



Come On Baby, Light My Car



DCC Impulses Column by Bruce Petrarca

Lighting your roling stock.

Never fear, the signaling column that I mentioned my the August 2013 column (http://model-railroad-hobbyist.com/magazine/mrh-2013-08-aug/di_where-is-my-train) is in process. Not ready yet. So we'll go elsewhere for now.

In August, I mentioned one of the advantages of DCC is constant track power. This can be used to illuminate passenger cars and caboose. I know that the official plural is cabooses, but if "geese" is good enough for a goose, give me a break. I like caboose, ok?

The techniques here are relatively scale independent. Variations in available room and track voltage may make a few changes. The basic concepts are universal.

Lighting and populating your cars can make the interiors pop out, especially when you are running at night.

Frequently, manufacturers make lighting kits for their cars. Some of these are DCC aware, but many are not. Some manufacturers' kits are even DCC friendly and include a decoder, allowing DCC control of the lights. If you wish, you can always add a lighting decoder as part of your conversion, if you want to control the lights.

Initially, this seems as simple as putting power pick-ups on the car and stuffing a few bulbs into it. Yes, with some caution, this can work.



1: Lighted passenger car (1:24 scale) for my RMP layout (<http://www.mrdccu.com/layouts/RMP/>)

But folks frequently find that there is more to making a great looking and performing car than first meets the eye. Think of this as a kit-bash project. Here are some of my ideas. You may come up with something really innovative that I didn't cover here. Please share them on the MRH forum web site, just click on the link (to rate this column) above, and leave your comments in the associated blog.

Manufacturers' kits

Most kits include parts to add power pick-up to your car. This simplifies the process, for sure. But they can have other issues.

Many kits from the DC era had low voltage bulbs that were pretty bright at about 8 volts or so. Putting full DCC voltage (12 to 18 volts) on these bulbs can cause lots of issues, including melted plastic and short lived bulbs. In addition, bulbs take a lot of power from the track (as much as 1/8 to 1/4 amp per car). Since there is no way to shut them off easily, a bunch of these cars can overwhelm the DCC system's power rating.

Adding a resistor in series with the lights can drop the track voltage down to what the bulbs want to see, but won't reduce the current draw from the DCC system. Also, this

resistor will probably take $\frac{1}{3}$ to $\frac{1}{2}$ of the power from the bulbs, getting very hot. Adding a decoder will allow you to turn the lights off. But the lighting kit and the decoder can add \$40 or \$50 per car.



2: Kato LED lighting kit in HO-scale – photo courtesy of Kato USA, Inc.

Followers of my columns know that I am a fan of LEDs for lighting, due to low cost, low current consumption, long life and cool operation. Some manufacturers, such as Kato (2) offer lighting kits with LEDs for their cars.

LED lighting kits don't use a lot of DCC power or generate a lot of heat. Since they have long (thousands of hours) life, they can be left on all the time, reducing the cost by not needing a decoder per car.

