Model Railroad Hobbyist |

DCC IMPULSES

column

BRUCE PETRARCA MMR

Click here for reader comments

Thinking through a DCC decoder installation

Getting started is the pivotal part of a decoder installation. But, before you heat up the soldering iron, there are a lot of things to think about and plan.

Some folks spend so much time thinking that they never start. Others jump in and find out half way through that they missed considering some critical areas before they started. Sometimes, no matter how much you seem to think ahead, things conspire to complicate the installation.

1. **Atlas (Kato-built) RS3 before decoder installation started.**

In this column, I'm going to walk you through the concepts and ideas as I install a sound decoder in an older HO Atlas (Kato-built) RS3 [1] for MRH Assistant Editor Don Hanley. Most "installation" write ups focus on what to do for a specific loco. I'm going to approach this from the point of view of what I'm thinking along the way. Hopefully, this will stir the creative juices in some readers.

For those that aren't aware of the loco, it is one of the good runners from the early Atlas HO era, when they were importing and selling Kato-built locos under the Atlas name. They are readily identifiable by the "Kato" lettering on the bottom of the fuel tank and trucks. Don has tricked this Erie model out with (inoperative) marker lights and individually applied grab irons and has weathered it.

The interior is unique, too [2]. There was a light board mounted above the motor with a single bulb and light pipes in the shell to direct the light to each end of the loco. There was no directional lighting on this puppy as it was built. There were two weights, one above each truck, that were a friction fit into the shell.

2. The interior of the Atlas RS3 showing the single centrally located bulb. The light pipes are inside the shell and not shown in this photo. The weights sitting on each end of the frame are not attached to anything. They are wedged into the shell when the loco is assembled. I call the assembly in front in this photo the "frame" and the one in back the "shell".

Initial decisions

There are things to think about before the loco is even opened.

Selecting a decoder can range from an easy choice to a totally vexing project. There are some "givens," such as, "does it physically fit in the loco?" and "will it handle the current draw and the number of functions needed?," that need to be answered.

For sound installations, questions arise about the sound sets and quality in various decoders. Sometimes a simple "make a semi-appropriate noise" inexpensive decoder is desired. Other installations need "rivet-counter" accurate sound. Consider your needs and budget.

Don wanted a LokSound decoder with the new Full Throttle sound package. A LokSound Select Direct is designed to mount directly on the Atlas motor and has six functions.

As explained on my website, I tested stall current to make sure that the LokSound Select Direct could handle the loco. With the bulb connected (increasing the test current), I measured 0.85 amps at 12 volts. The LokSound Select Direct is rated for 1.1 amps, so it fits, can handle the current and has more than enough light functions. It is a go.

To load the sound, I used the LokProgrammer, as discussed in my August 2016 column. The Full Throttle Alco 244D V12 turbo sound set (73401) was loaded. The LokProgrammer software needs to be version 4.4.21 or newer to load the new Full Throttle sound package. With the Select Direct, the only connection needed for the LokProgrammer is the track, so I just used a set of clip leads to the track pads on the decoder.

“How to get the sound out?,” is always a question. With similar locos, I’ve had good luck mounting the speaker on the weight and routing the sound out around the rear truck, such as shown on my website. The floating weights in the Kato design won’t work the the same way that those that are screwed down on later Atlas locos do. Time to improvise.

There were two choices. The easy way would be to mount a sugar cube speaker with an enclosure or iPhone speaker in the shell and let the sound make its way out.

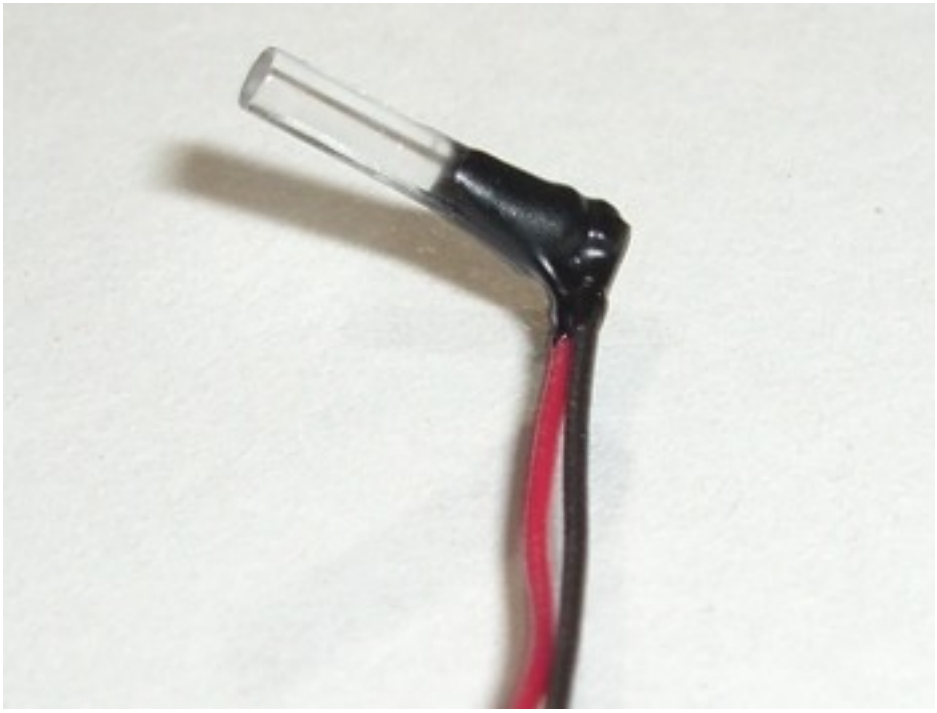
Don wanted the best sound possible and is willing to double head locos if necessary. So, we decided to remove weight and build a baffle that would

