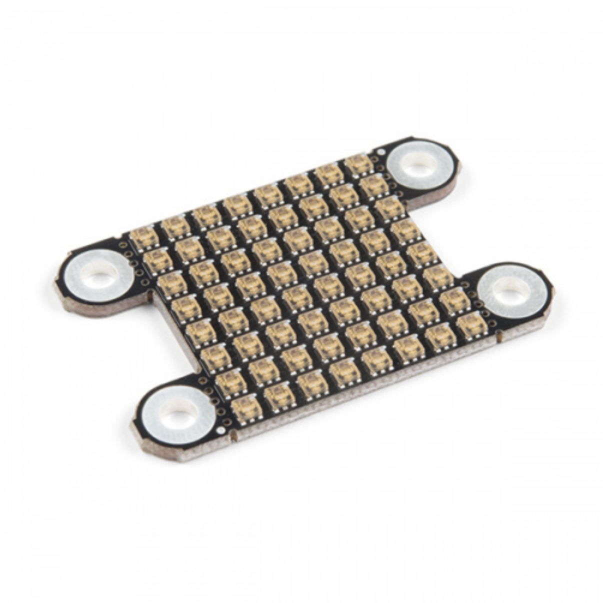
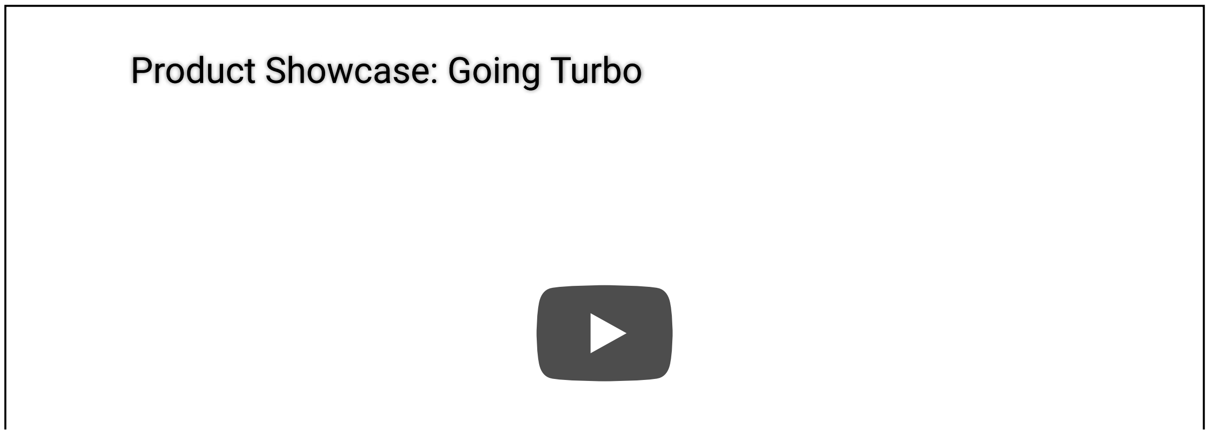
LuMini 8x8 Matrix Hookup Guide

Introduction

The LuMini 8x8 Matrix is a great way to add a square of light to just about anything, or even make a screen of a custom shape. The LuMini product line uses the same LED used on our Lumenati boards, the APA102, just in a smaller, 2.0x2.0 mm package. This allows for incredibly tight pixel densities, and thus, a screen with less pixelation. The LuMini Matrix packs 64 LEDs into a measly square inch!



SparkFun LuMini LED Matrix - 8x8 (64 x APA102-2020)
● COM-15047



In this tutorial, we'll go over how to connect the LuMini Matrix up to more LuMini Matrices as well as other APA102 based products. We'll check out how to map out a matrix of lights in software so we can get a little more creative with our animations. We'll go over some things to consider as you string more and more lights together, and we'll also go over some neat lighting patterns to get you away from that standard rainbow pattern (Iif you have 16 million colors why would you use 255).

Required Materials

To follow along with this tutorial, you will need the following materials. You may not need everything though depending on what you have. Add it to your cart, read through the guide, and adjust the cart as necessary.

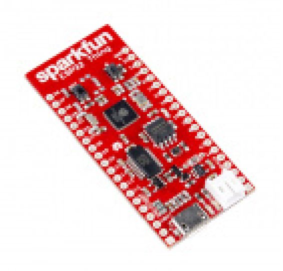
Choosing a Microcontroller

You'll need a microcontroller to control everything, however, there are a few things to consider when picking out one to control a whole ton of LEDs. The first thing is that, although they don't have to operate at a specific timing, APA102 LEDs can transmit data *really really fast* for an LED, **20 MHz** fast! So you should use a microcontroller that is fast enough to take advantage of this capability. Another consideration is the amount of RAM taken up by the LED frame; especially, when you start getting into higher LED counts. Each LED takes up 3 bytes of space in RAM. This doesn't sound like a lot, but if you're controlling 5000 LEDs, you might need something with a bit more RAM than your traditional RedBoard. The below chart outlines the amount of LED's where you may start running into memory issues. Keep in mind that these are very generous estimates and will decrease depending on what other global variables are declared.

