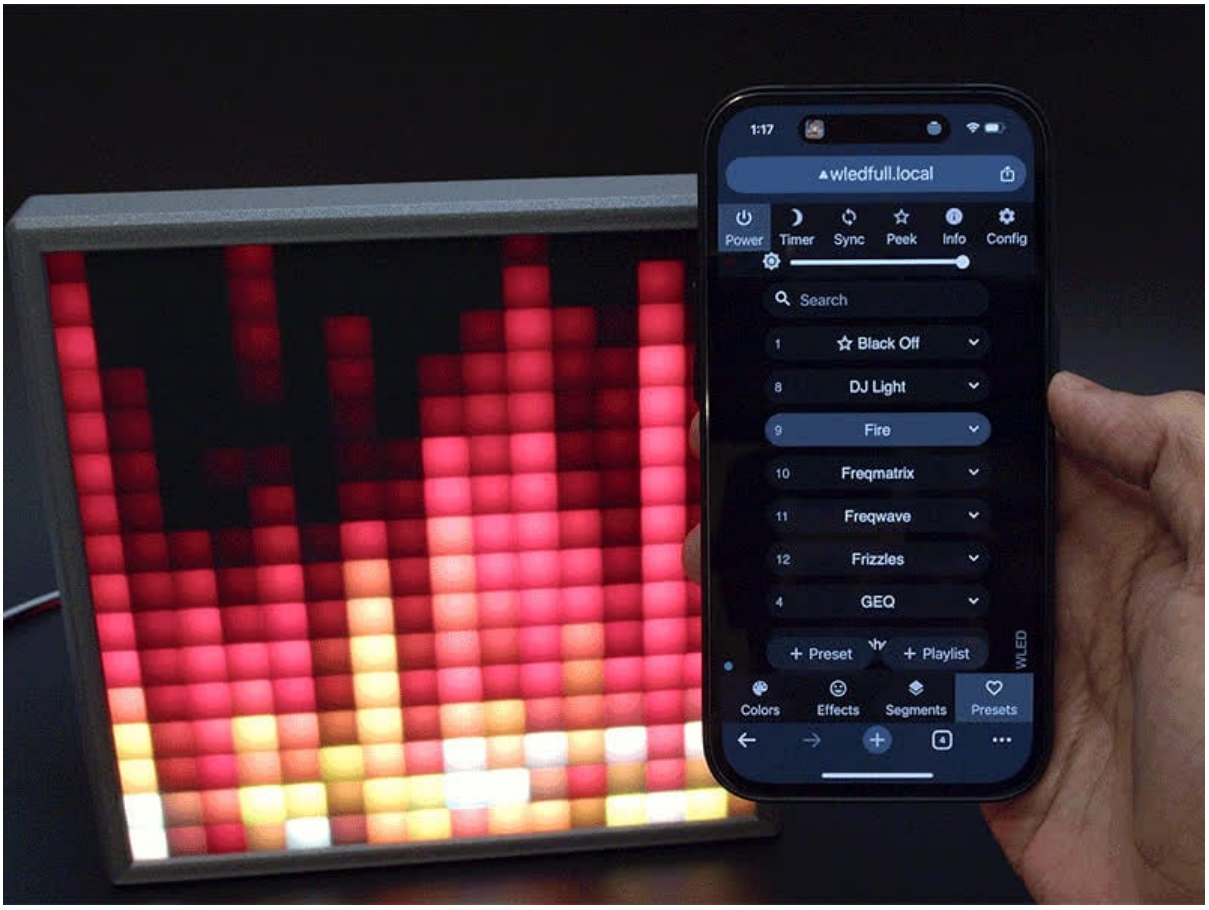
16x16 NeoPixel Matrix Square Pixel Display

Created by Ruiz Brothers



https://learn.adafruit.com/16x16-neopixel-matrix-square-pixel-display

Last updated on 2025-03-05 12:47:10 PM EST

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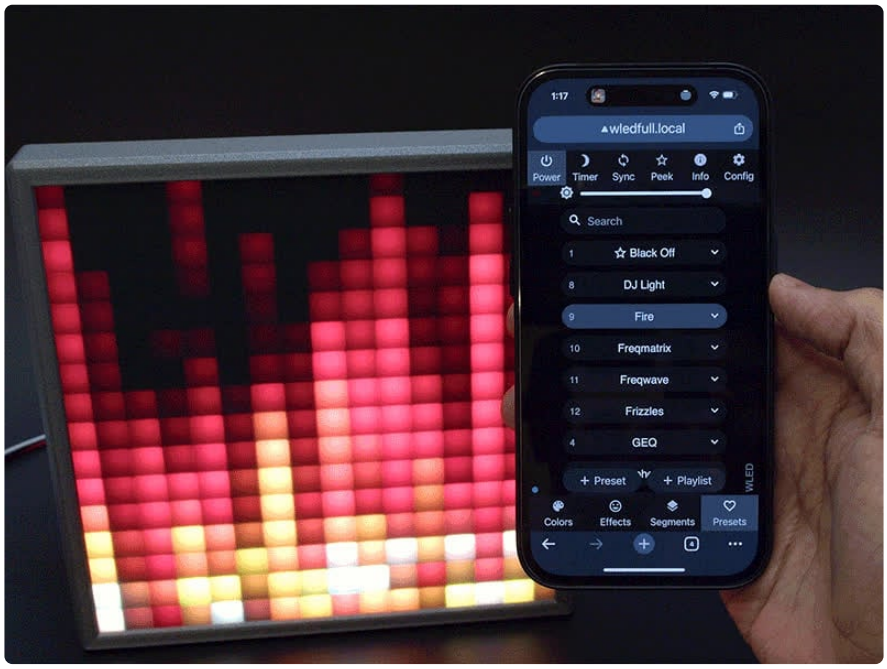
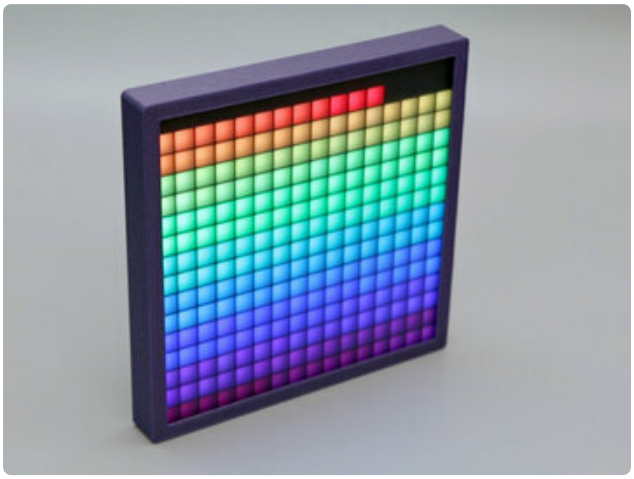
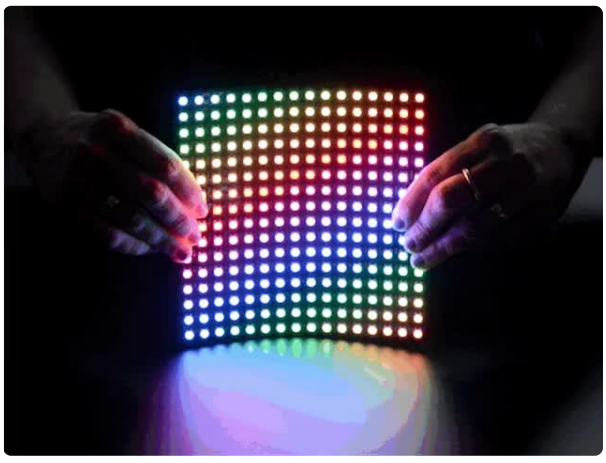




Square Pixel LED Display

Build an amazing LED display using Sparkle Motion and a 16x16 NeoPixel matrix. Use WLED software to play awesome animations that are designed for 2D matrices. A 3D printed frame and piece of black LED acrylic create an assembled display that can sit upright or mounted to a wall.

