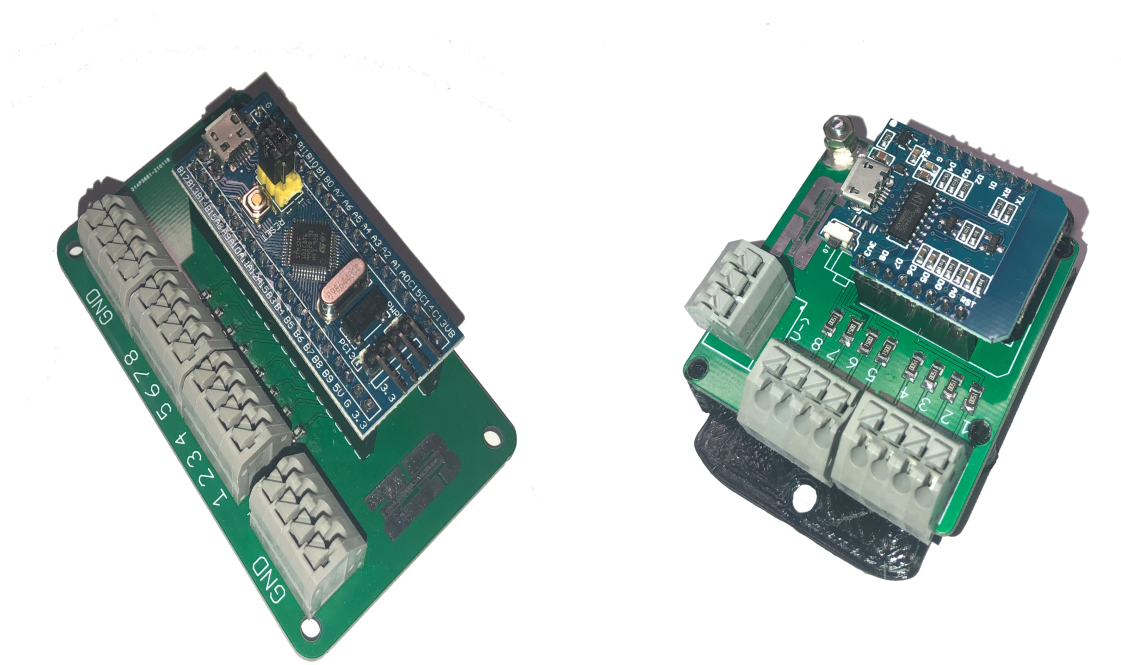




Serial Addressable Lighting

INSTALLATION & USE



STM32 Board OR WEMOS Board



BEFORE YOU BEGIN

Working with electricity comes with huge risks that should never be taken lightly, safety should always come first.

To avoid personal injury, possible damage to equipment or danger of fire, all work on electronic equipment should be conducted following these safety procedures.

General Safety

Before working on any electronics, consider following these basic safety precautions to help reduce any hazards.

- Remove any electronic equipment you're testing or working on from the power source.
- Never assume the power circuit is off. Test and test again with a voltmeter to confirm.
- Remove fuses and replace them only after the power to the circuit is disconnected.
- Don't connect power to a circuit until you're done working on it and rechecked the work.
- Always ensure that all electronics equipment is properly grounded
- If it's damaged, replace it. For instance, replace cables instead of repairing with insulating tape.
- Always use the right electronics repair and maintenance tools.
- Always return covers after removing them to reduce the risk of electric shock.
- Make sure your circuit is not overloaded.
- Always have safety equipment like a fire extinguisher, a basic first aid kit and a mobile phone nearby.

Personal Safety

Here are some personal safety precautions to keep in mind:

- Always keep your work area dry.
- Always work in a well-ventilated area.
- Don't wear flapping or loose clothing when working.
- Don't work with metallic jewelry on your hands like watches, rings and bracelets.
- Always wear non-conductive shoes.
- Always remove power to a circuit before connecting alligator clips.
- Always wear safety goggles.
- Be careful when handling large capacitors as they can still hold high voltage even after you've disconnected the circuit from power.

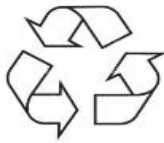
Static Damage Prevention

Static electricity can damage electronic devices and your system. To avoid damage, keep static-sensitive devices in their static-protective bags until you are ready to install them.

To reduce the possibility of electrostatic discharge, observe the following precautions:

- Limit your movement. Movement can cause static electricity to build up around you.
- Handle the device carefully, holding it by its edges or frame.
- Do not touch solder joints, pins, or exposed printed circuitry.
- Do not leave the device where others can handle and possibly damage the device.
- While the device is still in its antistatic bag, touch it to an unpainted metal part of the system unit for at least 2 seconds. (This action removes static electricity from the package and from your body).
- Remove the device from its package and install it directly into your system, without putting it down. If it is necessary to put the device down, place it onto its static-protective bag. (If your device is an adapter, place it component-side up.) Do not place the device onto the cover of the system or onto a metal table.
- Take additional care when you handle devices during cold weather. Indoor humidity tends to decrease in cold weather, causing an increase in static electricity.

