Tony's Tech Notes

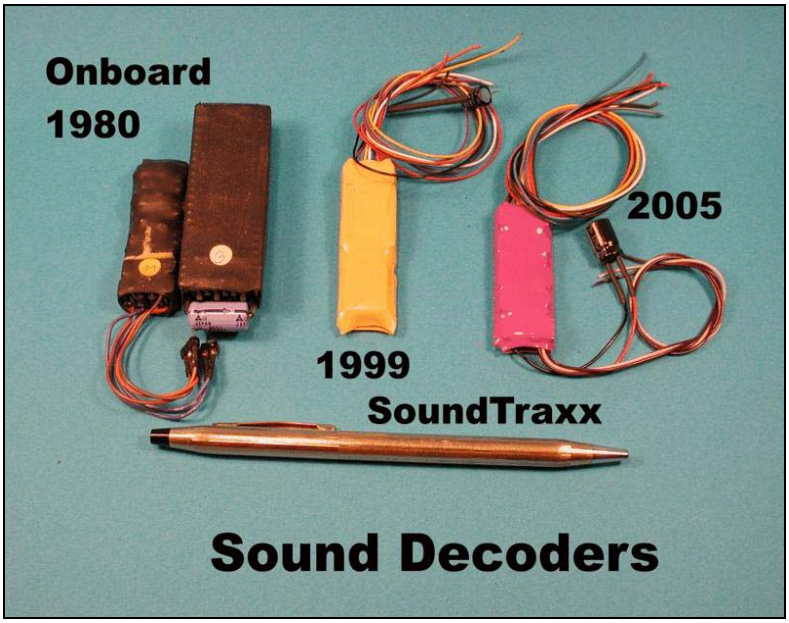
SoundTraxx Tsunami Hints II

By Don Fiehmann

This Tech Note addresses some of the problems that have surfaced when using the new Tsunami sound decoder with its wider range of sounds and frequencies. Small speakers are OK with high frequencies, but fall short with the lower frequencies.

SoundTraxx Whistle/Horn Selections

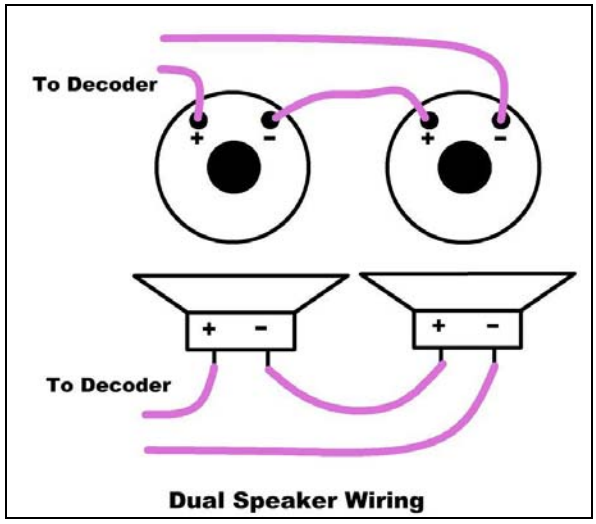
When the Onboard sound system came out modelers where thrilled with the ability to have control of the whistle onboard their locomotive. Onboard even had a dip switch that would allow some variation in the whistle sound. What more could one ask for! That was back in the 1980's. Advancements in technology have allowed more information to be stored in a smaller space. SoundTraxx came out with a decoder with a choice of steam whistle or diesel horn of your choice. This was followed by the CL series that allowed a choice of 3 whistles or horns. The latest is the Tsunami line of sound decoders. The Tsunami uses 16 bit sound samples that produce a superior sound quality compared to the older decoders with 8 bit sound. Each of the Tsunami steam decoder models has a choice of between 6 to 8 different whistles. The whistles range from the shrill high-pitched sound of the Peanut Whistle to the low moan of Union Pacific's #4018 whistle.



New Tsunami on the right is smaller than the earlier sound decoder in the center.