Generic Kits

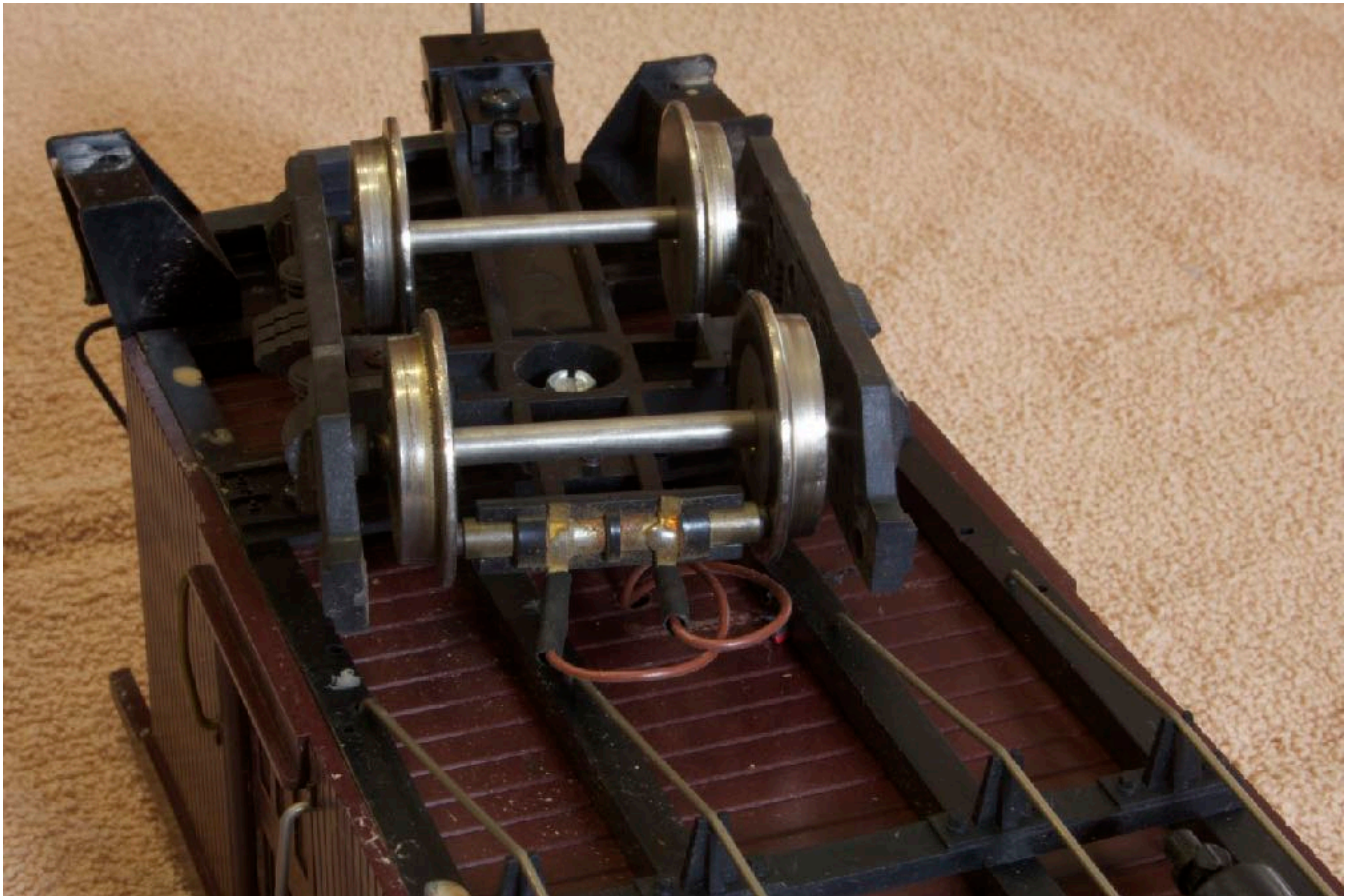


3: Minitronics generic LED lighting kit

Miniatronics makes a couple of kits which include LEDs, a power supply and a large storage capacitor (more on this later). The longer one (475-100ICL01) is aimed at HO-scale passenger cars and the shorter (3) version (475-100CB201) is aimed at HO-scale caboose and N-scale passenger cars. These kits also include the metal to make power pick-ups for your cars. This total kit costs about what you'd spend on all the parts, if you set out to make your own. A real value, for sure.

Power Pick-up

The car that I show outfitted with lights in figure 1 was purchased for \$10 or \$15 at a local swap meet. Even though Bachmann didn't have lights in it, it had carbon wipers on the back side of one set of wheels on one truck (4). Notice that they are spring loaded against the wheels on opposite sides of the same axle. That keeps the wheels centered in the bolster. If you apply force against one side of one axle and the other side of a different axle, the wheels will tend to track poorly and may become a running nightmare.

