



**Tsunami™ Digital Sound Decoder**

# **Installation Guide**

for the New User

Software Release 1.00

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# All Aboard!

## Overview

Congratulations on the purchase of your SoundTraxx™ Tsunami™ Digital Sound Decoder™. Properly installed, your Digital Sound Decoder (DSD) will provide all the pleasures of high quality, digital onboard sound and the benefits of today's DCC (Digital Command Control) technology. With the proper tools, basic modeling skills and common sense, equipping a locomotive with sound is not difficult. It may, however, be a new experience for you, and you will find that successive installations will go more quickly than the first. Please note that while each decoder is tested thoroughly before it is shipped, we cannot control the correctness or quality of the installation. It is imperative that you follow the directions, and never remove the protective heat shrink from the decoder; there are no adjustments or user serviceable parts and this will void your warranty.

If this is your first decoder installation, this **Installation Guide** will give you step-by-step instructions for a successful first installation. The **User's Guide** will walk you through the various aspects of programming your Tsunami decoder, as well as some tips on troubleshooting. Once you've had some experience using and programming your decoder, the Tsunami **Technical Reference** will provide a list of all the CVs available for use with Tsunami decoders. This reference also explains their exact function and make-up for those who wish to have a complete reference for advanced programming techniques.

Technical bulletins covering various topics are also published from time to time, and these, along with the **Technical Reference** may be downloaded free of charge from our website at [www.soundtraxx.com](http://www.soundtraxx.com).



# All Aboard!

## Tsunami Features

Tsunami Digital Sound Decoders have a great number of new features designed to enhance your operating experience. Many features operate similarly to previous SoundTraxx decoders, but some features will require a little explanation.

Some of the enhancements include:

### Decoder Features

- Supports extended address mode for assigning any locomotive number up to 9,999.
- Supports advanced consist addressing.
- Supports 'Operation Mode Programming', allowing CVs to be changed on the mainline without using a programming track.

### Sound Features

There are many new sound effects (now over 20 sound effects!) and the ability to adjust the sounds to suit your ear (and model) has been greatly expanded and improved. You can now adjust the volume of each sound effect individually with Tsunami's built-in mixer!

The addition of a short whistle/horn effect will allow you to more easily incorporate signaling practices into your operations. There is also the option of replacing the short whistle function with an alternate whistle or horn for the engine which carried two whistles or occasionally, a horn and a whistle.

For those with limited function keys, you may wish to enable the automatic signal feature, which will activate Stop, Forward, Reverse and Grade Crossing whistle signals automatically in response to train motion.

### More Sound Features

- Adjustable Volume Controls
- Seven-Band Equalizer
- Auto-Exhaust™ allows chuff to be synchronized to the locomotive speed without a synchronizing exhaust cam (steam); cam is optional.
- 1-Watt Audio Amplifier
- Adjustable Reverb

### Steam Sound Effects

- Steam Exhaust Chuff
- Whistle
- Airpump
- Water Stop
- Brake Release
- Sniffer Valve
- Johnson Bar/Power Reverser
- Steam Release
- Fireman Fred's tool box (5 effects)
- Dynamic Digital Exhaust™ modifies exhaust volume, cutoff and timbre as locomotive load changes.
- Bell
- Short Whistle
- Dynamo
- Brake Squeal
- Side Rod Clank
- Injectors
- Firebox Blower
- Boiler Pop Valve
- Coupler Clank



# All Aboard!

## Diesel Sound Effects

- Engine Exhaust (8 notches)
- Engine Shutdown
- Airhorn
- Compressor Pop-off
- Brake Squeal
- Radiator Fans
- Turbo Whine (some models)
- Engine Startup
- Bell
- Short Airhorn
- Dynamic Brakes
- Brake Release
- Coupler Clank
- Fireman Ed's tool box

## Throttle Features

Tsunami Digital Sound Decoders have greatly improved throttle features built into our Hyperdrive system. With the addition of these features, you will be able to better eliminate motor noise, better control your locomotive speed under varying conditions and adjust for differences between various manufacturers' models.

- Supports 14, 28 and 128 speed step modes.
- Programmable acceleration, deceleration and starting voltage for prototypical starting and stopping.
- Use of standard and alternate speed tables.
- Load Compensation
- Silent High Frequency Motor Drive

## Lighting Features

All of our Hyperlight effects are available in our Tsunami decoders. One new addition, the Dyno-Light, provides the missing element in the operation of the Dynamo, or steam generator. This mimics the effect of the gradual increase in brightness as the generator spools up and supplies power to the headlight.

The new LED Compensation will adjust the lighting output level to account for the visual differences in your lighting effects when using an LED rather than an incandescent bulb.

- Four function outputs for headlight and backup light or other effects
- Supports "Rule 17" operation or automatic direction control
- 100mA Current Sink Capacity
- Each output may be programmed with our Hyperlight™ Lighting effects:

## Lighting Effects

- Simple On/Off Lamp
- Oscillating headlight
- Pyle-Gyalite
- Western-Cullen Rotary Beacon
- Type I and II Ditch Lights
- FRED (Flashing Rear End Device)
- Firebox Flicker
- Smart Firebox Flicker – synchronizes with sound of the firebox door opening and closing
- Dimmable light
- Mars Light
- Prime Stratolite
- Single Strobe
- Double Strobe
- Engine Exhaust Flicker
- Dyno-Light



# Installation

## Pre-installation Check List

It will be a great temptation to begin connecting wires immediately. Before you install your Tsunami Digital Sound Decoder, there are some simple precautions you should take.

First, read the instruction sheet that came with your decoder carefully! It will always be the source of the most recent information. Then finish reading this **Installation Guide**.

- The DSD should be handled carefully in a static-free environment. To discharge static electricity, touch a water pipe or grounded, metal surface before handling the decoder.
- Never remove the decoder's protective shrink tubing. First, you will void your warranty and second, you will compromise the decoder's built in thermal management system.
- Never make connections to the decoder while it is powered. Doing so makes for an accident waiting to happen.
- Make sure all electrical connections are insulated. Avoid using electrical tape, as it tends to unravel over time. We recommend using heat shrinkable tubing instead.
- Never allow the decoder leads to come in contact with any DCC track wiring except those specifically designed for that purpose.
- Never allow speaker outputs to become shorted together.
- Never allow motor outputs to become shorted together.
- Do not exceed the output ratings for which the decoder is designed.
- Take your time and have fun!

In the event you damage your decoder during installation, our return policy is stated in the rear of this manual as well as posted on our website with an effective date reflecting any changes.

## Tools and Materials You Will Need

In addition to the common hand tools found on most modeler's workbenches, you should have at your disposal:

- Low wattage (under 25 watts) solder iron
- Rosin Core Solder
- Hobby Knife
- High Speed Motor Tool (such as a Dremel)
- Miniature Screwdriver Set
- Diagonal Cutters
- Multi-meter
- Double Sided Tape
- Silicone RTV
- Heat gun
- Assorted sizes of heat-shrink tubing (SoundTraxx P.N. 810037)
- Insulative Tubing (SoundTraxx P.N. 810036)



# Installation

We also recommend the following items to aid your installation:

Micro connectors can be used to facilitate easy separation of items like speakers from the locomotive. SoundTraxx offers an economical 2-pin connector (P.N. 810012) and a 10 pack of mini-micro connector pins and sockets (P.N. 810058).

SoundTraxx P.N. 810123 is an NMRA-compatible 8-pin socket useful for converting harnessed decoders to a more 'plug and play' format.

SoundTraxx offers two sizes of 1.5 Volt micro-bulbs for use with the included lighting effects. P.N. 810022 is a 1.3mm diameter bulb and P.N. 810024 is a 2.2mm diameter bulb. Bulbs are also available in economical six-packs.

SoundTraxx offers a variety of high quality, miniature speakers suitable for use with Digital Sound Decoders. Wherever possible, choose the largest speaker that can be fit into the locomotive.



*P.N. 810012  
2-pin Micro-connector*



*P.N. 810058  
Pkg. of 10 Single-pin  
Micro-Mini Connector*



*P.N. 810123  
Pkg. of 4 Eight-pin  
NMRA Connectors*



*P.N. 810022  
1.3mm 1.5 Volt Micro-bulbs*



# Installation

## Step 1. Select Your Locomotive

If this is the first time you have installed sound in a locomotive, then we suggest you choose your locomotive carefully. A few simple precautions will ensure that your first effort produces a great sounding locomotive instead of an intimidating ball of wires:

- Don't pick a locomotive whose stall current exceeds the rating of the decoder.
- Do pick a smooth running locomotive that runs well on straight DC power. A smooth running mechanism is vital for good throttle control and enhances the realism of the sound. Dirty, worn out or binding mechanisms not only overload the decoder, but also will have trouble starting smoothly and will destroy the illusion created by the Auto-Exhaust feature if they barely lurch along at half throttle.
- Do start with an engine that is 'sound-ready' if possible, such as an engine with predrilled speaker holes. The simpler you can make your first installation, the better.
- Don't pick a noisy engine, or one which experiences some arcing or sparking when in operation. The best sound will come from locomotives powered with can motors. Older, open-frame motors may produce an offensive, interference sound.

