

The EasyDCC command control system: 3



Extensive use of color helps clarify wiring diagrams. Use a color printer for best results.

Decoder installation tips for ALL DCC systems



This article is an excellent source of decoder installation tips and techniques. The file size is larger to make the pages easier to read.

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PHOTOS BY REBECCA SALITURE

We introduced the EasyDCC command control system in the February issue with the command station. Last month we showed you how to build the EasyDCC booster. This time we'll take a break from step-by-step construction to discuss decoder installation. You'll need to install a decoder in each locomotive to use the EasyDCC system. The only exception is that one non-decoder-equipped locomotive can be run in the "analog" mode. Our installation tips apply to all Digital Command Control systems, not just EasyDCC.

EasyDCC is designed to function with any decoder that complies with the National Model Railroad Association DCC standards. Since we can't describe every installation possible, we'll show you some of the basics and walk through several examples. Before installing any decoders, take a few minutes to read the instructions that came with them.

Decoder basics

Before delving into decoder installation in detail, let's start with some general guidelines.

- Use the proper tools. Invest in a good soldering iron and high-quality solder. Part 1 of this series provided a list of suggested tools and sources. Decoder installation is not a job for your old soldering gun!

- Insulate all connections. I recommend $\frac{1}{16}$ "-diameter heat-shrink tubing. Plastic electrical tape is not an acceptable substitute since it has a habit of unwrapping itself.

- Use the proper size wire. Most decoders come equipped with 28 or 30AWG stranded wire. However, this may not be heavy enough to handle surge currents caused by a short between the locomotive trucks. Heavier wire, such as 24AWG, is a better choice for jumpers between truck pickups.

- Disassemble locomotives carefully. Refer to the exploded parts diagram

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that comes with the locomotive when taking an engine apart. For complex models it's a good idea to label the parts and place them in a multicompartment box.

- Isolate the motor. Before installing a decoder, the two motor terminals must be electrically isolated from the chassis or frame.

- Reliable track pickup is essential. Most of today's plastic diesels feature all-wheel pickup. With few exceptions, most brass locomotives (and some brass diesels) don't. They use the drivers (or lead truck in the case of brass diesels) to pick up from the right rail and the tender wheels (or rear diesel truck) to pick up from the left rail. This usually results in erratic operation. Consider adding wipers or other extra pickups before installing a decoder. [See Jeff Johnston's March 1995 article, "Contact! The key to reliable performance." - Ed.]

- Do not exceed the decoder's current rating. You can use a lower-rated motor with a decoder rated at a higher current, but not vice-versa. Also, provide adequate ventilation. Decoders heat up under load or when operated near the rated output current.

- Neatness counts. Don't allow any exposed wires or components to touch the metal chassis or weights. Use caution when wiring headlights. When headlights are wired to the decoder, be sure to add the total current of the headlights to the motor current.

- Equip each locomotive with its own decoder. A decoder in each locomotive provides better performance and lets you tune the performance of that particular locomotive.

- Use decoder addresses that are easy to remember. You may recall that

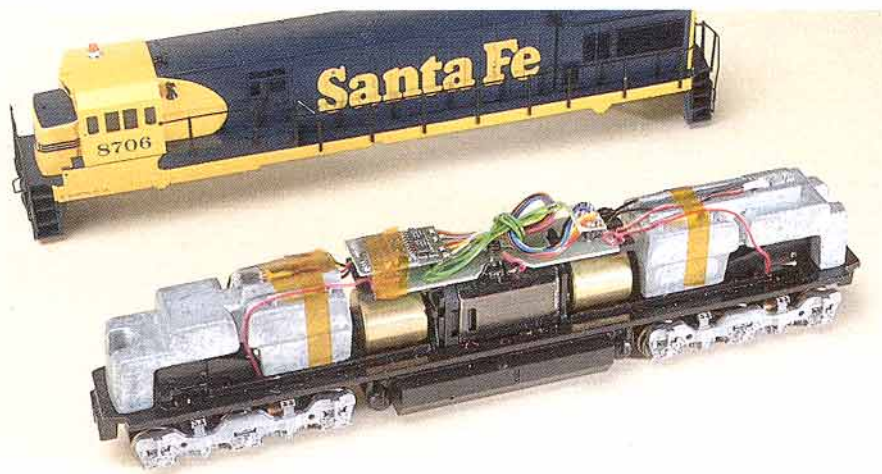


Fig. 1 FACTORY INSTALLED SOCKETS. Several manufacturers offer locomotives with factory-installed decoder sockets to accept DCC decoder plugs. These include the Life-Like HO E7 (page 80) and the Atlas HO U36C shown above with a Lenz LE111 decoder.