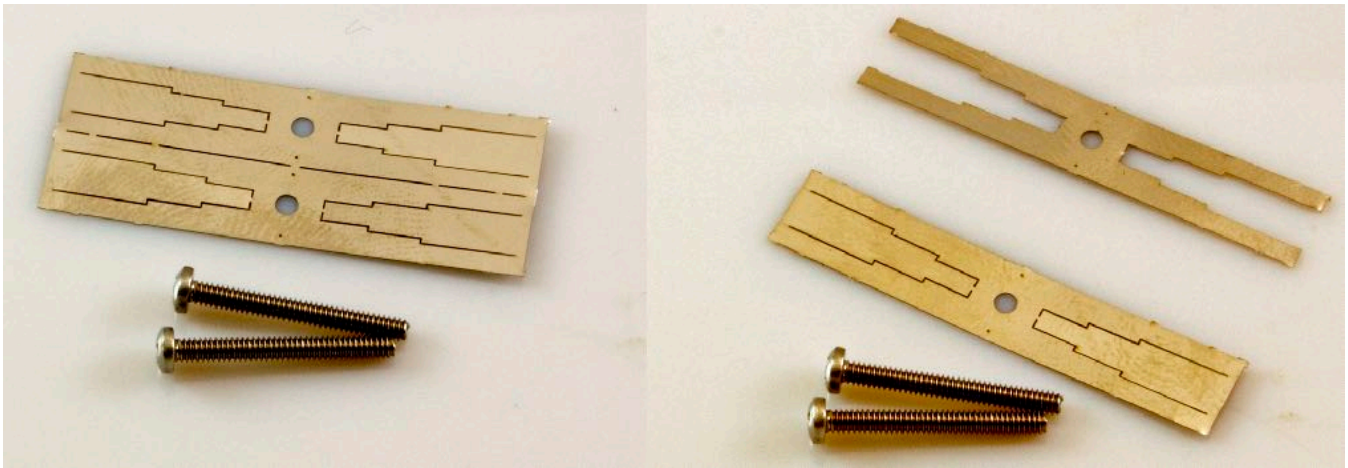


4: Carbon wipers on the wheels of a Bachmann 1:24 passenger combine

Unless the car you are converting already has trucks with power pick-ups, your first task will be to add them. So, let's talk about that process.

Copper doesn't make for good power wipers. Why not? While it is very conductive, it is soft and hard to keep in good contact with rotating wheels. I prefer a spring alloy of copper and beryllium. Titchy Train Group sells it in wire with sizes from 0.01 inches to 0.032 inches. It is also sometimes available in sheets. If not beryllium copper (BeCu), then I like stainless steel.

Jim Hinds of Richmond Controls has made it easy for us to electrify many cars, with each truck picking up off one rail. He makes kits (5) that I found when I owned Litchfield Station. There are two kits, one aimed at HO-scale and one intended for N (<http://www.litchfieldstation.com/xcart/product.php?productid=290007>). These kits may be adapted for other scales, too. They have etched stainless steel wipers and mounting screws, allowing for an easy conversion, as long as the trucks mount to an insulated area, such as a blue-box Athearn kit.



5: Richmond Controls HO-scale wiper kit as received and with one part cut out

A pair of scissors makes cutting out the etched parts pretty straight forward. As you can see in figure 6, the HO parts are plenty long and will need to be trimmed to fit.

The wheel sets need to have metal axles which connect to all the way to the tire on one side. I like to use the Intermountain wheels for HO – good quality and a reasonable price (part number 85-40055 - <http://www.litchfieldstation.com/xcart/product.php?productid=999003140>).

The supplied screws are 2-56 in the HO scale kit. To complete the installation, you will need some 2-56 nuts and, possibly, some washers. I like to use a ring terminal and jam nuts to hold the assembly together. However, it is hard to find ring terminals for #2 screws and folks usually want you to buy a hundred or so. I keep the copper rings that I take off motor tabs. The N-scale tabs are perfect to use as tabs for 2-56 screws.

