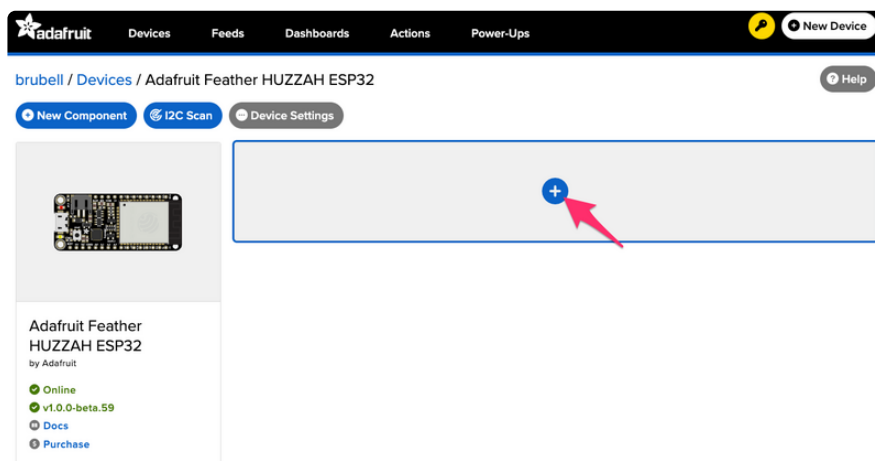
Make the following connections between your Adafruit HUZZAH32 and the MCP9808:



Board power to MCP9808 VIN  
Board ground to MCP9808 GND  
Board SCL to MCP9808 SCL  
Board SDA to MCP9808 SDA

## Add an MCP9808 Component

On the device page, click the New Component (or "+") button to open the component picker.



## New Component

Which component would you like to set up?

X MCP9808

Displaying 1 matching Components.



Search for the component name by entering **MCP9808** into the text box on the component picker, the list of components should update as soon as you stop typing.



## Filtering and searching for components

Since WipperSnapper supports such a large number of components, there is keyword filtering. Try searching for various keywords, like:

- component names: **ah20**, **servo**, **buzzer**, **button**, **potentiometer**, etc
- sensor types: **light**, **temperature**, **pressure**, **humidity**, etc
- interface: **i2c**, **uart**, **ds18x20**, **pin**, etc (also I2C addresses e.g. **0x44**)
- vendor: **Adafruit**, **ASAIR**, **Infineon**, **Bosch**, **Honeywell**, **Sensirion**, etc

There are added product and documentation links for every component, follow the links beneath the component descriptions to be taken to the appropriate product page or Learn Guide.



Select the **MCP9808** from the list of results to go to the component configuration page.

There will be a back button if you select the wrong component, and you can use the Edit component icon (⚙️) on the device page to update the component configuration in the future.

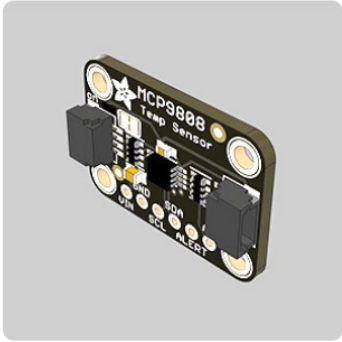
On the component configuration page, the MCP9808's I2C sensor address should be listed along with the sensor's settings.

Create MCP9808 Component

Select I2C Address:  
0x18

☒ Enable MCP9808: Temperature Sensor (°C)?  
Name:  
MCP9808: Temperature Sensor (°C)  
Send Every:  
Every 15 minutes

☒ Enable MCP9808: Temperature Sensor (°F)?  
Name:  
MCP9808: Temperature Sensor (°F)  
Send Every:  
Every 15 minutes



The MCP9808 sensor can measure ambient temperature. This page has individual options for reading the ambient temperature, in either Celsius or Fahrenheit. You may select the readings which are appropriate to your application and region.

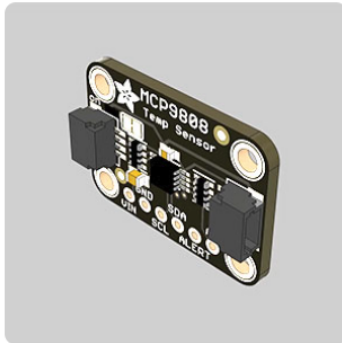
The **Send Every** option is specific to each sensor measurement. This option will tell the board how often it should read from the sensor and send the data to Adafruit IO. Measurements can range from every 30 seconds to every 24 hours.

For this example, set the **Send Every** interval for both seconds to **Every 30 seconds**. Click **Create Component**.

