

Installing SoundTraxx Tsunami2 Steam Decoder in IHC 2-8-2 Mikado

Sound decoders in Steam engines are a truly enjoyable experience. This article describes my installation and setup of a SoundTraxx Tsunami 2 Steam Decoder (TSU 2200 Steam) into an IHC 2-8-2 Mikado Steam locomotive. The TSU 2200 has 6 function outputs, and a steam locomotive can realistically make use of them all. I was able to avail myself of 5 out of the 6, including the engine exhaust feature, and the firebox glow using yellow and red LEDs. The Tsunami2 Steam sound effects such as Cylinder cocks and Dynamic Digital Exhaust are very realistic and versatile.

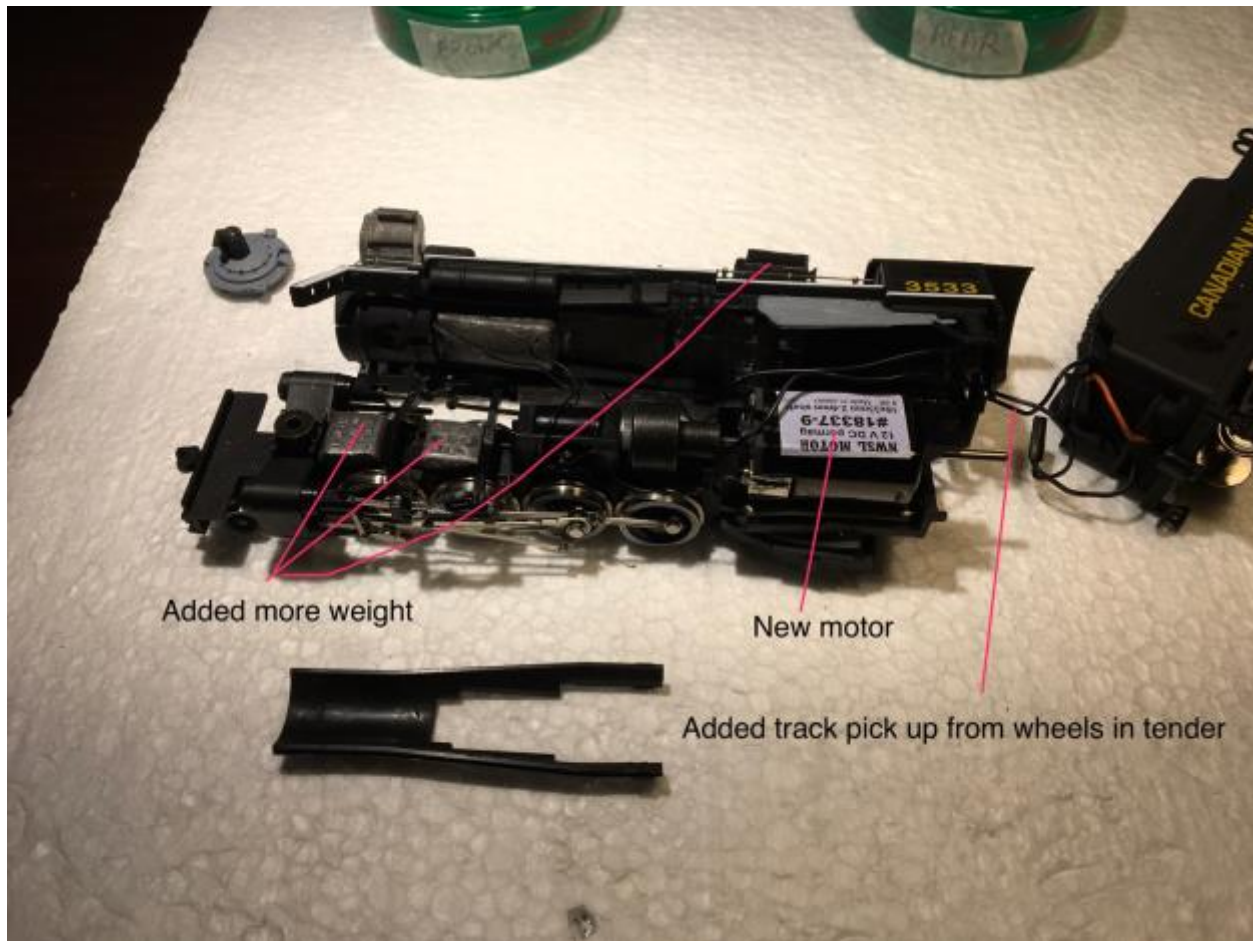
Here are the parts to get started:



In addition to the TCS 6 pin wire connector and harness, you require a 2 pin wire connector.

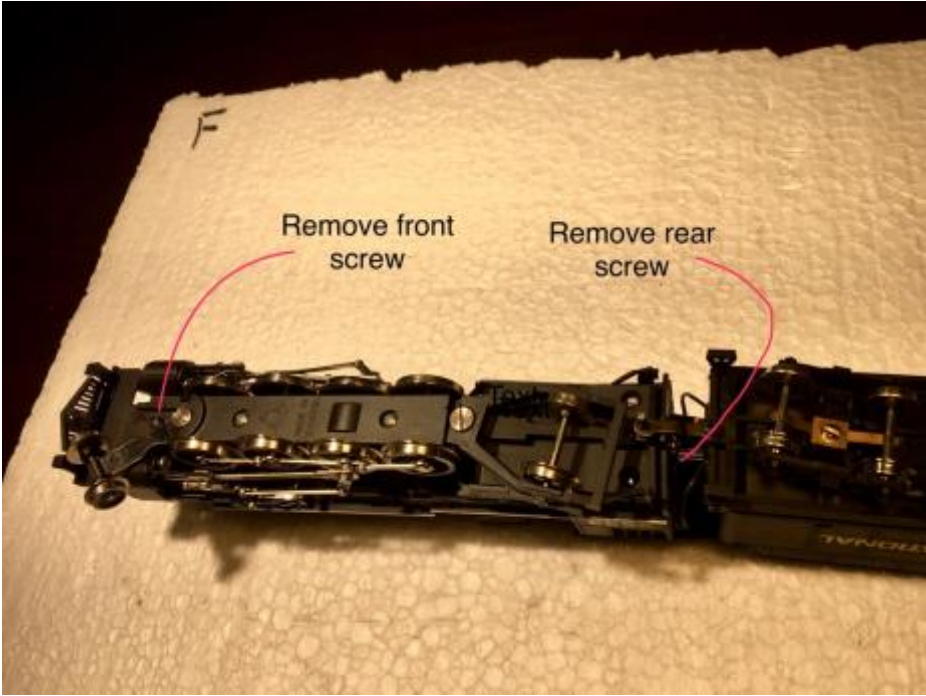
I had previously made some upgrades to the original IHC Mikado engine which included replacement of the original motor with an NWSL 12 volt DC permag Motor part# 18337-9. In addition I added some extra weight, and more electrical pickup by connecting track pickup wires to the tender wheels. See photo below.

