Brass Steam Loco DCC Installation Tips

I've been doing a bunch of HO brass steam loco installations recently and want to share my thoughts and ideas with you this month. These techniques will work just fine for HO, HOn3, Sn3 or S-scale locos - generally those with 1-amp rated decoders. There might not be enough space in an N-scale engine for some of the things covered here.

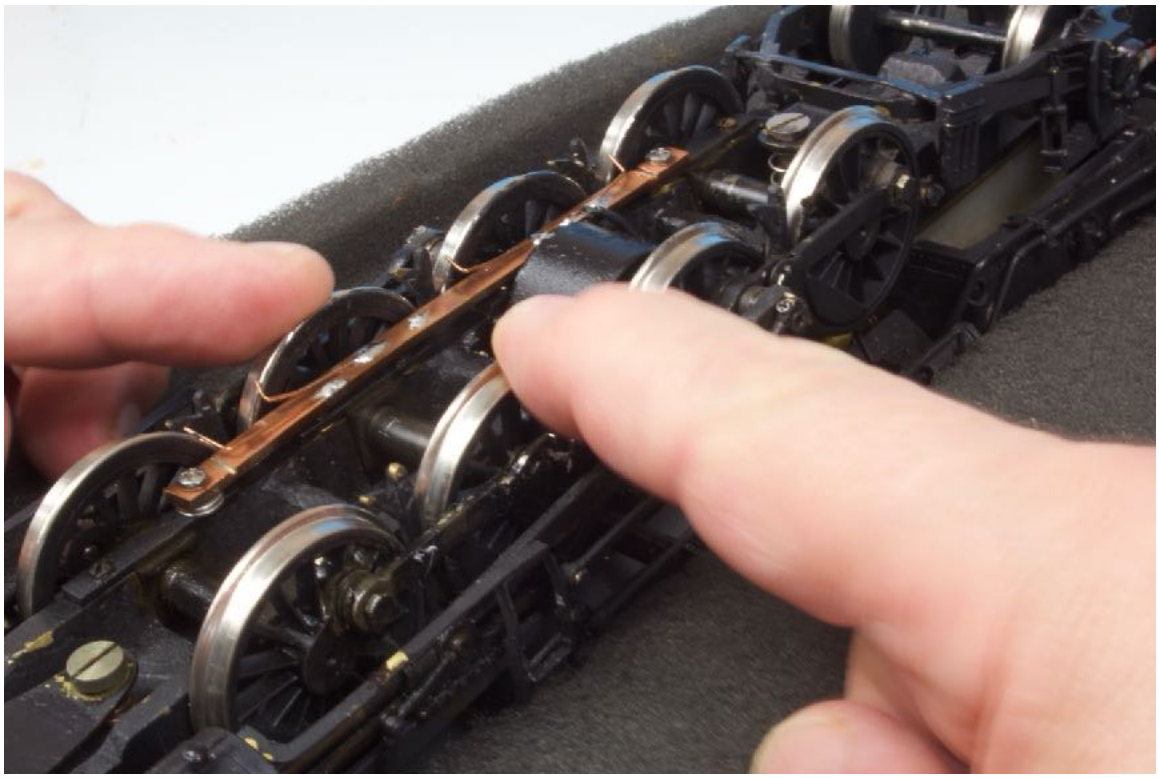
O scale and larger are similar, but will need heftier connectors to go with the beefier decoders due to the larger motor load. These are all sound installations. Non-sound installations would be very similar, just no need for the speaker and associated wiring.

First, make it run well

The mantra I frequently repeated is, "DCC will exaggerate your loco's operation. If it runs well, it may run better with DCC. If it runs poorly on DC, it will probably run worse with DCC."

Many of the brass locos folks are converting these days are 40 or more years old. A lot has changed in the interim. Here are areas to consider before starting a DCC installation.

1.TESTING DRIVERS FOR LOOSENESS



Drivers: Over time the drivers can loosen on the axles. They can move back and forth, perhaps enough to upset the quartering, causing binding of the rods. A quick check [1] is to place the loco upside down on a foam cushion or other padding and grab the drivers on one axle. Rotate one driver forwards and the other backwards. Repeat for every driver axle. If there is any slop, then a major repair is needed. For long-term reliability, re-quarter and glue the drivers, even if there is no slip.

Motor: Older motors can be inefficient, noisy and may lack the smoothness of new motors. For best performance replace any of the open-frame motors [2] and test can motors for operating and stall current before starting a DCC installation. Changing out the older, inefficient motor for an efficient one makes for a better performing DCC loco.