Create MCP9808 Component

Select I2C Address:  
0x18

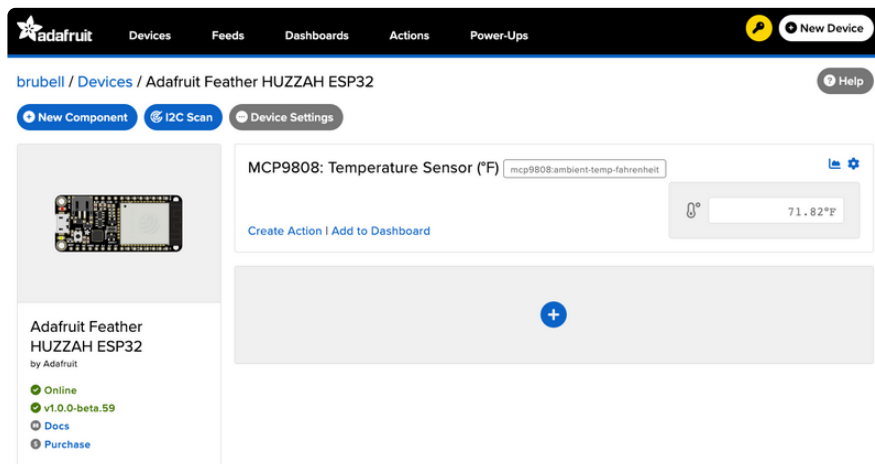
☐ Enable MCP9808: Temperature Sensor (°C)?  
☒ Enable MCP9808: Temperature Sensor (°F)?  
Name:  
MCP9808: Temperature Sensor (°F)  
Send Every:  
Every 30 seconds



[← Back to Component Type](#)

Create Component

The board page should now show the MCP9808 component you created. After the interval you configured elapses, the WipperSnapper firmware running on your board automatically reads values from the sensor and sends them to Adafruit IO.



## Read I2C Sensor Values

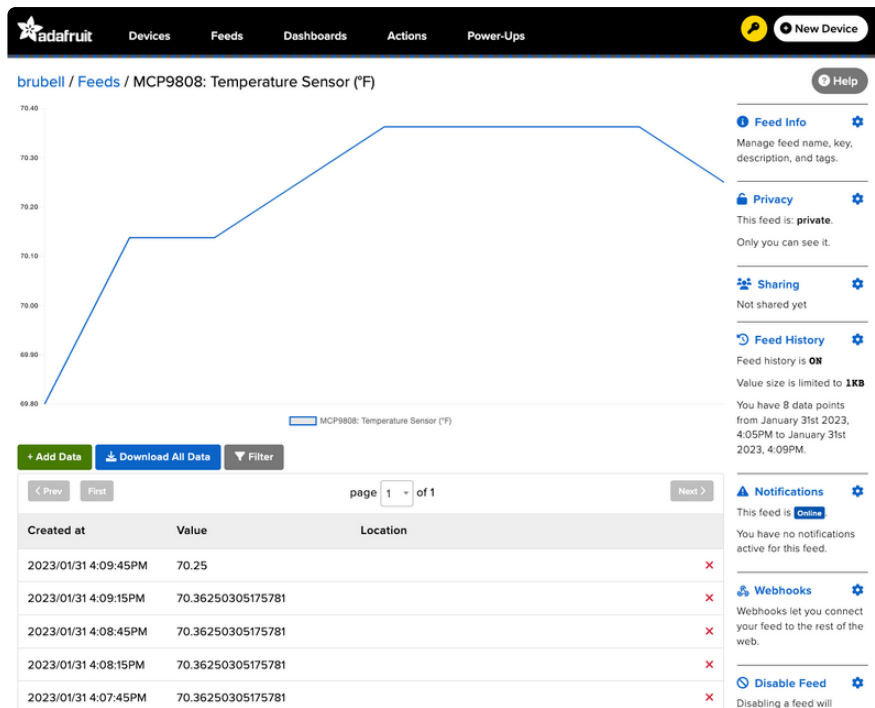
Now to look behind the scenes at a powerful element of using Adafruit IO and WipperSnapper. When a new component is created on Adafruit IO, an [Adafruit IO Feed](https://adafru.it/ioA) (<https://adafru.it/ioA>) is also created. This Feed holds your sensor component values for long-term storage (30 days of storage for Adafruit IO Free and 60 days for Adafruit IO Plus plans).

Aside from holding the **values** read by a sensor, the component's feed also holds **metadata** about the data pushed to Adafruit IO. This includes settings for whether the data is public or private, what license the stored sensor data falls under, and a general description of the data.

Next, to look at the sensor temperature feed. To navigate to a component's feed, click on the chart icon in the upper-right-hand corner of the component.



On the component's feed page, you'll see each data point read by your sensor and when they were reported to Adafruit IO.