Disposal

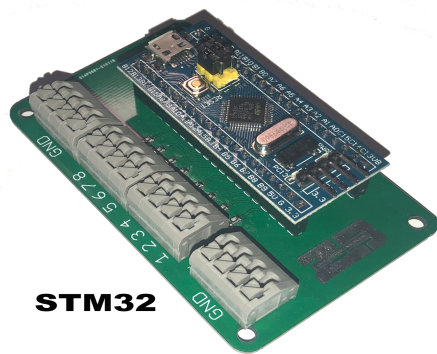


Observe the approved methods and ordinances of your locality with regard to proper disposal of used electronic appliances.

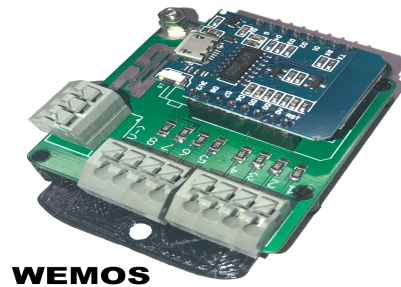
Table of Contents

1.	Kit Includes
2.	Theory of Operation
3.	Connection
4.	Software & Configuration
5.	Troubleshooting

Included in Standard Kit:



OR



1pc STM32 Based Controller OR 1pc WEMOS Based Controller

Requires MicroUSB B cable – NOT included

Included in Plug & Play Kit:

1pc STM32 Based Controller OR 1pc WEMOS Based Controller

1pc 12V 360Watt Power Supply and Housing

2pc WS2815(B) 12V 144 LED/Meter RGB serial addressable LED Reels

1pc USB micro B cable

1pc Power Supply Power Cable



Theory of Operation:

Serial Addressable LEDs operate on the basis that each individual LED can be independently controlled by a single controller through a continuous stream of data.

For the purposes of this manual each RGB LED will be referred to as a pixel and each pixel is comprised of 3 separate LEDs – 1 x Red, 1 x Green and 1 x Blue.

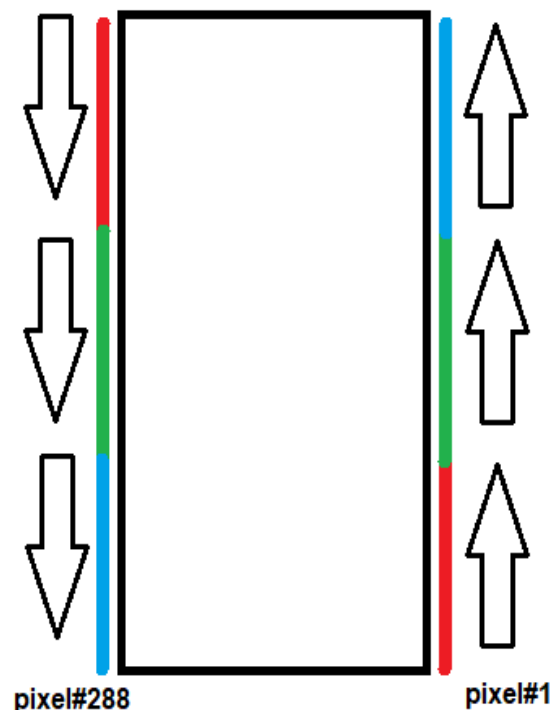
Each pixel receives its data by the position of that data information in the stream. Pixel #1 would therefore receive 3 bytes of data at the very beginning of the stream – byte #1 being Red, byte # 2 being Green, Byte # 3 being Blue in the case of RGB LEDs although most Serial Addressable strings are actually formatted as GRB (Green, Red, Blue).

In either case, the concept remains the same – 3 bytes of data per pixel, the position of that data in the stream determines which pixel it is.

Because, as the name implies the LEDs are connected in series, pixel #1 is at the front of the line and pixel number 144 is at the end. Since 2 strings of 144 pixels total 288 pixels, the final pixel in the string is # 288. It's actually more complicated than that but thankfully DOF and the controller take care of that.

Laying out your strings of pixels requires deciding several factors – how long each string is going to be, what the position of the string is in the cabinet and which string starts the chain and which ends it.

Looking at the cabinet from the top down, the arrangement of pixels from the lower right to the lower left would be ...



In order for DOF to correctly assign the information to the pixels it requires several pieces of information about the physical layout of your LED Strips. This information is passed to DOF from the cabinet configuration file (cabinet.xml).

The information required is:

- The name of the controller controlling the leds
- The communications port address of the controller (COMport)
- The total number of pixels in the chain
- The starting point and ending point of the chain
- How the chain is laid out and what pattern this layout requires
- What effects and patterns will be used in the output to the chain

For the example above that information would be broken down into:

- Teensy Controller
- whatever the COMport is that Windows assigned it
- 288 pixels
- 1 & 144, 145 & 288 (since we will use 2 outputs on the controller to drive each string individually)
- Strip#1 runs from the lower right to upper left (BottomUpRightLeft) and is 1 pixel wide x 144 pixels in height
- Strip#2 runs from the upper right to the lower left (TopDownRightLeft) and is 1 pixel wide x 144 pixels in height
- Ledwiz Equivalent assignments created in the DOFconfigTool

More information on the actual variables available for the xml file can be found in the DOF documentation found here ...

