DCC Install

Christian Kier

April 13, 2026

Table of contents

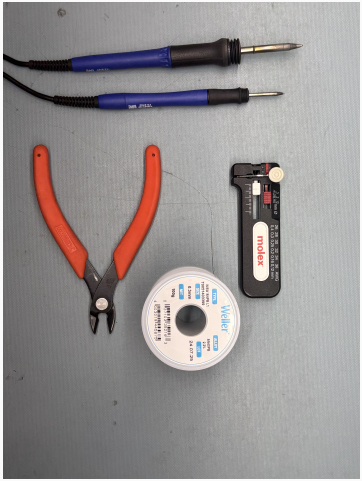
Getting Started

Introduction

- DCC stands for Digital Command Control, a standard for controlling model trains.
- It allows for independent control of multiple trains on the same track.
- Each locomotive is equipped with a decoder that receives commands from a central controller.
- Most locomotives today can be purchased with a decoder already installed, or are DCC ready allowing for easy installation.
- Older locomotive models may require a decoder to be installed, and that is what this project is about.

Tools

- Soldering Iron: A good quality soldering iron is essential for making secure electrical connections.
- Solder: Use rosin-core solder for electronics work, which helps to create strong and reliable joints.
- Wire Strippers: The wire strippers shown here are designed for fine gauge wire, which is commonly used in DCC installations.
- Wire Cutters

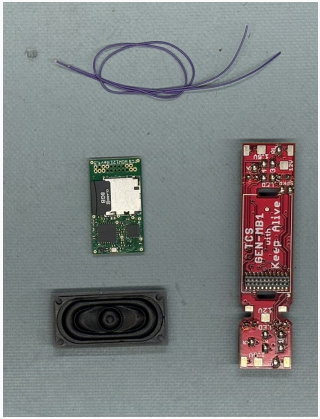


Tools

- Fine String: Used to keep wires organized and bundled together.
- Fine Screwdrivers: Small screwdrivers are needed for disassembling and reassembling locomotives.
- Fine Tweezers: Useful for handling small components and wires.
- Multimeter: Used to test electrical connections and LED polarity.
- Fiberglass Scraper: Used to clean brass contacts, like those on locomotive trucks.

Supplies

- Decoder: This is installed in the locomotives to receive commands from the controller. They come in various sizes and capabilities.
- Speaker: If you want sound in your locomotive, you'll need a speaker to produce the audio effects.
- Wires: You'll need wires to connect the decoder to the locomotive.
- Keep Alive: This is a small circuit that provides power to the decoder when the locomotive is stationary, preventing it from losing its settings.
- Mother Board: A drop in board for older locomotives.

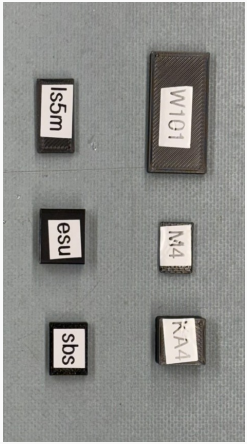


Supplies

- You will need wires to connect the decoder to the locomotive.
- I use 30 or 32 gauge wire for decoder installations.
- You can source an assortment of wire colors in small quantities from TCS.
- Use colors specified by the DCC standard.

Planning

- Plan decoder power output requirements based on the locomotive's motor and any additional features like lighting or sound.
- Figure out where to place the decoder, speaker, and keep alive in the locomotive.
- Consider the size of the components and the available space in the locomotive.
- Plan the wiring route to ensure a clean and organized installation.
- 3D printed block gauges to visualize the space requirements.



Skills

- Soldering: This is a crucial skill for installing DCC decoders, as it involves making secure electrical connections between the decoder and the locomotive's wiring.
- Patience: Installing a DCC decoder can be a meticulous process that requires careful attention to detail and, patience to ensure everything is connected correctly.
- Problem-Solving: You may encounter challenges during the installation process, such as fitting components into tight spaces or troubleshooting wiring issues, so problem-solving skills are important.

