North Raleigh Model Railroad Club

Installing Decoders in N Scale Locomotives
Detailed Instructions

Atlas Two-Truck Shay

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Introduction

The following detailed description covers installation of a Lenz LE0511W decoder in an Atlas Two-Truck Shay locomotive as actually performed by the author of this publication, and reflects the experiences encountered during those installations.

The Atlas Two Truck Shay is quite an impressive locomotive with working crankshaft/side shaft details and a nice metal casting body with added on details. Since my layout is DCC, if this was going to run on my pike, I would have to figure out a way to shoehorn a decoder in it. One nice thing is that this decoder installation does not require touching the side crankshaft/side shaft details.

This is a difficult DCC conversion to carry out due to the sizes and delicate details involved, and is not recommended for a first or early-on installation.

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. They will help with laying out the parts and understanding the terminology used.

These instructions are one way to do it. Please note the cautions and other observations in the text.

Tools Required

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

Installing the Decoder
- Small Phillips-head screwdrivers
- Wire stripper
- Soldering iron with fine tipped point, 20 watts maximum
- Fine resin core solder
- Tweezers (hook tipped work best)
- Long-nosed pliers, small
- X-Acto knife with #11 blade and #17 chisel blade
- Qty 2 620-ohm surface mount or 1/8-watt resistors
- Kapton tape
- Double-sided cellophane tape
- Double-sided foam tape
- 3/64" Shrink tubing
- Liquid electrical tape

Modifying the Frame
- Walthers Goo
- Jeweler's files
- Dremel Tool with 1/8" high speed cutter (1/8" shank and 1/8" dia. bit) and Fiberglass cutoff wheel
- Safety glasses
- Styrene material

- .010" thick Brass material
- Qty 2 620-ohm surface mount or 1/8-watt resistors
- Engine Black paint
- Dial or vernier calipers
- 600 Grit sandpaper
- Styrene cement
- Thick cyanoacrylate glue

Detailed Installation Instruction
## Atlas Two-Truck Shay

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.

Before starting, test the decoder to insure that it is functioning correctly and that the locomotive is broken in and running well. This is critical as we will be checking the operation several times during the decoder installation process. Note that care must be taken when handling the Shay as there are many details (including the crankshaft and rotating parts) that are easily bent, broken or lost.

❑ Turn the locomotive over and remove front and rear couplers by unscrewing the coupler screws. You may want to use tweezers or pliers to hold them when removing the screws as I had one disassemble itself when I removed the screw holding it to the frame.

❑ Remove the 4 screws that hold the frame to the body. Note which screws come from which holes. The front screws are shorter than the rear screws, and on my unit, each rear screw only worked in the hole it came out of.

❑ The body should now lift off the frame. If needed, alternating a little light tug on the front and rear trucks should be all it takes to separate the frame from the body.

❑ On the frame, closely examine where the motor contacts touch the electrical pickup that runs the length of the frame on both sides. We need to get a piece of Kapton tape between the motor contact and the electrical pickup strip. Ideally this would be done without removing the motor from the frame, but that was one thing I couldn't quite figure out.

❑ Look at the bottom of the frame and you will see four clips that hold the motor to the frame. Note that the front set has one clip shortened to clear the cylinder bracket on the bottom and the rear set of clips are the same size. Using a pair of tweezers with the points spread, lightly push on the bottom of the front clips to disengage them from the frame. Push towards the center of the frame and up towards the motor. If all goes well, the motor will disengage from the frame once one end is free from the frame. Be careful with

the shortened clip as it is easy to break, and if it is broken, you will have to glue the motor mount to the frame later during reinstallation. (This was learned on conversion #1).

❑ Modify the tabs on the front motor mounting plate as shown.
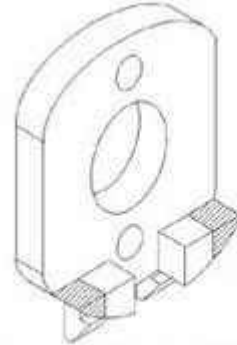

