

GE C40-8 Tsunami2 2200 Decoder Installation Date: May 2018

Installing a Tsunami2 TSU-2200 Sound Decoder with Current Keeper into a Bachmann HO Dash 8-40CW.

The parts list:

Tsunami2 TSU-2200 Diesel Digital Sound Decoder. P.N 885007 Soundtraxx

Current Keeper Soundtraxx P.N. 810140

Mini Oval 35mm x 16mm Speaker Soundtraxx P.N. 810113

5 1500 ohm 1/2 watt resistors

4 3mm sunny white LEDs

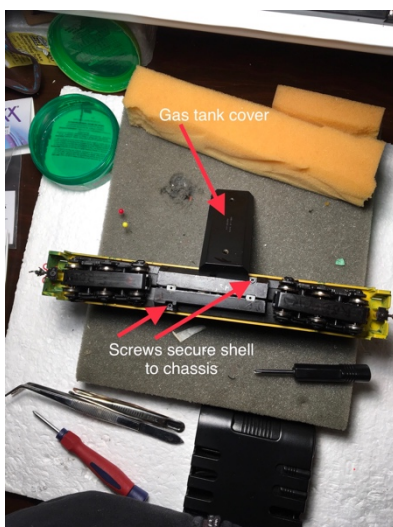
1 3mm red LED

30 gauge wire Color coded



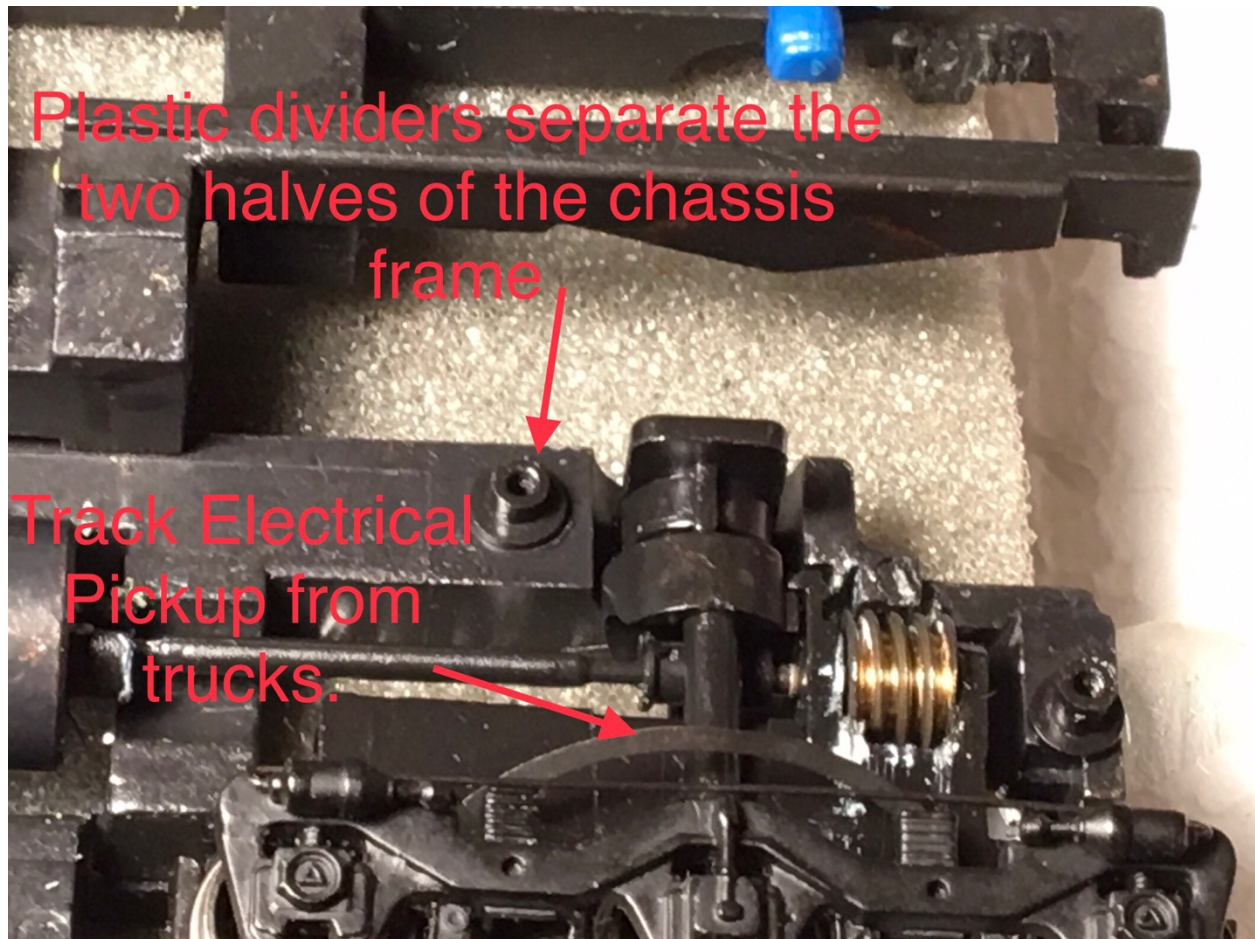
Removing the shell on a Bachmann HO Dash 8-40CW:

To remove the shell you do not have to remove the coupler gear boxes. Just remove the gas tank cover to reveal two screws and plastic lugs, one on either side, that fasten the shell to the chassis.



The chassis consists of two heavy metal frame halves that carry current from the track to the motor and therefore need to be isolated from each other. Note the plastic dividers. The track pick ups contact each metal half and I elected to maintain this system for the electrical track pick up.

Photo of frame halves and motor lead



The motor needs to be isolated from the chassis. Cut the copper leads from the motor that originally made contact with the chassis, and solder orange and gray wires to the positive and negative terminals of the motor. These leads will then be brought up to the top of the chassis between the two metal frame halves, eventually to connect with the orange and gray motor lead wires from the decoder.

(See Photo of motor with leads wired to terminals and photo of leads coming up between chassis frames)

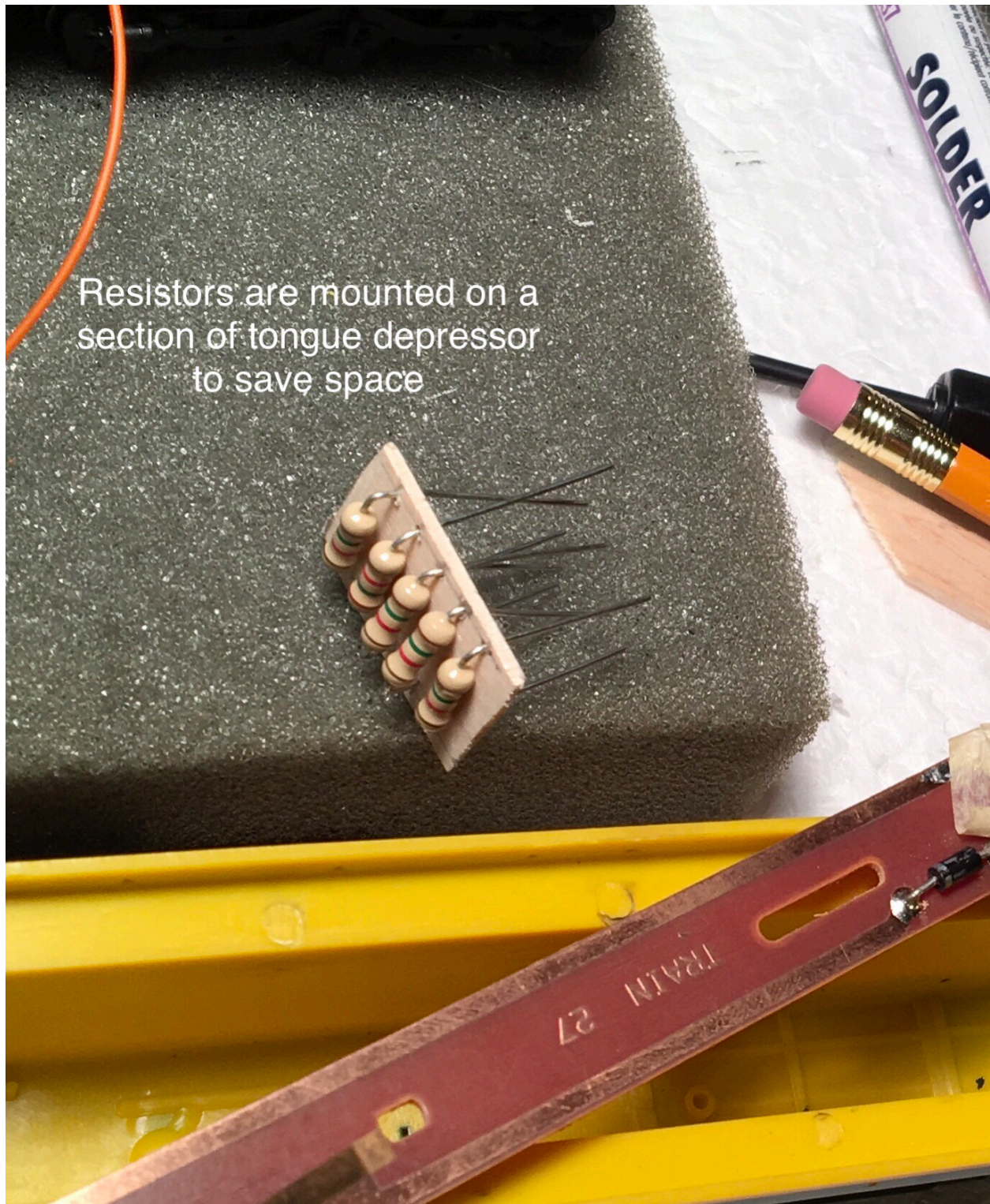


What you see after taking chassis apart



Solder orange (+) and grey (-) wires to the positive and negative terminals of the motor and pass these up between the two chassis halves to connect to the decoder

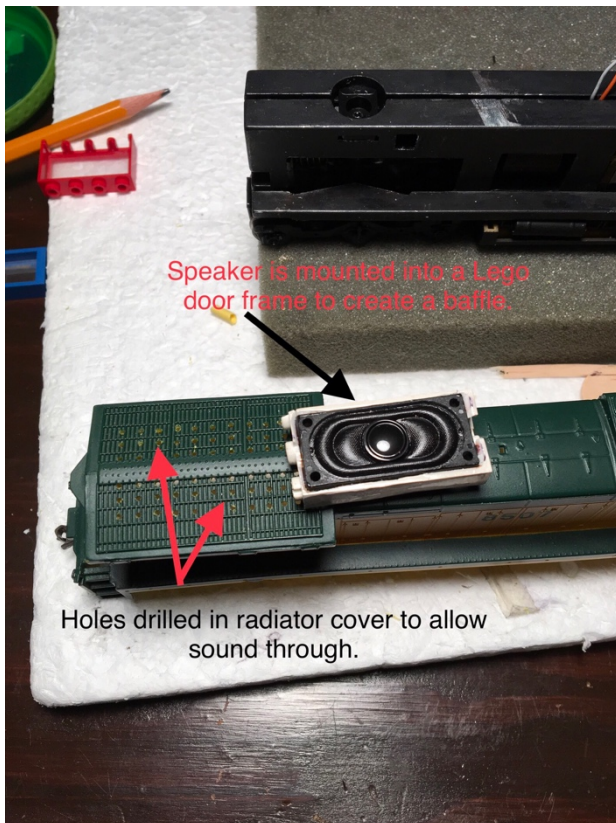
Five resistors (1.5 K ohm, 1/2 watt) are needed for the LED lights circuits. I mounted these resistors on a section of tongue depressor board in order to conserve space.



The resistor platform made from a section of tongue depressor

The speaker is mounted into a Lego doorframe to act as a baffle and multiple holes are drilled into the radiator covers on the top rear end of the locomotive to allow the sound to pass through. The speaker is then mounted into the shell under the radiator covers.

Photo of speaker and radiator cover with holes drilled



I used 5 out of the 6 function outputs provided by the Tsunami2 2200 Decoder.

