Installing a Tsunami2 PNP SoundTraxx Decoder into an Alco RS3 HO locomotive

From Wikipedia: “The ALCO RS-3 is a 1,600 hp (1.2 MW), B-B road switcher diesel-electric locomotive. It was manufactured by American Locomotive Company (ALCO) and Montreal Locomotive Works (MLW) from May 1950 to August 1956, and 1,418 were produced — 1,265 for American railroads, 98 for Canadian railroads, 48 for Brazilian and 7 for Mexican railroads. It has a single, 12 cylinder, model 244 engine.

Restored locomotive McLean Mill Port Alberni

Esquimalt and Nanaimo! Not many readers will have heard of this small ‘branch line size’ railroad on Vancouver Island, British Columbia. It was built as a condition of Canada’s confederation. On 13 August 1886, the last spike was driven at Cliffside, about 40 kilometres (25 mi) north of Victoria. Construction of the island railway took three and a half years. Prime Minister Macdonald drove the last spike, during his only visit to British Columbia. The railway was extended to Dunsmuir's mine at Wellington in 1887, and into Victoria in 1888. It was extended west to Port Alberni in 1911, west to Lake Cowichan in 1912, and north to Courtenay in 1914. Since abandoned by the CPR, it now awaits its fate as a tourist corridor, or rejuvenated passenger freight route or light rapid transit facility in accordance with future determinations by principal parties, the Southern Vancouver Island Railway and the Island Corridor Foundation.

The Atlas/Kato (Atlas Yellow Box) HO model of the prototype has always had a stellar reputation as a smooth running reliable model, using the Kato engine. This model is said by some to have altered the standards for future model railroad manufacturers, making a major contribution to raising the bar for smooth reliable running. The only purported ‘flaw’ in these early Atlas ‘yellow box’ models concerned the coupler gear box mounts. The pilots are rather weak and will flex under heavy coupler loads. This

issue was corrected in subsequent Yellow Box releases. This might be something to look at in preparing this model for a DCC upgrade.

I chose to install a SoundTraxx Tsunami2 PNP Sound Decoder with the addition of a TCS Keep Alive KA3 capacitor, and a SoundTraxx mini oval speaker. (Soundtraxx part number 810112 25mmx14mm 8 ohm impedance). As with most sound decoder Installations space is a premium, and the SoundTraxx Current Keeper capacitor was marginally too large for this install. The TSU-PNP has 6 Function outputs….and all the features that go with the TSU – 2200. I elected to use only Function output 3 as an additional output for a rotary beacon on the roof of the cab. The main reason for this was a lack of space for more LEDs and resistors. Also my usual predilection for flashing ditch lights did not seem appropriate for an Esquimalt and Nanaimo road switcher.

As with any decoder installation project, certain essentials must be checked. As per Tony's Trains:
- Make sure loco runs well on DC FIRST
- Make sure decoder can handle current draw of the motor
- When mounting the decoder, insulate all metal that has a potential for touching the decoder
- Make sure motor brushes are isolated from the frame and track pick-ups

This decoder installation proved to be one of my most successful and fastest decoder installation projects.There is one consideration to keep in mind before starting the wiring to install the decoder into an RS3.. Most railroads ran their early RS3 prototypes Long hood forward. However, some model railroad manufacturers wired the motors for running short hood forward. Look up the history of the railroad. Check which direction the 'people' in the cab are facing. It might be wise to confirm which motor lead is positive (usually the one on top of the motor assembly) and which is negative (the one arising from the bottom terminal). The E and N Railway ran the long hood forward. My crew were facing long hood forward, and my model's motor terminals (Atlas/Kato mechanism) were wired with the correct polarity…positive on top. Should your model be different, and confusion ensues, you can always program CV29 to Reverse the direction after the fact.

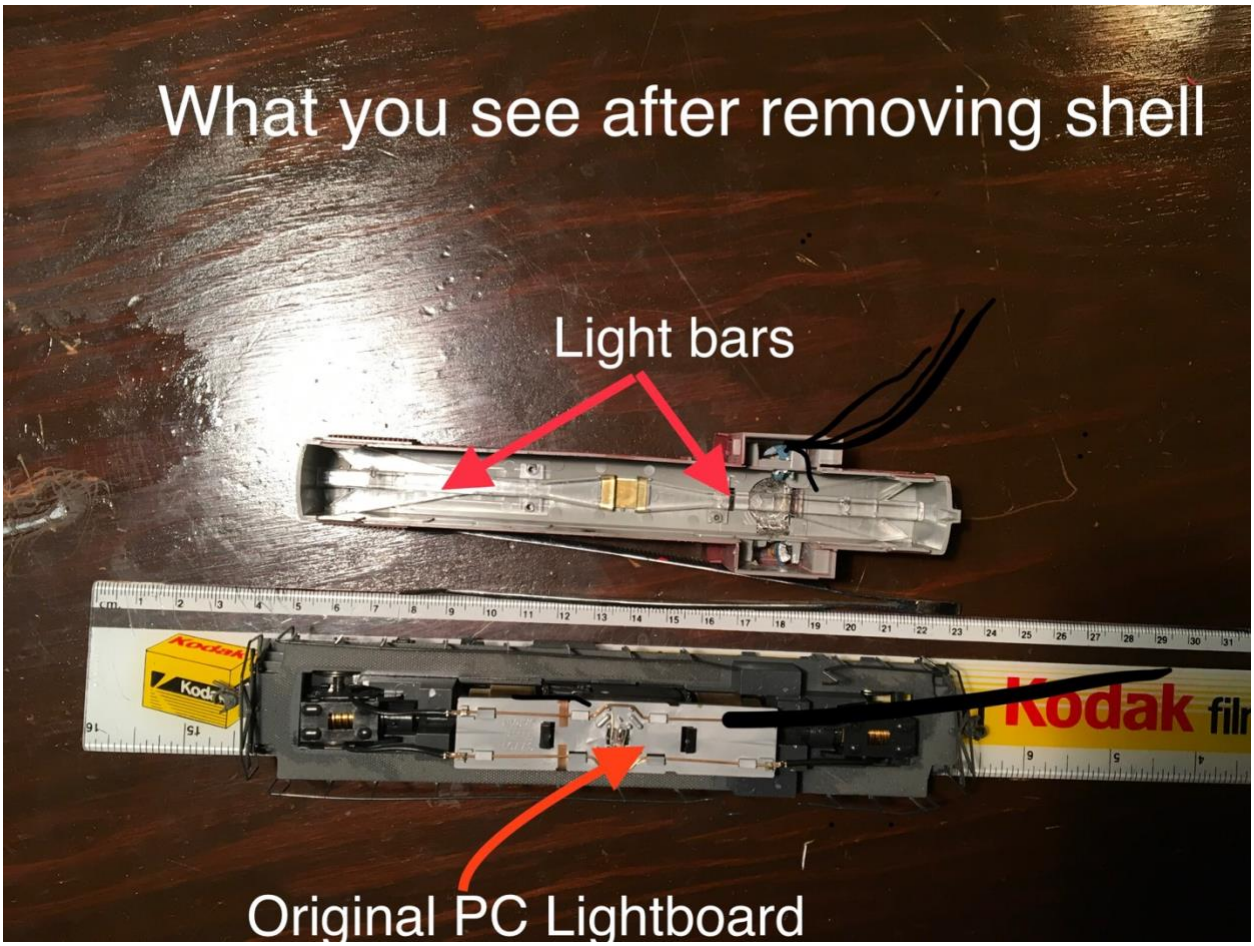
The parts list is as follows:

Tsunami2 TSU-PNP Digital Sound Decoder (SoundTraxx) P.N. 885015 for Alco diesel models
Mini Oval Speaker SoundTraxx P.N. 810112 25mm x 14mm 8 ohm impedance
Keep Alive KA3 TCS Train Control Systems
LEDs 5mm 3.5 volts 2 white 1 red
3 - 1.8 K ohm SMD surface mount resistors
30 AWG colour coded wire
Heat shrink tubing
Kapton tape
Double - sided tape

Components used in this installation

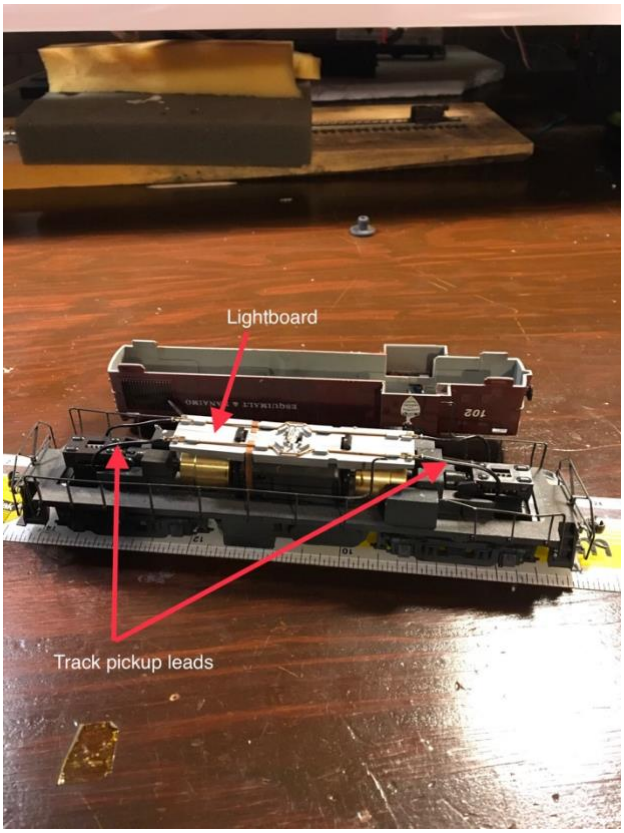
Removing the shell.

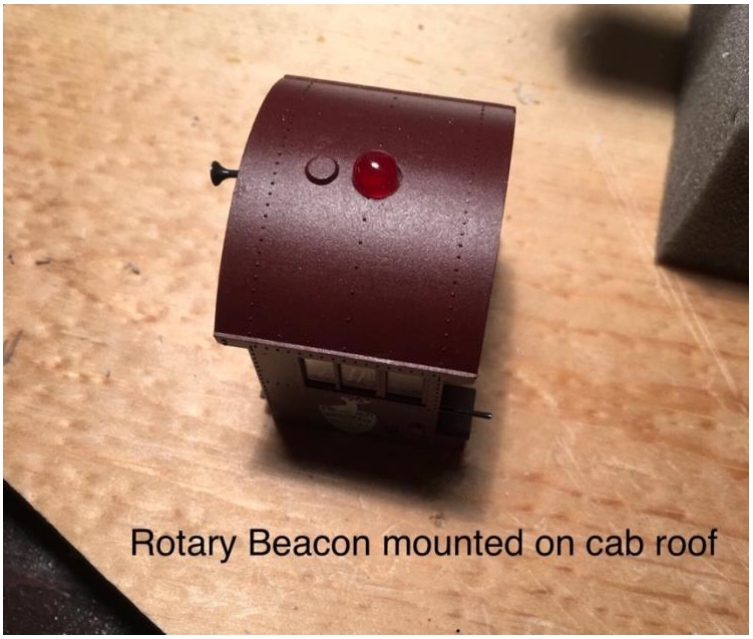
To remove the shell do not unscrew the two screws on the bottom middle that secure the motor to the chassis. The couplers do not have to be removed. Disconnect the railings from the cab and shell on both sides. Four tabs secure the top plastic shell to the chassis walkway platform. There are two at the front and two at the rear. Gently squeezing the rear sides together and lifting removes the shell.



The light bars and the original PC lightboard are to be removed and discarded. Before doing so, be sure to cut off the lens from the ends of the front and rear light bars and place in the front and rear openings in the shell for the headlights. The 5 mm white LEDs will be mounted, using double-sided sticky tape, abutting against the backs of these lenses at the front and rear of the shell.

I decided the first thing I would do after removing the shell was to construct a rotary beacon. The Tsunami2 PNP board has 6 Function outputs, and given the fact I love flashing lights and other bells and whistles, it was difficult to restrain my self from creating flashing ditch lights, cab light, etc. However, because of space limitations and the fact ditch lights did not seem appropriate for an Esquimalt and Nanaimo road switcher, I settled for a Western-Cullen Rotary Beacon, using Function output 3.





