



About our DCC columnist



Bruce Petrarca is a well-known expert on all things DCC.

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DCC Impulses: Wired Decoder Installation - part 2

How to tame difficult locomotives

What to do when YOUR locomotive is driving you loco ...

Last month, I laid some groundwork for decoder installation: skills, tools, supplies, motor isolation and some other concepts (model-railroad-hobbyist.com/magazine/mrh-2012-01-jan/dcc_impulses). You might want to review that column before you press forward in this one – what I will be discussing here is based on items discussed there.

Most of my examples will be HO (as that is the most popular scale), but many of the concepts apply to other scales.

I covered plug-in decoders last November (model-railroad-hobbyist.com/magazine/mrh-2011-11-nov/dcc_impulses). This column will deal with soldering decoders into a locomotive.

Let's review the goals of an installation:

- Removing the connection between the rails and the motor
- Inserting the decoder

Figure 1: Schematic for DCC decoder connection – adapted from a SoundTraxx drawing

- Adding lights and other functions.

Don't Reinvent the Wheel

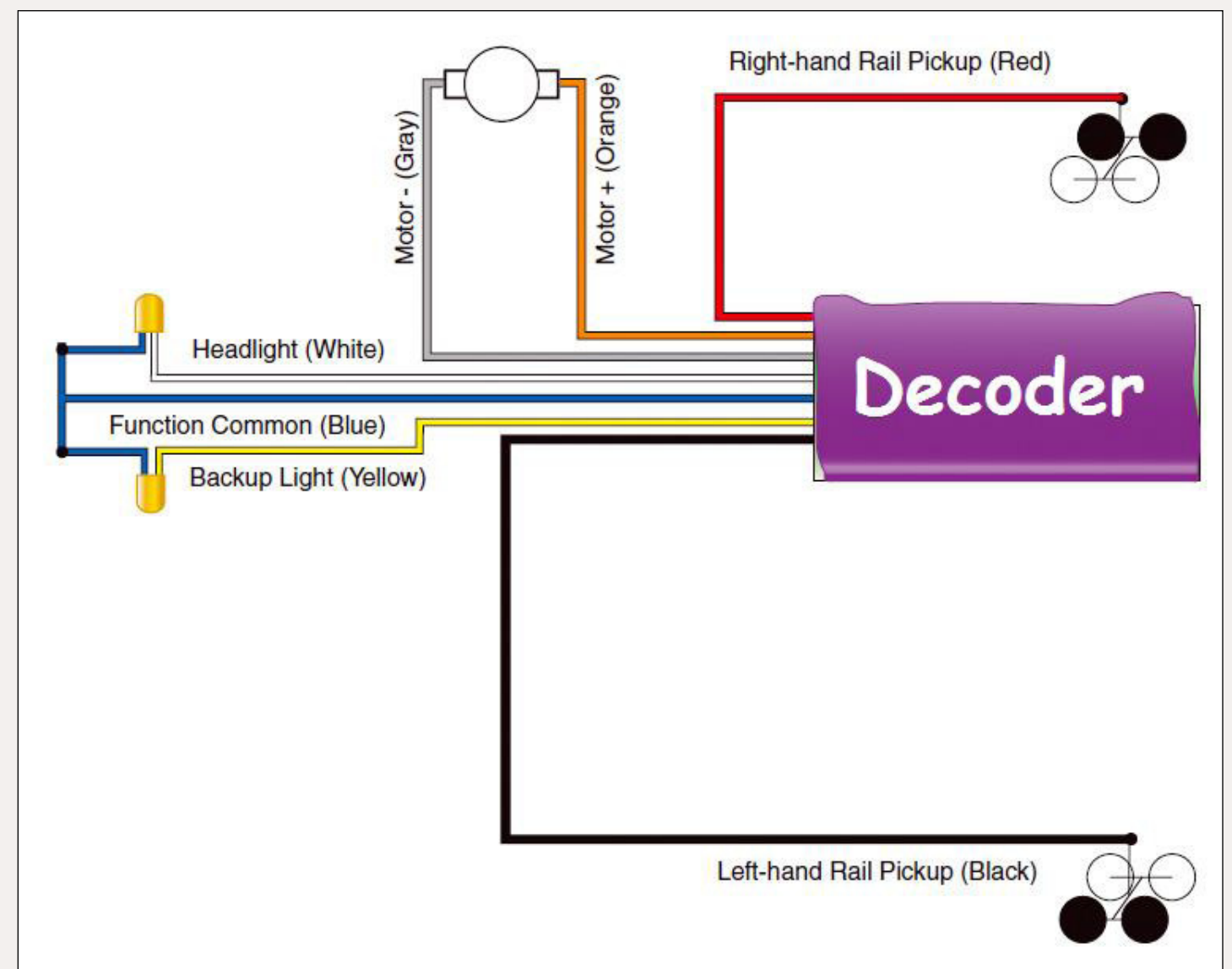
If you can find installation hints or instructions for the combination of locomotive and decoder you're using, check them out, and if they make sense, follow them. Sometimes you may find installation examples for similar locomotives or decoders. Even though they're not exactly what you're looking for, they can be useful, too.

If you haven't already acquired a decoder, do some research on which decoders make the most sense for your locomotive.

This column may give you some ideas regarding an installation. You may be able to use them for your situation.