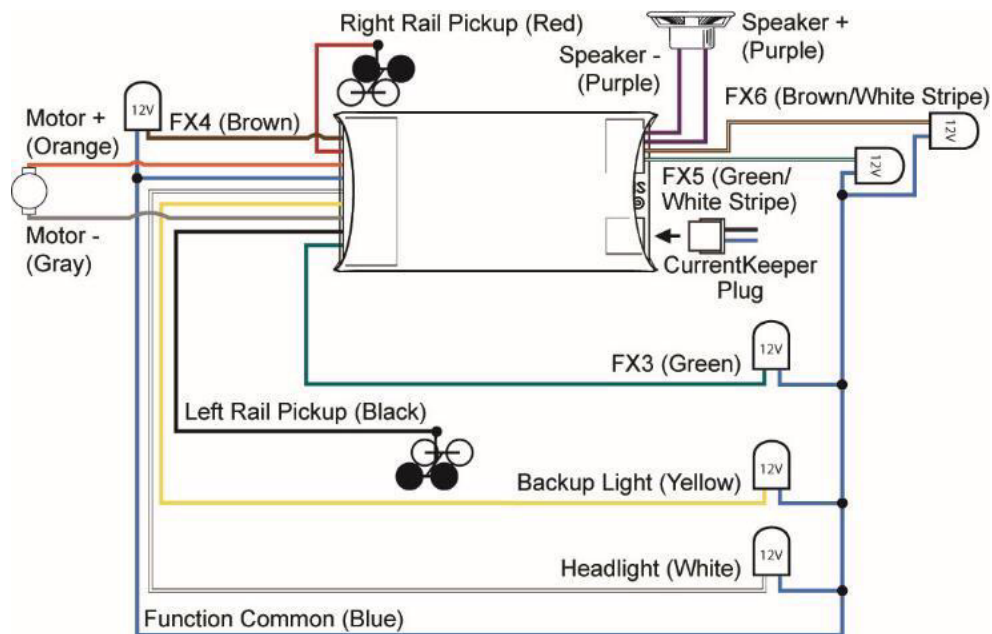
FX1 and FX2 F(0) (white and yellow wires) for front and rear headlight LEDs

FX3 (green wire) for the Rotary Beacon

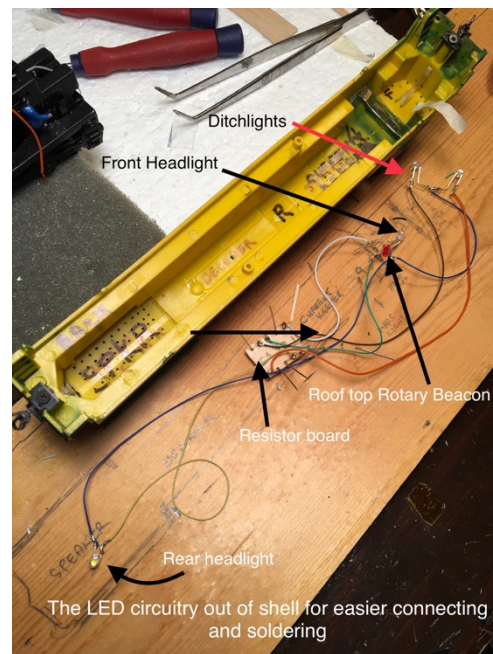
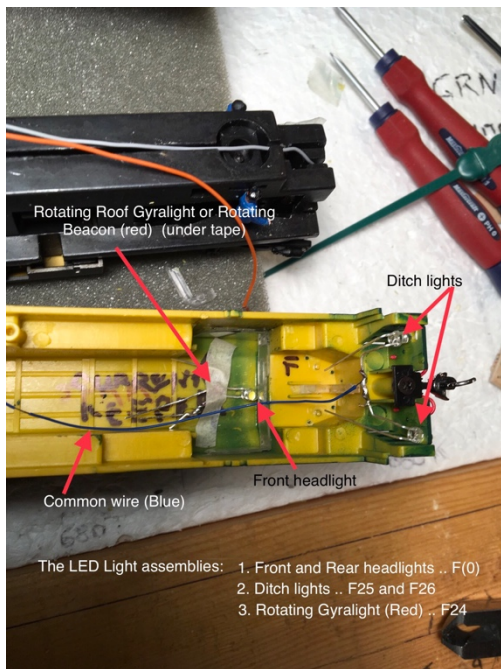
FX4 (brown wire) for Ditchlight 1

FX5 (green/white wire) for Ditchlight 2

See the schematic wiring diagram below provided by Soundtraxx. For setting CVs to obtain the desired light function effects see 'Programming CVs' text below.