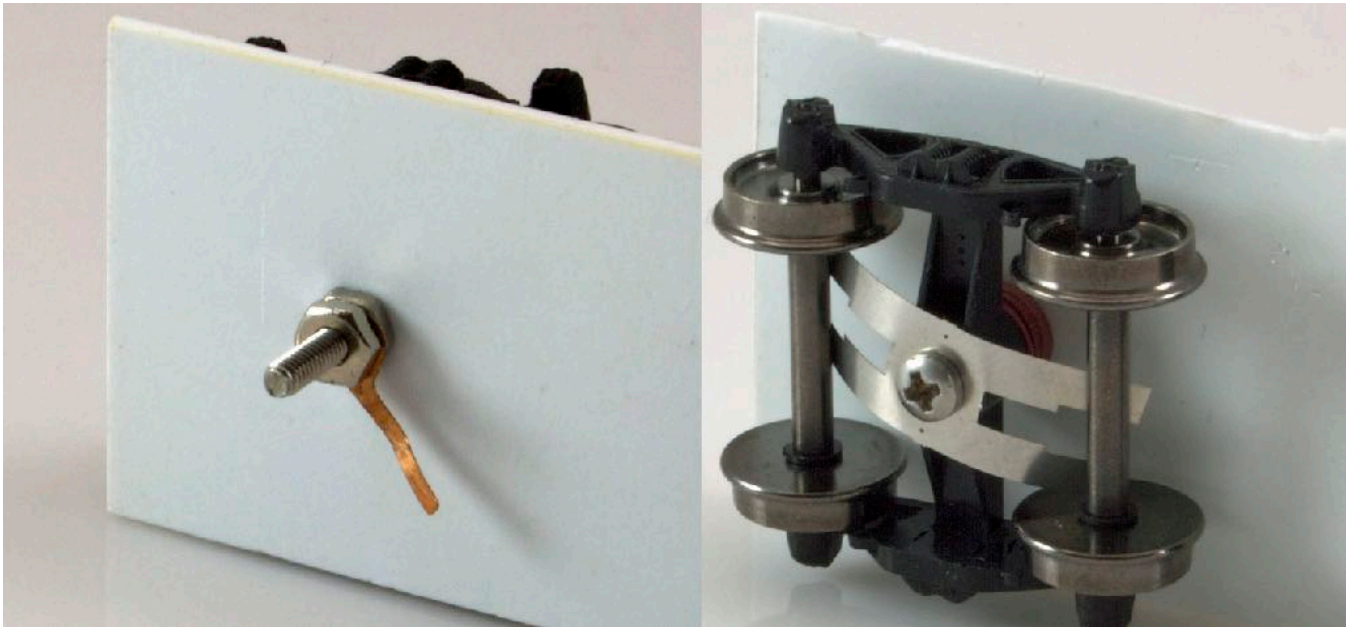
The wipers rub against the axle and transfer the power to the bolster mounting screw. Inside the car, an electrical contact transfers power to your lighting kit. The truck on one end of the car has the insulated wheels on one side. The opposite end has the other side insulated.



6: Richmond Controls wiper kit and Intermountain wheels on an HO-scale truck

Figure 6 shows how much excess material there is, which needs to be trimmed for HO. This excess allows usage on much larger trucks, even as large as O-scale. While the stainless steel isn't as conductive as copper, it is fine for this usage. Its ability to hold a shape helps keep it in contact with the axle.

To assemble the truck and wiper, I like to have the wheels out of the bolster. Feed the screw through the stainless wiper and through a hole in the floor of the car (7). Run one 2-56 nut down the screw until it is loose just above the floor inside the car. Install the ring terminal (or make one by looping your pick-up wire around itself to make a ring and tin it in place). Then add a second nut to hold the terminal in place. Use a pair of wrenches or pliers to jam the nuts against each other making a tight electrical connection, while the truck is free to pivot through the floor. That's why they are called jam nuts. Then install the wheel sets, making sure that the insulators are on the same side (bottom in the photo 7). When mounting the trucks on the car, make sure each truck has the insulators on the same side and they are different between the trucks. Otherwise, there will be a rail-to-rail short.



7: top and bottom view of truck & wiper assembly attached to a mock-up of floor (using Kadee red washers to simulate the pivot surface) with jam nuts and ring contact – note wipers have been trimmed since figure 6.

Conductive lubrication, such as Never-Stall (<http://www.litchfieldstation.com/xcart/product.php?productid=999003384>), should be applied to the sliding surfaces between the contact strip and the axle and between the contact strip and the mounting nut-bolt-washer combination.

Lights

If I'm building my own lighting kit into a car, I prefer LEDs. They may be surface mount (SMD) LEDs or 3 mm or even 5 mm, depending upon the space available. Enclosed LEDs, such as 3 mm or 5 mm devices frequently focus the light in a column, so I tend to use SMD units whenever possible, as they frequently provide a broader area of illumination.

The large scale car that I've been featuring throughout this column (8) used two strips that had three SMD LEDs and a dropping resistor designed for 12 Volts. I bought them at an electronic surplus store online. They came with blue-white colored LEDs. While these make a good "fluorescent" look, they don't fit in an 1930s vintage passenger car. So, I tinted them with Tamiya acrylic X-26 clear orange paint (<http://www.litchfieldstation.com/xcart/product.php?productid=999003257>). The variation between LEDs obtained by hand painting the LEDs helped the overall look. The light is not evenly distributed throughout the car, as it would be with factory tinted LEDs.