Parts

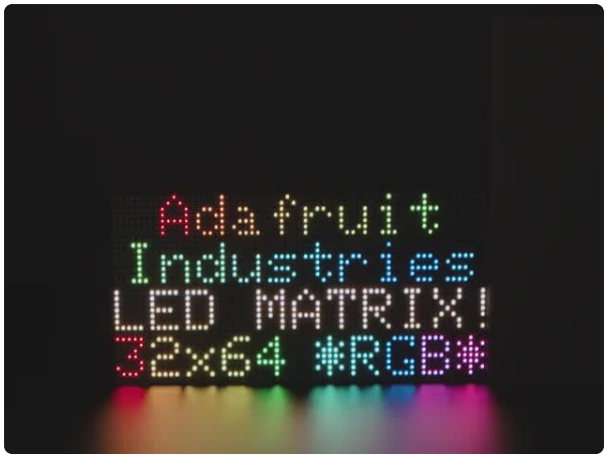


Flexible 16x16 NeoPixel RGB LED Matrix

For advanced NeoPixel fans, we now have a bendable, Flexible 16x16 NeoPixel LED Matrix! Control all 256 ultra-bright LEDs using a single microcontroller pin, set each...

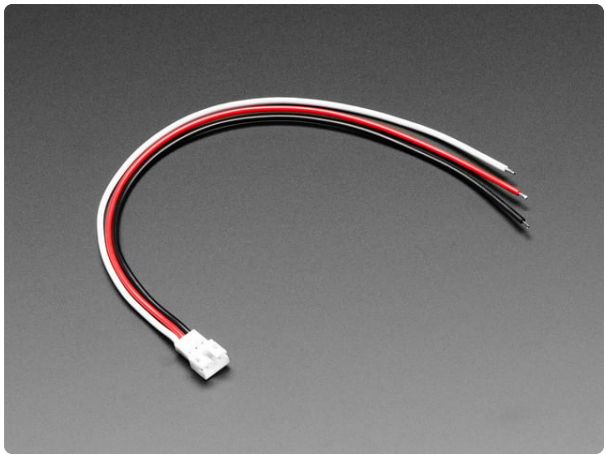
https://www.adafruit.com/product/2547

[Adafruit Sparkle Motion - All-In-One WLED and xLights Board]
The Adafruit Sparkle Motion is the flagship in our series of "Sparkle Motion" boards, that are our attempt to make the best...
https://www.adafruit.com/product/6100



[Black LED Diffusion Acrylic Panel 12" x 12" - 0.1" / 2.6mm thick]
A nice whoppin' slab of some lovely black acrylic to add some extra diffusion to your LED Matrix project. This material is 2.6mm (0.1") thick and is made of special cast...
https://www.adafruit.com/product/4594

[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



[JST PH 2mm 3-Pin Socket to Color Coded Cable - 200mm]
This cable will let you turn a JST PH 3-pin cable socket into 3 individual tinned wires. These are great to match up with our JST 3-PH cables, for extending and connecting...
https://www.adafruit.com/product/4046

M2.5 Thread

1 x Black Nylon Machine Screw Set
M2.5 Thread
https://www.adafruit.com/product/3299

1 x USB 5V 2A Power Supply
USB 5V 2A Power Supply
https://www.adafruit.com/product/1994

1 x USB Type C Cable
2 meters long
https://www.adafruit.com/product/5044

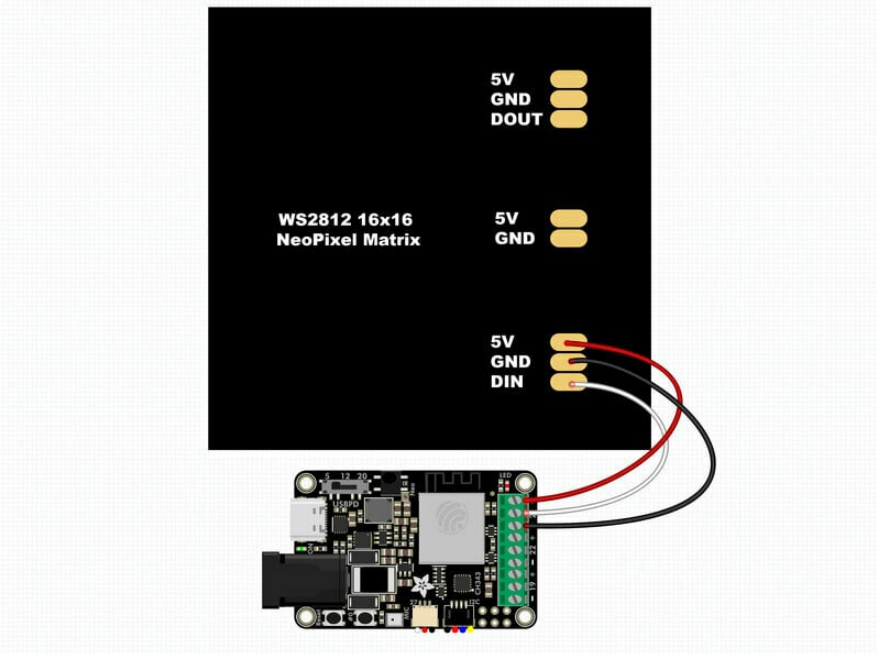
1 x Right Angle USB C Adapter
USB 3.1 Gen 4 Compatible
https://www.adafruit.com/product/4432

Circuit Diagram

The diagram below provides a general visual reference for wiring of the components once you get to the **Assembly** page. This diagram was created using the software package Fritzing (https://adafru.it/oEP).

Adafruit Library for Fritzing

Adafruit uses the Adafruit's Fritzing parts library to create circuit diagrams for projects. You can download the library or just grab individual parts. Get the library and parts from GitHub - Adafruit Fritzing Parts (https://adafru.it/AYZ).



Wired Connections

- **– (negative)** pin from Sparkle Motion to **GND** pin on NeoPixel matrix

- + **(positive)** pin from Sparkle Motion to **5V** pin on NeoPixel matrix
- **21** pin from Sparkle Motion to **DIN** pin on NeoPixel matrix

The Sparkle Motion is powered by a 5V 2A power supply.

WLED Software

Board Choices

WLED runs on several different boards in Adafruit's collection. There are different benefits to each, but the installation process is largely the same. This page contains instructions for multiple boards -- be sure to use the pinouts and installation instructions for the one you're using,

Sparkle Motion

This is our flagship ESP32 board, designed with WLED and Xlights in mind. It has 4 outputs and is set up to drive either 5v, 12v or 24v pixels. It's a workhorse of a board and for larger projects it's the clear winner. It has an onboard microphone for instant sound-reactive support, and an IR sensor built in, to make it easy to control your project with an infrared remote. It also has a couple stemma ports so you can add your own sensors or peripherals.