Speaker Selection

The Peanut Whistle is something that would be used a small locomotive, like a logging engine. The Union Pacific #4018 is a whistle that better match's a larger locomotive. (This whistle is only found in the Heavy Steam version of the Tsunami.) There is a large range in tones and frequencies between the two whistles! The high frequencies of the Peanut whistle works OK in the small 1 inch and even small speakers. With the low frequencies, like the steam boat type of whistles the sounds are not as compatible. The laws of physics are against us. In Hi-FI small speakers called tweeters are used for high frequencies and a large speaker known as woofers for the low frequencies. There are even sub-woofers used to generate earth shaking low frequencies. All of these larger low frequence speakers are designed to move large amounts of air needed to produce the low frequency's sounds and vibrations. There was a saying that "The bigger the box the better the bass."

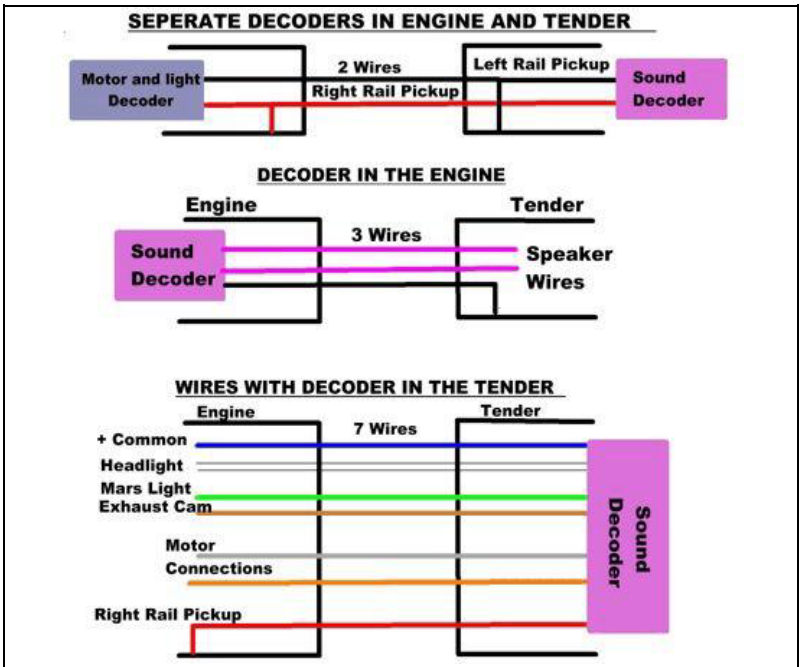


Dual Speaker Wiring

Another problem with low sound levels is something called the Fletcher-Munson curve. This basically shows that the ear is not linear. It is most sensitive in the middle range of hearing and fall off on both low and high frequencies as the volume level drops. This is just one more problem with trying to reproduce a low frequency sound. To over come this many hi-fi sets have a **Loudness** switch that reduces the middle range of hearing faster than the lows and highs as the volume is turned down. The Tsunami has a 7-band equalizer that can compensate for some of this. But we still have to content the small size speakers.

Speakers and Frequence Range
The range of speakers that we sell go from the smallest, a 13 mm (0.5 inches) round to the largest oval speaker at 28 X 40 mm. (1.1 x 1.57 inches). The frequence rating of the our 16 mm speaker is 20 kHz to 300 Hz. The large oval speaker rating is only 20 kHz to 110 Hz. Increasing the size of the speaker lower's the frequency response.

Speakers and Ohms
It is best to match the speakers to the output of the decoder. Speakers come in different sizes and in different "ohms"ratings. If you take an 8-ohm speaker and measure it with an ohm meter it will measure far less than the 8 ohm rates. This is due to the way the measurements are taken. Ohms are measured in **dc** as **resistance**. Ohms in **ac** are measured as **impedance**. Normally speakers are measure using a 1000 cycles per second tone. Sound is an ac like wave form. The sound output from decoders also has a rating in ohms. Most sound decoders are rated at 8 ohms. There are some recent variations. The new Digitrax sound decoders use 32 ohm speakers and LokSound 100 ohm speakers. The higher Ohm value means the speaker uses less current and more voltage for the same amount of power. A rule-of-thumb is you can drive a higher impedance from a source, but not go to a lower impedance. For maximum power transfer the output and speaker should be matched.



The number of wires between the engine and tender depends on where the decoder is installed.

Someone on the internet was having a problem with a Tsunami that was cutting out after it was operated for a short period of time. The problem turned out to be one of the edge wise speaker that was rated at 4 ohms and caused an overload in the Tsunami by driving the lower impedance speaker.