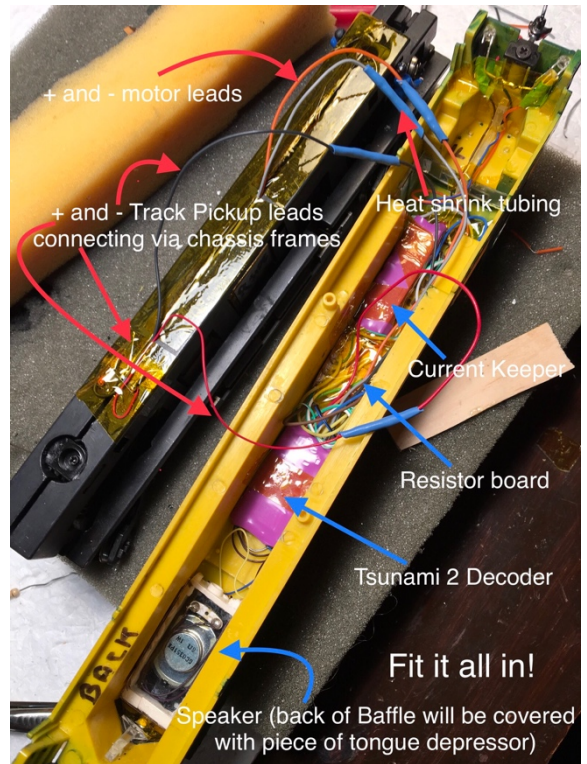
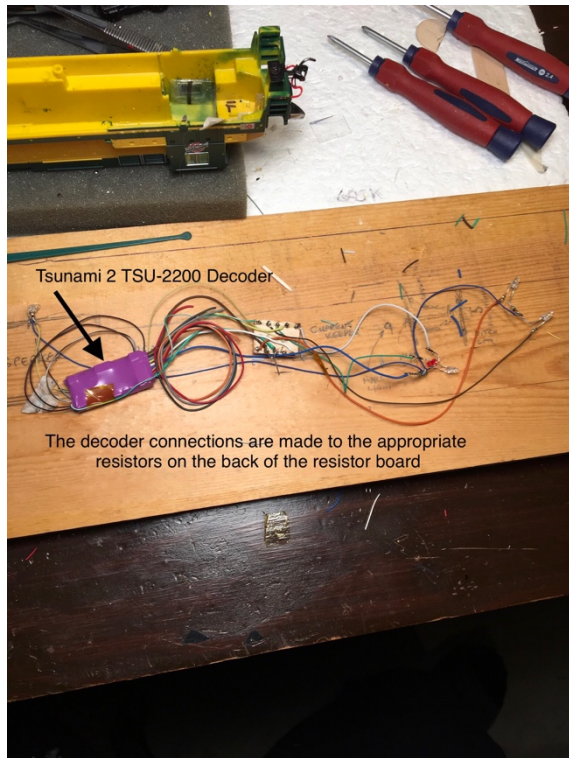


The schematic wiring diagram for Tsunami2 2200 Diesel Decoder as provided by Soundtraxx



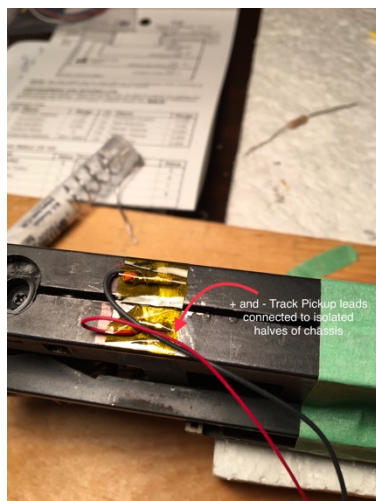
I used FX4 and FX5 for the Ditchlights activated by Function button F25 after remapping both FX4 and FX5 function outputs to Function button F25. (See below). For the Rotary Beacon use a 3mm Red LED connected to FX3 (Function Output 3). See the 'programming CVs' section below for the appropriate CV settings. The rotary beacon LED protrudes through a hole drilled in the roof of the cab and is secured by Kapton tape from underneath the shell. The Ditchlights are also mounted by drilling holes in the front of the shell apron at correct locations for the prototype and secured from the inside of the shell with

Kapton tape. Wiring the LED circuitry and the resistor connections were done outside the shell and then after soldering was completed, secured to the roof of the shell with Kapton tape. The decoder and Current Keeper connections can also be made before securing the assembly to the shell.



Photos of LED and Decoder circuit assembly and Track Pickup leads

It is wise to ensure that the leads from track pickups and to the motor terminals are long enough to facilitate easy removal and placement of the shell for later servicing. The Track Pickup leads are electrically secured to each half of the chassis, preferably with die and tap screws.