Fig. 2 TESTING STALL CURRENT

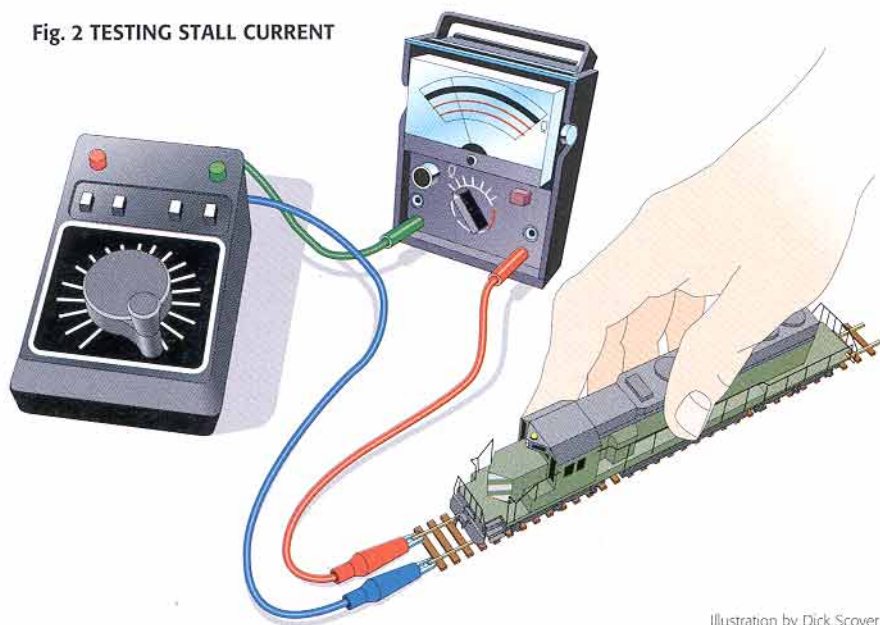


Illustration by Dick Scorer

GP38-2 no. 266 has an address of "4," but will your operators? We suggest using the last two digits of the locomotive number. It's also a good idea to place a self-adhesive label listing the decoder type and address on the underside of each locomotive.

Basic decoder installation

Manufacturers such as Atlas, Kato, Life-Like, and Stewart have made decoder installation a breeze in their newer HO locomotives by including a receptacle (fig. 1) that's prewired for a DCC decoder. You simply remove the factory-installed plug, plug in the appropriate decoder, and you're ready to go. But before you can do this you

need to determine which decoder is the best to use.

All decoder installations include the following steps: (1) Select a decoder that fits inside the body shell and has the required current rating, (2) isolate the motor from the track pickups, (3) install the decoder along with wiring for any extra effects, and (4) test the completed installation.

Selecting a decoder

The decoder size will be dictated by the amount of room inside the engine or tender. You also need to select a decoder with a current rating higher than the stall current of the motor. It's best to measure the stall current on

your particular locomotive. Figure 2 shows a typical test setup.

Set the meter on the DC amps scale. Grasp the locomotive so it doesn't take off and turn the power pack to full. Push down until the engine stalls and note the current. This is the "stall" current.

One decoder can drive multiple motors, provided the sum of the stall currents doesn't exceed the decoder's current rating.

Isolating the motor

The motor must be completely isolated from all track pickup points. If the locomotive has a built-in command control socket the motor is already isolated. But an older model, or one without a built-in socket, means you need to find and eliminate all connections between the motor brushes and track pickups. This is usually the biggest problem people have when they first get into command control.

Figure 3 shows an Athearn motor (not isolated) and a Sagami motor (isolated). Note the pickup connections on the underside of the Athearn motor. Diesel locomotives are fairly straightforward, but in brass steam engines the mechanical pickups can be quite ingenious and well hidden.