direct the sound out the front truck from the front of the speaker. Sound from the rear (magnet) side of the speaker would be left to filter out the rear truck opening.

For more help with the sound design concepts, see my August 2012 column, "How Do I Get The Sound Out?" and the accompanying You Tube video.

There won't be room for the light pipes and the speaker in the final installation. Besides, the single bulb design is dated. So I decided to install LEDs.

3. LED mounted to a clear light pipe from Streamlined Backshop. Designed to fit Athearn openings, they work just perfectly in the Atlas / Kato-built. *SBS4DCC photo*



With the dual openings on each end of the loco and Don's investment in the looks of this loco, I decided to go with LEDs that are designed to mount in each hole. MRH advertiser Streamlined Backshop has just such a critter. While they are designed for Athearn locos [3], they fit perfectly in the Atlas / Kato-built shell. The 4-pack has just enough LEDs for this installation.

4. Ulrich Models resistor board allows connection of eight LEDs to "track level" decoder outputs. It comes with 1KΩ resistors, as shown. *Ulrich Models photo*

With these four LEDs mounted in the shell, there would normally be a bunch of wires (five to eight) between the shell and the frame. Ulrich Models to the rescue. They make a board [4] that can be used to combine these into three wires and provide a separate resistor for each LED. The board comes populated with 1000 Ω (1KΩ) resistors. My plan was to use this board.

I had a couple of boards in stock. I went to verify the price from Ulrich and didn't find their website. I did find the boards for sale by them on eBay.

An alternative method would have been to have cut off the light pipes just inside the shell and mounted one LED on each end of the frame such that it would shine on the light pipes. This would eliminate the need to bring wires from the frame to the shell. It would be less expensive, but more cumbersome.

The installation

Okay, we have made the design decisions. Here is how it all came together.

Check out the sidebar for the actual parts and some of the supplies used.

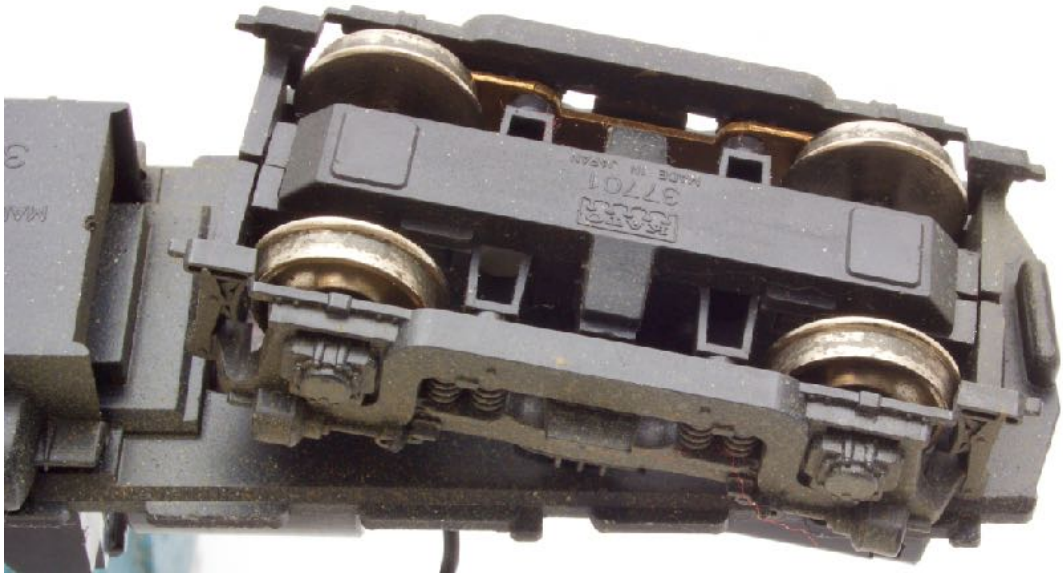
Before moving on to my methods, now would be a good time to review tips and techniques I've discussed in prior columns. Specifically, I recommend:

My first two columns on the basics in October and November 2011. Also, check out my 17 tips column from June 2013:

Preparing loco

Before I install a decoder, I like to clean and lube the loco. The wheels on Don's had collected a bunch of crud over the years [5], which is typical for older locos.

