



PyPortal View Master

Created by Ruiz Brothers



<https://learn.adafruit.com/pyportal-view-master>

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Overview



In this project we're building a view master inspired device using Adafruit's PyPortal.

The eyepiece makes the viewing experience feel immersive and novel.

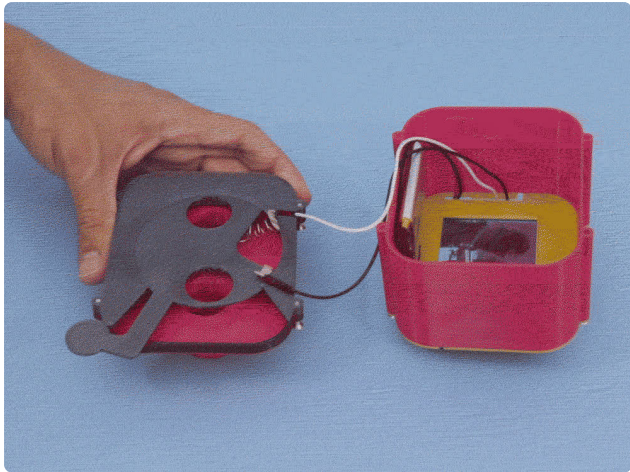
When you pull the down on the crank, it goes through the image on the screen like a slideshow.



The mechanism uses a compression spring so it can spring back when it's released.

The case design is 3D printed and uses fasteners to secure all the components in the assembly.

For portability it uses PowerBoost and battery.

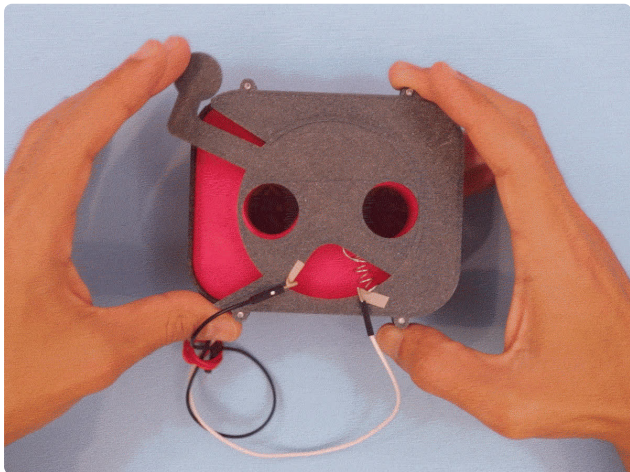


Inside are pieces of Conductive Nylon Tape that close a switch when the crank is pulled.

Code is written in Circuit Python and uses Adafruit's libraries to make a slideshow.

Use the Adafruit PyPortal libraries to display bitmap images from either the internal storage or micro SD card.

The images actually fade in and out when cycling through them so it makes for nice and smooth effect.



Parts List

Adafruit PyPortal ([link](#))

Adafruit PowerBoost 1000C (<http://adafru.it/2465>)

3.7v 2000mAh lipo battery (<http://adafru.it/2011>)

Slide Switch (<http://adafru.it/805>)

2x 3-pin JST cables (<http://adafru.it/3893>)

Conductive Nylon Fabric Tape (5mm wide / 10m) (<http://adafru.it/3961>)

Mini Oval Speaker (<http://adafru.it/3923>) (optional)

Compression Spring 5/16x1 1/2 x .02" (7.9x38x.5mm)

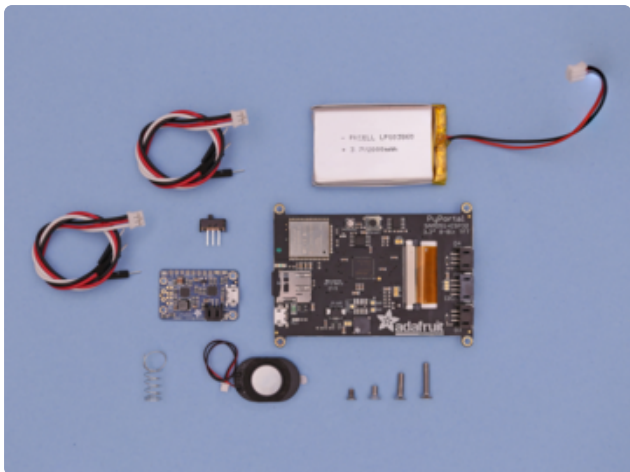
Cut 20.5mm short

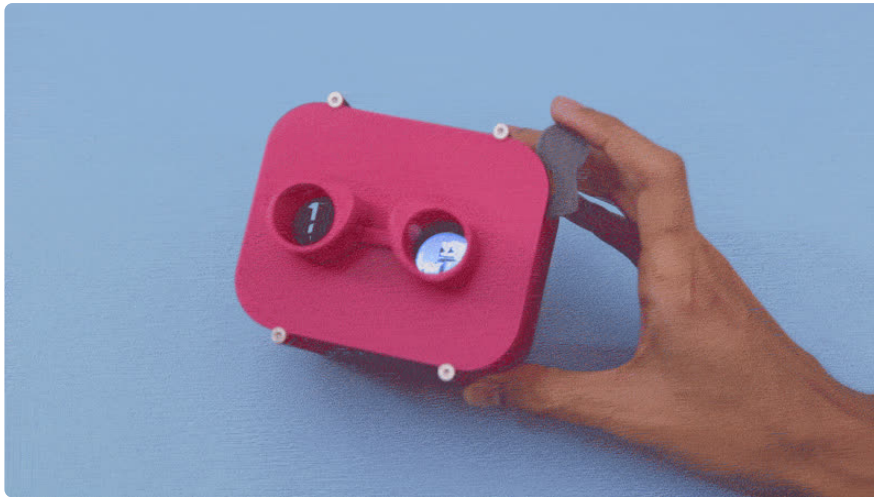
4x M3x16mm (for EyePiece Assembly)