Sparkle Motion Mini

The Sparkle Motion Mini is a smaller version of the Sparkle Motion board. It has two LED outputs, a microphone, and two stemma ports that make it easy to add an IR sensor or other peripherals. It's got an onboard NeoPixel and a small footprint, making it perfect for wearables or smaller projects. It will power a whole lot of pixels through the onboard USB port: it's safe to draw up to 4A through this port, giving you plenty of power for most wearable projects.

At this time, the Sparkle Motion Mini works best with WLED 0.15.1 -- the extra GPIO for the microphone pins are not supported in WLED 0.15.0. This should be fixed with the release of version 16.

To get mic support now, the following combined .bin file can be used. Get it by downloading this zip file:

esp32_bootloader_v4_WLED_0.16.0-alpha_ESP32.zip

https://adafru.it/1adL

To install, extract the .bin file from the zip and then follow the same ESB Web Flasher process used for installing CircuitPython (https://adafru.it/1adF). At the "Programming the Board" step, choose the .bin file and leave offset as 0x0.

QT Py Pico ESP32

The QT Py Pico (http://adafru.it/5395) is small and affordable, so usually my go-to for smaller costumes or wearables. It also has a range of BFF add-on boards that add functionality. Here's a guide with more QT Py info (https://adafru.it/1abD). The QT Py will drive up to around 30 pixels through the onboard USB port, so if you have more LEDs than that you may want to consider the Sparkle Motion Mini instead, or you can power the board through the +5v pin.

Note: WLED works on the QT Py Pico but NOT on the S2 or S3 versions, at the time of writing.

Feather Huzzah ESP32

The Feather Huzzah ESP32 (http://adafru.it/3405) the top of the line. It's a great choice for projects where you want to add sensors, interaction, or drive a whole lot of LEDs. It's the most reliable as well -- I've run these for two months straight with no power cycling and they just keep on truckin. Adafruit has a very wide selection of Feather Wing boards that connect to the Feather microcontroller line. The sky is the limit with these boards.

It also comes in a version with a high-powered WiFi range extender! If you're trying to sync multiple instances across distance, check this one out. Feather Huzzah ESP32 V2 w.FL Antenna (http://adafru.it/5438)

Feather Huzzah ESP8266

The Feather Huzzah ESP8266 (http://adafru.it/2821) will run WLED as well, but won't drive as many pixels: the ESP32 limit on WLED is around 1000 pixels per input, but the ESP8266 tops out at around 500. It's about $5 cheaper though, so for smaller projects it's a great way to save a little money and still have access to all the Featherwing options in the Adafruit store.

Driver Update

Some versions of our controllers have a new serial chip which needs a driver installed before we can install WLED. Head over to our How to Install Drivers for WCH USB to Serial Chips (https://adafru.it/-f8) tutorial, and download and install the new driver.

If you have an older QT Py with CP2102 USB-to-Serial bridge, use SiLabs' driver instead (https://adafru.it/11em).

Install WLED

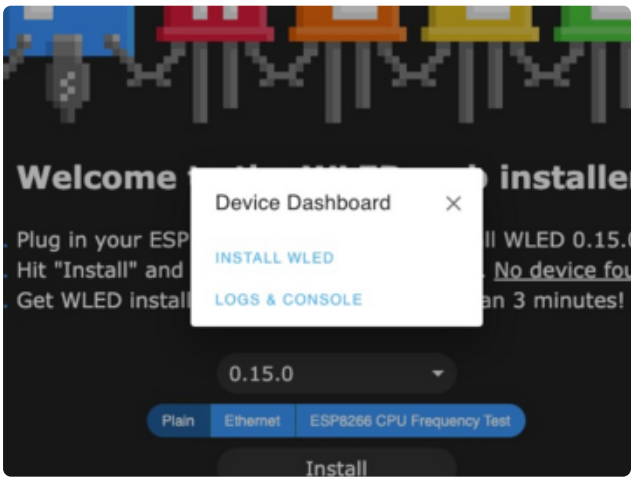
These next steps require a **Web Serial-compatible browser**. As of this writing, that means **Google Chrome**, **Microsoft Edge** or **Opera** “desktop” browsers. Other browsers (Safari, Firefox, Explorer and anything mobile) won’t work.

Visit https://install.wled.me/ (https://adafru.it/11dL)

Plug your microcontroller into your computer with a known good USB cable. Click "Install" and select the port for your board.

Depending on the USB-to-serial bridge chip on the board, you might see one or two serial ports. On Mac, for instance, there might be both “/dev/cu.usbmodem[number]” and “/dev/cu.wchusbserial[number]”. Use the “**wchusbserial**” one.

After successful installation, enter your WiFi network name and password when prompted. This must be a **2.4 GHz** WiFi network; ESP32 does not support 5 GHz networks. If it can’t connect, then as a fallback WLED will create its own 2.4 GHz WiFi access point.



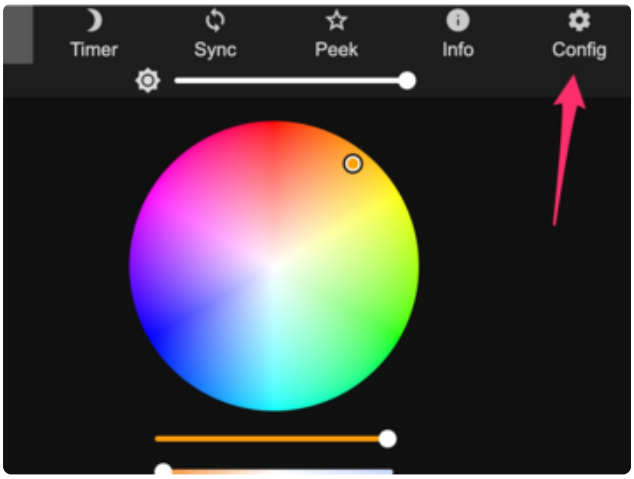
If you don't see the "Connect to Wi-Fi" prompt, you'll need to set up your WiFi network using AP (access point) mode. Open up your WiFi settings and look for a WiFi network called `WLED-AP`. Connect to this network using the default password `wled1234`. The WLED interface will pop up in its own browser.

From here, go into Config/Wifi Settings and enter your WiFi credentials near the top. Give your project a name in the mDNS field a little further down the page. Now you can type in "projectname.local" (where "projectname" is your mDNS name) into any web browser on the same wifi network to access your microcontroller.

You can also scan the QR code below to open access point mode.

For more help and troubleshooting tips visit the Getting Started page on the WLED knowledge base. (https://adafru.it/1acu)

Setup & Preferences



WiFi Setup

Head to the **WiFi Setup** screen under Config and create a good URL so you can control your project from any web-enabled device. Call it something you'll remember, that's easy to type into any web browser on your WiFi network in order to connect to your project.

In Safari or Chrome on your phone or computer, type in this web address to access the WLED interface: http://projectname.local (https://adafru.it/1acs) (where "projectname" is whatever you put into this field).

Check out the Additional Settings page for more info on accessing your project. WLED has an "access point mode" that doesn't require a WiFi network for when you're out on the go. It's also helpful to download one of the WLED apps to help manage and organize your projects.