Remove Shaded Areas

Front Mounting Plate Modification

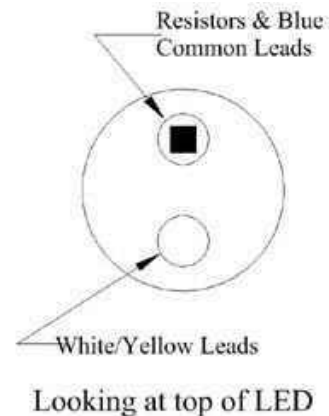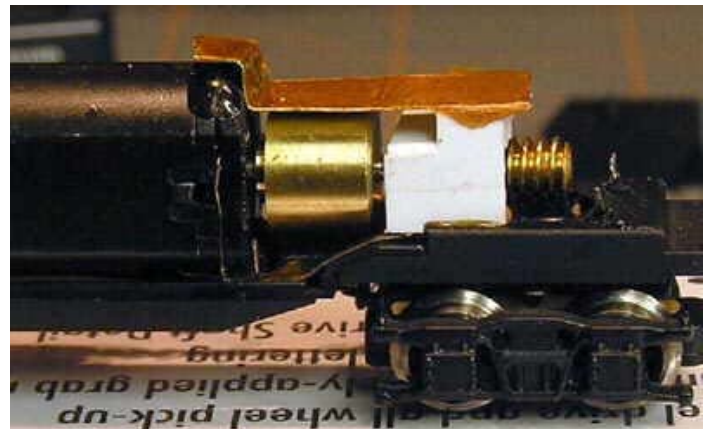❑ Bend the motor contacts out and up into a U shape as shown. Clean and tin the front of the contacts.

❑ Turning our attention to the frame, place 1/16" wide by Â¼" long Kapton tape strips over the electric pick up strips directly underneath where the bent motor contacts originally contacted them.
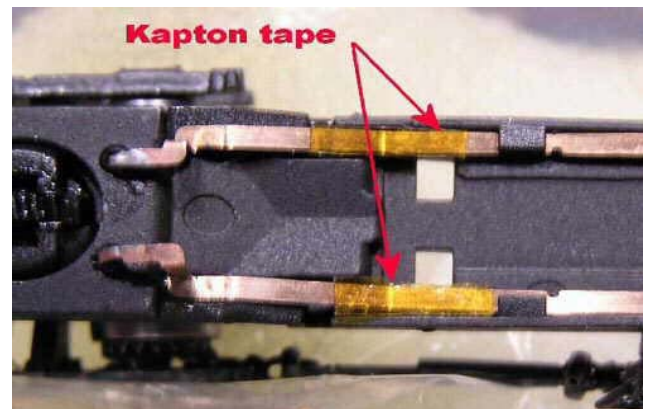
❑ Carefully note exactly where the front and rear lights are located and their relationship to the body mounting holes. Also note the height of the LEDs from the frame and which one is the headlight and which one is the tail light as one is ORANGE and the other is YELLOW when illuminated. Needless to say, we want to get the right LED in the right spot when we reassemble the locomotive. After making your measurements/notations/etc, unsolder the lights and resistors from their contacts coming through the frame.

❑ Fold the unsoldered front light contacts towards the rear of the locomotive (parallel to the worm gear). Use liquid electrical tape (LET) or small pieces of shrink tubing and insulate the front headlight contacts above the frame. Use a little Goo to secure the shrink tubing if necessary.

❑ Build a decoder mounting platform from styrene and brass sheet. See illustrations below for identification of materials and basic construction details that I used. I formed the platform base supports first and Goo'd them to the frame making sure they didn't contact the flywheel or interfere with the rear truck rotation. A styrene shelf for supporting the decoder leads was cut to fit and glued in place. The decoder mounting plate was cut from .010" brass sheet and bent to shape as shown below. Kapton tape was applied to the entire top of the brass sheet and then the decoder plate was Goo'd to the decoder plate supports. The important thing is to keep the decoder from touching any rotating parts (flywheel and worm gear), giving the wires clearance to get from the decoder to their solder points, and keeping the decoder low enough to clear the modified oil bunker and cab bulkhead.

.040" THK STYRENE

Decoder Plate Support

.010" Thk. Brass

Decoder Plate

Decoder Mount Construction
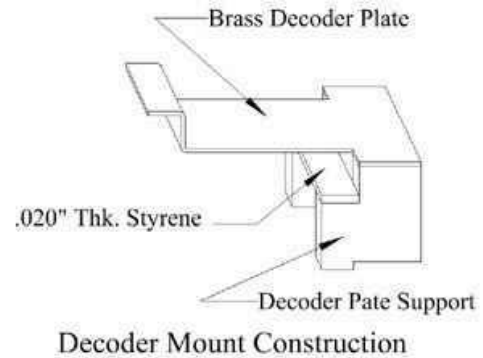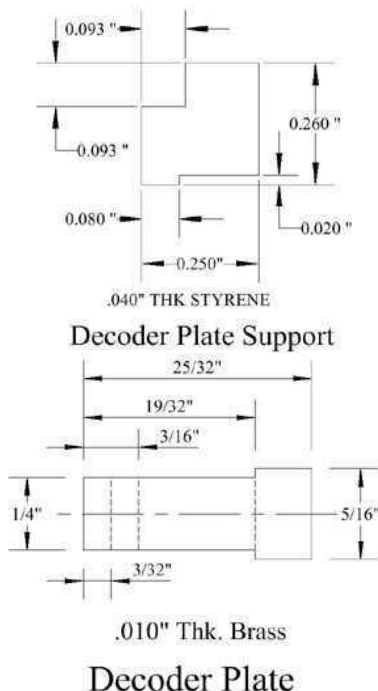
See photo below for installed decoder mounting platform.

