

DIY: Powering RGB Elements

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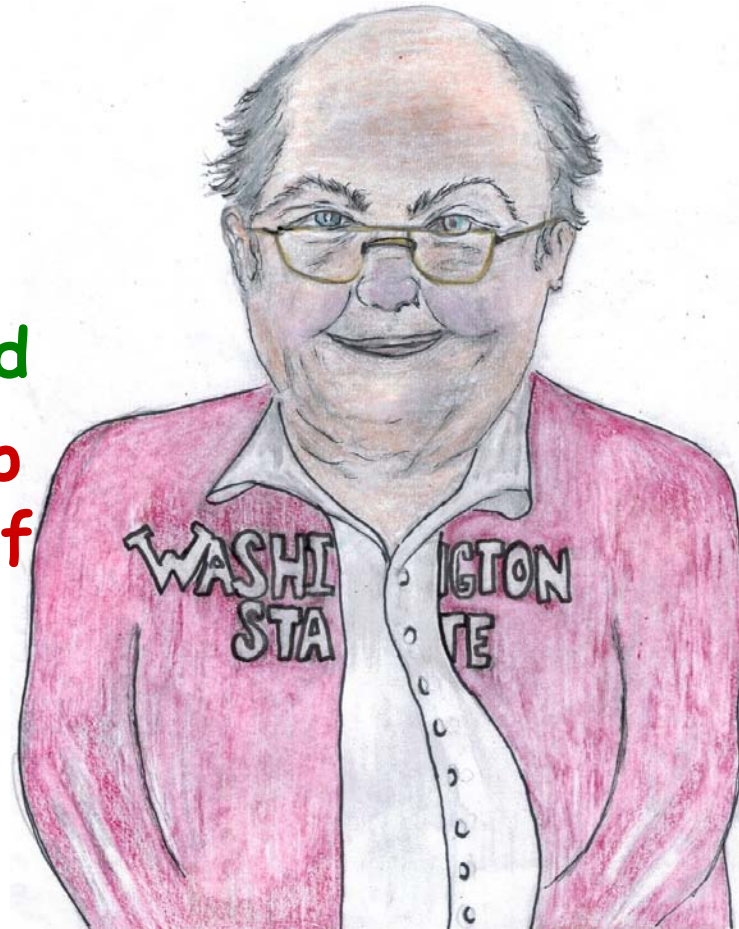
Bill Foley
June 1, 1940 -
October 12, 2012

As with any new concept, there is a certain amount of research that is required, but nothing works better than getting your hands on equipment, plugging things in, and working through issues.

As with any activity around **POWER**, caution is always advised

Also, if you're considering a jump into **RGB** and are not a member of [AusChristmasLighting](#) form, you need to be. There is a **TON** of information on that site.

With that said.....



Topics: Power-Power-Power

- Powering RGB Pixels/Strip
- Powering Controllers
- Watts Up With That?
- Power Supplies
- Voltage Drop
- Cabling Options
- Misc - Issues - Concerns
- Resources



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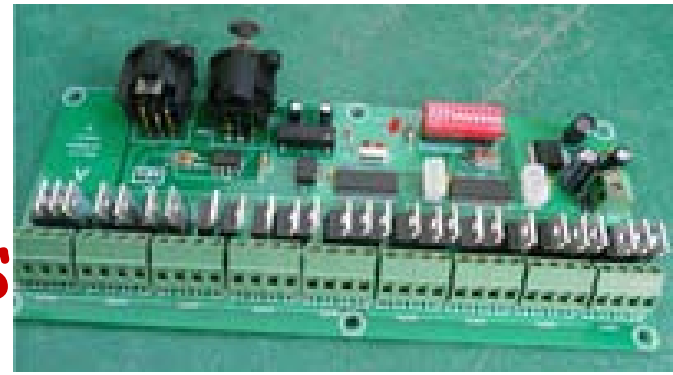
October 12, 2012

Powering RGB Pixels/Strip

- Dumb & SPI Pixels/Strip *typically* require 5VDC - 12VDC
 - There are some that are 24V
 - 5VDC vs 12VDC - Great explanation by FastEddy on ACL - [HERE](#)
 - 12VDC = Longer string length, more power used, low efficiency
 - 5VDC = Shorter string length, less power used, high efficiency
- 2 options for power:
 - Powered directly from a Power Supply
 - Powered from Controller
 - Depending on your set up, both could potentially be used at the same time