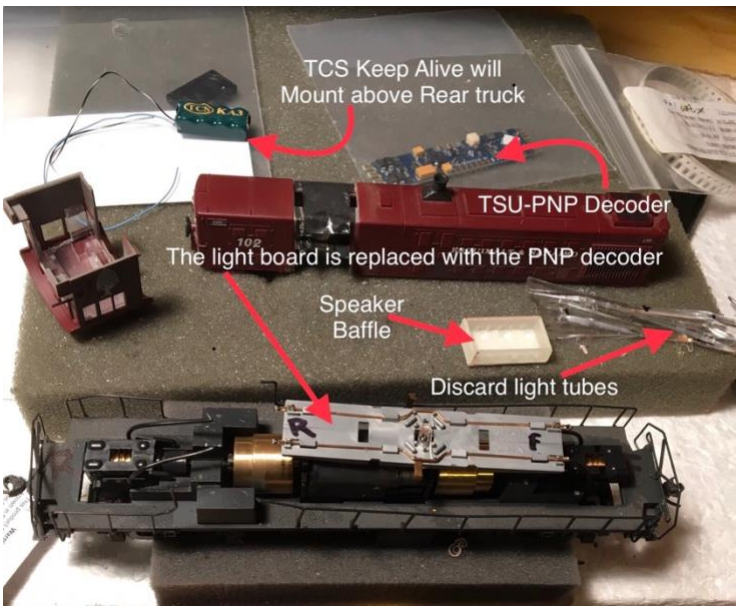
What you see after removing the shell.

The Western-Cullen Rotary Beacon

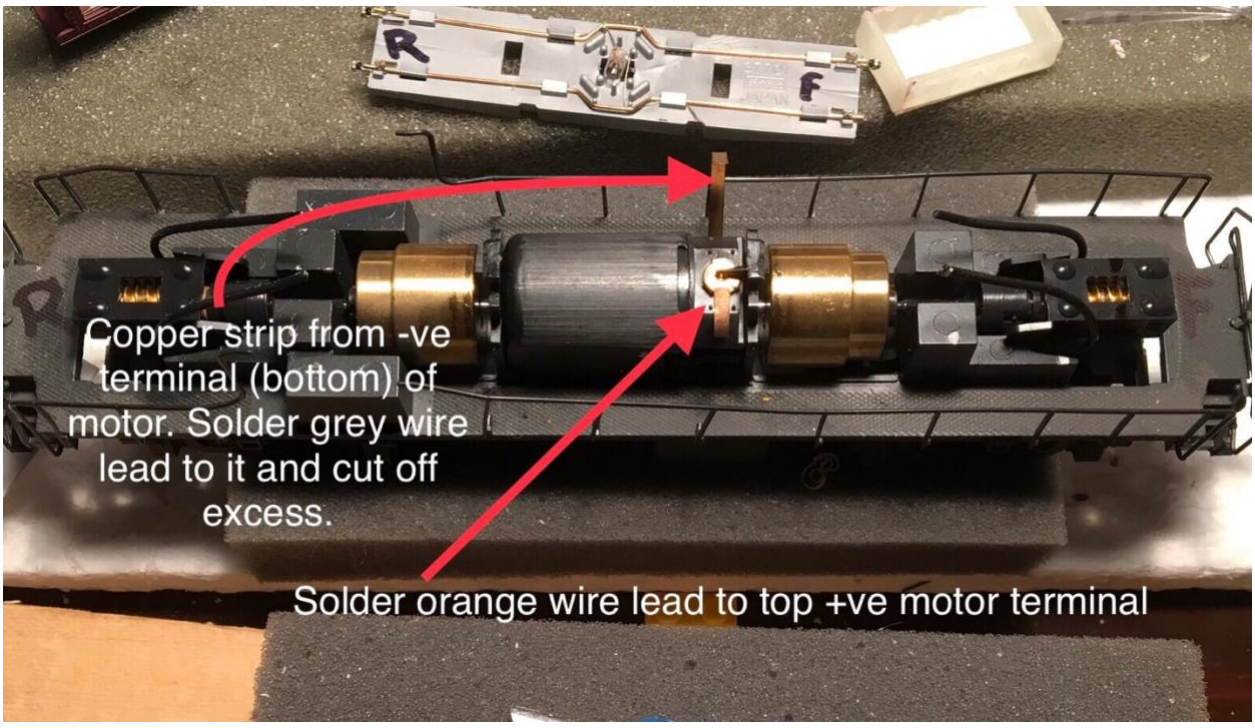
This necessitated drilling a slightly less than 5 mm diameter hole in the roof of the cab. To start this use a fine drill bit and a pin vise, increasing the diameter of the hole bit by bit, so as not to crack or damage the cab roof. I used a red 5 mm 3.5 volt LED. This requires a current limiting resistor. Space is limited in the cab and so this seemed to be a good location for using a SMD 1.8 K ohm surface mount resistor. It is debatable as to how much space is saved using SMD resistors versus the regular size ½ watt resistor. The soldering can be finicky and possibly a hotter resistor in terms of heat dissipation results, although this has never been an issue for me? When 3 resistors are required for the installation, I think the space saving and extra time spent with the soldering is worth it. See the section on Programming CVs below to get information on setting up the Western-Cullen LED light effect.

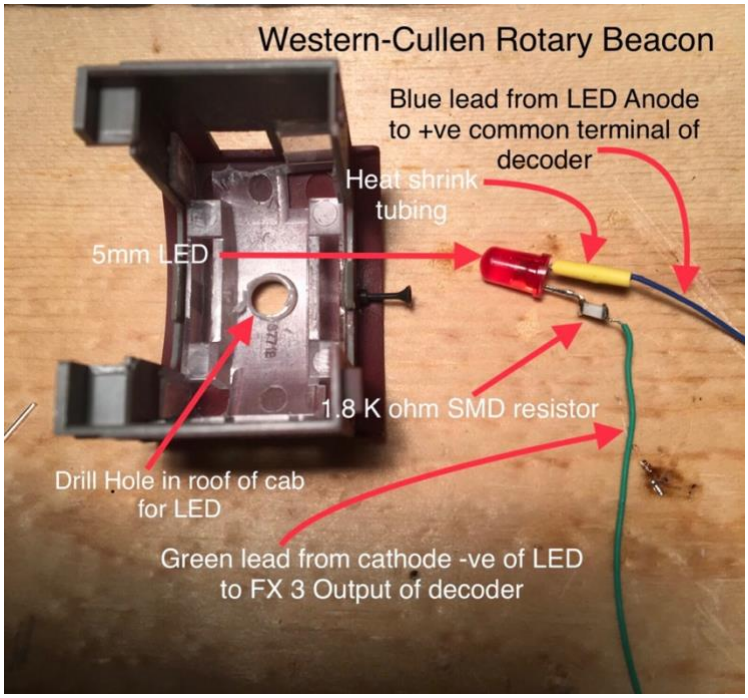
The two other LEDs used were white 5mm LEDs for the front and rear headlights. I ‘cut off’ the lens on the end of the light tubes before discarding, and placed the lenses back in the orifices for the front and rear headlights on the shell. See photos on page 8 for clarification.