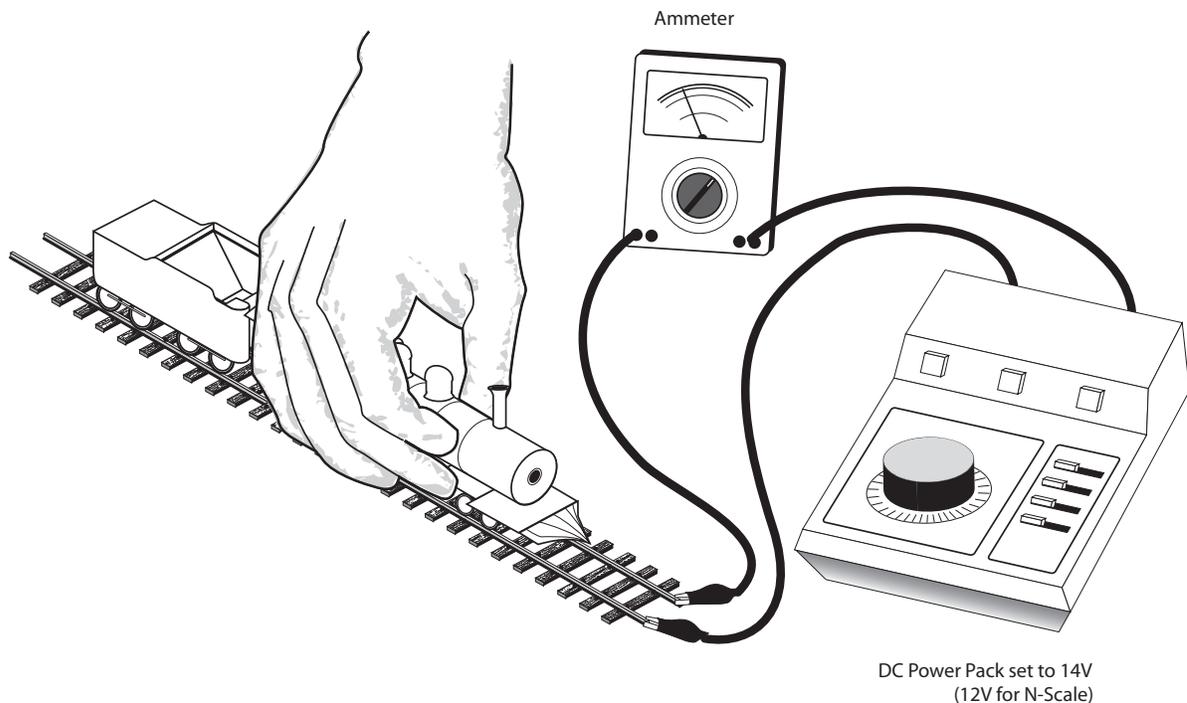


# Installation

## Step 2. Test the Motor Stall Current

Test the locomotive's stall current to ensure that it is compatible with the Tsunami model you have selected.

1. Place the locomotive on a section of track powered by a conventional DC power pack set to the same track voltage as your command station (typically 12-14 volts).
2. Connect a DC ammeter in series with one of the track feeders as shown in Figure 1. If your power pack has built in meters, they may be used for this purpose.



*Figure 1 - Testing the Locomotive's Stall Current*

3. While grasping the locomotive to prevent it from taking off, turn the power pack on.
4. Stop the motor from turning by firmly pushing it down into the track or grabbing hold of the flywheel.
5. To ensure the most accurate measurement, be sure that the power pack voltage remains at the voltage set in Step 1 of this test.
6. Measure the current the locomotive is drawing while the motor is stalled. This is the stall current and must be less than the decoder's rated capacity.



# Installation

## Step 3. Plan the Installation

You should give some thought to where the installation of the various DSD components will be within the locomotive before you get started. Provide ventilation for the decoder if possible, mounting the decoder so that some airflow can occur. Also, mount the decoder away from other heat sources, such as the motor or lamps to reduce the chance of overheating. If you can, mount the decoder so that the 'flat' side is against a metal chassis or weight. This will further help to dissipate heat. Always, *always* provide a proper baffle (enclosure) for the speaker. Lack of a speaker baffle is the leading cause of poor sound quality or low volume. Finally, make sure to use the largest speaker that you can fit, as a bigger speaker will provide more volume and deeper bass.

Figure 2 shows a typical Tsunami installation in a die-cast locomotive. Following as many of the guidelines above as possible, we've mounted the flat side of the decoder against the tender shell to help dissipate some heat. The speaker is mounted up under the coal load, and the decoder is not mounted near the motor or lamps.

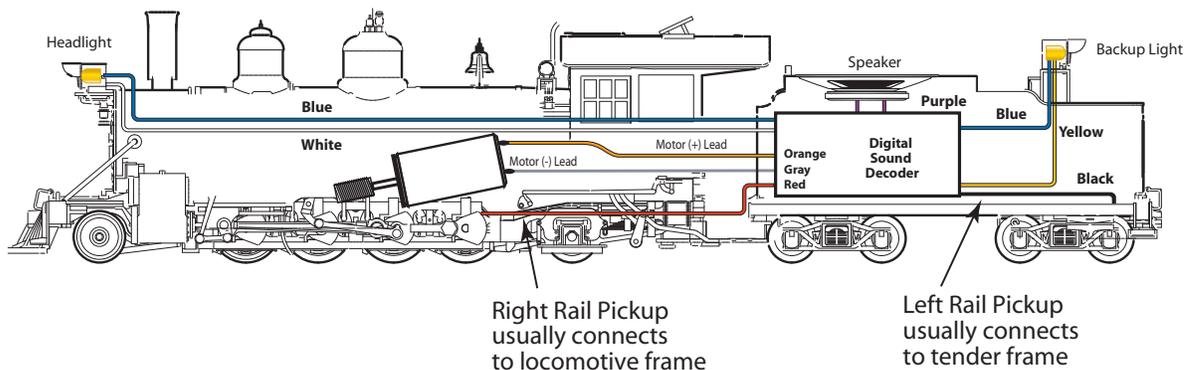


Figure 2 - Typical Steam Sound Installation

In Figure 3, the speaker is mounted on a deck plate fabricated from sheet styrene pointing up through the coal load. The tender shell acts as a baffle for the speaker. The plastic coal load can be perforated with small holes made with a pin vise or hand drill. The decoder is mounted to the weight on the floor of the tender.

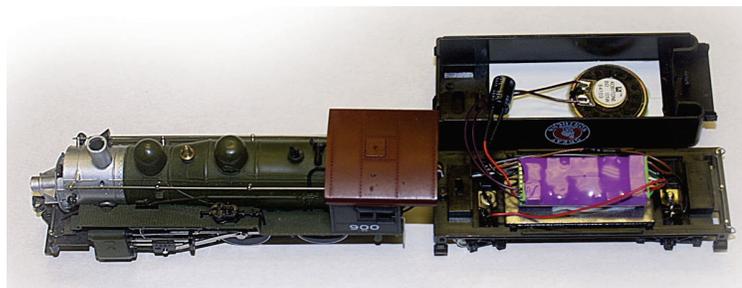
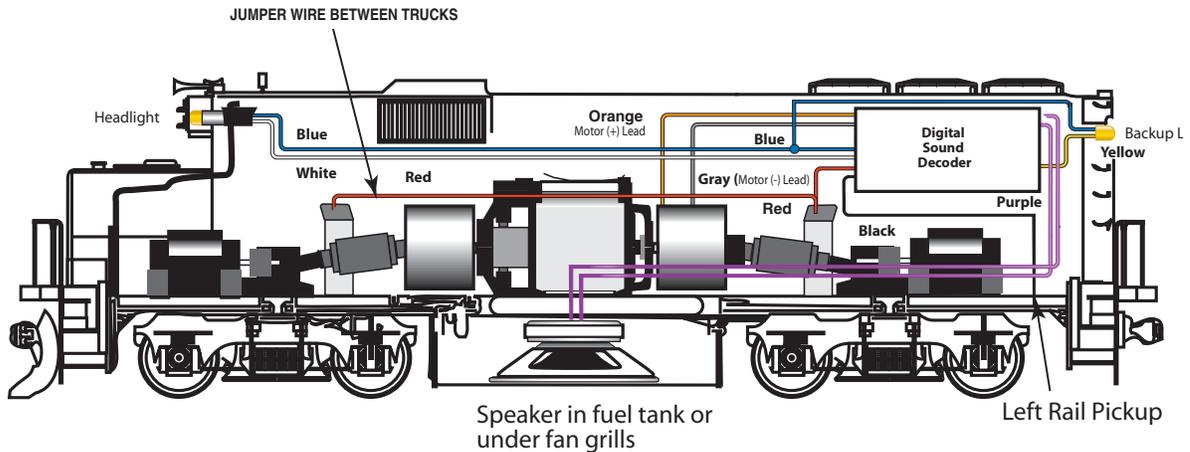


Figure 3 - A typical speaker installation using the tender as the speaker enclosure.