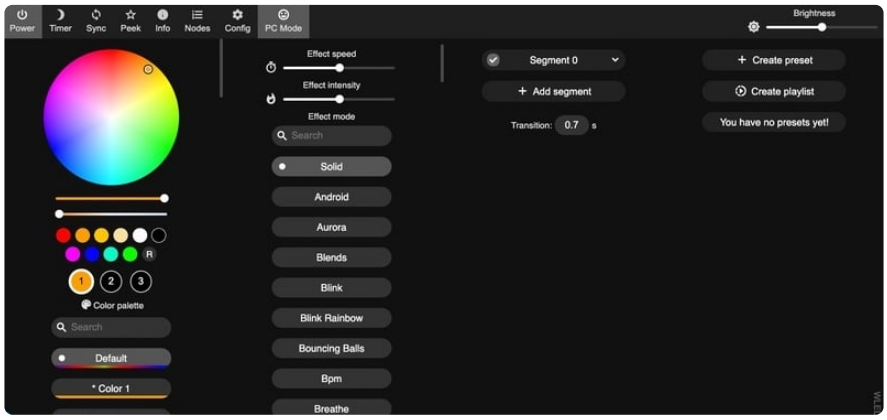
LED Preferences

Next, head to the **LED Preferences** tab under the Config menu.

Scroll down to **Hardware Setup**. Put your total number of LEDs into the "Length" field, and change GPIO to the pin number associated with the pin you soldered to. Check the pinout diagram for the board you're using (it's the number in yellow).

Sparkle Motion Pinout (https://adafru.it/1acD)
Sparkle Motion Mini Pinout (https://adafru.it/1acE)
QT Py Pico Pinout (https://adafru.it/11dK)
Feather Huzzah ESP8266 Pinout (https://adafru.it/1a53)
Feather Huzzah ESP32 Pinout (https://adafru.it/1aaj)

Use It



Now you can use any computer or handheld device to control your LEDs.

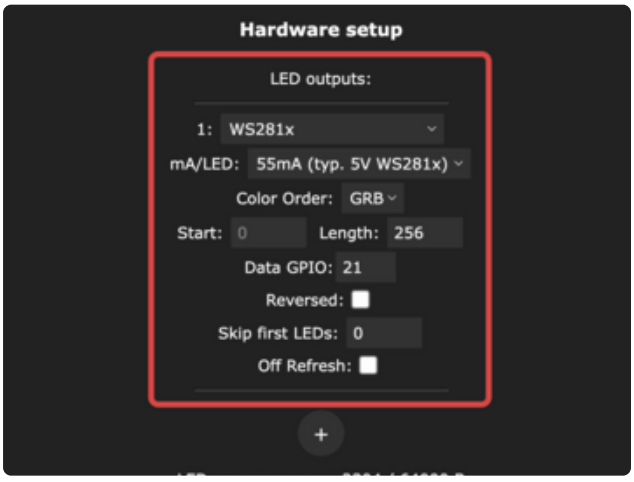
Make sure your device is on the same WiFi network as your board. Navigate to your custom URL (projectname.local/) in a web browser. You'll see a color picker above a whole bunch of color palette choices.

Choose a color, choose an effect, and watch your lights animate and glow!

Save your favorite combinations as presets, create playlists, control the speed and intensity of the animations, and lots more. This web app is incredibly intuitive and easy to use.

Head over to the WLED wiki at https://kno.wled.ge/ (https://adafru.it/11dN) to delve into all the particulars.

WLED Configuration



LED Settings

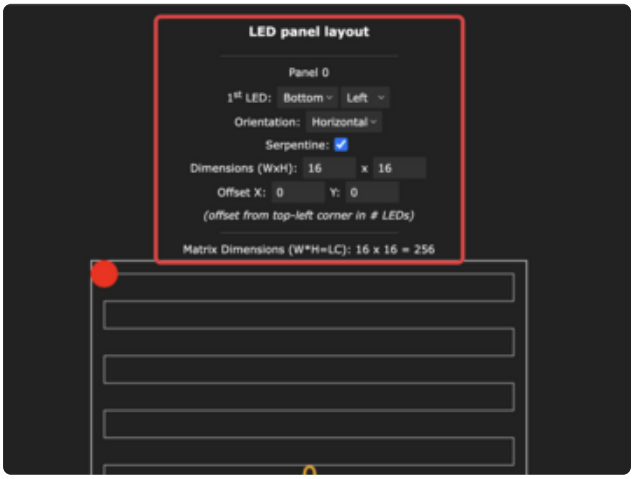
The 16x16 NeoPixel matrix will need to be configured in order to display the animations correctly. Follow the settings below to configure the LED matrix.

Click on the **Config** icon on the homepage of WLED, then click on **LED Preferences**
Under section **LED outputs** set the following

1: **WS281x**
mA/LED: **55aA (typ. 5V WS281x)**
Color order: **GRB**
Start: 0 Length: **256**
Data GPIO: **21**

Click **save** at the top when settings have been updated.

2D Configuration

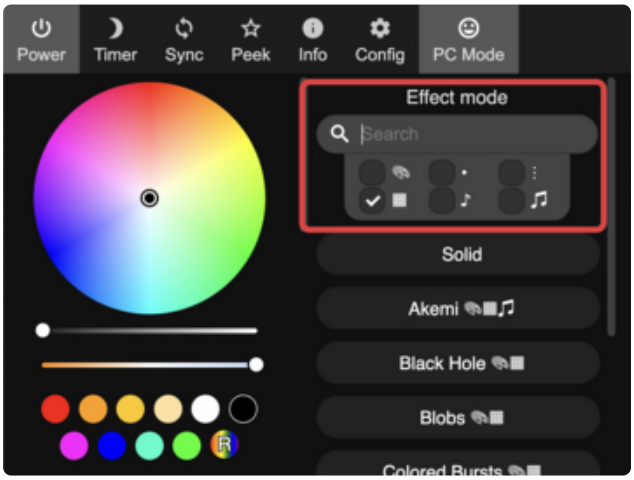


In the Configuration menu, click on 2D configuration and make the following settings.

Under the 2D setup section, select **2D matrix** from the dropdown menu.
Under the **LED panel layout** section make the following adjustments

1st LED: **Bottom Left**
Orientation: **Horizontal**
Serpentine: **ON**
Dimensions: **16** x **16**

Click **save** at the top when settings have been applied.



2D Effects

In the WLED homepage, under the **Effect** mode click on the search box. In the categories popup, click on the matrix icon. The list of effects will filter out all effects and will show all available 2D effects. Click on any of these effects to display on the 16x16 NeoPixel Matrix.

Audio Settings

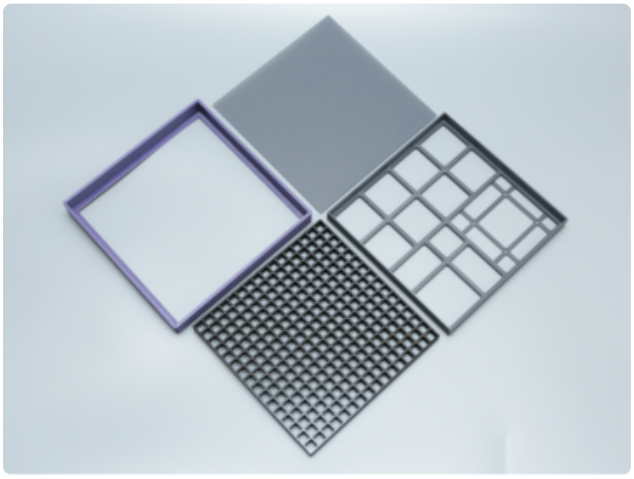
In the Configuration menu, click on Usermods. Make the following adjustments.