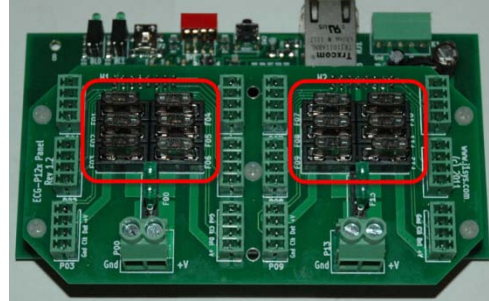
Powering Controllers



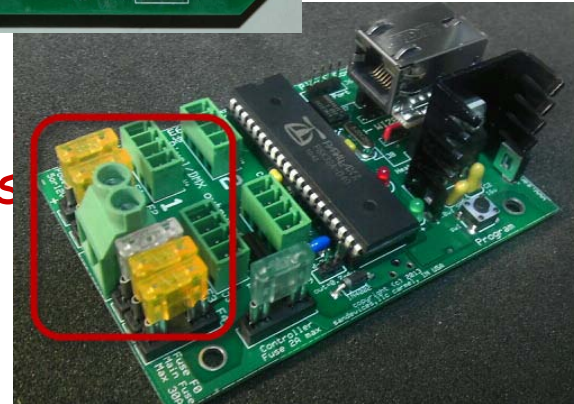
- Basic **RGB** DMX Controllers
 - Typically not a high amperage requirement
 - Some controllers require power
 - Some controllers supply power
 - Know what you are buying before you spend your money
 - Limited number of pixels
 - less than 1 DMX Universe
 - Schemes to use Cat5/6 for comms & power
 - Devise your own, or see [Slide 14](#)

Powering Controllers

- E1.31 Pixel Controllers
 - 1 to 12 DMX Universe support (currently)
 - Higher amperage requirement
 - Power is required for controller and pixels
 - Fused circuits to protect pixel strings
 - These will require stand alone power supplies. The PS will need to be sized accordingly for your intended use
- ACL ECG - P12R Guide
 - (Pgs 11-13) - Example set ups



J1sys
ECG-P12R



Sandevise E6804

- All DC Controllers fall into this category as well!
 - Remember you can use these to drive dumb **RGB** strings

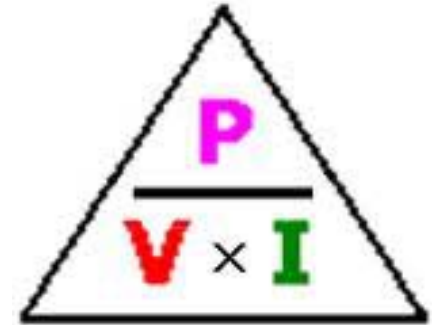


LOR CMB16D-QC



Watt's Up With That?

- Watts Law - *(Thanks Pete!)*
 - **P = Watts** (Power)
 - **V = Voltage** (electrical force)
 - **I = Amps** (flow of electrons)



To Find Desired Value
Cover Letter and Perform Math

$$P = I \times V$$

$$V = P / I$$

$$I = P / V$$

Now let's put this to the test.....



Watt's Up With That? (Thanks Pete!)

- Determine the Load you will need. This is done by finding the voltage and amperage of the load or finding the total wattage of the load
- Use Watts Law to find the total wattage or use the wattage given on the load (light) and multiply the wattage by the number of loads (RGB's pixels)
- Multiply the total wattage by **1.2** - this will allow a 20% increase in our Total Wattage. The amount calculated will be the size in watts for the Power Supply
- **Remember** - we do not want to operate our Power Supply at more than **80%** of the Total Wattage of the Power Supply. This is why we Multiply by **1.2**

Example:

You want to power one DMX Universe of SPI 2811 pixels.
512 DMX (channels) / 3(RGB) =
170 pixels per universe - **MAX!**

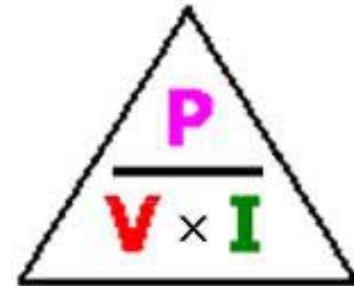
2811 Pixels, labeled at .3W,
12VDC. This means that each
Pixel requires 12Volts DC to
operate and uses .3 Watts
each