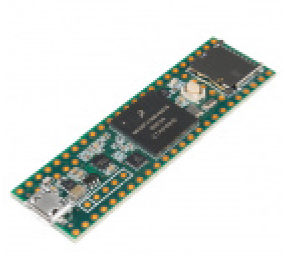
Microcontroller	**Max LED's**	**Clock Speed**
SparkFun RedBoard	600	16 MHz
Arduino Mega 2560	2600	16 MHz
Pro Micro	700	16 MHz
SparkFun ESP8266 Thing	27,000	160 MHz
SparkFun ESP32 Thing (Plus)	97,000	160 MHz or 240 MHz
Teensy 3.6	87,000	180 MHz (240 MHz Overclock)

It's pretty easy to choose either the ESP32 or Teensy 3.6 when it comes to stuff like this, as they've got a ton of overhead in clock cycles to run wacky calculations for animations. However, if your project isn't all about lights, and you're just tossing a LuMini Ring on a project as an indicator, less powerful microcontrollers will suffice.

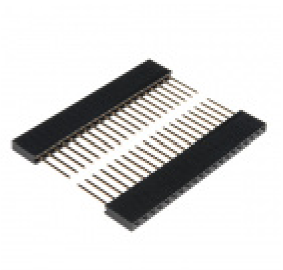
Here are links to the ESP32 Thing and Teensy 3.6; otherwise, you can look at the other microcontrollers listed in our catalog. If you want headers for these boards, here are links to those products as well. *(*The Teensy 3.6 has 24 breadboard pins, so you can use 4 of the photon headers.)*



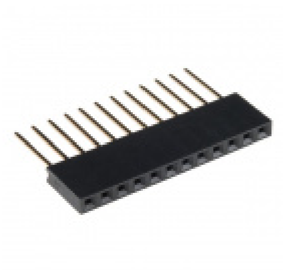
SparkFun ESP32 Thing
◉ DEV-13907



Teensy 3.6
◉ DEV-14057



ESP32 Thing Stackable Header Set
○ PRT-14311



Photon Stackable Header - 12 Pin
◉ PRT-14322

Selecting a Power Supply

In most cases, your LED installation is gonna pull more current than your board can handle. Depending on the brightness and animation, anywhere from 100-250 LED's will be too much for your board's voltage regulator, so you should snag a sweet 5V power supply that's got enough wattage in the cottage for all of your LED's. Here are a few 5V power supplies to start off with:

Wall Adapter Power Supply - 5.1V DC 2.5A (USB Micro-B)
◉ TOL-13831

Mean Well Switching Power Supply - 5VDC, 20A
◉ TOL-14098

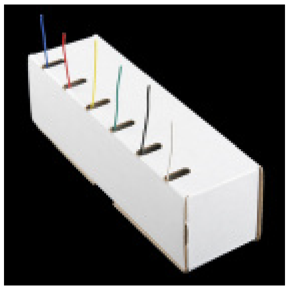
Mean Well LED Switching Power Supply - 5VDC, 8A
◉ TOL-14602

Mean Well LED Switching Power Supply - 5VDC, 5A
◉ TOL-14601

You can either estimate the necessary size of your power supply by taking the amount of LED’s and multiplying by 60 mA (0.06 A) which is the amount of current it takes to run an LED at full white. This calculation will give you the maximum amount of power your LED’s could draw. However, most of the time, this is a gross overestimate of the amount of power you’ll actually end up consuming. Instead of calculating the maximum current draw, I usually like to test my completed installation on a benchtop power supply using the brightest animation it’ll be running, and then add 20 or 30 percent to give myself a little wiggle room if I want to turn the brightness up in the future.

Additional Hardware

You will also probably need some soldering equipment and a 4.7 µF SMD capacitor (in a 603 package). The capacitor will be used to decouple the power supply. This will reduce high frequency noise in the power line and compensate for voltage drops due to the change in current demand from devices turning on and off. The 603 package might be a little tricky to solder, a good set of tweezers will help.



Hook-Up Wire - Assortment (Solid Core, 22 AWG)
◉ PRT-11367

SparkFun Beginner Tool Kit
⊖ TOL-14681

Tweezers - Curved (ESD Safe)
◉ TOL-10602

Capacitor 4.7uF - SMD (Strip of 10)
◉ COM-15169

Suggested Reading

If you aren’t familiar with the following concepts, we recommend checking out these tutorials before continuing.

LEDs, Light, and Power

Light
Light is a useful tool for the electrical engineer. Understanding how light relates to electronics is a fundamental skill for many projects.

How to Power a Project
A tutorial to help figure out the power requirements of your project.

Light-Emitting Diodes (LEDs)
Learn the basics about LEDs as well as some more advanced topics to help you calculate requirements for projects containing many LEDs.

Electric Power
An overview of electric power, the rate of energy transfer. We'll talk definition of power, watts, equations, and power ratings. 1.21 gigawatts of tutorial fun!

Soldering Fundamentals

How to Solder: Through-Hole Soldering
This tutorial covers everything you need to know about through-hole soldering.

How to Solder: Castellated Mounting Holes
Tutorial showing how to solder castellated holes (or castellations). This might come in handy if you need to

solder a module or PCB to another PCB. These castellations are becoming popular with integrated WiFi and Bluetooth modules.