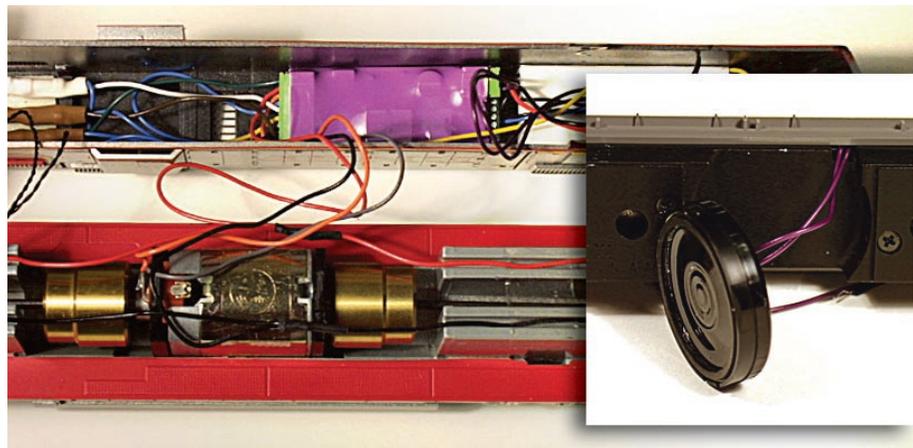
# Installation

When planning a diesel installation the same rules apply. In general you want to draw heat away from the decoder by mounting the flat side against a metal chassis or weight, or providing additional airflow if possible. This may not always be an option, so don't mount the decoder above the motor which generates it's own heat and will cause the natural tendency of the decoder to get warm during operation to be accelerated.



*Figure 4 - Typical Diesel Sound Installation*

Figure 4 shows a typical Tsunami installation for a diesel locomotive. In this instance, the speaker is mounted in the fuel tank, with the module itself under the fan grills. If the fan grills are open, some airflow can be created by drilling some small holes in the bottom of the frame without compromising the sound quality since the speaker is isolated in the fuel tank (a natural baffle!). If the chassis is metal, the flat side of the decoder can be mounted against it to help dissipate some heat. Like the steam installation on the previous page, the decoder is not mounted near the motor or lamps.



*Figure 5 - A typical speaker installation in a powered diesel locomotive. Note baffle and fuel tank compartment.*



# Installation

## Speaker Considerations

You will want to use the largest speaker possible to get the best volume and bass response.

The decision most critical to the success of your installation will be where to put the speaker. Obviously, the 'where' of speaker installation will depend on the size and type of the locomotive. But when considering the speaker's location, remember that the volume of the speaker will be greatly enhanced when the speaker is fitted into a small airtight enclosure with the front of the speaker open to surrounding air. The reason for this is simple: in order to generate any appreciable sound, the speaker must develop air pressure. Without an enclosure, an opposite pressure behind the speaker cancels any pressure developed by the front of the speaker. The enclosure isolates the front and back surfaces of the speaker, thereby increasing the sound pressure and hence, the volume. It is critical therefore to make sure you seal these baffles well; any holes or loose seams will diminish the results and in some cases cause unwanted vibrations.

Additionally, the enclosure must be sized proportionally to the speaker such that the volume of air enclosed is several times larger than the speaker diameter. As a rule of thumb, for small speakers, the minimum for the length, width and height should be equal to the speaker diameter. Unfortunately, as space is limited in most models, this is only a general guideline, and exceptions can and must be made in many circumstances.

HOWEVER, the use of a proper speaker enclosure cannot be over emphasized and failure to use one is almost always the cause for poor sound quality.

In many cases, the tender of a steam loco tender can serve as the speaker enclosure. In this case, mount the speaker facing down through an opening in the tender floor or up through an opening in the coal load as shown in Figure 2. For diesel models, the fuel tank makes a good natural enclosure. Alternatively, up under the fan grills or in the cab can be good locations.

SoundTraxx offers a variety of high quality, miniature speakers suitable for use with the Tsunami Digital Sound Decoders (see the table on page 12) as well as baffle kits for some of the more popular models.



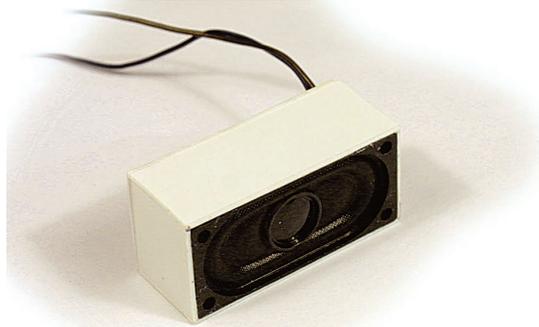
Figure 6 - SoundTraxx Snap-together Baffle Kits



# Installation

SoundTraxx currently offers four sizes of snap-together speaker baffle kits for use with SoundTraxx speakers. P.N. 810107 is designed for use with a 3/8" round speaker, P.N. 810108 fits a 1/2" round speaker, P.N. 810109 accommodates a 3/4" round speaker and our P.N. 810110 is perfect for a 1" round speaker.

If you wish to fabricate your own, a speaker enclosure need not be fancy and can be built from sheet styrene, bass wood, and even cardboard in a pinch! A 35mm film canister usually produces excellent results, as does a pill bottle or the cardboard tube center of a roll of paper towels.



*Home-made Baffle from Sheet Styrene*



*Baffle Fabricated from Bottle Cap*

*Figure 7 - Other Types of Speaker Enclosures*

The Figure 7 illustrates some home-made speaker baffles. With a little creativity, you'll be surprised at how many baffles you can create from sheet styrene or from items just laying around the house or workbench.

## Choosing the Right Speaker

While each and every SoundTraxx sound decoder is packed with awesome digital sound, the reality is that without a good speaker, you won't hear that great sound. The table on the following page should help you choose the best possible speaker to match to your particular installation.

In general, a larger speaker will provide better sound; therefore, try to choose the largest possible speaker for your installation. Once you have determined what physical space is available, look at the chart below to determine which speakers will fit. Remember to consider the size of the speaker baffle as well. If you have more than one choice available, look at the frequency response of the speaker and choose the one with the lower number.

## Using Tsunami with Multiple Speakers

In most cases, one speaker properly installed and baffled will provide more than enough volume for the average model. In cases where size constraints may make it desirable to use multiple smaller speakers instead of one, care should be taken to observe the following:

Tsunami's amplifier is designed to drive an 8 ohm load. If you choose to use



# Installation

multiple speakers wire them according to the directions on page 23 so as not to exceed this load. If not wired correctly, multiple speakers can overload the amplifier.

**Note:** Do not use Tsunami with speakers whose (total) impedance is less than 8 ohms. Doing so may result in erratic operation or even component failure!

## SoundTraxx Speaker Comparison Chart

Part Number	Diameter (in.)	Depth (in.)	Frame Style	Impedance (Ohms)	Max. Input Power (Watts)	Frequency Response
810083	0.39	0.18	R	8	0.20	750-3.5K
810089	0.59	0.19	R	8	0.10	540-20K
810053	0.80	0.13	R	8	0.20	600-7K
810054	1.10	0.20	R	8	0.20	550-6K
810055	1.50	0.65	R	8	0.20	700-4K
810056	2.00	0.70	R	8	0.30	500-4K
810087	2.50	0.84	R	8	0.50	330-4.5K
810057	3.00	0.96	R	8	1.50	280-5K
810059	4.00	1.50	R	8	3.00	160-12K
810112	1.00x0.56	0.19	O	8	1.00	750-3.5K
810113	1.38x0.63	0.28	O	8	1.00	500-12K
810103	1.56x0.78	0.32	O	8	1.00	550-12K
810078	1.12x1.57	0.50	O	8	1.00	350-12K
810084	1.50x2.50	1.10	O	8	2.00	230-20K

R = Round    O = Oval

## Decoder Considerations

It is normal for the DSD to get warm after periods of extended operation and its thermal overload protection will shut down the audio amplifier if it gets too warm. Therefore, it is important to install the decoder in a location where it can dissipate the most heat. Avoid placing the decoder near heat sources such as the motor or lights wherever possible.

## Lighting Considerations

Each Tsunami is equipped with four function outputs that are intended to drive headlight, backup light and special effect lights. The outputs can be independently programmed for a multitude of Hyperlight effects and may be used in a variety of ways. Each output is rated for 100mA.

**Do not exceed this rating! Be sure that the combined current of all lights as well as the motor stall current measured in Step 2 does not exceed the decoder's current rating.**



# Installation

The DSD lighting outputs may be used with 12-16 volt incandescent lamps, LEDs or 1.5-volt micro-bulbs. For more on lighting outputs, see pages 25 and 26.

## Other Considerations

Finally, you will need to decide whether or not to hardwire the electrical connections or use a plug-able connector. A connector will allow you to easily separate the components for storage, painting and service easier but also opens the possibility of accidentally damaging the decoder by reversing the connector during reassembly. Hardwiring the decoder will prevent this possibility at the expense of making separation more difficult.



*Figure 8 - Miniature connectors make installation easier.*

After you have fully read the installation instructions that came with your decoder, we suggest you draw yourself a schematic showing all connections between the DSD and various sub-components. This will help you determine which type of connector is best suited for your needs.