Click the **Enabled** checkbox under the **Audio Reactive** headline.
Under **Digitalmic** type dropdown box select **Generic I2S.**

Pin I2S SD: 25
Pin I2S WS: 33
Pin I2S SCK: 26

Click **Save** button when settings have been set.

CAD Files



3D Printed Parts

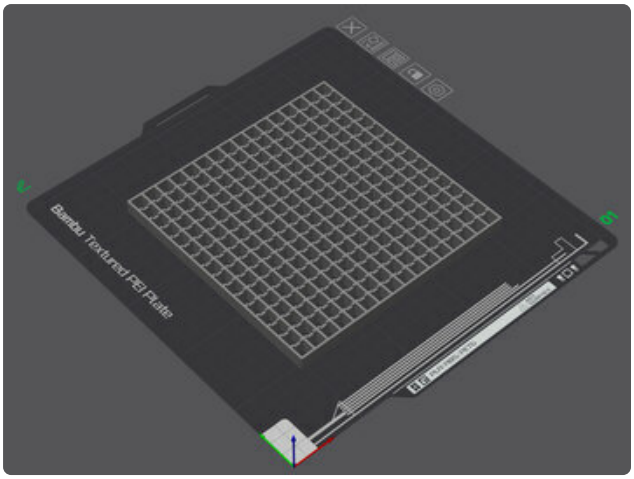
Individual 3MF files for 3D printing will need to be oriented in slicing software to print on FDM machines without any support material using PLA filament. Original design source may be downloaded using the links below.

Download 3MF.zip

https://adafru.it/1afg

Download CAD_Source.zip

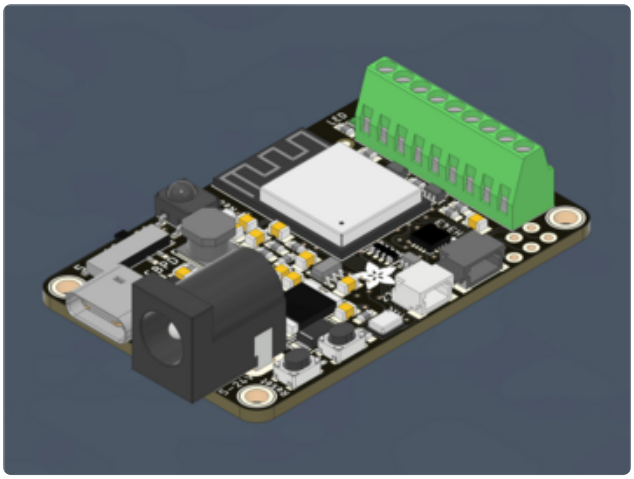
https://adafru.it/1afh



Build Volume

The parts require a 3D printer with a minimum build volume of:

174mm (X) x 174mm (Y) x 22mm (Z)

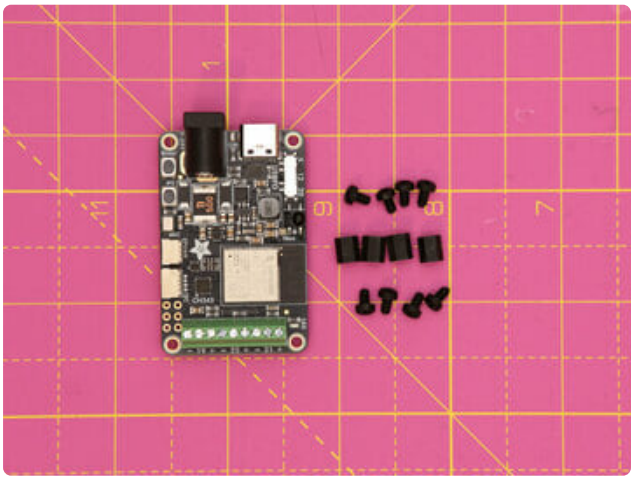


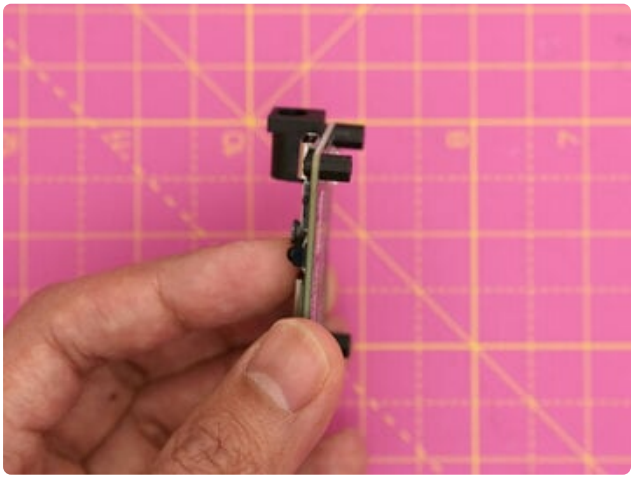
Design Source Files

The project assembly was designed in Fusion 360. Once opened in Fusion 360, It can be exported in different formats like STEP, STL and more.

Electronic components like Adafruit's boards, displays, connectors and more can be downloaded from the Adafruit CAD parts GitHub Repo (https://adafru.it/RvF).

Assembly

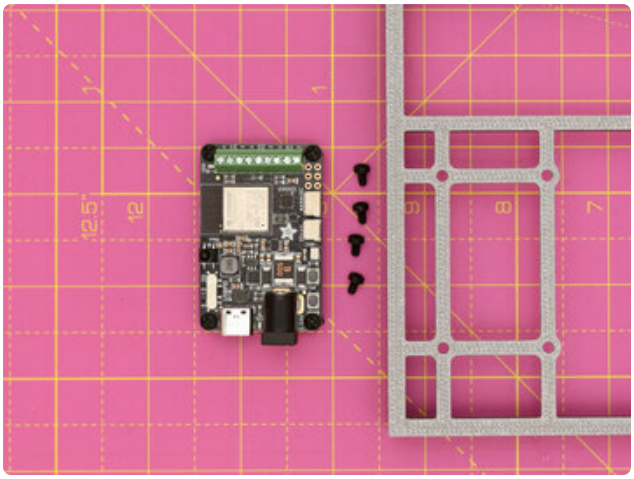


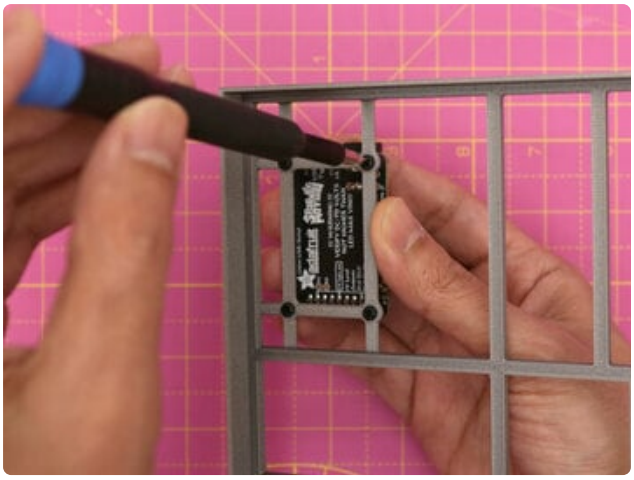


Install Hardware

Install the following fasteners onto the Sparkle Motion as shown:

4mm FF standoffs
4x M2.5 x 4mm screws

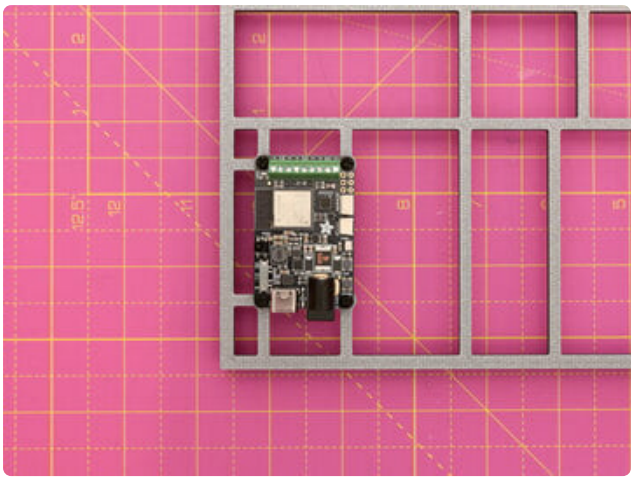




Secure PCB

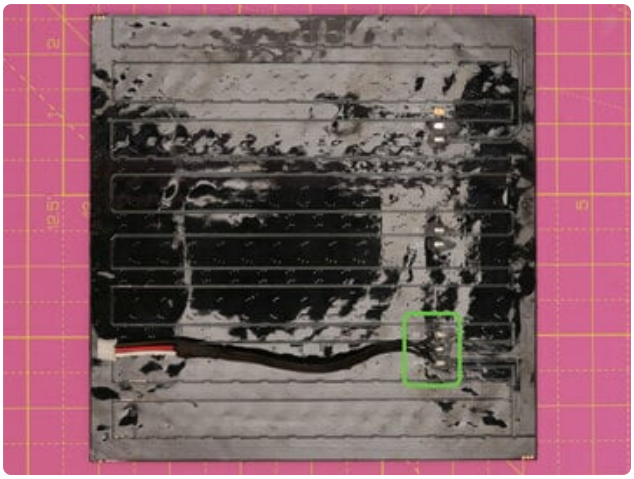
Orient the Sparkle Motion PCB with the back frame.

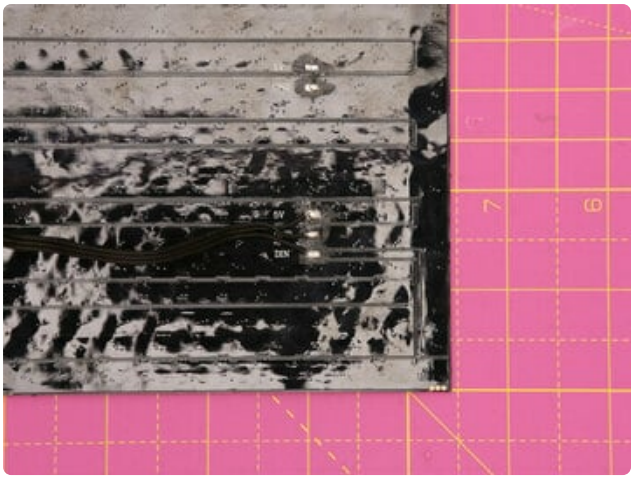
Place the PCB over the mounting holes and secure using four M2.5 x 4mm screws.



Secured Board

Double check the orientation of the Sparkle Motion board is correct.



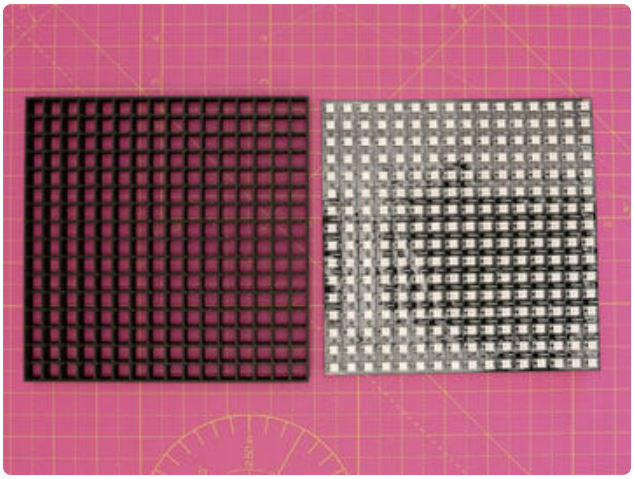


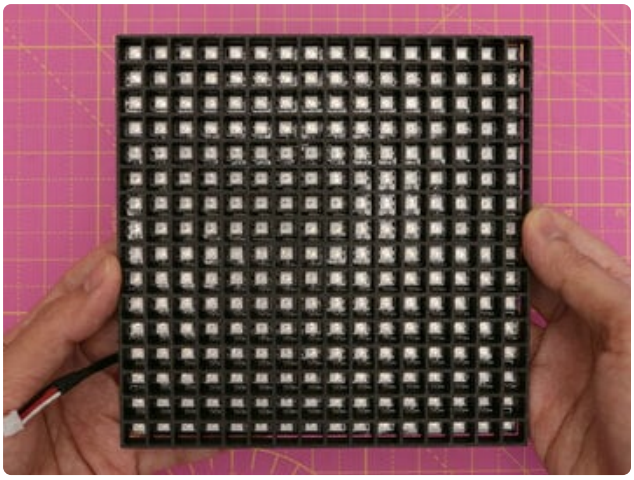
Solder Cable

Desolder all of the stock cables from the back of the NeoPixel Matrix.

Solder the 3-pin JST plug cable to the following pads on the matrix.

Red wire to **5V**
Black wire to **GND**
White wire to **DIN**

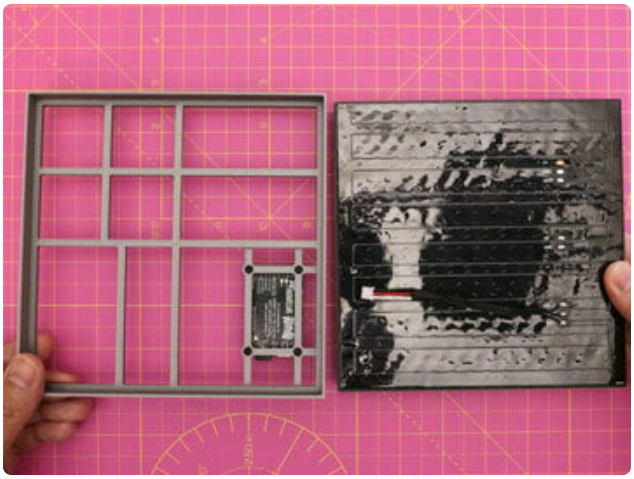




Install Grid

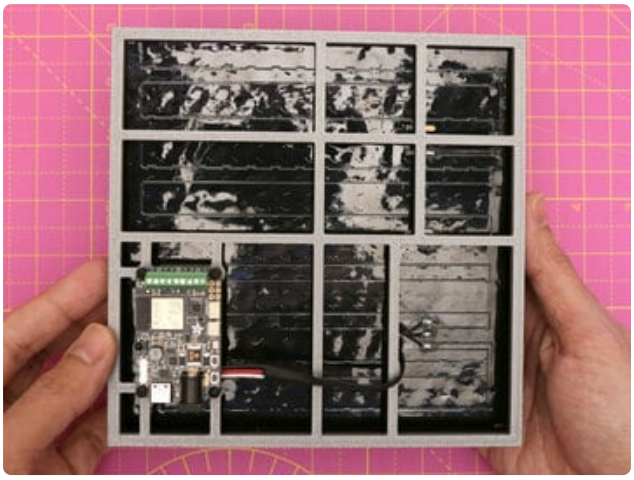
Orient the diffuser grid with the NeoPixel Matrix so the notches are fitted over the SMD capacitors.