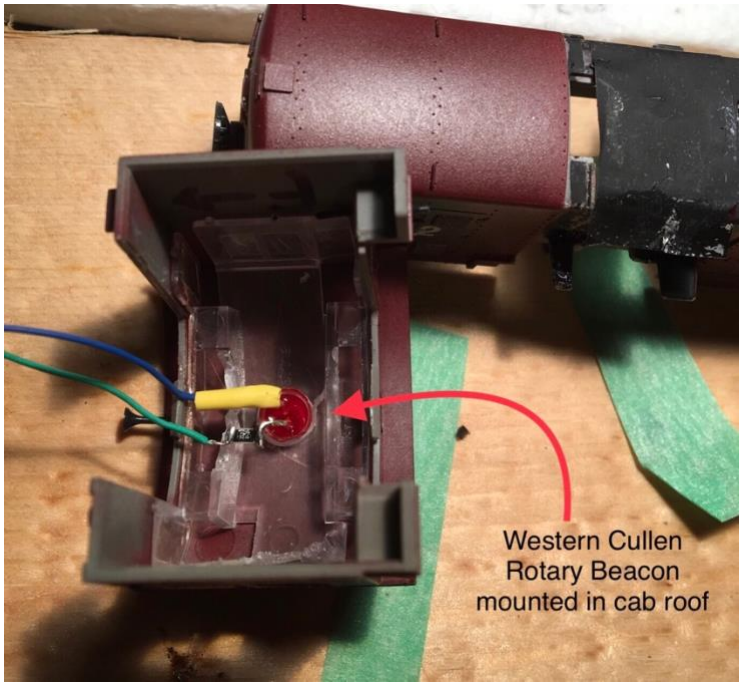
It is wise to take a few moments to get organized and plan where you are going to place all the required parts.



Keep in mind that some preliminary work is needed to get the motor ready for installation of the decoder. See page 10.

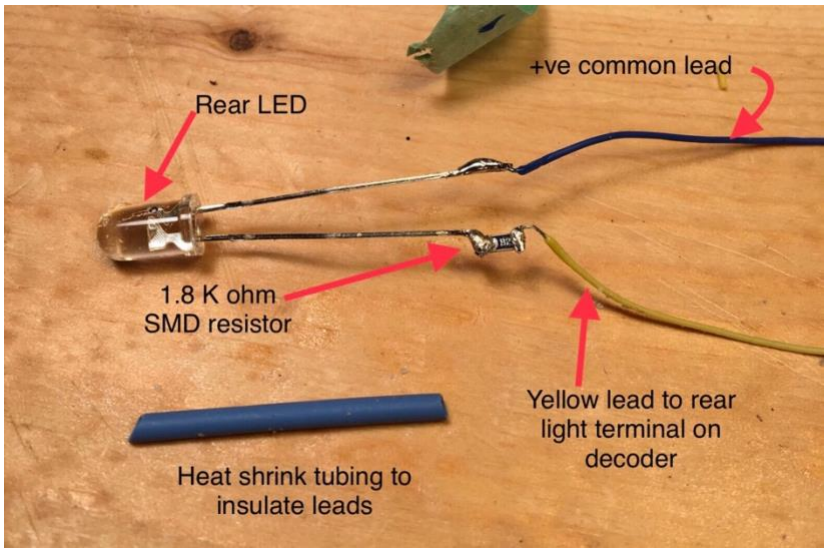






Red LED mounted in cab roof to simulate a Western-Cullen Rotary Beacon. See CV program information below.

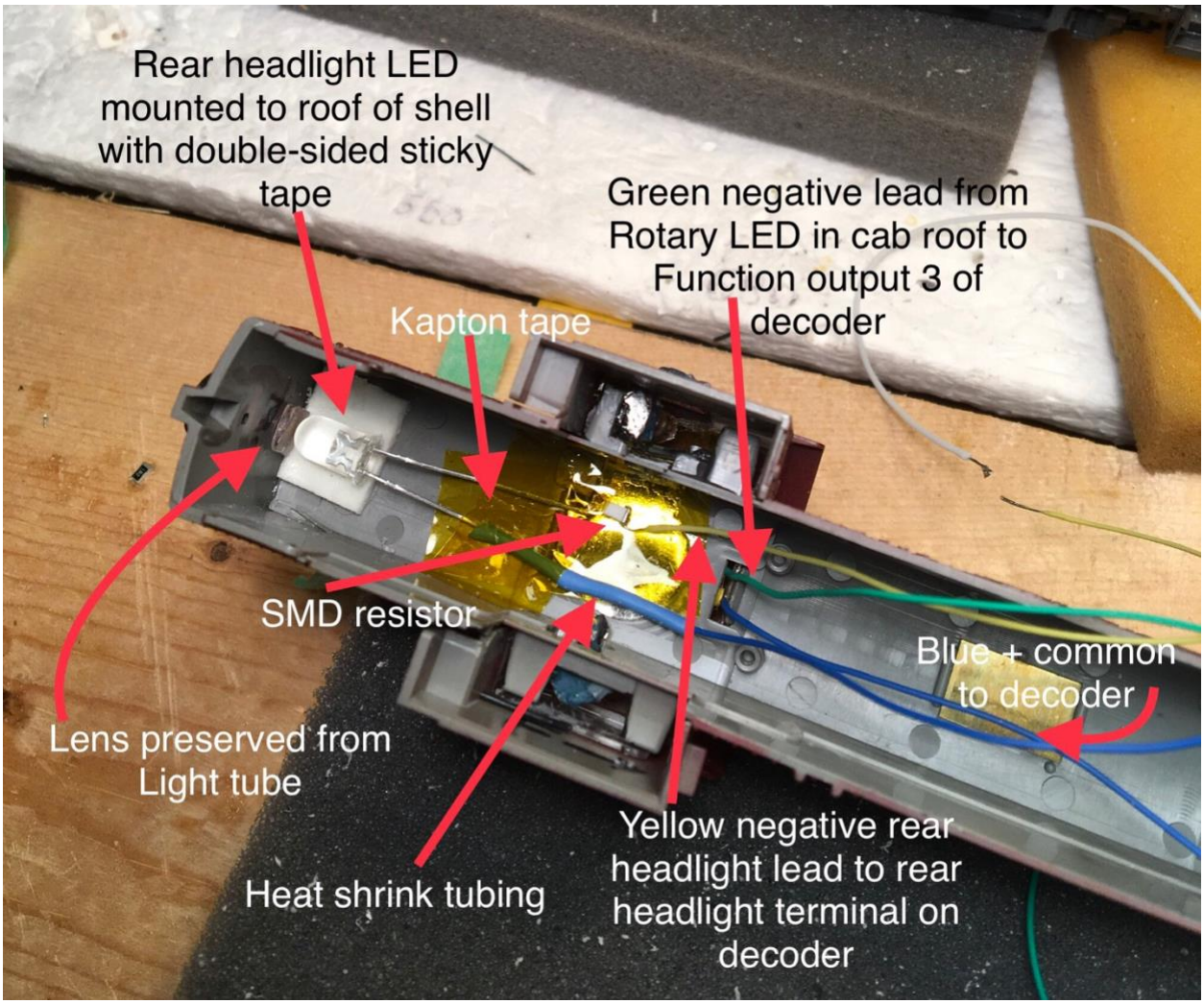
The short lead from the 'flag' of the LED is the -ve cathode, and the long lead is the +ve anode of the LED The resistor can be connected on either the cathode or anode side. My preference is connecting the resistor on the -ve side.