5. The wheels need cleaning as can be seen in this close-up photo.



In the process of cleaning the wheels, I noticed that the gears were cracked. This can be diagnosed by checking each axle separately.

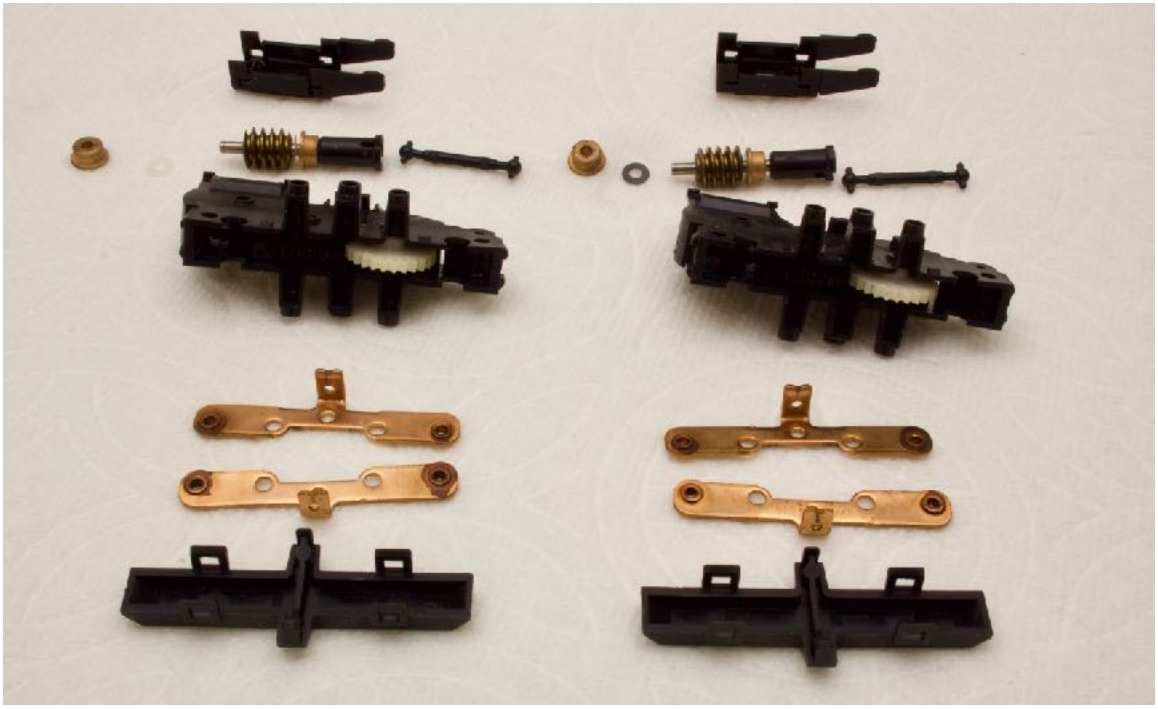
Hold one wheel stationary (I use my thumb) and try to turn the opposite wheel. If they turn independently, frequently the gears that hold the metal axle shafts are cracked.

This situation is very common on Proto 2000 locos, especially those from the mid 1990s. The Atlas Kato-built locos are less prone to this cracking, but not immune. I ordered four new axle sets (two wheels plus a gear per axle) from Atlas. They have a very good stock of replacement parts and are good folks.

I ordered extra gear train thrust washers and a few other parts at the same time. I frequently loose the pesky little thrust washers, so having extras on hand is a blessing. Besides, they only cost a few pennies each. Thinking ahead here saves time and (postage) money.

While I was replacing axles, I decided to completely rebuild the trucks, cleaning out the old lubrication and replacing it with Nano-Oil. I disassembled the trucks as shown in [6]. I don't recommend taking apart the gear boxes any further unless you are very familiar with locomotives and reassembling them.

6. The parts of the loco drive train after cleaning. They are laid out drying on a paper towel organized like an exploded view. Note the (new) black thrust washer near the right gear. There is an original (white to clear) one that is barely visible next to the left gear. These guys are easy to loose, that's why I ordered extras.



I put all the parts in a stainless steel cup and filled the cup with my cleaning solution. I use 4 parts of 50% isopropyl alcohol to 1 part Simple Green degreaser. The easy way is to take a pint or quart bottle (liter or smaller) of 50% isopropyl and fill the empty space with Simple Green. I frequently find both at a "dollar store."

I filled the ultrasonic cleaner (an inexpensive model from Harbor Freight) about half way with water. Then I put the cup in the ultrasonic and ran a cycle or two. I used a stainless steel screen ("dollar store", again) to separate the parts from the cleaner. I filtered the cleaning solution through paper towels back into the bottle so I could reuse it.

