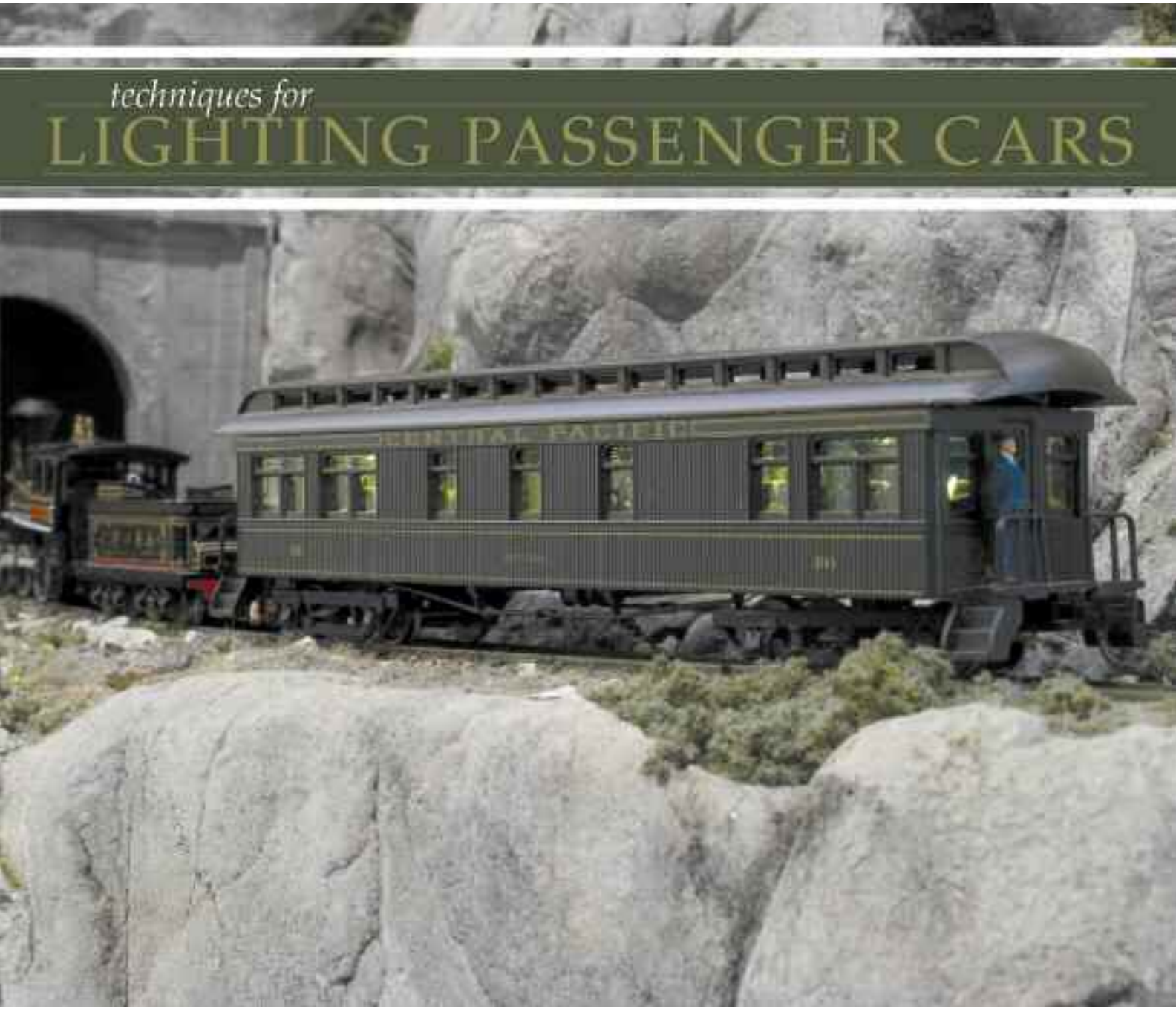
techniques for

LIGHTING PASSENGER CARS



by **Ken Harstine**

Trains we did and did not ride kindle our desire to recreate them. Whether we observed the trains from the inside, the outside, or simply in print, we want to see them again in miniature. We go to great lengths to replicate even the small details of a particular passenger train. Often, lighting them is overlooked because of the difficulty of adding power contacts and the relative quality of the resulting lighting. Passenger cars had lights and the interiors were visible in the evening and at night. Our models should also have lights. This article will explain how to add realistic lighting to any passenger car.