4x M3x10mm (for PyPortal Assembly)

4x M3x5mm (for Lid Assembly)

4x M2.5x5mm (for PowerBoost)

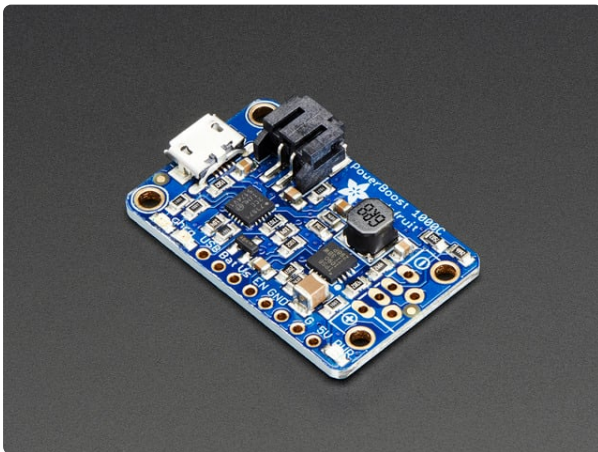




Adafruit PyPortal - CircuitPython Powered Internet Display

PyPortal, our easy-to-use IoT device that allows you to create all the things for the “Internet of Things” in minutes. Make custom touch screen interface...

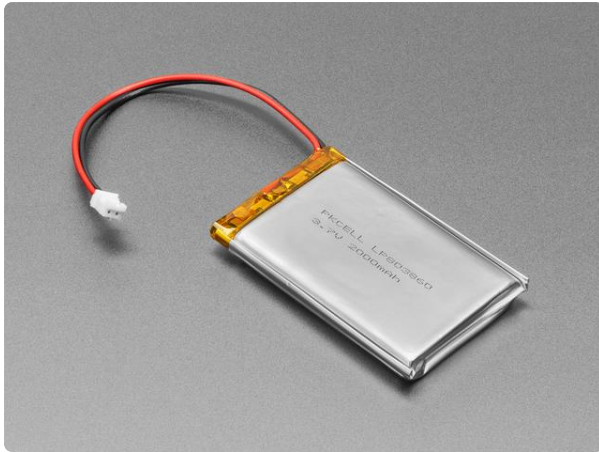
<https://www.adafruit.com/product/4116>



PowerBoost 1000 Charger - Rechargeable 5V Lipo USB Boost @ 1A

PowerBoost 1000C is the perfect power supply for your portable project! With a built-in load-sharing battery charger circuit, you'll be able to keep your power-hungry...

<https://www.adafruit.com/product/2465>



Lithium Ion Battery - 3.7V 2000mAh

Lithium-ion polymer (also known as 'lipo' or 'lipoly') batteries are thin, light, and powerful. The output ranges from 4.2V when completely charged to 3.7V. This...

<https://www.adafruit.com/product/2011>



Breadboard-friendly SPDT Slide Switch

These nice switches are perfect for use with breadboard and perfboard projects. They have 0.1" spacing and snap in nicely into a solderless breadboard. They're easy to switch...

<https://www.adafruit.com/product/805>



STEMMA JST PH 2mm 3-Pin to Male Header Cable - 200mm

This cable will let you turn a JST PH 3-pin cable port into 3 individual wires with high-quality 0.1" male header plugs on the end. We're carrying these to match up with our...

<https://www.adafruit.com/product/3893>



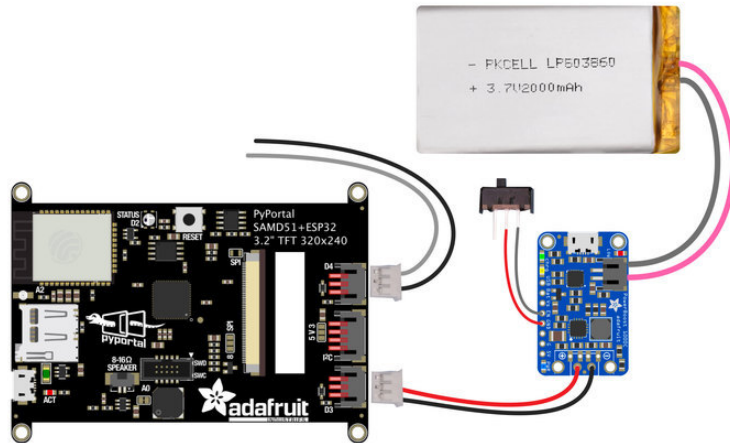
Conductive Nylon Fabric Tape - 5mm Wide x 10 meters long