Use a volt-ohm meter to verify electrical isolation. Set your meter on the ohms (resistance) scale and touch both probes together. The meter will indicate a short (0Ω). You don't want to see this indication when you're checking for motor isolation!

Place one of the probes on a brush and touch the other probe to the chassis or left rail pickup wire and then move it to the right rail pickup wire. If the motor is isolated you will read an open circuit. Move the probe to the other brush and repeat the tests. If both tests indicate an open circuit, the motor is isolated and you can safely proceed with decoder installation.

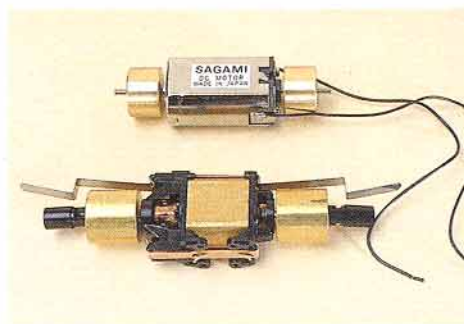


Fig. 3 IDENTIFYING MOTOR TYPES. The Sagami motor (top) is insulated from the frame. The Athearn motor includes two pickup tabs under the motor that must be cut off in order to install a decoder.



Fig. 4 ATHEARN GP40-2 INSTALLATION. Athearn HO diesels are ideal for your first decoder installation. This model has been equipped with a Wangrow decoder.

Athearn HO diesel installation

Since most HO railroads have at least one Athearn diesel, showing how to equip one with a decoder seemed an excellent starting place for us. Athearn motors aren't isolated from the frame, so the first step is to change that.

We used a DH155 decoder from Wangrow Electronics for our Athearn GP40-2 (fig. 4). The drawing in fig. 5 shows the GP40-2 installation. The Athearn C44-9W installation is virtually identical except we used a North Coast Engineering DK-2 decoder. This decoder (fig. 6) comes as a kit and is available direct from North Coast Engineering. We chose these decoders because they fit inside the shells and have a current rating exceeding the stall current of the Athearn motors.

Remove the shell from the frame and discard the metal connector clip. Don't remove the brush-retaining clips located underneath. Next, pull up on the motor until the mounting pads pop out of the holes. The drive train will slip apart as the motor comes out. Set these components aside.

Place a strip of nylon-reinforced strapping tape on the floor of the fuel tank. Completely cover the shiny metal area where the motor was sitting, but be sure to keep the tape clear of the motor mount holes.

The brushes are held in place with clips, and we'll be soldering the motor connection wires directly to these. Pry off both clips, being careful not to let the brush springs and brushes fly across the room.

Cut the two small prongs from the underside of the bottom brush clip and file smooth. The decoder's color-coded wires should comply with the NMRA-recommended coding shown in table 1. Solder the gray motor - (minus) wire to the outside of the curved end of the lower brush clip. Replace the brush and spring and snap the clip back onto the motor. Then solder the orange

