

# LIONCHIEF PASSENGER CAR LED LIGHTING CONVERSION

By Charles E. Kinzer

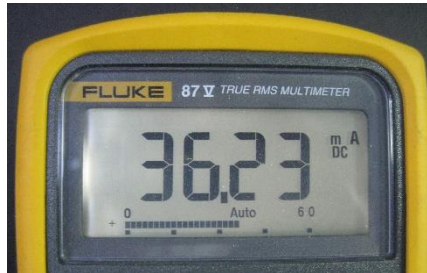
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LionChief passenger cars have been made with both incandescent lighting and LED lighting. (Lionel's LED lighting is a circuit board at each end of the car with capacitance to help prevent flickering.)

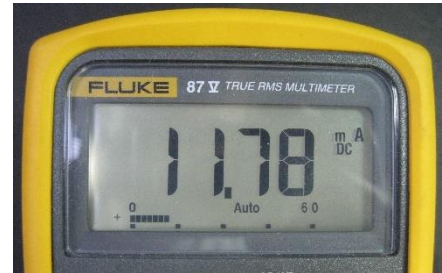
The following modification replaces incandescent bulbs with LEDs. It doesn't have a regulator. The first try did not have a "keep alive" capacitor scheme, but even with clean track, wheels, and rollers there was some flickering. So, a capacitor was then added. Current draw is dropped significantly as compared to the incandescent bulbs.



Current draw from car with incandescent lights at 18 VDC.

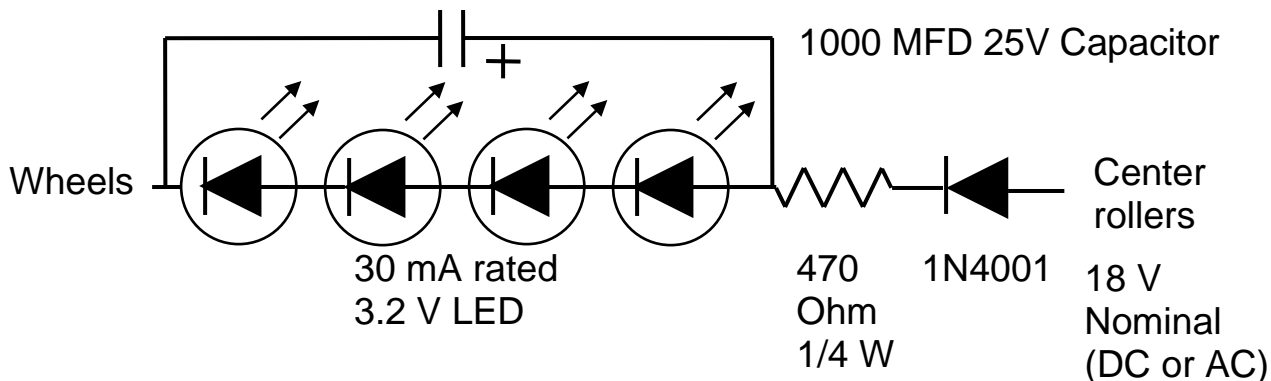


Current draw from car with Lionel LED boards at 18 VDC. This also has "keep alive" capacitance and had an inrush current of about 250 mA.



Current draw after LED conversion modification at 18 VDC.