The obstacles to good lighting are:

1. Power to the lights.
2. Lighting that does not fade or flicker.
3. Sufficiently uniform lighting through the entire car.

The lights of prototype passenger cars are of constant brightness and do not flicker (with the exception of certain electrified lines and then only when passing from one substation to the next). Except for Rapido Trains and Centralia Car Shops products, all of the factory supplied lighting kits will flicker and vary in intensity. This flickering is caused by the low weight of the passenger cars and even more often by poor electrical pickup. Kato, Walthers and some others provide the best possible pickup by collecting power from all wheels, but flickering will still likely occur. The old Rivarrosi/Atlas/Con-Cor cars are much worse with pickups only

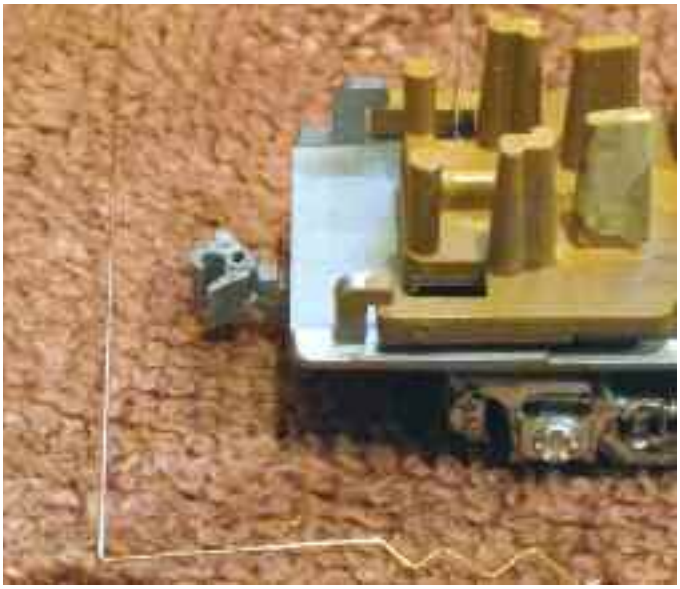


Photo 1

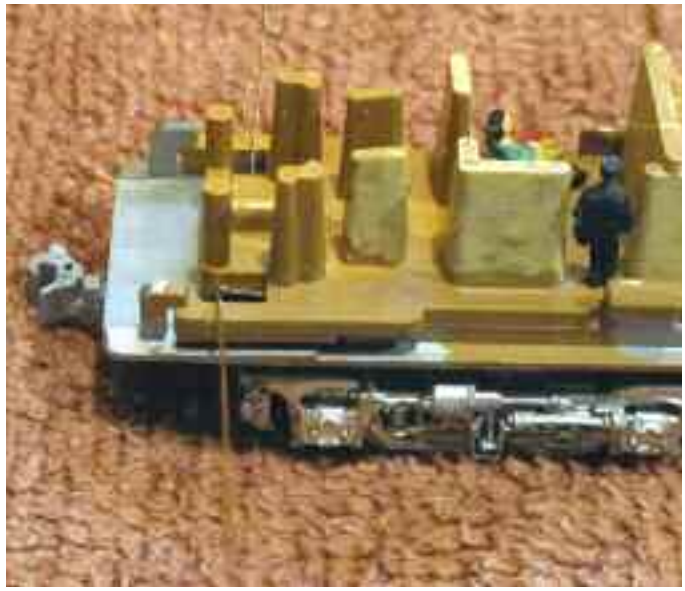


Photo 2

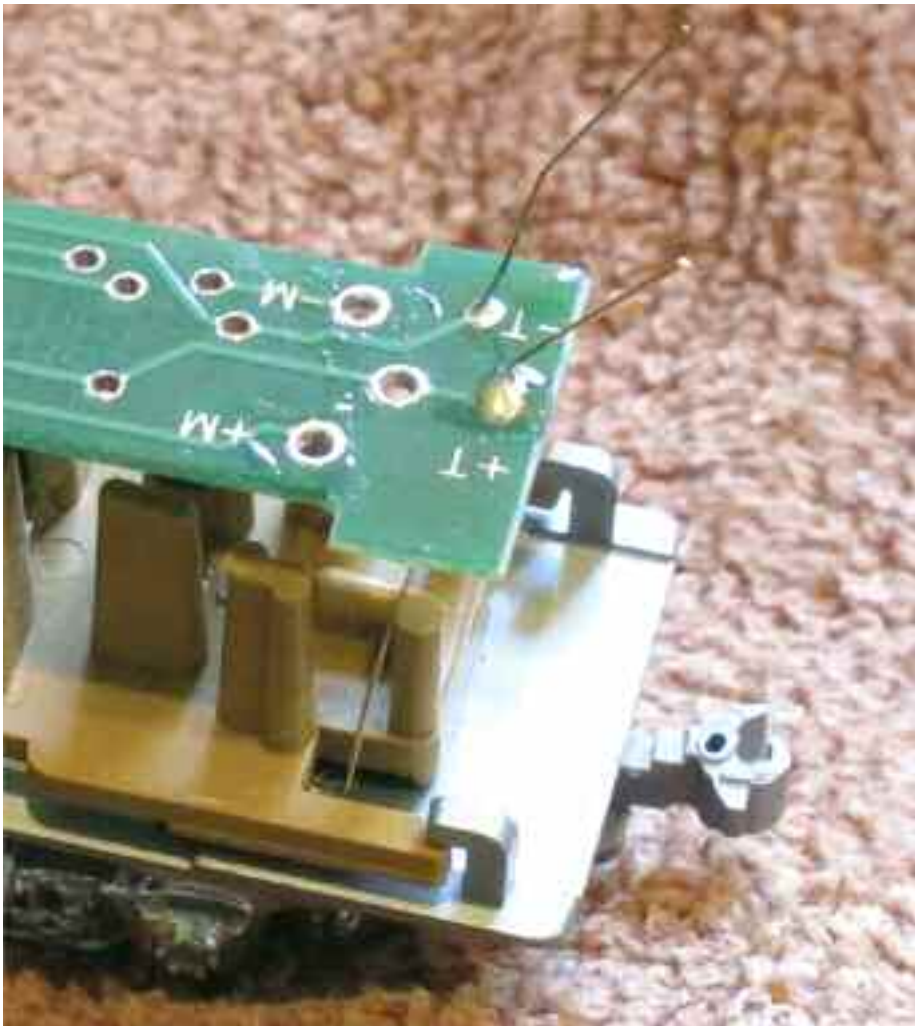


Photo 3

on one side of each wheel set. In non-DCC systems, the brightness of factory lighting will also change with the throttle setting. Rapido Trains, Centralia Car Shops and Kato products use a single LED at one end and a clear plastic light guide in an attempt to provide uniform lighting throughout the car. Invariably the lighting is stronger on one end of the car and darker on the other end.

There are several solutions available for these problems. Richmond Controls (http://www.richmondcontrols.com) has been offering lighting kits for a long time. They offer the EZ51, EZ52, EZ53, EZLS and EZ54 for lighting passenger cars, as well as kits for other lighting projects. The EZ54 is designed to replace the Kato lamp and requires the Kato lighting system to be installed. The EZ51 is designed for full-length N scale passenger cars and includes super-capacitors and regulators to eliminate all lighting variations. The EZ51 is orderable with many options with regards to marker lights. The EZ52 is basically an extension module for the EZ51. The EZLS is a kit where you assemble the circuit board, as well as wiring to and from it, can be ordered as a kit and is configurable for any desired length from 1"-23". The EZLS has many options, including a super-capacitor, voltage regulators and current limiting. The output voltage regulator provides constant brightness, while the super-capacitor eliminates flickering. Richmond Controls states that the super-capacitors provide a minimum of several seconds of light after power is removed. With the exception of the EZ54, all of the Richmond Controls kits will require additional wiring and modifications of the cars for installation.