Cooling

I'm going to start by discussing something many folks ignore – how to cool the decoder. All electronics generates



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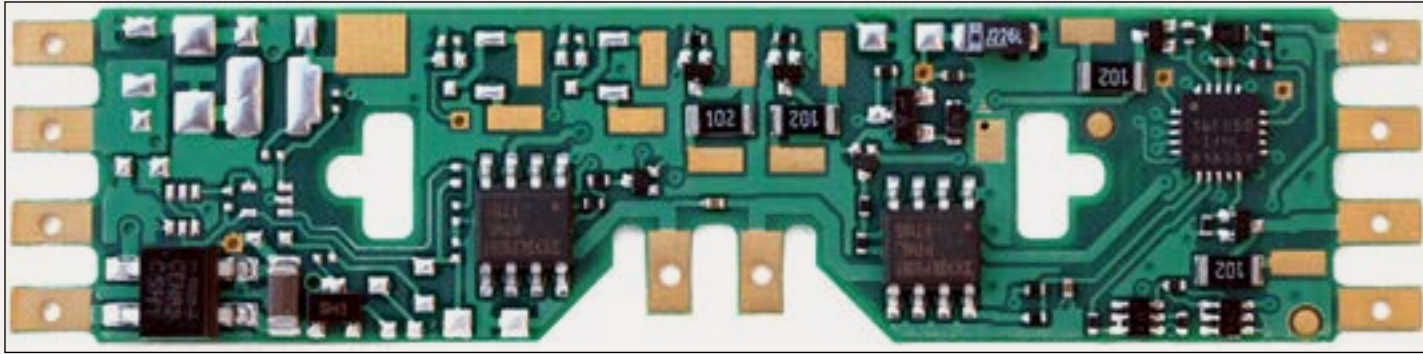



Figure 2: The TCS A4X decoder is an example of an open board decoder – photo courtesy of Train Control Systems.

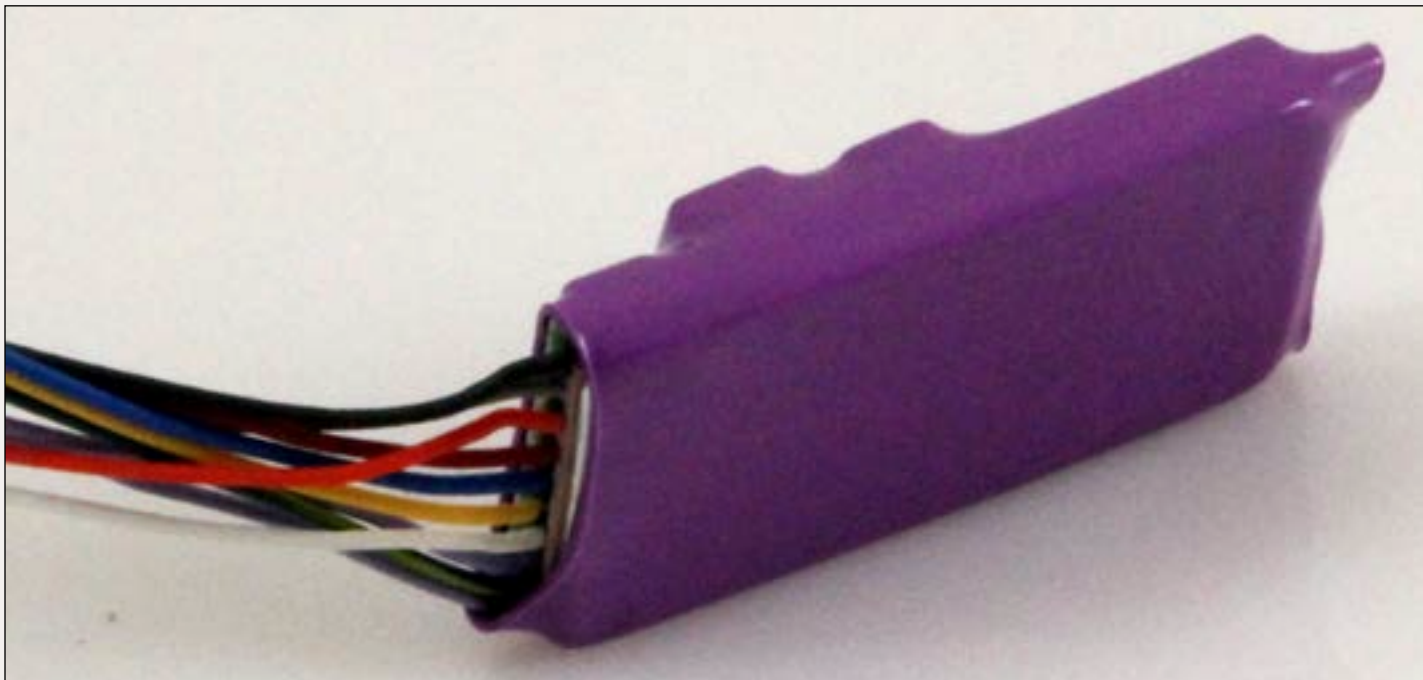


Figure 3: The SoundTraxx Micro Tsunami is an example of a wrapped decoder. In this photo, the heat sink side is toward camera.

heat when operating. Getting rid of the heat is essential to longevity.

You may have installed many decoders without considering the heat issue. But eventually, you'll find an installation where some extra attention is needed in that department. By keeping heat management in the back of your mind, you can't go wrong.

If the decoder is an open board as shown in figure 2, don't cover it up – it is expecting to see what is called

“free air” for cooling. Wrapping it in tape will “insulate” it, raise its operating temperature, and reduce its life..

Others, such as the Micro Tsunami decoders from SoundTraxx, come wrapped in plastic heat-shrink tubing (figure 3). DON'T remove the tubing, even to take a curious peek inside.

Many “wrapped” decoders have a heat sink – often looking like a large flat raised area. If at all possible, mount this type of decoder with the heat sink

(the flat area) in contact with a metal surface inside the loco. This lets the locomotive frame help suck heat out of the decoder. The extra heat dissipation may not be needed, but running cooler won't hurt.