With our fun assortment of conductive materials,

<https://www.adafruit.com/product/3961>

Circuit Diagram

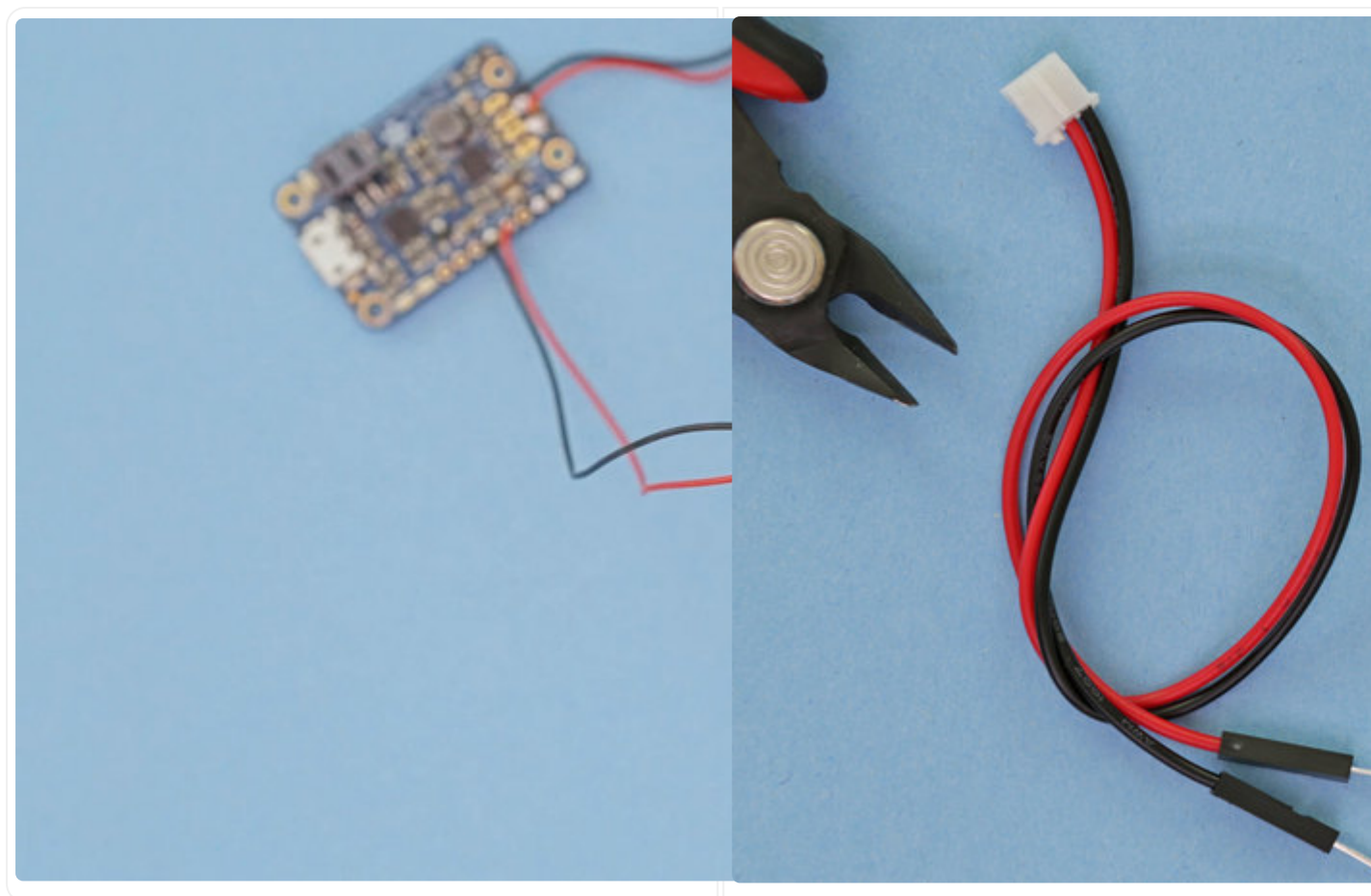
This provides a visual reference for wiring of the components. They aren't true to scale, just meant to be used as reference. This diagrams was created using [Fritzing software](https://adafru.it/oEP) (<https://adafru.it/oEP>).



Circuit Diagram

The 2-pin JST cable from the battery connects directly into battery port on the PowerBoost 1000C. Voltage and Ground wires from the PowerBoost 1000C connect to the 3-pin JST port on the PyPortal (doesn't matter which one).

- **5V/VCC** pin from **PowerBoost 1000C** to **3-pin JST(VCC)** on PyPortal
- **GND** from **PowerBoost 1000C** to **3-pin JST(GND)** on PyPortal
- **EN** from **PowerBoost 1000C** to switch
- **GND** from **PowerBoost 100C** to switch



Slide Switch

Use a 2-wire cable (110mm long) to connect the slide switch to the PowerBoost. Remove a bit of insulation from the tips of the wire and tin them with a bit of solder. Connect the wires to the middle pin and either the far left or right pin on the switch. A third helping hand tool can hold the switch and wire in place while soldering.

Connect JST Cable

We'll use a 3-pin JST cable (9cm long) to easily connect the PowerBoost to the PyPortal. We only need two of the three wires, so you can remove the white wire. Using wire strippers, remove a bit of insulation from the tips of the wire and tin them with a bit of solder. Solder the wires to the voltage (+) and ground (-) pins on the USB output of the PowerBoost.

Code



As of CircuitPython 9, a mount point (folder) named `/sd` is required on the `CIRCUITPY` drive. Make sure to create that directory after upgrading CircuitPython.

Follow these steps to create the `/sd` directory

<https://adafru.it/19ei>

CircuitPython Setup

Your Adafruit PyPortal should already come with CircuitPython but maybe there's a new version, or you overwrote your board with Arduino code! In that case, see the below for how to reinstall or update CircuitPython. Otherwise you can skip this and proceed with the build.

Install CircuitPython for PyPortal

<https://adafru.it/Egk>

Images on internal flash

The code looks for an `"images"` folder on the `CIRCUITPY` drive by default. If it can't find any there, it'll search for images on the SD card.

Images on SD Card

If no images are on the internal storage, the code will search on the microSD card. The microSD card must be FAT32 and contain a folder named "images".