The Easy Peasy lighting kit from Rapido Trains Inc. is perhaps the easiest to install. It is installed just below the roof of the car and involves no wiring. The lights are powered by batteries and turned on by means of a magnetic wand. Easy Peasy lights provide light from a single LED and a light guide that

disperses the light through the length of the car. This lighting system is very good, but is not completely uniform from end to end of the car and of course the batteries will eventually need to be replaced.

I have created another third option that is similar to the offering from Richmond Controls. My business is called Voltscooter (www.voltscooter.com). The major differentiator between my system and the Richmond Controls options are that lighting is adjustable after installation and less space is required. The EZ51 has a thickness of 0.26" (6.6mm) at the super-capacitor and 0.14" (3.8mm) otherwise. My light board is also installed between the cabin and the roof of the passenger car and has a maximum thickness of 0.1" (2.5mm). My Constant Lighting Kit includes two super-capacitors, is DCC friendly (current draw as well as capacitive load is limited), and compatible with analog control. The Voltscooter lighting is regulated for constant brightness and the level of brightness can be adjusted with a small screwdriver. The lighting board is a drop-in replacement for the Walthers passenger cars and can also be wired to pickups on the car. The circuit board uses 8 white LEDs to provide a more uniform brightness than can be achieved with single LEDs with plastic light guides. This light board can provide constant light at realistic levels for at least 30 seconds after power is removed, and much longer if gradual dimming is acceptable. The ultimate duration after removal of power is dependant on the actual brightness level that has been set. By having such a large storage capacity, it is possible for steady lighting to be maintained even with poor pickups and track that is not as clean as it could be. While contact exists, the super capacitors are charged at a controlled rate of no more than 100mA until fully charged. The following sections describe techniques for installation that are applicable to all light boards. My light board serves as an example.

Installation in Kato Cars

Kato cars can be wired to lighting kits for better appearance and operation. Obtain 0.008" (0.22mm) phosphor bronze wire or similar thickness phosphor bronze wire. I don't recommend brass wire as it does not make a good spring and will tend to oxidize when placed against the Kato phosphor bronze pickups. The phosphor bronze

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

wire can be obtained from better hobby shops or on-line retailers. Most people use the phosphor bronze wire to add handrails and such. Form the phosphor bronze contacts as shown in Photo 1. The zig-zag part is in the same plane as the rest of the wire. The wire is then inserted into the slot used by Kato's lighting kit (Photo 2). Because the zig-zag is in the same plane as the rest of the wire, the wire will be under spring tension when you raise it to connect it with the circuit board (Photo 3). The circuit board should be attached to the chassis as high as possible, but such that it will not interfere when you install the car body over the whole assembly. Place the car onto a powered section of track and adjust the brightness to the desired level (Photo 13). Reassemble the car.