Each pixel string has 42 pixels:
 $42 \times 4 = 168 \text{ pixels} > 170$

Multiply the number of pixels,
(42) times the .3 Watts. This
equals 12.6 Watts. Now
multiply by **1.2** = 15 Watts per
42 pixel string. Times 4 strings
per universe. This equals 60
Watts

You need a Power Supply that
delivers 12VDC and 60 Watts,
or 12VDC - 5amps

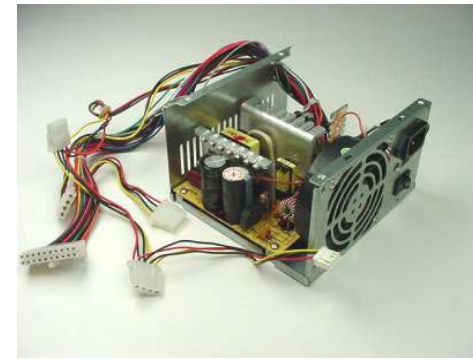
Scale the math to meet your
requirements



P = Watts
V = Voltage
I = Amps



Power Supplies



- 3 primary options
 - Switch Mode Power Supply
 - Linear Power Supply
 - Repurpose PC Power Supplies
 - Multiple voltages (5, 12, 24V)
 - Make sure you know your watts support
 - Remove them from the cage to save room
- Switch Mode Power Supply (SMPS) vs Linear
 - Limitation with SMPS is they cannot be connected in parallel if you need more current to a single controller.
 - Due to the high cost of new 600W and greater supplies it's often just as cost effective to split the lights onto more controllers.
 - A linear power supply supplies constant voltage while a switched power supply doesn't
 - A linear power supply is much simpler than a switched mode power supply
 - A switched mode power supply is more power efficient than a linear power supply
 - A switched mode power supply is more likely to create interference than a linear power supply
 - Reference - [HERE](#)



Power Supplies

- Off the Shelf Vendors for Power Supplies
 - Allied Electronics
 - Bravo Electro Components
 - PowerGate
 - Master Electronics
 - Mouser
 - Jameco
 - TRC Electronics
 - Future Electronics
 - Peak to Peak Power
 - Onlinecomponents.com
 - Component Distributors Inc
- Obtain Quality Power Supplies
 - Meanwell Power Supplies
 - Reputable, safe option
 - Careful of Chinese knockoffs
 - Know your vendors



Voltage Drop

- Pixels look "rose colored" instead of WHITE?
 - Voltage drop is the culprit

Voltage drop is determined by 3 main factors

1: Distance of the run

Need to add both the $+V$ and the $-V$ together to calculate the total distance.

2: Gauge size of the cable (ohms/meter or foot)

All cables have a resistance value in either Ohms/meter or Ohms/foot and the larger the diameter (gauge) the cable is, the lower the resistance is.

3: The amount of current being drawn

Calculate from the wattage per pixel times the number of pixels per string



Voltage Drop

- How to avoid or augment
 - Keep pixel pigtails as close as possible to power supply for shortest length
 - Use larger cable for your power connections
 - Inject power at both ends of pixel strings
 - [ACL 101 Lighting Manual](#) (Pg 47)
 - Leverage step up/down Voltage Regulators to step power up, then down
 - 12V to 48V ----cable---- 48V to 12V
 - Allows you to use a smaller cable, Cat5/6
 - [J1sys ECG-PPX](#) - these can be used for low power/comms



Voltage Drop Calculator

Reference : <http://auschristmaslighting.com/forums/index.php/topic,4006.0.html>
<http://auschristmaslighting.com/forums/index.php/topic,3668.0/topicseen.html>

Cable Options

- SPT1 -2
 - 7 - 10 amps respectively
- 4 & 6 Core Security Cable
 - Both are relatively inexpensive
 - With 4 core, easy to find 3 way taps & couplers
 - Come in white or black



Leverage 3 way tap for power injection!