2. OLDER, INEFFICIENT, OPEN-FRAME 3-POLE MOTOR. NOTE ALSO THE AGED PIECE OF TUBING USED IN THE DRIVE LINE. MARK SCHUTZER PHOTO

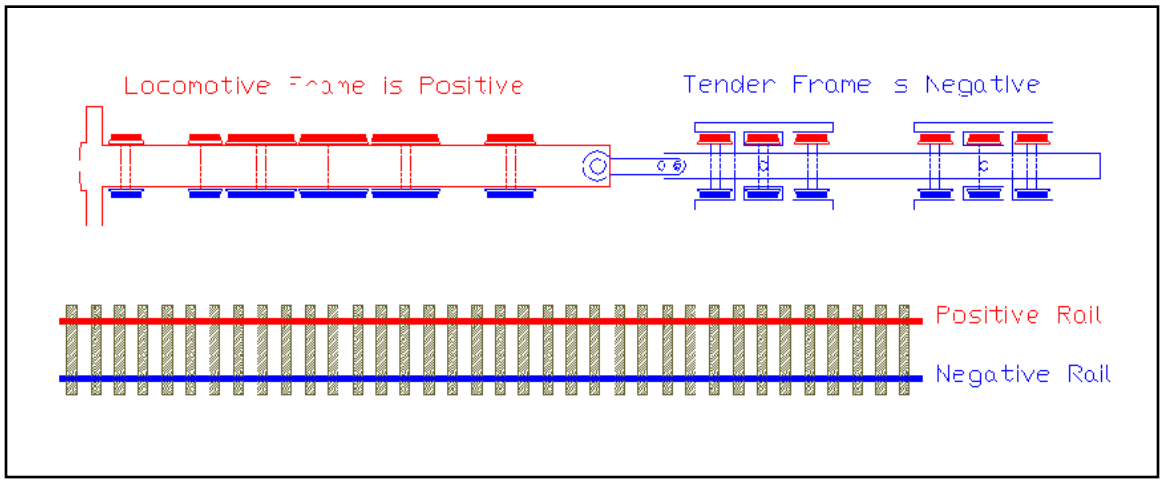
Drive train: The drive line [2] and gear box or open gears are very likely to contribute to poor running in older locos. Solutions here revolve around installing U-joints to replace tubing in the drive line, and serious gearbox work. The gearbox may work fine with cleaning and lubrication. However, replacement with modern designs including lower gear ratios is frequently the way to go. This repair and reworking is beyond the scope of this DCC column. However, my friend Mark Schutzer has done clinics all about this at several venues. I was able to attend his clinics at the NMRA national convention in Sacramento in 2011.

His clinics are available on line. See:
www.markschutzer.com/Brass_Clinics/TroubleshootingBrass2011.pdf and
www.markschutzer.com/Brass_Clinics/RebuildingBrass2011.pdf

A lot of information is packed into these clinics. Anyone working with brass steam locomotives can benefit from studying them.

Power pickup: Most brass steam locomotives use the same pickup methodology [3]. The locomotive frame is electrically connected to the right wheels and the tender frame connects to the left wheels and the electrical power from the left wheels is transferred to the locomotive via the draw bar.

3. Brass steam locomotive wheel polarity - top view. of locomotive and track. Mark Schutzer diagram



Installation techniques

There are two basic approaches to decoder installation.

One approach puts the decoder and speaker in the tender. This way, wires between the loco and tender include right rail, motor, and whatever lights are used in the loco (head, marker, firebox, cab, etc.). This is the approach I prefer and will feature in this column. It gives the most options for speaker size and a nice-sized tender enclosure. If a lot of different lights are going to be used in the loco, the option for a second function-only decoder in the loco exists.

The other approach is to put everything, or almost everything, in the locomotive. This method may require no additional wires between the loco and tender if using the draw bar to bring the left rail power to the locomotive. This approach is workable in O and larger scales some times. In S and smaller scales, it is hard to find enough room in the boiler for

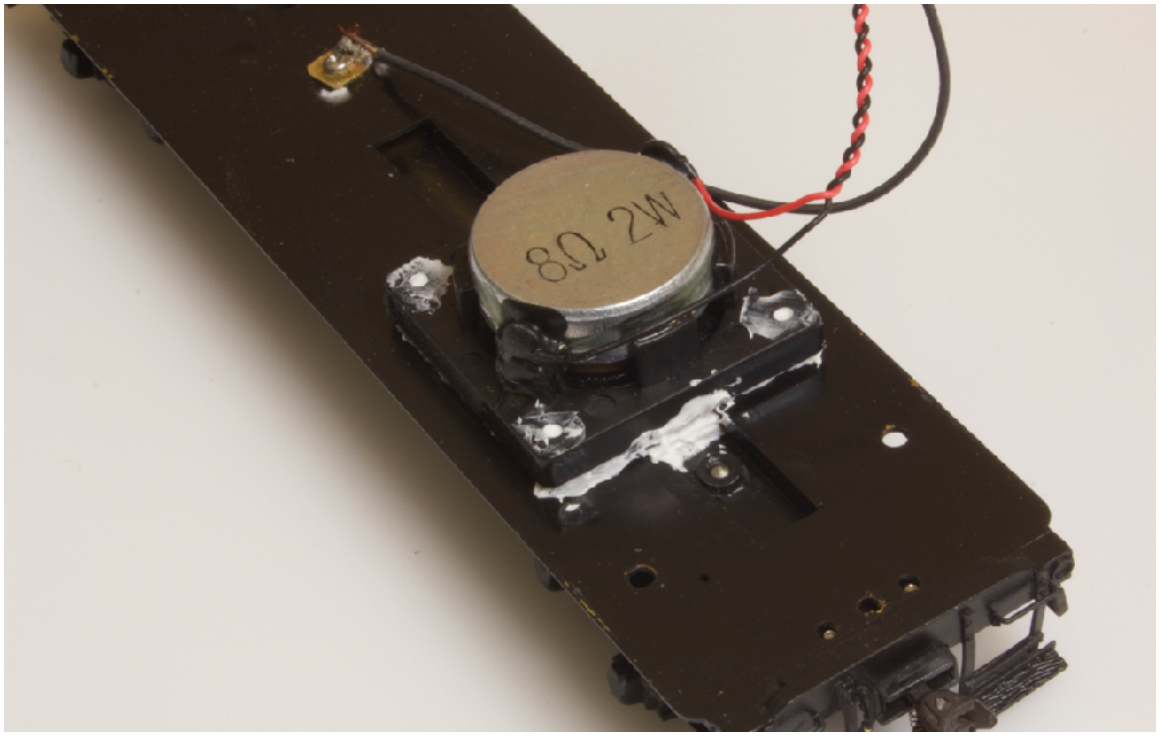
the decoder, speaker, lighting control and motor. The sound frequently suffers from the smaller speakers necessitated by the limited space. Frequently, too, weight must be removed to make room for all the parts. The advantages are no, or few, wires between the loco and tender and the ability to channel the sound out the stack, making for a sharper aural image coming from the loco, not the tender.