Fig. 5 TYPICAL ATHEARN INSTALLATION

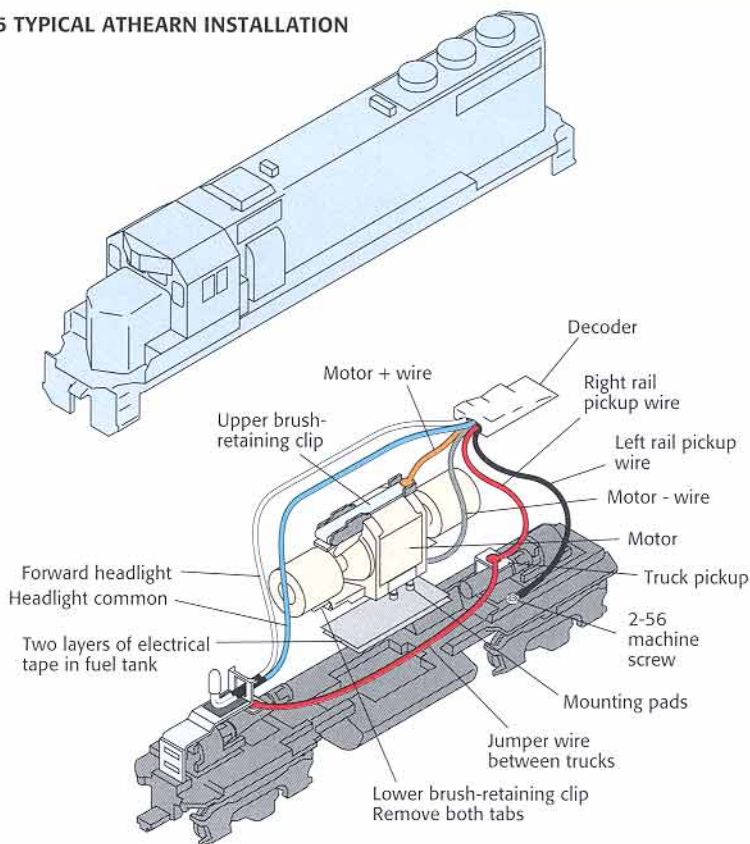


Illustration by Rick Johnson

motor + (plus) wire to the center of the upper brush clip. Reinstall the brush and spring. Snap the clip back in place then set the motor aside for now.

The track pickup wires connect with the chassis. Drill and tap a hole in the chassis for a 2-56 brass machine screw where it won't interfere with the body. Next, solder the left rail pickup wire (black) to the top of the bolt.

Carefully reinstall the motor by reseating the rubber pads and test the motor to ensure it's completely isolated. Now solder the red right rail

pickup wire to the top of the metal tab on the truck. Jump the two trucks together using a short length of red wire. Mount the decoder using a piece of double-sided tape. Snap the body back onto the shell and your decoder is ready for programming.

The extra wires on the decoder are for optional effects including headlights and other functions. Consult the decoder instruction booklet for suggestions and limitations. The diagram shows how we equipped our Athearn engines with directional lighting.

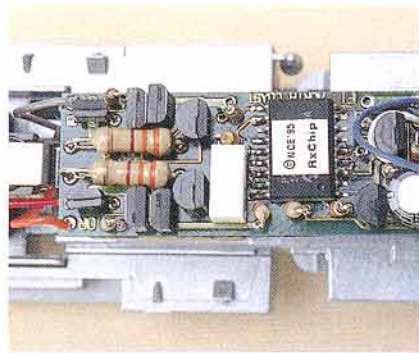


Fig. 6 NORTH COAST DECODER. Factory-assembled decoders are only one way to go. This North Coast Engineering DK-2 decoder was assembled from a kit.

Table 1 STANDARD NMRA COLOR-CODING

Color	Function
Red	Pickup (right)
Black	Pickup (left)
Gray	Motor -
Orange	Motor +
Blue	Lamp common
White	Forward headlight
Yellow	Rear headlight
Green	Function 1 (decoder dependent)
Purple	Function 2 (decoder dependent)
Brown	Function 3 (decoder dependent)



Fig. 7 N SCALE DECODER. Newer, smaller decoders have made command control feasible for N scale layouts.

Atlas N scale GP30 installation

Some commercial decoders are now small enough to make command control a viable option for N scalers, but installation isn't always a simple task. Although current rating isn't a problem (most N scale locomotives draw little power), decoder size is. This usually means part of the locomotive frame has to be removed to make room for the decoder.

Kenny Collins installed a Digitrax DN93FX decoder in his Atlas N scale GP30 (fig. 7). He offers the following advice: "Be sure to take your time, use good soldering techniques, and check and recheck everything."

Start by trimming all the decoder wires to the lengths shown in table 2. Strip away about $\frac{1}{10}$ " of insulation and twist and tin the strands. This prevents any stray bits of wire from shorting to adjacent areas.

Start by studying the exploded drawing in fig. 8. Remove the body, handrail, and frame assemblies from the mechanism. Then remove the contact strips. Next, gently remove the headlight cover and both headlight circuit boards. Set these parts aside.

Loosen the two bolts holding the frame halves together. Spread these apart until the trucks fall out. Lay the frame on a flat surface and use a toothpick to carefully release the tabs holding the saddle in the frame.