I often use a very thin bead of caulk to hold decoders in place. The caulk has relatively good heat conduction and can be peeled off easily if you need to remove the decoder. I use blue masking tape to hold everything in place while the caulk sets. Be sure to remove the blue tape before you replace the locomotive's body shell!

Pickup Wiring

DCC track signals include both the power to run a locomotive and the control signals that tell the decoders to move the train forward or backward, how fast, etc. A consistent connection between the track and the decoder is basic to reliable operation.

I cannot stress enough the need for good quality wheels. If there is lots of corrosion and pitting on your electrical pickup wheels, you may want to reconsider converting the loco to DCC unless you can replace the wheels. Nickel silver wheels are best.

The more wheels that pick up power, the better. We will discuss adding pickup wipers on some types of locos later in this column.

If you're wiring an A / B set of FT units and the locomotives will be

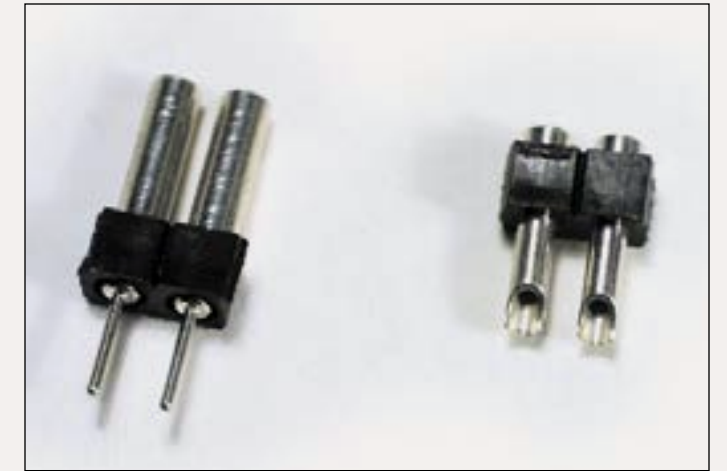


Figure 4: SoundTraxx 2-pin connectors – photo courtesy of SoundTraxx

permanently joined with a drawbar, why not connect the track power (picked up from the wheels) in both units? Heat shrink tubing works to hold the wires on the drawbar.

If the units can be uncoupled, F3s for example, I like to use a small 2-pin connector, like the SoundTraxx 810012 (figure 4), between units.

This allows a power connection between units but still lets you separate the units for hostling or running independently. One of the most reliable DCC installations I've ever seen was an A-B-B-A set with all units interconnected – sixteen wheels picking up power from each rail and distributed to all four units!

If your locomotive has relatively stiff wires between the trucks and motor, they may prevent the trucks from swiveling smoothly. I recommend replacing them with the extremely flexible “2951” wire

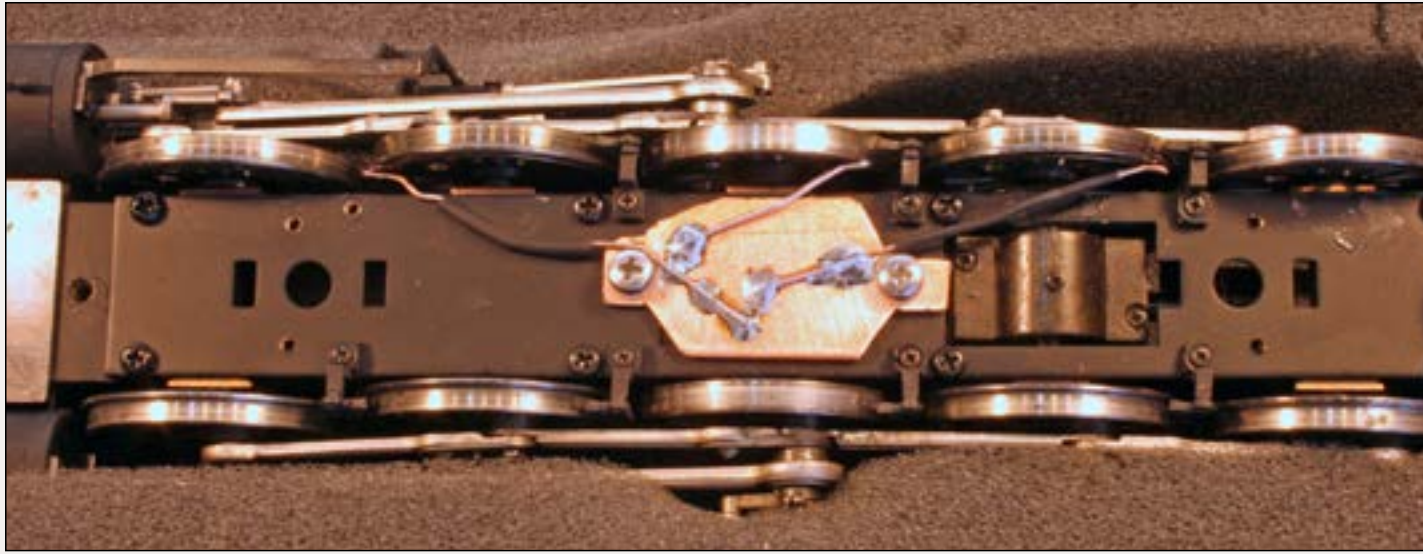


Figure 5: Added opposite rail pick-ups in an O-scale brass loco - similar pick-ups were added to the tender on the opposite side. The drivers equipped with wipers are insulated between the wheel tread and the inner parts. Note the wipers only touch the outermost portion of each wheel to avoid bridging the insulation and causing short circuits.

(29 awg, 51 strands) I discussed last month. Solder the wires in place; don't rely on push-on connectors.