The focus here is on mounting the electronics and speaker in the tender. Most of the techniques will work regardless of where the parts are located.

Getting the Sound Out

In my August 2012 column, ***How Do I Get the Sound Out?***, I concentrated on baffling the sound out of a diesel locomotive. I find that steam sound is best when the entire tender is configured as an enclosure, or box.

4. SPEAKER (HIGH-BASS TYPE) MOUNTING IN A BRASS LOCO TENDER. THE SPEAKER WAS HELD DOWN AND SEALED WITH WHITE CAULK. THE THREE WIRES COMING OFF THE TOP OF THE PHOTO GO TO THE TENDER CONNECTOR.



Yes, the boiler could be configured as a baffle, with one phase of the sound (positive pressure) coming out the stack and the other being routed out near the cab. A few folks

have the resources, time, talent and patience to mount larger speakers inside HO-sized boilers. To keep it simple, we will not pursue this avenue.

Many tenders, such as the one shown in [4] have openings in the floor for speaker mounting. Absent those holes, it is fairly easy to drill your own.

A high-bass speaker slightly over an inch in diameter (27 or 28 mm) will usually fit the width of an HO-scale tender. The square version is a bit less tall and may fit better. If you can use the deeper round version, even better. Many high-bass speakers need 0.04” (1 mm) thick shims in front to keep the cone from hitting the floor. Keep this space in mind when planning the installation. In [4], the shims are used. Being black and covered by the white caulk, they blend in.

Be sure to dry-fit all the pieces before you start mounting things permanently. I would love to say that I've never misjudged. But … there are some installations that I've had to rip out and start over when I couldn't get the shell to close.

Wiring between loco and tender

Plan your work and work your plan. I used to scratch out on a sheet of paper how many wires I needed and where they would go. I found that each loco was different this way.

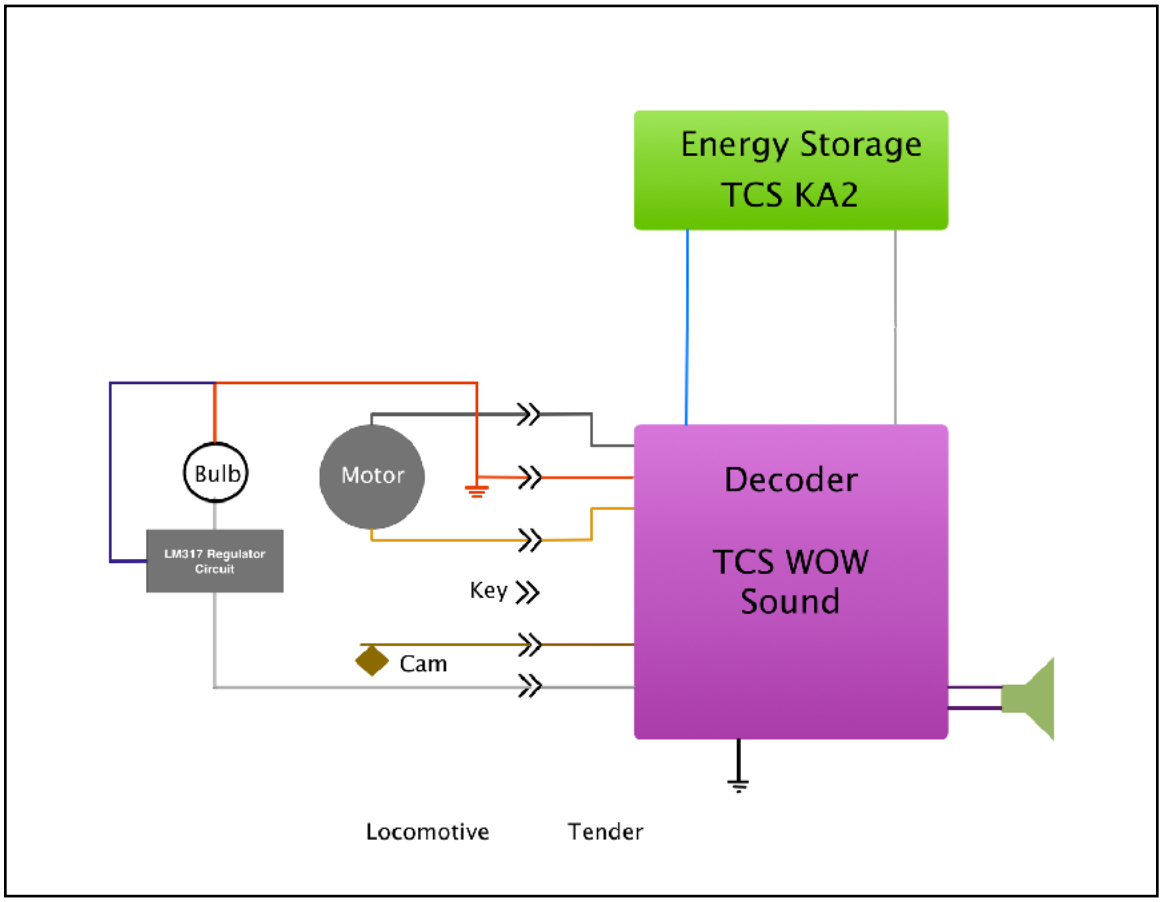
Then I graduated to using a paint program to draw a more formal diagram to give to the locomotive owner. That was better, but I still was inconsistent. I found that I didn't take the time to go back and look at what I had done previously, so I was constantly reinventing the wheel.