# Installation

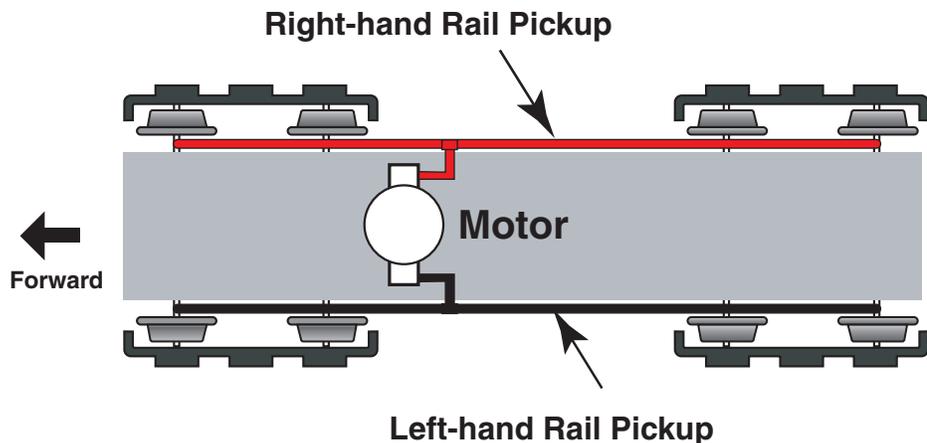
## Step 4. Isolate the Motor

The two motor brush connections must be electrically isolated so they are driven exclusively by the DSD motor outputs. We're not kidding about this! Nowadays, many locomotives are being designed and sold as 'DCC-ready'. Unfortunately, this means different things to different manufacturers, but it generally means that this step has been taken care of for you. In the case of a 'DCC-ready' locomotive, follow the instructions on page 27.

***Failure to properly isolate the motor will damage your decoder and turn it into an effective, but short-lived smoke generator!***

Begin motor isolation by removing the body shell from the locomotive and in the case of a steam locomotive, the tender shell as well.

Before you proceed further, it is important to carefully examine the locomotive wiring and determine where each wire goes and what it does. The manufacturer's assembly drawings may be useful here or you may elect to create your own wiring diagram. In particular, you will need to identify the connections to the left and right power pickups as well as the (+) and (-) motor connections. Note: for N, HO, and S scale locos, the positive motor connection is the one connected to the right rail (engineer side) power pickup.



*Figure 9 - Conventional DC Power Pickups*

Disconnect all wires leading to both motor terminals. Note that some motor brush connections are made using a spring contact to the chassis. In such cases, it will be necessary to remove or modify the spring contact as well. Be aware that some locomotives may make contact between the motor and frame only when the body is reinstalled.



# Installation

Next, verify that each motor terminal is electrically isolated from the left and right rail pickups using an ohmmeter or continuity tester:

1. With your meter set to the ohms scale, touch both meter probes together and note that the meter indicates 0 ohms (short circuit). You don't want to see this indication again!
2. Touch one of the probes to one of the motor brush terminals.
3. Touch the other probe to the locomotive frame, then the left rail power pickup wire, and finally to the right rail power pickup wire.
4. Move the first probe to the other motor brush terminal and repeat the tests. If all tests indicate an open circuit, the motor is properly isolated. Do not proceed further until this is done.

You will also need to disconnect the wires leading to any lights you wish to use. Using an ohmmeter, check that each lamp lead is electrically isolated from the frame as well as the left and right rail pickups.



# Installation

## Step 5. Modify the Tender or Body Shell

In the case of a steam locomotive, you will probably be mounting the speaker facing down on the tender floor or facing up in the coalbunker. You may need to cut an opening in the tender floor for the speaker. A series of small holes can be easily drilled and will work as well as one large hole provided the open area is at least one half the area of the speaker cone. In either case, there should be no openings outside or larger than the speaker cone itself. If the locomotive is plastic and you will be drilling holes in the coal load, drill them at slight angles and they will appear nearly invisible.

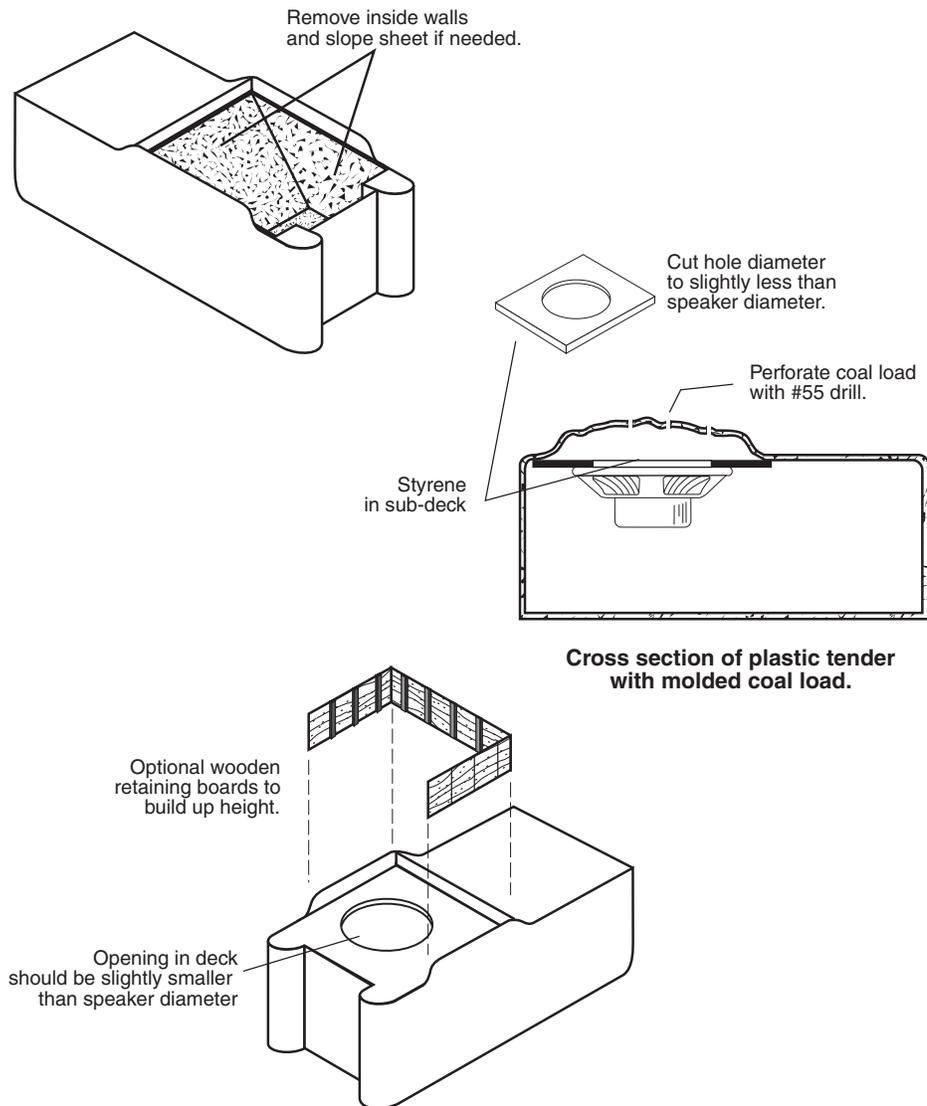


Figure 10 - Examples of Some Tender Modifications

In the case of a diesel model, you may need to mill out some of the weight



# Installation

in the fuel tank or replace the model's fan grills with some open-grill detail parts. Figure 11 shows some of the modifications you might make in a diesel installation. By milling out some of the weight in the fuel tank an enclosure is made for the speaker. You will need to fashion a mounting plate for the speaker and seal it well.

If you place the speaker under open fan grills, you may still wish to baffle the speaker rather than use the body as the baffle, as it may be difficult to seal the chassis well enough to achieve the results you want.

