



# Labo Piano Light FX

Created by Collin Cunningham



<https://learn.adafruit.com/labo-piano-light-fx>

Last updated on 2024-06-03 02:20:26 PM EDT

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# Overview

[Nintendo Labo Toy-Cons](https://adafru.it/C1b) (<https://adafru.it/C1b>) are a lot of fun to build, but customizing them is the real icing on the cake. Let's spice up the **Piano Toy-Con** with sound-triggered lighting effects courtesy of [Circuit Playground Express](http://adafru.it/3333). (<http://adafru.it/3333>)



## What you'll need

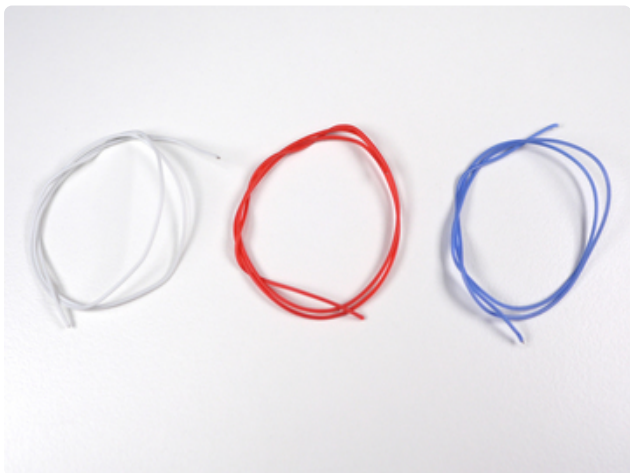
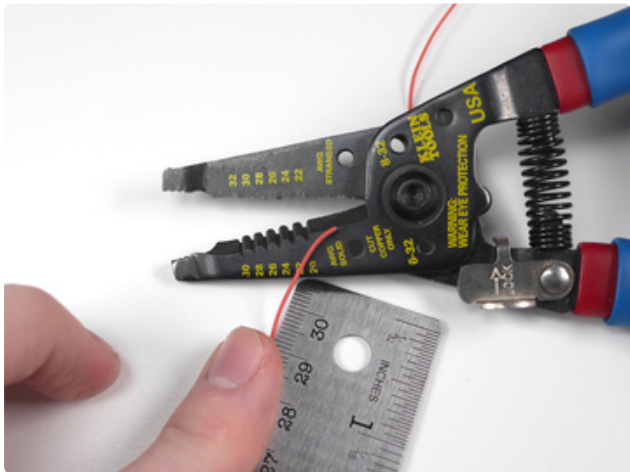
- Nintendo Switch
- Assembled Labo Piano Toy-Con
- [Circuit Playground Express](http://adafru.it/3333) (<http://adafru.it/3333>)
- [Electret Microphone Amplifier Board](http://adafru.it/1713) (<http://adafru.it/1713>)
- Silicone Cover Stranded Wire in [three](http://adafru.it/2006) (<http://adafru.it/2006>) [different](http://adafru.it/2002) (<http://adafru.it/2002>) [colors](http://adafru.it/2001) (<http://adafru.it/2001>) ([solid core](http://adafru.it/3111) (<http://adafru.it/3111>) works too!)
- [LiPo Battery](http://adafru.it/1578) (<http://adafru.it/1578>)
- [Soldering Iron](http://adafru.it/3685) (<http://adafru.it/3685>) & [Solder](http://adafru.it/1886) (<http://adafru.it/1886>)
- Double Sided Tape
- [Wire Strippers](http://adafru.it/527) (<http://adafru.it/527>)
- [Micro USB cable](http://adafru.it/592) (<http://adafru.it/592>)
- Computer

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# Wiring

Circuit Playground Express has a built-in microphone, but we'll need to mount it away from the Switch's speakers in order to see our lighting effects. Let's use a separate mic that we can mount close to the Switch's speaker - then use wires to connect it to the Circuit Playground Express.