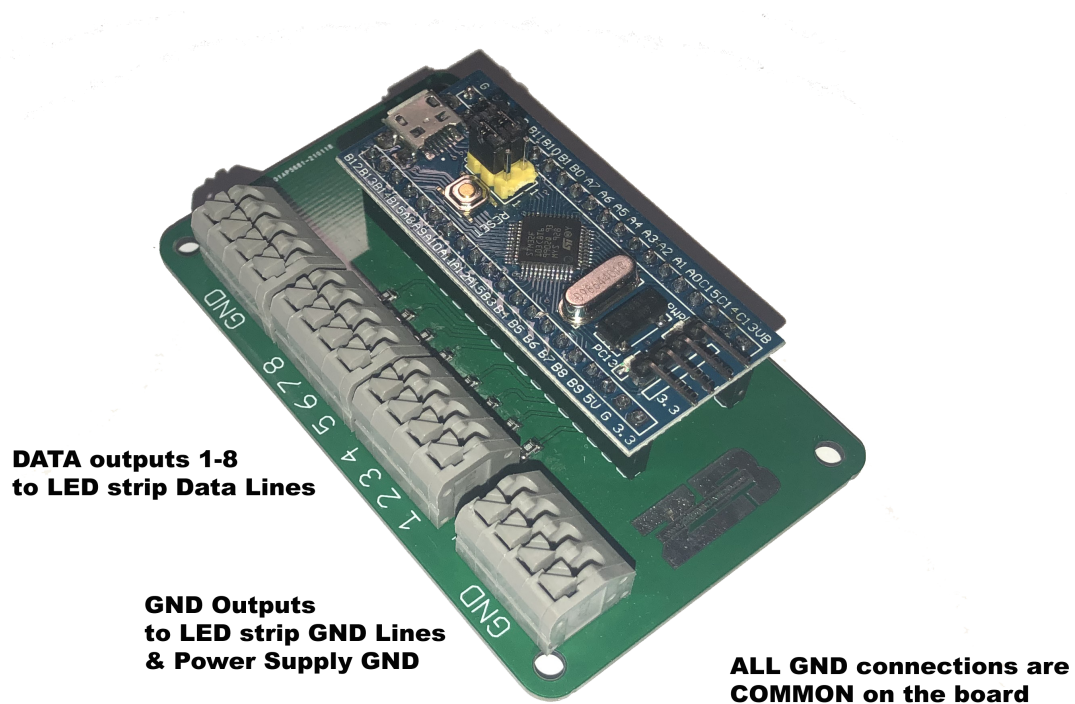
http://directoutput.github.io/DirectOutput/toy_builtin.html#use_DirectOutput_Cab_Toys_Hardware_LedStrip_samplexml

For the purposes of the Zebsboards controller the changes you will need to make to the included cabinet file are minimal. They are:

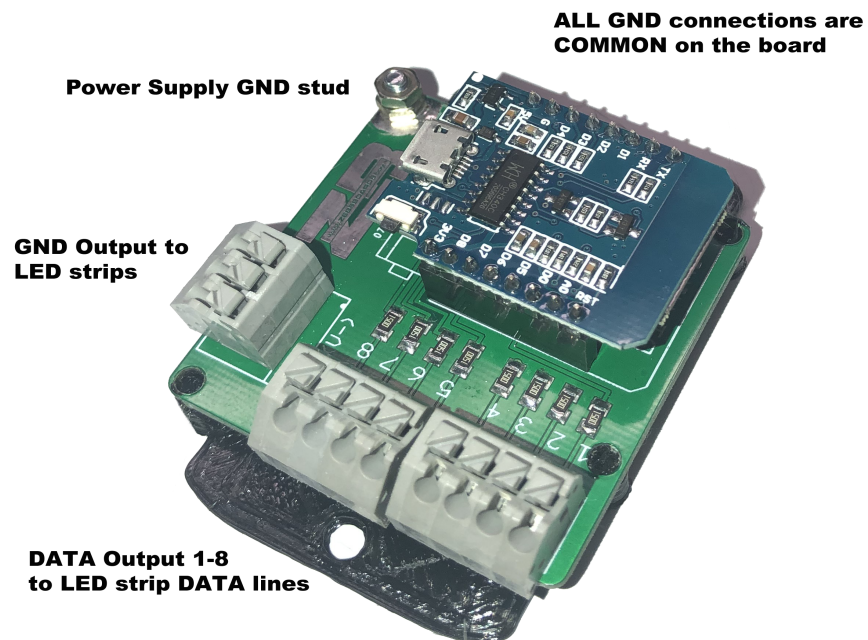
- The number of pixels per strip that you have installed
- The Comport (COM) number Windows has assigned to the controller

Connection:

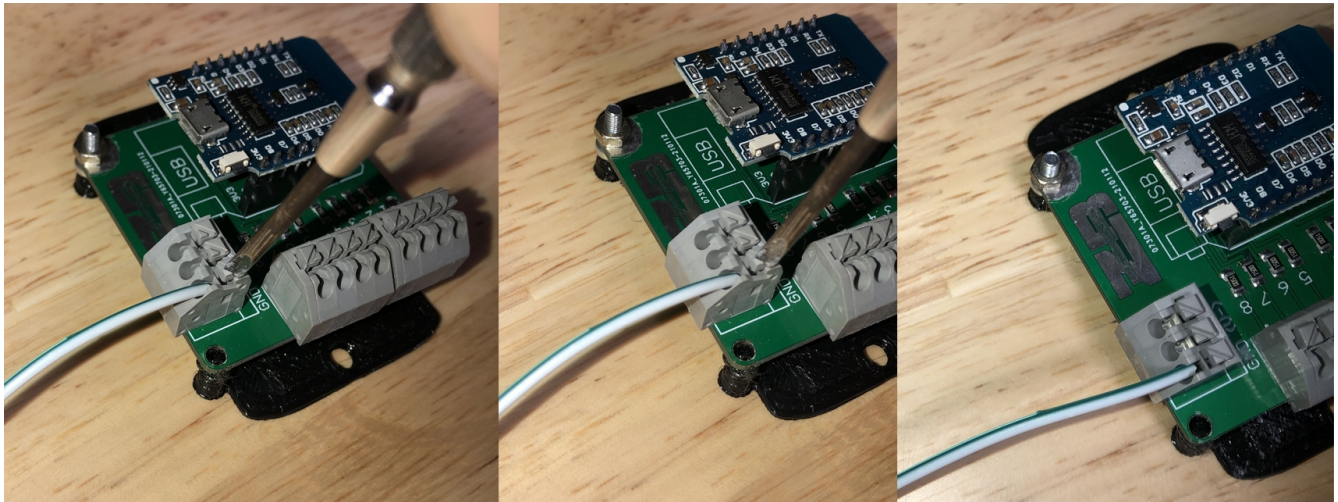
STM32 Board:



WEMOS Board:



To use the spring loaded terminal blocks you first strip back 1/4" (6mm) of insulation from your wire and push down on the slotted stud on the terminal block with a small bladed screwdriver. Insert the wire into the opening with the stud depressed and release the stud once the wire is seated.

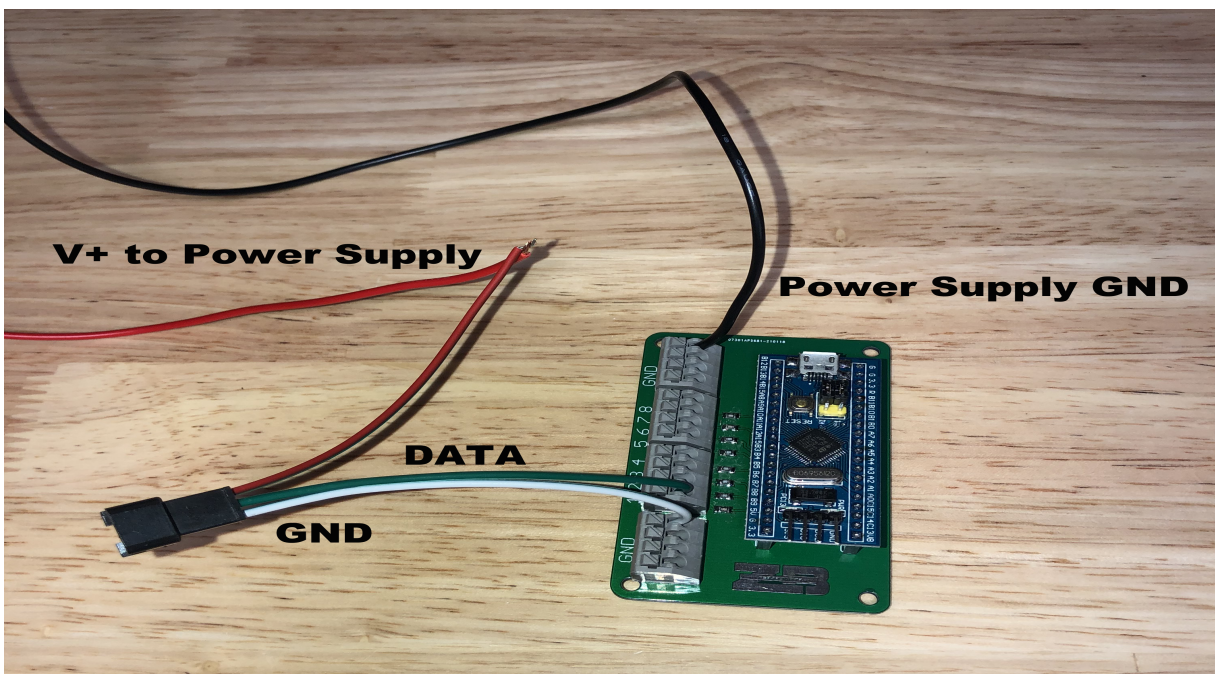


For each LED strip connect :