Image file names can be titled arbitrarily but avoid using special characters, hyphens and the sort. Your images must be in the following format and resolution.

- Images must be **320 x 240 pixel 16-bit color .bmp** files

Download our sample image pack to get you started!

image-samples.zip

<https://adafru.it/Egl>

Upload Code Files

Click the **Download Project Bundle** button below and save the zip file to your computer. Connect your PyPortal to your computer via a known good USB data+power cable. The PyPortal should show up as a drive in your file explorer app named **CIRCUITPY**.

Copy the files from the zip file to the **CIRCUITPY** drive.

```
# SPDX-FileCopyrightText: 2019 Anne Barela for Adafruit Industries
#
# SPDX-License-Identifier: MIT

import os
import board
import busio
import digitalio
import storage
import sdcardio
from adafruit_slideshow import PlaybackOrder, SlideShow, PlaybackDirection

# Default location to look is in internal memory
IMAGE_DIRECTORY = "/images"

switch = digitalio.DigitalInOut(board.D3)
switch.direction = digitalio.Direction.INPUT
switch.pull = digitalio.Pull.UP

spi = busio.SPI(board.SCK, MOSI=board.MOSI, MISO=board.MISO)
try:
    sdcard = sdcardio.SDCard(spi, board.SD_CS)
    vfs = storage.VfsFat(sdcard)
    storage.mount(vfs, "/sd")
    IMAGE_DIRECTORY = "/sd/images"
```

```

except OSError as error:
    print("No SD card, will only look on internal memory")

def print_directory(path, tabs=0):
    for file in os.listdir(path):
        stats = os.stat(path + "/" + file)
        filesize = stats[6]
        isdir = stats[0] & 0x4000

        if filesize < 1000:
            sizestr = str(filesize) + " by"
        elif filesize < 1000000:
            sizestr = "%0.1f KB" % (filesize / 1000)
        else:
            sizestr = "%0.1f MB" % (filesize / 1000000)

        prettyprintname = ""
        for _ in range(tabs):
            prettyprintname += "  "
        prettyprintname += file
        if isdir:
            prettyprintname += "/"
        print('{0:<20} Size: {1:>6}'.format(prettyprintname, sizestr))

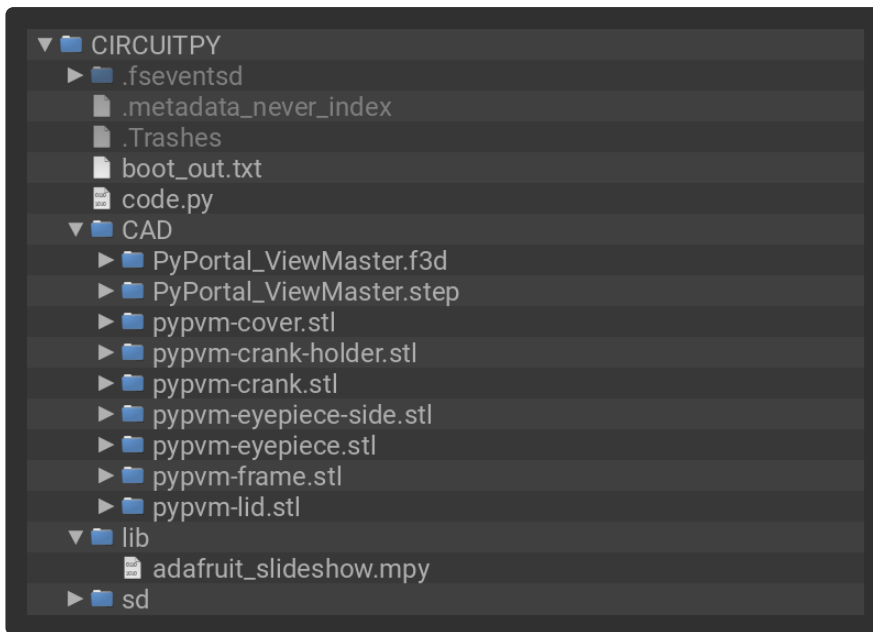
        # recursively print directory contents
        if isdir:
            print_directory(path + "/" + file, tabs + 1)

try:
    print_directory(IMAGE_DIRECTORY)
except OSError as error:
    raise Exception("No images found on flash or SD Card")

# Create the slideshow object that plays through once alphabetically.
slideshow = Slideshow(board.DISPLAY, None, folder=IMAGE_DIRECTORY, loop=True,
                      order=PlaybackOrder.ALPHABETICAL, dwell=0)
while True:
    if not switch.value:
        print("Click!")
        slideshow.direction = PlaybackDirection.FORWARD
        slideshow.advance()
        while not switch.value:
            pass

```

Your **CIRCUITPY** drive should look like the file directory structure below:



Libraries

These libraries should be on the **CIRCUITPY** drive **lib/** directory:

- **adafruit_pyportal**
- **adafruit_imageload**
- **adafruit_slideshow**
- **adafruit_bus_device**
- **neopixel.mpy**

3D Printing



3D Printed Parts

Parts are designed to be 3D printed with FDM based machines. STL files are oriented to print "as is". Parts are listed below with file name and description. Parts require tight tolerances that might need adjusting slice setting. Reference the suggested settings below.