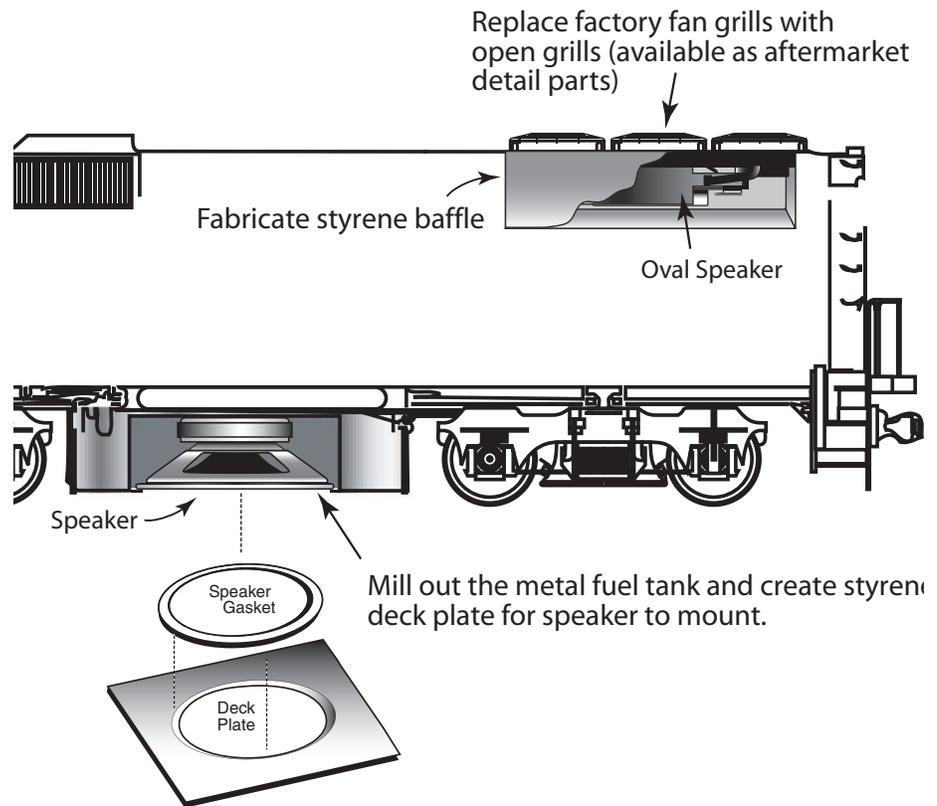


Figure 11 - Diesel Modifications

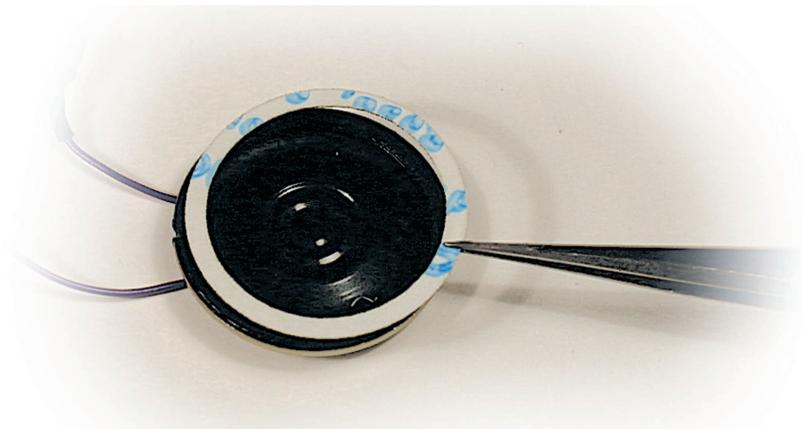


# Installation

## Step 6. Secure the Speaker in Place

Once work is complete and the speaker has been fitted in place, it must be secured tightly to the enclosure. For the best sound, an airtight seal is needed around the speaker edge.

We have found the best way to hold the speaker in place is to use our special speaker gaskets. The gaskets have adhesive on both sides. Peel off the backing with a pair of tweezers or the blade of a knife and mount one side to the rim of the speaker, making sure not to stick the gasket to the cone itself. Remove the other backing and mount your speaker in the desired location.



*Figure 12 - Applying the Speaker Gasket*

SoundTraxx has four different gasket sizes available in packages of four:

**P.N. 810118**

3/4" round gaskets for use with our 3/4" diameter speaker (P.N. 810053)

**P.N. 810119**

1" round gaskets for use with our 1" diameter speaker (P.N. 810054)

**P.N. 810120**

20x40mm gaskets for use with our oval speaker (P.N. 810103)

**P.N. 810121**

14x25mm gaskets for use with our smallest oval speaker (P.N. 810112)

Another option is to use silicone RTV - it provides the airtight seal needed and unlike epoxy or other hard glues, allows the speaker to be readily removed in the future. Be careful that you don't get any RTV onto the speaker diaphragm, as this will severely distort the sound quality!



# Installation

## Step 7. Install the Cam (Optional, Steam Only)

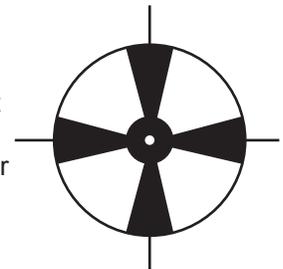
If you are intending to synchronize the steam exhaust chuff using a mechanical cam switch, you have a little more work to do. Otherwise, if you are planning to use the Tsunami's Auto-Exhaust feature, you may skip this step.

SoundTraxx offers its P.N. 810038 Exhaust Cam Kit as an easy to install alternative to traditional axle mounted sound cams. The Exhaust Cam set provides nine different synchronizer disks of varying diameters and configurations. Installation is straightforward and unlike the traditional sound cam, has the advantage that the drive wheel does not need to be removed from the axle.

Begin by selecting the synchronizer disk pattern appropriate for your engine:

### *2-Cylinder Steam Locomotives*

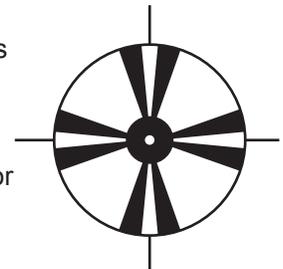
In all conventional 2-cylinder steam engines, use a synchronizer disk with 4 foil segments. You can achieve the proper prototypical exhaust chuff timing by aligning the foil strips of the synchronizing disks to the crank pin on the driver wheel.



### *Articulated Steam Locomotives*

Articulated engines come in two flavors, simple and compound. On simple articulated engines, the cylinders on the front and rear are the same size. On compound engines, one set of cylinders is considerably larger than the second set.

For compound articulated engines, 4 chuffs per driver revolution is correct. Install the same as for regular locomotives.

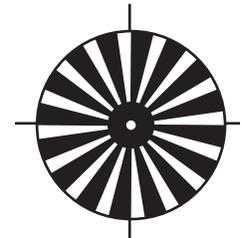


For simple articulated engines, a synchronizer disk is available that provides 8 chuffs per driver revolution.

### *Geared Locomotives*

Geared engines require a larger number of chuffs due to multiple cylinders and gearing of the drive wheels. Due to the large number of contacts required for each wheel revolution, it is usually impractical to achieve the prototypically correct number of exhaust chuffs per revolution.

The Shay disk (supplied with the Exhaust Cam set) will provide a reasonable compromise. Optionally, you may elect to use the Auto-Exhaust feature.





# Installation

## Install the Synchronizer Disk

Carefully measure the diameter of your locomotive's driver axle. Drill a hole of the same diameter in the center of the synchronizer disk you plan to use.

**Note:** the thin disk material will be easier to drill if you temporarily adhere it to a smooth wood block with a water soluble glue. The disk can be separated from the block by soaking in water after the drilling operation is complete. Be sure to use a sharp drill to get a clean burr-free hole.

Once the hole is drilled, check that there is still enough foil at the 'hub' to connect all the spokes together. If not, you will need to use a synchronizer disk with a larger hub.

Cut the disk out with a sharp pair of scissors, and trim the disk diameter to slightly less than the locomotive drive wheel diameter. This is important as clearance will be needed to clear turnout frogs, guard rails, and other trackwork features.

Using the scissors, make a single radial cut in the disk between the foil spokes from the outer edge to the center hole. Slip the disk over the drive axle with the insulated side facing against the drive wheel. Check for a correct fit and make any needed adjustments. The disk should fit flush against the drive wheel and there should be a close fit against the axle. Once you are satisfied with the fit, glue the disk against the non-insulated drive wheel with epoxy or contact cement. You will need to electrically connect the synchronizer disk to the drive wheel axle. This is best done by soldering the axle to the foil hub. Alternatively, you may use conductive paint to make the connection.

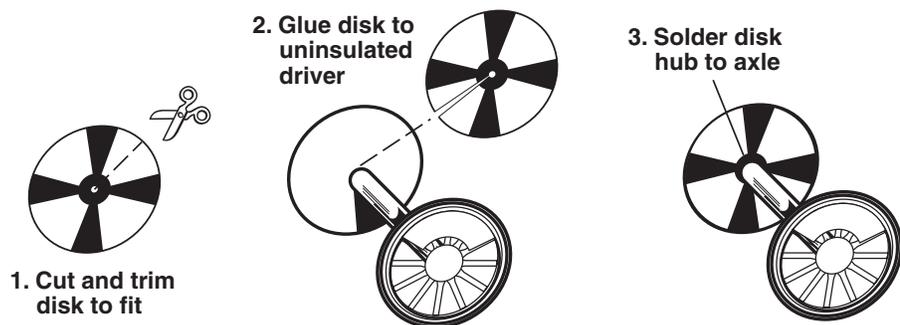


Figure 13 - Synchronizer Disk Installation

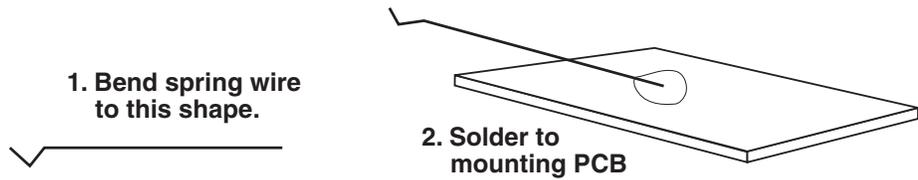
## Install the Cam Wiper

Using the spring wire supplied with the Exhaust Cam set, fabricate a contact wiper. Bend the wire to match the pattern of Figure 14 using a pair of needle nose pliers.

Solder the wiper to the small printed circuit board base as shown in Figure 14. Keep the spring wire as long as possible to provide flexibility. If the wire is too short, it will rub against the synchronizer disk with excess force causing premature wear and possible binding.

