

# Punk RC's LED Tutorial

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There are two main rules that have to be followed when using LED lights. They are:

**Rule #1 - You HAVE to limit the current going to a LED.** Do not hook it strait to a power source. It will very briefly be bright, and then burn out. You need a RESISTOR or a CURRENT REGULATOR!

*Note: The Punk Light Controller has a built in Current Regulator. No resistors needed!*

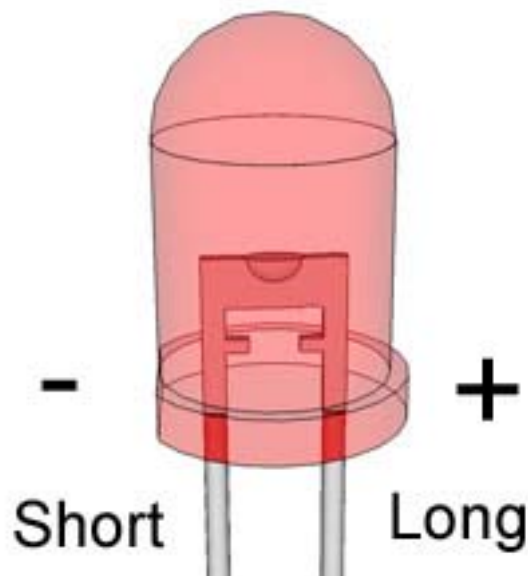
**Rule #2 – You need to hook up with the correct polarity.** No damage is done if hooked up reversed. It just will not light. 95% of the time, this is the problem.

## Section 1 – LED Polarity

*Where is the “+” and “-” sign?*

All LED's are polarity sensitive. Most will not work unless hooked up with a correct polarity.

The Best way to determine LED polarity is by the lead lengths or the Flat Side. Looking at the inside (or flag) or a LED is often wrong.



**Positive Side (Red) – Has the Longer Wire Lead and is the Non-Flat Side.**

**Negative Side (Black) – Has the Shorter Wire Lead and is the Flat Side.**

## Section 2 – Current Regulation the Old Fashioned (Non Punk) way

*Skip this section if you are using a PunkRC Light Controller. No Resistors Needed!*

If you want to have your LED never burn out and be the brightest it can, you have to select a proper resistor and wire it properly. First you need to find out about your LED light.

**Voltage Drop (Vd)** – Sometimes called the “Forward Voltage”. This is the about of voltage it takes to make electricity flow through a LED and thus light it up. This varies by LED color. This has to do with Quantum Mechanics and the Wavelength of the emitted photons. We won’t be going there.

Voltage Drop (Vd) by LED Color/Type varies from LED to LED. **Typically anything Red or Yellow, Vd = 2.2V and anything Blue, Green or White, Vd = 3.2V.** Those are “safe” values. Each LED is different, but if you have no clue, these are great numbers to use most all the time.

LED Color	Voltage Drop (VD)	Current Typical	Resistor @ 4.8V	Resistor @ 5.0V	Resistor @ 6.0V	Resistor @ 7.2V	Resistor @ 8.4V	Resistor @ 12V
Bright Red	2.1	20mA	130	150	200	270	330	510
Bright Amber	2.1	20mA	130	150	200	270	330	510
Bright Yellow	2.2	20mA	130	150	200	270	330	510
Bright Green	3.2	20mA	82	91	150	200	270	470
Bright Blue	3.2	20mA	82	91	150	200	270	470
Bright Purple	3.2	20mA	82	91	150	200	270	470
Bright Pink	3.2	20mA	82	91	150	200	270	470
Bright Turquoise	3.2	20mA	82	91	150	200	270	470
Bright White	3.2	20mA	82	91	150	200	270	470
Ultra Br. White	3.4	20mA	75	82	130	180	240	430

If you want to impress your friends and do the math yourself, use this equation below. Once you get a answer for resistance, round UP to the nearest resistor value.

$$\text{resistance in ohms} = \frac{\text{power supply voltage} - \text{LED voltage drop}}{\text{LED current rating}}$$

For more information on LED labels (aka Color Codes) and Common Values, go to:

<http://www.tinkerz.net/documents/Resistor%20Codes.pdf>

## Section 3 - Hooking up LEDs like a Punk

*This only applies to the Punk RC Light Controller!*

Worried about resistors? Don't be.

Do your LEDs already have resistors wired? They are okay to keep them on.

The PunkRC Light Controller will automatically supply 20mA to your LED. Most LEDs operate normally and at rated brightness at this current.

When it comes to hooking up LEDs to the Light Controller, make sure LED polarity is correct. Use the LED polarity picture above. Also take note of the marking on the bottom of the Light Controller. There is a "+" under the Positive Terminal and the Port Number under the Negative Terminal.

*Note: You can turn on all the lights by resetting the unit or other ways described in the manual. This help for hooking up all the lights.*

### *Advanced Stuff*

#### **Using only One Wire**

You can run the positive side of the LED right off any battery, instead on the Light Controller. You will only have to wire the negative side to the negative side of the port. This is handy if putting switches or running a single power wire. Make sure all power supplies share a common ground.

#### **Multiple LEDs to One Port**

This one is can be tricky, but this method works well for using two Red or Yellow LEDs that do the same function.

First, you need to run the LEDs in a series, so the Negative of LED#1 will hook into the Positive of LED#2. Then wire LED#1 Positive to "+" and LED#2 negative to the negative side of the port on the Light Controller.

Second, you need to make sure that the LEDs are getting enough voltage. This method usually only works for Red, Yellow and Amber LEDs due to their low Voltage Drop (Vd). Here is how to find out:

$$(\text{Supply Voltage}) - (\text{Vd of LED\#1}) - (\text{Vd of LED\#2}) - (0.8\text{V}) > 0\text{V?}$$

If it is not greater than zero, then use the "One Wire" method and use a higher supply voltage up to 17V. This could be a separate battery. Still not working? Consider multiple light controllers or wiring some "always on" lights directly to power with a resistor to free up a port.

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