While the parts were still wet with the cleaning solution, I used an acid brush (cut off to about ⅜ inch bristles) moistened with more cleaning solution to work the old lubricant out. Once they were all clean, a clear water rinse made them ready to spread out for drying [6].

After the parts dried it was time to reassemble the trucks. I lubricated them with Nano-Oil [7]. I own a kit of three weights: 5, 10 and 85. The 5 weight is used to penetrate small spaces and suck the 10 or 85 behind it. So I coated all mating surfaces with 5 and then applied 10 to the bearing surfaces and 85 to the gear teeth.

7. Nano-Oil in 5, 10 and 85 weight viscosities.

Yes, I have found a major improvement in the smoothness and low speed running of locos when they have been cleaned and lubed in this manner. Is it worth the time and money? I firmly believe so.

I used a rubber coated very flexible wire to run between the copper side frames and the decoder terminals. Northwest Short Line called this wire 2951 (29 AWG made of strands of 51 AWG wire). I slipped a bit of shrink tubing [8] onto the tab after I soldered the wires to the side frames.

8. The truck side frames with wire soldered and shrink tubing providing some strain relief.

Whether you have rebuilt the trucks or not, now is the time to check the wheel spacing against a NMRA (or equivalent) gauge.

Time to work on the shell

I installed the Streamlined Backshop LEDs, using MEK to hold them in place - applied ***sparingly*** inside the shell. I shoved them as far through the shell as possible [9]. When the MEK had set up, I clipped the light pipe off with cutters and sanded the end lightly. A drop of Faller Expert cement brought the optical surface back to top condition.

I slid a bit of shrink tubing over the four wires from each end of the loco to help dress them in place and keep them out of rotating components in the final assembly.

The Ulrich Models resistor board [4] was installed in the shell with a bit of caulk and allowed to cure overnight. The next day, I wired it.