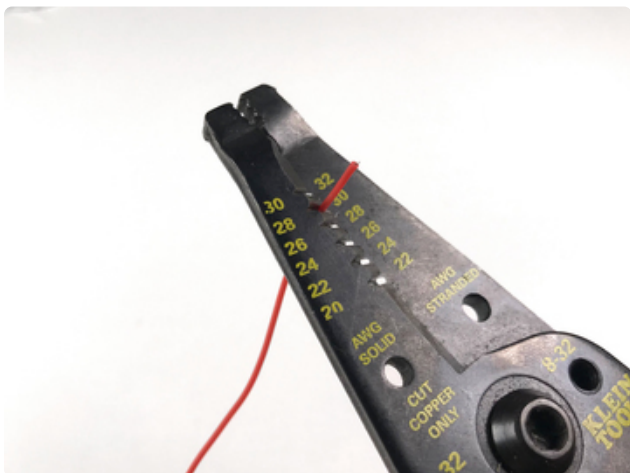
## Prep the wires

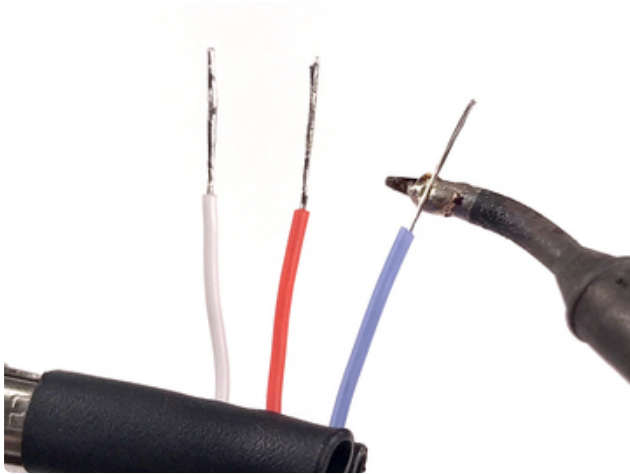


Cut **three pieces of wire** - each about **30cm** long, one in **blue**, one in **white**, and one in **red**.