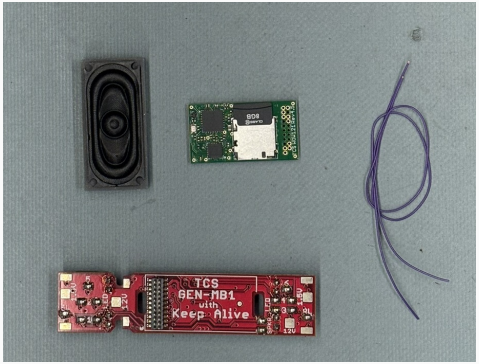
A Simple Project (EMD F7A)

Athearn Genesis F7A

- This is one of my older locomotives and I have many of them.
- It was not DCC ready, but at the time Digitrax made a drop-in decoder board.
- Now I wanted to upgrade to a modern decoder with sound and a keep alive.

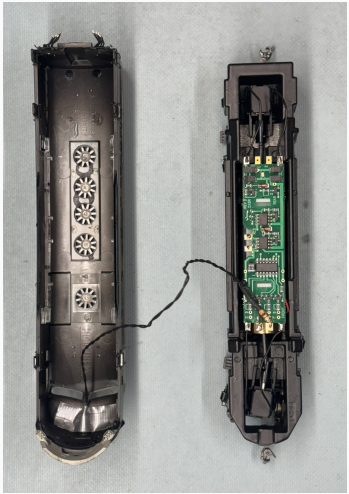
Decoder Selection

- I chose a TCS WOWKit that was designed for the Athearn Genesis F7A.
- It includes a decoder, speaker, mother board, and keep alive all in one package.



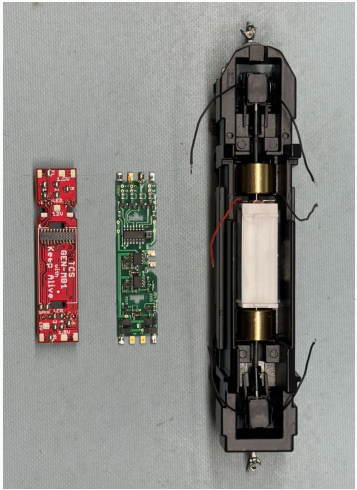
Disassembly

- This is the locomotive disassembled, with the original decoder board still installed.
- Visible is the original front light bulb wire including an in-line resistor.
- This is a simple as it gets.



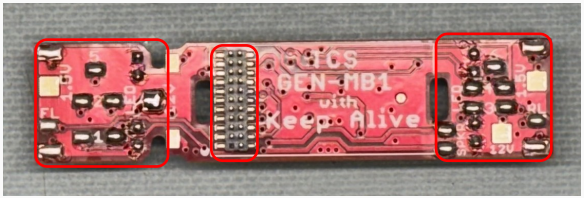
Disassembly

- The old decoder board has been removed.
- I have disconnected all the wires. On the older decoder the wires were not soldered.
- You can see the comparison of the old Digitrax board and the new TCS motherboard.



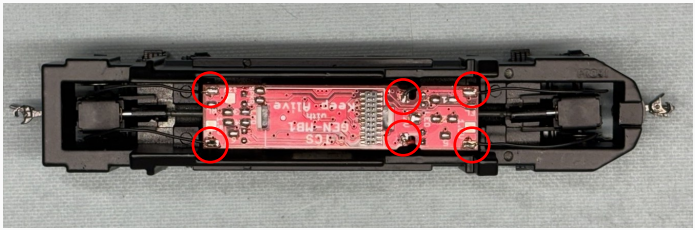
Prepare Decoder Board

- In this close-up view, you can see that the Keep-Alive is integrated into the board.
- I have added solder blobs to wire pads to make it easier to solder the wires.
- I have called out the 21 pin decoder connection.
- The keep alive capacitors are on the bottom of the board.



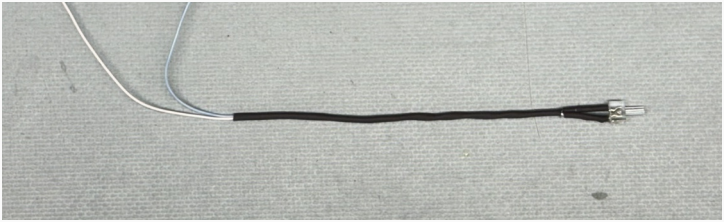
Wiring

- I have wired the decoder to the locomotive. The wires are color coded and the TCS board has labels for each wire location.
- Here you can see connections for:
  - Track power (black wires).
  - Motor connections (red and black wires).
  - Note: Wire colors do not match the DCC standard.



