North Raleigh Model Railroad Club

Installing Decoders in N Scale Locomotives
Detailed Instructions

Atlas (Kato) EMD GP30/GR35 Diesel Locomotives

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Introduction

The following detailed description covers installation of a Digitrax DN93 decoder in Atlas (Kato manufacture) EMD GP30 or GP35 diesels, as actually performed by the author of this publication, and reflects the experiences encountered during those installations. Atlas GP30 and GP35 diesel locomotives are identical, except for the shell. Since multiple units (6) of the same type were converted from analog to digital, the descriptions presented reflect problem resolution and shortcuts developed.

This is one of the more difficult DCC conversions to carry out, and is not recommended for a first or early-on installation.

The Digitrax DN93 decoder was chosen because it was the most advanced available at the time of installation. Other Digitrax decoders could be used, as well as N scale decoders from Lenz, NCE, etc.

The most important factor to remember in performing an analog to digital conversion is to ensure both motor brushes and the decoder orange and gray wires are insulated from the frame. Any contact of the brushes and/or these wires with the frame may result in virtually instant destruction of the decoder.

The first step in the description which follows is to test the decoder for proper operation, following the instructions provided by the manufacturer. The purpose of this step is to ensure any non-operational or dead-on-arrival decoder can be repaired by the manufacturer under warranty.

As you carry out the detailed instructions below, also refer also to the assembly diagram and parts list provided by Atlas with the locomotive, and any instructions provided with the retroframe. They will help with laying out the parts and understanding the terminology used.

Retroframe

This installation uses the N Scale of Nevada (NSN) RRR-3035 Receiver-Redi Retroframe (RRR) and a Digitrax DN-93 decoder. Note that the TM3001 TrackMaster™ frame from Aztec Manufacturing Company (requires original frame be sent to Aztec) or the AGP3035N Digi-Frame from Southern Digital could also be used. The method of installation is similar in either case; filing and fitting are not required with the Aztec and Southern Digital frames.

Note that the NSN retroframe is no longer available, so current conversions must make use of the Aztec or Southern Digital frames.

Follow the procedure below to modify the Atlas frame yourself.

Tools Required

To install the decoder and modify the frame you will need the following tools:

Installing the Decoder
- Small Phillips-head and flat-head screwdrivers
- Wire cutter and stripper
- Soldering iron with fine tipped point, 20 watts maximum
- Fine resin core solder

- Tweezers (hook tipped work best)
- Long-nosed pliers, small
- Paint or magic marker

Motor Conversion

- Hacksaw
- Safety glasses
- Motor Tool with Metal cutting bits (ball shape, cone shape, etc.)
- 600 Grit wet and dry sandpaper

Modifying the Frame

If you do not wish to purchase one of the Retro-frames, above, you can modify your own existing frame to accept a DCC decoder. If you have the tools, time and inclination, this approach can save the extra cost of purchasing another frame in what is already an expensive process.

The following process applies to the Atlas frame. Refer to the detailed installation instructions for the locomotive in the next section, and follow those instructions to the point where you have the frame disassembled. Then proceed as follows:

❑ Remove the insulating bushings and place in a safe place.

❑ Assemble the bare frame halves together without the insulating bushings. Align the halves before the final tightening of the screws.

❑ Using the DCC decoder as a guide, mark the rear portion (assumes the cab and short hood are the front of the locomotive) of the frame to indicate the metal to be removed to accommodate the decoder.

❑ Hold the frame in a vise, and use a hacksaw and/or motor tool to cut out the marked portion. The cut does not need to be super-accurate because it will be dressed up with a file. Remove all sharp edges with a file.

❑ Use a Dremel #106 1/16" diameter rotary engraving cutter or equivalent in a motor tool to grind the necessary channels for the decoder wires (remember to wear eye protection). The channels need only be as deep as the diameter of the wire. Smooth the sharp edges of the channels with fine sandpaper to ensure the insulation on the wires cannot be pierced.

❑ Use 600 grit wet and dry sandpaper to polish the entire frame, especially in the areas where metal was cut.

❑ Clean all of the grindings from the frame.

❑ Disassemble the frame, placing the screws and nuts in a safe place.

You can now proceed to install the decoder per the detailed instructions, just as if you had purchased a new frame.

Detailed Installation Instruction
Atlas EMD GP30/GP35 Diesel Locomotives

Set your browser left and right margins to 0.5" (File Page Setup) and print out this document. As each step in the installation is completed place a "X" or a check-mark through the box. All references to the frame are based on the front being at the top or away from you.

The RRR-3035 contains some basic instructions. Read the instructions carefully before proceeding. This installation requires great care to insulate the decoder orange and gray wires from the frame; because of this it is one of the more difficult installations. Any contact of these wires with the frame will result in instant destruction of the decoder.