Cable Options

- Cat5/6 for Power & Comms
 - **CAUTION!!!**
 - If you are combining data and power, ensure your wiring scheme is consistent and that you do not crosswire power with data!
 - DMX + Power over Cat(x)
- Stranded Cable ONLY!
 - Used for lower amperage
 - Double up wires for added amperage capacity
- Cat5
 - 24-**26** AWG
- Cat6 **\$\$**
 - **22-24** AWG
 - Current Pixel Controllers do not take advantage of Cat6 bandwidth
 - The only benefit of Cat6 today is the larger wire size for amperage purposes
- Do not just buy, by name - **VERIFY THE SIZE!**
- Shielded Cable **\$\$\$**
 - Arguably beneficial against EMI issues
 - How-To Video to make your own cables:
- Wiring conventions dictate gap from jack to twisted pair
 - Cat5 = ~ 3/16" - 1/4" from termination to twisted pair
 - Cat6 = ~ 1/16" - 3/32" from termination to twisted pair



Misc - Issues - Concerns

- Cat 5 Splitters and cable extenders
 - They are used in displays, they are not part of the DMX512 standard
 - They should be prepared with something like Corrosion X, or dielectric grease to combat galvanic corrosion
- Cheaper power supplies may not like to be powered on 24x7. You may want to look at a "switched" circuit (timer) or a background channel with LOR
- Keep a spare power supply for each type of voltage you use in your display
- Adequately enclose your PS and Controllers from the weather as you would with any DIY set up.



Resources

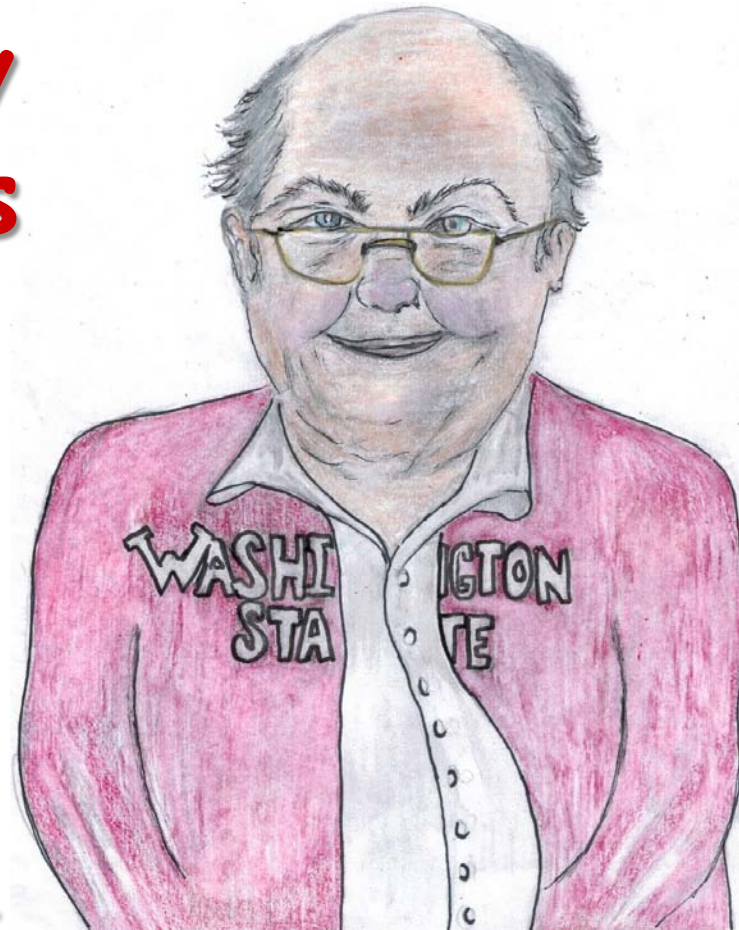
- Pete Peters - CLAP 2012 - DC Basics
- AusChristmasLighting
 - RGB Forum
 - Power Supply Forum
 - ACL 101 Lighting Manual
- Intro to RGB Starter Kit Facebook page
- E1.31 test Utility
- Introduction to E1.31
- Holiday Coro RGB video and Blog;
 - Outlining your house in RGB video
 - Outlining your house in RGB Blog
 - Technical Guide to RGB Wire Selection



**Bill: To say
Thank You, is not
enough. You have
forever touched my
life, and will always
be a part of my
display**

**Thanks again to Pete Peters &
FastEddy of ACL for their
guidance & input**

www.woodinvillewonderland.com



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