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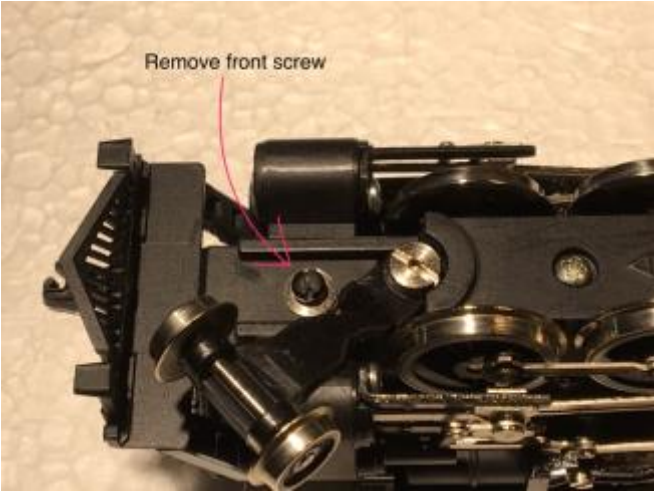


Extracting the shell from the locomotive chassis involves removing two screws, one at the front and one at the rear of the locomotive. The original internal weight is secured by the front screw, and can then be removed as well. Take the plastic Motor guard out to allow better access for wiring LEDs for the stack exhaust and for connecting the decoder wires to the front headlight. I used the original 12 volt incandescent bulb for the front headlight, which will not require a resistor, and 5mm standard LEDs for the rear headlight, the exhaust glow(red) LED in the stack, and for 2 LEDs, 1 red and 1 yellow for the firebox effect. The LEDs of course all require current limiting resistors, in my case 1.5K ohm ½ watt. The IHC Mikado locomotive predates the days of DCC Ready engines and so there is no help from convenient colour coded wires in the original wiring set up. The wire colours were not going to match when crossing to the tender to reach the decoder! For this reason I kept a handy drawing always available during soldering and wire hook up stages so as not to get my wires crossed! There are 9 wires in total that need to cross from the locomotive to the tender. Therefore I used the TCS 6 wire harness, a 2 wire connector, and a single wire connection (for Function output5.. the green/white wire to the decoder). I 'scratch built' a connection harness for this single wire using heat shrink tubing. See the wire diagrams below.

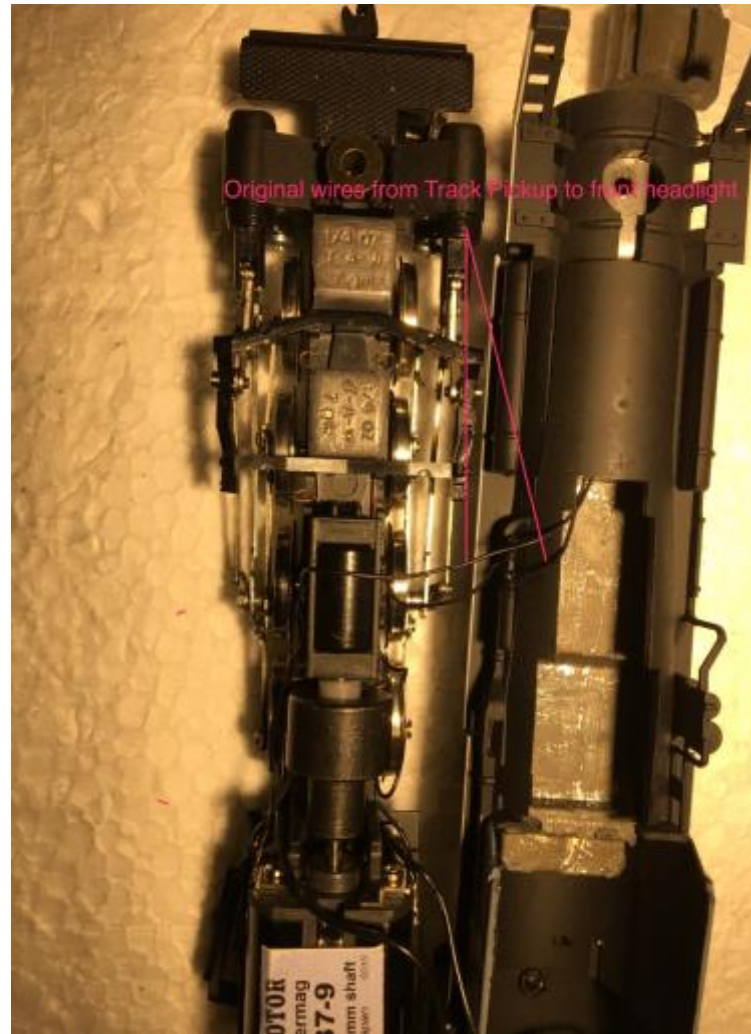
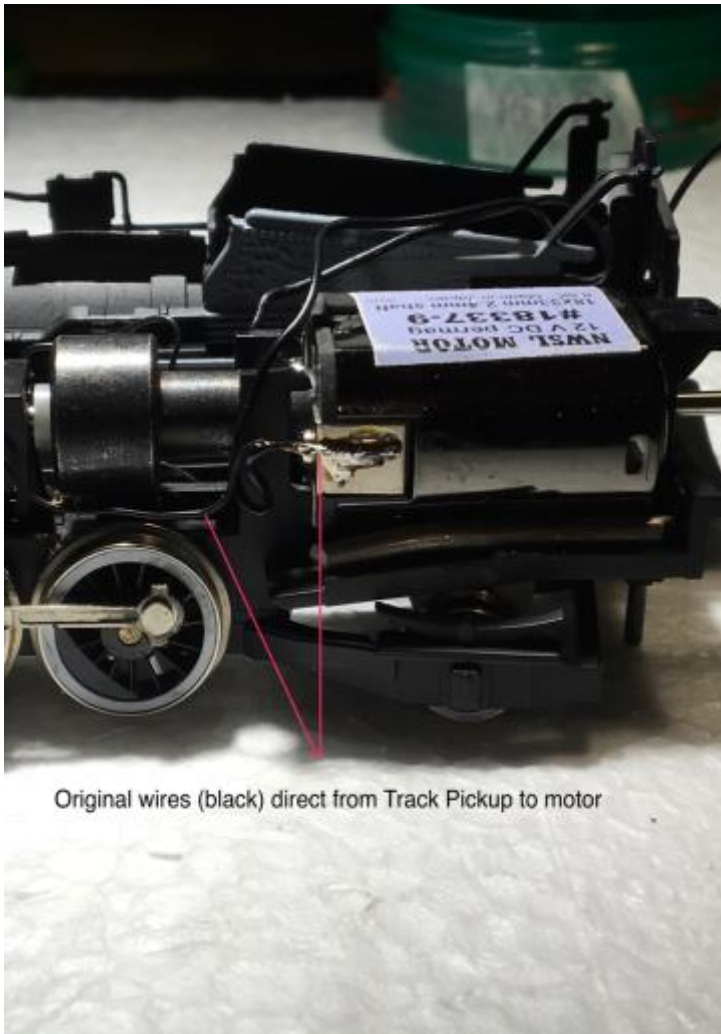
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Remove these two screws to extract the shell from the locomotive chassis.