Last year, I started using a photo editing program (Photoshop is the best known but I use PixelmatorPro on the Mac). These programs allow more detailed drawing than paint programs and they also utilize layers. I was able to build a master file [5] that had most of the features that I would build into an installation. Thus, I can bring up the master file and enable the layers that are used on a specific installation, such as lights, or a cam, or energy storage.

For example, in [5] the gray box labeled "LM317 Regulator Circuit" and the blue wire that connects to the red wire is a layer. When that layer is turned off, it vanishes. Similarly, the "Energy Storage" module and the associated wiring are a layer.

Using a common template for wiring diagrams is not only quick, but it keeps the wiring consistent between locos.

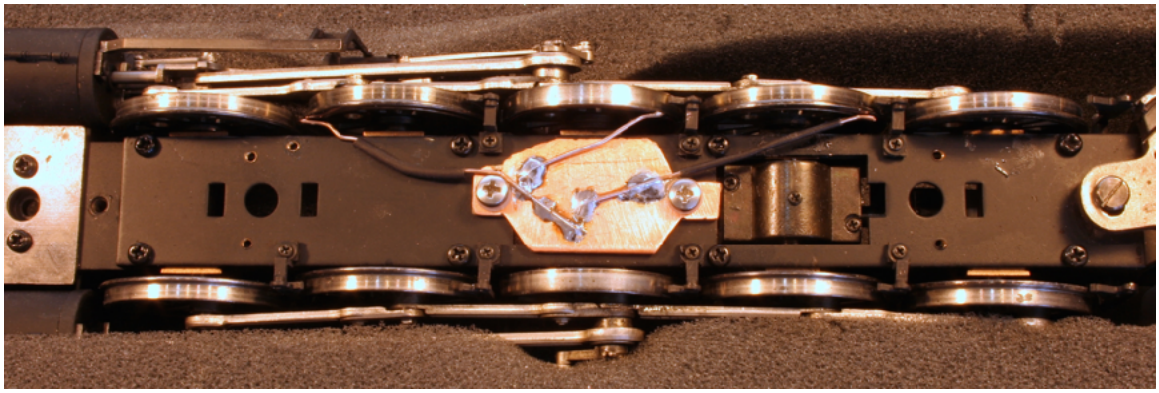
5. Sample wiring diagram created in Pixelmator. The connector is represented by the arrowheads in the middle of the diagram.



Power pickup

Before the recent development of large energy storage systems (TCS Keep-Alive and SoundTraxx CurrentKeeper, to name two) it was imperative that opposite-rail pickup [6] be added to the locomotive and tender for reliable operation. I have rallied for adding those pickups. The last few HO-scale brass steam locos that I've done have successfully utilized energy storage modules without additional pickups.

6. Added power pickup in an O-scale locomotive.



I still recommend adding pickups in the larger scales, like O. The motors take a lot more energy to run, making the energy storage systems relatively ineffective. The good news is that the larger scales have more room for the pickups.

Lighting

Many of these older brass locos had jewels instead of active lights. If the modeler has the skill and tools to drill out the reflector and insert a light, a lot of realism can be added. A LED is the way to go. Small SMD (surface mount device) LEDs are available, some with wires attached.

Be sure to shrink 3/64 inch tubing over the enamel-insulated wires where they penetrate the shell to prevent abrasion from causing a short. It would be a good idea to strip some larger (20 AWG or so) wire and use the insulation as a cover for the enamel wire pair until you get them safely to where you can pigtail them with regular insulated wire.