Another speaker specification is the power rating. The 8 ohm speakers we sell are rated from 0.1 watts to 1 watt. The output of the Tsunami has a rating of 1 watt of audio power. The amount of power out depends on the volume of the output. This means that you can overdrive a low power speaker and damage it! Putting a resistor in series with the speaker can limit the power to the speaker. Another way is to use more than one speaker and spread the power. Adding speakers also gives more surface area to move air. This helps with volume especially at lower frequencies. When you connect multiple speakers they should be wired so they are all in a phase. That is, the speakers should move in the same direction when audio power is applied, otherwise they can cancel each other.

Two eight ohm speakers in series will give the equivalent of 16 ohms. Since this is higher impedance than the Tsunami output, it will not overload the circuit. It is also possible to match the 8 ohm output of the decoder by using four 8 ohm speakers. Two speakers in series equal16 ohms. By putting two of the series connected speakers in parallel you reduce the impedance to 8 ohms. This is also a way to use 0.1 watt speakers and raise the wattage to 0.4 watts.

I programed the Tsunami on the bench before it was installed. Then the decoder was mounted in the locomotive boiler just above the motor. The weight in the boiler was put on a diet and reduced in size to make room. While the engine was apart, the old open frame motor was replaced with a can motor and the two headlights were replaced with white LEDs. The top LED was setup as a Mars light and the lower as a headlight and as dimmable. If you are installing an LED, you need to have the 7 bit (value 128) *on* in the Hyperlight Effects Select CVs (CV 49-52). This will make the LEDs act more like the response of a lamp.

Speaker Testing
I wanted to hear the difference between the different whistles. The Tsunami was going to be installed in a brass Daylight 4-8-4. The tender was large enough for an oval speaker. By removing one of the cross straps from the tender body and the weight from the middle of the tender floor there was room for two of the larger oval speakers. Holes were drilled in the bottom under the speakers. The speakers were wired in series and a three wire connector was used. (See drawing) More weights were added to the inside of the tender shell to compensate for removed weight. I tested the sound level from the two speakers and found they were some what weak without the tender shell installed.

Two oval speakers were installed in the floor of the Daylight tender. The Tsunami decoder was install in the engine.

Volume Settings
There are a couple of things that can be done to increase the audio output. CV-128 is the Master Volume Control and is set up by default at the value of 192 (75%). This can be increased to the maximum of 255. There is also the equalizer that works by lowering the overall volume so it can be controlled ±12db in seven frequency bands (62Hz, 125Hz, 250Hz, 500Hz, 1KHz, 2kHz and 4Khz). CV-153 Has 7 preset setting that setup the equalization these depending on what type of speaker is used. If you set CV-153 to a value of 7, you can set to 7 equalizer CVs (154 to 160) to a higher value. I set the Master Volume Control to 225 and the preset equalizer to 4 for over four inch speakers. I felt the two speakers should equal close to at least a 4 inch speaker

Next was a road test out on the mainline. One item of concern was the volume level. With the two speakers the sound level should be OK. I called my son into the train room to show him the difference between the volume with and without the tender shell in place. His comment was “Amazing!” There is a dramatic increase in volume when the shell is put on. My curiosity made me dig up my old Radio Shack db meter. I measured the whistle difference between without the tender shell and with the tender shell. Without the shell the whistle was +66 db, a very low level, with the shell the volume went to +82 db. A rise of +16 db.


A sound level meter was used to show the difference in sound level with the tender shell on and off. The shell dramatically increased the sound level.

The chuff rate was very close to the correct rate without adjustment. One problem was fireman Fred kept shoveling coal into this oil fired locomotive. There are 15 CVs used to control background sounds and coal shoveling was one of them. I simply set this volume to zero and no more coal shoveling.

CVs 128 and Higher
I got a call with someone having a problem setting the Dynamic Digital Exhaust (DDE) sound. All of the CVs for setting DDE, and many other new CVs, are above CV-128 and his DCC system could not access CVs higher than 128. The Tsunami has a cure for this problem. It uses CV-119 is used like a shift key. There are 10 setting in CV-119. An example is a setting of 3 in CV-119 shifts the Seven Band Equalizer from CV-153 to 160 to the lower CV 120 to 127. Then you use the CV numbers of 120 to 127to set these upper numbered CVs.