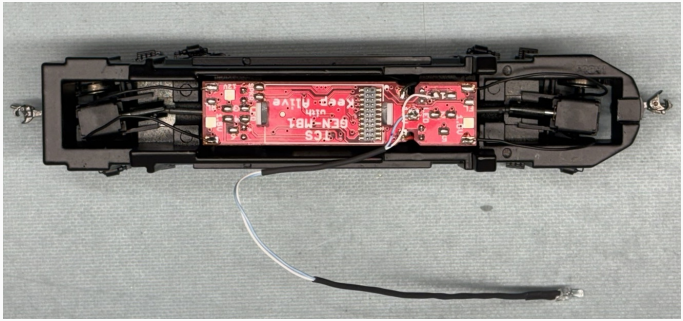
Front Light Wiring

- The white and blue wires are connected to new LED for the front light.
- I have not included a resistor in this circuit because the TCS board has built in resistors for the lighting circuits.
- I have used heat shrink to keep the wiring organized.



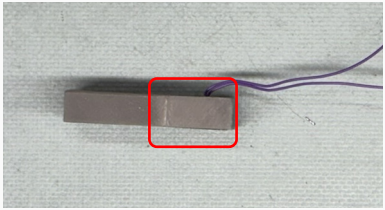
Front Light Installed

- The front light has been installed.
- This is an F7, so there is no rear light.



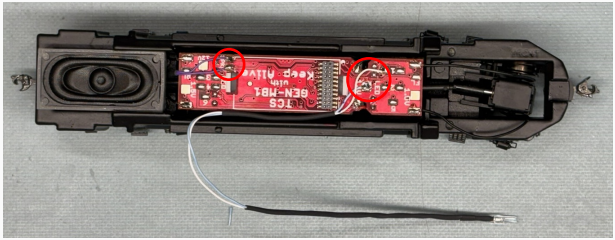
Speaker Preparation

- A small part of the speaker sound box needs to be filed away to fit in the locomotive.
- The two wires are soldered to the speaker wire tabs.
- The speaker is fit into the sound box and then glued in place with canopy glue.



Installation Completed

- All connections made.
- The locomotive decoder can be configured and then tested on the track.
- Testing involves checking that the locomotive responds to commands from the controller, that the motor runs smoothly, and that the front light functions correctly.
- For the TCS decoder, JMRI is the best way to customize its programming.



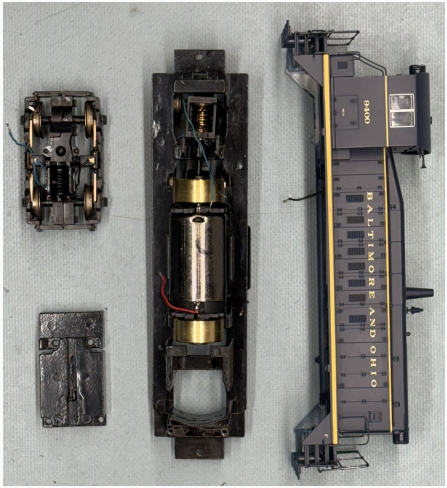
A More Complex Project (EMD SW900)

LifeLike Proto 2000 SW900

- This locomotive was purchased DCC ready and I installed an NCE drop-in decoder board.
- The interior of the locomotive is very tight, so to add a sound decoder and keep-alive will take some modification.

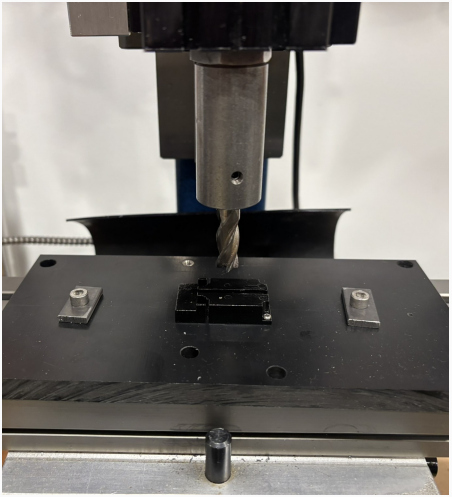
Disassembly

- The locomotive is disassembled.
- The original decoder has been removed and wires unsoldered.
- The front weight has been removed and will be modified to make room for the new decoder and speaker.
- The front truck has also been removed to be cleaned and rewired.