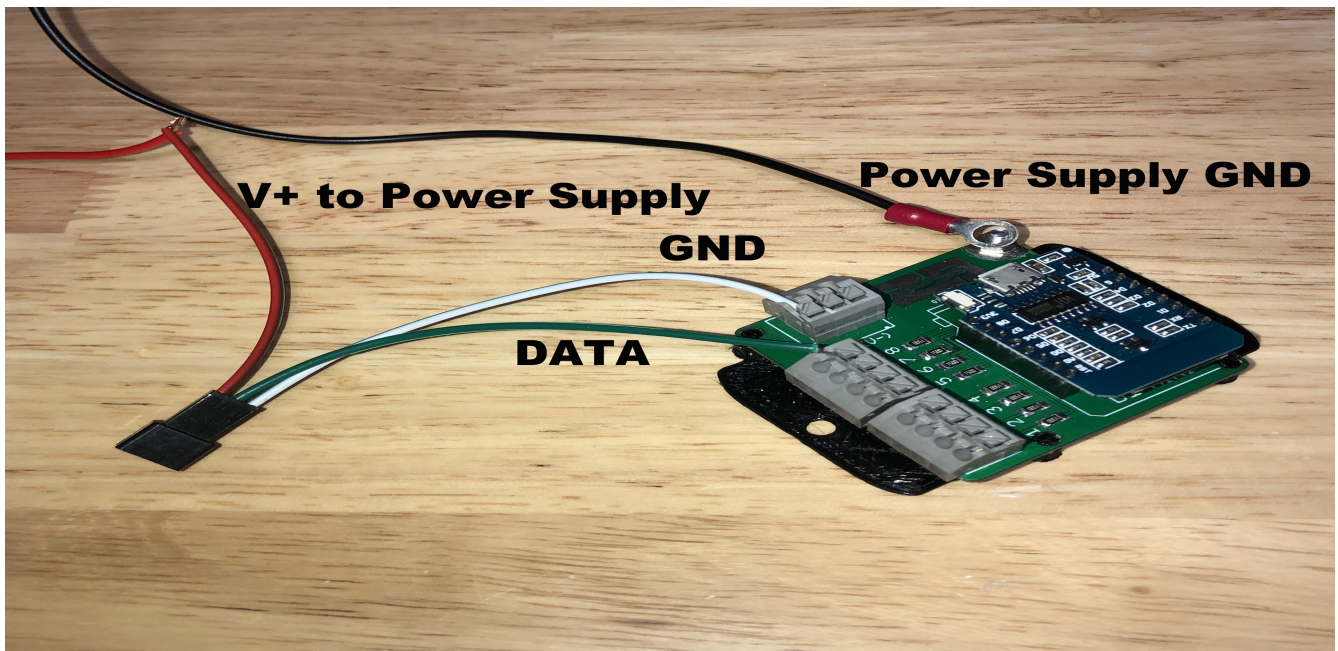
- The GND wire to a GND terminal output on the board
- The DATA wire to a DATA terminal on the board
- The +V wire to the +V terminal on your power supply

For WS2815(B) 12V LED Strips connect the secondary (BUFFER) wire to the same DATA terminal Connection as the DATA wire is connected to.

STM32 Board Example:

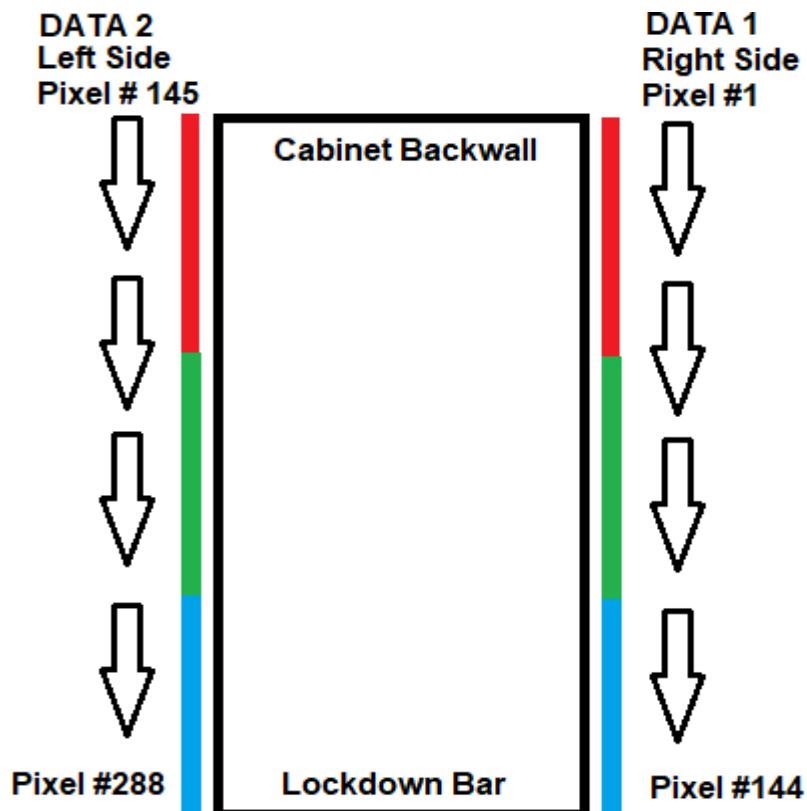


WEMOS Board Example:



To match the layout for the included cabinet.xml file(s) mount the controller at the back of your cabinet so that the ledstrips are starting at the back and ending at the lockdown bar area and connect:

- the **Right side LED strip DATA line to OUTPUT 1**
- the **Left side LED strip DATA line to OUTPUT 2**



Be sure to insulate your power connections.