Installation on Con-Cor and Similar Cars with Micro-Trains Trucks

Installing your own pickups is more advanced, but with the right tools, is not too difficult. For tools, I recommend a small soldering iron that lets you get close to the solder point, good lighting and magnification, jewelers tweezers, small needle nose pliers and small wire cutters. The Iso-Tip rechargeable soldering iron with the Micro-Tip is excellent for this purpose. The Micro-Tip is very fine and the iron also has a lamp to let you see what you are doing. You will also need metal wheel sets, some plastic to make supports for the lighting board, fine magnet wire (36 AWG or preferably smaller), 0.008" (0.22mm) phosphor bronze wire or similar thickness phosphor bronze wire, and of course your light board. Fine magnet wire can be obtained virtually for free from an old relay or modem transformer. Just hack into the relay or transformer to free its core and unwind the wire. Mouser Electronics carries magnet wire, but at a cost of greater than $60 for a spool. Ebay has small spools for less than $15. Hobby Search in Japan has some excellent 0.1mm polyurethane magnet wire for about $6, but it is not always available. A low cost and local source for some very fine (small diameter) wire is to purchase reed relay PN 0275-0233 for $3.49 from Radio Shack. Disassemble the relay and unwind the wire you need from the spool. The magnet wire will be used to connect the light board to the trucks so it needs to be fine enough that when the truck turns, the force of the wire that resists the turning of the truck is very small. The phosphor bronze wire is used to create the contacts with

the metal wheels. Heavier phosphor bronze wire will not allow the wheels to roll freely. Install Micro-Trains trucks on the passenger car as described by Micro-Trains. Drill the kingpin all the way through (Photo 4). Install one of the metal wheels into the truck's frame. One side of the metal wheel has an insulator between the axle and the wheel. You will be placing the phosphor bronze wire next to the other non-insulated wheel as shown in Photo 5. Do not pre-bend the wire. The wire needs to be sprung (under tension) to make good contact. Bend the end of the wire around the axle to keep it from slipping off (Photo 6). Now install the second wheel set by slipping it under the phosphor bronze wire. Be sure that the non-insulated side of the axle is on the same side as the other wheel set on this truck (Photo 7). Trim the wire with cutters (Photo 8). Bend the wire as before to secure it.

Tin the magnet wire and the phosphor bronze wire. The magnet wire has insulation on it and the tinning process will need to vaporize that insulation layer. The soldering iron should have a bead of solder on it and the magnet wire tip should be kept in that bead of solder until the insulation is completely gone and the end is nicely tinned. Form a hook on the end of the magnet wire. Hook the magnet wire onto the phosphor bronze wire as shown in Photo 9. Now solder the magnet wire to the phosphor bronze wire. Insert the other wire into the hole that was drilled through the kingpin as shown in Photo 10. Now repeat the above procedure for the other truck. Make certain that the non-insulated sides of each wheel set are on the opposite sides from the first truck. You are trying to pick up power from each of the two rails.

