adafruit learning system

USB Foot Switch Controller in Circuit Python

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Last updated on 2020-04-21 03:50:47 PM EDT

Overview

USB Circuit Python Controllers

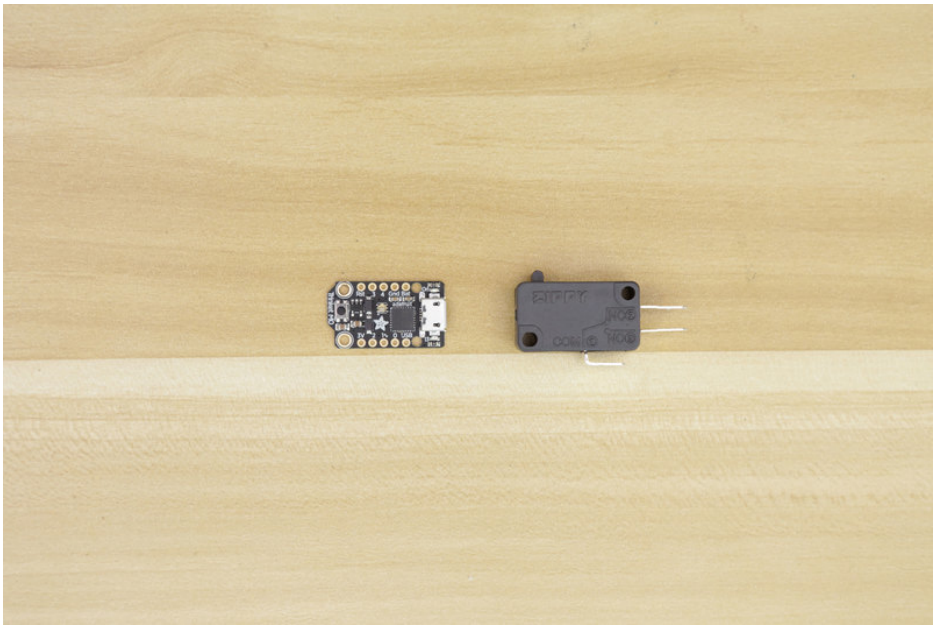
In this guide, we'll build a USB foot switch controller. This can be used as an addition to your keyboard or as a way to free up your hands. I'm using it to do overhead photography so I can trigger the camera and use my hands at the same time.

It's powered by Adafruit's Trinket M0 which is a tiny microcontroller that can run Circuit Python. Just connect over USB and load it as a flash drive. All of the code and libraries are accessible on the drive so you can make small edits and iterate quickly. The Adafruit HID library simulates USB devices so it can send keypress just like a mouse and keyboard.

Prerequisite Guides

If your new to electronics and soldering, I suggest walking through the following guides to get the basics. The Adafruit Excellent guide to soldering will walk you through process of learning how to use a soldering iron to make solid electrical connections.

- Adafruit Guide to Excellent Soldering (https://adafru.it/CjY)
- Welcome to Circuit Python (https://adafru.it/cpy-welcome)
- Collin's Lab: Soldering (https://adafru.it/dyT)



Electronic Components

The Trinket M0 and Foot Switch are the main electronic components used in this project.

1 x Trinket M0

Adafruit Trinket M0 with CircuitPython

Out Of Stock

1 x Micro Switch

Premium Zippy 3-Terminal

Add To Cart

Hardware and Supplies

Just a few screws, wires and some handy supplies.

4 x M2.5 x .45 x 5mm

Metric Flat Head Phillips Machine Screws

BUY NOW

2 x #4-40 x 5/8"

Imperial Flat Head Phillips Machine Screws

BUY NOW

1 x 26AWG Wire

Silicone Cover Stranded-Core Wire - 25ft

Add To Cart

1 x Solder Wire

Solder Spool - 1/4 lb SAC305 RoHS lead-free / 0.031" rosin-core - 0.25 lb / 100 g

Add To Cart

1 x Heat Shrink Tubing

Multi-Colored Heat Shrink Pack - 3/32" + 1/8" + 3/16" Diameters

Add To Cart

Cool Tools!

These help make the project a smooth building experience. You don't need them all of them, but I recommend them.