Tsunami2 Steam Decoder Installation in IHC 2-8-2 Mikado



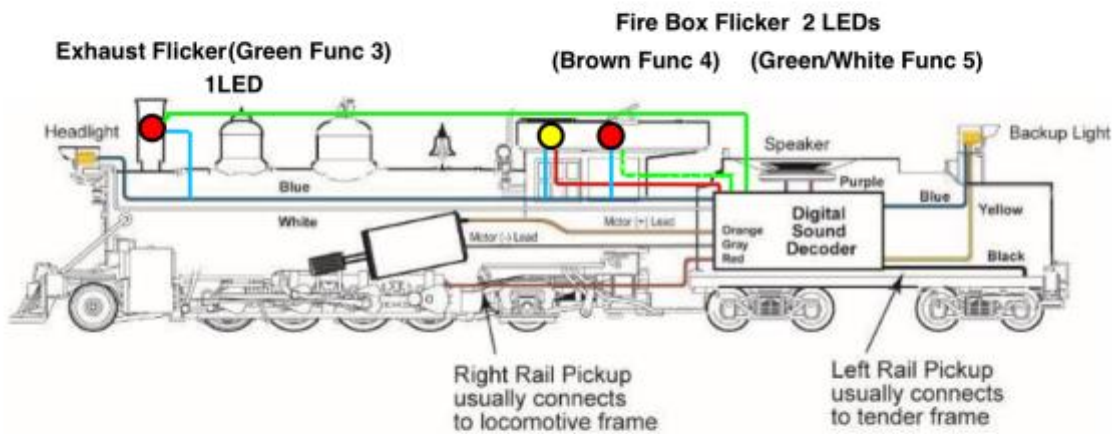
The original wires in the IHC Mikado are not colour coded. Be very careful to keep track of which wires connect to the colour coded wires from the decoder.

Making the 6 pin and 2 wire harness connections:



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The General wiring plan. Note that 9 wires must cross to the tender from the locomotive.



