



Complete Train Control
Run Your Trains, Not Your Track!

SDH164D SoundFX™

**Wired Mobile Decoder for HO
Locomotives**

**Preloaded with selectable Steam
and Diesel Sound Schemes**

HO Scale

**SDH164D: Wired Decoder with
SoundFX™**

**6 Function FX³ 200ma outputs
Includes 28mm 32 Ohm
Speaker & 330uF Capacitor**

Features:

- **Digitrax SoundFX™ Sound System**-Your locomotives will sound in scale like the real thing with SoundFX
- **Customizable 8 Bit Sound**
- **3 simultaneous voices**
- **Downloadable Sound** with Digitrax PR2/3 and SoundLoader software
- **4 Megabit Onboard Sound Memory**
- **1 Watt Sound Output**
- **Cam input**-synchronized steam-chuff option for steam locos
- **SoundFX™** does not require an external rate sensor to vary workload.
- **Digitrax Easy Connect 9 Pin Plug** for flexible install options.
- **Factory 28mm speaker on 10 Pin Plug** design makes installation quick and easy.
- **Smart Power Management**-no more booster or programmer shutdowns! No extra equipment needed to program or run
- **Digitrax LocoMotion® System**-Your locomotives look like the real thing. The Digitrax LocoMotion® System makes them run like the real thing, too!
- **SuperSonic** motor drive for silent operation.
- **Digitrax FX³ Functions**-Control lights and functions for prototypical lighting effects and on/off control:
- **Transponder ID Equipped** ready for transponding on your Layout
- **Program using any Digitrax Compatible Control system** without having to buy any extra equipment
- **Direct mode programming**
- **Operations Mode Programming**
- **Decoder Reset CV** with or without speed table reset.
- **Motor Isolation Protection** helps prevent damage to your decoder.
- **Basic, Advanced & UniVersal Consisting**
- **2 Digit and 4 Digit Addressing**
- **DCC Compatible**
- **Digitrax “no worries” warranty**
- **FCC Part 15, Class B RFI compliant**

Parts List

- 1 SDH164D Function Decoder with Sound FX™
- 1 Instruction sheet
- 1 10 pin Sound harness with 28mm 32 Ohm speaker and 330 uF capacitor
- 1 9 pin Track, Motor and Function Harness

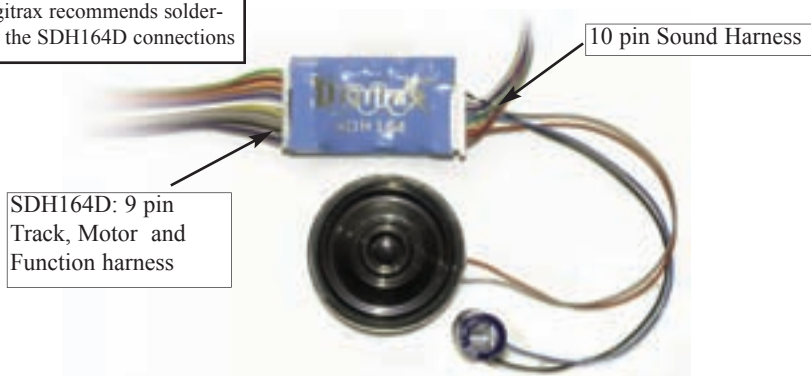
Installation Information

See the Digitrax Decoder Manual for complete decoder test procedures, installation instructions, programming and technical information. Digitrax manuals and instructions are updated periodically. Please visit www.digitrax.com for the latest versions, technical updates and additional locomotive-specific installation instructions.

Installation Instructions

Figure 1: SDH164D Decoder connections.

For most reliable operation
Digitrax recommends soldering
the SDH164D connections