1 x Wire Strippers

Hakko Professsional Quality 20-30 AWG Wire Strippers - CSP-30-1

Add To Cart

1 x Wire Cutters

Flush diagonal cutters - CHP170

Add To Cart

1 x Soldering Iron

Adjustable 30W 110V soldering iron - XY-258 110V

Add To Cart

1 x Panavise

Panavise Jr. - PV-201

Add To Cart

1 x Helping Third Hands

Helping Third Hand Magnifier W/Magnifying Glass Tool - MZ101

Add To Cart

1 x Ultimaker 2+

3D Printer

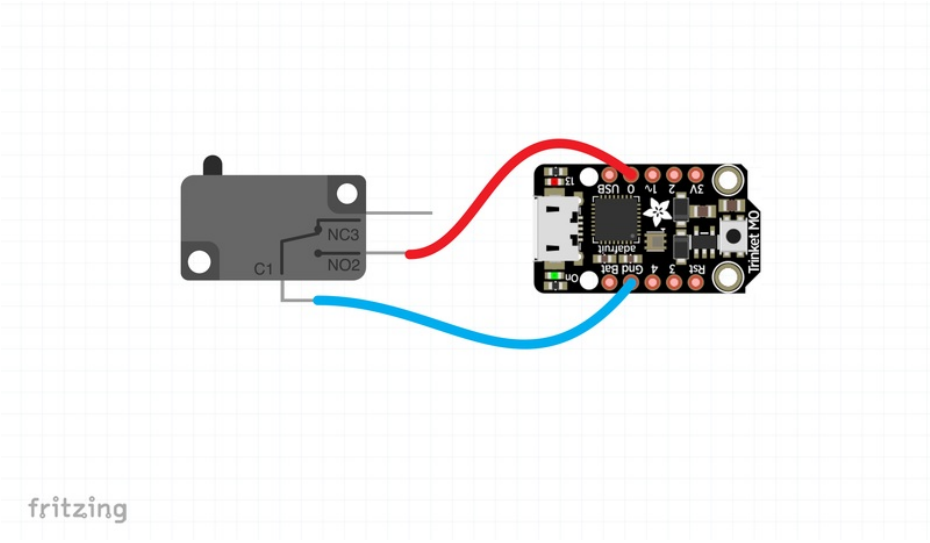
Out Of Stock

Circuit Diagram

Circuit Diagram

This provides a visual reference for wiring of the components. They aren't true to scale, just meant to be used as reference. Generic micro switches follow a standard pin out with visible markings on the body of the switch. Here's each label markings:

- (C1) – "common ground".
- (NO2) – "normally open".
- (NC3) – "normally closed".



Wired Connections

Just two wired connections are needed for this circuit, which makes it very easy!

- (C 1) **Common** from micro switch to **Ground** on **Trinket M0**
- NO 2) **Normally open** from micro switch to **#0** on on **Trinket M0**

Software

Setup Adafruit Trinket M0 for CircuitPython

Your Trinket M0 should already come with CircuitPython but maybe there's a new version, or you overwrote your Trinket M0 with Arduino code! In that case, see the below for how to reinstall or update CircuitPython. Otherwise you can skip this and go straight to the next page.

https://adafru.it/ABS

https://adafru.it/ABS

Download Adafruit CircuitPython Library Bundle

The Trinket M0 needs to have the USB HID library in order to run the code, so check yours to see if it's in the lib folder. Otherwise, you can download it from the Library Bundle (https://adafru.it/ABU). Unzip the downloaded file and look for the adafruit_hid library then drop it into the lib folder, create one if it's not already there.

https://adafru.it/ABU

https://adafru.it/ABU

List of USB HID Keycodes

The long list of available keyboard characters are listed in the webpage linked below. Most of the characters are for USA keyboard only. Function keys and modifiers can be used but only some special characters are not supported.

https://adafru.it/AOi

https://adafru.it/AOi

Upload The Code

Copy and paste the code below into a new text document (we recommend using Mu as your editor, which is designed for CircuitPython.). Save the file and name it as main.py