Add some supports for the light

Photo 10

Photo 11

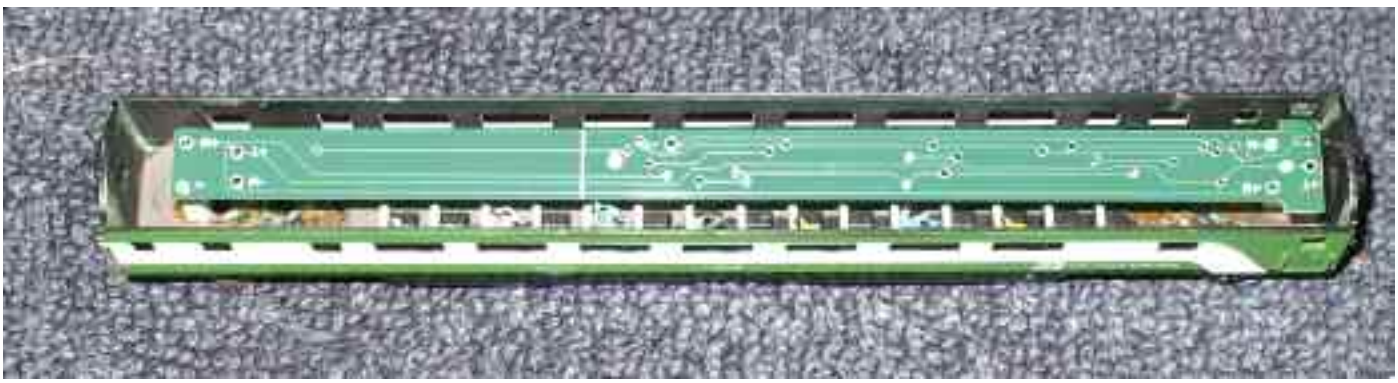


Photo 12

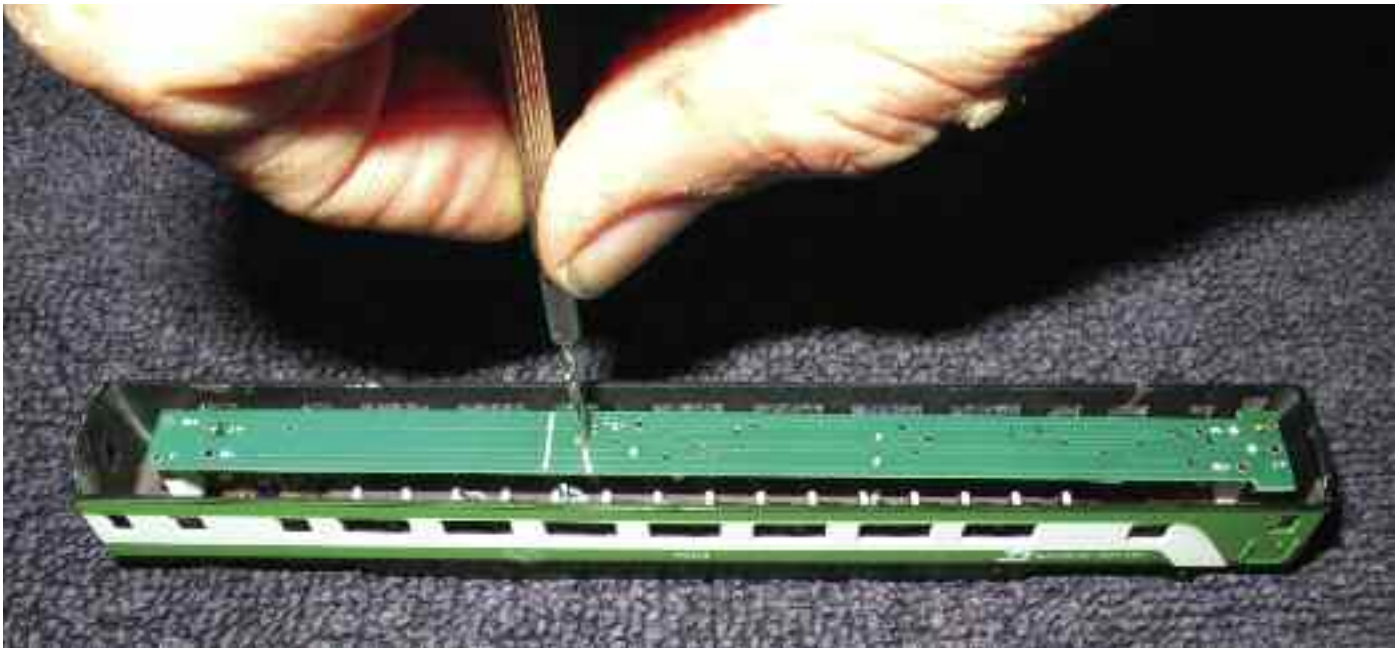


Photo 13

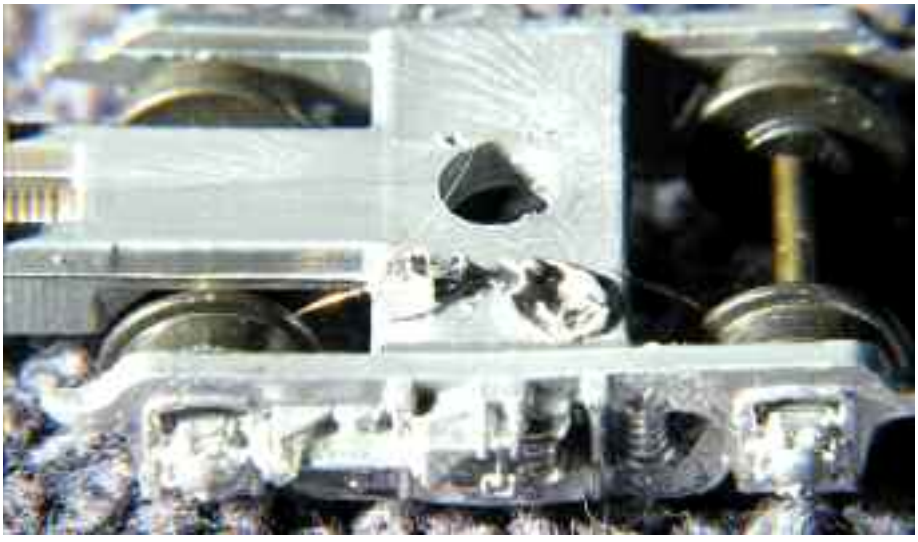


Photo 14

Photo 15

board (white styrene blocks in Photo 11).

Thread the magnet wire into the T+ and T- holes on the light board. Secure the light board (Photo 12).

I prefer to use contact cement such as Walther's Goo for securing the light board. Solder and trim the magnet wire to the light board. Again, since the magnet wire is insulated, you will need to maintain contact with the soldering iron much longer than normal in order to vaporize the magnet wire's insulation. Place the car onto a powered section of track and adjust the brightness to the desired level (Photo 13).

The car is complete once you put the roof/window piece back on.

Installation on Con-Cor Cars with Con-Cor Trucks

This is perhaps the most difficult light board conversion. Modern Con-Cor cars come with knuckle couples, so the addition of Micro-Trains trucks is not necessary. Also, since the mounting style has changed, it is not as easy to mount Micro-Trains trucks onto the Con-Cor cars. Although the modern Con-Cor cars come with metal wheels, I recommend replacing them with Fox Valley wheels because the quality of electrical contact with the supplied wheels is not very good. Otherwise, the materials required are much the same as the Micro-Trains trucks. You will need 0.008" phosphor bronze wire, fine magnet wire and some plastic to make supports for the circuit board. Install the phosphor bronze wire in the same way

as was described for the Micro-Trains trucks. Because of the limited clearance between the new Con-Cor trucks and the Con-Cor chassis, you will need to recess the phosphor bronze wire. Heat the phosphor bronze wire by holding the soldering iron in contact with the wire until it melts into the surface of the truck (Photo 14). Stop heating the phosphor bronze wire once it is fully recessed. Now sand the top of the truck flat (Photo 15). Solder the magnet wire (Photo 16). Do the same to install the contacts on the second truck. Make sure that the non-insulated wheels and contacts are on the opposite side of the truck when installed on the car body. (Because the couplers will be facing the opposite direction, the trucks will be identical with regards to contacts and non-insulated wheels.) There are a couple of ways to install the feed wire. You can either drill a hole through the center of the bolster screw, or alternately drill a hole through the floor of the car, as close to the bolster as possible to minimize flexing of the wire. The bolster screw is brass metal and long, so greater care must be taken to drill a straight hole. A micro-drill press is recommended, but not necessary in order to drill this hole. Install the Con-Cor trucks onto the car and thread the magnet wire through the hole in the bolster screw (Photo 17). Add the supports for the circuit board. Install the circuit board and make the connections between the magnet wire and the circuit board. Adjust the brightness and reassemble the rest of the car.