All right, let's get into specific types of model locomotives.

Brass Locomotives

Most brass steamers (and many brass diesels) as well as some early plastic steamers have what I call the "brass design". That means power from one rail is picked up by the wheels in the engine and the other rail by the wheels in the tender. This may also occur with the front and rear trucks on a diesel. This is problematic with DCC. The loco may hiccup on long insulated-frog turnouts or track that isn't perfectly clean.

Adding "keep-alive" capacitors or another energy storage system helps. But nothing will fix poor power pickup

better than adding wipers to additional wheels. I use phosphor bronze wire soldered to a small piece of printed circuit board (figure 5).

Examine the engine closely to determine how much of the wheel is electrically connected to the rail. Some steam engine wheels are insulated just beneath the tire (rim). Wipers are trickiest to install when only the tire of the wheel is electrically connected to the rail. Pickup wipers must contact the tire but NOT the wheel.

Other wheels, such as those in a tender or a diesel, are insulated at the axle. Wipers can make contact nearly anywhere on the back of these wheels without creating a short circuit. Use your buzzer, discussed last month, to test the wipers for shorts before proceeding with decoder installation.

Remember to provide room for side-to-side movement of the wheels as the locomotive goes around tight curves. The length of the wipers in figure 5 let them do this.

Frame to One Rail

Many early models of diesel locos had one rail connected to the frame of the loco and the other connected to an internal contact. The most common example of this is the Athearn "blue-box" series. Early Life-Like Proto 2000 units were a close copy of Athearn in many ways, including power pickup.

You MUST isolate the motor from the frame for a DCC installation in these locomotives (a DCC motor drive wire shorted to track power – the frame – will kill a decoder). The sidebar shows the steps needed to prepare a "blue-box" locomotive for DCC.

HO Life-Like S-1

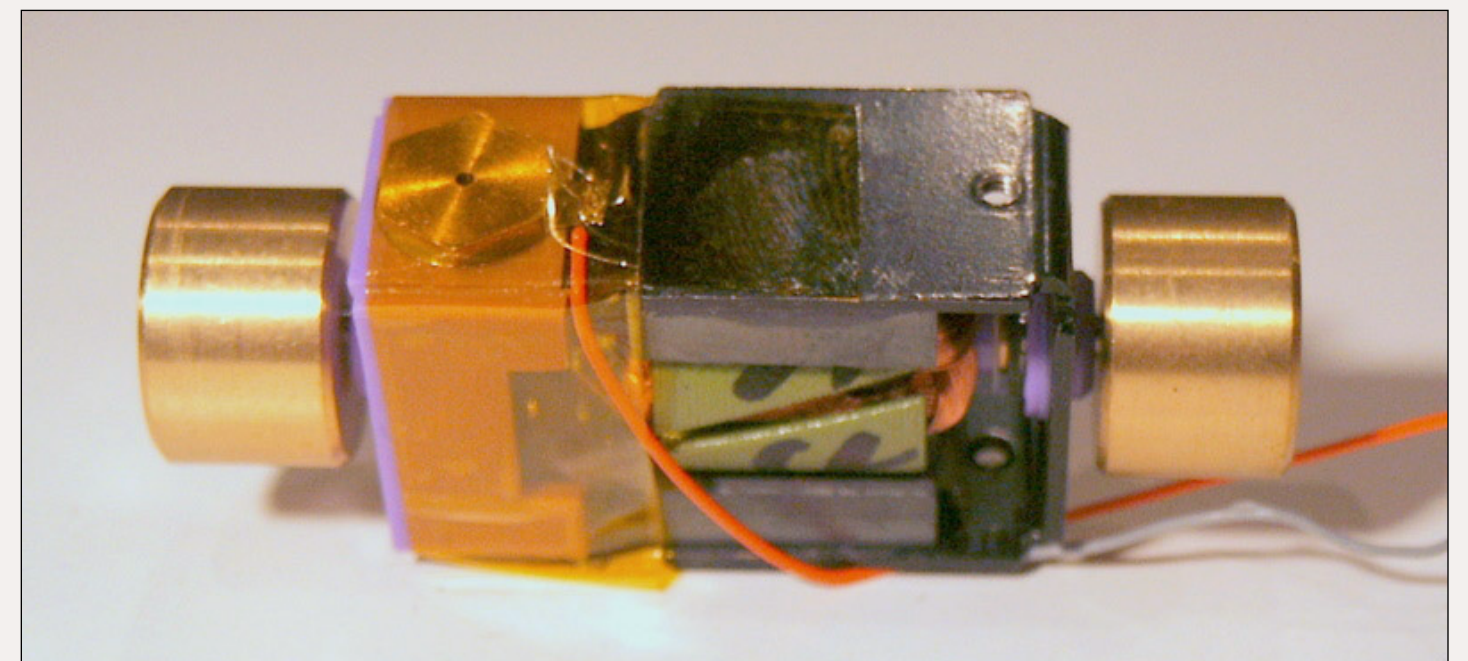
A special case of a loco with the motor connected to the frame is the Life-Like HO-scale S-x loco series. All locos in this series (S-1, S-2, S-3 and S-4) are the same internally and need the treatment specified here.

The motor must be removed and an orange wire soldered to the lower terminal. The terminal is then surrounded with a single layer of Kapton tape to insulate it from the frame before reassembly (figure 6).

Split Frame

Many locos have this type of design; each half-frame is insulated from the other and connected to its respective rail. Examples include: Bachmann HO diesels and some of their steamers, most N-scale locos. The Kato HO

Figure 6: Life-Like Proto 2000 S-1 type motor with an orange wire added and insulated with Kapton tape, ready for reinstallation.