Head Light 12 V (original lamp)
Backup Light 5mm LED

9 wires cross from Loco to Tender

Three resistors in tender + Decoder
Current Keeper
Speaker

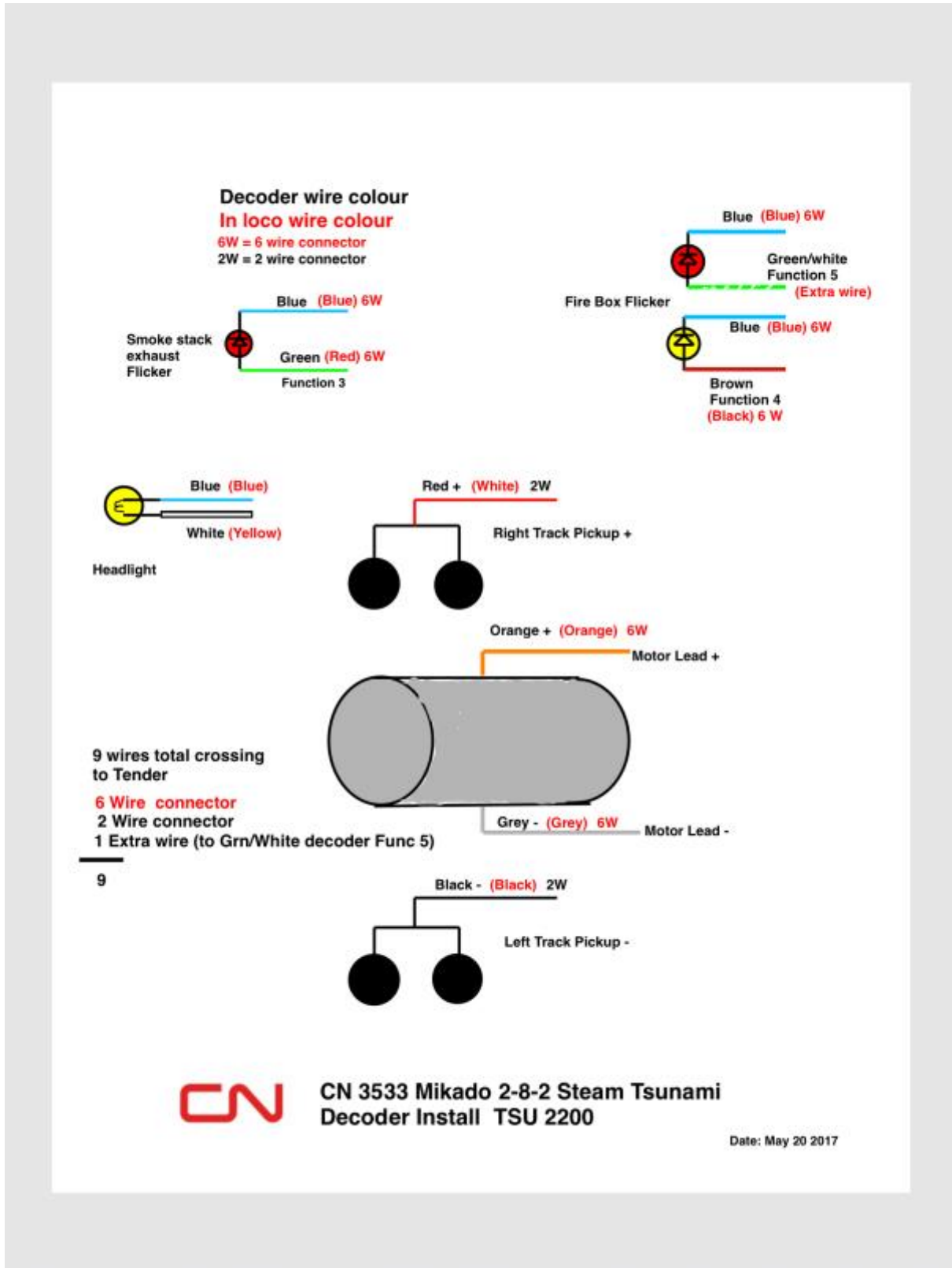


CN 3533 Mikado Steam Decoder Project

Date: May 13 2017

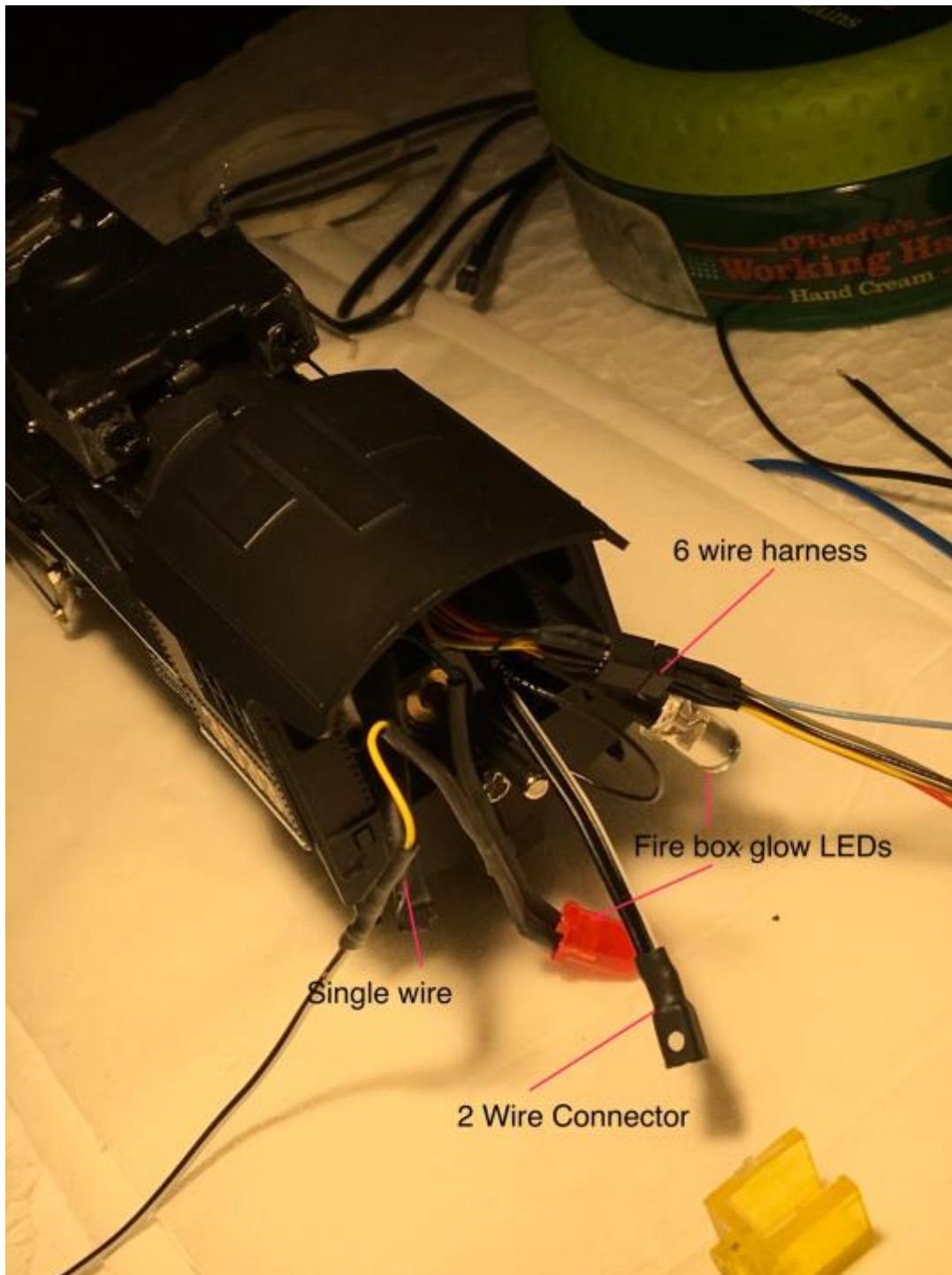
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Make a note of which wires connect to the 6 pin and 2 wire connecting harness. It is easy to get your wires crossed.