Mark the top of the motor with a pen or hobby knife. Study how the parts go together and then carefully remove the motor, motor saddle, worm assemblies, plastic bushings, and plastic hex nuts from the outside of the frame.

You have to grind away some metal (fig. 9) from the frame pieces to make room for the decoder. Kenny found a Dremel tool with a drum-shaped grinding bit worked well. Wear safety glasses and work slowly since you don't want to remove too much material. File the edges smooth and use a

Fig. 8 ATLAS N SCALE GP30 INSTALLATION

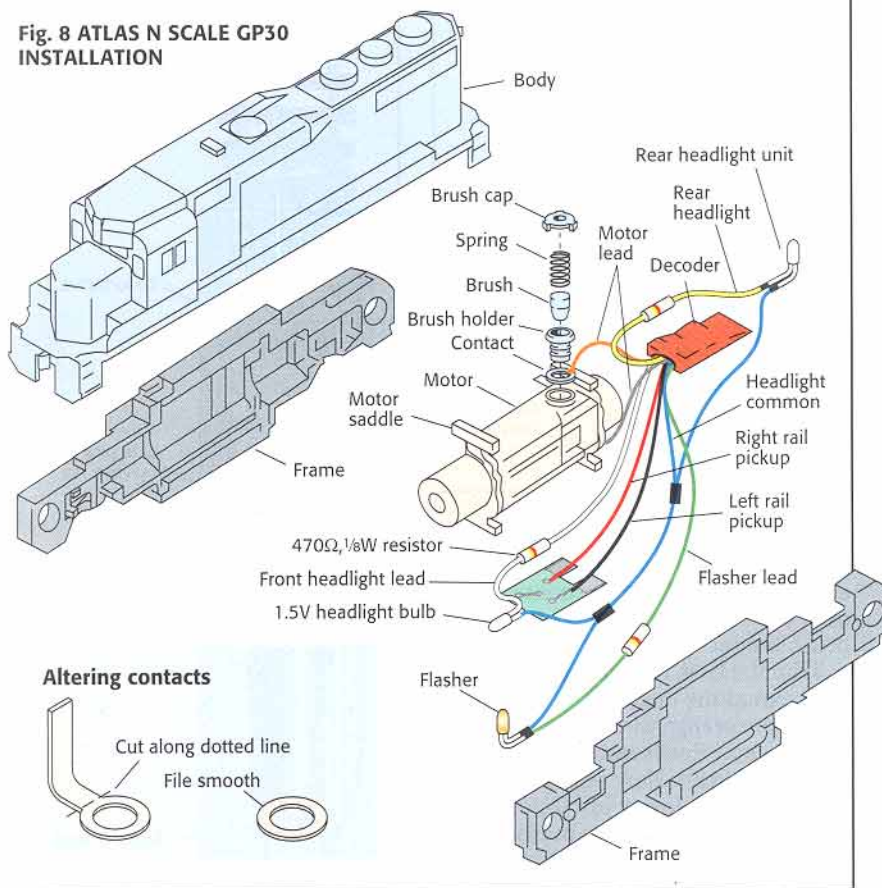


Illustration by Rick Johnson

Fig. 9 MAKING A DECODER POCKET

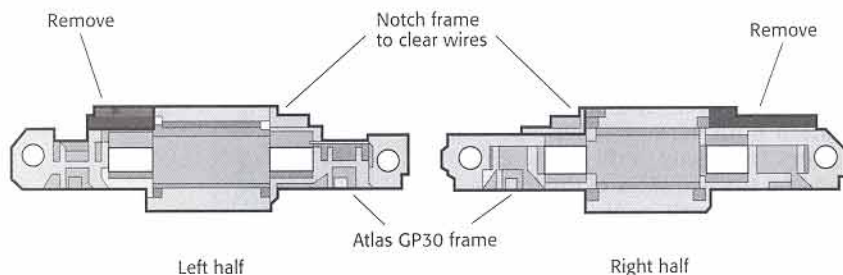


Illustration by Terri Metzger

stiff brush to scrub the frame clean of any metal slivers. [If you don't want to grind your own frames, Aztec Manufacturing (2701 Conestoga Dr., No. 113, Carson City, NV 89706, 702-883-3327) offers milled frames for a number of popular N scale locomotives. They cost about \$20 each. Contact Aztec for details and availability. — Ed.]