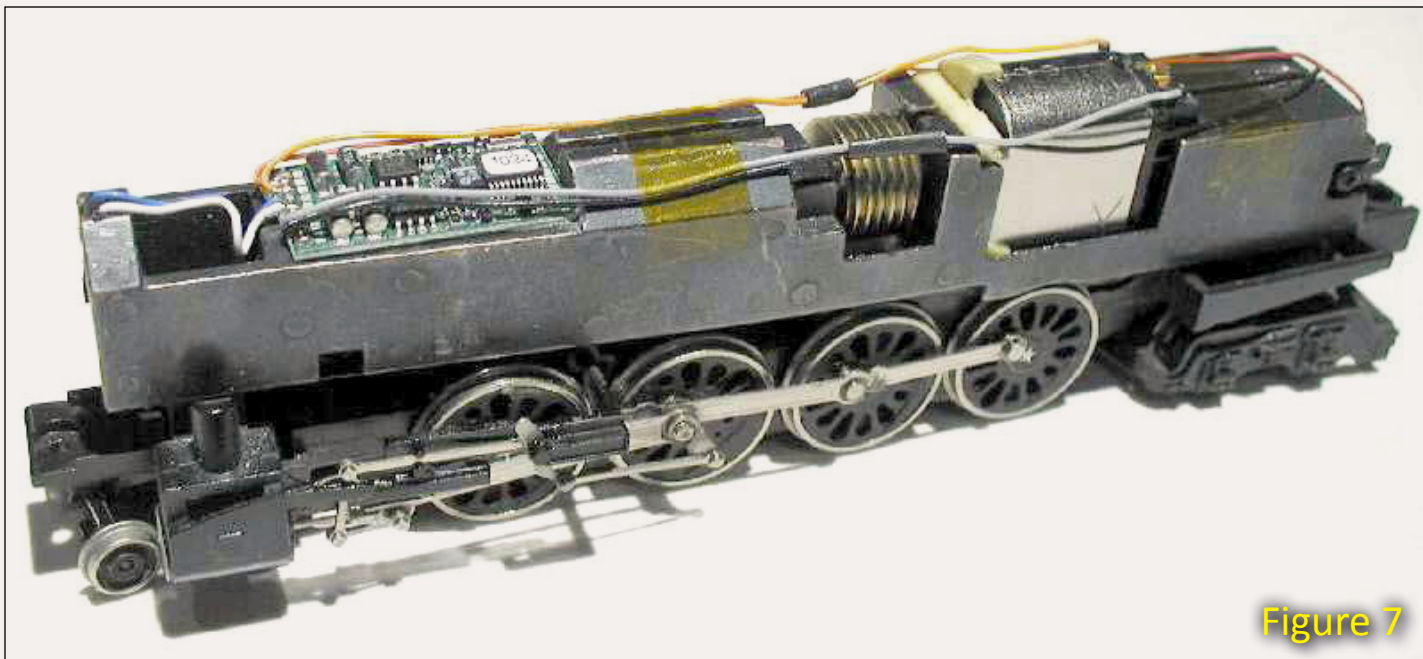


Figure 7

Figure 7: Bachmann GS-4 split frame HO locomotive.

Figure 8: Atlas N-scale C-420 split frame loco with the TCS-AMD-4 decoder installed – photo courtesy of Train Control Systems