**Strip about 7mm** of shielding from both ends of each wire.

**Tin** each exposed end with **solder**.



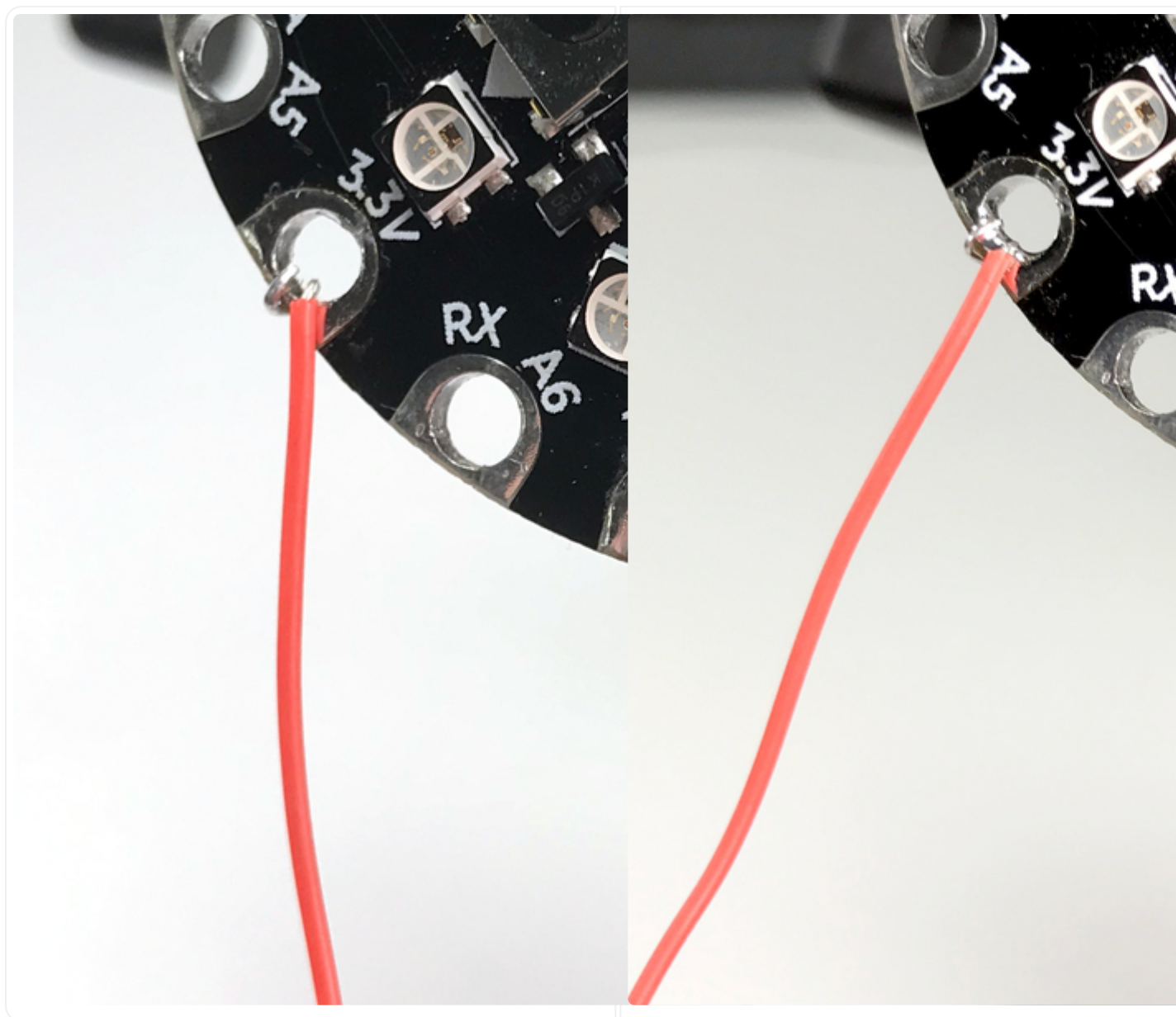


## Solder wires to the Circuit Playground Express

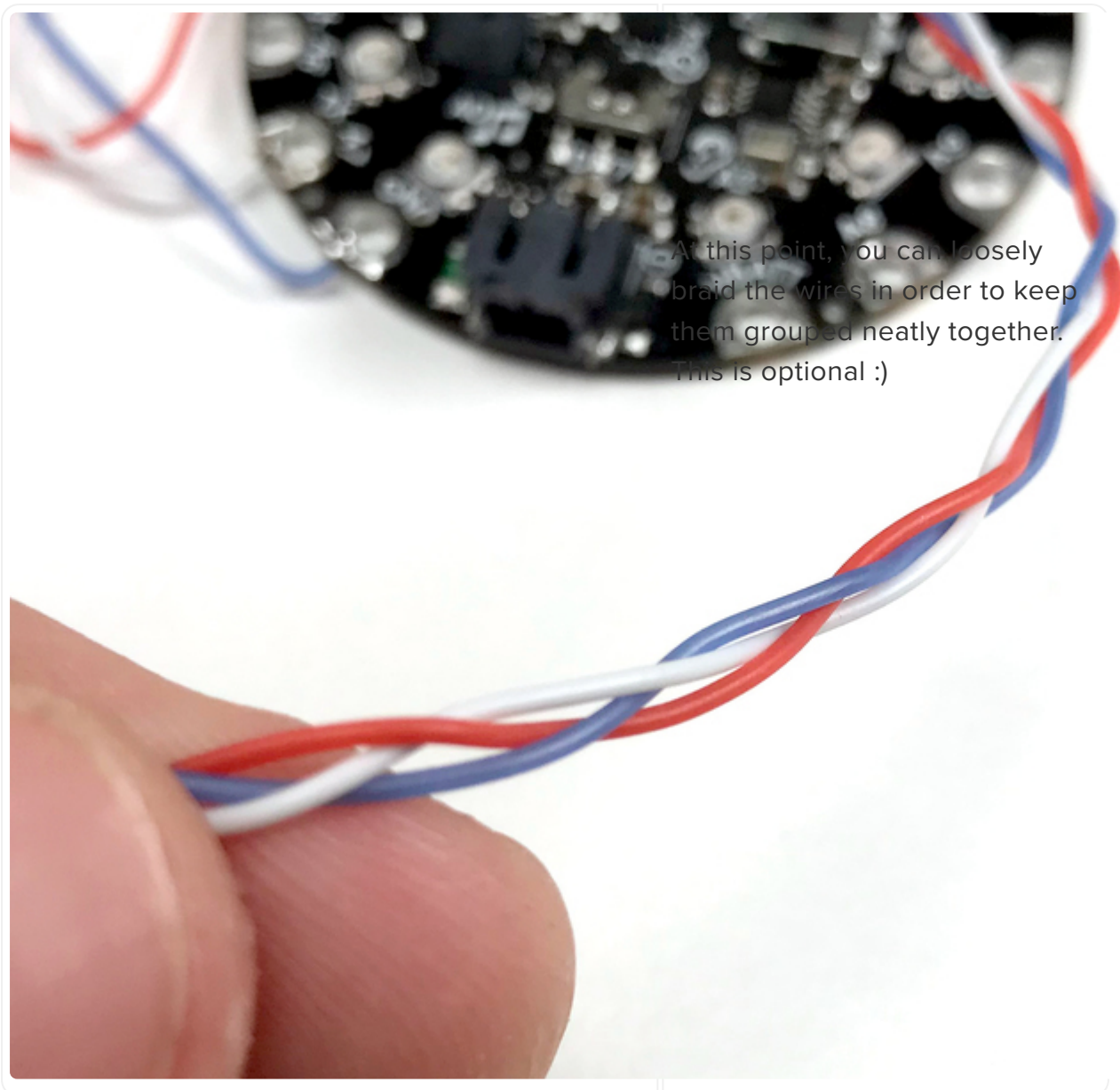
Now we'll connect those wires to the Circuit Playground's contacts. Each wire color connects to a specific contact pad:

- **Red** wire connects to **3.3V**
- **Blue** wire connects to **GND**
- **White** wire connects to **A7**





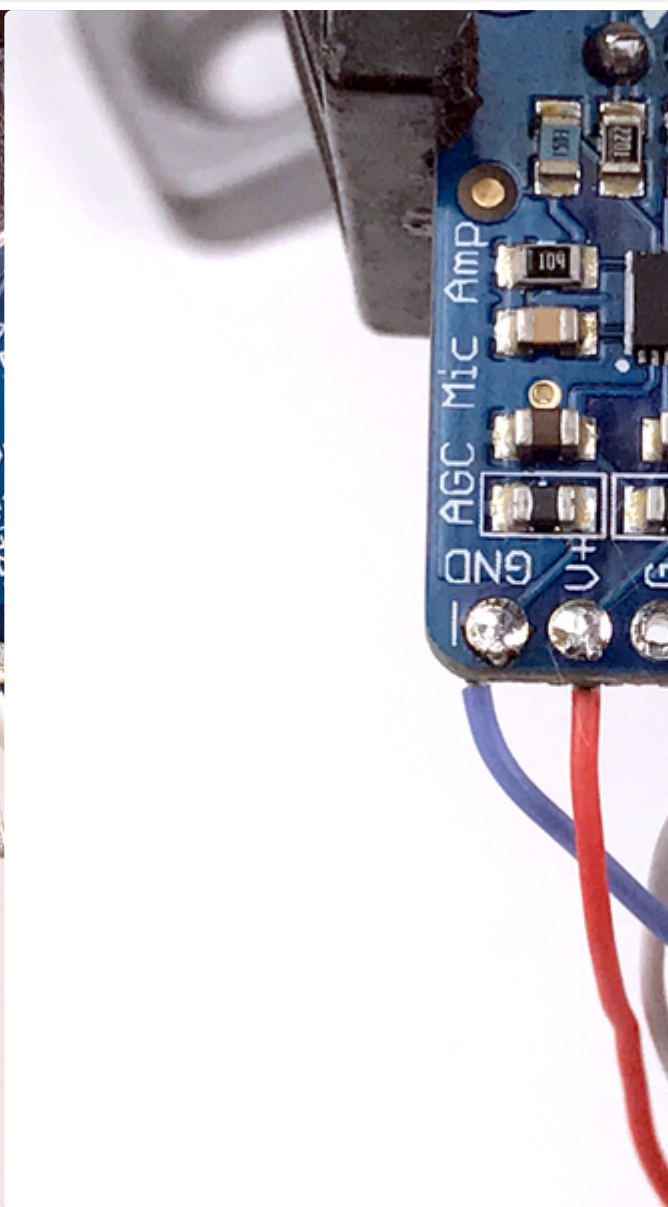
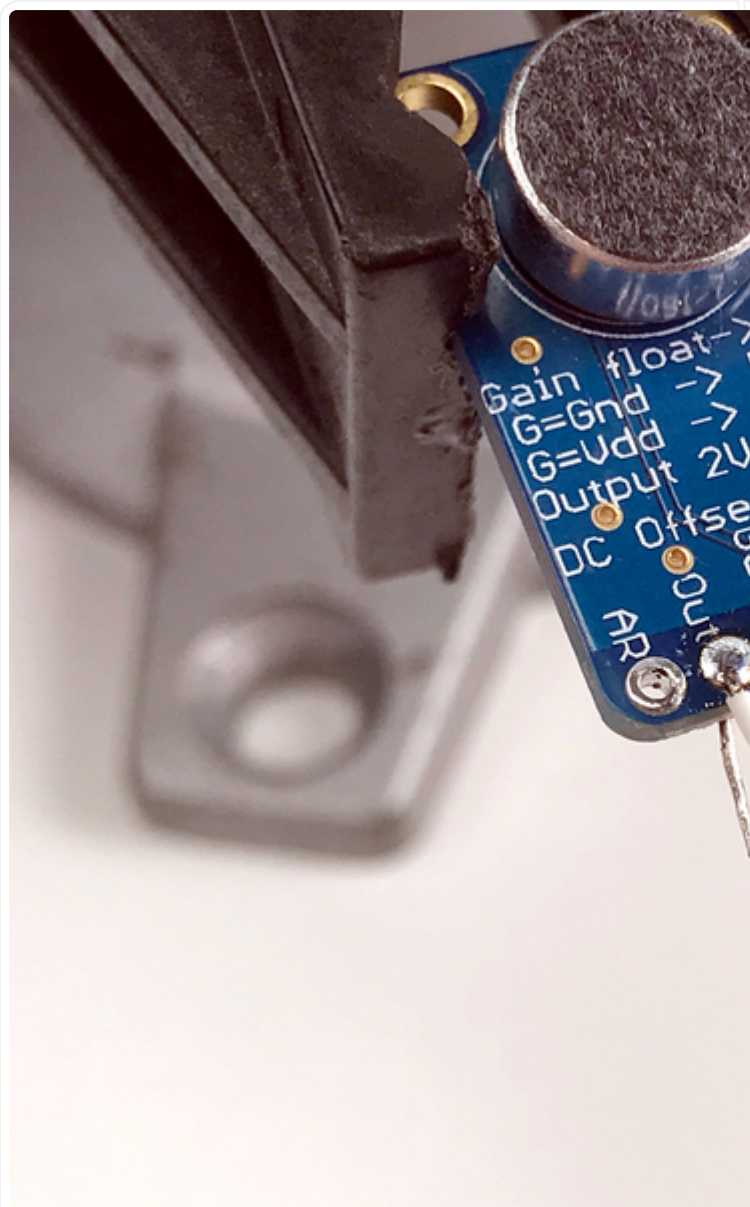
Poke each tinned wire lead through its corresponding contact pad, bend the wire around the outside of the pad to keep it in place - and then **solder** it securely.