Front and rear LED headlights and current limiting resistors will be mounted inside on the roof of the shell and secured with Kapton tape.

See the wiring schematic on page 11

Prior to discarding the light tubes, cut off the headlight lenses from the extreme ends of the light tubes and insert these into the openings for the front and rear headlights in the shell. Then place the corresponding LED headlight behind these lenses, mounting using double-sided sticky tape. The yellow rear headlight wire and resistor and the white front headlight wire and resistor can be fixed to the roof of the shell using Kapton tape.

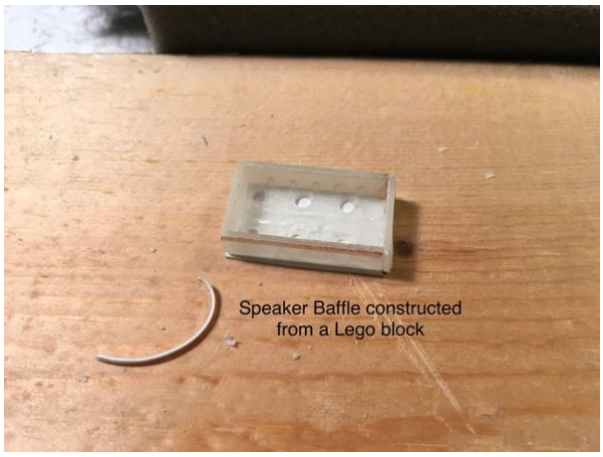


All the blue +ve anode common leads from the anodes of all the LEDs connect to the + common terminal on the decoder board. See the wiring schematic on page 11.

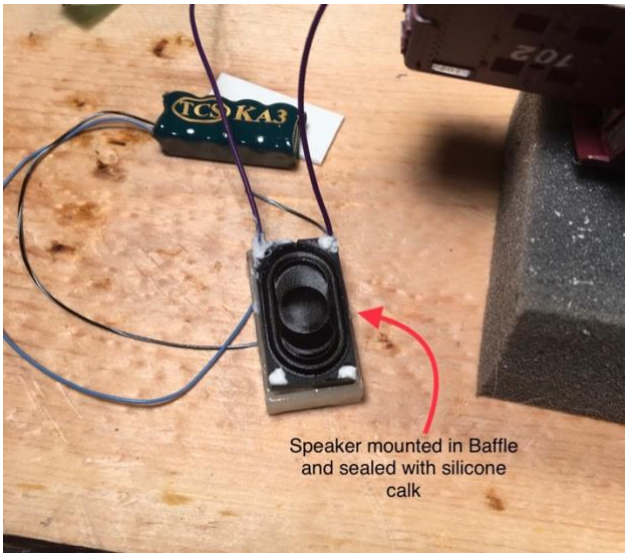
The speaker

I used a SoundTraxx small mini oval 8 ohm speaker (part number 810112 25mm x 14mm 8 ohm impedance) for this project. It is mounted to the chassis over the front truck using Cyanacrolate glue. All speakers produce better sound if housed in a Baffle of the appropriate size. I created this Baffle by modifying a piece of LEGO block, and making a 'back' with a piece of styrene. All openings including where the wires protrude should be sealed with silicone caulking. In order to facilitate the sound

escaping, drill multiple small holes in the radiator covers on the roof and sides of the shell. Use a pin vise to do this.



The baffle (top)



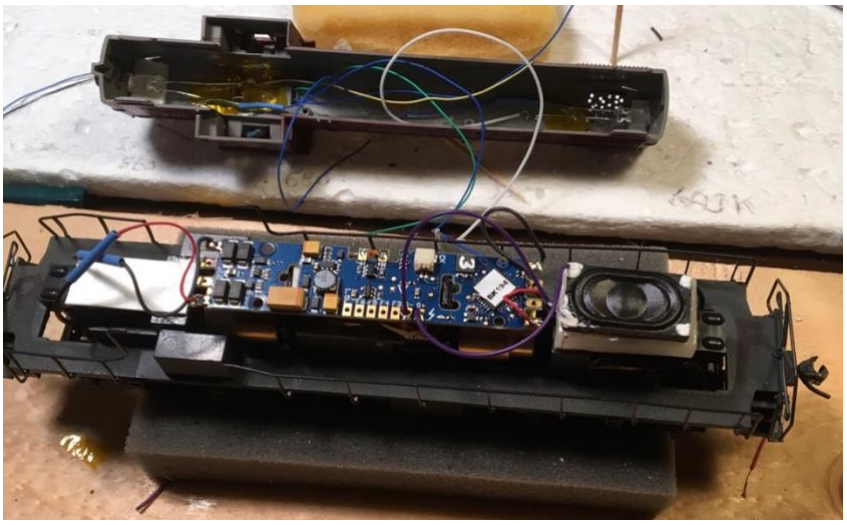
Sealed with silicone caulk (right)

Holes drilled in the radiator covers to let the sound escape

Due to space constraints I used a TCS Keep Alive KA3 capacitor instead of the SoundTraxx Current Keeper, which was marginally too long. The Keep Alive is mounted on a styrene ‘plate’ glued to the chassis over the rear truck. The speaker is mounted over the front truck.