Manuals available
If you go to the SoundTraxx website at www.soundtraxx.com , you will find a number of guides, manuals and technical reference documents on the Tsunami. I downloaded them and put them into a three-ring binder. The documents are (1) Installation Guide (2) Quick Start Guide (3) Steam User’s Guide and (4) Technical Reference.

The Steam Sound User's Guide has a lot of useful information about setting up the Tsunami. This is a guide that will walk you thru setting up the advance features. Many of these have step- by- step instructions on how to optimize CV values for the best results. There is a good explanation on how the CVs for the Hyperdrive works. There is also information on setting up all the special lighting effects. The reverb mixer is covered. Even a setup for the SP 4449 to let you have both the steam whistle and the air horn. Function key F3 is used to switch whistle types.

More Tips and Hints on Sound

One very active modeler in sound installations is Ogden Lamont. He has a great website with a lot of good sound information available over the internet. It is loaded with the latest sound information, including the Tsunami. The document is at:
http://home.pcmagic.net/ogdenj/addsound/addsnd.htm

Conclusion

The Tsunami is the best sounding decoder that I have tested. It has a complex set of sounds available. Most of these are set to default values and need little or no adjustment. I have been fascinated with the amount of modelers that have gotten interested is DCC sound now that the Tsunami is available. I'm sure that the Tsunami's great sound will convince others to improve the quality of their sound decoders.

DonF

Tsunami Digital Sound Decoders

The **Light Steam** version (P.N. 826101) contains eight whistles appropriate for a variety of light steam engines. These are suitable for all switchers and engines with the following wheel arrangements: 4-4-0, 4-4-2, 2-6-0, 4-6-0, 2-8-0 and others. Whistles included are:
Colorado & Southern #74, (Road Mix)
Colorado & Southern #74, (Yard Mix)
Baldwin Class B-4G, Consolidation 2-8-0
Heisler
Westside Lumber Co. Shay #14
Peanut Whistle
D&RGW Single Chime
Reading 6-Chime

The **Medium Steam** version (P.N. 826102) contains eight whistles appropriate for a variety of medium steam arrangements: 4-6-2, 2-8-2, 4-6-4, 2-10-0, and others. Whistles included are:
Santa Fe Freight
Baltimore & Ohio 3-Chime
Colorado &Southern #801
Pennsylvania Railroad Banshee
Lehigh Valley
Nathan 5-Chime (Road Mix)
Nathan 5-Chime (Yard Mix)
USRA 6-Chime

The **Heavy Steam** version (P.N. 826103) is recommended for installation in articulated and heavy steam engines including engines with the following wheel arrangements: 4-8-4, 2-10-2, 2-12-2, 2-8-8-2, 4-6-6-4 and others. Whistles included are:
Frisco #1522
Norfolk & Western #1218
Union Pacific #4018
Southern Pacific #4449 (Whistle)
Southern Pacific #4449 (Airhorn)
USRA 6-Chime

The **Denver & Rio Grande K-Class** version (P.N. 826104) includes a collection of whistles and sounds commonly heard on Denver & Rio Grande Western K-Class Mikados. This decoder is also suitable for use with other light and medium locomotives. Whistles included are:
K-27 #463
K-36 #487
K-36 #488
K-36 #489
K-36 #489 (with broken chime)
K-37 #497

The **Denver & Rio Grande C-Class** version (P.N. 826116) contains whistles and sounds commonly heard on Denver &Rio Grande Western C-Class Consolidations. This decoder is also suitable for use in other light engines. Whistles included are:
C-19 #340 (Yard Mix)
C-19 #340 (Road Mix)
D&RGW Single Chime
Westside Lumber Co. Shay #14
Peanut

The **Light Logging** version (P.N. 826120) contains whistles suitable for installation in geared and light logging locomotives such as the shay, climax, heisler and other small engines. Whistles included are:
Westside Lumber Co. Shay #14
Westside Lumber Co. Shay #12
Heisler
Peanut Whistle
D&RGW Single Chime

Rumor has it that more models are coming. One maybe a cabforward with their wheezing air pump!