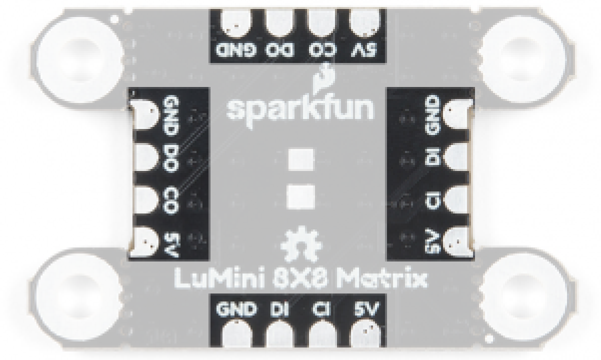
How to Work with Jumper Pads and PCB Traces

Handling PCB jumper pads and traces is an essential skill. Learn how to cut a PCB trace, add a solder jumper between pads to reroute connections, and repair a trace with the green wire method if a trace is damaged.

Hardware Overview

I/O Pads

The LuMini Matrix is powered and controlled using a few pads on the back of each board. Each board has a set of pads for **5V** and **GND** (ground), a set of pads for **DI** (data in) and **CI** (clock input), and a set of pads for **DO** (data out) and **CO** (clock output). These pads are outlined in the below image.

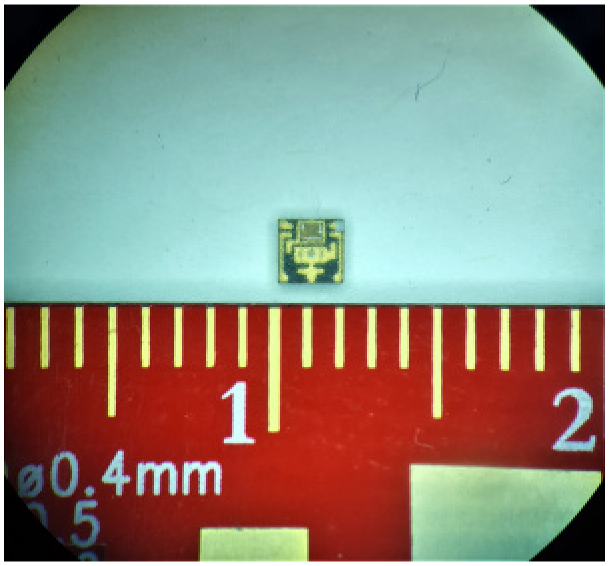


LuMini Matrix 8x8 I/O pads.

APA102

Heads up! The LiMini Rings and Matrix has a different footprint compared to the individual APA102-2020s that are sold in packs of 10 (i.e. COM-14608).

The APA102 is an addressable RGB LED with 8-bit color (256 colors) and 256 levels of gray scale. This essentially means that you can tell each individual LED what color you want it to show and how bright it should be.



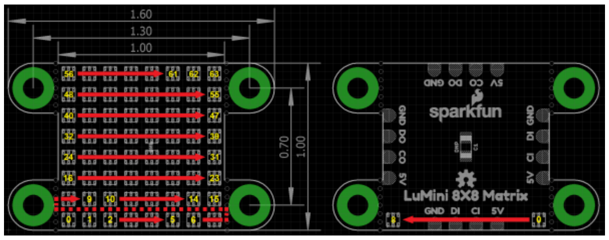
APA102 LED under a microscope. ***Click*** *to enlarge image.*

The LEDs employ a 2-wire communication protocol consisting of a clock line and a data line. While this requires one more wire than standard WS2812B addressable LEDs, the advantage is that the communication with the LEDs becomes somewhat timing independent, allowing you to run these off boards without long, precisely-timed data streams.

Note: We've found that setting the global brightness using the FastLED Library to `32` is good for testing, as it's easier on the eyes. You can also tape a small piece of paper to the front to get better diffusion of each LED.

LED Indexing

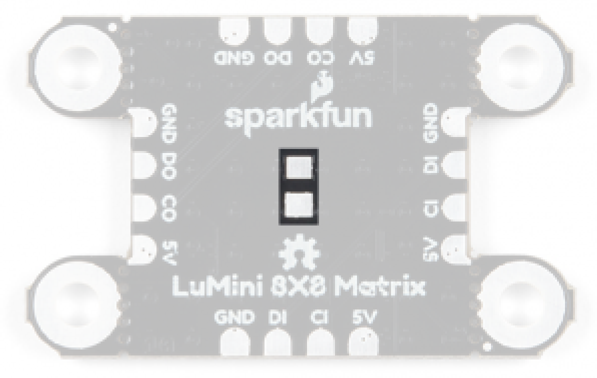
Each matix acts like a string of LEDs. The indexing (or numbering) of the LEDs moves from left to right, bottom to top of the board, on the LED facing side, as shown in the diagram below.



LED indexing for LuMini Matrix 8x8 (Left: Front or LED facing side, Right: Back). ***Click*** *to enlarge image.*

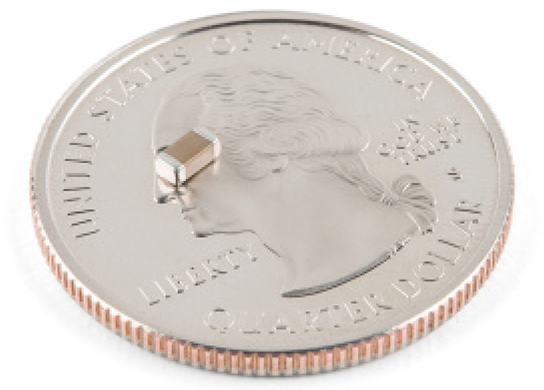
Capacitor Pads

In larger installations you may need to add a decoupling capacitor between power and ground to prevent voltage dips when turning on a whole bunch of LEDs simultaneously. The spot to add this optional capacitor is outlined below.