Looking at top of LED

❑ Unsolder the existing resistors from the LED's and see the illustration for the correct location of the new resistors. Note that the new resistor on the rear LED goes to a different lead from which the original resistor was removed. The headlight goes into a constricted area and the resistor shouldn't protrude far outside of the LED body. Make sure you can distinguish which post is which (one circular and one circular with a black square in it). The post with the black square in it is the brightest part of the LED and we will need to position the LED correctly to get the appropriate brightness from the light lens in the body.

❑ Now for the decoder itself. I recommend building the decoder mount, and then determine the lead length needed for your particular installation as any variation in lead routing will make a difference in the final lead length.

❑ Wiring Scheme (looking at frame as an Engineer sits in it):

| Lead Color	Goes To
Red	Right hand electric pickup (original right real light lead)
Orange	Right hand motor contact
Black	Left hand electric pick up (original left rear light lead)
Gray	Left hand motor contact
White	Headlight
Yellow	Rear light
Blue	Head and rear lights with resistors

❑ Thread the Red and Black decoder leads through the decoder mount (over the shelf and worm gear, underneath the mounting plate). Cut decoder leads to length, and slide shrink tubing over leads. Both leads were stripped back 1/16" and tinned.

❑ Run Orange and Gray motor contact leads to their respective contacts and cut decoder leads to length. Strip leads back 1/16" and tin.

❑ Solder the electrical pick up and motor contact leads.

❑ Tape off the light leads and place the frame on a programming track. Locate and fix any shorts. Program the decoder to Precision Glide Control (CV50 = 01) instead of the default Silent Drive (CV50 = 08). Place the running frame on a DCC powered track and confirm proper operation in both directions. Fix any new operational problems before proceeding.

❑ Slide shrink tubing over solder joints on the Red and Black decoder leads and carefully shrink tubing to insulate the solder joints.

❑ Place a small piece of thin double sided foam tape on the decoder mounting plate and affix the decoder.

❑ Place a piece of Kapton tape over the top of the decoder to insulate it from the Oil Bunker and cab bulkhead cutout.

❑ Modify the blue common lead by splicing an additional lead to it as shown. The added lead should be at least 1½" in length
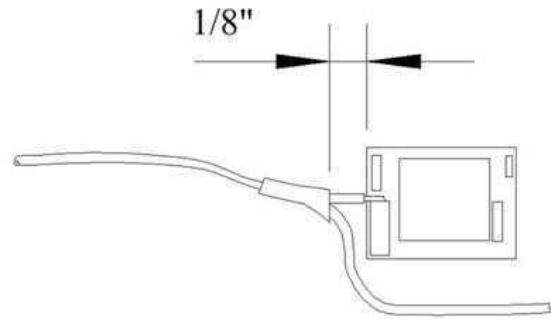

Blue Lead Modification

❑ Temporarily place the headlight and resistor in place with Goo. Make sure the LED post with the black square in it will be directly behind the headlight lens. Confirm the LED's location with your previous measurements/notations.

❑ Run the long Blue and White decoder leads across the top of the motor and down in front of the flywheel. Make sure the flywheel cannot contact either wire. Bend wire and leads as necessary to meet with the temporarily placed LED. Keep the leads as close as possible to the worm gear without touching it. I ran the headlight leads over the top of the folded down and insulated light leads. Cut leads as necessary, allowing at least 1/16" extra for stripping, tinning, and soldering.

❑ Remove LED, and clean all Goo from the resistor and LED lead.

❑ Solder the long Blue lead to the resistor for the front LED and the White lead to the other LED contact post. Use Liquid Electrical Tape to insulate the solder joints.

❑ Place a piece of double sided cellophane tape to the top of the motor. Press the white and blue leads to the tape.

❑ Fix wires and leads to frame with Goo.

❑ Use Goo to secure the headlight and resistor in place.