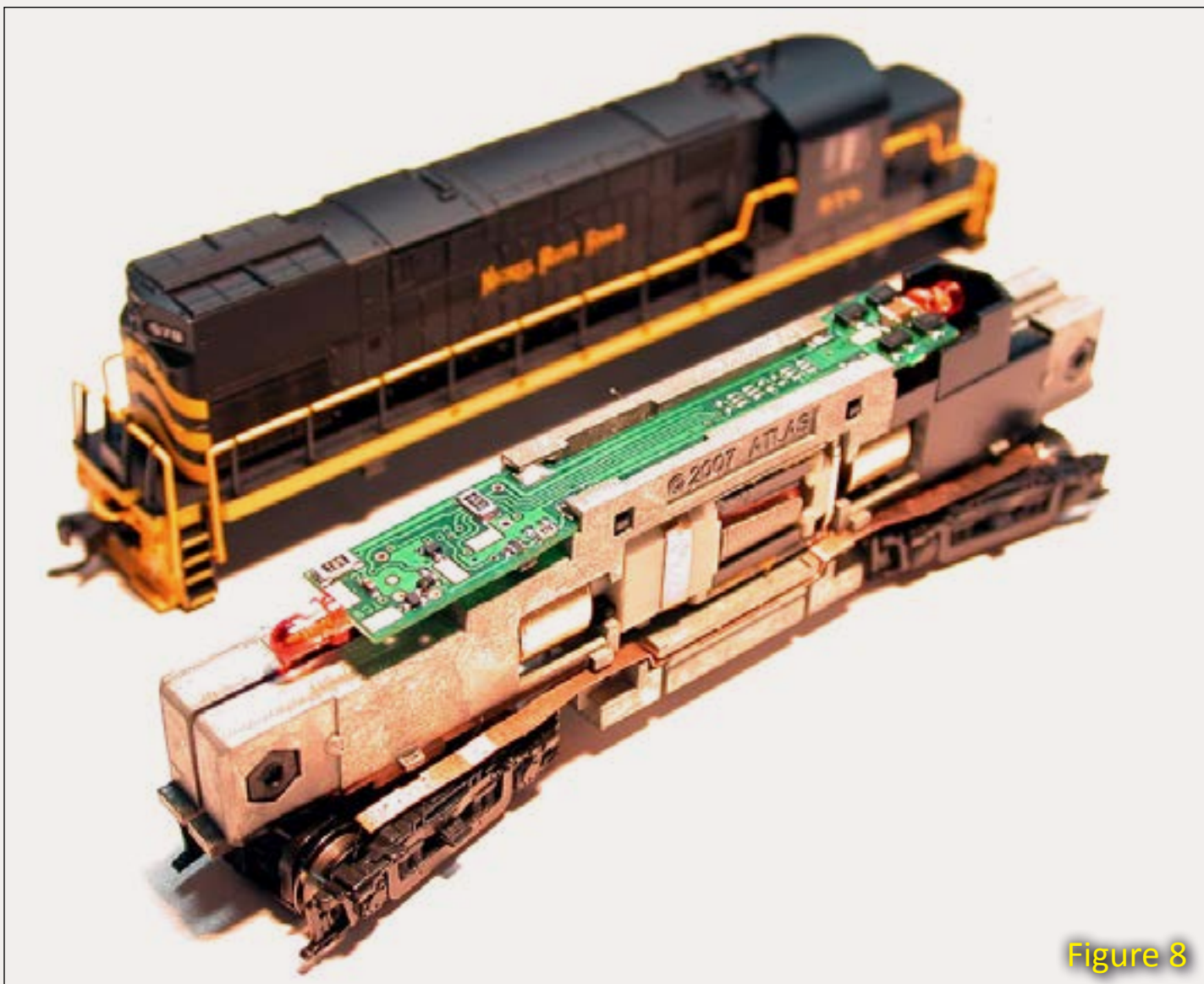


Figure 8

scale NW2 is a popular example of this kind of frame.

The challenge with most of these is isolating the motor from the frame. A reason for designing a loco this way is simplifying the motor connection for the manufacturer. The trucks connect to each frame half directly and the motor is buried inside the frame. Mechanical contact strips let the motor pick up power from each frame half.

These locos usually require a bit of machining or some fancy insulating technique to get the motor disconnected from the side frame. Then the decoder is wired between the frame halves and the motor.

An example of this technique is the older HO-scale Bachmann GS-4 loco shown in figure 7. The decoder's track connections are wired to the frame halves. The motor is insulated from the frame halves and wired directly to the decoder orange and gray wires.

N-scale split frame diesels frequently have loco-specific decoders. The decoder manufacturer designs the isolation of the motor into their circuit boards. Be sure to follow the manufacturer's directions, paying close attention to insulating the motor connections from the frame halves.

The loco shown in figure 8 came with a board incorporating LEDs for lighting, and providing the motor connections. The drop-in DCC board handles the motor connections.

I mention these in the context of wired decoders, because they frequently need some work to connect the motor to the decoder.

Many of these designs rely on contact pressure between motor tabs and pads on the decoder. I frequently need to solder some "2951" wire between the contact and the decoder pad for reliable operation.

Testing the loco on the programming track will often reveal an immediate need for this if you cannot read or write the CVs in the decoder.

Totally Isolated

If your loco has wires directly from insulated contacts on the motor to the track pickups, it is probably totally isolated.

Use your buzzer for a quick check. Disconnect both wires from the motor. Connect one lead from your buzzer to one motor contact. Probe all the wheels with the other buzzer contact. For good measure, repeat for the other motor contact. If it doesn't buzz, then you are ready to go. Just install the decoder!

Even some N scale locos are designed with isolated motors.

Figure 9 shows a Kato N-scale PA. As built, the truck power contacts come through a plastic insulator and contact strip assembly that conducts track power to the motor and a light board.

Install a decoder by applying Kapton tape to the contact strips where the motor tabs touch them to isolate the motor. The decoder sits on the strips and is held down by the motor tabs.

Programming Track

When you finish your install, the programming track is your best friend! I know you really want to run your loco right away. Resist this temptation!

Put the loco on a programming track (not programming on the main) and read the address. If you can read the address, write the new address into the decoder and read it back. If you can read and write on the programming track, you've probably correctly isolated

the motor from the track power. If you get errors or cannot read the decoder, thoroughly check all your wiring. Use the buzzer to check for motor-track isolation. Remember the buzzer will show continuity between the rails because the DCC power supply connects them!

In future columns, we will get into lighting and sound installations.