SDH164D showing 10 pin sound harness with 32ohm 28mm Speaker, 330uF Capacitor

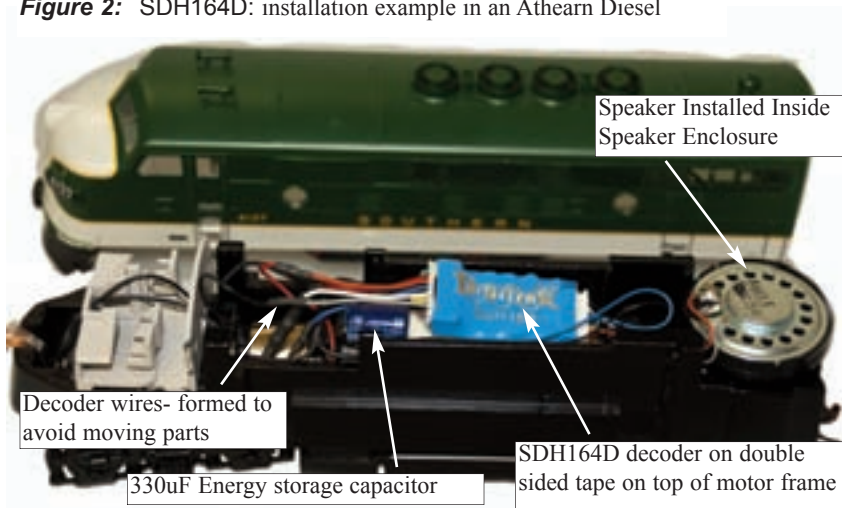
1. On the 9 pin Track and Function harness connect the Red and Black track wires to the locomotive track power connections. Now connect the Orange and Gray motor leads to the motor connections that have been isolated from the track connections. Note that to be able to read Sound FX CV's a motor should be connected to the Orange and Gray leads or a combination of function lead loads of at least 60mA at 12volts should be connected to the function leads.
2. On the 9 pin Track and Function harness connect the function leads that are to be used for e.g. lights. Insulate any unused function leads so they cannot short to the locomotive frame or track power. Pulling the wire jacket back a little over the lead ends will do this.
3. Mount the factory 28mm speaker attached to the 10 pin sound feature harness in a suitable sound enclosure (refer Figure 2, and next section). Be

sure to inspect the speaker diaphragm for magnetic debris or damage, which will affect sound quality. Other speaker(s) may be substituted in combinations as long as the total impedance on the Orange/Gray wires of the 10 pin sound connector is greater than 8ohms.

Depending on the locomotive model and construction it may be necessary to modify the frame or parts of the internal shell to make room for one or more speakers and enclosure.

4. Mount the 330uF/25V electrolytic energy storage capacitor from the 10 pin sound harness. Be sure not to short the capacitor case or leads to the track leads or locomotive frame or damage to the decoder may result. In figure 2 the storage capacitor is shown stuck down on some double sided foam tape above the motor, alongside the SDH164D decoder. Note that the wires are formed so as not interfere with the motor, flywheel and gear operation.
5. For Steam units using external synchronization cam capability, connect the White CAM wire of the 10 pin Sound harness to the output connection of

Figure 2: SDH164D: installation example in an Athearn Diesel



your cam, and configure CV133 to a value of 128 to change the steam chuff to external cam synchronized.

6. Inspect the installation before testing the sounds and replacing the shell. In particular be sure that wires are correctly connected and routed and that the motor and capacitor leads are not shorting to the frame or track.
7. Connect to active DCC track power from a compatible DCC system and select the factory default address 03 to enable sounds for testing
8. Be sure F8 (mute) is OFF to allow sound output, and then press F1(bell) or F2 (whistle/horn) ON to hear these associated sounds.



9. Customize sounds by programming Sound CV's to adjust the desired configurations, as shown in the following tables of Sound FX CVs. Sound schemes other than the factory preloaded default Steam (CV60=0) or Diesel (CV60=1) schemes may be loaded by using a Digitrax PR2 or PR3 Sound FX Programmer.

Speaker Mounting and baffle or enclosures.

The sound performance of any attached speaker(s) is greatly affected by the mounting system and required baffle or rear enclosure.

The baffle is used to isolate the speaker diaphragm front sound waves from the “out of phase” rear sound waves. This minimizes sound cancellation, particularly at lower frequencies. For most efficient sound generation, the cubic volume of the baffle should be as large as practically possible, and the baffle walls should be acoustically rigid so not to allow acoustic interference.

Practical baffle materials are plastic, cardboard and even sheet metal. Common items such as cardboard tubes or 35mm film canisters may be modified and trimmed to create reasonable baffles in the available space.

Commercial baffles are also available in many sizes to match many types of speakers, such as; an “AHD enclosure for 1.10” speaker from Ulrich Models [1-877-600-8657] or a “TDS Enclosure 1.10” diameter” from Tony's Train Exchange [1-800-978-3472] unit that will match the 28mm factory speaker of the SDH164D

Most HO or O scale or similar locomotives have limited internal volume within the shell, so the choice of speaker mounting benefits from some ingenuity to get best sound performance and volume. An example of a commercial molded baffle in a ready-to-run locomotive is the Kato HO F40-PH, where the 28mm speaker clips into an enclosure at the upper rear of the locomotive shell.