[View Design on A360](#)

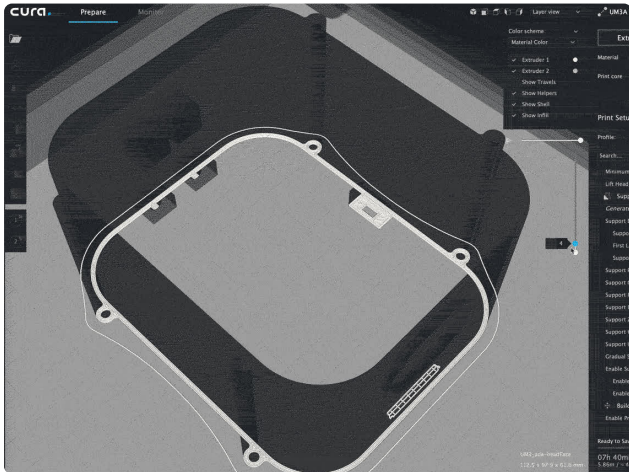
<https://adafru.it/Egm>

Source CAD files on GitHub

<https://adafru.it/Egn>

Download STLs from Thingiverse

<https://adafru.it/Ego>



Slice Settings

Use these settings as reference. Values listed were used in Ultimaker's CURA 3.X slicing software.

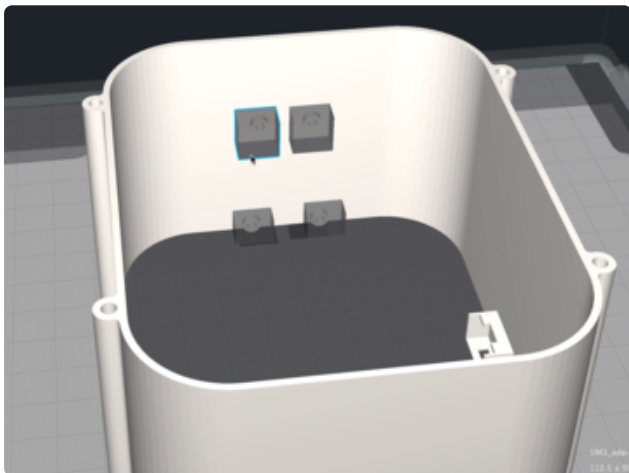
0.2mm Layer Height / 0.4mm nozzle

0.35mm Line Width (inner & outer widths)

60mm/s printing speed

20% infill

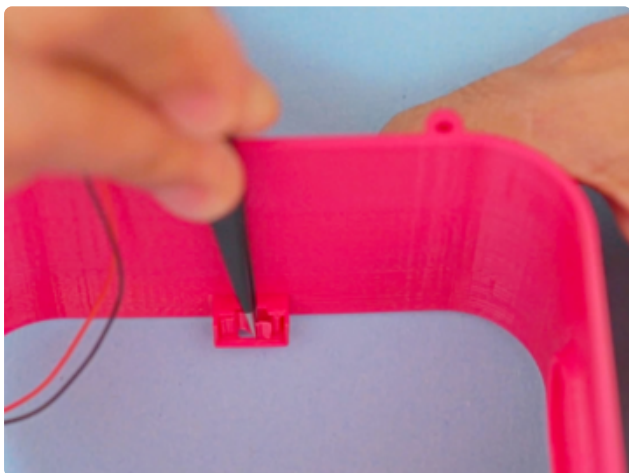
Supports: Yes



Cura Support Blockers

We added support blockers to the four standoffs on the **Frame** part, since we'll only need supports under the roof of the slide switch geometry.

We can lower the support destiny to 10% using a zigzag pattern to make removal easier.



Support Removal

To remove the supports, we used tweezers to fit between the zigzag pattern to grip and pull the supports away.

Assemble



Crank Assembly

First we'll start by assembling the crank that acts as a switch to advance to the next photo. Lay the **Crank** part inside the groove in the **Crank-Holder** part.



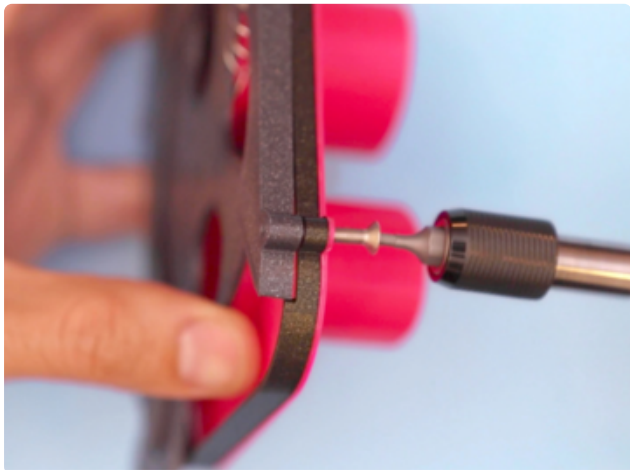
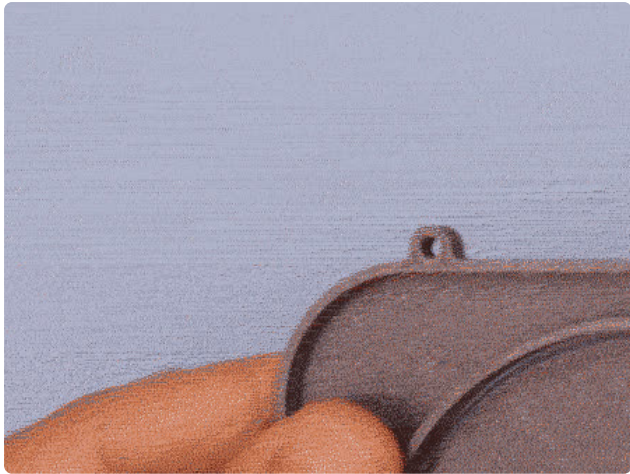
Attach Spring

Cut a 5/15"x1 1/2x.02" (7.94mmx38x.5mm) spring compression to 20.5mm in length. Next carefully bend one of the ends flat. Pass the end through the ring on the **Crank** part as shown in the picture.