Place the diffuser grid over the NeoPixel Matrix.

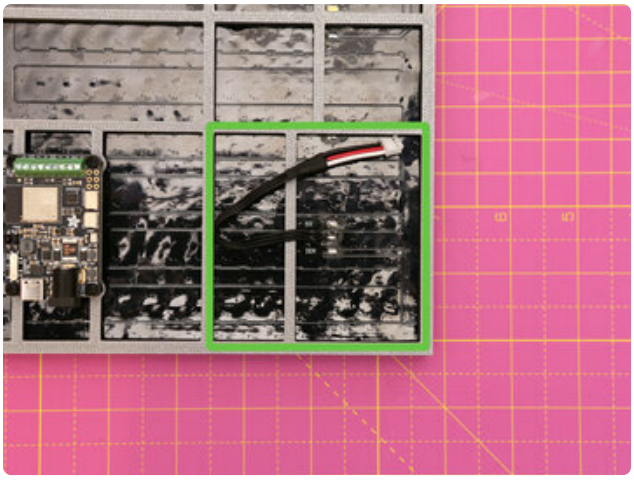


Install Back Frame

Orient the back frame with the NeoPixel matrix.

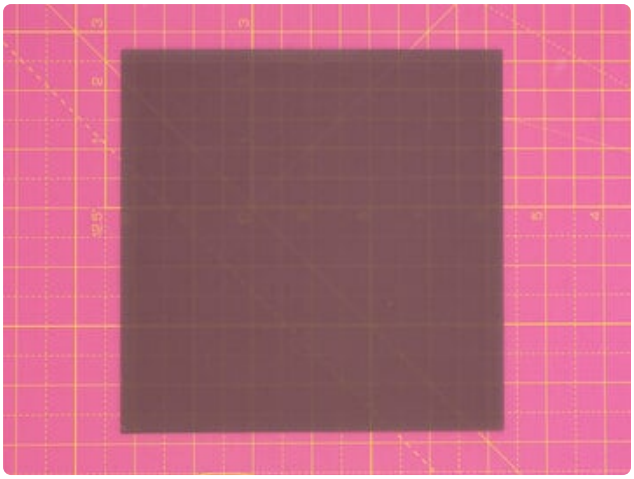


Fit the diffuser grid into the back frame and firmly press them together while making sure the wires are not being pinched.



Fitted Cable

The 3-pin JST cable should be fitted through the opening in the back frame.

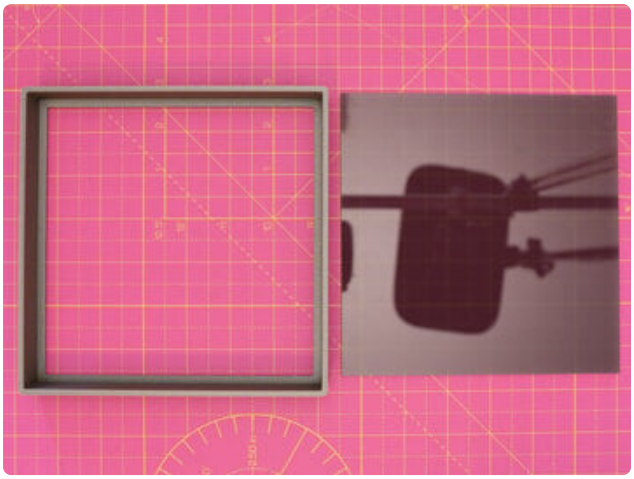


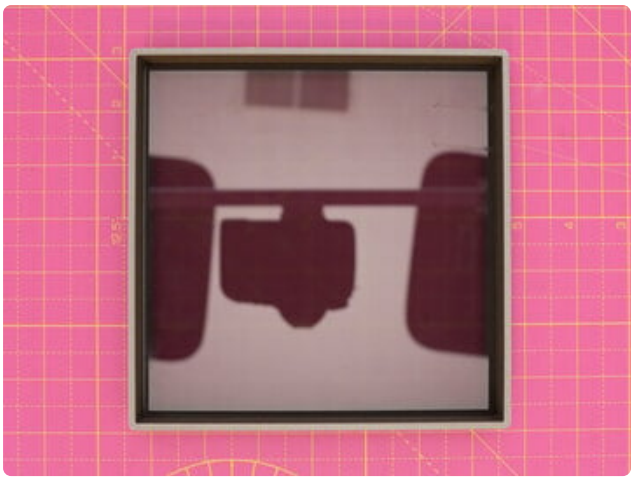
Cut Acrylic

Cut the acrylic to the following dimensions:

166mm (6.54 in) x 166mm (6.54 in)

You can use a hand saw, band saw, table saw, laser cutter, score and snap or a few other methods to do this.

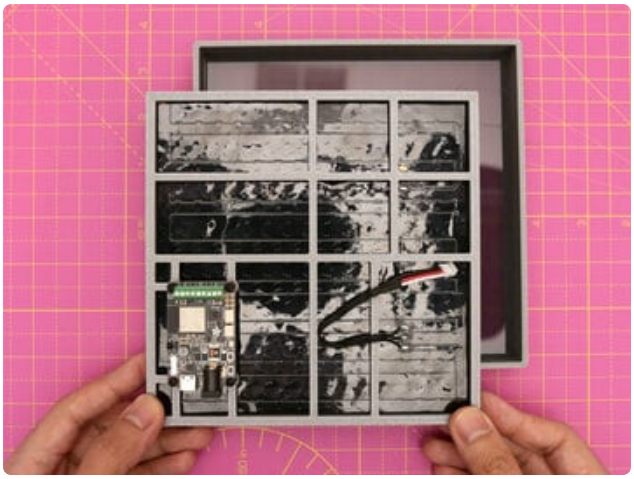


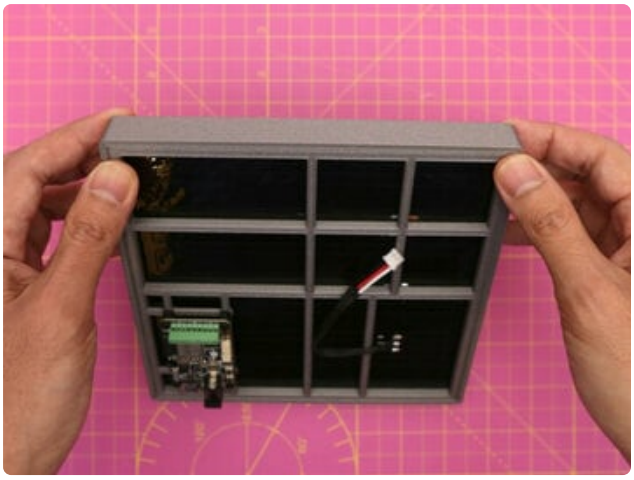


Install Acrylic

Orient the black LED acrylic with the shiny side facing up.

Place the acrylic into the front frame.