LuMini Matrix 8x8 pads for capacitor.

We’d recommend the below 4.7 µF capacitor. If you’ve never done surface mount soldering before, this part might be a little tricky, but check out our SMD tips and tricks on doing just that.



4.7 µF capacitor on a quarter for size comparison.

Note: You only need capacitor one per setup and not one for every board in your installation.

Heat Dissipation

As with most high power LEDs, the APA102 LEDs used on the LuMini Matrix 8x8 generate a lot of heat. To keep the LEDs from damaging themselves and the board, the ground plane (back/bottom layer of the board) is used for heat dissipation. The stand off pads are also tied to the ground plane and can be used for greater thermal dissipation.

Note: Be careful to make sure your animations don't run too hot, and if they do, you can always lower the brightness (see **Warning** below).

We've found that setting the global brightness using the FastLED Library to `32` is good for testing, as it's easier on the eyes. Even if all the LEDs are set to white, the temperature of the board will idle around (90-95°F... depending on your ambient room temperature).

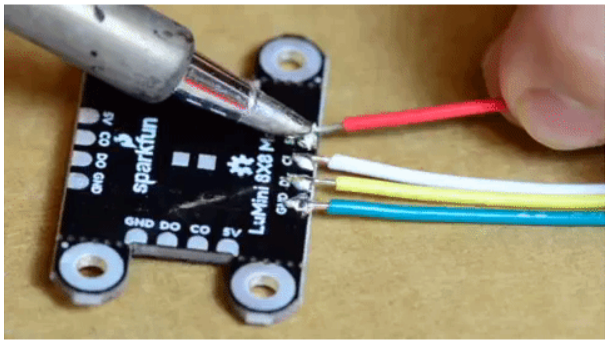
⚠ **Warning! Do NOT** try this at home! (*We tested the Matrix at full-tilt so that you don't have to.*)

Setting all the LEDs on white and turning the brightness up all the way up will result in damage to your board and may result in injury and/or fire 🔥🔥🔥! We only ran our display for about 20-30 seconds before we decided to turn it off, in that time it climbed to **over 300°F** and was still rising!

Hardware Assembly

Soldering to the LuMini Matrix

Soldering wires to the pads on the LuMini Matirx is pretty simple. The trick is simply to pre-solder both the pad and wire before attempting to solder the two together. Then, press the wire onto the pad and solder away! Check out the below GIF if you're a little confused.



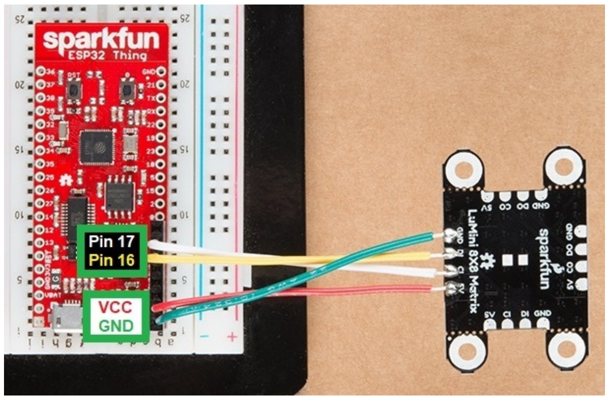
Soldering wire to board.

Choosing Pins

The APA102 LED is controlled on an SPI-like protocol, so it's generally good practice to connect **CI** on the LuMini Matrix to `SCLK` on your microcontroller, and connect **DI** to `MOSI` . However, This setup isn't required, and you can connect data and clock up to most pins on your microcontroller. Go ahead and determine which pins you will use, and solder your Data and Clock lines into your microcontroller.

Connecting to a SparkFun ESP32 Thing

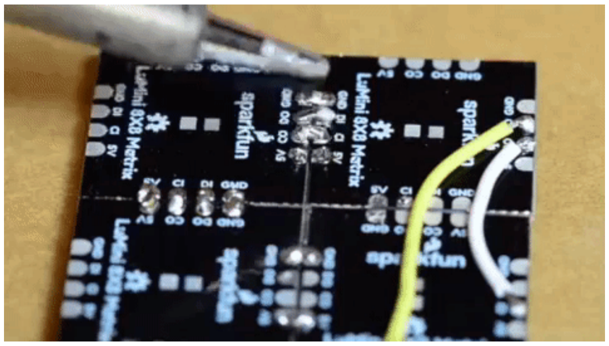
In the examples below, we will be using a SparkFun ESP32 Thing. For the hardware connections, the **5V** line is connected to the **VUSB** pin, **GND** is connected to the **GND** pin, **DI** is connected to pin **16**, and **CI** is connected to pin **17**.



Pin connections to SparkFun ESP32 Thing for examples below. ***Click*** *image for wiring on the matrix panel.*

Creating a Larger Installation

Now that we know how to solder to these pads, we can start making a grid of LuMini Matrices, or even tie them to other APA102 based products. To do this, all we'll need to do is solder **CO** and **DO** of one matrix panel to the **CI** and **DI** of the next matrix panel. Below, is an image multiple matrices soldered together to make a larger display.



Castellated soldering for I/O pads.

Troubleshooting Tip: The standoffs mounting points can be clipped with a pair of dikes (diagonal wire cutters). You may need sand or file the edges square, since the diagonal cutters will leave a rough edge.