Take the motor out of the saddle and then gently pry off the top brush cap with a hobby knife. Remove the spring and turn the motor over, allowing the brush to fall out. Pry out the brush holder and remove the contact strip. Don't discard it since it's still needed to insulate the brush holder from the commutator.

Table 2 WIRE LENGTHS

Color	Function	Trim to
Red	Right rail pickup	1 1/2"
Black	Left rail pickup	1 1/2"
Orange	Top motor brush	1"
Gray	Bottom motor brush	1 1/2"
Blue	Headlight common	1/2"
White	Forward headlight	7/8"
Yellow	Rear headlight	1/2"
Green	Flasher	7/8"

Fig. 10 MODIFYING HEADLIGHT CIRCUIT BOARDS

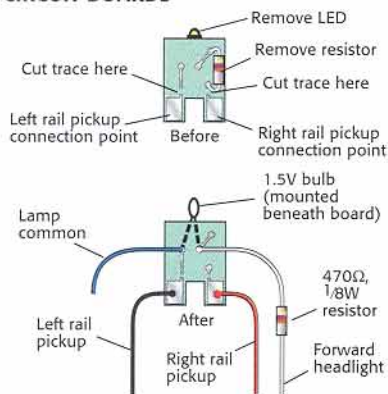


Illustration by Dick Scovier

Use a pair of wire cutters to trim the strip as close as possible to the round section (fig. 8). Place the contact back onto the brush holder and reinstall the brush holder.

Trim the bare wire so it doesn't stick out beyond the edge of the brush cap. Solder the orange wire to the top of the brush cap. Reassemble the brush, spring, and cap. Now repeat this procedure for the lower brush, only this time solder the gray wire in place.

File two small notches into the motor saddle directly over the top brush. These will prevent the wires from getting pinched between the two frame sections.

Reinstall the saddle, motor, and both worm drive assemblies. Attach the second frame half but don't tighten the nuts yet. Spread the two halves apart and insert the trucks. Fingertighten both screws. Then use your meter to verify an open circuit between the two sides of the frame.

Reattach both contact strips and snap on the fuel tank. Secure the decoder in the opening with a small piece of tape.

The headlight circuit board is a convenient location for the two track pickup wires. First make two small cuts as shown in fig. 10 to separate the LED connections from the frame contacts. Next, remove the LED and limit resistor. Before soldering the wire to the board, touch your iron to the trace and apply a bit of solder. Solder the red and black wires to the board.

We advise replacing the stock Atlas LED headlight with two Miniatures 1.5V incandescent bulbs (no. 18-001-20) in series with 470Ω, 1/8W resistors. You can also use 18V bulbs without resistors. The flasher shown in the diagram is an optional connection using the green function-1 wire and another 470Ω, 1/8W resistor.

