



Decoder 101 INSTALLING A DCC DECODER IN A LOCOMOTIVE

By Ernie Little

What has to be done prior to installing a decoder?

There are several things that should have been done prior to starting the installation.

The decoder to be installed had to be selected, which is very important as installing or trying to install the wrong decoder will lead to a lot of frustration. One of the first steps in the selection process is what size of decoder you need. We are not speaking of physical size here; rather, we are looking at what current rating is needed to provide the electrical capacity large enough to supply the locomotive's electric motor. A stall test was performed to determine what the maximum draw, in terms of current, was required by the locomotive. This allowed us to select a decoder that was rated for at least that amount of current which will be needed by the locomotive when it is first starting from a dead stop, when the maximum draw of electric current takes place.

Another step in the selection process is to determine what physical size decoder can be installed in the locomotive's frame and shell. Although decoders are designed for N, HO, O, G and the other gauges of track, just because you have a particular scale decoder doesn't mean that that decoder will fit in the locomotive itself. For example for a steam engine you may need to locate the decoder in the tender due to space limitations inside the body of the steam locomotive's body. Another step in the selection process, just as important as the other two we have already mentioned, is selecting a decoder that is compatible with the wiring of the locomotive. Today's decoders are of such design that they can be installed using at least three different methods in a locomotive.

- ❖ Direct replacement of a circuit board with a decoder circuit board,
- ❖ Removal of a dummy plug which allows the installation of a plug attached to a decoder that just plugs into the provided receptacle, or
- ❖ Rewiring of the locomotive to connect the decoder's wires to the appropriate wires on the locomotive. This is the method you will have to use if your locomotive is not DCC ready.

The decoder that allows it to be installed, taking up the least amount of space and is compatible with the locomotive's wiring system is the one you want to install. Remember rule number 1; Model railroading is supposed to be a fun and enjoyable activity.

Next you will have to determine how to remove the shell of the locomotive, and there isn't only one way to do it. If you can find the literature that came with the locomotive (You know the papers that showed you the parts, told you about the warranty, and those papers you put in a special place for safe keeping, yeah, right!) you should be able to find a drawing of the locomotive that shows the how the parts are assembled. If you can't find, or never did have such a thing, then you are into the next challenge of

installation. Locomotives usually can have the shells removed by one of the following methods.

- ❖ Removal of screws that go through the frame into a retainer that is attached to the shell.
- ❖ Removal of the screws that retain the couplers and perhaps removal of the couplers also.
- ❖ Slight squeezing of the shell at two or more points to permit the retention devices to release.
- ❖ Slight spreading of the shell on each side of the frame to permit retention devices to release.

If none of the above work, or if you are not sure, you may want to get in touch with your hobby shop expert to seek their advice. You could also surf the Internet as there are web sites dealing with decoder installation that have step-by-step directions for some of the more popular brands of locomotives. (I.E. Digitrax.com or Digitrax@yahoogroups.com)

How do I install a decoder?

Now that you have gotten this far and have made the decision that you are going to get the decoder installed in your favorite locomotive, perhaps with a little help, and you have gotten the shell off of the frame without breaking it you are ready to move to the installation of the decoder itself.

Looking at the internal workings of the locomotive you need to determine if the locomotive's electric motor is ***isolated*** from the frame. For the decoder to work all paths that current can get to the motor from the rails must be intercepted by the decoder or it isn't going to work and probably short out and go up in smoke. Some locomotives use the frame as a method to carry current from one of the rail pickups to the motor. If you encounter this the wiring must be changed so this isn't the case. A simple test with a continuity light will tell you if this is true or not. If you find continuity between either of the two motor wires and the frame that indicates that the frame is being used for pickup and you will need to modify the wiring to make the pickup come through the decoder instead. This will involve connecting a new wire to the frame, possibly removing an internal connector between the motor and the frame, and installing a layer of insulated material (I.E. electrical tape) between the motor and the frame.

Once you assure that the locomotive's electric motor is isolated, you can now get to the nuts and bolts of decoder installation.

The wiring of a DDC decoder has been simplified for you by the standards set out by the National Model Railroaders Association for colors of the wires relating to their purpose and the connector size and pin locations on the connectors.

The wires you see on the decoder are ***coded*** as follows:

BLACK wire- left rail pick up

RED wire- right rail pick up

Orange wire- electric motor negative

Gray wire- electric motor positive

Think of it like this gray is a light black and orange is a light red.

PWMRC clinic- Installing a decoder in a locomotive

March 4, 2005

Page 3 of 4

BLUE wire- a common for the functions

WHITE wire- the forward headlight (F0)

YELLOW wire- the reverse headlight (R0)

OTHER wires- related to other functions depending upon the decoder.

If you have to modify the wiring of your locomotive or attach wires to the solder terminals on the decoder board I recommend that you solder them using an appropriate wattage solder iron or pencil. You should also use fine electronic solder and rosin soldering paste or fine electronic solder with rosin. The use of an appropriate weight of solder and type of flux is important as use of the wrong type may be corrosive to electrical wire and connectors. Use enough heat but not too much as we don't want to melt the circuit boards or decoder chip.

Some soldering tips:

- ❖ Strip and tin the wire tip,
- ❖ Put a small quantity of paste on the tinned tip and board,
- ❖ Clean any excess rosin off immediately with alcohol.

The decoder should come with a set of directions showing the wire colors and their purposes.

If you have a DDC ready locomotive and selected the appropriate circuit board or plug connector all you have to do is remove and replace the circuit board or dummy plug with the new decoder board or plug.

If the decoder has a connector it will be one of the following:

- ❖ Small plug-N-scale 6 pins in a straight configuration
- ❖ Medium plug-HO- scale 9 pin in a straight configuration
- ❖ Medium plug-HO- scale 8 pin in a rectangular configuration (2x4)
- ❖ Large plug- Large scale 4 pin

What about the forward and reverse head lights?

Look at the headlight bulbs and note what voltage and amperage they are rated for. Unless you selected a decoder that has voltage control to the headlights you will have to install a resistor on the wires going to the headlights to drop the voltage for the 1.5-volt rated headlights. The size of the resistor will depend upon how much amperage the headlight uses. If you don't know what the draw is start with a 1,000 OHM, ½ watt resistor and work your way down until you get enough light. Headlights rated for over 12-14 volts will not present a problem.

What else do I need to do?

You need to secure the decoder to the frame using something that is not electrically conductive, such as double sided adhesive, electrical, or scotch tape. Remember to dress up the wiring so it doesn't interfere with any of the moving parts of the locomotive.



PWMRC clinic- Installing a decoder in a locomotive

March 4, 2005

Page 4 of 4

Give the decoder a little bit of room to breath, remember, it has current going through it and it will heat up, especially when you are trying to run those 200 car trains.

Then put the shell back on the frame and secure it in place by using whatever retention system it uses. You are then ready to program the decoder if it requires such.

How do I program the decoder?

The brand of decoder you selected will indicate how you program it. One of the first things you probably will want to do is assign it an address so that you can control your locomotive. This will probably require you to program it to a new address different from the default. You will have to decide if you want a two digit or four-digit address. Your decoder may or may not be capable of four digit addressing. You will also want to look at programming the functions 1-6, if applicable to your decoder, the NDT (Normal Direction of Travel), and F0 (headlight function).