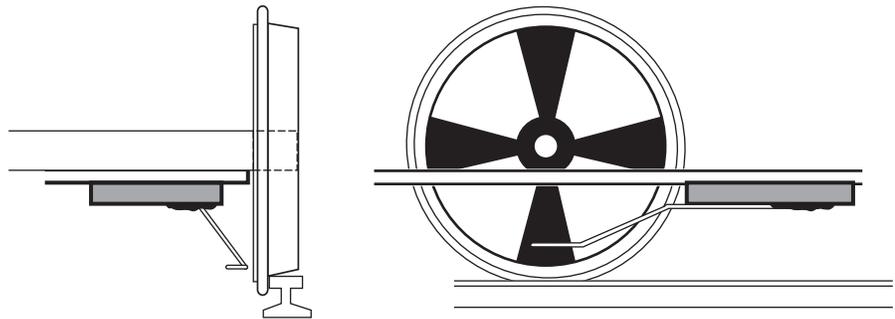


# Installation



*Figure 14 - Cam Wiper Fabrication*

Temporarily mount the insulated side of the wiper base to the locomotive frame such that the wiper end barely rubs against the synchronizer disk and does not touch any other part of the locomotive. Referring to Figure 15, adjust the spring wire so that the contact point is centered directly below the axle and its plane is parallel with the top of the rail. Once the wiper has been properly adjusted, move the wiper base until the spring wire is deflected by about 1/32" to 1/16" and secure the base in place with epoxy.



*Figure 15 - Contact Wiper Alignment*



# Installation

## Step 8. Install and Wire the Decoder (Non DCC-Ready Models)

Begin by securing the decoder in place using double-sided foam tape. Temporarily refit the tender or body shell to ensure that adequate clearance still exists.

When wiring the decoder, trim all wires to reduce unnecessary lead length. This will not only give your installation a neater appearance but also prevent wires from interfering with the drive mechanism and getting pinched when closing up the boiler or tender shell.

To ensure long-term reliability, solder all connections and insulate with heat-shrink tubing such as SoundTraxx P.N. 810036.

Make your connections according to the Master Wiring Diagram and the figures that follow.

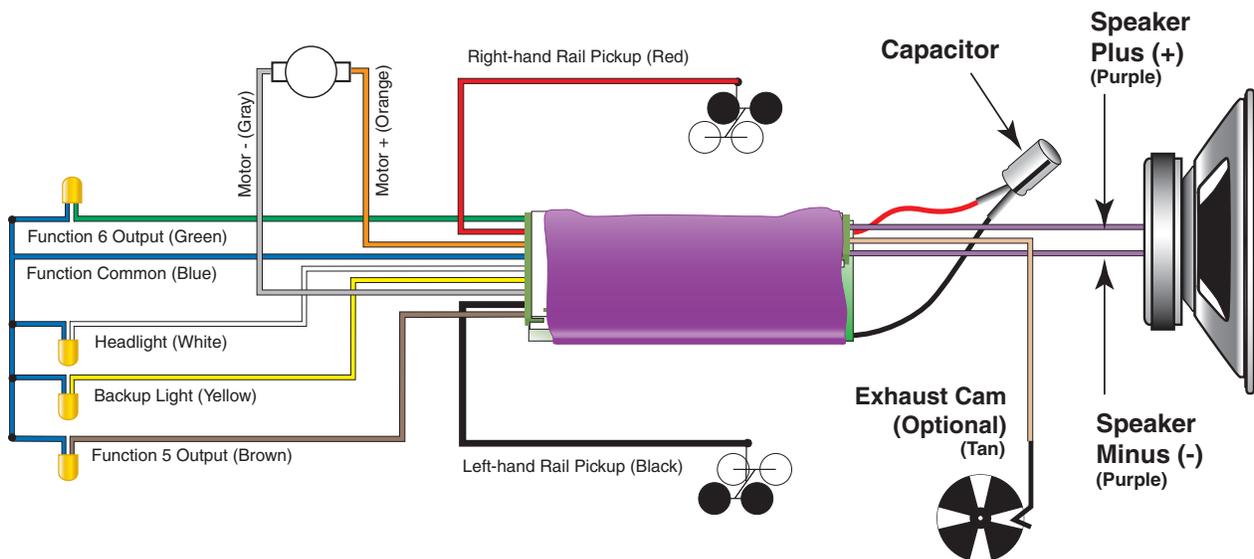


Figure 16 - Master Wiring Diagram

### Track Connections

Connect the RED wire of the decoder's wire harness to the right (engineer's side) track power pickup and the BLACK wire of the decoder's wire harness to the left track power pickup.

### Motor Connections

Connect the ORANGE wire of the decoder's wire harness to the motor's (+) terminal and the GRAY wire of the decoder's wire harness to the motor's (-) terminal.



# Installation

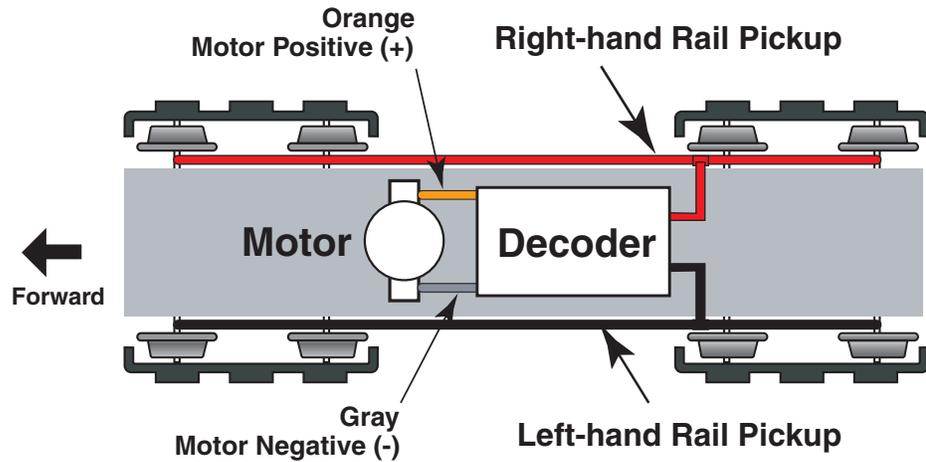


Figure 17 - Track and Motor Connections

## Speaker Connections

Connect the decoder's PURPLE speaker (+) wire (pin 12) to one of the speaker terminals. Connect the other PURPLE speaker (-) wire (pin 10) to the other speaker terminal. **Note:** *Tsunami does not need a capacitor to be wired in series with the speaker as required by some other SoundTraxx decoders.*

*Note:* the polarity of the speaker terminals is only important when using multiple speakers (see below). If you have installed multiple speakers, make sure they are phased properly, i.e., positive lead to positive lead and minus lead to minus lead of each speaker.

On smaller speakers, solder the wires to the outside edges of the solder pads as shown in Figure 18.

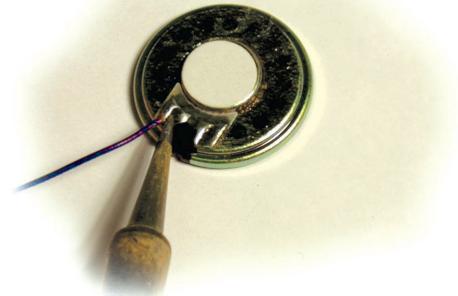


Figure 18 - Soldering to the Speaker Terminals

## Wiring Multiple Speakers

When wiring multiple speakers, it is very important to observe speaker polarity as noted above. If a speaker is wired backwards with respect to another speaker, each speaker will produce a sound wave that is 180 degree out of phase with the other. The two sound waves will effectively cancel each other out resulting in a diminished volume level! If the speaker does not have polarity markings on their terminals, wire like terminals to like terminals (i.e., left terminal to left terminal). If in doubt, try swapping the polarity of one speaker and see if the sound improves or worsens.

Tsunami is designed to drive an 8 ohm load. You must properly wire multiple speakers according to the directions that follow so as not to exceed this load.



# Installation

In Figure 19, two speakers are wired in series, with the positive speaker lead connected to the positive speaker terminal, the negative speaker lead to the negative terminal and the remaining speaker terminals connected to each other as shown. When wired in series, the ohms of the speakers are essentially doubled, making 16 ohms. Note that larger numbers equal a lesser load, therefore 16 ohms is a lesser load than 8 ohms.

Note: This illustration shows how to correctly wire two 8-ohm speakers in *series*, resulting in a total load of 16 ohms.

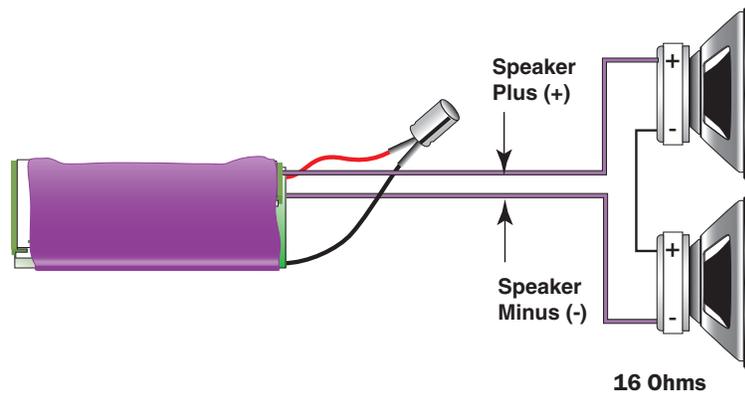


Figure 19 - Wiring Two 8-Ohm Speakers in Series

In Figure 20, four speakers are wired in a series/parallel configuration. Each pair of speakers wired in series equals 16 ohms, but since wiring in parallel will halve the ohms, the total is still 8 ohms.

