North Raleigh Model Railroad Club

Installing Decoders in N Scale Locomotives
Detailed Instructions

Con-Cor GE U-50 Diesel and UP Gas Turbine

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Introduction

The following detailed description covers installation of a Digitrax DZ120 decoder in Con-Cor GE U-50 diesels and the Con-Cor UP Gas Turbine, as actually performed by the author of this publication, and reflects the experiences encountered during those installations. Since multiple units of the same type were converted from analog to digital, the descriptions presented reflect problem resolution and shortcuts developed.

This is one of the easier DCC conversions to carry out, and is recommended for a first or early-on installation.

The Digitrax DZ120 decoder was chosen because its size allowed a "perfect" fit at the rear of the locomotive frame, the current handling capacity was sufficient, and the FX functions of the DN140 decoder were not required. For example, no prototype U-50 or Gas Turbine was equipped with ditch lights. Other Digitrax, Lenz, NCE, TCS, etc., decoders can be used.

Also covered is the installation of either the factory provided headlight or Miniatronics Catalog No. 18-001 1.5 volt focused headlights.

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.

Retroframes

There is no retroframe available for this conversion, nor is one needed since there is only a minor modification to the frame required. This is the cutting or filing of a slot for the wires to the motor brushes to pass up the side of the frame so they do not bulge the shell. Refer to the appropriate section below for information on this modification.

If the Miniatronics headlight option is selected, a second slot must be cut or filed in the frame; refer to the appropriate section.

Tools Required

To install the decoder 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
- Set of flat hobby files
- Paint or magic marker

Modifying the Frame

- Motor Tool with metal cutting buts (ball shape, cone shape, etc.
- Round hobby file
- No. 600 wet and dry sandpaper
- Safety glasses

Modifying the Frame

You will be cutting a 1/16" deep vertical slot in the side of the upper frame section approximately 5/8" back of the front of the

top-most part of the frame, which is approximately 2-3/8" back from the front of the frame.

When directed in the detailed installation instructions below, modify the frame of the U-50 as follows:

- ❑ Mark a vertical line on the right side of the upper frame approximately 5/8" back of the front edge of the top-most part of the frame. This is approximately 2-3/8" back from the front of the frame.
- ❑ Place the upper frame in a vise. Use a round hobby file or a Dremel #106 1/16" diameter rotary engraving cutter or equivalent in a motor tool to grind the necessary channel for the decoder wires (remember to wear eye protection). The channel needs to be only as deep as the diameter of the decoder wires. 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 frame in the areas where metal was cut.
- ❑ Clean all of the grindings from the frame.

If you will be installing the Miniatronics headlight option, you also need to enlarge the existing slot on the top front of the frame as follows:

- ❑ Place the upper frame in a vise. Use a round hobby file or a Dremel #106 1/16" diameter rotary engraving cutter or equivalent in a motor tool to grind the existing channel down to the flat surface of the frame. (Remember to wear eye protection.) Smooth the sharp edges of the channel with fine sandpaper to ensure the insulation on the wires cannot be pierced.
- ❑ Clean all of the grindings from the frame.

You can now continue to install the decoder per the detailed instructions which follow.

Detailed Installation Instruction
Con-Cor GE U-50 Diesel & UP Gas Turbine

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.

In normal analog (DC) operation, the U-50/Gas Turbine upper frame is connected to the left rail and the lower frame is connected to the right rail. (The metal screw on the left side of the frame is the left rail, and on the right side is the right rail.) The motor top brush is the left rail connection and the bottom brush is the right rail connection.

- ❑ Begin by testing the Digitrax DZ120 decoder for proper operation per the instructions provided by Digitrax.
- ❑ Cut the decoder wires as follows, then strip 1/8" insulation from the ends:

Red	3¾"
Black	3¾"
Orange	3"
Gray	2-5/8"
White	4"
Blue	4"
Yellow	Note

Note: The U-50/Gas Turbine does not have a rear headlight. It is suggested the yellow decoder wire be cut to 1/2", leaving a length that can be used should the decoder be later installed in another locomotive.

- ❑ Remove the U-50/Gas Turbine shell by spreading the bottom of each side of the shell carefully with your fingers and lifting upwards until free. Set aside.
- ❑ Remove the fuel tank by undoing the Phillips screw in the bottom. Set aside.
- ❑ Undo the four (4) screws on the left side of the frame — three (3) insulated screws and one (1) metal screw (which anchors one of the headlight leads). Put aside in a safe place.

  This releases the truck sets and the left truck anchor plates. Set the trucks and anchor plates aside.
- ❑ If you are replacing the Rapido couplers with other couplers such as Micro-Trains, Unimate or Kato couplers do this now. Note the distinction between front and rear truck sets is only in the coupler mounts and pilot.
- ❑ Remove the two (2) screws from the right side of the frame and set aside in a safe place. Place the headlight aside.
- ❑ Note the two (2) black plastic spacers between the top and bottom of the frame. These are the gear covers. Each gear cover has four (4) nipples, two (2) of which extend up into the top portion of the frame and two (2) that extend into the bottom portion of the frame. Carefully lift off the top of the frame, and release the gear covers before removing completely.
- ❑ Remove the gear covers from the bottom part of the frame and set aside.
- ❑ At this time go to the section on Modifying the Frame and make the necessary modifications to the top section of the frame for the decoder wire channel and, if installing the Miniatronics headlights, the headlight wire channel.