Also, make sure that the LED contact is insulated from the shell. Filling the lens area with Pacer Canopy Cement (by Robart Mfg. Inc – available through Walthers dealers) while the LED is held a bit away from the reflector does two things – insulate the LED and provide a realistic looking lens.

"Half wave" wiring of LEDs works just fine. This is where the anode (long pin) of the LED is connected directly to one rail (the frame of the loco or tender) and the other lead connects through a dropping resistor to the function (white or yellow) decoder lead.

For more options, see my web site: https://mr-dcc.com/index.php/dcc-info/lighting

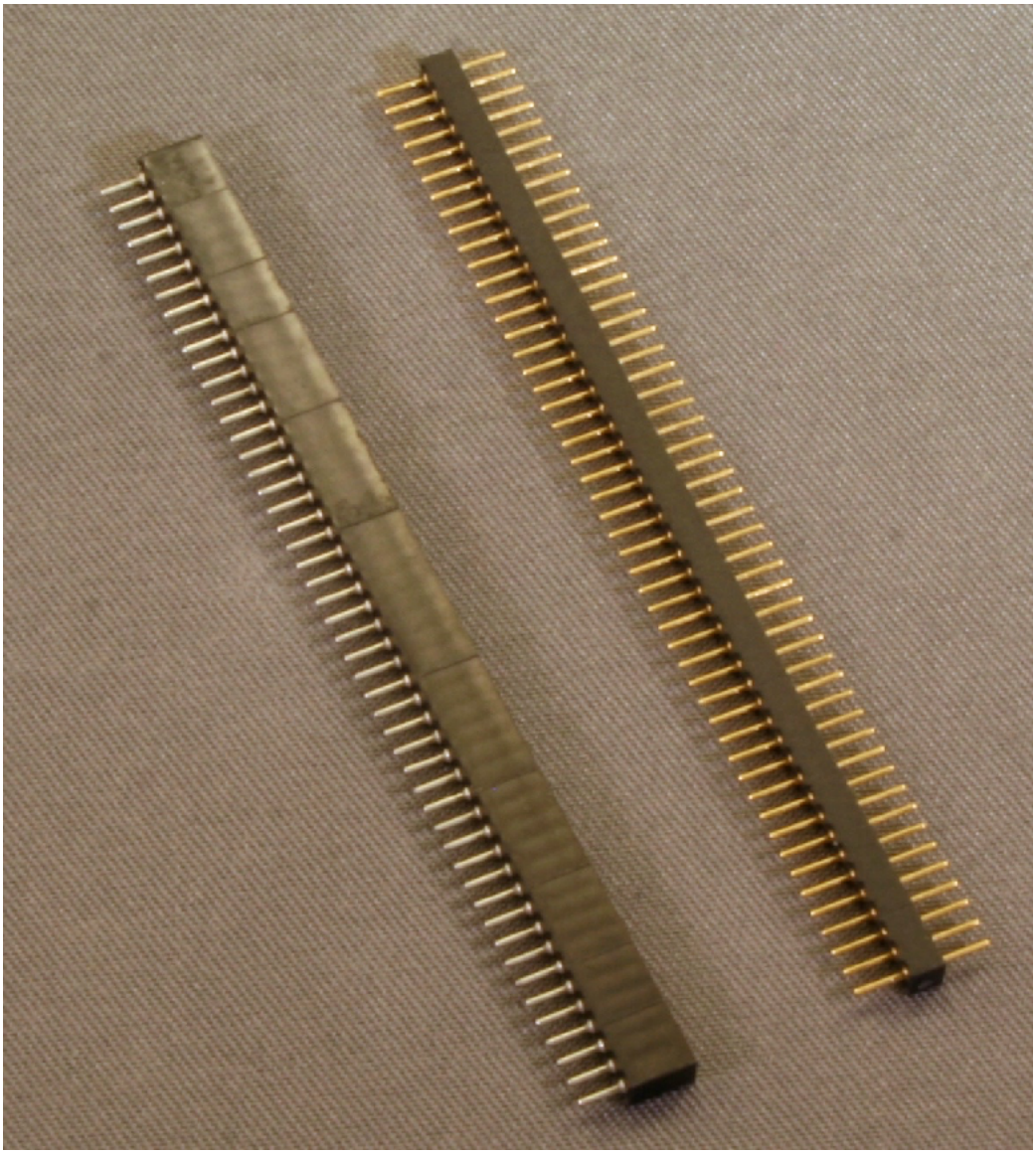
The 50-pin header

Litchfield Station stocks a 50-pin header set www.litchfieldstation.com/xcart/product.php?productid=999003204 which can be cut up into connectors with exactly the

number of pins needed. It has the same pin size and spacing as the 6-pin NEM651 connector found on some N-scale decoders. The pins are good for about one amp of current.

Use wire cutters to cut out the number of pins needed, based on the wiring diagram. Plan on losing one pin. So, if a 6-pin connector is needed, cut on the 7th pin. Keep the loose pins, as occasionally you may need a 1-pin connector.

7. 50-pin header - the starting point for connectors.