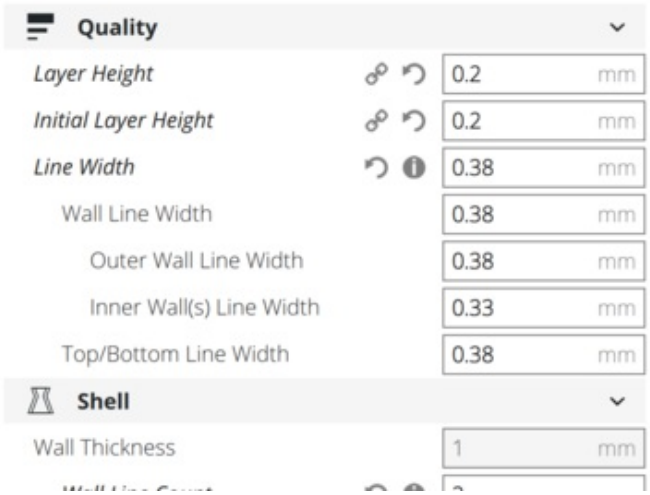
Once the files has been uploaded to the drive, the Trinket M0 will automatically reboot and run the code.

```
import digitalio
from board import *
import time
from adafruit_hid.keyboard import Keyboard
from adafruit_hid.keycode import Keycode

# A simple neat keyboard demo in circuitpython
buttonpins = [D0]

# The keycode sent for each button, optionally can be paired with a control key
buttonkeys = [44]
controlkey = Keycode.LEFT_CONTROL

# the keyboard object!
kbd = Keyboard(usb_hid.devices)

# our array of button objects
buttons = []

# make all pin objects, make them inputs w/pullups
for pin in buttonpins:
    button = digitalio.DigitalInOut(pin)
    button.direction = digitalio.Direction.INPUT
    button.pull = digitalio.Pull.UP
    buttons.append(button)

print("Waiting for button presses")

while True:
    # check each button
    for button in buttons:
        if (not button.value):   # pressed?
            i = buttons.index(button)

            print("Button #%d Pressed" % i)

            # type the keycode!
            k = buttonkeys[i]    # get the corresp. keycode
            kbd.press(k)
            # Use this line for key combos kbd.press(k, controlkey)
            kbd.release_all()

            while (not button.value):
                pass  # wait for it to be released!
    time.sleep(0.01)
```

3D Printing

What If I Don't Have A 3D Printer?

Not to worry! You can use a 3D printing service such as 3DHubs (https://adafru.it/jNb) or MakeXYZ (https://adafru.it/veh) to have a local 3D printer operator 3D print and ship you parts to you. This is a great way to get your parts 3D printed by local makers. You could also try checking out your local Library or search for a Maker Space.

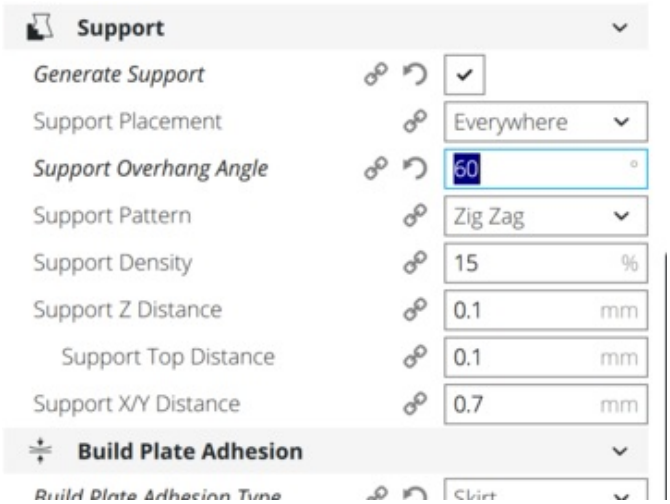


Slice Settings

These parts have been tested and 3D printed on an Ultimaker 2+ and 3 using PLA filament. The parts were sliced using CURA 3.x with the following slice settings.

- 220C extruder temp
- 65c bed temp
- 0.2 layer height
- 0.38 line width
- 2 Wall Line Count – 0.4 nozzle
- 20% infill
- 70mm/s print speed

3D printed support material is required for the top cover, turn it on in your slicing software.



Support Material / Overhangs

The **top cover** requires support material. The overhang angles on the support material can be increased to 60 degrees which will use less material and reduce the printing time. Features on the sides of the **top cover** part are 60 degrees so they don't need any supports.