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Here are the 9 wires that cross to the tender. Note the red and white LEDs connected to function outputs 4 and 5, that create the fire box glow effect. These are kept together and inserted back into the Cab. The affect might be enhanced if allowed to reflect against a piece of aluminum foil?



The main electronics are housed in the tender. This includes the speaker, 3 resistors (current limiting resistors to protect the LEDs), the decoder itself, and a Current Keeper. The red positive Track Pickup wire from the decoder connects to the right rail positive track Pickup wires from the locomotive and

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from the tender. Similarly the black negative wire from the decoder connects to the left Track Pickup wires from the locomotive and the tender.

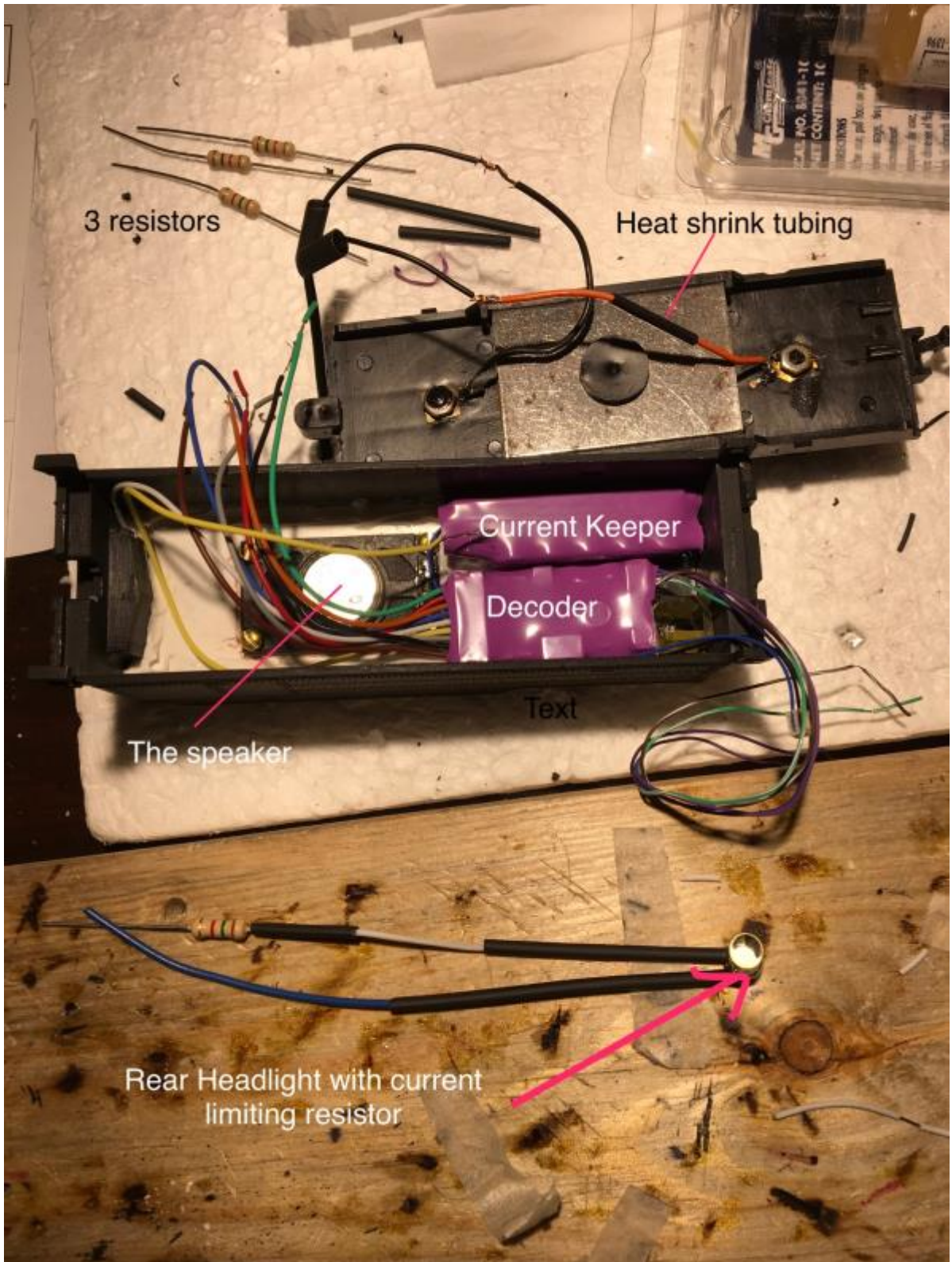


The speaker is mounted to the underside of the coal pile on a styrene plate with screws as shown. Seal around the speaker mount with silicone caulk. Small holes are drilled into the coal pile to let the Sound out.