Photo 16

Photo 17

Installation on Older Atlas/Rivarossi/Con-Cor Cars

Installation is very similar to the

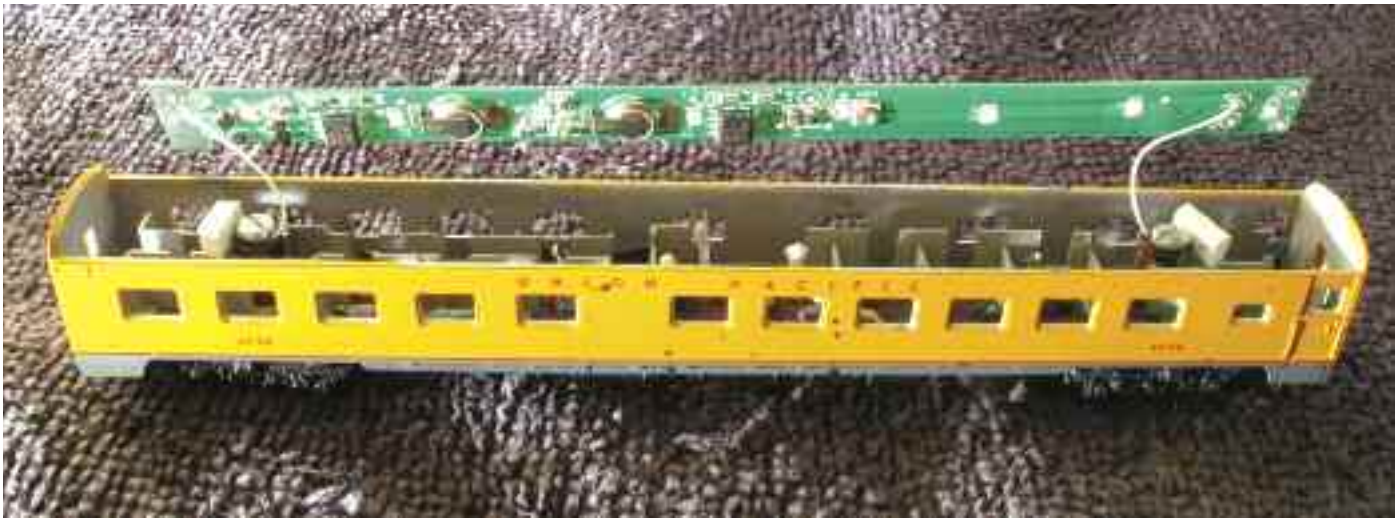


Photo 18

modern Con-Cor car above. If Rivarossi cars already have electrical pickups, then you can use those, otherwise the bolster pin will need to be drilled out and phosphor bronze contacts will need to be installed. Wheels should be replaced with Fox Valley or similar wheels for the best operation and looks (Photo 18, Photo 19, and Photo 20).

Conclusion and Notes on Detailing

To make the best use of my lighting, I have painted and installed passengers in my cars. Non-painted plastic is somewhat transparent and does not look well when lit. Walls and seats should not allow light to pass. As much as I can, I choose colors that are typical of the era of the car. Information on interior colors is not easy to come by. If you actually rode the trains you are modeling, perhaps you have some memory of appropriate colors. Books or articles about the train sometimes have color details. Promotional brochures that show interiors are also great and can be found in books, on-line through Ebay and similar sites, museums, and railroad historical societies. I painted anti macassars onto the seats of my coach cars as I remembered them on the Amtrak cars and on the San Francisco Chief. These were standard equipment from the 19th century until the early days of Amtrak and they are visible through the windows. For the passengers, I use inexpensive Chinese made Z scale figures from Modelleisenbahn Figuren (http://www.modelleisenbahn-figuren.com/). Because of the un-prototypically thick walls and floors of N scale passenger cars, the Z scale figures fit much better than actual N scale figures. The fluorescent light began being marketed in 1938 by General Electric. Based on some research I have done, it appears that streamliners from at least the mid 40s onward had fluorescent lighting. For earlier cars, I placed transparent orange tape over the LEDs. Of course, the lights will likely need to be adjusted to a higher level if the transparent orange tape is placed over the LEDs because of the reduced amount of light. Of course, older cars were not as well lit as modern cars either.

I have a great deal of fun with my passenger cars. My favorite venue for showing them is on NTRAK layouts. I like to go fishing for train watchers on the NTRAK layout. With my DCC equipped trains, I see if I can snag an observer, and then see how long I can hold their attention. I have sometimes been able to get children to follow the train around the entire layout.

Photo 19

Photo 20

Photo 21