Design Source Files

The spool holder carousel assembly was designed in Fusion 360. This can be downloaded in different formats like STEP, SAT and more.

https://adafru.it/AQq

https://adafru.it/AQq

3D Printed Parts

All of the parts are 3D printed with FDM type 3D printers using various colored filaments. All of the parts are separated into pieces to make 3D printing easier. Assembly is pretty easy and straight forward. Use the links below to download the STLs files.

https://adafru.it/AQH

https://adafru.it/AQH

https://adafru.it/ARi

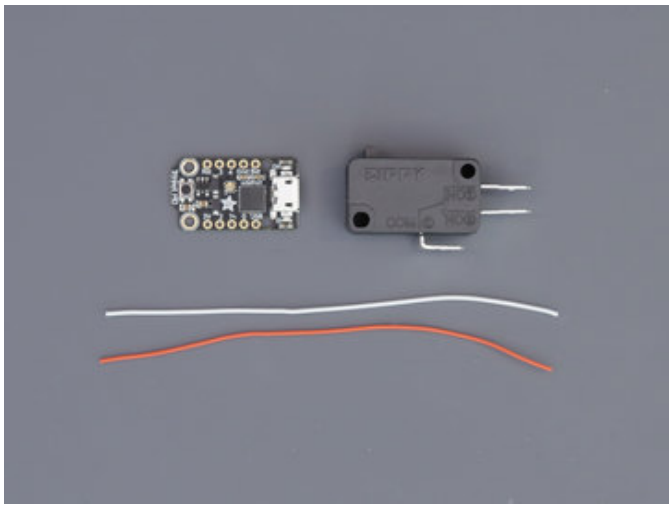
https://adafru.it/ARi

Design Source Files

The enclosure assembly was designed in Fusion 360. This can be downloaded in different formats like STEP, SAT and more. Electronic components like the board, displays, connectors and more can be downloaded from our Fusion 360 CAD parts github repo.

https://adafru.it/AW8

https://adafru.it/AW8

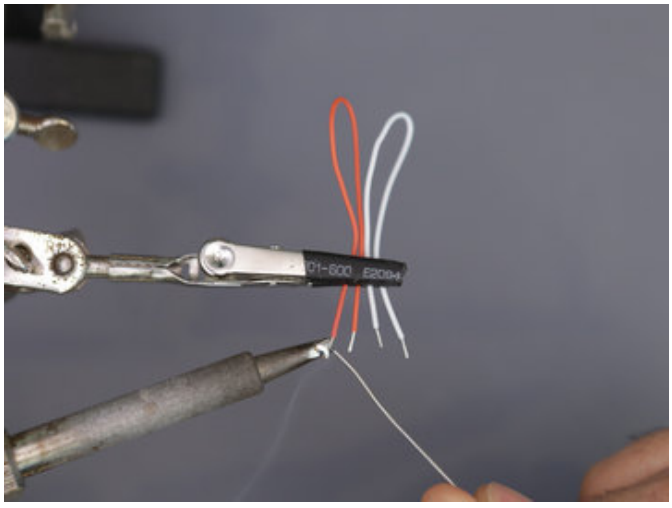


Wires for Micro Switch

We'll need two pieces of wires to connect the micro switch to the Adafruit Trinket M0. These can be about 10 cm in length. I'm using 30AWG silicone covered wires (https://adafru.it/ekF) in this project.

Wire Strippers

In order to connect the wires to the electrical leads and pins on the components, we'll need to strip the ends to expose the bare metal wire. Use wire strippers to remove a bit of insulation from the tips.

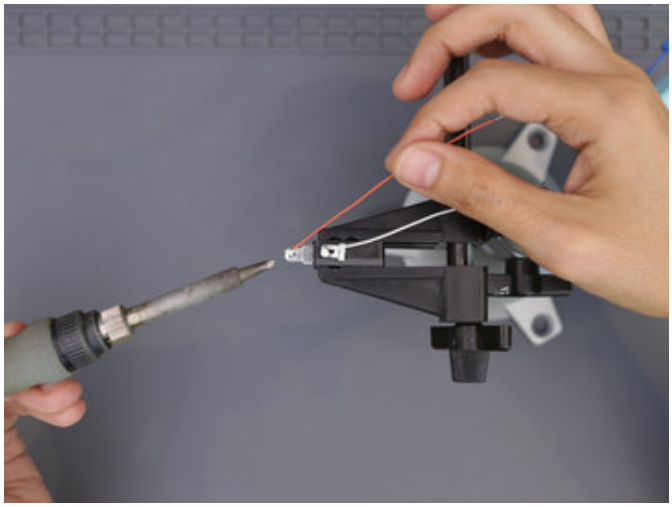


Tinning Wires

To prevent the strands of wires from fraying when soldering, we can add a small amount of solder to fuse them. I'm used third helping hands tools to hold the wires in place which makes soldering more conformable.