Note: This illustration shows how to correctly wire four 8-ohm speakers in a series/parallel combination, resulting in a total load of 8 ohms.

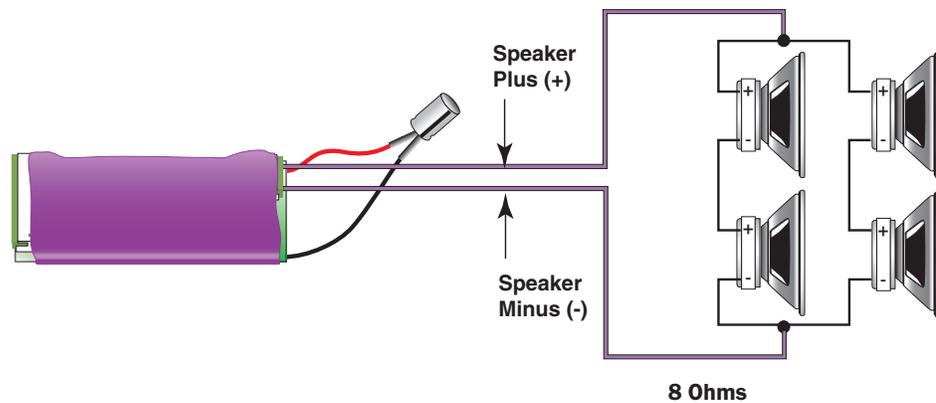


Figure 20 - Wiring Four 8-Ohm Speakers in Series/Parallel



# Installation

## Lighting Connections

12-16V lamps can be directly wired to the function outputs as shown in Figure 21.

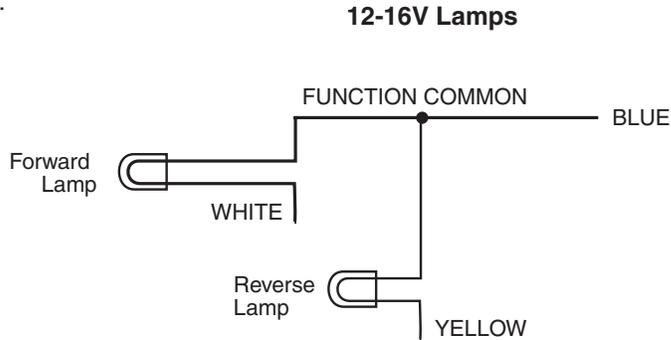


Figure 21 - Wiring the Decoder for 12 Volt Lamps

If you are driving 1.5V microbulbs with your Tsunami decoder, it will be necessary to wire a small current-limiting resistor in series with each of the lamps to prevent them from burning out (see Figure 22).

A separate resistor must be used for each bulb even if they are connected to the same output. A 560-ohm, 1/4W resistor is recommended for use with SoundTraxx P.N. 810022 or 810024 microbulbs, however, you may need to adjust the resistance value to get the desired brightness depending on the output voltage of the command station. Lower resistance will increase the brightness of the lamp.

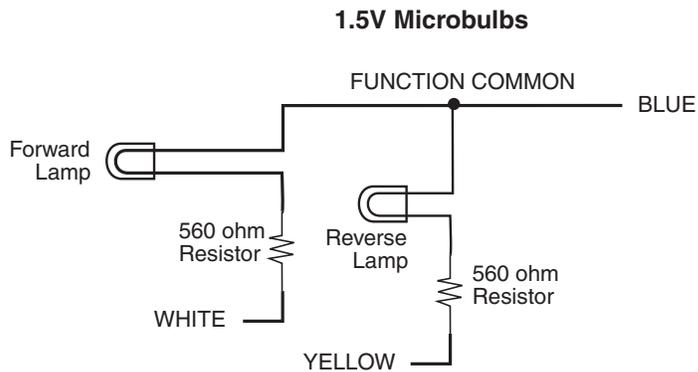


Figure 22 - Wiring the Decoder for 1.5 Volt Lamps

1. To wire the Headlight, connect one end of the bulb to the decoder's WHITE wire. Wire the other bulb lead to the decoder's BLUE wire.
2. To wire the Backup light, connect one end of the bulb to the decoder's YELLOW wire. Wire the other bulb lead to the decoder's BLUE wire.

If you use Functions 5 and 6 for lighting effects:

3. To wire the Function 5 output, connect one end of the bulb to the decoder's BROWN wire. Wire the other bulb lead to the decoder's BLUE wire.



# Installation

- To wire the Function 6 output, connect one end of the bulb to the decoder's GREEN wire. Wire the other bulb lead to the decoder's BLUE wire.

Any outputs not used can be left disconnected, but you should cut off and insulate the ends of the wires so they do not come in contact with locomotive or locomotive wiring.

## Using LEDs

Tsunami decoders may be used with LEDs, which also require a resistor to be wired in series, typically about 680-ohms, 1/4W. Unlike lightbulbs, LEDs are sensitive to polarity. The minus (-) cathode end of the LED (the *shorter* of the two leads) is connected to the function output and the plus (+) anode end is connected to the decoder's BLUE (function common) wire.

- To wire the Headlight, connect the cathode end of the LED to the one lead of the resistor. Wire the other resistor lead to the decoder's WHITE wire. Wire the anode LED lead to the decoder's BLUE wire.
- To wire the Backup light, connect the cathode end of the LED to one lead of the resistor. Wire the other resistor lead to the decoder's YELLOW wire. Wire the anode LED lead to the decoder's BLUE wire.

*If you use Functions 5 and 6 for lighting effects:*

- To wire the Function 5 output, connect the cathode end of the LED to one lead of the resistor. Wire the other resistor lead to the decoder's BROWN wire. Wire the anode LED lead to the decoder's BLUE wire.
- To wire the Function 6 output, connect the cathode end of the LED to one lead of the resistor. Wire the other resistor lead to the decoder's GREEN. Wire the anode LED lead to the decoder's BLUE wire.

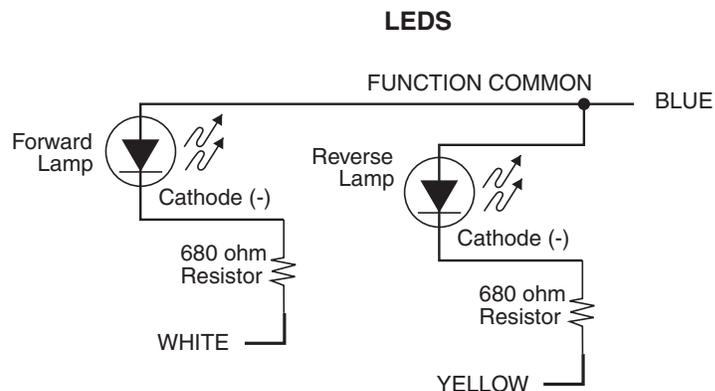


Figure 23 - Wiring the Decoder for LED Lamps

## Exhaust Cam Connections *(steam only)*

Connect the TAN wire from the 3-pin Speaker/Cam harness of the DSD to the exhaust cam wiper switch. The decoder is factory-programmed to operate using the Auto-Exhaust feature. If you wish to use an exhaust cam, you must enable the cam-synchronized exhaust by setting CV 112 to 128.



# Installation

## Installing Tsunami in a DCC-ready Locomotive

If your locomotive is wired with an NMRA-compatible 8-pin socket, you may solder a mating connector to the DSD's wire harness, which will allow you to easily install the decoder by simply plugging the connector into the socket, with the exception of the speaker and cam connections. SoundTraxx offers P.N. 810123, which is a package of four connectors that meet NMRA specifications. Wire the connector as follows:

Solder the wires from the sound decoder to the cup side of the connector as shown in the Figure 24. Speaker and cam wires are not soldered to this connector.

1. Wire the decoder according to the illustration. Before plugging in the decoder, we highly recommend you perform a simple test on the socket itself to ensure it is properly wired. Never assume this socket has been wired correctly at the locomotive factory!