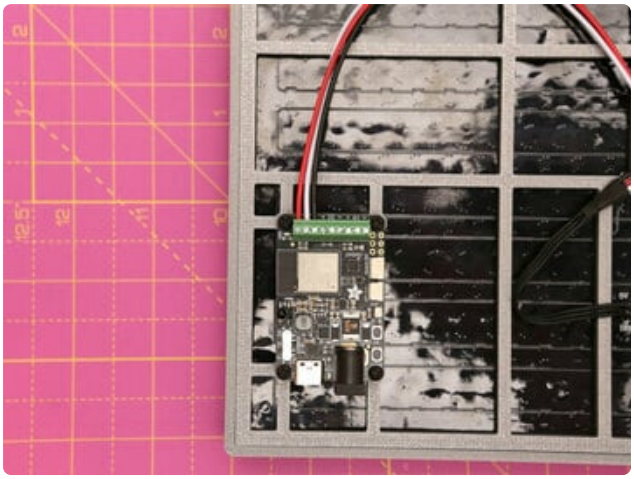
Install Front Frame

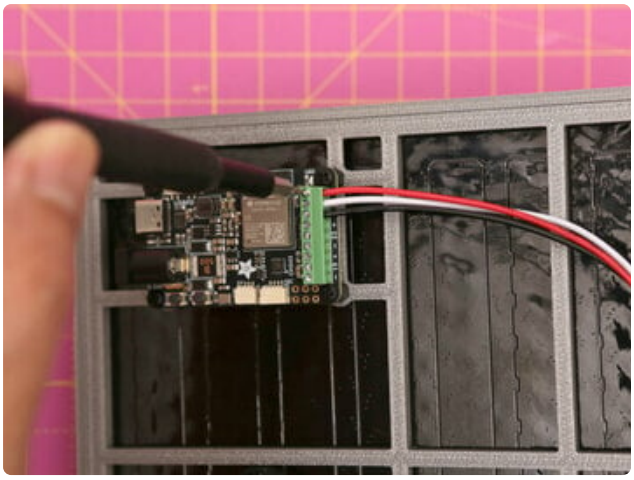
Begin fitting the assembled back frame into the front frame.

Firmly press the two parts together so they both sit flush with each other.

Assembled Frame

Double check all sides of the frames have been correctly assembled.



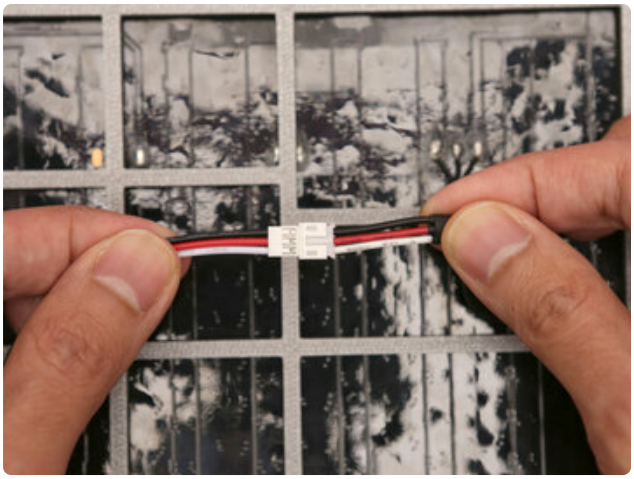


Install Cable

Insert the 3-pin socket JST cable into the screw block terminals on the Spark Motion board.

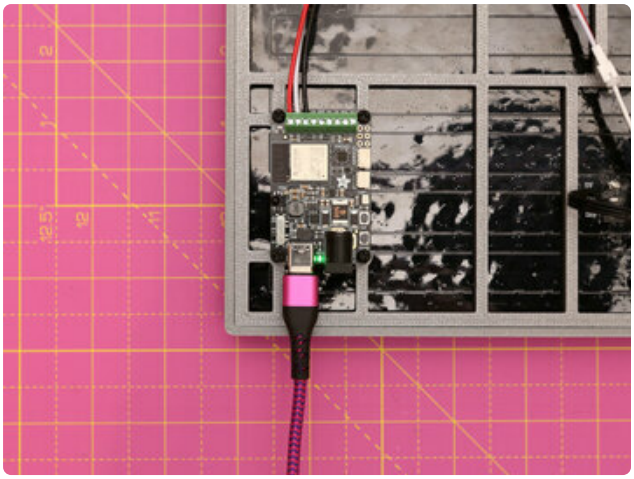
Red wire to + **positive**
White wire to **pin 21**
Black wire to **– negative**

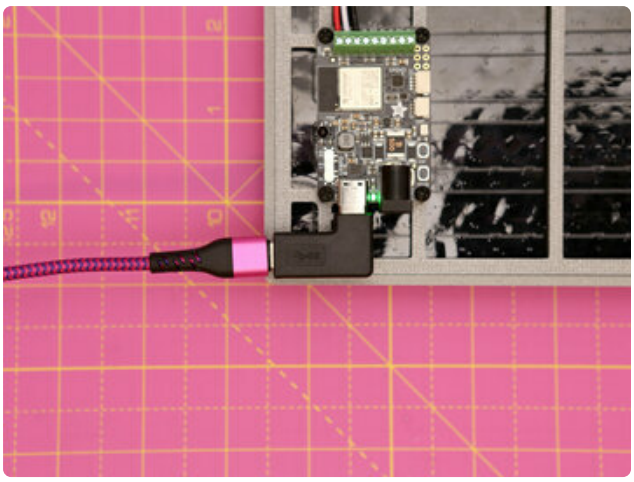
Secure the three wires to the terminals using a screwdriver with a flat tipped bit.



Connect Cables

Plug in the matching 3-pin JST cables together.

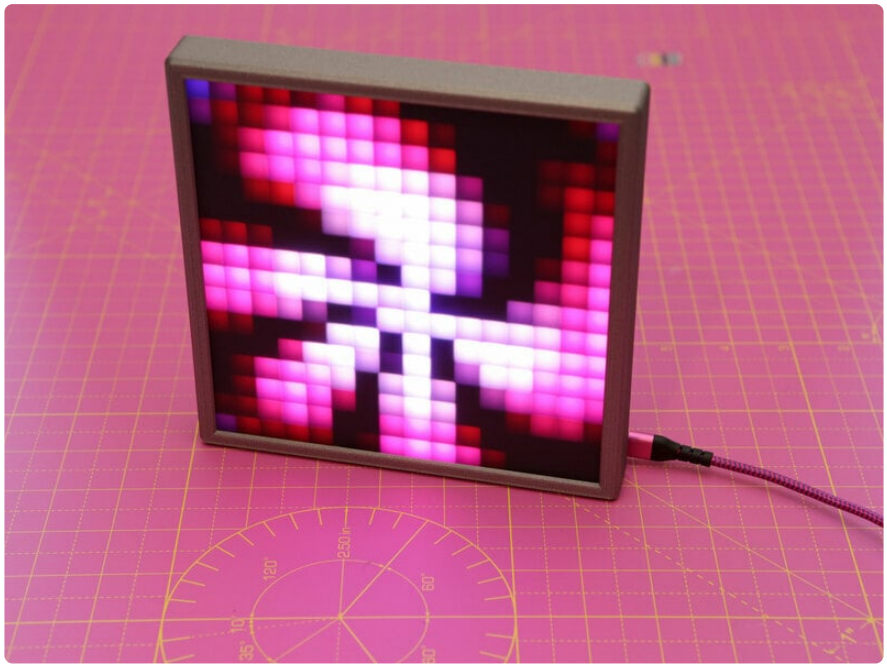




USB Connect

Power on the Sparkle Motion board using a USB-C cable and a 5V 2A power supply.

Or, use the right angle USB C adapter to allow the display frame to stand upright.



Final Build

Congratulations on your build!