The two brass rods running the length of the car have rectified DCC on them. The LED modules connect between the rods. Alternatively, individual LEDs with dropping

resistors, or 12 volt LEDs, could have been used. I just happened to have the modules in stock when I did this car, so I used them.



8: Lighted passenger car from figure 1 with the roof off, showing LED packages installed

I have also obtained some LEDs that flicker like candles or other flames (<http://shop.evilmadscientist.com/productsmenu/partsmenu/189-candled>). I'm going to experiment with adding some of them to this car to create an effect based like oil lamps.

Power Storage

What hasn't been mentioned so far, is that all of these concepts rely on sliding or rotating power pickup from the track and frequently have only one or two contact points per rail. The result is flickering lights. If one is modeling an era before electric lights, flickering lights can be fun, as I mentioned before. The entire car shouldn't flicker at once.

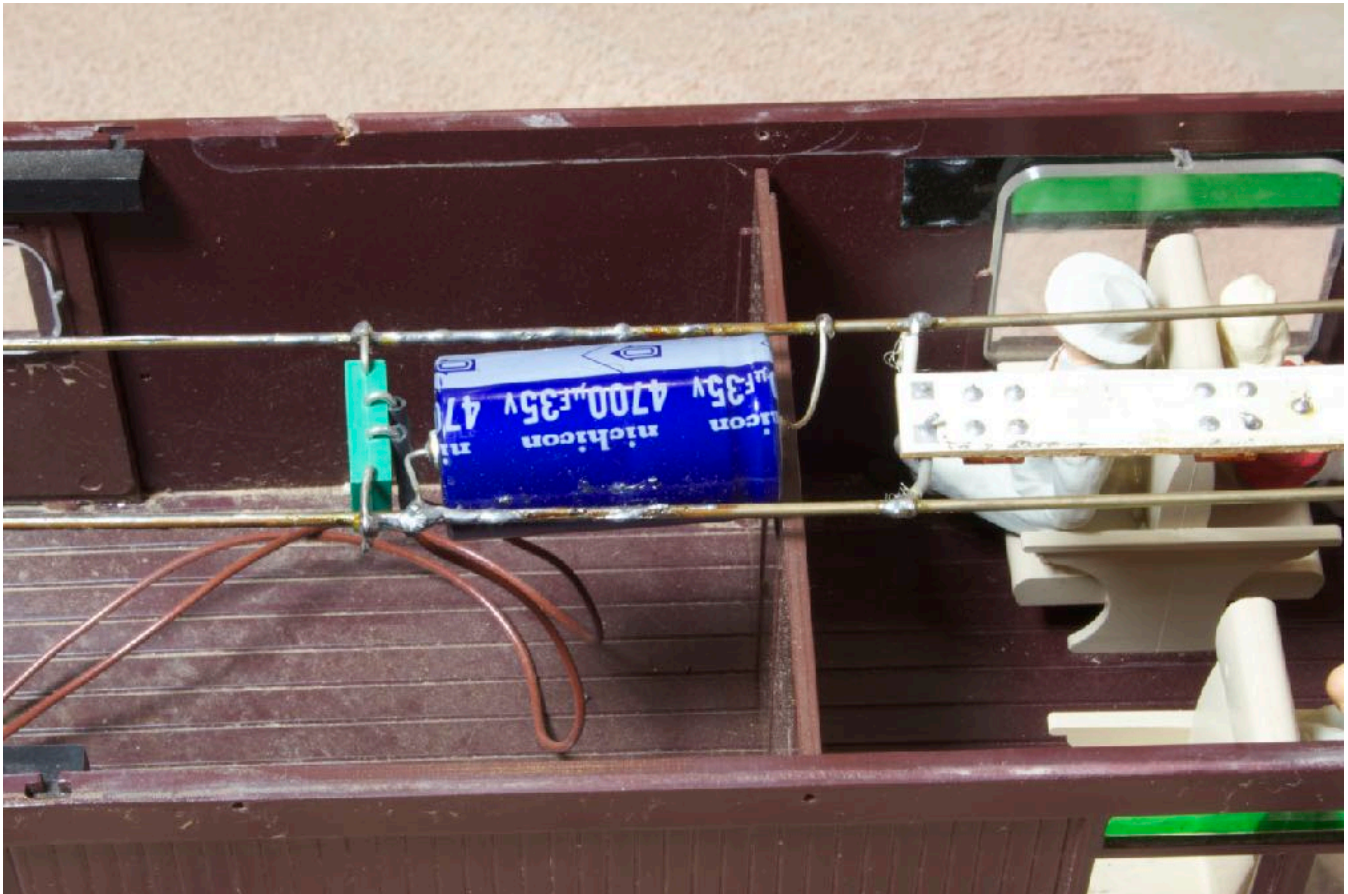
Eliminate the flicker with onboard energy storage. Since LEDs draw relatively little current, large electrolytic capacitors can fill the need. There is no need to revert to super caps or the large energy storage modules necessary to keep a motor turning.