Arduino Library

Note: This example assumes you are using the latest version of the Arduino IDE on your desktop. If this is your first time using Arduino, please review our tutorial on installing the Arduino IDE. If you have not previously installed an Arduino library, please check out our installation guide.

We'll be leveraging the ever popular `FastLED` library to control our LuMini Matrix. So go ahead and start by downloading the library by clicking the button below or searching for `FastLED` in the Arduino Library manager.

DOWNLOAD THE FASTLED LIBRARY (ZIP)

Light It Up

SparkFun has also written some example code specific to the rings to get you started. These example sketches can be found in the LuMini 8x8 GitHub Repo under Firmware. To download, click on the button below.

DOWNLOAD THE EXAMPLE SKETCHES

Make sure to adjust the pin definition depending on how you connected the LEDs to your microcontroller.

Note: Be careful to make sure your animations don't run too hot, and if they do, you can always lower the brightness `LEDS.setBrightness(##);` (see **Warning** below).

⚠ **Warning!**
Setting all the LEDs on white and turning the brightness up all the way up will result in damage to your board and may result in injury and/or fire 🔥🔥🔥!

Example 1 — Matrix Test

Glen Larson invented the Larson Scanner as an LED effect for the TV series Knight Rider. In this example, we'll begin to reproduce it that effect and add in some color for flavor. This sketch is a great way to test all of the LEDs. First, we begin by creating an object for matrix `CRGB matrix[NUM_LEDS]` .

```
#include <FastLED.h>

// How many leds in your chain? Change the value of NUM_BOARDS depending on your setup
#define NUM_BOARDS 1
#define NUM_LEDS 64 * NUM_BOARDS //64 LED's per board

// The LuMini matrices need two data pins connected, these two pins are common on many microcont
rollers, but can be changed according to your setup
#define DATA_PIN 16
#define CLOCK_PIN 17

// Define the array of leds
CRGB matrix[NUM_LEDS];
```

We then, initialize the matrix using the `LEDS.addLeds` function below. Notice the **BGR** in this statement, this is the color order, sometimes, the manufacturer will change the order in which the received data is put into the PWM registers, so you'll have to change your color order to match. The particular chipset we're using is **BGR**, but this could change in the future.

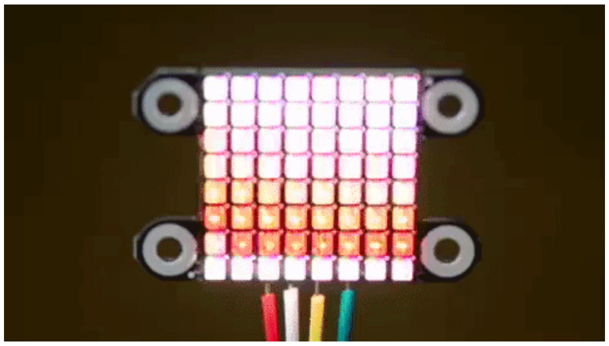
```
void setup() {
  Serial.begin(115200);
  Serial.println("resetting");
  LEDS.addLeds<APA102, DATA_PIN, CLOCK_PIN, BGR>(matrix, NUM_LEDS);
  LEDS.setBrightness(32);
}
```

In this sketch, the global brightness is set to **32** `LEDS.setBrightness(32);` . Although, the full range of this setting is **0** to **255**, we've found that **32** is good for testing, as it's easier on the eyes. Even if all the LEDs are set to white, the temperature of the board will idle around (90-95°F… depending on your ambient room temperature).

Our animation is then contained in the `fadeAll()` function, which loops through every LED and fades it to a percentage of it's previous brightness. Our `loop()` then set's an LED to a hue, we increment the hue, then show our LEDs. After this we use the `fadeAll()` function to fade our LED's down so they don't all end up being on.

```
void fadeAll() {
  for (int i = 0; i < NUM_LEDS; i++)
  {
    matrix[i].nscale8(250);
  }
}

void loop() {
  static uint8_t hue = 0;
  //Rotate around the circle
  for (int i = 0; i < NUM_LEDS; i++) {
    // Set the i'th led to the current hue
    matrix[i] = CHSV(hue++, 150, 255); //display the current hue, then increment it.
    // Show the leds
    FastLED.show();
    fadeAll();//Reduce the brightness of all LEDs so our LED's fade off with every frame.
    // Wait a little bit before we loop around and do it again
    delay(5);
  }
}
```

Your code should look like the below gif if you've hooked everything up right. If thing's aren't quite what you'd expect, double check your wiring.



You should see this on the LuMini matrix if you have done everything correctly.

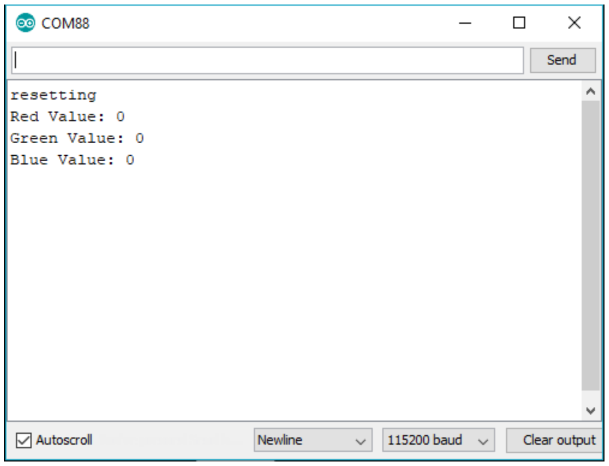
As a challenge, see if you can create an actual Larson scanner. It should only take a few modifications to the example code.