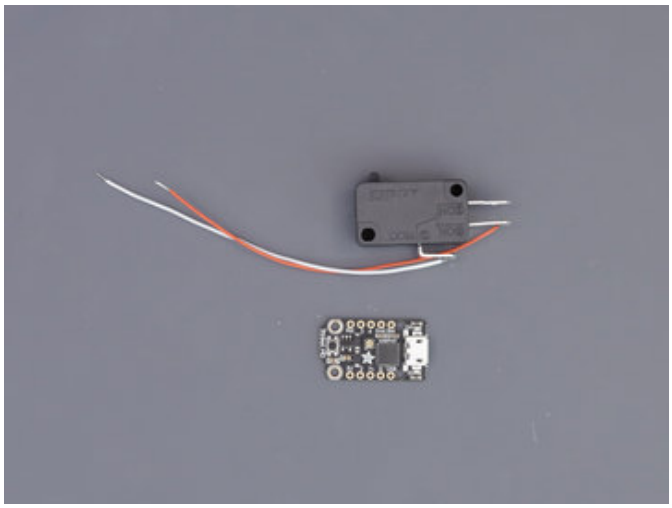
Tinning Micro Switch

We can do the same process for the leads on the micro switch. Since we'll only be using two of the leads, we only need to tin the NO3(Normally Open) and C1(Common) labeled leads.



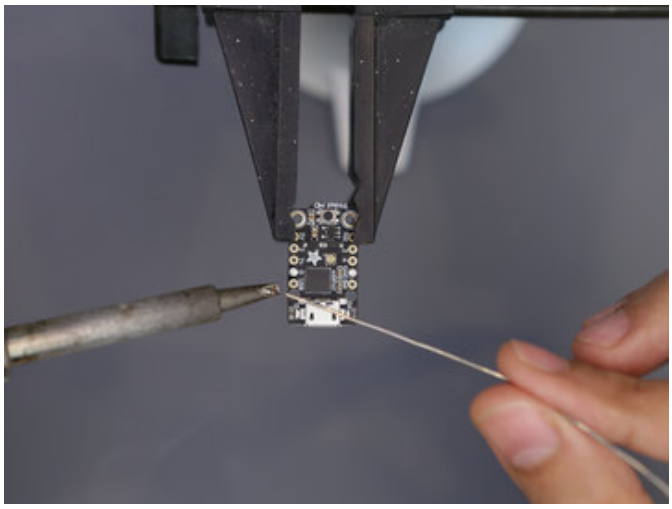
Wiring Micro Switch

Now we can attach the wires from the Trinket M0 to the micro switch by heating up the leads and placing the wires down onto them. I used a Panavise Jr to hold the micro switch steady while soldering.



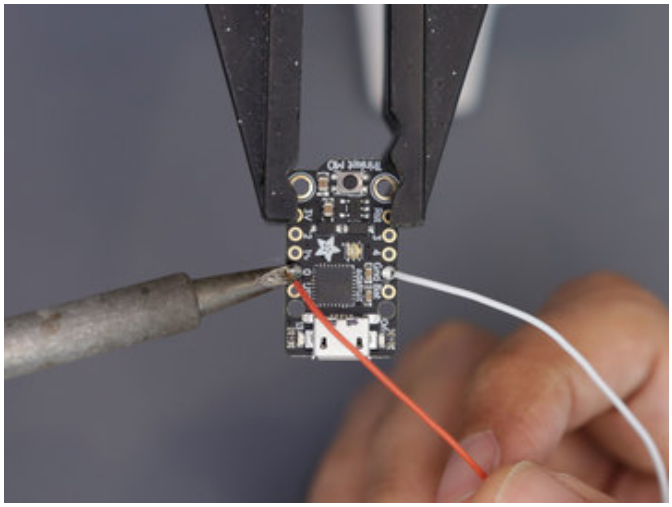
Wired Micro Switch

Now we have a wired micro switch, nice work! Double check your solder joints and make sure the wires a fully connected and for any shorts.