## Doing more with your sensor's Adafruit IO Feed

This only scratches the surface of what Adafruit IO Feeds can accomplish for your IoT projects. For a complete overview of Adafruit IO Feeds, including tasks like downloading feed data, sharing a feed, removing erroneous data points from a feed, and more, [head over to the "Adafruit IO Basics: Feed" learning guide \(https://adafru.it/ioA\)](https://adafru.it/ioA).

## ESP32 F.A.Q

Some pins are special about the ESP32 - here's a list of 'notorious' pins to watch for!

- **A2 / I34** - this pin is an input only! You can use it as an analog input so we suggest keeping it for that purpose
- **A3 / I39** - this pin is an input only! You can use it as an analog input so we suggest keeping it for that purpose
- **A4 / I36** - this pin is an input only! You can use it as an analog input so we suggest keeping it for that purpose
- **IO12** - this pin has an internal pulldown, and is used for booting up. We recommend not using it or if you do use it, as an output only so that nothing interferes with the pulldown when the board resets
- **A13 / I35** - this pin is not exposed, it is used only for measuring the voltage on the battery. The voltage is divided by 2 so be sure to double it once you've done the analog reading





## Why does the yellow CHARGE LED blink while USB powered?

The charging circuit will flash when there is no LiPoly battery plugged in. It's harmless and doesn't mean anything. When a LiPoly battery is connect it will stabilize the charger and will stop flashing



## Why can I not read analog inputs once WiFi is initialized?

Due to the design of the ESP32, **ADC2** is not available once WiFi has started. You can still use **ADC1** even if WiFi is in use.



## Why is Serial.read() not working as expected on ESP32 Breakout?

This is a minor design issue with the initial version of the Breakout (does not apply to Feather version). If you are having issues similar to the [discussion here \(https://adafru.it/ven\)](https://adafru.it/ven), try the trick of enabling the internal pull-up as [described here \(https://adafru.it/ven\)](https://adafru.it/ven).

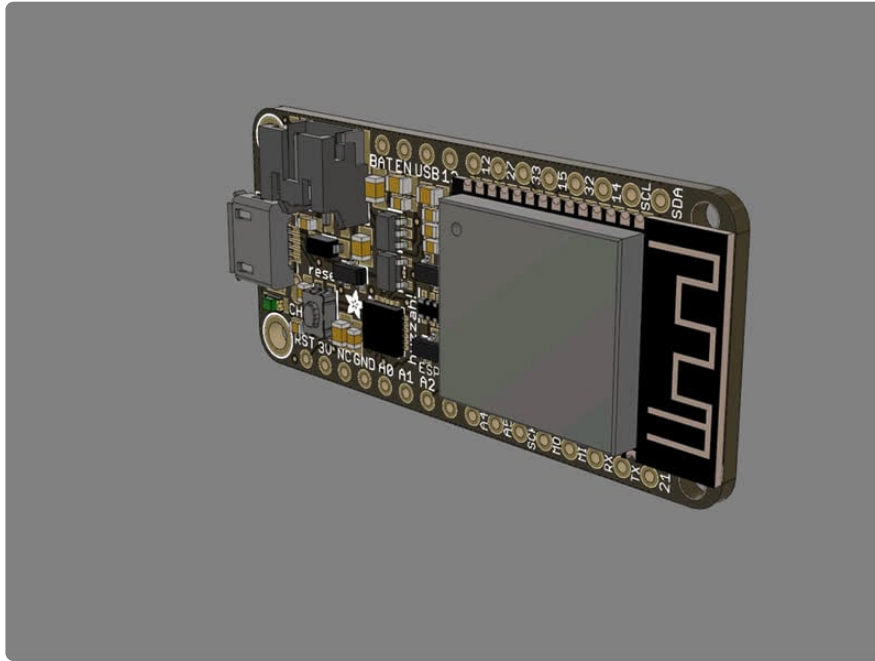
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## Downloads

### Files

- [ESP32 WROOM32 Datasheet \(https://adafru.it/EVE\)](https://adafru.it/EVE)
- [ESP32 Technical Manual \(https://adafru.it/weC\)](https://adafru.it/weC)
- [Don't forget to visit esp32.com for the latest and greatest in ESP32 news, software and gossip! \(https://adafru.it/weD\)](https://adafru.it/weD)
- [EagleCAD PCB files on github \(https://adafru.it/weE\)](https://adafru.it/weE)
- [Fritzing object in the Adafruit Fritzing library \(https://adafru.it/aP3\)](https://adafru.it/aP3)
- [3D Models on GitHub \(https://adafru.it/GAA\)](https://adafru.it/GAA)
- [PDF for Huzzah32 ESP32 Feather Board Diagram on GitHub \(https://adafru.it/ZKA\)](https://adafru.it/ZKA)

SVG for Huzzah32 ESP32 Feather  
Board Diagram



## Schematic and Fabrication print