Example 2 — RGB Color Picker

In this second example, we'll use the serial terminal to control the color displayed by the matrix. We initialize everything in the same way. We then listen for data on the serial port, parsing integers that are sent from the Serial Monitor from the Arduino IDE and putting them in the corresponding color (red, green or blue). The code to accomplish this is shown below.

```
#include <FastLED.h>

// How many leds in your chain? Change the value of NUM_BOARDS depending on your setup
#define NUM_BOARDS 1
#define NUM_LEDS 64 * NUM_BOARDS //64 LED's per board

// The LuMini matrices need two data pins connected, these two pins are common on many microcont
rollers, but can be changed according to your setup
#define DATA_PIN 16
#define CLOCK_PIN 17

CRGB color;
char colorToEdit;

// Define the array of leds
CRGB matrix[NUM_LEDS];

void setup() {
  Serial.begin(115200);
  Serial.println("resetting");
  LEDS.addLeds<APA102, DATA_PIN, CLOCK_PIN, BGR>(matrix, NUM_LEDS);
  LEDS.setBrightness(32);

  //Display our current color data
  Serial.print("Red Value: ");
  Serial.println(color[0]);
  Serial.print("Green Value: ");
  Serial.println(color[1]);
  Serial.print("Blue Value: ");
  Serial.println(color[2]);
  Serial.println();
}

void loop()
{
  if (Serial.available()) //Check to see if we have new Serial data.
  {
    colorToEdit = Serial.read();
    switch (colorToEdit)
    {
      case 'R':
      case 'r':
        color[0] = Serial.parseInt();
        break;
      case 'G':
      case 'g':
        color[1] = Serial.parseInt();
        break;
      case 'B':

      case 'b':
        color[2] = Serial.parseInt();
        break;
    }
    //Display our current color data
    //Display our current color data
    Serial.print("Red Value: ");
    Serial.println(color[0]);
    Serial.print("Green Value: ");
    Serial.println(color[1]);
    Serial.print("Blue Value: ");
    Serial.println(color[2]);
    Serial.println();
    for (int i = 0; i < NUM_LEDS; i++)
    {
      matrix[i] = color;
      FastLED.show();
      delay(10);
    }
  }
}
```

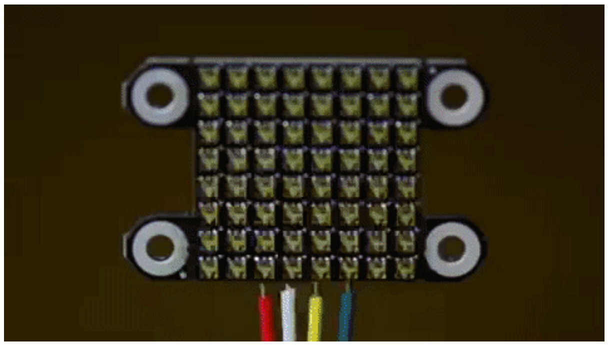
Go ahead and upload this code, then open your Serial Monitor to a baud rate of **115200**. It should be displaying the current color value (`R:0, G:0, B:0`), if not.



```
resetting
Red Value: 0
Green Value: 0
Blue Value: 0
```

*Serial monitor entries (for animation below `r255` **->** `r100g50b200` **->** `r255g255b255`).*

Changing the value of a color is done be sending the letter of the color (**R**, **G**, or **B**) followed by a value between **0** and **255**. For instance, turning **red** to half brightness would be achieved by sending **`R127`** . Play around and look for your favorite color.



You should see this on the LuMini matrix if you have done everything correctly.

Troubleshooting Tips:

- You may get some weird responses using low values for RGB; around 50 or less.
- The letters for the color entry are not case sensitive.

- You can also send multiple entries. Try sending `r100b50 g200` or `r0, b200,g150` in the serial monitor.
- `CRGB` is an object defined in the FastLED library. If you look up the object definitions, you play with how it operates in your code. For example, modifying this line of code:

  ```
  matrix[i] = CRGB::White;
  ```

  will set your entire panel color to white.