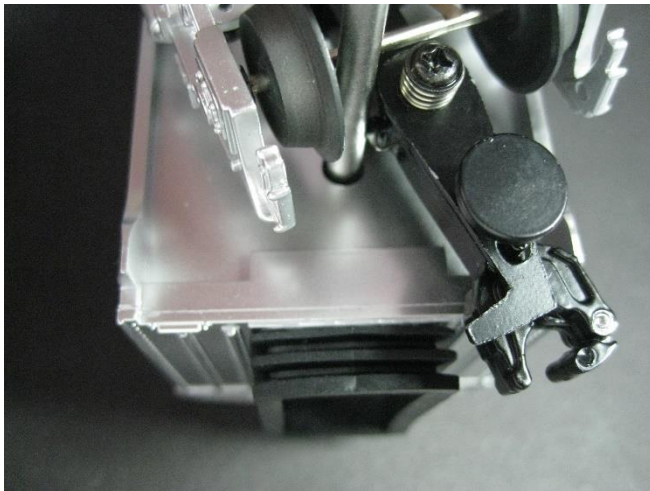
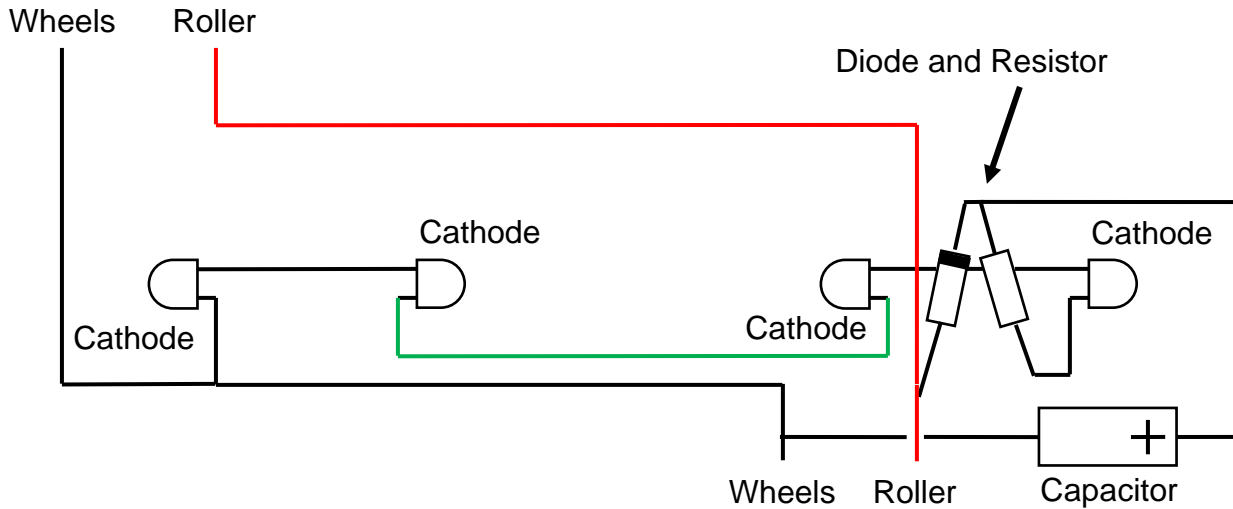
The schematic is quite simple, and its main feature is that it has four LEDs in series. Being in series lets a single current do the work of powering all bulbs. And power is taken from both trucks wired in parallel. (Lionel has each light powered from one truck.) This requires some lengths of wires running between the two lighting locations, but the reliability improvement is worth it. The diode is to prevent reverse voltage across the LEDs if using DC that is reversed. If running on DC, such as with a Lionel Wall Pack, the center rail should be positive. The diode also allows operation from AC track power. The resistor limits the LED current. The capacitor helps prevent flickering.



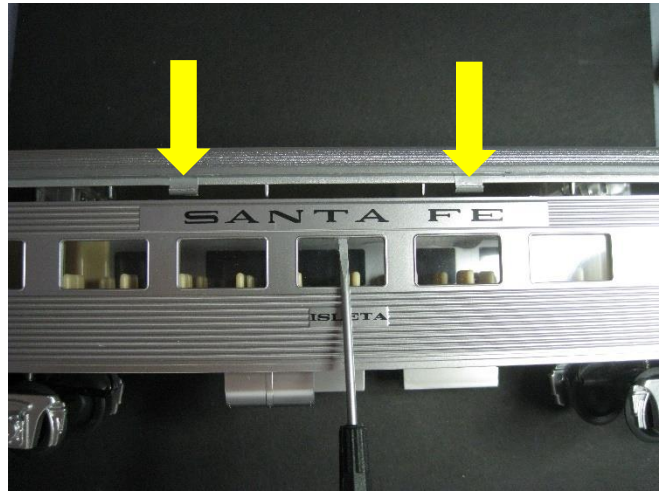
The diodes used are Cree # C513A-MSS-CW0Z0131 30 ma Warm White. Mouser Electronics part number 941-C513AMSSCW0Z0131. Many others would also be suitable.

The modification scheme is physically fairly crude, but it works and is simple.

This is a wiring diagram which may be easier to follow doing the modification than the schematic.



Remove screw at each end with Philips screwdriver as shown. (These screw into studs molded into the roof.)