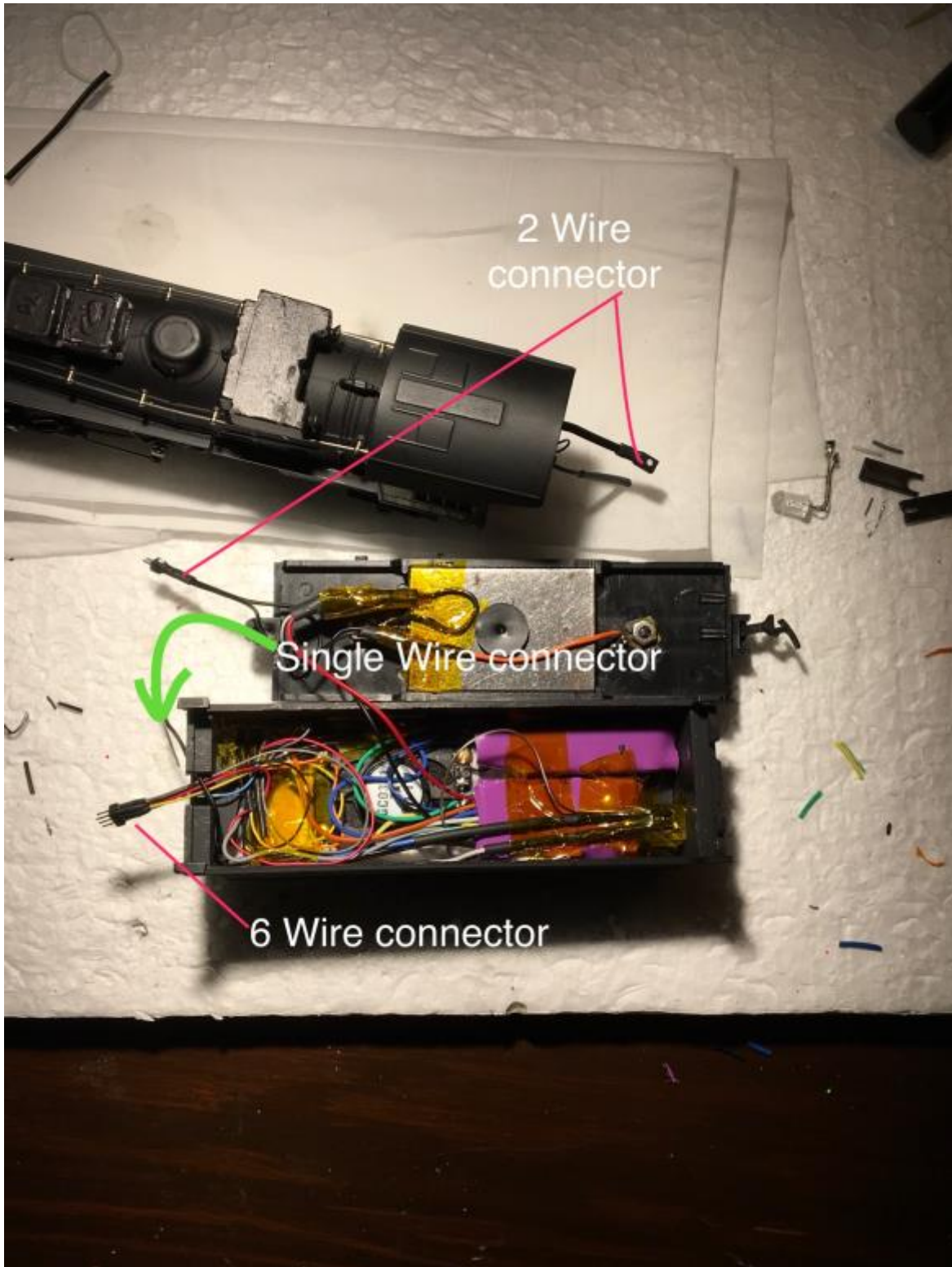
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The contents of the tender:



Tsunami2 Steam Decoder Installation in IHC 2-8-2 Mikado

The final hookup:



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Note that the 5 mm red LED for the smoke stack exhaust flicker nicely fits inside the smoke stack. No glue is necessary.



Setting up the CV values using an NCE Power Pro DCC controller on the Programming track was relatively easy. The Dynamic Digital Exhaust and Cylinder Cocks discharge as implemented by SooundTraxx are very impressive. My trials and experimentation to arrive at satisfactory values for programming the appropriate CVs are documented below. I used a NCE PH Pro 5 Amp DCC system to do this programming. My use of short addresses on some of my locomotives reflects the fact I also own an MRC Tech 6 Sound Controller which does not recognize Long Addressing. Therefore you may wish to program your CV addresses for a long Address rather than my using the Short Address 5 for this

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locomotive. The first part of this documentation is listed as how it appears on the LED Menu readout on the PH PRO CAB readout when using Standard programming. Most of the CV Programming information used here is taken directly from the SoundTraxx Tsunami2 Steam User's Guide and Technical Reference Manuals.

CN3533 2-8-2 Mikado. Tsunami2 Steam Decoder

Date: Jun 3 2017

Programmed to Short Address 5

Manufacturer : 141

Decoder version: 071

Active Address Short (Enter)

Change to 5

Set Configuration: CV 29

Direction bit Normal

Speed Steps 28. (Enter)

DC Analog Mode No (Enter)

Advance Acknowledge No. (Enter)

Speed Table Selection Std (Enter)

Enable Long or Short Address S (Enter)

Setting Up Motor Control Parameters...Press Enter to escape (do this later in OPS mode

Motor Control Parameters

Start Voltage CV2 10? Now 20. Trying 10. Currently 10..less jerkey? But on track 12 Yard 2 it strains /stalls motor and therefore reverted to 20. Works best with starting from 0 using INC FAST Button.

Mid Voltage CV 6 128

Max Voltage CV 5 255

CV 29 = 2. Short Addressing, Speed Table = STD (vrs ALT), DC Analog disabled, 28/128 speed steps (vrs 14 ..old decoders!) Direction NORMAL, bit 3 bidirectional communication is not even brought up when using NCE CFG programming. Therefore CV 29 = 2

STE Bit 4 = 0 STE: Speed Table Enable

0 = 3-point speed table enabled (CVs 2, 5 & 6) pg. 23 of Tsunami2 Steam User Guide.

(1 = Linear/28-point speed table (CV 25))

CV 3 Acceleration 50 Trying 75 Changed to 35. ...now 16 .. 45

CV 4 Deceleration 35 Trying 75 Changed to 50 now 35now 8 .. 75

Used NCE MOMENTUM BUTTON set to 2 (0-9)

Multiplier by default is 8 (see NCE Manual) and therefore CV 3= 16 and CV 4 = 8

This is not that much momentum but seems to keep jerkiness to a minimum?