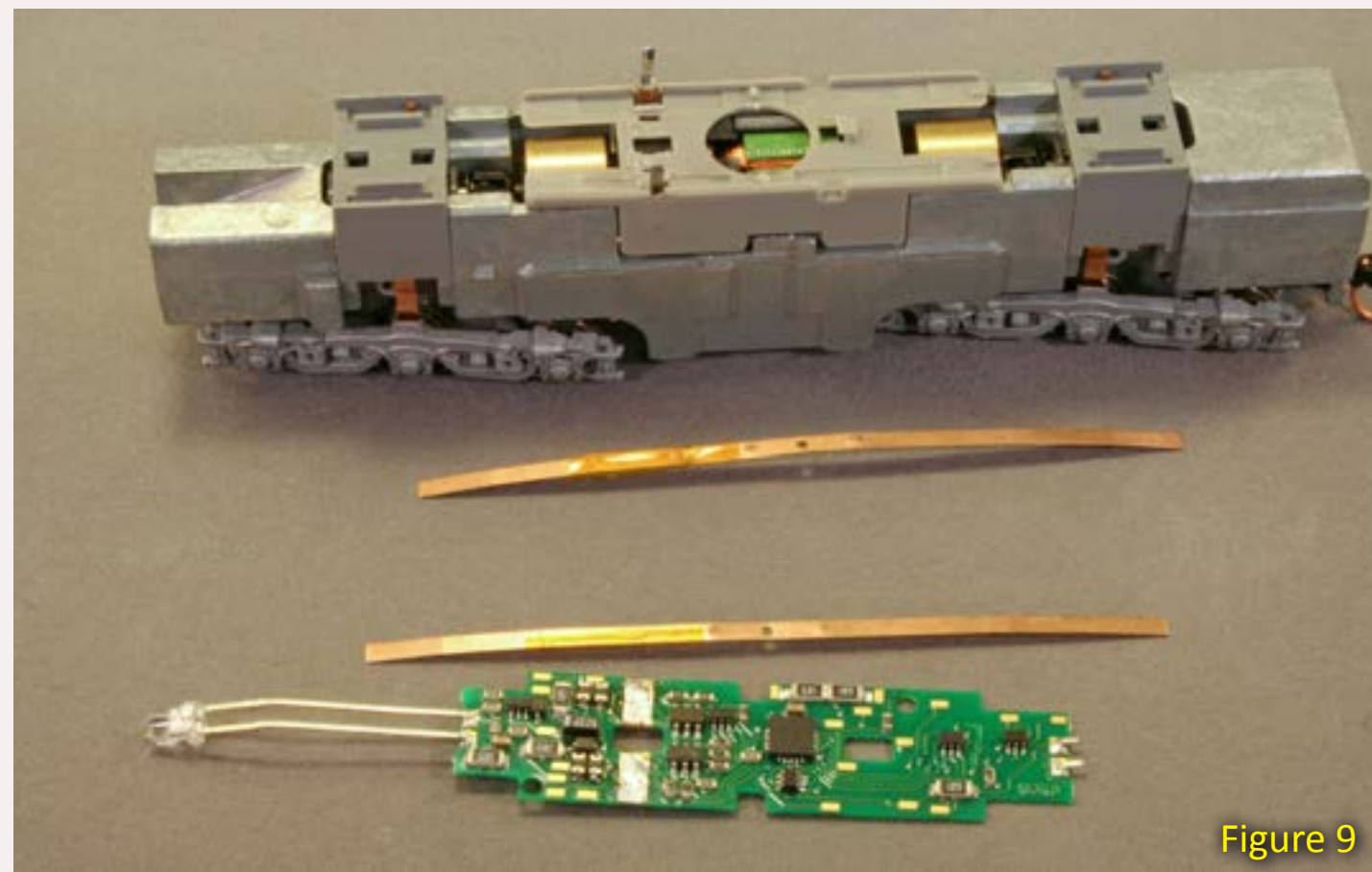
Thanks for reading and for all the encouraging comments on the Reader Feedback MRH web pages. 



Figure 9: Kato N scale PA shown with the contact strips covered with Kapton tape ready for reassembly with the Digitrax DN-163K0a decoder.



Preparing an Athearn blue-box locomotive for decoder installation

Start by removing the motor from the frame. Cut a piece of 0.01" thick styrene about 1-1/2" long and 1/4" wide to insulate the motor contact area (figure 10a).

3/8" or wider Kapton tape holds the styrene strip in place (figure 10b). Caulk is an alternative to the tape.

Cut the tabs off the bottom motor contact spring (figure 10c) smoothing it so no pointed ends can press through the newly installed insulation. Replace the motor contact on the insulator (figure 10d).

Next it's time to solder decoder wires to the motor – gray for the bottom sidebar text continues on next page

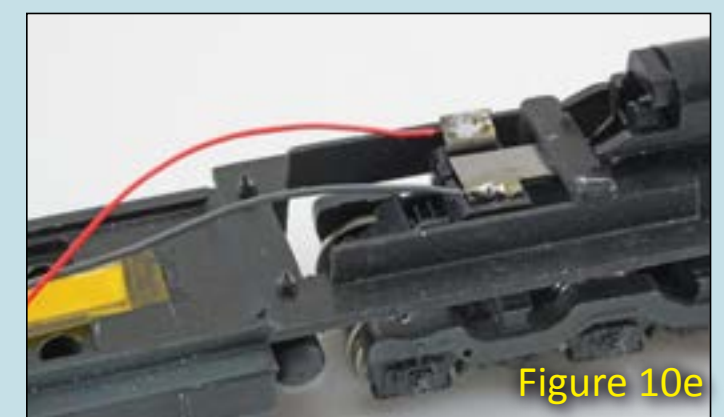
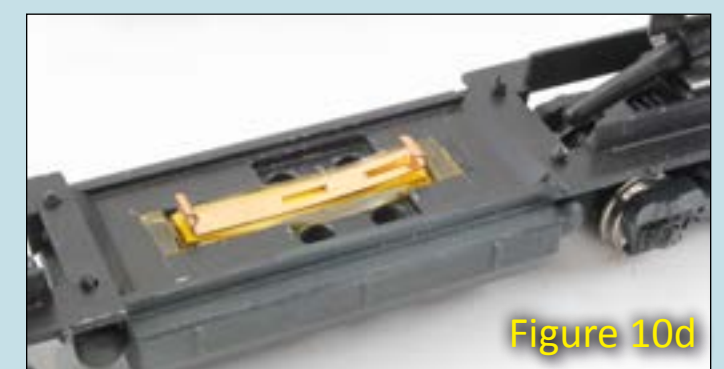
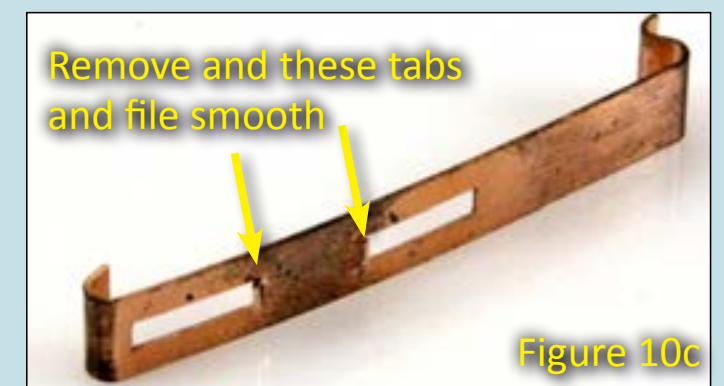
Figure 10a: Athearn blue box loco: Plastic sheet cut to fit and installed in the motor contact area as an insulator.