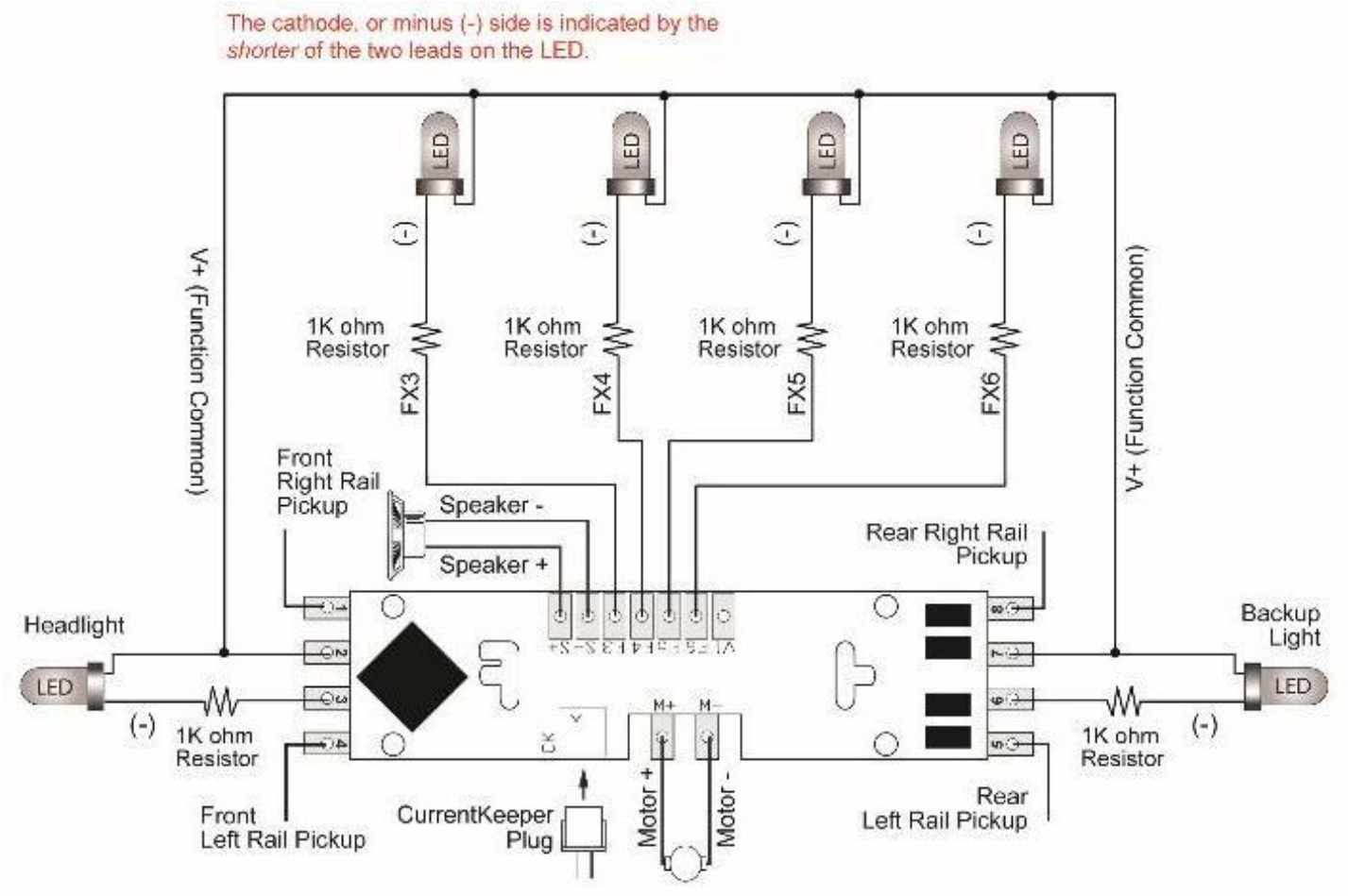
Soldering the motor leads to the top (+ve orange wire) and bottom (-ve grey wire) terminals requires some caution. See image on page 6. I must have applied heat too long, as to my horror, I see the top terminal ‘arise’ out of the motor after applying heat. I feared the worse but fortunately all that was required to fix this was to push the terminal post back down into the motor housing. None the worse for wear..the motor continued to work. I do not know what caused this to happen? Note that the copper strips from the motor terminals need to be clipped short for appropriate length. Solder grey (negative) and orange (positive) wires to the motor terminals and connect to the + and – motor terminals on the decoder. See comments above re reversing polarity if necessary for movement long hood forward.

It’s now time to mount the decoder on the chassis.