Connect the included usb micro cable to the usb port on the board and the other end to a suitable usb port on your computer (will work with either USB 2.0 or usb 3.0).

Software and Configuration:

Zebsboards serial controllers are running a proprietary firmware and rely on later builds of the DOF R3++ Grandeur Unified software (version 20210128 or later) which can be downloaded from

https://www.zebsboards.ca/public_html/support_docs/DirectOutput-mjr-20210128.msi

Installation should always be done with the directoutput folder being installed to the root directory of your C:\ drive and the config subdirectory contained within it. If installed correctly you should wind up with a relative path to your cabinet.xml file of:

C:\directoutput\config\cabinet.xml

Once installed and configure you can copy the cabinet file, Globalconfig file and other files downloaded from

https://www.zebsboards.ca/public_html/support_docs/Serial%20Addressable.zip

to the C:\directoutput\config\ directory on your hard drive.

Be sure to right click on the zip file you downloaded, select properties in the popup window and unblock the zip file before extracting it.

Go to the C:\directoutput\config\cabinet.xml and open the cabinet.xml file for your particular model of controller (cabinet_Wemos.xml or cabinet_STM32.xml) in notepad.exe or your preferred editor.

Make the following changes:

Cabinet_WEMOS.xml

```
<?xml version="1.0"?>
```

```
<Cabinet xmlns:xsi="http://www.w3.org/20...Schema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">
```

```
<Name>Zebsboards</Name>
```

```
<OutputControllers>
```

```
<TeensyStripController>
```

```
<Name>LEDStripController</Name>
```

```
<NumberOfLedsStrip1>144</NumberOfLedsStrip1>
```

```
<NumberOfLedsStrip2>144</NumberOfLedsStrip2>
```

```
<NumberOfLedsStrip3>256</NumberOfLedsStrip3>
```

```
<NumberOfLedsStrip4>0</NumberOfLedsStrip4>
```

```
<NumberOfLedsStrip5>0</NumberOfLedsStrip5>
```

```
<NumberOfLedsStrip6>0</NumberOfLedsStrip6>
```

```
<NumberOfLedsStrip7>0</NumberOfLedsStrip7>
```

```
<NumberOfLedsStrip8>0</NumberOfLedsStrip8>
```

```
<ComPortName>COM17</ComPortName>
```

```
<ComPortBaudRate>921600</ComPortBaudRate>
```

If you are not using a full 144 pixels per strip then these numbers will have to be changed to match the actual count of pixels per side. If a matrix is being used on DATA 3 then this should match the actual number of pixels in your matrix.

This must match the comport number for the controller found in the Devices and Printers Section or Device Manager in Windows.

```
</TeensyStripController>
```

```
</OutputControllers>
```

```
<Toys>
```

```
<LedStrip>
```

```
<Name>PF Right</Name>
```

```
<Width>1</Width>
```

```
<Height>144</Height>
```

```
<LedStripArrangement>TopDownLeftRight</LedStripArrangement>
```

```
<ColorOrder>GRB</ColorOrder>
```

```
<FirstLedNumber>1</FirstLedNumber>
```

```
<FadingCurveName>SwissLizardsLedCurve</FadingCurveName>
```

```
<OutputControllerName>LEDStripController</OutputControllerName>
```

```
</LedStrip>
```

Change to match the number of pixels in your LED strip. It must match the number assigned above.

```
<LedStrip>
```

```
<Name>PF Left</Name>
```

```
<Width>1</Width>
```

```
<Height>144</Height>
```

```
<LedStripArrangement>TopDownRightLeft</LedStripArrangement>
```

```
<ColorOrder>GRB</ColorOrder>
```

```
<FirstLedNumber>145</FirstLedNumber>
```

```
<FadingCurveName>SwissLizardsLedCurve</FadingCurveName>
```

```
<OutputControllerName>LEDStripController</OutputControllerName>
```

```
</LedStrip>
```

Change to match the number of pixels in your LED strip. It must match the number assigned above.

The next number after the last pixel in the Right PF strip.

```
<LedStrip>
```

```
<Name>PF Back</Name>
```

```
<Width>32</Width>
```

```
<Height>8</Height>
```

```
<LedStripArrangement>BottomUpAlternateRightLeft</LedStripArrangement>
```

```
<ColorOrder>GRB</ColorOrder>
```

```
<FirstLedNumber>289</FirstLedNumber>
```

```
<FadingCurveName>SwissLizardsLedCurve</FadingCurveName>
```

```
<OutputControllerName>LEDStripController</OutputControllerName>
```

```
</LedStrip>
```

The number of pixels in the width of the matrix.
The number of pixels in the height of the matrix.

The next number after the last pixel in the Left PF strip.

If a matrix is not being used the information in the PF Back section can be left as is.

When done editing save the file as cabinet.xml in the config directory.