Figure 9 shows closer detail of the power supply I built into the car. The brown wires bring track voltage from the truck (4). The green module is a bridge rectifier assembly. I

don't remember what the ratings for this one were, but 50 volts and 1 amp units are easy to find and inexpensive. Higher voltage or current ratings are okay, but not necessary.

The bridge rectifier puts DC on the two brass rods: positive on the far rod and negative on the near one. The LEDs can be hooked to these rods with a bridge rectifier connecting to the track. I did that originally and the LEDs flickered constantly. Time for energy storage.

I went back to my stock and found a 4700 uF 35 volt capacitor. This is the lowest standard voltage that is totally compatible with DCC standards (track voltage as high as 27 volts). However, if you promise not to use track voltages over 20 volts, you could use a 25 volt unit. Note that it is connected to the power rods correctly, with the negative lead connected to the one closest to the camera. This keeps the LEDs running for about 4 or 5 seconds with no power applied. If you want to experiment, try values in the range from 1000 to 10,000 uF. The higher the value, the longer the lights stay on.



9: Detailed look at power supply in lighted passenger car from figure 1

The advantage of using capacitors over rechargeable batteries is that there is no need for a switch to keep the batteries from fully discharging, which is hard on the batteries.

A decoder

Putting a lighting decoder into a car is not much different than doing a DCC installation into a locomotive. Only you don't have the motor connection to deal with. Some "function only" decoders have special things that need to be done to facilitate programming them. Be sure to read the instructions **before** you begin the installation. This way, you will reduce the repetitive rework.

Decoders require the same sort of energy storage whether they are for LEDs only or for motor, sound and lights: modules or external capacitors. The only advantage with LEDs is that you needn't have such large capacity units. A stayin' alive module that would power a motor for seconds will hold up LEDs for minutes!

So there you have a few of my views on car lighting.

If you liked this column, please click on the Reader Feedback link here and rate it **awesome**. Please join in the conversation that invariably develops there about the topics presented in the column. Share your experiences. Learn from others. Thanks.

Until next month, I wish you green boards.

From Mr. DCC's workbench

Your Digitrax system can wake up HAPPY.

One on-going issue folks seem to have with their Digitrax systems (except for the Zephyr series) is that they don't want to start or they wake up grumpy.

For reasons that I do not understand, Digitrax has the default configuration set so that it takes intervention with a DT400 series throttle to bring the system to life. They then hide the way to change it in chapter 9 of the Super Chief Xtra manual (<http://www.digitrax.com/static/apps/products/starter-sets/scfx/documents/SuperChiefXtra.pdf>). That section, starting on page 42 of the version referenced here, explains how to change the Option Switch (known as OpSw) settings that configure their command stations. The default for the command station is for all OpSws to be set to Thrown (t).



Here are the settings I recommend for the DCS-100 or DCS-200 system boxes. Note: I don't recommend the DB series boxes as system controllers; I only recommend them as boosters.

Close the following OpSws – this will require a DT-400 series throttle:

OpSw 5 – I don't know exactly what it does, but Digitrax recommends closing it. I don't understand why they don't have the default setting for whatever behavior they recommend.

OpSw 6 – **If you are using circuit breakers** to divide up your layout, close OpSw 6. That changes the booster shutdown time from 200 to 600 mS – from just under ¼ second to over ½ second. This gives the circuit breakers more time react before the booster shuts down and takes several districts with it.

OpSw 20 – Unless you are using your DCC system to run locos without decoders (a practice I recommend against), close OpSw 20. This will disable address 0000 running DC locomotives. The real reason for this is to stop the pulse stretching necessary to run DC locos. This will keep that from slowing down the DCC system response.

OpSw 33 and OpSw 34 – close these to have your system wake up and be ready to run when you apply power to the system. This saves you button presses on your DT-400 series throttle every time you power up.