Heat-shrink tubing (3/64” diameter) on every other pin will insulate the connections. Larger (⅜” to ½”) shrink tubing over the entire wired area will finish off the connector and insulate all the connections from the outside world. Finish the assembly with a bit of

white paint on one side of both the male and female connectors as a reminder of the proper orientation for mating.

Tender floor assembly

As mentioned earlier [3], the tender frame and shell is connected to the left rail. This makes it the connection point for the decoder black wire. This screw is visible in the rear of figure [4].

Drill a hole and tap it for a small (0-80) machine screw. To scrape the paint off, take out the rotary tool and a cutoff disk. Just a touch with the disk will knock the burrs off and clean the area around the hole right down to the metal. A solder lug may be made out of a bit of brass with an 0-80 clearance hole drilled through it. Any copper or brass bit of metal will work.

The speaker [4] got .040” styrene strips glued to its front, like a picture frame. Then the assembly was held down with caulk. On this sample, I used white, instead of my usual clear, for ease of viewing. The caulk was also used to plug places where sound pressure could sneak around the speaker. These include the unused mounting holes and the small opening below the center of the speaker where the tender floor drops.

Cut a 3-pin plug and socket from the 50-pin material. Wire the male side to the wires coming from the tender floor: the speaker and power. Use the center pin for the power. That way, the connection is symmetrical and it doesn't matter which way the connectors are mated.

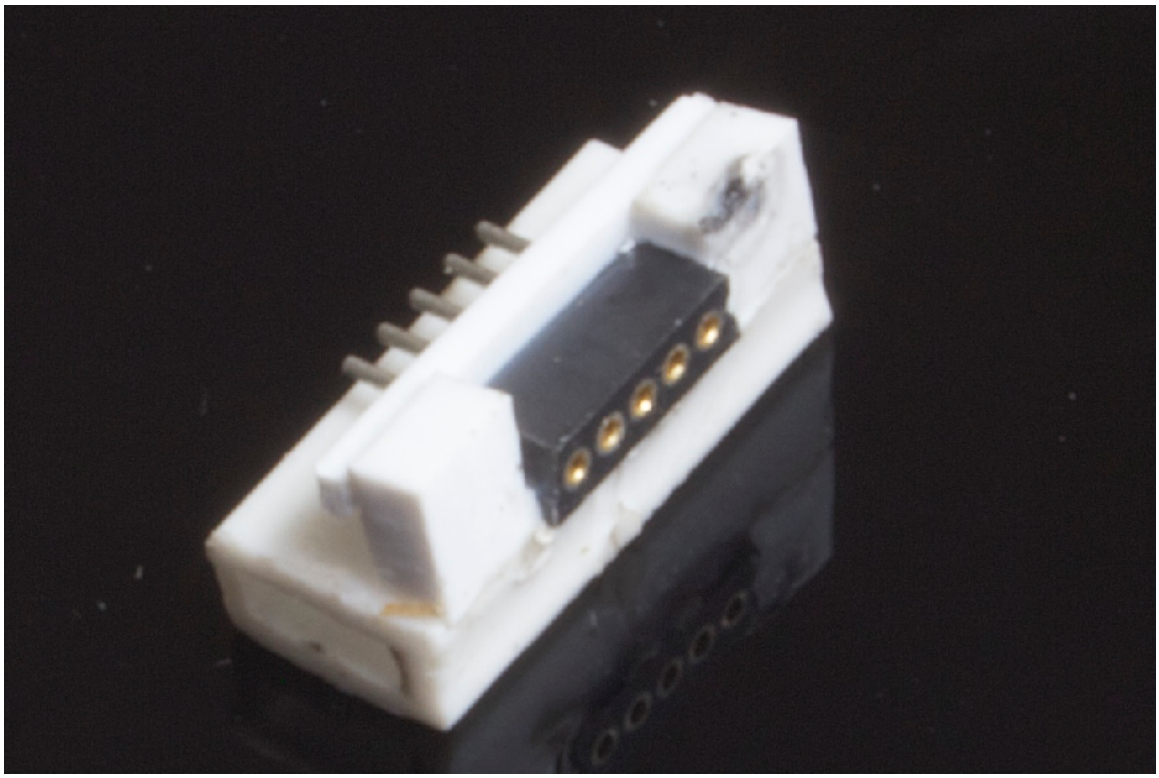
Tender shell assembly

The female side of the connector needs to be on the tender to protect the decoder. Also, I like to use one pin as a key. Break the end off of that male pin on the connector and shove it into the corresponding female socket. This makes it difficult to plug the connectors together offset by one pin. Making sure the key is not the center pin also helps to prevent plugging them together upside down.

Now for the scary part, making a hole in your brass baby for the connector. Use the rotary tool and a cutoff wheel to plunge into the brass on the tender shell [9] below the coal door to cut out the necessary material to mount the connector. Some installations need a small assembly to support the connector [8].

If you are really cautious, you may want to make a template out of styrene or wood and fit the connector to the template. Then cut the tender shell to match the template

8. 5-PIN CONNECTOR CUT OUT OF 50-PIN STOCK [7] WITH A SUPPORT STRUCTURE BUILT AROUND IT WITH STYRENE. NOTE, THE KEY PIN IS NOT YET INSTALLED.