❑ Thread the Yellow and short Blue tail light leads through the decoder mount as shown in the photos. Temporarily mount the tail light resistor and LED with Goo. Bend LED leads as necessary to place the LED in the same position as it was prior to unsoldering it from the frame contacts. Make sure the LED post with the black square in it is pointed toward the outside corner of the frame.

❑ I ran the tail light leads behind the rear of the original light leads (now soldered to the decoder Red and Black leads). Cut leads as necessary, allowing at least 1/16" extra for stripping, tinning, and soldering.

❑ Remove LED, and clean all Goo from the resistor and LED lead.

❑ Solder the short Blue lead to the resistor for the rear LED and the Yellow lead to the other LED contact post. Use Liquid Electrical Tape to insulate the solder joints.

❑ Once the goo and liquid electrical tape have dried, put the frame back on the programming track and check for shorts. If it passes this test, put it on a DCC powered track and test the running and light functions. Fix any shorts in the lighting or hitches in running


Or width to fit decoder

Cab Bulkhead Modification
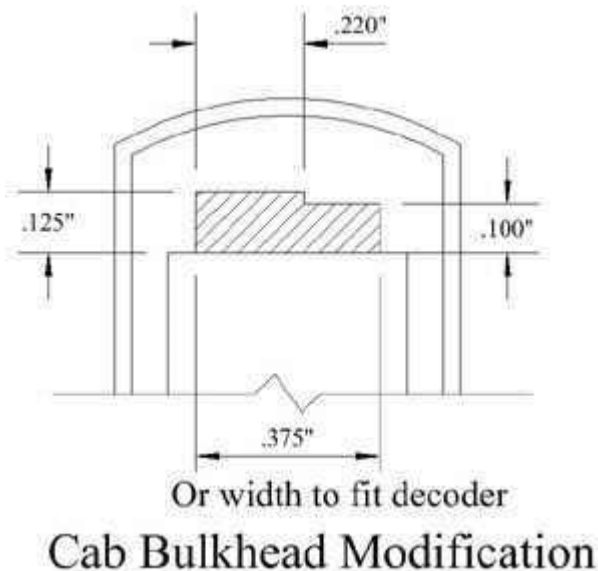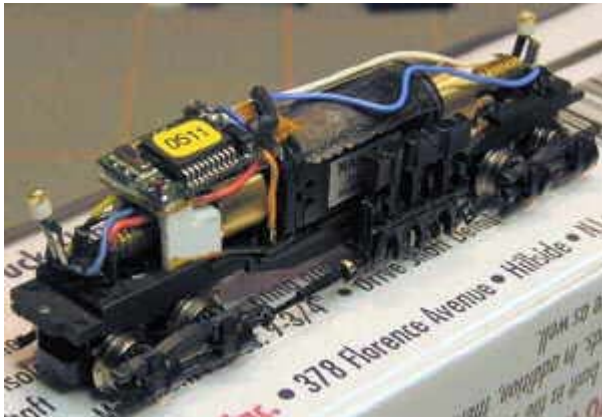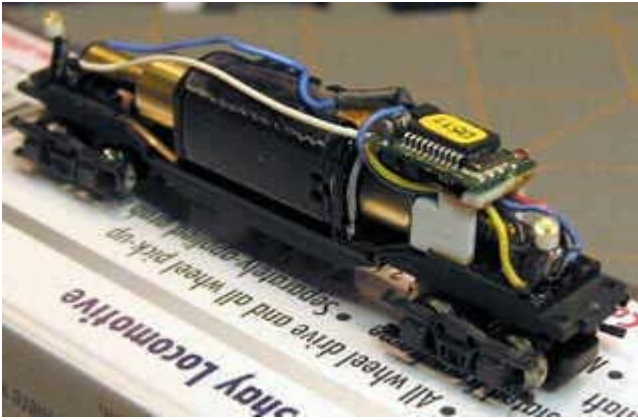
❑ Thoroughly clean the body of ALL dust, debris and metal filings.