Figure 10b: Kapton tape added to hold the plastic insulator in place.

Figure 10c: Tabs cut off lower motor contact strip – removed from motor for clarity.

Figure 10d: Motor contact strip (without motor) positioned above the plastic insulator demonstrates its final position.

Figure 10e: Both wires connected to truck for best power pickup.



Preparing an Athearn Blue-Box Locomotive for Decoder Installation (continued)

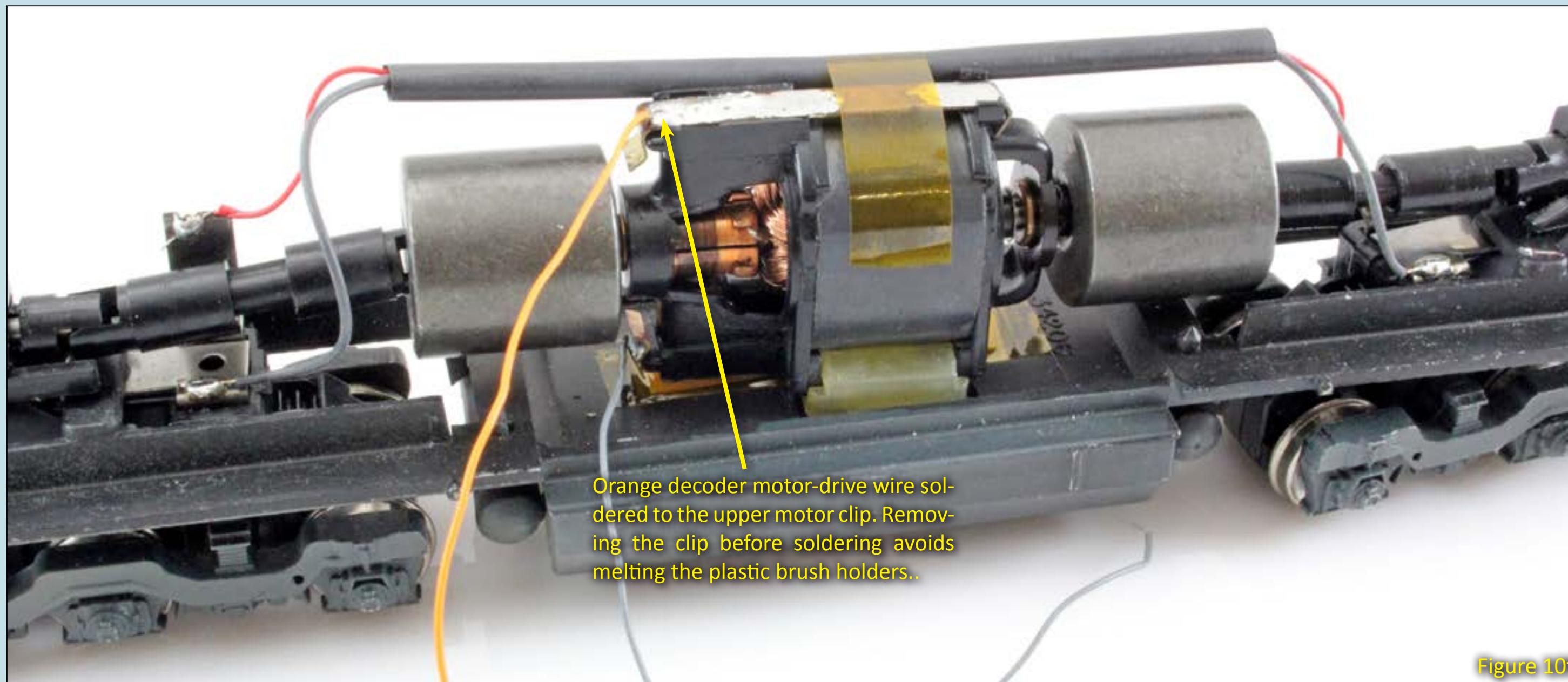


Figure 10f

Figure 10f: The motor isolation is complete. This locomotive is ready for decoder installation.

contact, orange for the top. There are two ways to do this:

- Remove the clips from the motor before soldering. Watch out! Make sure the brush springs and brushes don't "run away" and take care when reassembling the motor.
- Solder the decoder wires to the clips without removing them from the motor. Get in and out QUICKLY

to avoid melting the plastic brush holders. If damaged, the motor may not run properly anymore.

Even being a better than average solderer, I prefer removing the clips. It's too easy to melt the plastic brush holders. Or replace the stock 3-pole Athearn motor with a new 5-pole motor from A-line (ppw-aline.com/re-power.htm).

The red decoder wire connects to the top of BOTH trucks. The contacts can be cut back or left full-size (figure 10e).

For the best performance, I recommend that you solder the black decoder wire directly to the trucks, as shown in figure 10e. I ran a piece of "2951" wire between the two trucks. This step eliminates the sliding contact between the trucks and the frame from the electrical path – fewer places for poor contact to impact operations.

Alternatively, the black wire can be soldered to the frame contact on the front of the loco or screwed to the frame in a convenient place.

Figure 10f shows the loco with the motor isolated, ready for the decoder installation. I used a piece of shrink tubing (a soda straw will work, too) to keep the wires from getting tangled in the drive train.

Why not change the wheels for nickel silver, while you are at it? Northwest Short Line makes replacements.