9. Detail of the installation of the LEDs in the long hood of the RS3.

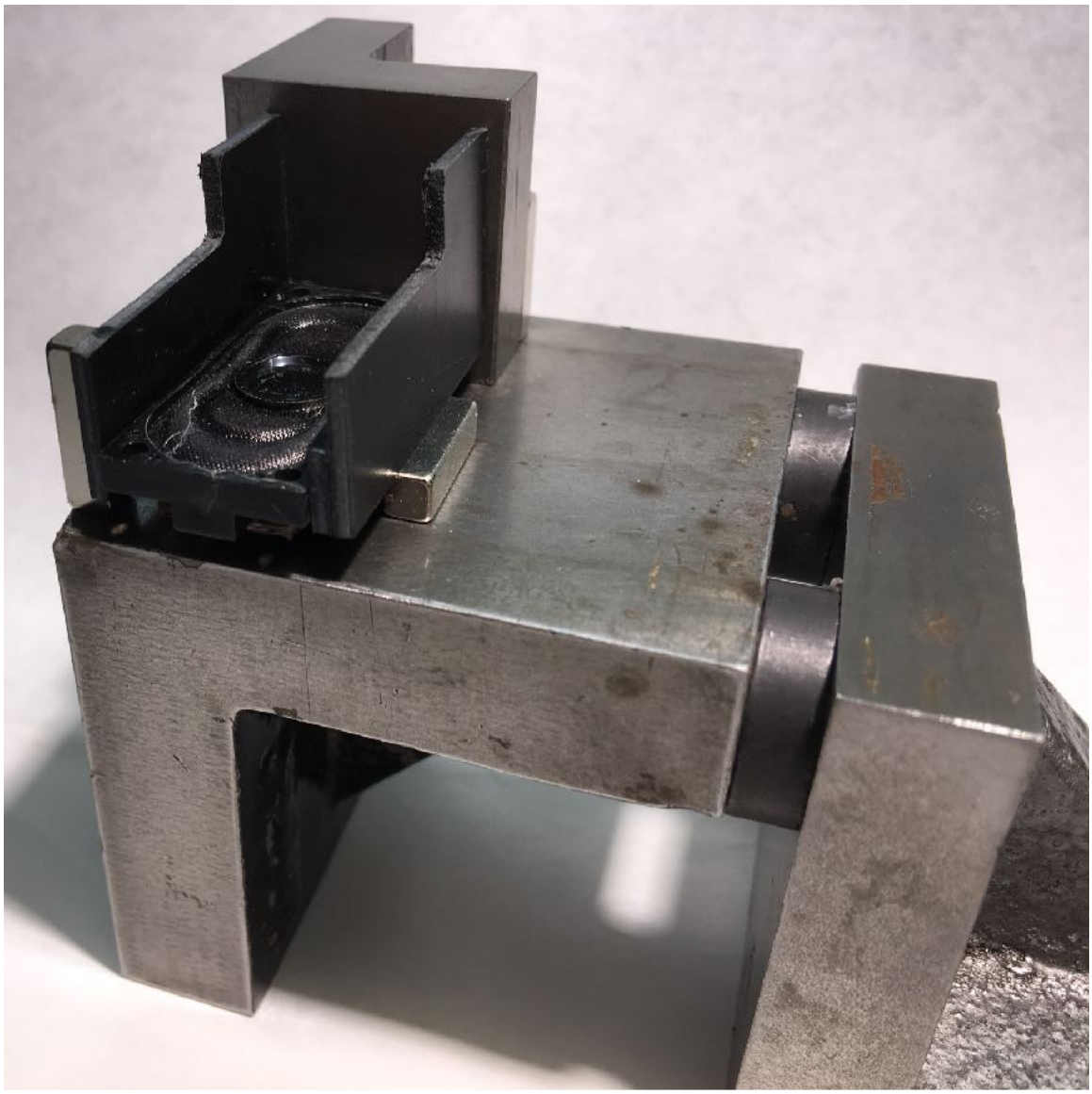
Time to work on the frame

The (16 x 35 mm) speaker was glued to bits of black styrene to create part of a baffle to direct the sound down over the front truck. The sample fitment [10] shows 0.06 thick styrene being held in place next to the speaker using magnets and a group of 3-inch and 1-inch angle blocks.

The size of the ears was determined such that the speaker will just clear the gear tower when at the extremes of its movement. Failure to assure this clearance will result in a loco that derails on curves and grades. Don't ask how I learned this. The story is too embarrassing.

Notice how I used two magnets to hold one angle block [10] with the flat side up. This gave me a magnetic surface that was level and raised up by the three inch thickness of the angle block.

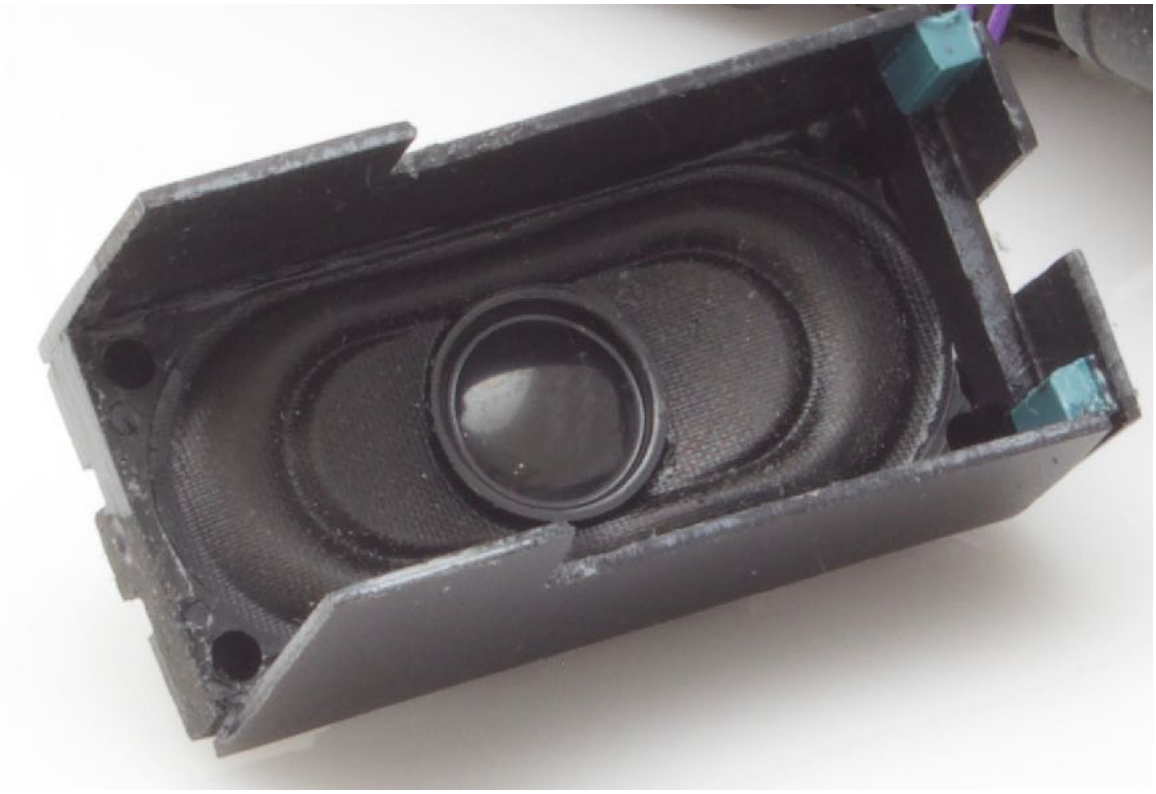
10. Speaker baffle being designed on a set of angle blocks with magnets.