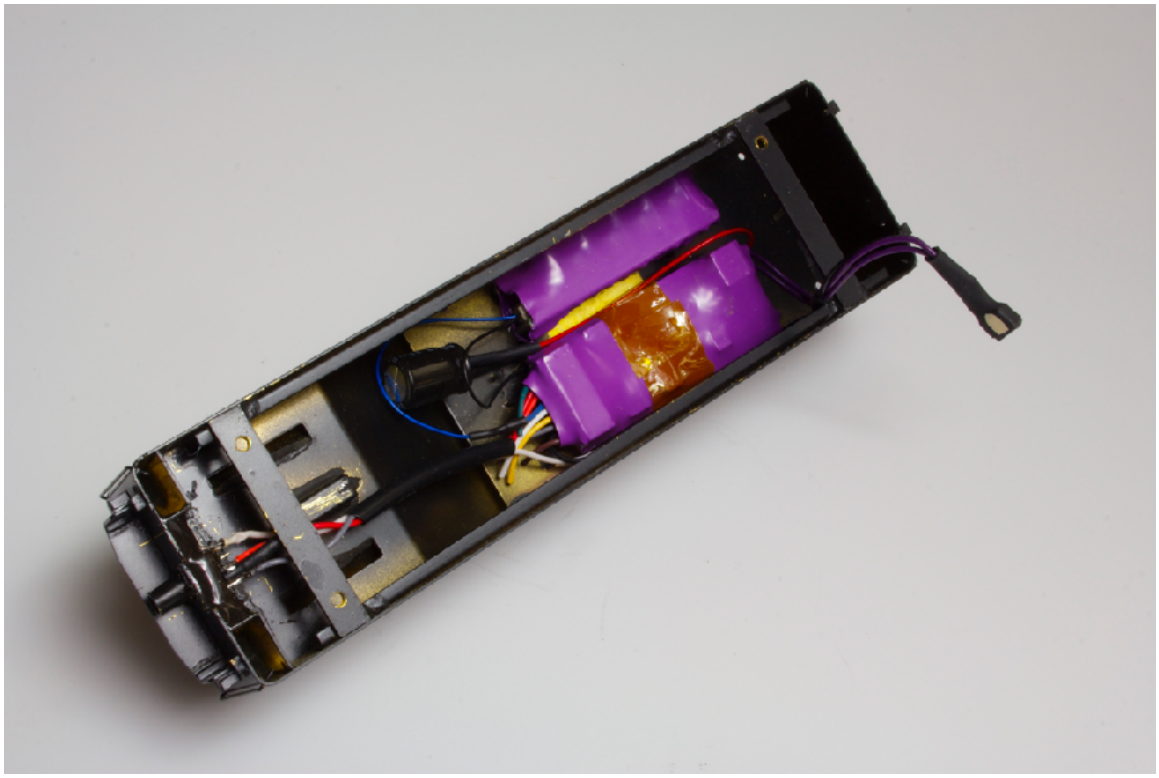
J-B Quick Weld epoxy is my preferred glue hold the connector into the shell. It is available from home improvement stores and Amazon www.amazon.com/dp/B0006O1ICY. It dries a dark gray color that blends in well.

In the installation shown [9], the Tsunami and CurrentKeeper were wired together and the assembly attached to the shell. The best way to do this is using a thermally conductive adhesive so that the heat from the decoder is transferred to the shell. Heatsink Silicone Glue is good and inexpensive and can be found on Amazon (https://www.amazon.com/dp/B072MSXHJD). It transfers heat but will not conduct electricity. The heat sink (flat) side of the decoder should be glued to the shell.

Once the connector and decoder are glued into the shell, let the assembly sit for a day so that the epoxies really set up well.

Wiring the tender is a straight forward matter of following the circuit diagram and putting the colors on the right connector in the right location.

9. THE TENDER SHELL WITH A TSU-1000 TSUNAMI AND A SOUNDTRAXX CURRENTKEEPER INSTALLED AND WIRED TO A FEMALE CONNECTOR IN THE FRONT. THE 3-PIN CONNECTOR FOR THE TENDER FLOOR CONNECTIONS IS IN THE UPPER RIGHT.