Cabinet_STM32.xml

```
<?xml version="1.0"?>
<Cabinet xmlns:xsi="http://www.w3.org/20...Schema-instance" xmlns:xsd="http://www.w3.org/2001/XMLSchema">

  <Name>Zebsboards</Name>
  <OutputControllers>

    <TeensyStripController>
      <Name>LEDStripController</Name>
      <NumberOfLedsStrip1>144</NumberOfLedsStrip1>
      <NumberOfLedsStrip2>144</NumberOfLedsStrip2>
      <NumberOfLedsStrip3>256</NumberOfLedsStrip3>
      <NumberOfLedsStrip4>0</NumberOfLedsStrip4>
      <NumberOfLedsStrip5>0</NumberOfLedsStrip5>
      <NumberOfLedsStrip6>0</NumberOfLedsStrip6>
      <NumberOfLedsStrip7>0</NumberOfLedsStrip7>
      <NumberOfLedsStrip8>0</NumberOfLedsStrip8>
      <ComPortName>COM17</ComPortName>
      <ComPortDtrEnable>true</ComPortDtrEnable>

    </TeensyStripController>

  </OutputControllers>

  <Toys>

    <LedStrip>
      <Name>PF Right</Name>
      <Width>1</Width>
      <Height>144</Height>
      <LedStripArrangement>TopDownLeftRight</LedStripArrangement>
      <ColorOrder>GRB</ColorOrder>
      <FirstLedNumber>1</FirstLedNumber>
      <FadingCurveName>SwissLizardsLedCurve</FadingCurveName>
      <OutputControllerName>LEDStripController</OutputControllerName>
    </LedStrip>

    <LedStrip>
      <Name>PF Left</Name>
      <Width>1</Width>
      <Height>144</Height>
      <LedStripArrangement>TopDownRightLeft</LedStripArrangement>
      <ColorOrder>GRB</ColorOrder>
      <FirstLedNumber>145</FirstLedNumber>
      <FadingCurveName>SwissLizardsLedCurve</FadingCurveName>
      <OutputControllerName>LEDStripController</OutputControllerName>
    </LedStrip>

    <LedStrip>
      <Name>PF Back</Name>
      <Width>32</Width>
      <Height>8</Height>
      <LedStripArrangement>BottomUpAlternateRightLeft</LedStripArrangement>
      <ColorOrder>GRB</ColorOrder>
      <FirstLedNumber>289</FirstLedNumber>
      <FadingCurveName>SwissLizardsLedCurve</FadingCurveName>
      <OutputControllerName>LEDStripController</OutputControllerName>
    </LedStrip>

  </Toys>

</Cabinet>
```

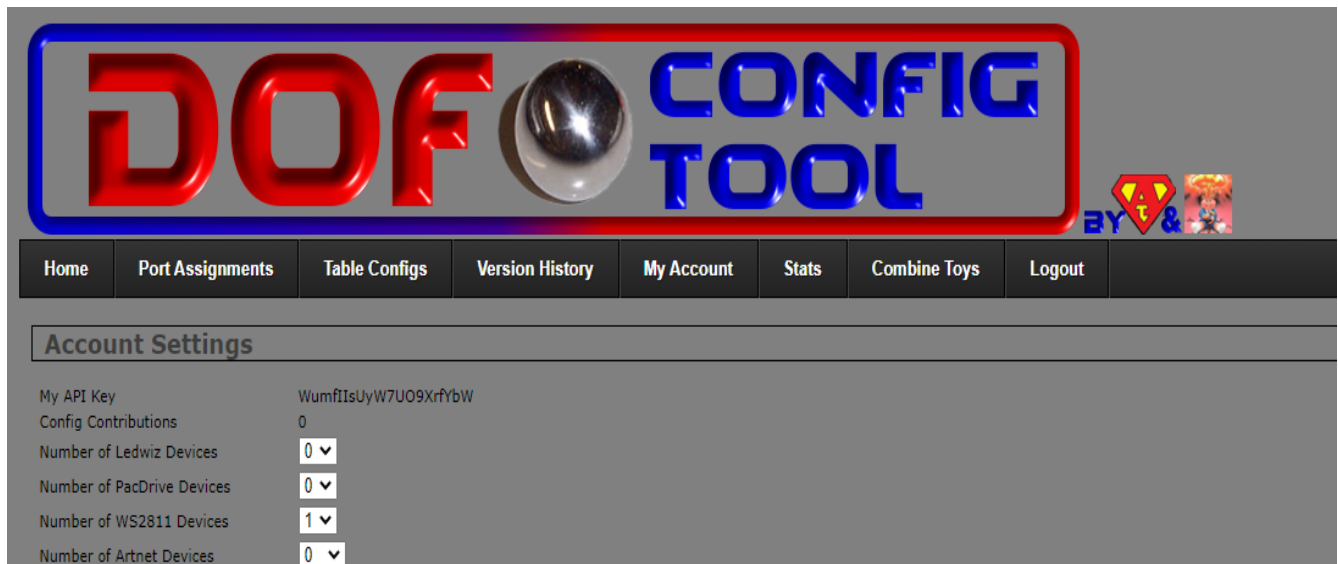
If a matrix is not being used the information in the PF Back section can be left as is.

When done editing save the file as cabinet.xml in the config directory.

DOFConfigTool Settings:

Navigate to <http://configtool.vpuniverse.com/login.php> and create an account if you haven't already got one.