Example 3 — HSV Color Picker

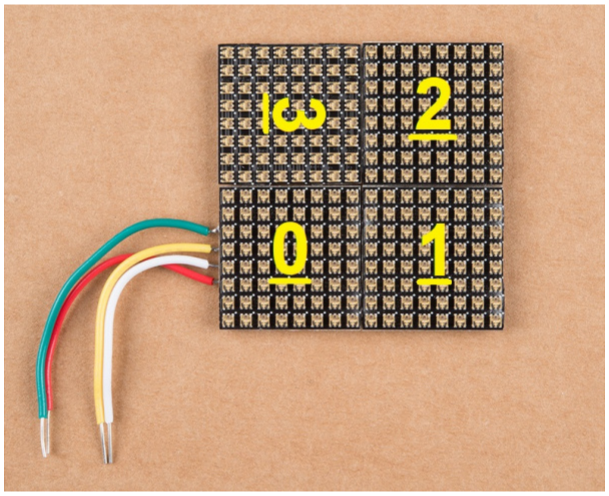
The third example is very similar to the first in that we are picking colors using the serial terminal. However, in this example, we are working with an HSV color space. This sketch works mostly the same as the previous one, only we send **h**, **s** or **v** instead of **r**, **g** or **b**. Upload the below code and play around in search of your favorite color.

```
#include <FastLED.h>

// How many leds in your chain? Change the value of NUM_BOARDS depending on your setup
#define NUM_BOARDS 1
#define NUM_LEDS 64 * NUM_BOARDS //64 LED's per board

// The LuMini matrices need two data pins connected, these two pins are common on many microcont
rollers, but can be changed according to your setup
#define DATA_PIN 16
#define CLOCK_PIN 17

CHSV color = CHSV(0, 255, 255);
char colorToEdit;

// Define the array of leds
CRGB matrix[NUM_LEDS];

void setup() {
  Serial.begin(115200);
  Serial.println("resetting");
  LEDS.addLeds<APA102, DATA_PIN, CLOCK_PIN, BGR>(matrix, NUM_LEDS);
  LEDS.setBrightness(32);

  //Display our current color data
  Serial.print("Hue: ");
  Serial.println(color.hue);
  Serial.print("Saturation: ");
  Serial.println(color.sat);
  Serial.print("Value: ");
  Serial.println(color.val);
  Serial.println();
}

void loop()
{
  if (Serial.available()) //Check to see if we have new Serial data.
  {
    colorToEdit = Serial.read();
    switch (colorToEdit)
    {
      case 'H':
      case 'h':
        color.hue = Serial.parseInt();
        break;
      case 'S':
      case 's':
        color.sat = Serial.parseInt();
        break;
      case 'V':
      case 'v':
        color.val = Serial.parseInt();
        break;
    }
    //Display our current color data
    Serial.print("Hue: ");
    Serial.println(color.hue);
    Serial.print("Saturation: ");
    Serial.println(color.sat);
    Serial.print("Value: ");
    Serial.println(color.val);
    Serial.println();

    for (int i = 0; i < NUM_LEDS; i++)
    {
      matrix[i] = color;
      FastLED.show();
      delay(10);
    }
  }
}
```

Once again, play around to try and find your favorite color. I find that HSV is a much more intuitive space to work in than RGB space.

Example 4 — Mapping Multiple Matrices

The LuMini Matrices can be easily daisy chained to create a screen of a custom size. When dealing with any screen or LED matrix, you'll want to be able to call some sort of function `XY(x, y)` to return an LED number at any given coordinate. In order to do this, we'll need to outline the path in which we've daisy chained our matrices as well as the orientation of each matrix. First let's look at the path that our matrices take.



Completed assembly for 2x2 matrices with matrix map marked. The orientation of third panel should be rotated 90° clockwise (from the front of the panels). ***Click*** *image to see the soldering connections on the back of the assembly.*

I've soldered together 4 LuMini matrices in the below picture. Each number represents which number the matrix is in the chain. I like to start at the bottom left, but you can lay out your matrix however you want. We'll then have to edit our `matrixMap[moduleHeight][moduleWidth]` object to tell our code where each matrix is. Notice how the numbers in the table identically map to the numbers on the matrices in the above picture.

```
#include <FastLED.h>

const int moduleHeight = 2; //The Height of our display, measured in numbers of LuMini matrices
const int moduleWidth = 2; //The Width of our display, measured in numbers of LuMini matrices

//The following matrix represents our entire LED display, with the number that each module is in
 the chain. My data flows in to the bottom left matrix (matrix 0 in my chain),
//then it goes right to the bottom right matrix (matrix 1 in my chain) then up to the top right
 matrix (matrix 2) then to the remaining matrix 3
//The below table should have identical matrix numbers/positions as that of the full multi-matri
x module
int matrixMap[moduleHeight][moduleWidth] = {
  {3, 2},
  {0, 1}
};
```

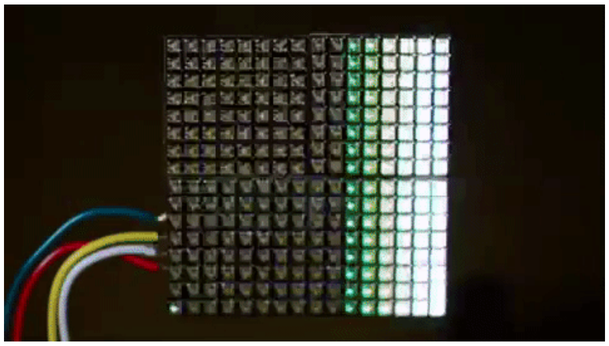
We'll then need to adjust the orientation of each matrix in code so that any physically rotated matrix gets it's pixels rotated in code as well. The easiest way to check the orientation is to first change the values of the `int orientation[moduleHeight * moduleWidth]` to 0, which is the default orientation when a LuMini matrix is facing straight up and down. Go ahead and upload your code. The last matrix should have a line going from top to bottom instead of left to right.

If your entire module was properly oriented, you would see a line of color swiping from left to right. If any of your matrices have a line swiping in a different direction, take note of the direction the line is swiping on the problem module. Use the below table to match the direction you're seeing to the necessary orientation in the `int orientation[moduleHeight * moduleWidth]` object.