In normal analog (DC) operation, the right half of the frame is connected to the right rail and the top motor brush, and the left half of the frame is connected to the left rail and the bottom motor brush.

❑ Begin by testing the Digitrax decoder for proper operation per the instructions provided by Digitrax.

❑ Remove the GP30/GP35 shell, by prying out on the bottom of the cab carefully with a hobby knife (both sides) until the cab is freed, being very careful to pull the handrails out from their holes in the cab. Then remove the hood casting and, finally, the handrails and walkways. Place aside where they will not get damaged. They are not used until the final step.

❑ Remove the fuel tank and, using tweezers, carefully remove the electrical contact strips from the frame, and set aside.

❑ Remove the shroud around the front lamp by sliding it towards the front of the frame.

❑ Remove both the front and rear lamp boards by pulling the front board towards the front and the rear board towards the rear of the frame.

❑ Prepare the RRR by removing any flash found upon the casting using files and a hobby knife with No. 11 blade. Do this very carefully with reference to the Atlas frame, to ensure no mounting tabs or other needed metal are removed. Note and mark the right half of the Retroframe by comparison with the Atlas frame.

File the slot where the gray decoder wire will pass through the frame to the bottom motor brush as large as possible to reduce any chance of the wire shorting to the frame.

If you bend the frame a bit during the filing and fitting procedure, place the interior surface of the frame on a *known* flat surface. Place a piece of scrap wood on the exterior surface and *tap it firmly* with a hobby hammer.

❑ Place the mechanism on its side, screw head side up, and remove the screws. Once the screws are completely loose, hold the frame up and press down on the screws so the nut on the other side will pop out. Using a flat blade screwdriver, gently pry the two halves of the Atlas frame apart, carefully lining up parts on your work surface in the same order as they are removed and noting what each piece is by looking at the diagram Atlas provided with the locomotive.

If the two halves of the frame do not come apart easily then locate the four holes around the motor in the center. This is where the motor saddle locks the two halves together. Gently lift and push the tabs to release the saddle clips.

❑ Before removing the motor, make note of which motor brush contacts the right side of the frame, and place a mark on the motor (piece of tape; dab of paint, etc.) to indicate the top. Note that some Kato motors are already marked with a white stripe, either on top or on one side near the top.

If you are going to modify the Atlas frame yourself instead of using a retroframe, follow the steps in the section above now.

❑ Check to find if the shaft bearing blocks fit the RRR as they should, and remove material from the RRR to permit that to happen, if necessary.

❑ Move the copper bearing retainer clips from the left half of the original frame to the left half of the new frame.

❑ Before installing the decoder, re-assemble the mechanism using the Redi-Retroframe in place of the OEM frame. Install the trucks, contacts strip, etc. â€" everything except the body parts. Put the assembly on a test track and make sure the locomotive runs as it should, checking both directions, etc. When operating correctly, disassemble it again as described above.

❑ Cut off the motor brush contact strips as close to the brush caps as possible. Use a small screwdriver to bend the remaining piece up next to the brush caps.

❑ Place the motor back into its saddle and place the saddle into the right half of the Retroframe. Hold the decoder in its mounting location on the top rear of the frame, and mark off the length of the gray wire needed to reach down the side of the frame, through the slot and connect to the bottom motor brush, then add ¼". Similarly, measure the length of the orange decoder wire needed to reach down from the top of the frame (through what will be a hole when the two frame halves are re-assembled) to the top motor brush, and add ¼".

❑ Strip 1/16" insulation from the orange and gray wires.

❑ Remove the motor from the saddle for the following steps.

❑ Pass the gray wire through the slot in the side of the Retroframe (with the decoder on the "inside" of the frame) and carefully solder the gray wire to the edge of the bottom (negative) motor brush cap.

Note: always remove the motor brush caps before soldering to them. Then lightly sand them to get a good clean surface, and apply liquid flux. Finally, solder the wires to the cap.

Do not attempt to solder to the motor brush caps while they are still in place in the motor, as too much heat applied to the brush caps during such soldering may melt the plastic brush housing and permanently damage your motor.
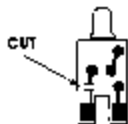
After soldering the wires carefully replace the brush, spring and brush cap into the motor.

❑ Solder the orange wire to the edge of the top (positive) motor brush cap. Make sure the wire does not pass through the slot in the side of the frame. When this step is complete, the gray decoder wire should pass through the frame from the outside to the lower motor brush cap, and the orange decoder wire should go directly to the top motor brush cap.

❑ Very carefully place insulating tape around the motor brushes so they cannot short to the Retroframe when the motor is mounted in its saddle to the frame, but still permit full seating of the motor in the saddle and the frame. This is the single most important step in this procedure.

❑ Place the motor in its saddle and mount the motor saddle, shafts and bearing blocks in the right side of the frame.

❑ Using an ohmmeter, carefully check for shorts between each motor brush and the frame. Correct any problems before proceeding.