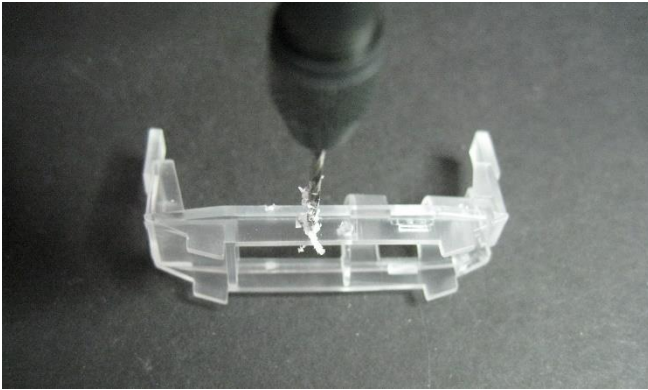
The roof is held by locking tabs and the side of the car must be pulled out to release them. One way is to VERY carefully pull it out with a small screwdriver on the inside upper edge of a window. Once the roof is released on one side, you can then remove it.



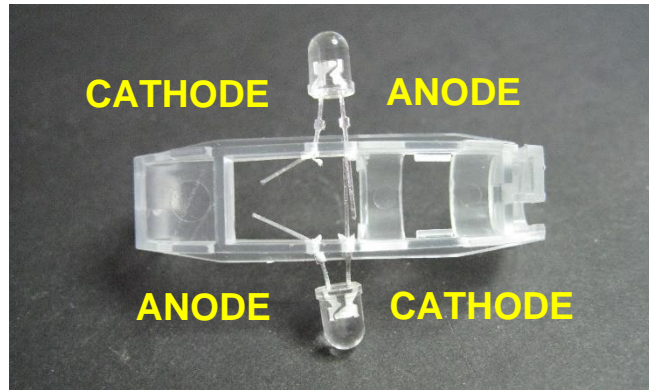
Factory incandescent bulb and its socket.



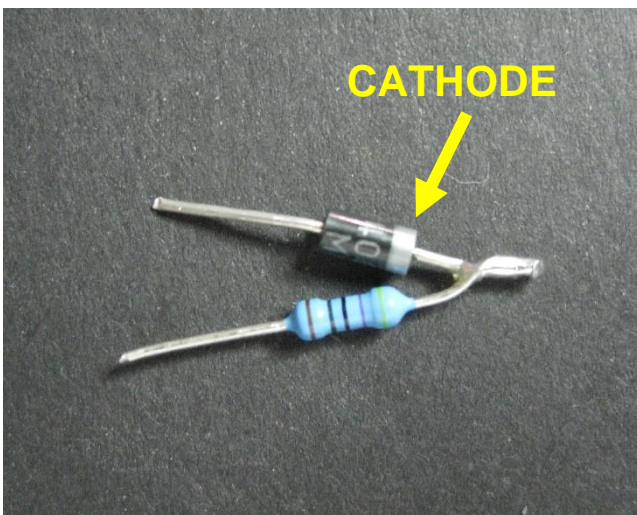
Factory reflective sticker on roof underside.



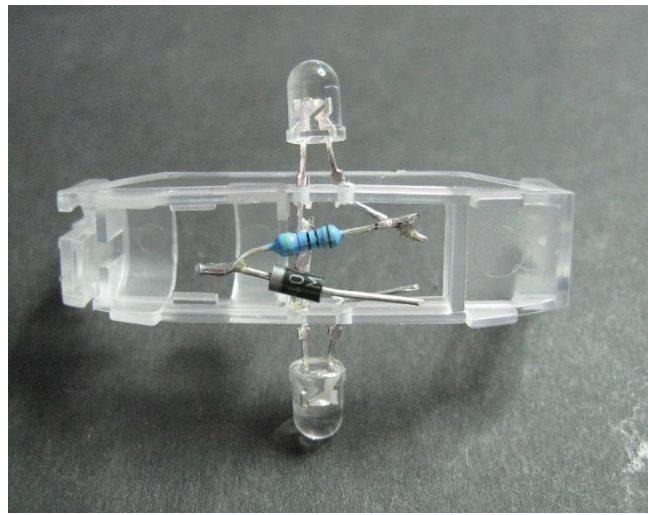
Remove the bulb holder parts (they just slide out) and drill small holes roughly the spacing of the LED leads. These holes will be used to anchor everything in place well enough.



Cut leads to length to install as shown through the holes. This is what will hold the LEDs in place. Note that two leads will be directly joined with each other to connect the two LEDs in series. Do this with both holders. Pay attention to the LED polarity. (The cathode lead is next to the flat.)