Fig. 11 TYPICAL HO STEAM LOCOMOTIVE INSTALLATION

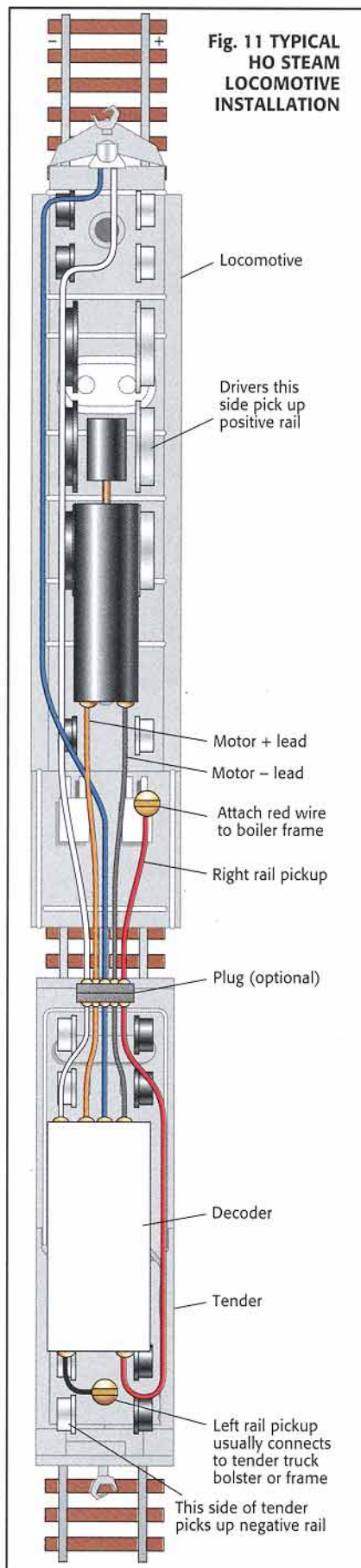


Illustration by Dick Scovier

IHC HO 2-6-0 installation

It's a little trickier to install decoders in steam locomotives, but it isn't difficult. Just keep in mind how most steamers pick up power from the rails and deliver it to the motor (fig. 11).

Since brass locomotives need to be approached on an (almost) case-by-case basis, we're going to describe steamer installation using International Hobby Corporation's 2-6-0 Mogul (fig. 12). The engine picks up power from the drivers on both sides. The front tender truck picks up power from the left rail and the rear truck picks up from the right rail. Two wires between the tender and locomotive transmit power from the tender to the motor.

The installation is shown in fig. 13. To install the decoder, remove the boiler mounting screws and gently lift the boiler from the frame. Next, remove the screw securing the motor mounting bracket and carefully lift the motor until you see the wires between the motor wires and the pickup strips. Cut these motor wires but don't cut the pickup wires from the tender. Unsolder the remains of the original motor wires and discard.

Solder two new wires to the sides of the motor. Use the wires supplied with the decoder and be sure they are at least 6" long. Connect these to the decoder motor output. Route the two new motor wires back toward the tender following the same path as the power pickup wires. You may want to place a small plug between the locomotive and tender.

Remount the motor, then slide the frame and motor assembly back into the boiler. Pull the wires back toward the tender and ensure the boiler fits properly. Install the pilot truck brass tensioner and mounting screw. Then install the screw underneath the cab. Finally, reattach the pilot truck.

Modifications to the engine are complete. You should have the two original pickup wires and two additional wires extending from the back of the locomotive frame.

We'll be mounting the decoder inside the tender but first we need to insulate the tender pickups from the frame. Remove the tender shell.

The two pickup wires are soldered to brass tabs on top of the truck screws. Leave these in place and solder two lengths of wire to connect

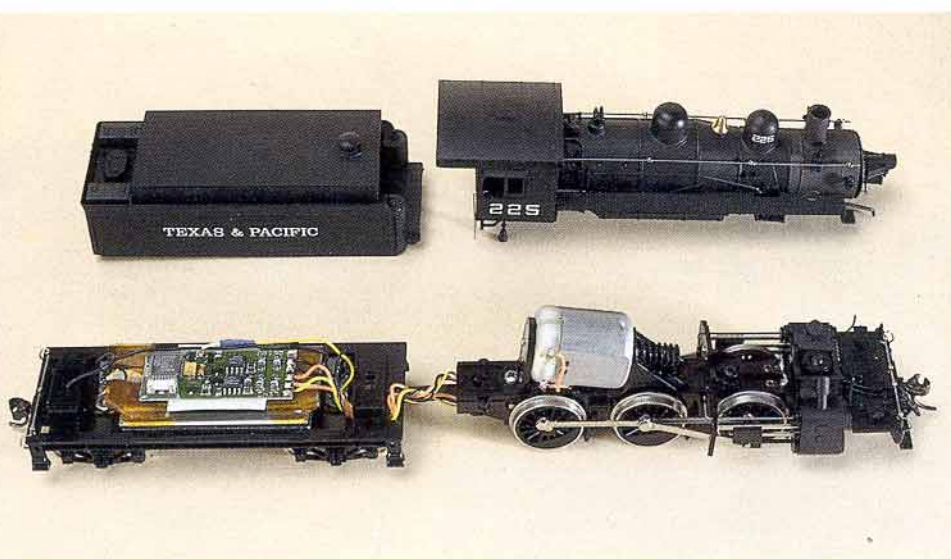
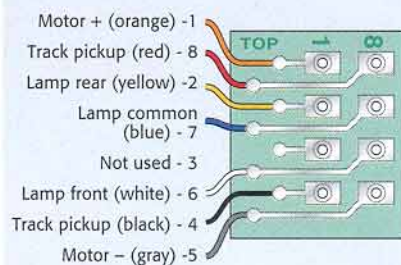


Fig. 12 IHC HO MOGUL INSTALLATION. The IHC Mogul is equipped with a Lenz LE103 decoder installed in the tender. The wire colors shown in the photo do not conform to NMRA specifications since existing wiring from a previous receiver installation was used.