Now we can attach the other end to the **Crank Holder**. Rotate the spring and Crank assembly to pass the end of the spring into the hoop on the **Crank Holder**.



Test the spring back action. Make sure the spring doesn't block the crank from rotating.



Eyepiece Layers

Next we'll sandwich the three layers that will holder the crank assembly in place.

Align the **Eyepiece** part with the **Eyepiece-side** and **Crank assembly**.

Use the **Crank** parts center nub to align with the **Eyepiece**. Insert the **post** on the **Crank** into the cavity on the **Eyepiece**.

Note the orientation of the **Eyepiece-Side** fits together with the cutaway on the **Crank Holder**.

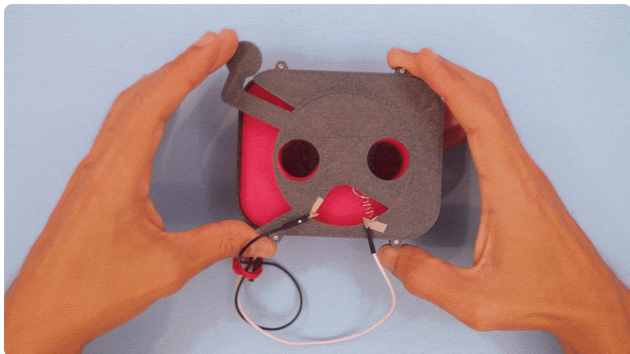
Fasten with together with four M3x16mm long screws.



Build Crank Switch

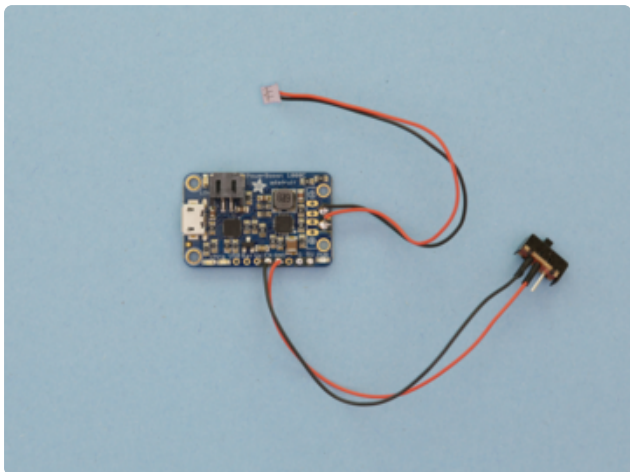
The switch is made with the use of conductive nylon tape. When the crank rotates, one contact meets with the other contact. This triggers the PyPortal to advance to the next picture.

We'll use two strips of conductive nylon tape to attach the **GND** and **D4** pins to the **Crank** and **Crank Holder** parts.



Attach Nylon Tape

We'll measure two strips of Conductive Nylon tape about 14mm long and wrap about 2/3 the length around each of pins ends. Stick the remaining length to the **Crank** and the other pin to the **Crank Holder** as shown in the picture.



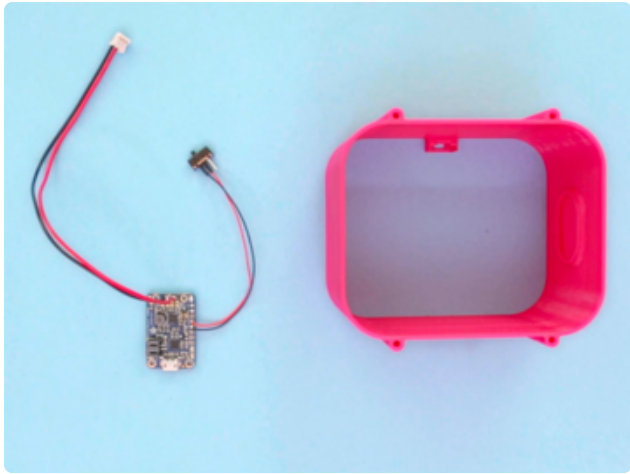
Assemble PowerBoost1000C

Now we can move on to adding our connections for the Slide Switch and Power wires for the PyPortal.

For the slide switch, we'll measure and cut two wires 110mm long.

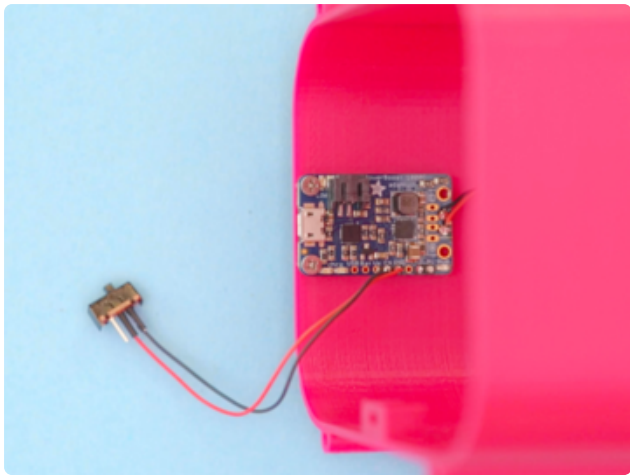
For power out, cut off the jumper pin ends and tin and solder the wires to the + and - pads on the PowerBoost.

We used [silicone wire \(http://adafru.it/1970\)](http://adafru.it/1970) to make bending them around components easier.