Under the MY ACCOUNT tab make sure that the Number of WS2811 Devices is set to 1



DOF CONFIG TOOL

Home Port Assignments Table Configs Version History **My Account** Stats Combine Toys Logout

Account Settings

My API Key WumfIIsUyW7U09XrfYbW

Config Contributions 0

Number of Ledwiz Devices 0 ▾

Number of PacDrive Devices 0 ▾

Number of WS2811 Devices 1 ▾

Number of Artnet Devices 0 ▾

Under the COMBINE TOYS tab create 2 combos (3 if using a matrix).

- Combo1 RGB Addressable Right Flashers MX Right Effects MX
- Combo2 RGB Addressable Left Flashers MX Left Effects MX
- Combo3 (optional)



DOF CONFIG TOOL

Home Port Assignments Table Configs Version History My Account Stats **Combine Toys** Logout

Toy Combo Management

Combo ID	Option	Toy Category	Toy 1	Toy 2	Toy 3	Toy 4
Combo1	Delete	RGB Addressable	PF Right Flashers MX	PF Right Effects MX		
Combo2	Delete	RGB Addressable	PF Left Flashers MX	PF Left Effects MX		
Combo3	Delete	RGB Addressable	PF Back Strobe MX	PF Back Effects MX	PF Back Beacon MX	PF Back PBX MX
New	Add	Mono ▾	▾	▾	▾	▾

Under the PORT ASSIGNMENTS tab select Device:WS2811 1 directoutputconfigini30

- Assign Port 1 to Combo 1 (RED)
- Assign Port 4 to Combo 2 (RED)
- Port 7 optional

The screenshot shows the DOF CONFIG TOOL interface. The top navigation bar includes links for Home, Port Assignments, Table Configs, Version History, My Account, Stats, Combine Toys, and Logout. The 'Port Assignments' tab is active. Below the navigation bar, the 'Device' dropdown is set to 'WS2811 1 - directoutputconfigini30'. The main area displays a grid of port assignments for 9 ports. The assignments are as follows:

Port	Assignment	Port	Assignment	Port	Assignment	Port	Assignment
Port 1	Combo1	Port 130		Port 259		Port 388	
Port 2		Port 131		Port 260		Port 389	
Port 3		Port 132		Port 261		Port 390	
Port 4	Combo2	Port 133		Port 262		Port 391	
Port 5		Port 134		Port 263		Port 392	
Port 6		Port 135		Port 264		Port 393	
Port 7	Combo3	Port 136		Port 265		Port 394	
Port 8		Port 137		Port 266		Port 395	
Port 9		Port 138		Port 267		Port 396	

Save your configuration by clicking the “Save Config” button and then download your config files by clicking on the “Generate Files” button

The screenshot shows the DOF CONFIG TOOL interface, similar to the previous one. The 'Port Assignments' tab is active. The 'Device' dropdown is set to 'WS2811 1 - directoutputconfigini30'. The main area displays a grid of port assignments for 9 ports. The assignments are as follows:

Port	Assignment	Port	Assignment	Port	Assignment	Port	Assignment
Port 1	Combo1	Port 130		Port 259		Port 388	
Port 2		Port 131		Port 260		Port 389	

At the bottom right of the interface, there are two buttons: 'Save Config' and 'Generate Config'. Both buttons are circled in red.

Give it a few seconds (it can be slow) and you will see the zip file being downloaded. Take the directoutputconfig30.ini file and put it in the C:\directoutput\config folder on your hard drive, allow it to overwrite the existing file if prompted.

Your serial lighting installation is complete.

Troubleshooting

If your lights aren't working as expected it can be frustrating. Here are some hints to find the trouble.

First steps:

- Check for power at the V+ wires of the LEDs
- Check for GND at the GND wires of the LEDs
- Check the GND connections to the controller
- Check the DATA connections at the controller

If everything above checks out, open the directoutput\config folder and check for:

- cabinet.xml file exists
- GlobalConfig files(s) exists
- directoutputconfig30.ini file exists

In the cabinet.xml file:

- make sure that the COMport number matches the actual number in the system
- make sure that the math works out on the led number assignments (1st led numbers, number of leds per strip, etc)

Still no luck? Open the directoutput.log file in the directoutput folder in notepad/wordpad/etc and see if the teensy controller is being initialized

```
2021.02.08 13:30:36.977 TeensyStripController LEDStripController intialized and updater thread started.
2021.02.08 13:30:36.977 Debug: Output controllers initialized
2021.02.08 13:30:36.978 TeensyStripController LEDStripController updater thread started.
2021.02.08 13:30:36.982 Initializing ComPort COM6 with these settings :
2021.02.08 13:30:36.982 BaudRate 9600, Parity None, DataBits 8, StopBits One, R/W Timeouts 200ms
2021.02.08 13:30:36.982 Handshake Timings : Open 50ms, Loop Start/End 20/50ms, DTR enable True
2021.02.08 13:30:36.984 Cabinet initialized

2021.02.08 13:30:37.104 TeensyStripController LEDStripController updater thread has connected to
TeensyStripController LEDStripController.
```

If you don't see anything that looks like the above it means that DOF can't find/load the serial controller (usually the wrong comport being assigned or an issue with the USB connection)