As of Date: Jun 9 2017 (to facilitate DDE)

CV 3 = 45

CV 4 = 75

Master Volume Level: CV 128 set to 192 out of 255 for 75% volume level.

All CV values confirmed as read from NCE Programming track. Date: Jun 4 2017.

Hyperdrive2 Motor Control CVs - DEFAULT VALUES

CV 119: Max Engine Recovery Speed - 204

CV 209: PID Kp Parameter - 48

CV 210: PID Ki Parameter - 16

CV 211: Low-Speed Compensation - 180 0= Disabled

Adjusting Low-Speed Operation:

CV 211 (Low-Speed Compensation) is used to compensate for irregularities (if any) that occur during low-speed operation.

CV 212: BEMF Feedback Intensity - 255 0 disables load compensation

Description:

CV 212 is used to set the back-EMF motor control intensity. Values from 0 to 255 may be entered to specify the percentage of back-EMF error (n/255) that is fed to the control loop. Setting CV 212 to a value of 0 will disable load compensation.

CV 213: BEMF Sample Period - 9

Description

CV 213 is used to set the back-EMF sample period.

Values from 0 to 31 may be entered into bits 0-4 (D0-D4) to set the BEMF Sample Period that specifies the time period in mS (milliseconds) between measurements.

CV 215: BEMF Reference Voltage - Default = 150

Set to 120 for referencing track voltage of 12 volts.

CV 216: Motor Speed-Step Deadband - 0

0 = Disabled 1 = Speed-step 1

Description:

CV 216 is used to determine the speed step at which voltage is first applied to the motor output to put the locomotive into motion.

CV 217: Motor Control Register - 10

Description

CV 217 is used to enable back-EMF control and auto-stop.

Additional Information:

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.

Therefore Default sets bit 1 and 3 to 1 enabling Back-EMF Control and Auto-stop.

CV 220: Constant Brake Distance - 0

Description:

CV 220 determines the fixed distance over which the locomotive will decelerate to a stop after setting the throttle to zero. Constant Brake Distance enables the train to be stopped in a set fixed distance regardless of speed.

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Additional Information:

Entering a value from 1 to 255 into CV 220 will adjust the constant brake distance proportionally to the value in CV 220, i.e., if the stopping distance = 1 foot with a value of 64 in CV 220, then a value of 128 would result in a stopping distance of 2 feet.. Entering a value of 0 into CV 220 will disable the constant brake distance feature, as will disabling Back-EMF in CV 217.

Current Motor Control CV changes

Date: Jun 7 2017

CV 211 Slow Speed Compensation Default = 180. Now set to 255.

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 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 215 Back EMF Reference Voltage Default = 150 (for track voltage 15V Now set to 120 (for track 12 volts)

I did not program CVs 209 and 210, Kp Coefficient and Ki Coefficient but these now read CV 209 = 48, CV 210 = 16 (default values)

Remember that F14 Switching mode cuts speed in half.

These changes made improvement. Now even less sensitivity to voltage drops??

Suggestion that CV 210 < 20 not good and range between 20-30 best for DDE?

CV 10 Default Value = 0

CV 10 (EMF Feedback Cutout) and CV 212 (Back-EMF Feedback Intensity) are used to control the amount of load compensation applied to the motor across the throttle range. CV 212 can be set to a value from 0 to 255 to determine the amount of load compensation that is initially applied to the motor. A value of 0 disables load compensation altogether, while a value of 255 corresponds to 100% compensation. CV 10 determines the degree that the load compensation is reduced as the throttle speed is increased. When CV 10 is set to 0, only the value in CV 212 is used.

Tsunami2 User Guide suggests CV 10 would be best at Value = 126. (Page 63)

Portland clinic suggests value of CV 210 (Ki parameter default Value= 16) be set between 20 -30. Stating < 20 detrimental to DDE.

Thus may test CV 210 at 25?

May set CV 10 = 126

Date: Jun 8 2017.

Tried 126 as per User Guide suggestion but seems jerky so put back to 255 which works best at speed step 1.

CV 10 = 255 When CV 10 is set to 0, only the value in CV 212 is used. Should CV 10 be set to 0? Will try this.

Setting Independent Brake and Train Brake:

First **calibrate DDE:**

CV 31 = 16 (default)

MUST USE OPS MODE PROGRAMMING ON MAIN. All CVs > 256 are indexed CVs and the page reference depends on value in CV 32. If CV 32 = 2 then CVs 2.257 to 2.512 are accessible for programming. With

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NCE you can not program indexed CVs on the Programming track. You must use Program on Main. (OPS).

CV 32 = 2

CV 512 = 16 DDE Load Sensitivity

CV 503 = 255 at Speed Step 1

CV 504 = 255 at Speed Step 25 -40

To increase or decrease sensitivity after calibration just enter value + or - into CV 2.512

Now set Brake CVs:

CV 3 = 45 (Acceleration)

CV 4 = 75 (Deceleration)

CV 117 = 178

CV 118 = 100

Independent Brake = F11 with F12 off.

Train Brake = F11 with F12 on

Completed Date: Jun 9 2017 ... works well. Train Brake has a longer stopping time. Independent Brake has a Brake squeal and stops faster.

Dynamic Digital Exhaust DDE

These are the pertinent CVs:

DDE Control CVs

CV 2.503: DDE Load Offset

CV 2.504: DDE Load Slope

CV 2.505: Side Rod Clank Low Volume Limit

CV 2.506: Side Rod Clank High Volume Limit

CV 2.507: DDE Exhaust Low Volume Limit

CV 2.508: DDE Exhaust High Volume Limit

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

Its cv 505 and 506 that adjust the volume for rod clank . They are indexed CVs. You will have to access cv 31 or 32 first to adjust them (forums)

By chance have you enabled the drift mode by selecting F 5? To get out of that mode you have to select F 6.