## Solder Wires to the Electret Microphone Amplifier

Next, we'll **connect our wiring** to the **Microphone board**. Each wire color connects to a **specific pad** on the **Microphone board**. Poke each wire through its respective pad and solder in place:

- **Red** wire connects to **V+**
- **Blue** wire connects to **GND**
- **White** wire connects to **Out**



Once each wire is soldered to the board, clip any excess leads off to avoid accidental bridging between the pads.

That's all for soldering and wiring - now we can move on to programming the board.

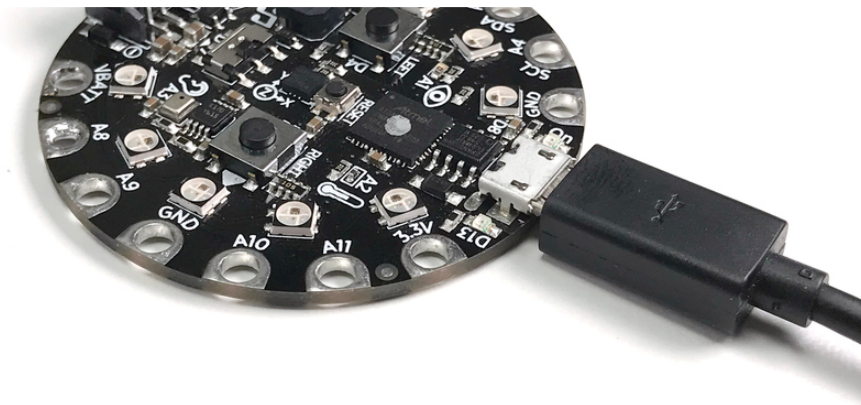
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## Software

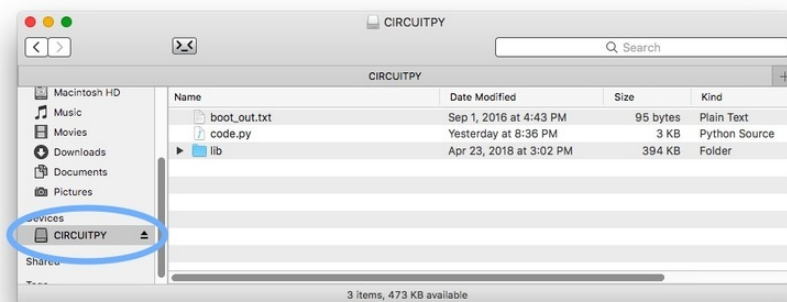
Now we'll add the software that will make Circuit Playground Express's neopixels light up whenever the Electret Microphone board detects sound.