Once the size was worked out with the thicker styrene, the “ears” were replicated in (thinner) 0.03 inch thick styrene and more of a baffle was built around the speaker [11]. The front was left open - the shell will complete the baffle there. Some pieces were added to the rear (along with blue square parts to strengthen the corners). An opening for the drive shaft was left. While this will diminish audio quality a bit, it is necessary to allow the loco

to run. Bits of square plastic were glued over the mounting holes to reduce air transmission front to rear. These bits of plastic are on the opposite side from the view in [11], so are not visible there.

11. Close-up of the speaker baffle



Since I was using external resistors, the on-board resistors on the LokSound Select Direct decoder needed to be bypassed. Instructions for this modification are on the LokSound instructions. This is easiest to do on the decoder before installation into the loco.

The decoder was then snapped into position on top of the motor and wired to the motor and trucks [12].

12. Decoder and motor wired. Now is the time to test the loco on the programming track.

It was time to test the basic installation. The loco was put on a programming track and the address was read (3) and new addresses were written (short = 14; long = 1014, with long address active). When the programming was done, the loco was run on address 1014 to verify operation.

Next, I wired the LEDs to the Ulrich board and test fit the shell on the frame. It turns out that the LokSound design is a bit thicker than other similar decoders and there wasn't enough room to get the Ulrich board in the shell above the decoder.

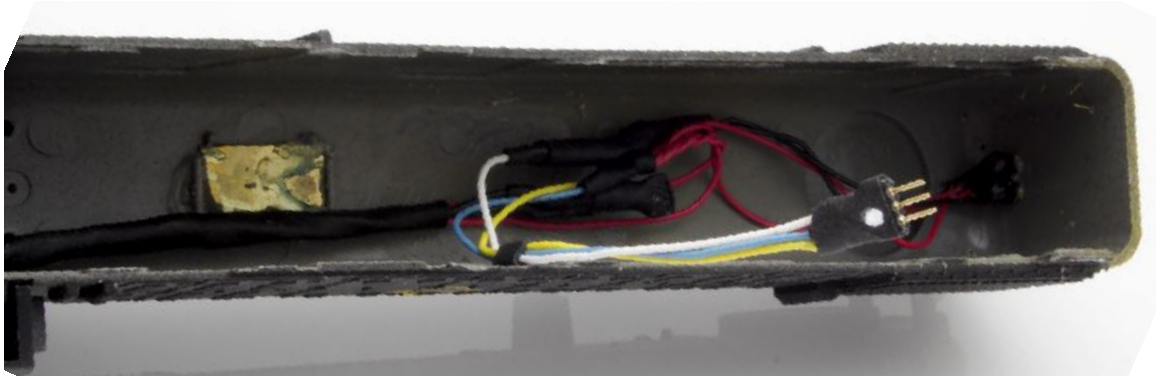
No matter how much you plan ahead, it seems that some gremlins can get you along the way. Time to rework the installation.

So, I removed the Ulrich board and wired all the LEDs together with 750 Ω resistors in the negative lead (between the black wire of each LED and the yellow or white wire, as appropriate).

These three wires were connected to a three-pin male connector created out of 50-pin headers. I wired the blue to the center pin. That way, if it is reversed in the socket, there will be no damage just the wrong light will be

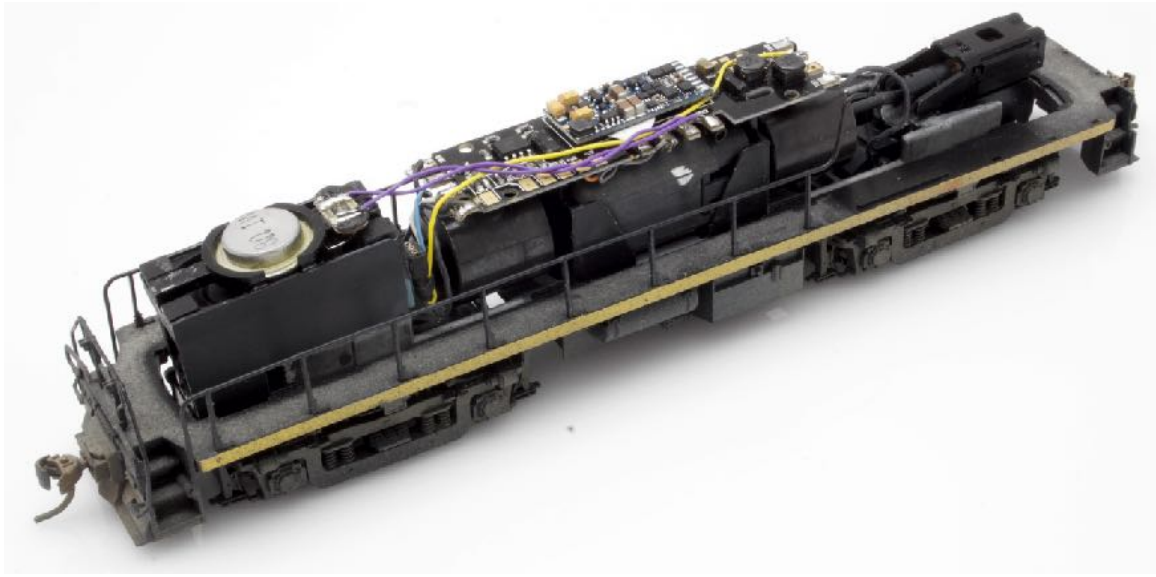
lit (reverse light when going forward). This connector with the polarity dot is shown in [13]. Having a connector in the three light wires allows the shell to be totally removed from the frame.