❑ Replace the body (without Oil Bunker) onto the running frame and check for any interferences from wiring and decoder placement. The body must slide down onto the frame without needing additional pressure to get it fully seated. If needed, cut notch in bulkhead deeper or wider until it no longer contacts the decoder. If the notch is going to be deeper than 9/64" (.140") to clear decoder, then check height of decoder mount plate to make sure it clears the flywheel by a minimal amount (.015-.020). Once the bulkhead notch clears the decoder, if the body still won't seat fully, check headlight/tail light placement and height, and finally headlight lead routing until all interferences are located and corrected.
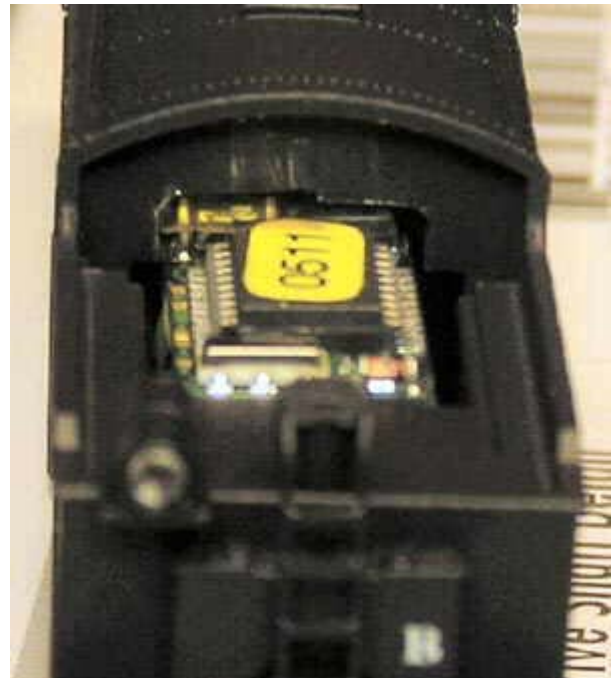
❑ Cut a notch in front of Oil Bunker as shown. I used a fiberglass cutoff disk in my Dremel tool for this. The first time I tried using the high speed cutter, but the vibration caused one of the bunker ears to fly off the bunker.

Bunker Modification
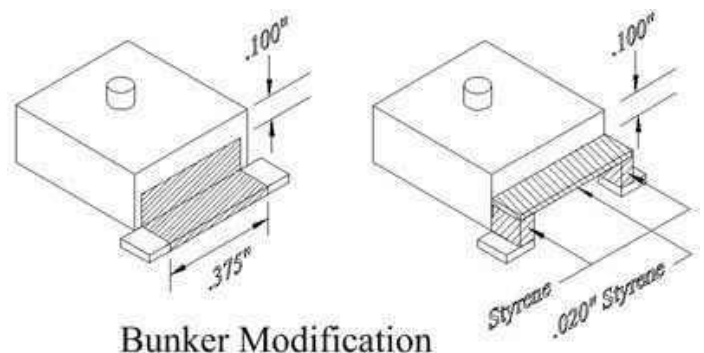
- Build up the front of the Oil Bunker with styrene as shown. Use styrene glue where appropriate and thick cyanoacrylate glue on the styrene to metal joints.
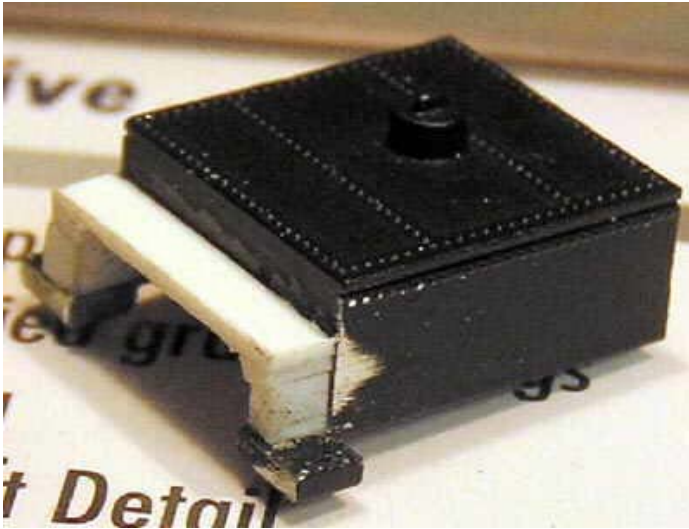
- Remove the body from the frame, install the modified Oil Bunker to the body, and note how well the modified bunker front opening matches up with the notch in the cab bulkhead (while looking at the underside of the body). They should be at the same (or very close) height and width. If not, modify the Oil Bunker front opening until they are close. Replace the body onto the frame, again checking for interferences. Once the body easily seats fully on the frame, the modifications are complete.

- Remove body from frame and remove Oil Bunker from body.

- File and sand Oil Bunker additions smooth and paint with Engine Black paint.

- Paint cab bulkhead cutout with Engine Black paint.

- Once paint is dried, install modified Oil Bunker to body and install body onto frame.

- Replace the 4 frame to body mounting screws.

- Replace front and rear couplers.

- Your Atlas Shay conversion is now ready to run!

- 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 "26" for decoders capable of 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 Shay.