First calibrate DDE:

CV 31 = 16 (default)

MUST USE OPS MODE PROGRAMMING ON MAIN

CV 32 = 2

CV 2.512 = 16 DDE Load Sensitivity

CV 2.503 = 255 at Speed Step 1

CV 2.504 = 255 at Speed Step 25 -40

To increase or decrease sensitivity after calibration just enter value + or - into CV 2.512

CV 2.505 = 255. Default Value = 0 (Side Rod Clank) try at 0

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CV 2.506 = 255. Default Value = 0 maybe should be 255? Did not notice much difference. Try 506 at 255...wow I hear the side rods!

CV 2.507 = 255 Default Value = 255 (Exhaust)

CV 2.508 = 255 Default Value = 255

CV 2.509 = 215 Default Value = 215. (Time)

CV 2.510 = 215 Default Value = 215

CV 2.511 = 255 Default Value = 10. (Throttle Sensitivity)

CV 2.512 = 255 Default Value = 32. (Load Sensitivity)

Left CVs 2.511 and 2.512 = 255 as this seems to sound best.

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

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. Currently CV 10 = 255 which according to the formula gives a BEMF Intensity of .992... ?

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

(On Mikado 2-8-2 Tsunami2 Steam Decoder) as of Jun 10 2017.

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 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)

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

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

CV 10 = 255. Should this be 0? Test?

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

CV 4 = 75

CV 2.505 = 0

CV 2.506 = 255

CV 10 = 255... Jun 10 2017 CV 10 = 126 (Jun 10 2017)

Configuring Lighting Outputs

CV 49: Headlight Configuration. (15)

CV 50: Backup Light Configuration

CV 51: FX3 Configuration

CV 52: FX4 Configuration

CV 53: FX5 Configuration*

CV 54: FX6 Configuration*

CV 57: Forward Direction Enable

CV 58: Reverse Direction Enable

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CV 59: Hyperlight Flash Rate
CV 60: Grade-Crossing Hold Time
CV 61: Brightness Register 1
CV 62: Brightness Register 2
CV 63: Dimmer Level
CV 64: Master Brightness Level

Exhaust Flicker FX 3: (current 0)
CV 51 = 12
Firebox Flicker Smart FX 4: White LED
CV 52 = 14. (Jun 10 2017)
Firebox Flicker Smart FX 5: Red LED
CV 53 = 14 (Jun 10 2017)

Or

Firebox Flicker FX 4:
CV 52 = 13
Firebox Flicker FX 5:
CV 53 = 13
ADD A VALUE OF 128 to the CVs to enable LED Compensation mode.
For example:
Exhaust Flicker FX 3 with LED Compensation:
CV 51 = 12 + 128 = 140

To enable Grade Crossing Bell:

Add 128 to Value in CV 122. and initiate the Grade Xing logic bell by pressing function 2 Long Whistle (default) or Function 9.
CV 122 = 27-31. (29) Add 128 = 157 Test..
CV 60 = Grade Crossing Hold Time (currently 4)
Takes Values 1 to 15.
Add 128 to Value in CV 122 to enable Grade Crossing Logic for a bell. Default Value = 29.
CV 122 = 157 gives a Heavy Brass bell with grade Crossing Logic . Done.Date: Jun 11 2017 works!

What about Whistle on stop.?

But for lights to add Grade Crossing Logic, you add 64 (bit 6) to the appropriate light CV Value.

To set headlights to reflect Rule 17:

From Model Railroad Forums Larry Puckett

Rule 17

covers an array of rules related to the use of headlights.

to set up the headlights so both

the front and rear lights can remain on ; in both directions, with dimming when running in the opposite direction.

SoundTraxx is more complex, since the CVs involved also program a large array of lighting features.

Setting

CVs 49 and 50 to 145, and on
Tsunami2 and Econami
decoders CVs 57 and 58 to
253, did the trick in my case.

Customize the Clickety-Clack

Follow the steps below to adjust clickety-clack CVs:

1. Ensure CV 31 (CV Index 1) is set to a value of 16.
2. Enter a value of 3 into CV 32 (CV Index 2) to select Indexed CV Page 3 as the active indexed CV page, and enable access to clickety-clack CVs.
3. Refer to the following information when accessing CV 3.257 and CV 3.258 from your command station to customize the clickety-clack sound effect.

You can set the number of axles per truck and number of trucks per car with CV 3.257 (Clickety-Clack Rate) to adjust the clickety-clack rate. Default = 5 (2 axels/truck,2 trucks/car).

CV 3.258 (Clickety-Clack Sound Scalar) allows you to fine-tune the frequency of clickety-clack and flat spots sound effects.

Enter a value from 1 to 255 into CV 3.258 to adjust the scale speed. A value of 0 will disable the clickety-clack sound effects. Default value = 180.

Sound volume of clickety clack: CV 153 Clickety-Clack. 15

Add 8 to CV 198 to **enable Automatic Cylinder Cocks**

Add 8 to CV 198 (Automatic Sounds Enable CV. for DCC.

CV 199. Try a Value of 8 Controls time on Done Date: Jun 15 2017

8 seconds after Start Cylinder Cocks shuts down. 1 to 255

A value of 0 will disable automatic cylinder cocks.

F4 function key

CV 199 = 15 Jun 21 2017

Example: Adjusting Fireman Fred Event Probability

I left injector CV 206 at default 128

Other CVs changed to the values in example.

Date: Jun 21 2017

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:

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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.

Adjust Chuff rate

Set CV 114 to Value of 67?

Default Value is 57

Takes Values from 0-255

0 = Auto-Exhaust disabled

255= Fastest chuff rate

Currently CV 114 = 57 (not verified from Programming track) Date: Jun 28 2017

Select the Exhaust

CV 123 (Exhaust Select) Default and current value = 6 (exhaust chuff 7) Tried all 10 and 6 or 7 are best.

Left it at 6. Date: Jun 28 2017



SPIRITWOOD SUBDIVISION

CN 3533 Mikado Steam Decoder Project

Doug Dyer Victoria BC

addyer@telus.net