## Connect



Connect the **Circuit Playground Express** to your computer with a micro **USB** cable. You should see a drive named **"CIRCUITPY"** appear on your computer.



## Install Libraries

You'll need to have the **Neopixel library** installed on your Circuit Playground Express in order to run this project's **CircuitPython** code. Follow the steps on [this page to install the CircuitPython library bundle \(https://adafru.it/ABU\)](https://adafru.it/ABU).

## Installing the CircuitPython Library Bundle

<https://adafru.it/ABU>

## Upload Project Code

Copy the following code, paste it into a **plain text file** or [code editor such as Mu](#) (<https://adafru.it/ANO>). Save the file as "**code.py**" to the **CIRCUITPY** drive.

```
# SPDX-FileCopyrightText: 2018 Collin Cunningham for Adafruit Industries
#
```

```

# SPDX-License-Identifier: MIT

import board
from rainbowio import colorwheel
import neopixel
from analogio import AnalogIn

n_pixels = 10 # Number of pixels you are using
dc_offset = 0 # DC offset in mic signal - if unsure, leave 0
noise = 100 # Noise/hum/interference in mic signal
lvl = 10 # Current "dampened" audio level
maxbrt = 127 # Maximum brightness of the neopixels (0-255)
wheelStart = 0 # Start of the RGB spectrum we'll use
wheelEnd = 255 # End of the RGB spectrum we'll use

mic_pin = AnalogIn(board.A7)

# Set up NeoPixels and turn them all off.
strip = neopixel.NeoPixel(board.NEOPIXEL, n_pixels,
                          brightness=0.1, auto_write=False)
strip.fill(0)
strip.show()

def remapRangeSafe(value, leftMin, leftMax, rightMin, rightMax):
    # this remaps a value from original (left) range to new (right) range

    # Force the input value to within left min & max
    if value < leftMin:
        value = leftMin
    if value > leftMax:
        value = leftMax

    # Figure out how 'wide' each range is
    leftSpan = leftMax - leftMin
    rightSpan = rightMax - rightMin

    # Convert the left range into a 0-1 range (int)
    valueScaled = int(value - leftMin) / int(leftSpan)

    # Convert the 0-1 range into a value in the right range.
    return int(rightMin + (valueScaled * rightSpan))

while True:
    n = int((mic_pin.value / 65536) * 1000) # 10-bit ADC format
    n = abs(n - 512 - dc_offset) # Center on zero

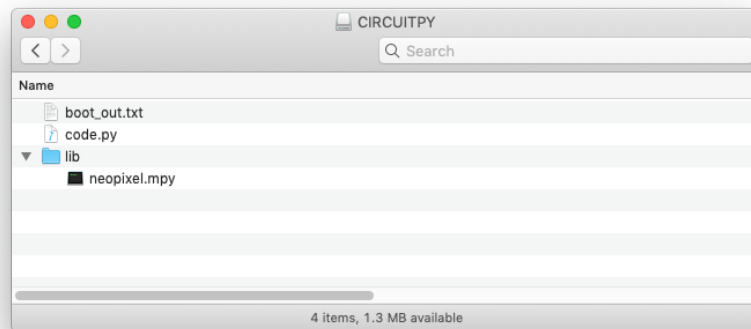
    if n >= noise: # Remove noise/hum
        n = n - noise

    # "Dampened" reading (else looks twitchy) - divide by 8 (2^3)
    lvl = int(((lvl * 7) + n) / 8)

    # Color pixels based on rainbow gradient
    vlvl = remapRangeSafe(lvl, 0, 255, wheelStart, wheelEnd)
    for i in range(0, len(strip)):
        strip[i] = colorwheel(vlvl)
        # Set strip brightness based on code audio level
        brightness = remapRangeSafe(lvl, 50, 255, 0, maxbrt)
        strip.brightness = float(brightness) / 255.0
    strip.show()

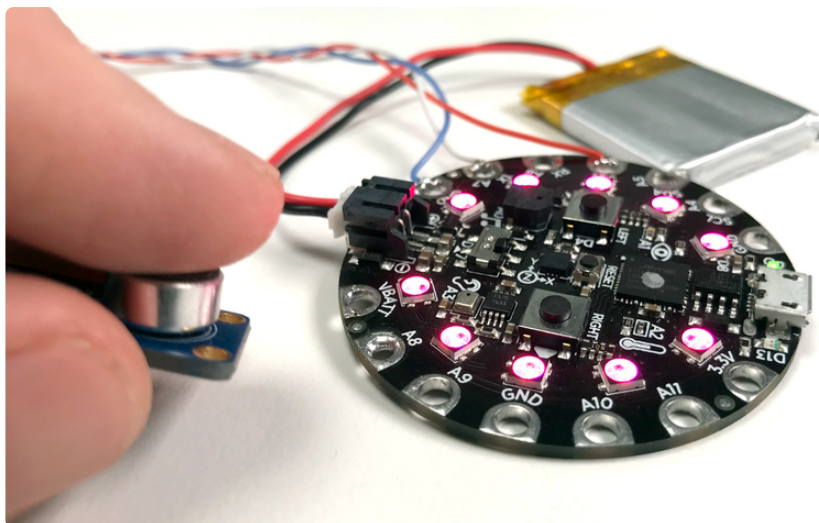
```