Programming CVs:

Setting up Soundtraxx Dynamic Digital Exhaust and other LED functions is straight forward. My settings follow but will vary for every individual locomotive. I also set up FX3 for a Western Cullen Rotary Beacon. See the Soundtraxx Tsunami2 Decoder User's Guide for comprehensive instructions and for fine tuning of your own settings.

What follows are the CV settings I used for programming the Ditchlights to alternately flash at a grade crossing when pressing F9 or turning on Ditchlights via F25 function button. These settings are taken directly from **the Soundtraxx Tsunami2 User Guide Decoder manual**.

CNW 8507 GE C40-8 Tsunami2 2200 CV settings programmed with an NCE PH Pro 5 Amp command station and Pro Cab.

CNW 8507 Tsunami2 2200 Diesel (Alco) Install Date: April 9 2018

Manufacture: 141

Decoder version: 071

Address: Long 8507 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 45

Deceleration 75

Function mapping Changed Dimmer to F11 and Braking to F7 on April 11 2018.

.....

CV 128 factory Value 192 changed to 225 range 0-255.

CV 128 = 225 (**Master Volume**) 192 changed to 175 April 11 2018

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:

CV 114 = 47

CV 32 = 2

CV 512 = 16

Calibrate CVs 503 and 504 = 255

Independant Brake

CV 117- 140 (manual suggests 178) Independent Brake

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. Note that 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.

Date: April 12 2018 Used **Decoder Pro** to **change function button 7 from Dimmer to Independant or Train Brake** for locomotive CNW8507. Used Function Mapping Screen. These CVs are indexed (CV 1.273) so have to use Program on Main because NCE PH Pro 5 Amp with Pro Cab does not allow writing to indexed CVs on the Programming track. So before going to the CNW8507 file, change Decoder Pro to

Program on Main. Then went to CNW8507 listing and opened Function Mapping tab. Changed Dimmer to Function 11 and Brake to Function 7 button. Click on Write sheet..it writes all highlighted values which in this case were all the highlighted squares for forward...reverse etc. When finished .. says OK. Worked. Now save changes to roster file on computer. I set Dimmer to F11. Note that if you are on 'Program on Main' mode, the Read buttons are faded out as you can only Read CVS when on the Programming track. So to Read CVs move loco to program Track. Throw toggle switch to Programming track (DCC), thus connecting siding track to the Programming track output on the PH Pro Command Station. You don't have to use the Cab to go to Program on Programming track menu (4), as Decoder Pro does this for you when you click on the Read button for any particular CV. If you go to the Programming sheet and make a change, Decoder Pro will only write the 'change', if you press on 'Write changes on sheet'.

.. next read **light CVs** from Decoder Pro

CV 49 F(0) (f)= 143 Decoder Pro indicated Incandescent light, and Dyno light. I changed value to LED.

Don't notice much difference? Disable ON/OFF Headlight with LED compensation = 1+128=129

CV 50 F0(r) = 143 Changed To 129 Date April 12 2018

Enabling Automatic Effects

Date: Jun 22 2017

Configure automatic effects that respond to direction and movement. Follow the steps below to enable automatic effects with CVs 1.385-1.512 (Effect Auxiliary Map Registers):

1. Ensure CV 31 is set to a value of 16.
2. Enter a value of 1 into CV 32.
3. Access CVs 385-512 from your command station and refer to the descriptions and CV values below to enable automatic effects.

Forward-Driving: Effect is turned on when the locomotive is moving in the forward direction. Add 1

Reverse-Driving: Effect is turned on when the locomotive is moving in the reverse direction. Add 2

CV 1.407: **Forward Whistle Signal** Default: 0?

For example bit 0 of CVs 1.385-1.512 references FWDD Forward-Driving:

FWDD: Forward-Driving

0 = Effect activated by function key only

1 = Effect active when moving in forward direction

CV 1.408: **Reverse Whistle Signal** Default: 0 means only activated by the function button.

Bit 1 of CV 1.385 - 1.512 references REVD Reverse-Driving.

Set bit 1 of CV 1.408 to 1 by adding 2 to CV 1.408 which will turn on the reverse whistle when loco starts up in reverse.

CV 1.409: **Stop Whistle Signal**. Default: 0

Added value of 12 to the Stop whistle signal to set bit 2 FWDS Forward-Standing (add value of 4) and set bit 3 REVS Reverse-Standing on by adding value of 8 so total value put in CV 1.409 = 12, to have Stop whistle blow automatically on stopping either from forward or reverse. Disable these automatic functions so they only operate from the function keys by changing the values of the appropriate CVs to 0.