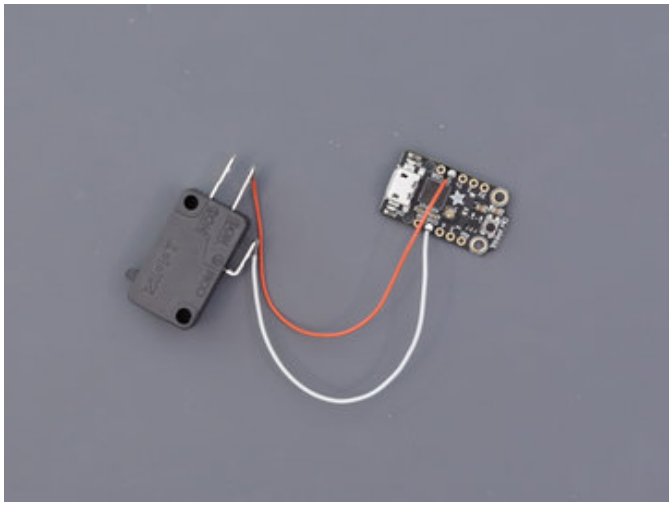
Trinket Tinning

We'll need to connect the wires from the micro switch to the pins on the Trinket M0. I like to add a bit of solder to the pins and then insert the wires.



Wiring Trinket M0

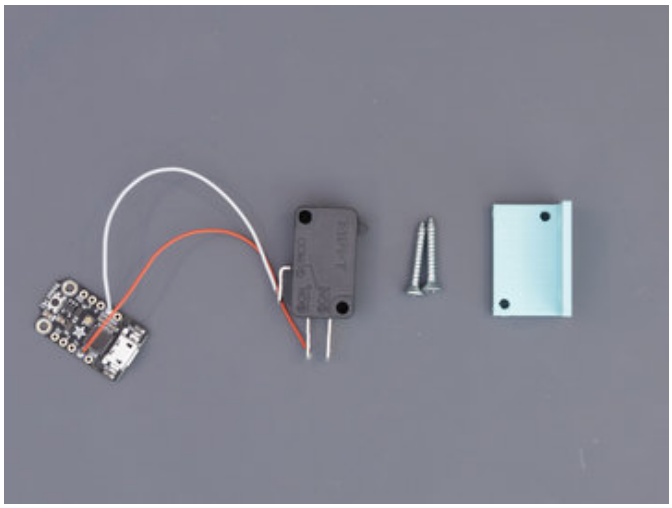
Solder the C1(common) wire to the ground (G) labeled pin and NO3(normally open) wire to pin number 0.



Wired Trinket M0 and Micro Switch

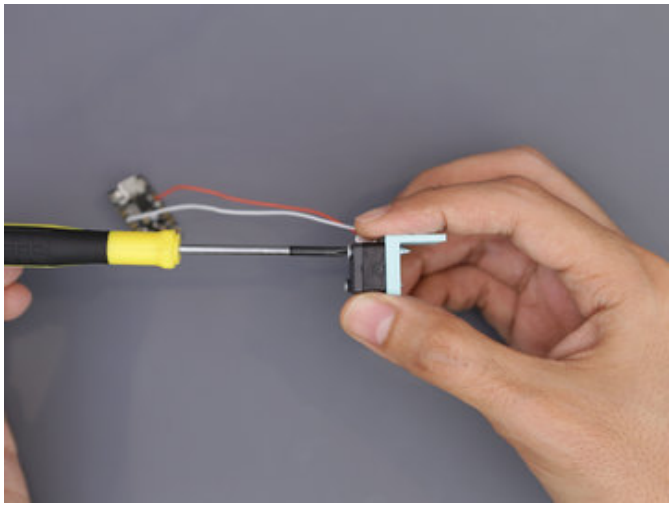
Now our micro switch is connected to the Trinket M0, high five! Now we can start putting our circuit into the 3D printed enclosure. Before we get started, let's double check our work and make sure we have solid connections.

Assembly



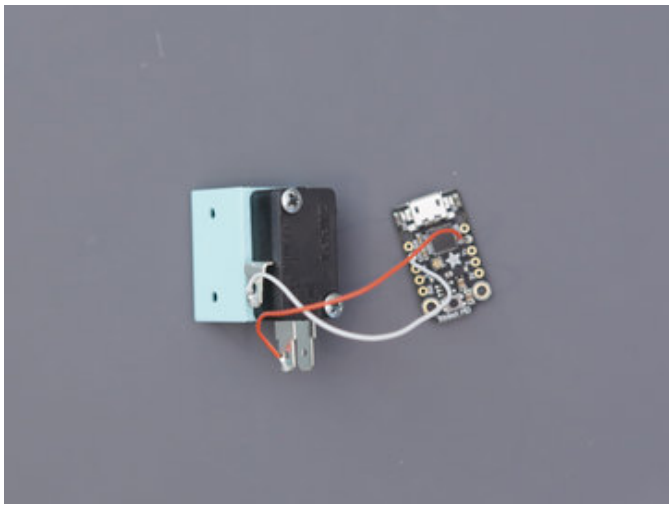
Hardware for Micro Switch

First up we'll need to get that micro switch secured to the mounting bracket. We have two long screws that will be inserted through the body of the switch and into the holes of the mounting bracket.