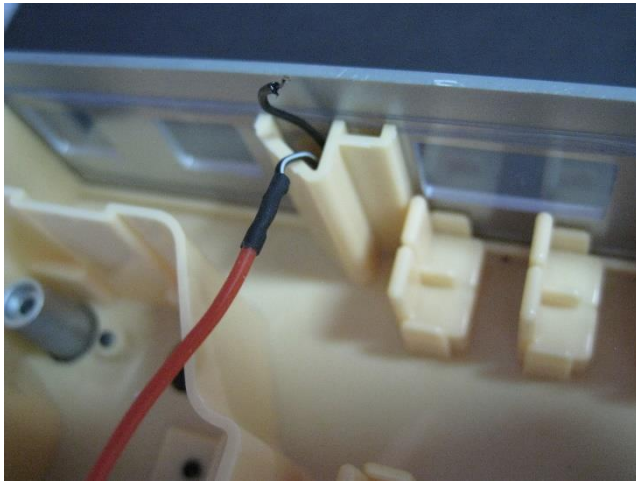


Twist the ends of the diode and resistor leads together, solder, and cut to length as shown. Note polarity of diode.

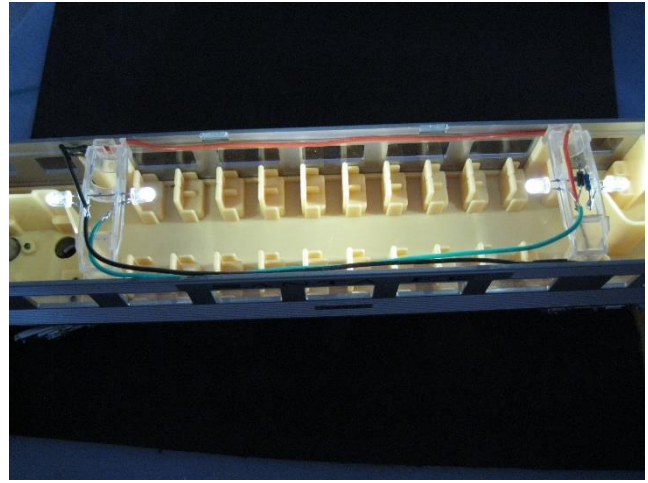


On one of the holders, solder the two LED leads together that will be under the diode and resistor. Solder the resistor to the anode of the LED. Locating the bodies of these parts directly over where the LED's join beneath them means you don't need to worry about insulating the bare leads.





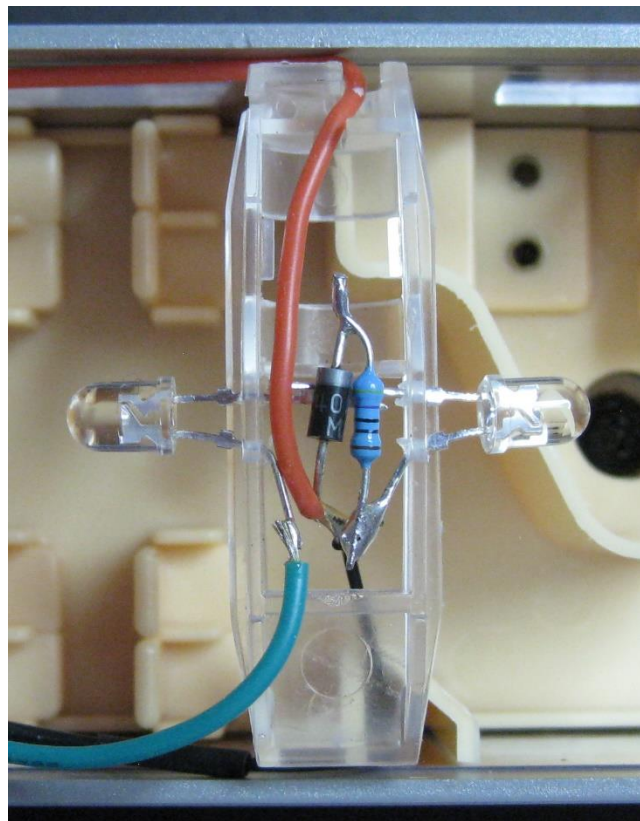
This is the first connection to existing wiring and is to the wire (black with white stripe – but check to make sure) from the pickup roller. Use 26 gauge stranded wire for the wiring. Insulate splice with heat shrink tubing.