❑ Using the screws, spacers and hex nuts, mount the left side of the RRR to the right side. Do not fasten too tight.

❑ Using an ohmmeter, again check for shorts between each motor brush and the frame, and between each half of the frame. Correct any problems before proceeding.

❑ Connect the red and black wires of the decoder to a suitable power pack, and test for proper analog operation of the motor to ensure there is nothing binding within the Retroframe. Resolve any problems before continuing.

❑ The red and black wires connect to the frame via the screw and nut at the rear of the frame. Holding the decoder in its place on top of the frame, determine the length of the red and black wires needed to reach the nut and screw, then add Â¼" and cut each wire. Strip 1/8" insulation from each.

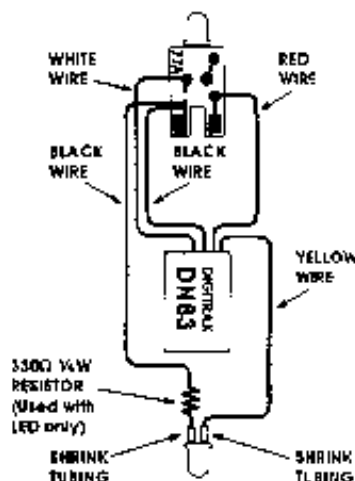❑ Remove the screw and nut from the rear of the frame, holding the frame together with your fingers or a small C-

clamp (be careful not to over tighten or you will bend the frame).

❑ Place the stripped part of the red wire under the nut as the nut is pushed into the frame. Be careful that the wire does not go into the hole through the frame.

❑ Place the stripped part of the black wire under the screw as the screw is pushed into the frame. Be careful that the wire does not go into the hole through the frame.

❑ Tighten the screw until the frame is secure.

❑ Using an ohmmeter, check for a short circuit between the two halves of the frame. If a short is detected, it is probable that the red and black wires are shorting through the frame screw/nut hole. Undo the screw and nut, and reposition the wires carefully. Tighten the screws and test again.

❑ Loosen the screws enough to install the trucks, then tighten. Make one more check for a frame short with an ohmmeter. Resolve any problems.

❑ Finish re-assembly of the mechanism, such as the contact strips on each side. Fully tighten the RRR. Install the fuel tank on the frame to hold the contact strips in place.

❑ Ensure the white and yellow wires cannot short against anything or each other, and test the locomotive for both analog and digital operation on the layout. Resolve any problems and ensure the mechanism runs perfectly before continuing.

Note: if the locomotive runs in the wrong direction, the motor may be mounted in the locomotive upside down. Remove the brush retaining caps and turn the motor over. Replace the brush retaining caps and test again.

❑ Carefully cut the left hand trace on the front headlight assembly circuit board just in front of where it meets the RRR, as shown at right, so the circuit is not complete to the left half of the RRR.

❑ Mount the front headlight assembly to the RRR in the normal manner.

❑ Solder the end of the white wire to the left trace on the lamp circuit board in front of the cut made previously.

❑ Snap the front lamp shroud back in place.

❑ There is not sufficient clearance over the decoder to use the rear headlight assembly directly. Remove the circuit board.

❑ Carefully unsolder the LED and resistor from the circuit board, and solder the resistor directly to the same wire from the LED that it was soldered to on the circuit board; this is important for polarity reasons.

Note: this diagram shows an alternate way of connecting the decoder red and black wires to the frame.

❑ Solder a wire from the resistor to the part of the left trace on the forward light circuit board that contacts the frame, i.e. the part of the trace opposite where the white wire is soldered. Solder the yellow wire from the decoder to the remaining terminal on the LED. The final wiring diagram is shown above.

❑ Test the locomotive to ensure proper operation of all functions of the decoder. Resolve any problems before continuing.

❑ Position the decoder and rear light in place over the RRR, and, using electrical tape, tape in place. Dress all wires over the top of the frame and to the rear of the frame so that they will not interfere with the body as it is placed back on the frame. Adjust and secure with tape as necessary.

❑ Place the handrails and walkways on the frame, then replace the hood. Check to ensure all wires are positioned out of the way, and that they do not cause the hood to bow out anywhere. Finally replace the cab, and put the handrails in their proper holes in the cab. Installation is complete.

❑ Test the operation of the locomotive on the railroad. It should operate just as if no modifications had been made. Resolve any problems.

❑ Place the locomotive on the DCC programming track and set the DCC Command Station to the programming mode.

❑ Program Configuration Variable "CV29" to "06/x06" (for 2-digit addressing or "38/x26" for 4-digit addressing) then program the decoder to the desired address.

❑ Carry out a final check of the locomotive on the railroad.

❑ Record the decoder CV's and address, and the reporting marks of the locomotive.

The conversion is complete. Enjoy your DCC-equipped locomotive.