Swipe Direction (Orientation 0)	**Orientation Number**
Left to Right	0
Top to Bottom	1
Right to Left	2
Bottom to Top	3

Since the last matrix has a line swiping from top to bottom due to its orientation, I'll change the orientation of the last matrix like so.

```
int orientation[moduleHeight * moduleWidth] = { 0, 0, 0, 1 };
```



You should see this on the 2x2 matrices if you have done everything correctly.

Example 5 — Using Gradients

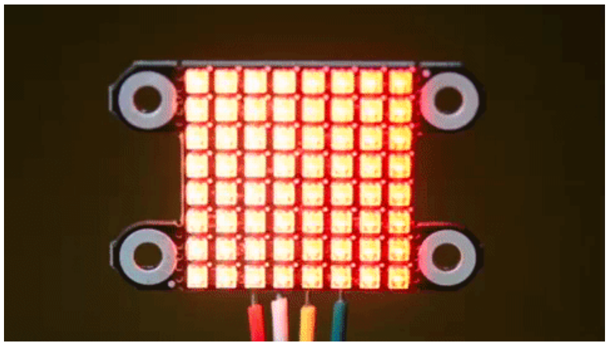
In this final example, we'll leverage FastLED's palette object (**`CRGBPalette16`**) to create and visualize a color palette on our matrix. We have much the same initialization as our previous examples, only this time we also initialize a `CRGBPalette16` object which will be full of colors along with a `TBlendType` which will tell us whether or not to blend the colors together or not. This can be either `LINEARBLEND` or `NOBLEND` . To populate this gradient, we use examples 2 and 3 to find the colors we want to put into our gradient. The gradient included is a bunch of colors created in HSV space, but you can easily change to RGB space if you prefer. You can also use any of the preset palettes by uncommenting the line that sets it equal to `currentPalette` .

```
TBlendType    currentBlending = LINEARBLEND;
CRGBPalette16 currentPalette = {
  CHSV(5, 190, 255),
  CHSV(0, 190, 255),
  CHSV(245, 255, 255),
  CHSV(235, 235, 255),
  CHSV(225, 235, 255),
  CHSV(225, 150, 255),
  CHSV(16, 150, 255),
  CHSV(16, 200, 255),
  CHSV(16, 225, 255),
  CHSV(0, 255, 255),
  CHSV(72, 200, 255),
  CHSV(115, 225, 255),
  CHSV(40, 255, 255),
  CHSV(35, 255, 255),
  CHSV(10, 235, 255),
  CHSV(5, 235, 255)
};

//currentPalette = RainbowColors_p;
//currentPalette = RainbowStripeColors_p;
//currentPalette = OceanColors_p;
//currentPalette = CloudColors_p;
//currentPalette = LavaColors_p;
//currentPalette = ForestColors_;
//currentPalette = PartyColors_p;
```

We then use the `ColorFromPalette` function to put the colors from our gradient onto our LED matrix.

```
void loop() {
  for (uint8_t x = 0; x < matrixWidth; x++)
  {
    uint8_t gradientIndex = (x * 2) + rotation;//Multiply by 2 to show more of the gradient on t
he matrix
    for (uint8_t y = 0; y < matrixHeight; y++)
    {
      matrix[XY(x, y)] = ColorFromPalette(currentPalette, gradientIndex, brightness, currentBlen
ding);
    }
  }
  FastLED.show();
  rotation++;
  delay(30);
}
```

Play around with the colors in your palette until you're satisfied. If all is hooked up correctly your LED matrix should look something like the below gif.



You should see this on the LuMini matrix if you have done everything correctly.

Additional Examples

There are quite a few additional examples contained in the FastLED library. These can be obtained by opening up **File** -> **Examples** -> **Examples From Custom Libraries** -> **FastLED**

Resources & Going Further

Now that you've successfully got your LuMini Ring up and running, it's time to incorporate it into your own project! For more information about the LuMini Matrix, check out the links below.

- Schematic (PDF)
- Eagle Files (ZIP)
- Datasheet - APA102 (PDF)
- SMD Soldering Tips
- GitHub FastLED Arduino Library
- Example Code
- GitHub Product Repository
- SFE Product Showcase

Or, you can check out some of our other LuMini products:

New!

New!

LuMini Ring Hookup Guide
The LuMini Rings (APA102-2020) are the highest resolution LED rings available.

LumiDrive Hookup Guide
The LumiDrive LED Driver is SparkFun's foray into all things Python on micro-controllers. With the SparkFun LumiDrive you will be able to control and personalize a whole strand of APA102s directly from the board itself.

Here are some tutorials for more projects and ideas:

Lumenati Hookup Guide
Lumenati is our line of APA102c-based addressable LED boards. We'll show you how to bring the sparkle to your projects!

Using Artnet DMX and the ESP32 to Drive Pixels
In this tutorial, we'll find out how to use Resolume Arena, a popular video jockey software, to control custom-made ArtNet DMX fixtures.

Getting Started with the SmartLED Shield for Teensy
In this tutorial, we will connect different RGB LED matrix panels to PixelMatix's SmartLED shield and Teensy.

Introduction to DMX
DMX512 is an industry standard in lighting and stage design, whether it be controlling lights, motors, or lasers, DMX512 has many uses. In this tutorial we'll cover DMX512 (Digital Multiplex with 512 pieces of information).

Check out the following blog posts for more LED Fun:

DIY LED Motorcycle Helmet
OCTOBER 31, 2017

Mathematical Color Fading
DECEMBER 26, 2018

Python and the SparkFun LumiDrive
JANUARY 22, 2019