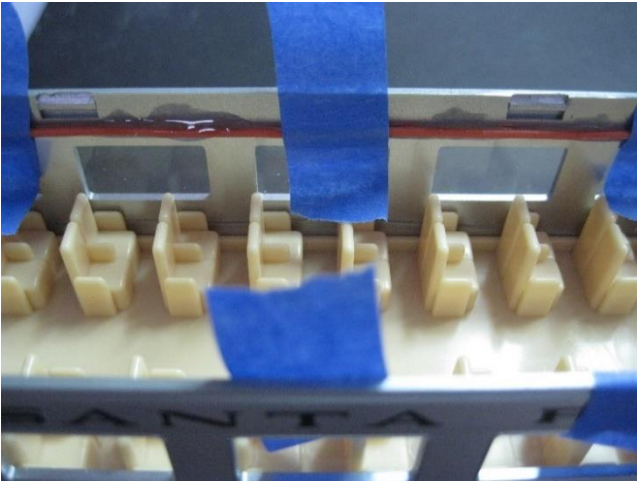
Wire to match the schematic. Used a red wire for the roller to connect from end at left to the roller pickup at right and to the right assembly. Used black for the wire from the wheels at right and over to the left. Used green for the series connection between the two sets of diodes.



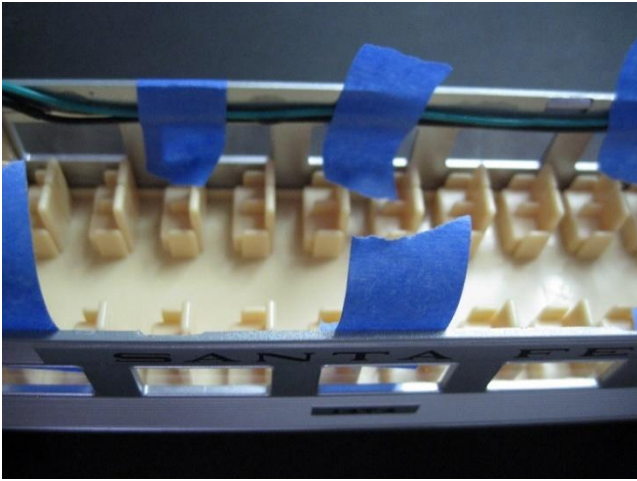
Closer view of left side.



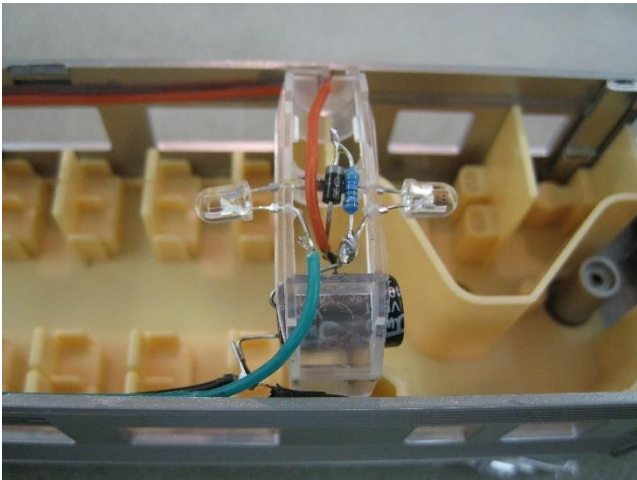
Closer view of right side. Where the red wire connects to the diode looks soldered to the lower end of resistor in photo. It is not and is pushed down and spaced away to prevent a short. You could certainly insulate things more, or daub on some RTV here and there if you want, it probably isn't necessary.



Using painters tape, temporarily tape the wires neatly down just above the tops of the windows. Put a little bit gap filling CA cement in a few spots. Do this very carefully and don't use too much. Over several minutes it will wick along the wire. Let it dry which will be longer than usual since it is exposed to air.



Cementing the wires in place on the other side of the car.



The modification originally had no “keep alive” capacitor. But even with perfectly clean track, wheels, and rollers, some light flickering still occurred. A 1000 MFD 25 volt capacitor was added, and this solved the flickering problem. It is connected in parallel across the string of four LED's.



Comparison with incandescent on the left, LED modified car on the right. Even though “warm white” LEDs were used, the incandescents still look quite a bit more orange.



Comparison with Lionel factory LED lighting on the left, LED modified car on the right. Lionel used LED's much “warmer” (more orange) than typical “warm white” LEDs.