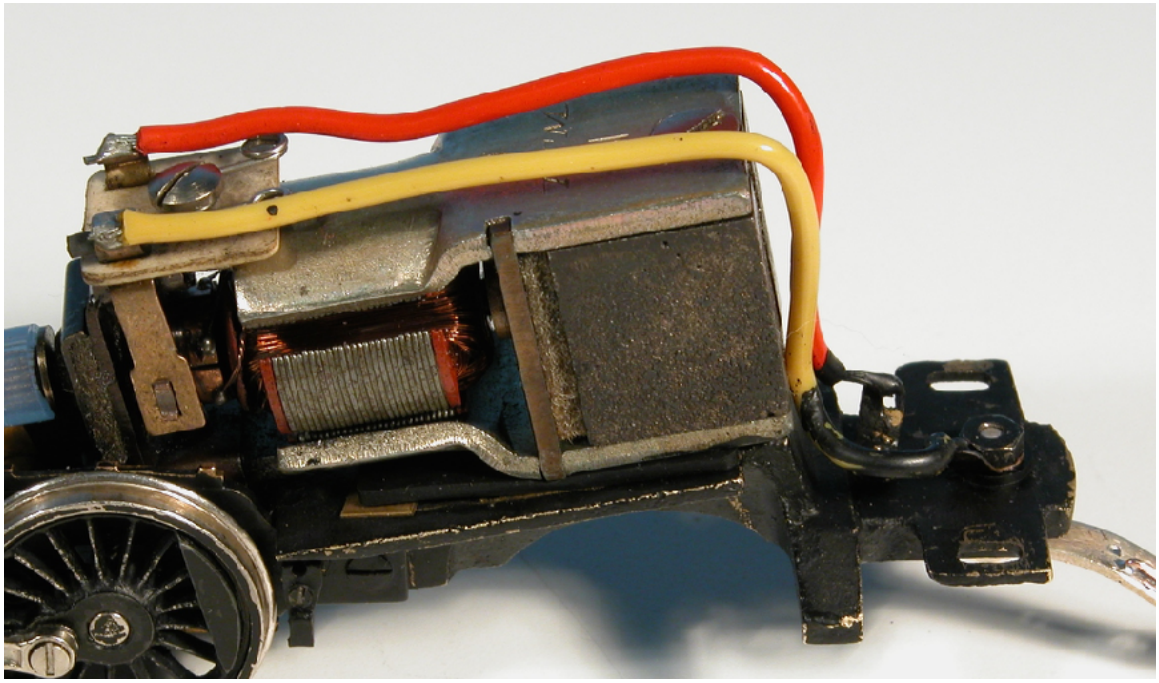
Isolate the motor

Once you have the shell off the locomotive, you will need to isolate the motor from the frame. Mark the motor contact that connects to the frame of the loco. This will be the orange lead from the decoder. The other motor lead will connect to the gray decoder lead.

Disconnect all the wires from the motor. Use a multimeter or even a buzzer to probe between a motor contact and the frame of the loco and the terminal on the draw bar There should be no connection -- very high (megohms) resistance or no buzz. Also, check to see that there is no connection between the draw bar post and the frame of the loco, as this will translate into a rail-to-rail short when the loco and tender are placed on the track.

If you have continuity between a motor contact and the frame, it must be dealt with before you move on. Check for continuity between the motor frame and a contact. If you didn't replace the open frame motor, one brush of the motor may not be isolated from the frame.

10. THIS (NOT RECOMMENDED) OLDER, 3-POLE, MOTOR WOULD BE EASY TO ISOLATE FROM THE FRAME. UNSOLDERING THE YELLOW AND ORANGE WIRES FROM THE MOTOR AND DISCARDING THEM WILL SUFFICE. BUT, TO BE SURE, CHECK WITH A METER OR BUZZER.
MARK SCHUTZER PHOTO.



Locomotive wiring

Once the motor is isolated, it is time to wire the locomotive.

My favorite wire for this is a 29 AWG stranded wire made up of 51 strands and having a rubber coating. Northwest Short Line calls it part 99007-9. Somewhat less expensive is the Wire-2951 [11] from Litchfield Station www.litchfieldstation.com/xcart/product.php?productid=410120 . This is very flexible, but the rubber insulation can be damaged by chafing. Be sure to slip some shrink tubing over the wire where it would rub against the loco or tender.

11. Wire-2951 - 29 AWG wire made of 51 strands.

Chuff cams are a topic unto themselves. If there is enough interest, I may cover them at a future date.

In order to minimize the connections, I like to run the 2951 wire all the way from the motor, or frame, or light to the male connector. Cut the wire a few inches longer than needed and solder one end to the motor contacts or to the headlight, etc. Insulate with 3/64” heat-shrink tubing. Slide larger shrink tubing (3/16” to ¼”) over the bundle at chafe points.

Don’t put the shell back on, but set this assembly aside until the epoxy in the tender is cured.

Once the tender epoxy has cured, put the loco and tender upside down in a foam cradle, separated as they would be when running plus just a bit (⅛”). Plug the male socket into the female on the tender shell.

Slide wires back and forth through the shrink tubing to verify where they are coming from. Trim and solder them to the connector, again, using 3/64” shrink on every other pin. Create an outside housing with larger shrink and put a dot of white paint on the bottom of the male connector. When properly mated, the white dot will not show.

As with all decoder installations, take the loco to the programming track and verify that you can read and write CVs successfully before putting it on a full power DCC track. This step may save a decoder in the event of a mistake in wiring.

Once you verify that the installation is wired correctly, shrink the tubing used to keep the wires from chafing on the loco or tender.

The process of installing a decoder as detailed here takes me a few hours spread over two or three days. That time does not include reworking the locomotive per Mark Schutzer's web site. It is not a quick process, but the results are worth the effort.

Folks always seem to have additional ideas to share. Just click on the Reader Comment 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. There will be no Mr. DCC’s Workbench segment this month. This entire column would qualify.