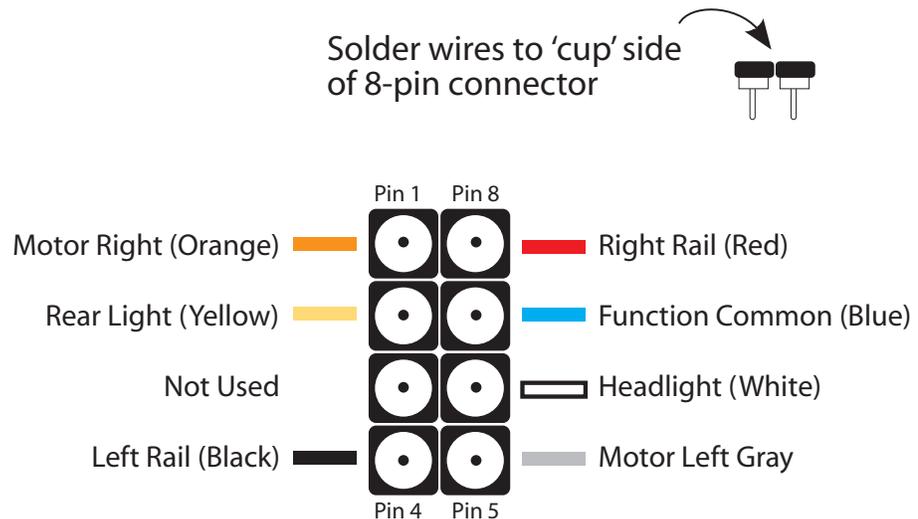
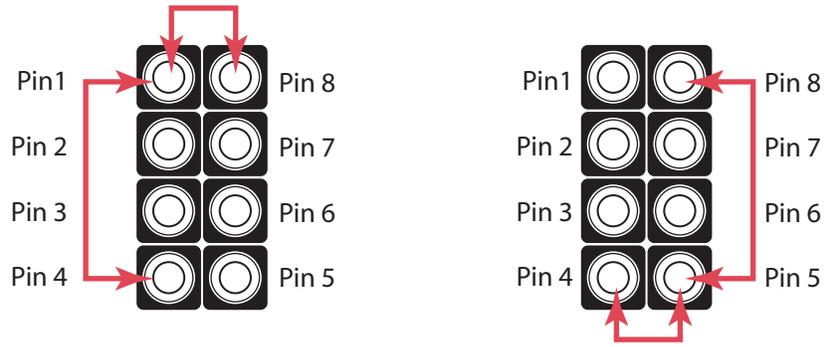


Figure 24 - NMRA 8-Pin Connector Wiring Code

2. Remove the 'dummy' plug from the NMRA socket.
3. Using an Ohmmeter, test the motor connections by touching one probe to Pin 1 and the other to Pin 8. You should see no response from the meter. Now touch one probe to Pin 1 and the other to Pin 4. Again, you should see no response. Repeat this procedure with Pin 5 and Pin 8, then Pin 5 and 4.
4. Now test the headlight connections by repeating the above procedure with Pins 8 and 2, Pins 8 and 6 and Pins 8 and 7.
5. Continue the test with Pins 4 and 2, Pins 4 and 6, and Pins 4 and 7. Remember, you should see no response from the Ohmmeter!
6. Now plug the newly wired connector into the socket with the orange wire at pin 1 on the manufacturers circuit board. Most manufacturers have labeled the sockets with pin 1 or pin 8 (at a minimum). Once you have plugged in the 8-pin connector, you will still need to wire the speaker and cam according to the instructions for a non DCC-ready decoder.

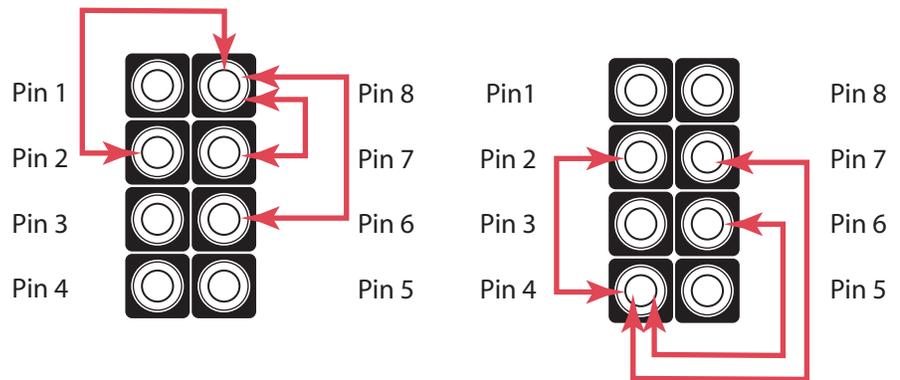


# Installation



Test the Motor Connections

Figure 25 - Testing the NMRA Socket - Motor Connections



Test the Headlight Connections

Figure 26 - Testing the NMRA Socket - Headlight Connections



# Installation

## Step 9. Test the Installation

Now you are ready for the test track! We recommend your test track be fused with a fast-blo fuse appropriately rated for your decoder (i.e. 1 amp decoder, 1 amp fuse). Place the locomotive on the track, and turn on power to the system. Set your controller for locomotive address 3. You should be able to run the engine in both directions as well as turn the lights on and off with the function keys. If this is a steam engine, you should also hear the steam airpump running in the background. Diesel models will idle softly.

If the locomotive does not travel in the appropriate direction, you have reversed the polarity of the motor brush connection. Turn the power off, switch the ORANGE and GRAY motor leads and try again. If everything seems OK at this point, it is time to program the decoder's Configuration Variables to get the desired sound and lighting effects. If the decoder does not respond as expected, first re-check your wiring. If no solution is found, proceed to the Troubleshooting section of the **User's Guide**.



# Support

## SoundTraxx 90-Day 'Safety Net' Warranty

Each SoundTraxx Digital Sound Decoder is tested thoroughly before it is shipped and warranted to be in good working order and free of manufacturing defects. However, in the event that a mistake does occur during installation, SoundTraxx will cover the repair under our 'Safety-Net' Service Warranty.

If during the first ninety (90) days you damage your Digital Sound Decoder or it fails to operate, SoundTraxx will repair or replace the system free of charge if:

1. The original sales receipt showing purchase from an authorized SoundTraxx dealer accompanies the decoder. Receipt must show purchase date to be within the last 90 days Your original receipt will be returned with your repaired unit.
2. There is no damage resulting from unauthorized repairs or modifications. This includes but is not limited to:
  - Removing the shrink tubing from the decoder
  - Drilling or enlarging circuit board holes
  - Cutting or trimming the circuit board
3. The Digital Sound Decoder is returned properly packaged, postage paid and insured - SoundTraxx is not responsible for product lost or damaged in transit.

### Exclusions

Onboard locomotive speakers are not covered by this warranty. This warranty does not cover damage resulting from accidents, fire, floods, or other acts of God.

### Limits of Liability

The foregoing shall constitute the sole and exclusive remedy of any owner of this product for breach of warranty including the implied warranties of merchantability and fitness. IN NO EVENT SHALL SOUNDTRAXX BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES OR FOR THE REPRESENTATIONS OF RETAIL SELLERS.

### Warranty Procedure

1. Return the Digital Sound Decoder with your dated sales receipt, properly packaged, postage paid and insured. SoundTraxx is not responsible for product lost or damaged in transit.
2. To help expedite your repair, complete a Service Request Form available from our website at [www.soundtraxx.com/support](http://www.soundtraxx.com/support) or by contacting our Customer Service Department. This allows our technicians to more quickly isolate the problem and perform the necessary repairs.
3. Please make sure you include a daytime phone number in case we should need to contact you regarding your repair. Your repaired decoder will be returned via UPS Ground (no P.O. Boxes please!). Decoders being shipped to foreign addresses will be shipped via U.S. Airmail.

**Important!** Return only the Digital Sound Decoder. Under no circumstances should you send your locomotive (or other model) to us, as we cannot assume any liability for their safe return.

### Non-Warranty Repairs

Digital Sound Decoders needing repairs after the ninety (90) day warranty period will be repaired at prevailing service rates. Rates are published on our website or can be obtained through our Customer Service Department.

### Out-of-Warranty Repair Procedure

To obtain service for Digital Sound Decoders which do not qualify as Warranty Repairs:

1. Return the decoder with your dated sales receipt, properly packaged, postage paid and insured. SoundTraxx is not responsible for product lost or damaged in transit.
2. To help expedite your repair, complete a Service Request Form available from our website at [www.soundtraxx.com/support](http://www.soundtraxx.com/support) or by contacting our Customer Service Department.
3. Please make sure you include a daytime phone number in case we should need to contact you regarding your repair.
4. Please include a check or money order in U.S. dollars drawn on a U.S. bank according to the posted rates, or provide a credit card number and expiration date (MC or VISA, please!). Posted rates include shipping via UPS (no P.O. Boxes please!). Decoders being



# Support

shipped to foreign addresses will be shipped via U.S. Airmail. If no payment is included with the repair, no work will begin until you have contacted the Customer Service Department.

5. While a rare occasion, in the instance a decoder is determined to be un-repairable, the system will be returned to you at no charge, with no repairs made. Optionally, the cost of a standard repair may be applied to the purchase of a replacement decoder. Purchase must be made directly through the factory.
6. A large percentage of Digital Sound Decoders that are returned are not defective or damaged at all, but have been incorrectly programmed or misused. Digital Sound Decoders returned that are found to be in good working condition will be returned less a \$10.00 charge plus the cost of return shipping. To avoid this, please follow our easy troubleshooting procedures which can be found in this manual and on our website before returning a sound system for repair.

For prompt factory service, contact:

SoundTraxx Service Department  
210 Rock Point Drive  
Durango, CO 81301  
Telephone (970) 259-0690  
Fax (970) 259-0691  
Email: [support@soundtraxx.com](mailto:support@soundtraxx.com)



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COMPATIBLE WITH  
THE NMRA DCC STANDARDS  
AND RECOMMENDED  
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