Wiring with DCC plugs and sockets



If you intend to use a DCC socket-equipped locomotive, you can build your own plug out of circuit board material and some pins. Or you can purchase a premade plug direct from CVP Products. In either case, use this diagram to correctly wire your decoders.

Illustration by Rick Johnson

Fig. 13 IHC HO MOGUL WIRING DIAGRAM

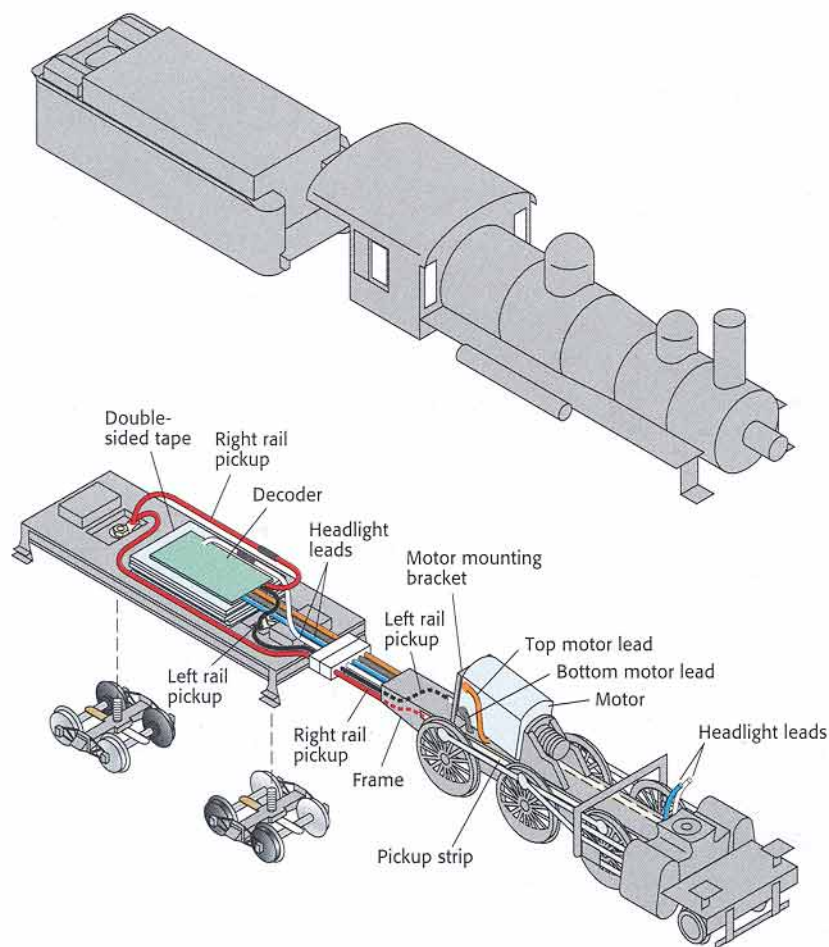


Illustration by Rick Johnson

each of the brass tabs with the two decoder input wires. Insulate the splice with heat-shrink tubing.

Solder the two motor wires to the motor wires of the decoder. If you're connecting the headlight or backup light to the decoder, make those connections now in accordance with the decoder manufacturer's instructions.

Insulate the metal weight inside the tender using electrical tape and install the decoder with double-sided tape. Check for loose connections, bare wires, or metal in contact with the decoder. Test the locomotive to ensure proper operation. If the locomotive direction is reversed, simply swap the motor wires.

Next time

That's it for now. You'll have a busy month getting a decoder installed in each of your locomotives. When we get together next month we'll install the EasyDCC command station on the layout and show you how to program decoders and run trains. ☘