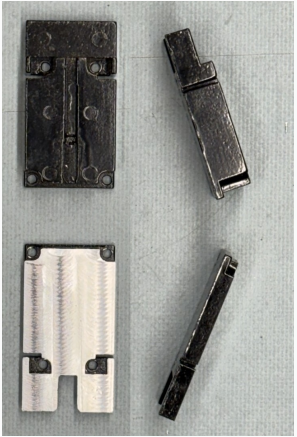
Modify Front Weight

- The front weight has been mounted to a fixture.
- I will remove about 200 mils from the surface to fit the new decoder and speaker.



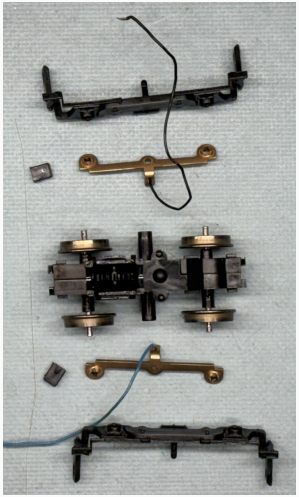
Modify Front Weight

- Front weight after removing material to fit the new decoder and speaker.



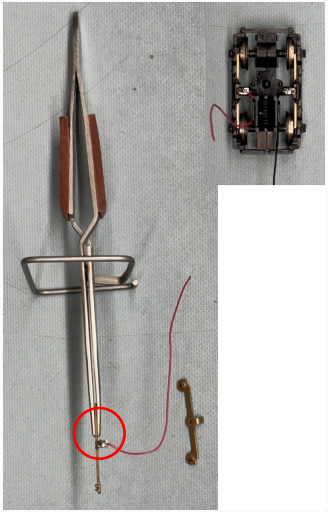
Truck Disassembly

- Disassembly of the front truck to clean and rewire.
- The truck can be disassembled even further if you want to clean the internal gears.
- I cleaned using isopropyl alcohol and then lubricated with a light oil.



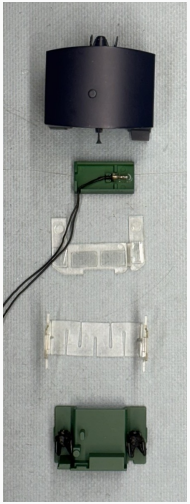
Truck Wiring

- Clean the brass wheel wiper with isopropyl alcohol and a fiberglass scraper.
- Use good quality solder meant for electronics work.
- I used the standard wire colors for left and right track power pickup.



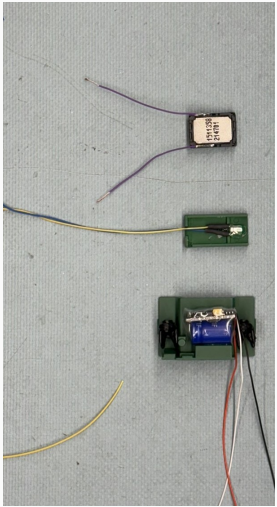
Cab Disassembly

- The cab is carefully pulled off of the main body and then disassembled.
- You can see the cab, rear light, windows and cab interior.
- The rear light bulb is removed and will be replaced with an LED.



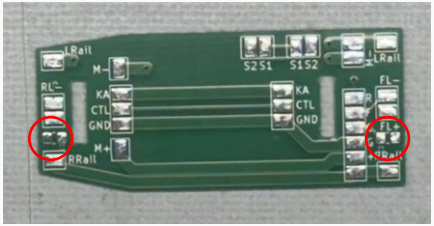
Accessory Wiring

- Accessories all wired up and ready to be installed back into the locomotive.
- From top to bottom: speaker, LED for rear light in the cab housing, and the keep-alive glued to the cab interior floor.
- I used the correct wire colors for the rear light but in the future I would use black as it is less visible through the cab windows.



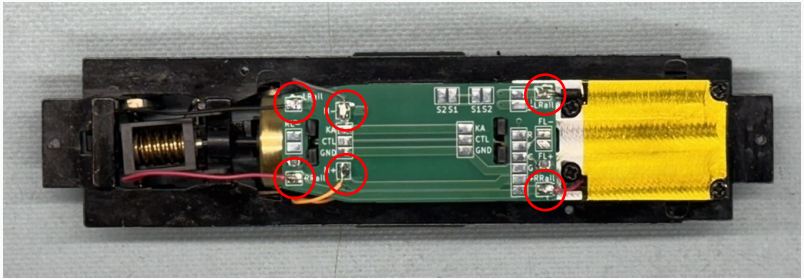
Replacement Circuit Board

- Custom circuit board designed in KiCad and manufactured by JLCPCB.
- Used to keep the installation neat and organized.
- Labels on the board make it easy to identify where each wire should be soldered.
- On board current limiting resistors are for front and rear LED lights.