Mount PowerBoost

Align the PowerBoost to the standoffs inside the **Frame** part. Orient the USB port so it faces the edge of the frame.



We used four M2.5x5mm long screws to secure the PowerBoost to the **Frame**.



Mount Slide Switch

Make sure to first remove the supports inside the slide switch mount.

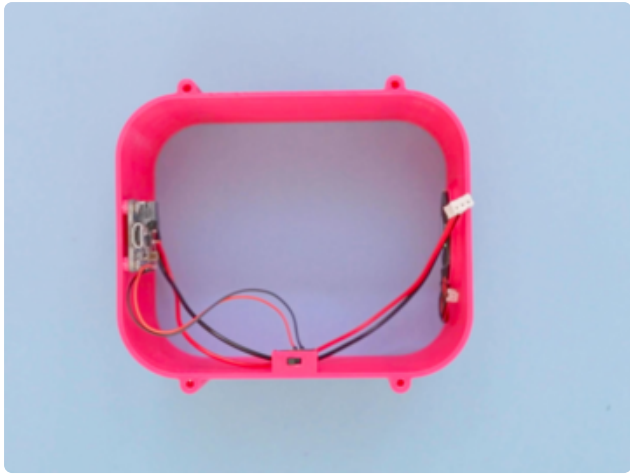
The slide switch press fits into the mounts inside the **Frame** part. Place the slide switch at an angle and press fit into place.



Speaker Mount

We can optionally mount an oval speaker to the opposite wall inside the **Frame** part.

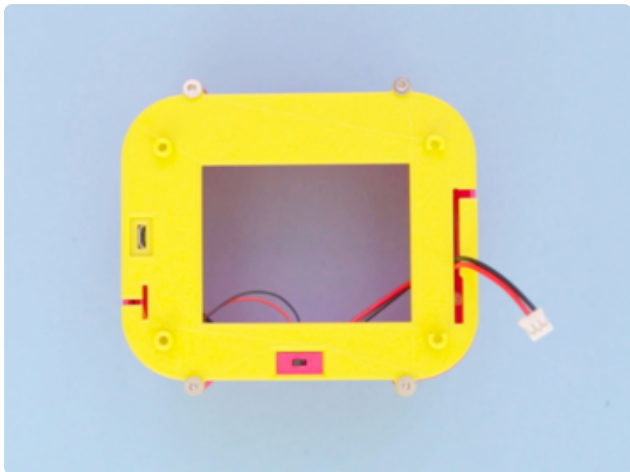
To mount, first peel the sticker from the ring around the front of the speaker, orient so the wires face closer to the slide switch, angle and press into place.



Attach Lid

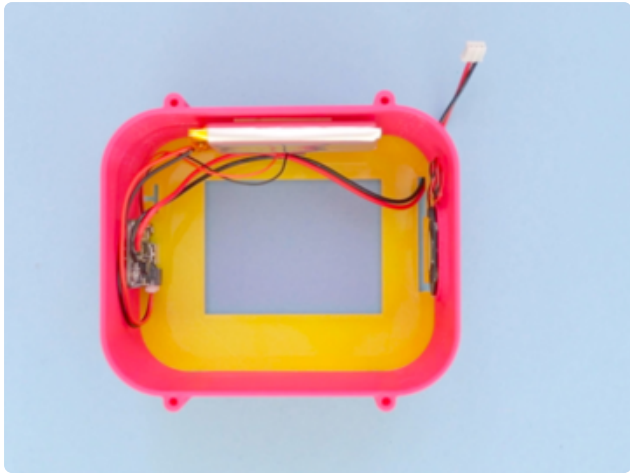
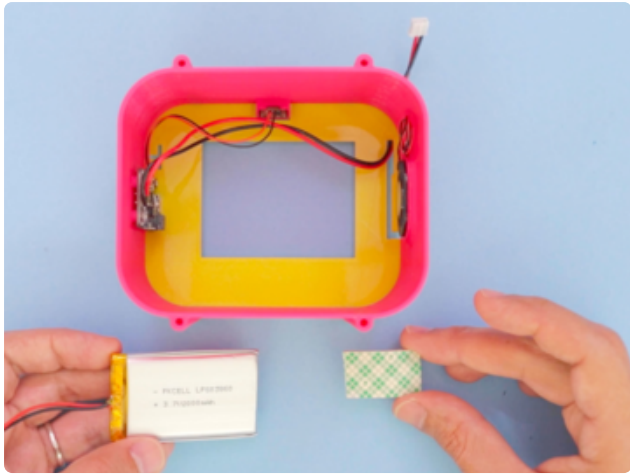
Next we'll mount the **Lid** part to the **Frame**. Align the **Lid** so the slot for the slide switch matches on the **Frame**.

We used M3x5mm screws to secure the **Lid** to the **Frame**.



Route Wires

The wires from the Powerboost can pass through the slot on the **Lid** part and into the PyPortal. Position the wires so they lay down and don't obstruct the screen.

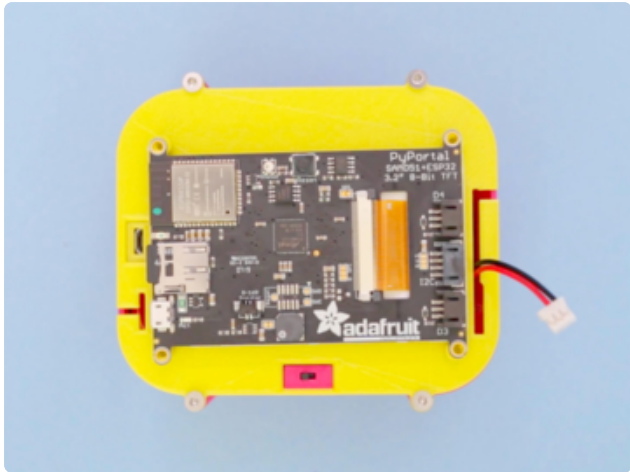


Mount Battery

Next we'll mount our battery to the **Frame**. We used a small piece of foam tape to secure it.