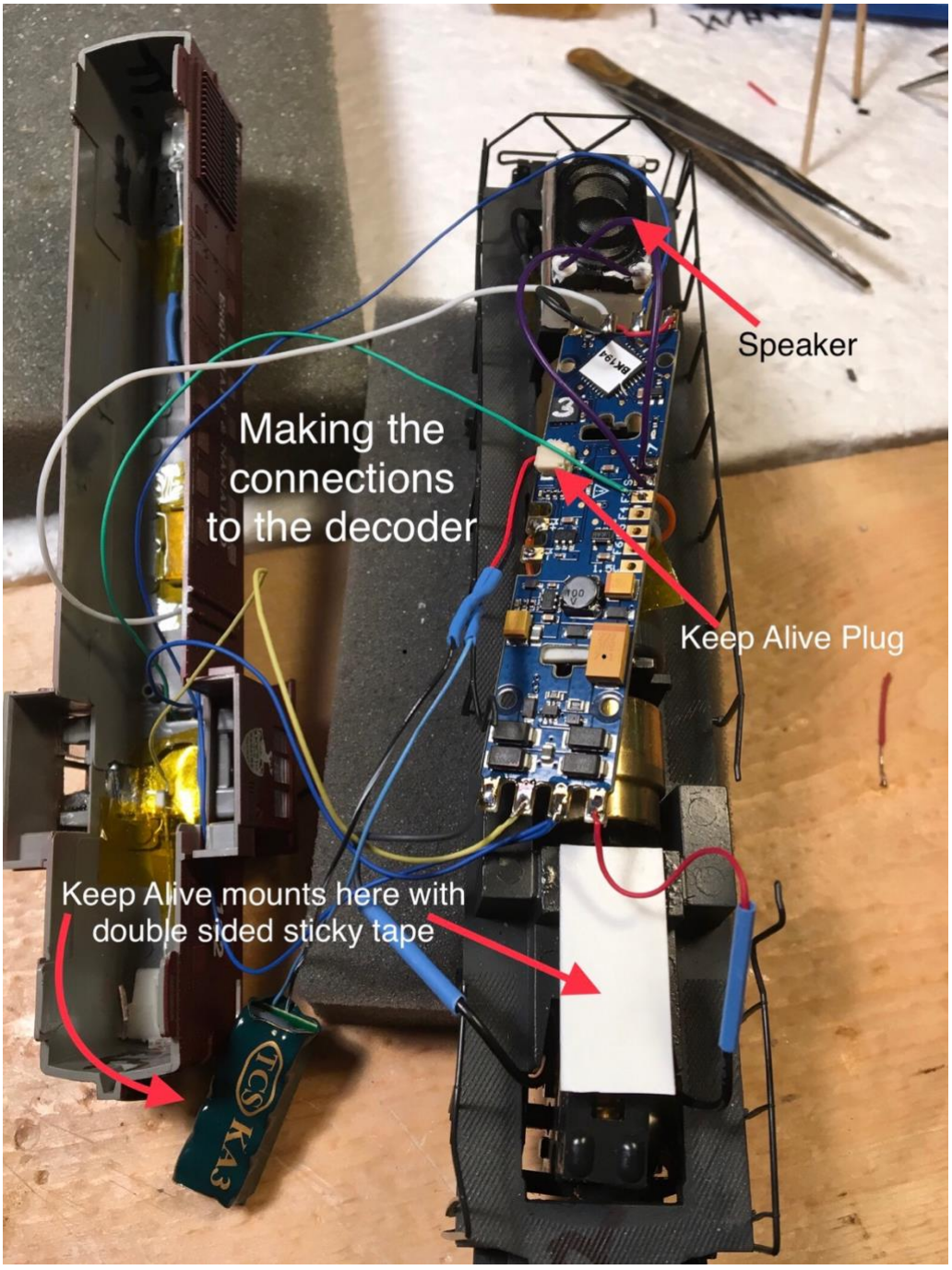


When placing wires make sure all are within the confines of the width of the decoder so as not to pinch any when replacing the shell.

LED Wiring Diagram The wiring schematic is supplied courtesy of SoundTraxx (www.soundtraxx.com)



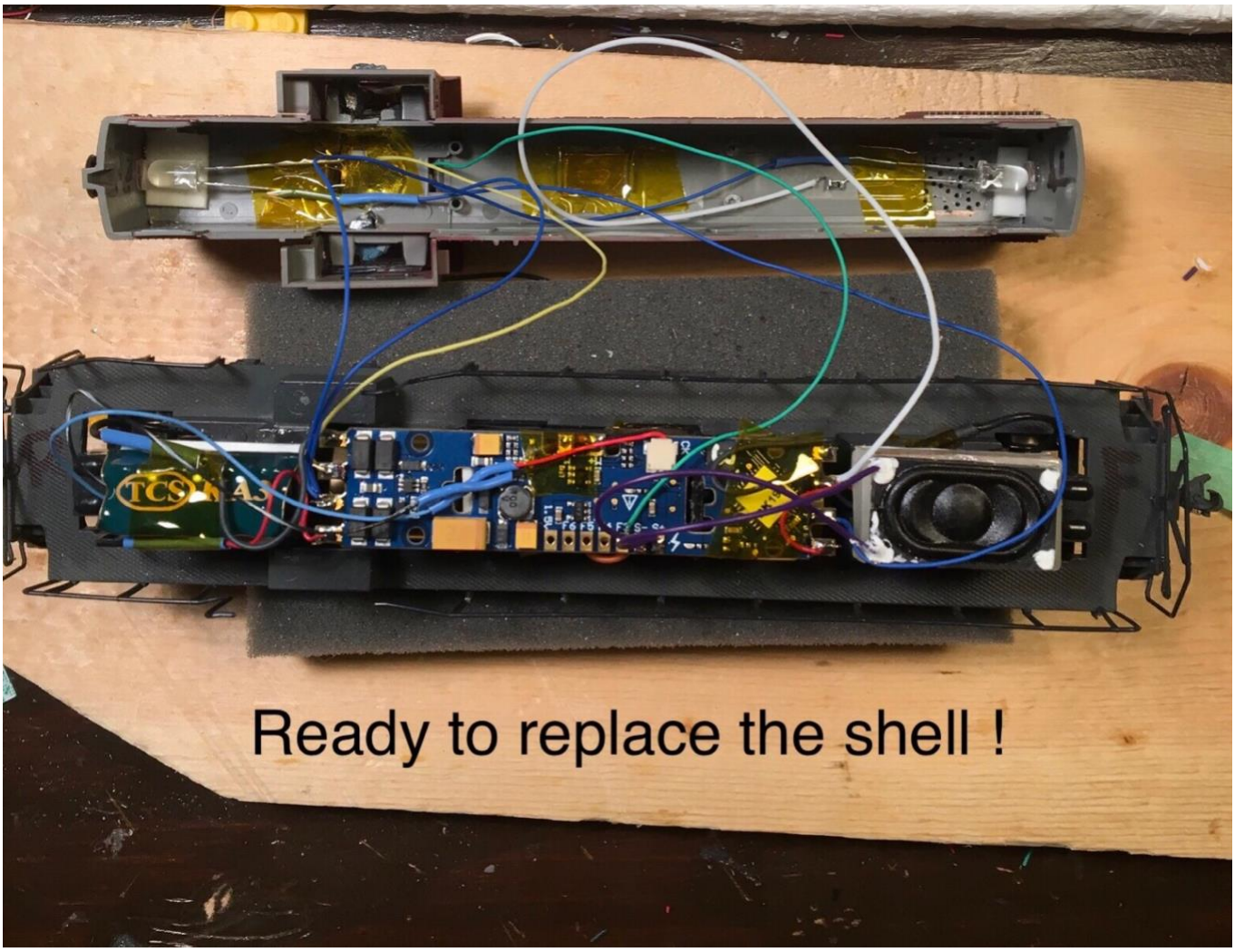
TSU-PNP/ECO-PNP LED Wiring Diagram. From the SoundTraxx Manual



I spliced the leads from the SoundTraxx Current Keeper Plug to the leads of the Keep Alive KA3 and insulated the joins using heat shrink tubing. The track pickup leads required short 30 AWG wire extensions to reach the terminals on the decoder.

See wiring schematic on page 11.

Let’s see if the shell will go back on!



It is good to have the wire leads from the LEDs in the shell roof long enough to allow removing and setting aside the shell for future servicing, but if you get them too long they will get pinched or otherwise interfere with replacing the shell on the chassis. Also make sure no wires are interfering with free motion of the trucks or worm gears.

Now time to program some CVs!