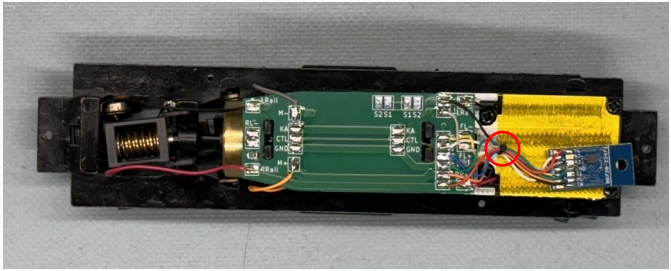
Basic Wiring

- Replacement circuit board installed.
- Proper color wires used for track and motor connections.
- Kapton tape to insulate the exposed metal on modified front weight.



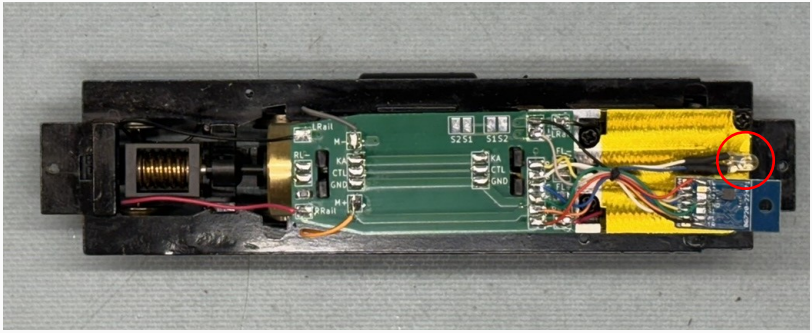
Decoder Wiring

- Wiring harness installation completed.
- Wires are carefully cut to length and soldered to the board and "bundled" using fine string.
- Decoder snaps into the wiring harness using a next18 connector.



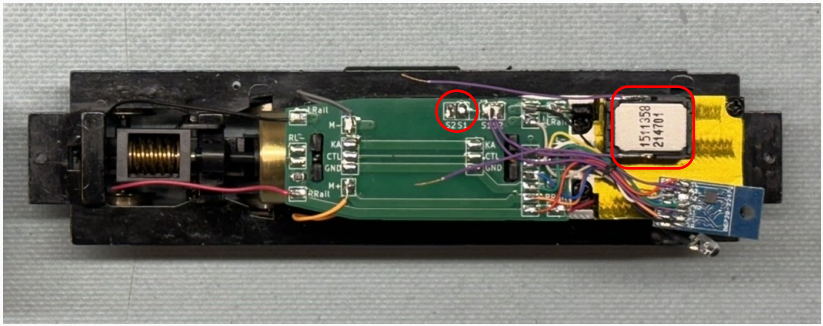
Headlight Wiring

- Front LED headlight wiring completed.
- The bulb will just lay in the slot between the decoder and the speaker.



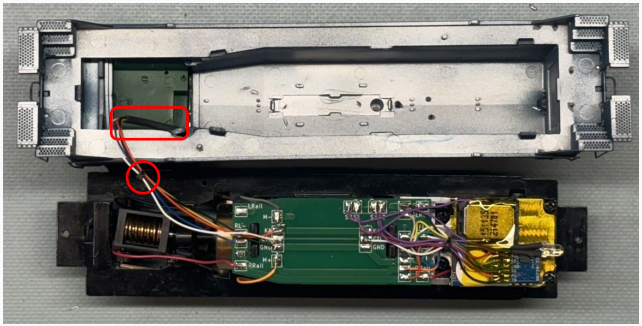
Speaker Wiring

- Speaker is glued with canopy glue to the front weight.
- The decoder and front light LED just float on top of the front weight.
- Speaker will be soldered to the circuit board tabs once the glue has dried.



Keep Alive Wiring

- Keep alive and rear light LED wiring completed.
- Added a small piece of shrink tube as well as string to keep wires organized.
- Decoder can now be configured and tested on the track.



Supplemental Information

References

- TCS website
- Streamlined Backshop website
- JMRI website
- KiCad website
- JLCPCB website
- NMRA standards
- YouTube Channels: Search for "DCC decoder installation" for various tutorials and demonstrations.