After the file saves, your Circuit Playground Express should reboot and start running the light effects code.



## Test It

To make sure everything is working, disconnect the Circuit Playground Express from your computer and connect the LiPo battery.



Now, try tapping the microphone - If the Circuit Playground's neopixels light up with each tap, then you'll know it's good to go!

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## Install & Use It!

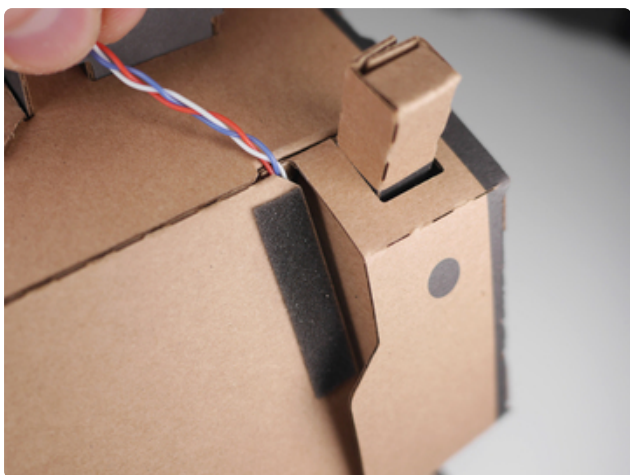
Now, we just need to install the **Circuit Playground Express & Electret Microphone** board in the **Piano Toy-Con**.

## Install the mic



Push back the **large cardboard plate** that supports the **Switch** until the interlocking front lip pops up.





Pull the large backing plate forward a bit and **slide the microphone board behind it** - be sure to keep the silver **microphone cylinder facing forward**.

