

Loco Lighting

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There have been several occasions where I had been working on a locomotive that either I or someone else for whatever reason needed to remove the factory electronics that runs the lighting. If converting to battery power with the RailBoss 4, it provides both voltage and current outputs for directional constant lighting. But what if you still using track power? Now the question is: **How do I power and control the lights?** Well, the first thing we need to know is ...

What kind of lights are there?

They could be 18V incandescent bulbs (lamps). These are powered directly from the track voltage (0-24V). At typical running speeds the voltage will be 11 to 18V. The brightness of the lamp will increase as track voltage increases. Diodes in series with the bulbs can be used for direction control of front and rear lights.

You may have 5V incandescent bulbs that were powered from a 5V power supply on the electronics board you removed.

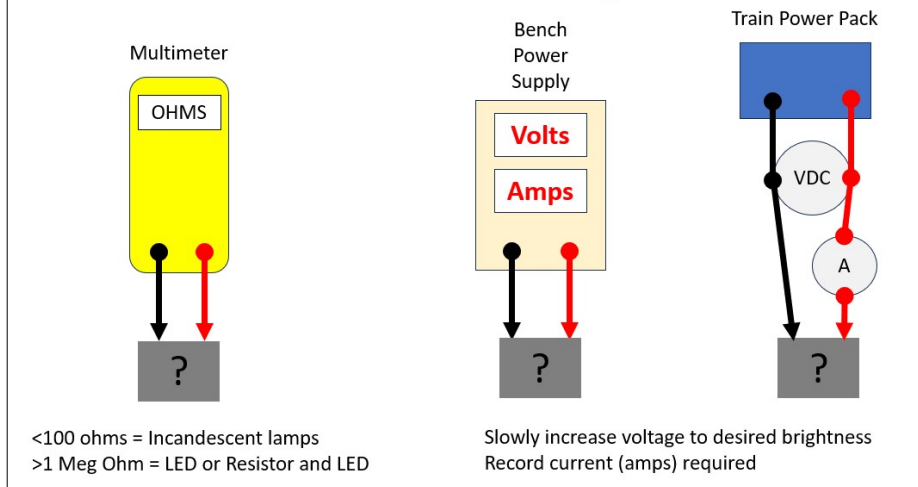
Maybe you have LEDs. LEDs require a specific current, rather than voltage.

Typically, they are used with a series resistor to limit the current to 11 to 20 ma at running voltage.

Which kind of lights do I have?

If you can physically look at the light, ideally at a side view, not head on, you can probably tell if it is an LED or a bulb. You can also use a multimeter set for ohms. Measure either on individual light or the connection that powers all the lights. Incandescent bulbs are a near short circuit, so you would see something like 100 ohms. If LEDs, they will look like an open circuit. (And us-

What kind of light(s)



ing your meter on the diode setting will likely not work because white LEDs require a voltage higher than your meter can supply for diode detection.)

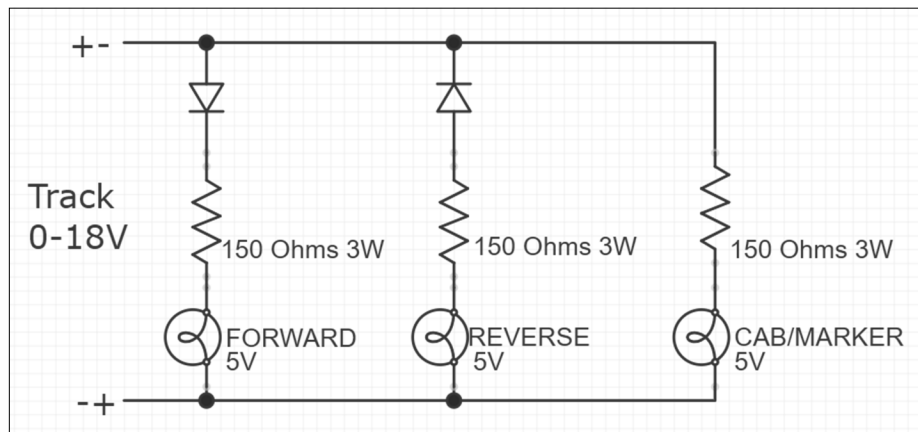
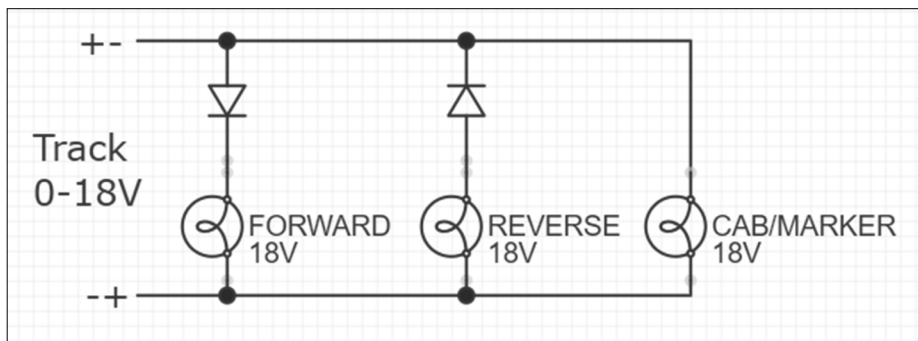
If you are installing new LEDs, then you will need to use a series dropping resistor for each LED. A value of 750 to 1000 ohms, 1/2 watt should work.

The big question is "How much voltage is required to get full brightness?"

Do test this, we need either a bench power supply or a train power pack in conjunction with two meters; a voltmeter and an ammeter.

Starting at zero volts, very slowly increase the voltage while observing the light. When the light is at full brightness, record the voltage and the current. If you have LEDs, you may

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have to reverse the polarity of the voltage source to get the light to work.

How do I power my lights?

18V incandescent bulbs can be powered directly from track power. So, as the speed of the loco increases, so does the intensity of the light the bulbs produce. Diodes in series with the bulbs can be used for direction control.

For 5V incandescent bulbs need a dropping resistor to keep from burning them out. This may take some experimentation with resistor values, but assuming we had full brightness at 15V during our test, divide that by the current draw we measured, and that is the resistor value. Choose the nearest standard value. Lets say you just have one bulb in the circuit, and measured 100ma. $15V / .100 A = 150 \text{ ohms}$. Power rating in Watts = $I^2 R$. So $0.1^2 \times 150 = 1.5W$. You need a 3W, resistor. It is going to get warm.

If you have LEDs with 1K resistors, the LEDs will serve as the diodes to switch between forward and reverse polarity, but the constant on LEDs will need a bridge rectifier to keep the proper polarity on the LED when track power changes polarity.

Instead of using resistors for the 5V bulbs, if we substitute 5V voltage regulators, we will have constant brightness lights for any track voltage over about 6V. We still need a bridge for the constant on lights, just as above.

The first 3 options can be implemented using point to point wiring. But since the 5V regulator solution has quite a few components, it is best done using a PCB (Printed Circuit Board). I designed a fairly small PCB using through hole components. Each 5V regulator circuit can handle up to a 1 amp load. The board is 1.7" X 1.4" X 0.25" and should fit in most locos.