- ❑ The bottom brush on the motor receives power from the right track and will thus be connected to the orange decoder wire. The top brush of the motor receives power from the left track and will thus be connected to the gray decoder wire. Before removing the motor, place a mark on the motor (piece of tape; dab of paint, etc.) to indicate the top. Note that some Con-Cor motors are already marked with a white stripe on the right side at the bottom.

  The motor rests in a cradle which will be removed with the motor. As you lift the motor the drive train will also raise, with the drive shaft bearings nearest the motor coming out of their guides.

  Remove the motor and cradle by lifting it until the motor gears clear the drive shaft gears, and then lift straight up until clear. Ensure the drive shafts are secured in the frame bottom.

- ❑ Remove the motor from the cradle, being careful not to lose the thin plastic spacer. Set the cradle and spacer aside in a safe place.

- ❑ Cut off both brush contact strips so they do not extend past the side of the motor.

- ❑ Carefully solder the orange decoder wire to the bottom motor brush contact strip, and the gray decoder wire to the top motor brush contact strip.

  Note: solder the wires to the brush contact strip quickly, as too much heat applied to the brush contact strips and caps during soldering may melt the plastic brush housing and permanently damage your motor.

- ❑ Place the motor back into its cradle — the motor brushes go towards the larger, irregular opening in the cradle — ensuring the plastic spacer is in place. Run the orange decoder wire up the right side of the motor.

- ❑ Replace the motor and cradle back in the frame, brushes towards the front, carefully re-aligning with the drive shaft, gears and bearings. Push the motor down into the frame as far as possible and ensure the gear bearings are correctly inserted in their slots and the drive train is completely aligned.

- ❑ Lubricate the drive train plastic gears and oil the bearings. Be sure to use plastic-compatible grease and oil.

- ❑ Place the gear covers back on the lower frame. The nipples for the lower frame go towards the end of the frame in each case.

- ❑ Insulate the bottom surface of the highest part of the top section of the frame with black electric tape or equivalent. This is done to ensure the top motor brush and gray decoder wire connection cannot short to the frame.

- ❑ Remount the frame top to the frame bottom and fasten using the two (2) metal right side screws.

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

- ❑ Lubricate the gears on the trucks. Be sure to use plastic-compatible grease.

- ❑ With the frame on its right side, position the rear truck set (note coupler pocket without the pilot) and then the truck anchor plate. Hold in place while inserting the two (2) insulated screws in the rear left side of the frame.

- ❑ Repeat for the front truck and truck anchor plate using one (1) insulated screw at the front and the last metal screw.

- ❑ Dress the orange and gray decoder wires up the right side of the motor into the slot previously cut in the side of the frame, then back to the rear of the frame. Tape the DZ120 decoder to the frame just to the rear of the rear right-side screw.

- ❑ Dress the decoder red wire forward over the frame. Loosen the screw at the right front of the frame, fasten the red decoder wire around the screw and re-tighten the screw.

- ❑ Repeat with the black decoder wire, fastening it to the metal screw at the left front of the frame.

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

- ❑ Test operation of the decoder and locomotive using a DCC system. Resolve any problems before continuing.

The next steps cover installation of the stock headlight provided by Con-Cor with the locomotive.

- ❑ Cut the headlight leads one (1) inch from the light. Discard the diode.

- ❑ Strip 1/8" insulation from each wire.

- ❑ Solder the white decoder wire to one headlight lead and insulate the joint. Solder the blue decoder wire to the other headlight wire and insulate the joint.

- ❑ Place the headlight in position on the frame just as it was on the original, unmodified locomotive. Tape the wires to the frame to secure the headlight in place.

- ❑ Proceed to the steps under "Final Assembly" below.

The next steps cover installation of the Miniatronics 18-001 incandescent 1.5 volt, 15 mA headlights. The lights will be connected in series with each other and with a 700-ohm, 1/8 watt resistor.

- ❑ Remove the plastic headlight lens assembly from the locomotive shell. Spot glue the window plastic to the shell to secure in place without the headlight plastic. Be careful not to get glue on the portion of the "glass" seen from outside the shell.
- ❑ Carefully drill out the headlight openings with a #55 drill. Check with the Miniatronics lights that they go through the drilled holes without too much resistance.
- ❑ Cut one wire of each Miniatronics lamp to 1/2", strip 1/8" insulation from each end and solder together. Insulate the joint.
- ❑ Place the lights in the enlarged headlight openings in the shell, and position so the front surface of the lights is even with the front of the headlight opening. Being careful not to move the lights, glue them in place. Set the shell aside until the glue is dry.
- ❑ Cut the remaining Miniatronics light wires to 2" and strip 1/8" insulation from each.
- ❑ Solder the blue decoder wire to one of the headlight wires. Insulate the joint.
- ❑ Solder the white decoder wire to one end of the 300-ohm resistor. Insulate the joint.
- ❑ Solder the remaining headlight wire to the other end of the 300-ohm resistor. Insulate the joint.
- ❑ Paint the portion of the headlights extending out the back of the headlight opening into the shell with black paint so the interior of the cab will not be illuminated when the headlights are turned on.
- ❑ Now proceed to the final assembly and testing of the locomotive.

The following steps cover final assembly, testing and programming of the converted locomotive.

- ❑ If the Miniatronics headlights were installed, dress the wires to the headlight so they fold into the shell above the frame.
- ❑ Carefully place the shell over the frame and press down until fully in place.
- ❑ 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" 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.