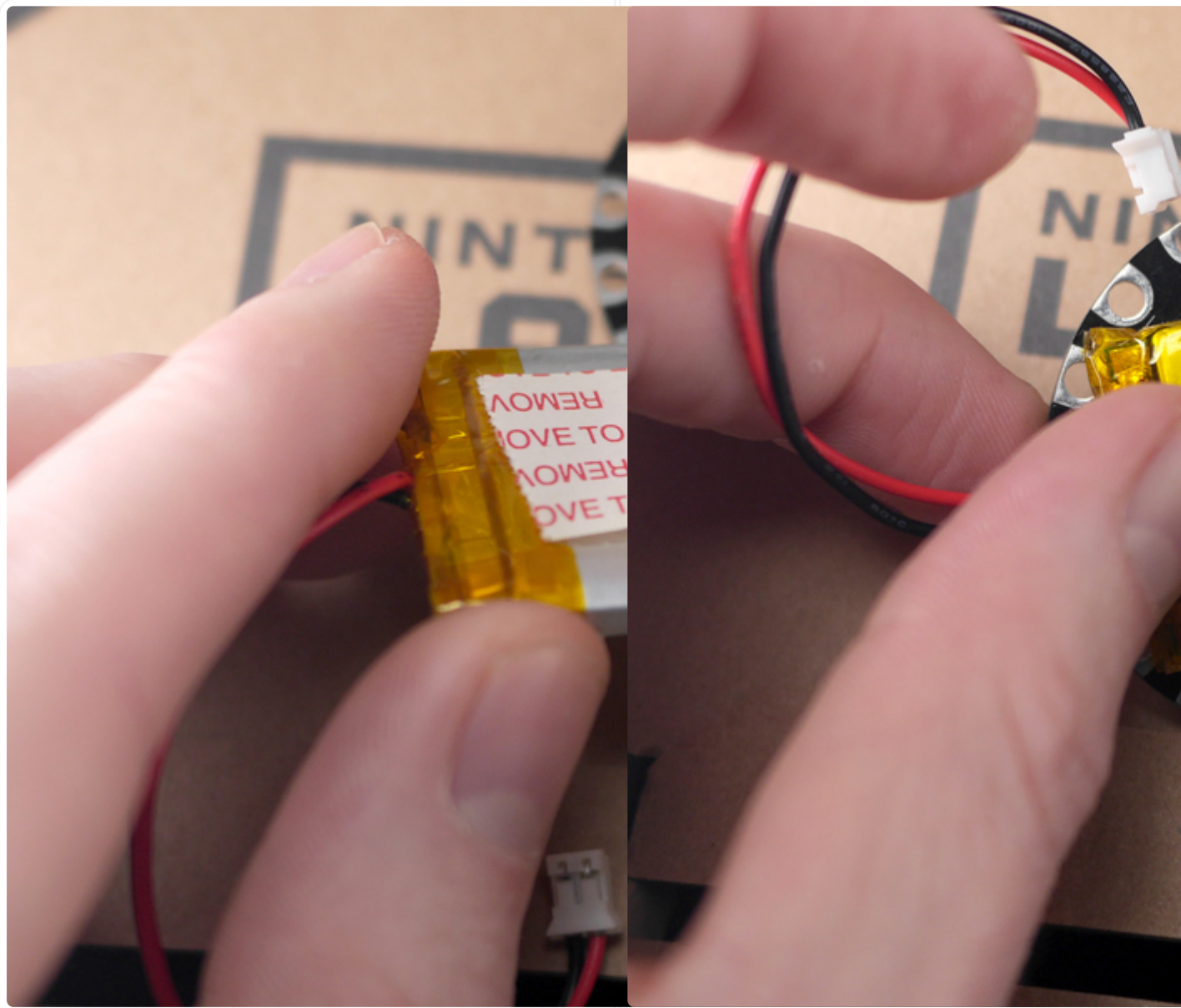
Pull the large backing plate forward a bit and **slide the microphone board behind it** - be sure to keep the silver **microphone cylinder facing forward**.

**Tuck the wires** behind the backing plate and route them up the right side - there's a triangular opening that will allow them to reach the Circuit Playground Express on top of the piano.

Once the wires are routed, **push the front lip back in place** with its tab locked into the backing plate.

## Mount the Circuit Playground Express

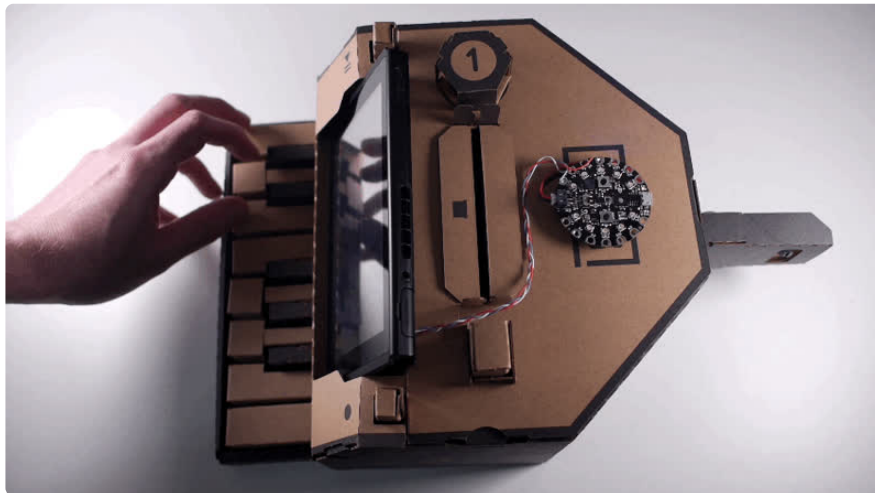
Use a small piece of **double-sided tape** to stick the the **LiPo battery** to the back of the **Circuit Playground Express**.



Use another piece of tape to secure the **LiPo battery** and **Circuit Playground Express** to the top of the piano.

# Play - with lights!

Install the **right Joy-Con** in the holder at the back of the piano and place the **Switch console** in its spot at the center. Set the Switch's **volume all the way up** and start up the **Piano Play** mode in the **Labo Variety pack cartridge**. Now - you're good to go!



Now, when you play the piano - you'll have a light show with every performance :)

To preserve battery, remember to disconnect the battery from the Circuit Playground Express when not in use.