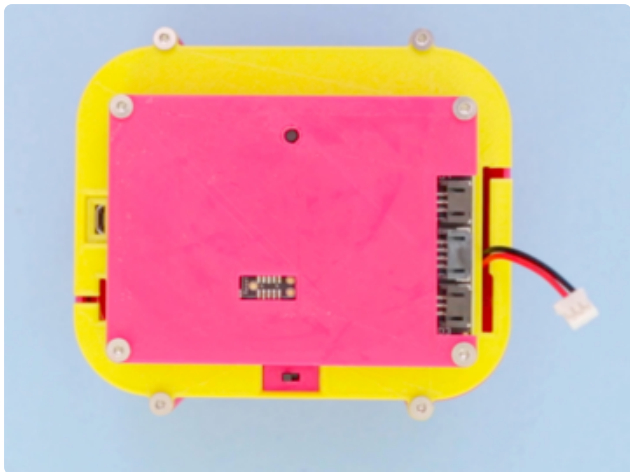
Orient the battery so the wires are facing the PowerBoost. Position the battery in the center of the **Frame** part, but with enough space away from the slide switch.

Connect the battery to the JST port on the PowerBoost. We can flip the switch off if it turns on.



Attach PyPortal

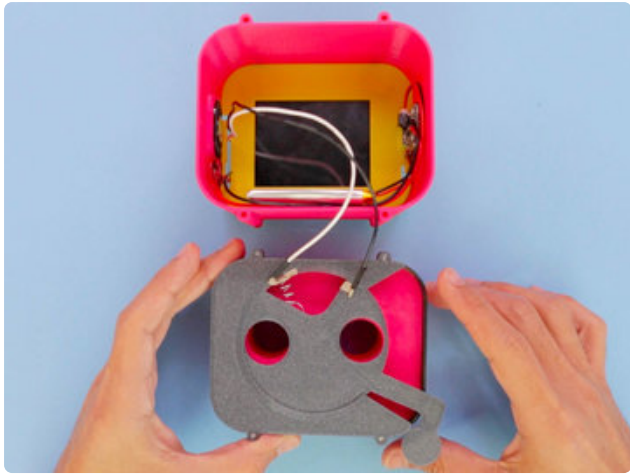
Moving on to mounting the PyPortal. Lay the PyPortal with the screen facing towards in the inside of the **Frame**. Orient so the ports on the PyPortal face the PowerBoost cable. The standoffs with the cut aways only align with the correct standoffs on the **PyPortal**.



Add Cover

Now we'll lay the **Cover** part on top of the PyPortal. Align the **Cover** part so the **Rest** button and **Port** openings match.

We'll use four **M3x10mm** long screws to fasten the **Cover** to the **PyPortal** and **Frame** parts.



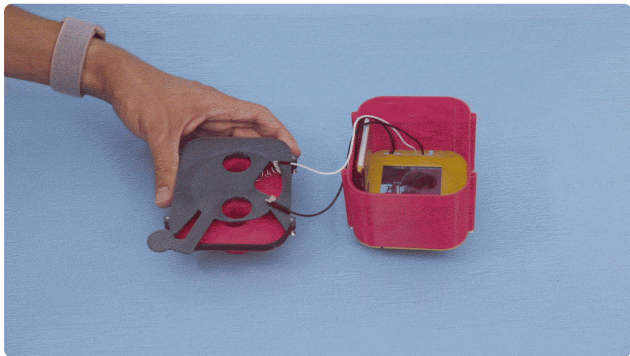
Attach Frame to Eyepiece

Final stretch! We can now move on to attaching the **Eyepiece** assembly to the **Fame** assembly.

Align the **Eyepiece** assembly with the **Crank** on the same side as the **PowerBoost**.

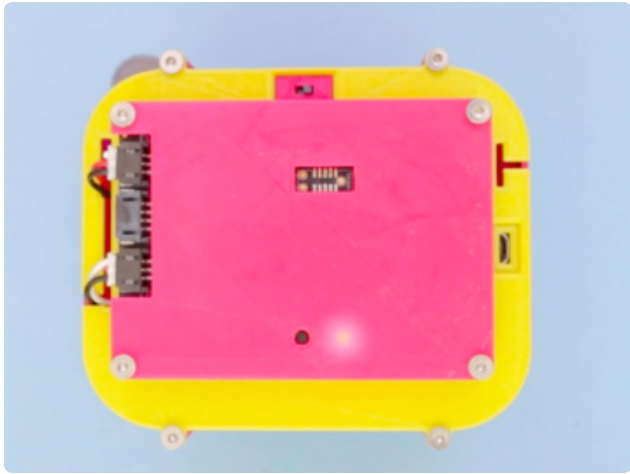


Pass the conductive switch wires through the slots on the **Lid** and position the wires so they lay down and don't obstruct the display.



Test Switch

Before we mount the **Eyepiece** assembly, we'll go ahead and switch on the **PyPortal** to test out the switch and adjust the Conductive Nylon Tape if needed. We can move the conductive nylon tape closer to the "end stop" if the **Crank** gets stuck during rotation.



Complete

Slide the switch on and try out the slideshow!