13. The wiring details inside front end of the shell. The brass plate is a heat sink from the original bulb installation.

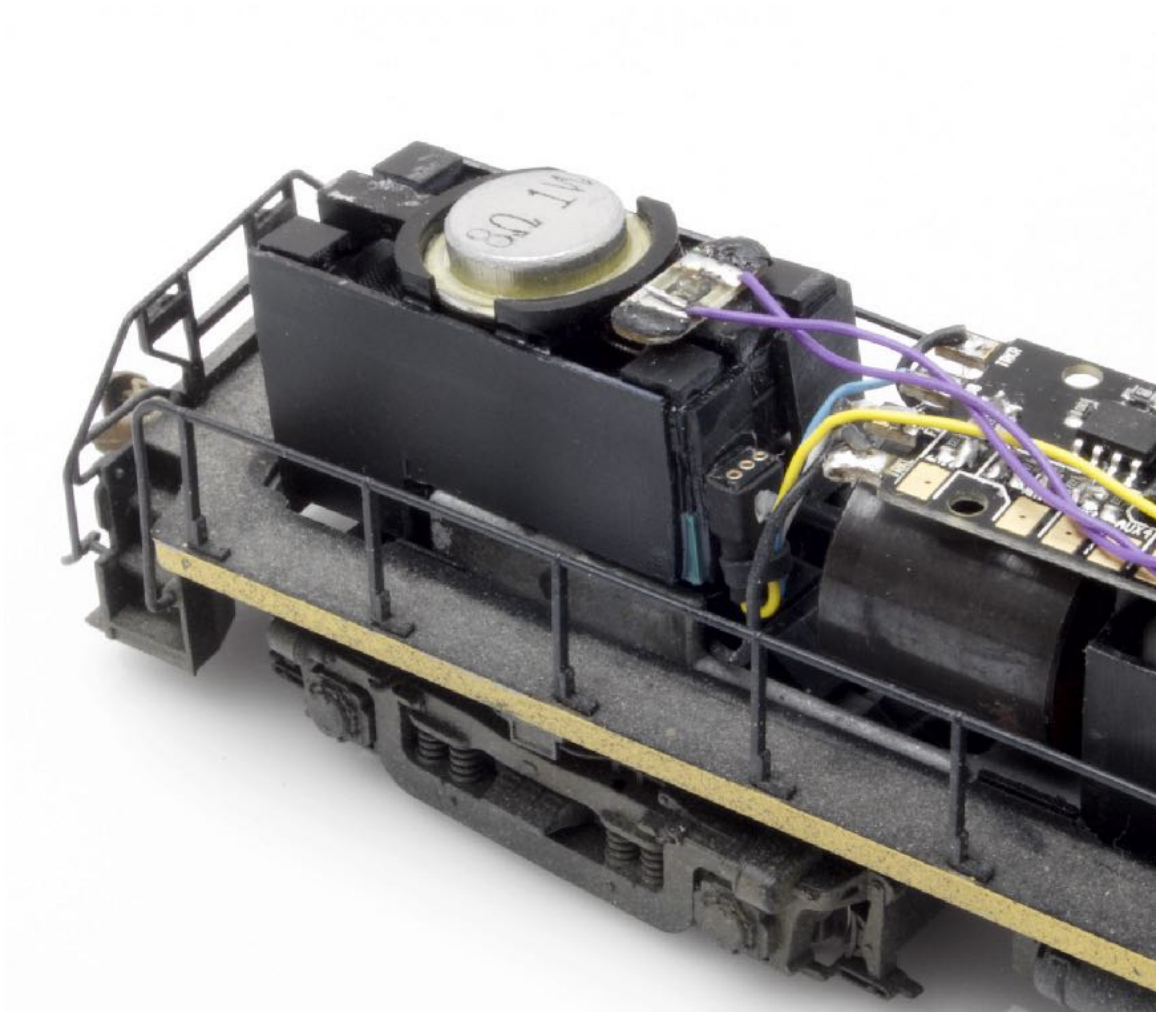


The wiring was finalized by connecting the speaker and the (female) socket for the LEDs, as shown in [14]. The speaker sits on the frame in a manner similar to the way the weight balanced previously.