My 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 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)

(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

(You can read indexed CVs on the Programming track but don't write CVs on the Programming track..write values using Program on Main if using the PH PRO 5Amp)

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 = 255 (Prime Mover)

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 in 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.

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.

BEMF Intensity = $CV\ 212 \times (1 - (\text{speed step} \div CV\ 10)) \div 255$

When CV 10 is set to 0, only the value in CV 212 is used.

CV 10 = 126 did not seem to work well. Should CV 10 be set to its default of 0.

Now set the appropriate **Motor Control CVs**.

Current Values of CVs 210, 211, 212, 215, 217

(On Mikado 2-8-2 Tsunami2 Steam Decoder) as of Jun 10 2017. Most of these settings are as suggested in the manual).

CV 209 = 48. (Default) Kp Coefficient

Values from 0 to 255 may be entered to specify a gain factor for the proportional coefficient of the PID motor control equation to optimize back-EMF control algorithms to complement a given installation.

CV 210 = 25 or 30? (25) Ki Coefficient affects DDE.

To specify a gain factor for the integral coefficient of the PID motor control equation.

CV 211 = 255 (Slow Speed Compensation)

CV 211 is set to a value of 255, the effect is applied across the first nine speed steps; also advances the starting point at which the PWM (Pulse Width Modulation) is applied to the motor. This helps compensate for motors that are more difficult to start... suggest setting CV 211 to the lowest value that will still improve low-speed operation. Default Value = 180.

CV 212 = 255 (BEMF Feedback Intensity - 255...0 disables load compensation) what is default?

Default Value = 255

Setting CV 212 to a value of 0 will disable load compensation.

Date April 9 2018: CVs 10 and 212 left at default values of 0 and 255 respectively.

CV 215 = 120 (Back EMF Reference Voltage Default = 150) ...for track voltage of 12 Volts..check this

CV 217 = 10 (BEMF Enable - Auto-Stop Enable)

CV 217: Motor Control Register

Default Value = 10

Setting bit 1 (BEMF) to 1 will enable back-EMF motor control.

Setting bit 3 (STP) to 1 will enable the auto-stop feature. When auto-stop is enabled, direction commands will bring the motor to a full stop for a duration of 500ms before the decoder changes locomotive direction.

So I assume on Tsunami2 decoder Back EMF and Auto Stop are enabled by default

The settings for the Acceleration and Deceleration CVs are important as Acceleration and Deceleration must be enabled for DDE to effectively work. These values depend on how much momentum you prefer in your own particular set up.

CV 3 = 45 (to facilitate Independent and Train Brakes and DDE)

CV 4 = 75

CV 10 = 0 Date: Apr 9 2018 On Mikado ? CV 10 = 126 (on Mikado?)

Note to disable DDE.

From Soundtraxx forums.

There are two types of DDE and one is already active on the TSU 2: From Justin at Soundtraxx :

"There are **two types of Dynamic Digital Exhaust** on our products, Active and Passive. By default, only the Passive DDE is enabled. The active DDE uses the motor feedback and the Passive DDE uses your command station's speed step setting. To disable it program CV2.511 = 0."

So, as is, the TSU 2 produces a DDE effect as a default feature.

Ditch lights and function outputs:

CNW 8507 Date: April 16 2018

Programmed FX3 Function 24 CV 51 =7. **Western Cullen Rotary Beacon.** Date April 10 2018

Set up Ditch lights:

FX4 Function 25 Ditch Light Type 1 with **Grade Crossing logic and LED Compensation**

CV52 = $9+64+128=201$

FX5 Function 26 Ditch Light Type 1 phase B (Offset) with Grade Crossing logic and LED Compensation

CV53 = $9+ 32+64+128= 233$

Add Grade Crossing Logic To Bell:

Read the value in CV122 to see which bell is programmed and add a value of 128 to enable Grade Crossing logic.

Ditch lights:

Set Ditch lights to come on with the same function button...F25.

By Default function button F24 controls the FX3 function output

Default F25 controls the FX4 function output

Default F26 controls the FX5 function output

FX4 Mapping CV 1.260 = 25 (Function output 4 set to be controlled by function button F25)

FX5 Mapping CV 1.261 = 25 (Function output 5 set to be controlled by function button F25)

Doug Dyer
Victoria BC