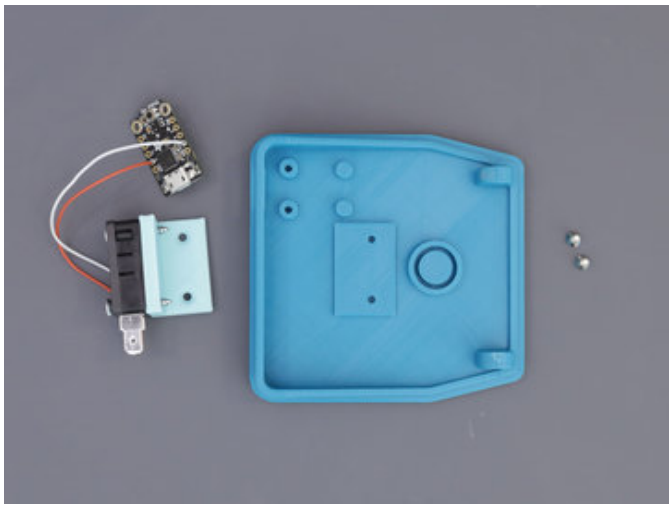
Secure Micro Switch to Bracket

Grab the two parts and line up the holes so ones on the micro switch are matching with the bracket. The actuator of the switch should face away from the 'L' shape of the bracket.



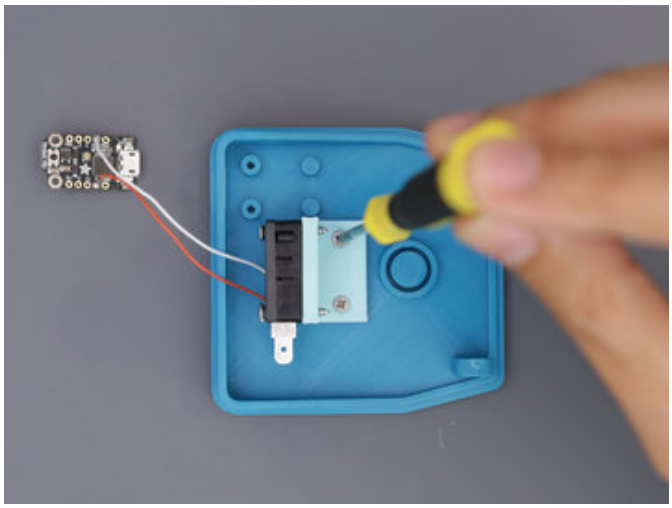
Micro Switch Bracket

Here's a better view of the orientation. Note how the C1(common) lead is parallel with surface of the 'L' bracket .



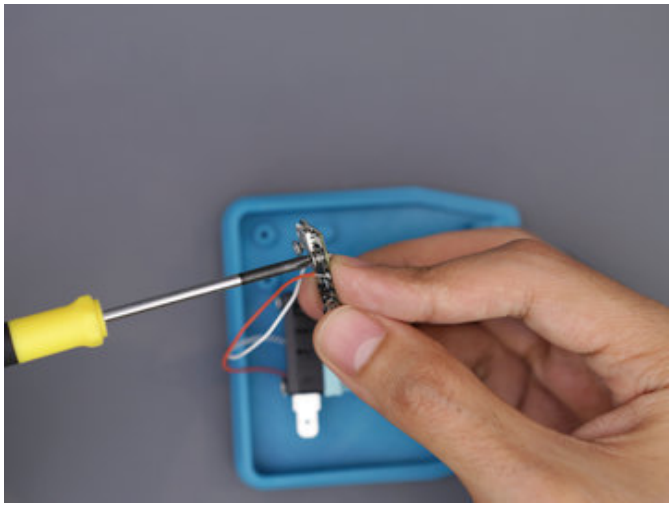
Installing Bracket

Next we'll work on mounting the bracket to the base part. We'll need two short M2.5 machine screws to secure the parts together.