The SoundTraxx Tsunami2 TSU-PNP Decoder is extremely versatile, and many CVs are made available to allow configuring the behaviour of your locomotive to exactly conform to the desired prototype. I have set up my rotary beacon to simulate a Western-Cullen Rotary Beacon, and enabled Independent and Train brakes. These settings have all been done using NCE PH Pro 5 Amp Command Station and an NCE Pro Cab. See the SoundTraxx Tsunami2 User Guide and the NCE manuals for specific information.

E and N 102 Tsunami2 2200 PNP

Esquimalt and Nanaimo Railway E and N 102 (Alco) Install Date: May 3 2019
Manufacture: 141
Decoder version: 071
Address: Long 102 Short 3 Long address activated
DC mode disabled
Set up Config:
  Direction bit = normal
  Speed steps equal 28
  Speed table standard
CV 2 Start Voltage 0
CV 6 Mid voltage 128
CV 5 Max Voltage 255
Acceleration 75 I think this is now 45? Check
Deceleration 75
CV 128 = 225 (Master Volume) 192 changed to 175 May 3 2019
(CV 128 factory Value 192 changed to 175 range 0-255.) CV 128 (Master Volume) is used to adjust the volume level of all enabled sound effects.
CV 129 = 225 Air horn volume (makes less distortion) Factory Value was 225
(CV 120 = 28 Air Horn. Leslie S3L)?

Bell: CV 122=10 Add 128 to enable grade Crossing logic
CV122=138 (Date April 12 2018)

Calibrated DDE: Date: May 3 2019
CV 114 = 47 (39)...at 39 lost momentum and DDE..reset to 47 and momentum is back. .? How did CV 114 get set at 39?.?!!!!!
CV 32 = 2
(Sets indexed CV page to page 2. See Tsunami2 User Guides for information on Programming SoundTraxx indexed CVs)
CV 2.512 = 16
Calibrate CVs 503 and 504 = 255
CV 512 and CV 511 set to 255 Date: May 3 2019
CV 2.507 = 255 Default Value = 0 (Prime Mover) (0) Note at 0 there was no DDE sound effect. Setting at 255 produced lots of DDE sound effect! (-12db) See Tech Reference Manual pg 125. Date: May 4 2019
CV 2.508 = 255 Default Value = 255
CV 2.509 = 215 Default Value = 215. (Time) 0=instant response
CV 2.510 = 215 Default Value = 215
CV 2.511 = 255 Default Value = 10. (Throttle Sensitivity)
(a value of 0 into CV 2.511 will disable DDE throttle sensing)
CV 2.512 = 255 Default Value = 0. (Load Sensitivity)
Left CVs 2.511 and 2.512 = 255 as this seems to sound best. Date: May 3 2019
Entering a value of 0 into CV 2.512 will disable DDE load sensing and sound effects will not be modified when the motor is impeded. Setting CV 2.512 to 255 indicates that the prime mover sound effect will be most sensitive to changes in motor load.

Independent Brake CV settings as below Date: May 3 2019

CV 117- 140 (manual suggests 178) Independent Brake rate
CV 118- 100 Train Brake.
Manual suggests value of 100 for more gradual braking rate for Train Brake.
Turning on F12, the brake select function, (to turn ON the Train Brake) will cycle the air compressor to simulate charging the train line
CV 116 - 140 Dynamic Brake.
To apply brakes to maintain speed, apply dynamic brakes with the dynamic brake function (F4 by default).
Manual suggests value of 60 for a gradual braking rate. Applying dynamic brakes will not bring the locomotive to a stop.
Note: **When consisting with active momentum and braking rates, ensure the values of CVs 3, 4, 116, 117, and 118 are the same for all units.**

Current settings for **DDE and Hyperdrive2 Motor Control CVs:**
Dynamic Digital Exhaust DDE
These are the pertinent CVs:
DDE Control CVs
CV 2.503: DDE Load Offset
CV 2.504: DDE Load Slope
For steam:
CV 2.505: Side Rod Clank Low Volume Limit
CV 2.506: Side Rod Clank High Volume Limit
For diesel:
Prime mover low and high volume limits are added to the volume level in CV 131 (Prime Mover Primary Mixer Channel)
CV 2.507: DDE Prime Mover Low Volume Limit
CV 2.508: DDE Prime Mover High Volume Limit
Time constants: Determine how quickly the DDE processor reacts to changes in load and speed
CV 2.509: DDE Attack Time Constant
CV 2.510: DDE Release Time Constant
CV 2.511: DDE Throttle Sensitivity
CV 2.512: DDE Load Sensitivity

First calibrate DDE: (Active)
See information in the user guides to learn about using SoundTraxx indexed CVs
(Soundtraxx recommend you automatically calibrate Dynamic Digital Exhaust load compensation settings before adjusting throttle and braking control CVs.)
CV 31 = 16 (default) CV Index 1 (This should not be changed)
MUST USE OPS MODE PROGRAMMING ON MAIN if using NCE PH PRO Command Station. This different for the Power Cab. See the NCE Manuals!
(You can **read** indexed CVs on the Programming track but **don't write indexed CVs on the Programming track..write values using Program on Main if using the PH PRO 5 Amp Command station)**

Ensure CV 114 (Engine Exhaust Control) is set to a value of 47 (default).
CV 32 = 2 (Changes to indexed CVs Page 2)
CV 2.512 = 16 DDE Load Sensitivity (after you change to indexed CV page 2 by setting CV 32 to 2, you now just choose 512..which is now indexed CV 2.512)
Now 'calibrate' the specific loco Motor by putting it on a straight and level track (loco only ... no freight cars) and running down the track at speed steps set to 1 and then 25 - 40 or whatever you anticipate to be your normal fastest running speed, and entering the appropriate values into CVs 503 and 504.
calibrate the nominal low-speed load level.
CV 2.503 = 255 at Speed Step 1 (DDE Load Offset)
calibrate the nominal high-speed load level.
CV 2.504 = 255 at Speed Step 25 -40 (DDE Load Slope)
To increase or decrease sensitivity after calibration just enter value more or less into CV 2.512

CV 2.507 = 255 Default Value = 0 (Prime Mover) (0) Note at 0 there was no DDE sound effect. Setting at 255 produced lots of DDE sound effect! (-12db) See Tech Reference Manual pg 125. Date: May 4 2019
CV 2.508 = 255 Default Value = 255
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Programmed **FX3 Output Function 24** CV 51 =135. **Western-Cullen Rotary Beacon**. Date May 4 2019
(7 + 128 = 135) 128 = LED Compensation

See the Tsunami2 User Guide for more information on enabling Automatic sound effects, or Function mapping etc.

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