14. The finished frame, ready for shell installation. The lighting connector was plugged together with the white and yellow wires oriented to be together.



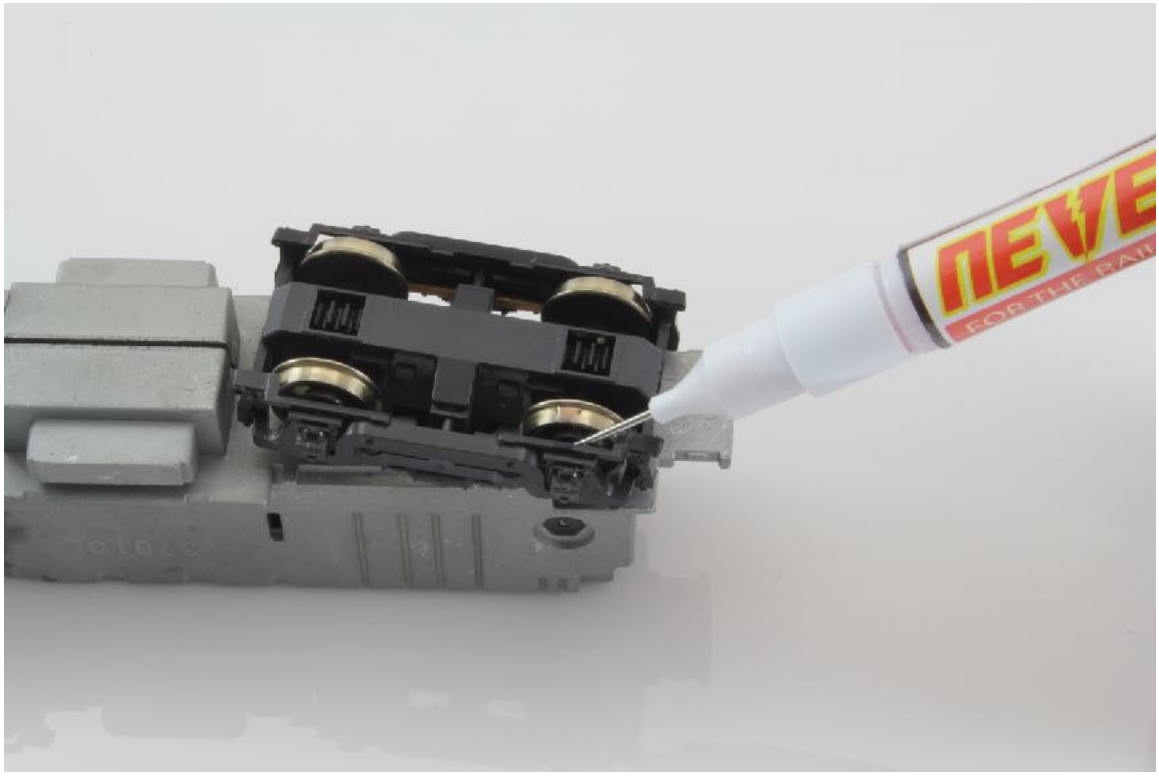
15. Detail view of left side of speaker baffle showing 3-pin lighting connector glued to the the side. The white dot on the side of the lighting (female) connector needs to be aligned with the similar dot on the male connector coming from the shell to get the correct lights on for the loco direction.



As you can see there is a lot to fit into this loco. I decided not to put the rear weight in. It just made the assembly too difficult.

As a final touch, I used Never-Stall to lubricate the rolling contacts where the power is transferred from the wheels to the side frames. This is shown on a similar loco (HO Kato NW2) in photo [16].

16. Applying Never-Stall to the axle to side frame contact to help with conductivity and lubricate the contact.



Now that Don Hanley has his NCE PowerCab controlled DCC layout, as detailed in the January 2017 MRH, he needs a switcher for it. Here it is. Having lost both weights, it won't pull quite as strongly as before the installation. However, his usage on a level switching layout will probably not tax its current capability. The sound is amazing. I imagine he will want to turn it down.

Please share your experiences and ideas. Just click on the Reader Feedback icon at the beginning or the end of the column. While you are there, I encourage you to rate the column. "Awesome" is always appreciated. Thanks.

Until next month, I wish you green boards in all your endeavors.

SIDEBAR

Parts used

LokSound Select Direct decoder
16 x 35 mm speaker
Styrene sheet (0.03 thick)
Styrene square (0.1 x 0.1 inch)
Athearn LED assemblies (kit of four) from Streamlined Backshop
750 Ω ⅛ watt resistors (4 each)
Replacement wheel / gear sets from Atlas
Replacement thrust washers from Atlas
50-pin male / female header stock

Some supplies used

MEK (Methyl Ethyl Keytone) solvent
Faller Expert styrene cement
30 AWG wire in several colors
2951 wire
50% Isopropyl alcohol
Simple Green degreaser
clear caulk
shrink tubing in several sizes