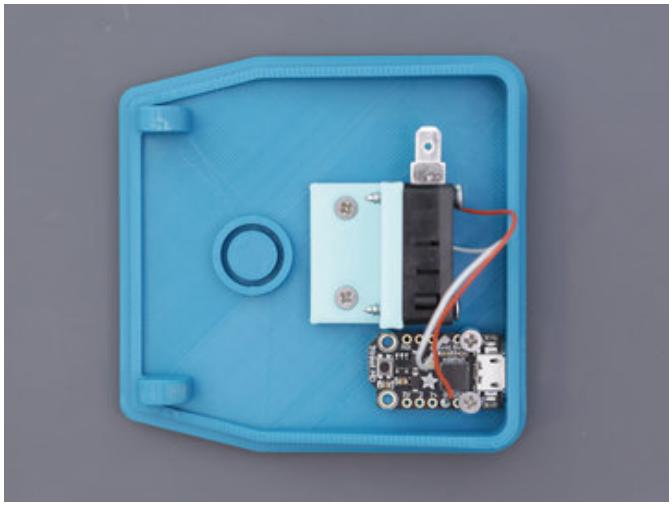
Installed Bracket

Place the bracket over the center of the base with the micro switch facing away from the circular post. Line up the mounting holes and insert machine screws. Fasten the screws until they're fully tightened with the two parts jointed and flush.



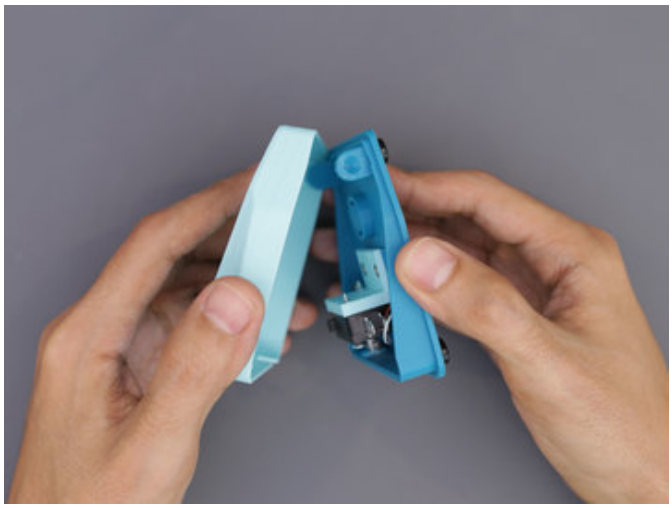
Tap Mounting Holes

We'll need to secure the Trinket M0 to the base with machine screws. It's easier if the screws are pre-fastened into the Trinket first. You may need to tap the mounting holes with the screws.



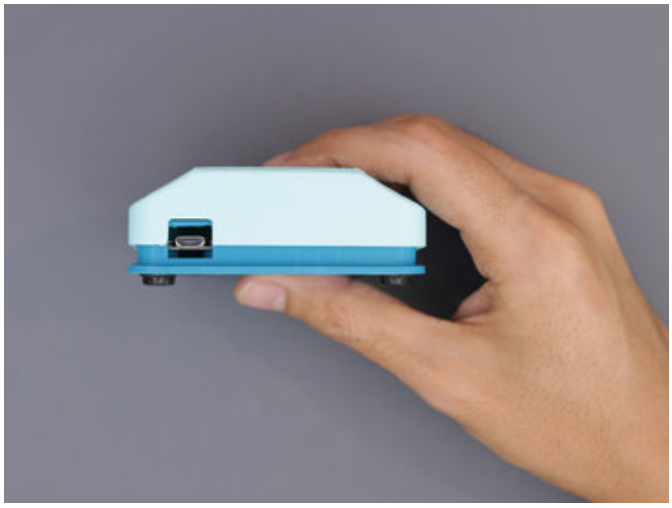
Secure Trinket M0

Place the Trinket M0 over the four standoffs on the base with the USB port facing the cut opening. Line up the holes on and fasten the machine secures until fully tightened.



Install Top Cover

All that's left todo now is to install the top cover. Grab the parts and line up the hinges with each other, you'll notice the top has extrusion while the base has dimpled features. Firmly press the parts together until the hinges click into place. They should join together nicely.



USB Port

Squeeze the top and base together to test out the micro switch. The hinges should be frictionless. The USB port is accessible through the open and the top accommodates for microUSB cables.