Of course, you can substitute an alternate after market speaker of the maximum size for the locomotive you have. For example you can use the SDH164D in a modern O-scale locomotive with a high-efficiency can style motor as long as the stall current is less than 1 amp at the track voltage in use. In this case it is possible to use a larger speaker that has a “high bass” or similar enhancement.

Customizing Your Decoder

Your Digitrax SDH164D Sound FX decoder is ready to run and will operate and generate sound using address 03 with no additional programming. On your Digitrax system, simply select the locomotive's address and the sound will start. On some DCC systems, it is necessary to select the locomotive address AND send a command to start the sounds.

For a more prototypical railroading experience, your decoder can be customized for your specific locomotive by programming some of the Configuration Variables, or CVs, available. Digitrax Sound decoders can be programmed using either the direct method on a programming track or with the operations mode using the main line. See the Digitrax Decoder Manual or the Digitrax web site for more information.

Initial Test and Programming: This decoder is preprogrammed and tested with a Steam locomotive sound scheme, and is ready to operate on factory default address 03. Before customizing the decoder it is useful to run it on the factory default address 03 to check the installation. The following sections show how to change the locomotive address and customize the decoder

For more information on general decoder installation and programming techniques and examples visit the www.digitrax.com

Changing the Decoder Address

The first CV most people change is the decoder address. This allows you to independently control each loco with a unique address. Digitrax decoders are shipped with CV01 (AD2), the two digit address, set to 03. Following is a brief description of how to change the decoder address with a Digitrax DT series throttle. See your Starter Set Manual for complete programming instructions.

1. Place the loco on the programming track. Go into Program Mode on your system. On DT400/DT402 press **PROG**. On DT300, DT100 & DT200 press **RUN/STOP & FN/F0**.
2. Choose AD2 for 2 digit addressing or AD4 for 4 digit addressing (DT400/DT402 and DT300). (Ad for DT100 & DT200, see set manual for 4 digit instructions).
3. Choose the address you want to set up for the decoder.
4. Complete address programming. On DT400/DT402 press **ENTER**. On DT300, DT100 & DT200 press **SEL**.

Note: CV29 must also be programmed to enable 4 digit addressing, this is done automatically by the DT400/DT402 & DT300 but not on earlier throttles.



Using this decoder in other locomotives

The factory supplied sound project loaded into the SDH164D is for a Steam (default) or SD38-2 diesel locomotive, selectable with the value in CV60. If you want to install it in a different locomotive, you can simply load a different sound project for that type of locomotive. The cam input is available for steam installations where you want to synchronize chuffing.

Digitrax LocoMotion® System

Your locomotives look like the real thing, now you can make them run like the real thing, too. Digitrax decoders incorporate torque compensation for smooth as silk operation. You can also program CVs that control momentum, 3 step and 128 step speed tables, switching speed, normal direction of travel, scaleable speed stabilization and more to take full advantage of the Digitrax LocoMotion System.

Momentum-CV03 & CV04

Momentum is part of the LocoMotion System. Acceleration is controlled by CV03 and deceleration by CV04. Both come from the factory set to 000. A range of 000 to 031 is available for both accel and decel. Try CV03:003 and CV04:000 as a starting point for experimenting with momentum.

Speed Tables-How the Loco Responds to the Throttle

With Digitrax LocoMotion, there are two types of speed tables: 3 Step Tables and High Resolution 28 Step Tables. Please see your Decoder Manual for a discussion of the 28 Step Tables. The 3 Step Tables are set up by programming 3 CVs: Start Voltage (CV02), Mid point Voltage (CV06) and Max Voltage (CV05). These values are set at 000 at the factory. All have a range of values from 000 to 255. We recommend the following CV values as a starting point for experimenting with speed tables.

Loco Type	V Start CV02	V Mid CV06	V Max CV05
Switcher Concentrated low speed. Limited top speed	002	038	064
Road Switcher Prototypical top speed w/evenly distributed curve from 0 to top speed	002	048	098
Mainline Loco Quick increase to cruising speed then levels off to prototypical top speed.	002	128	154

Other LocoMotion® Features: Switching Speed, Normal Direction of Travel & Scaleable Speed Stabilization (Back EMF) Features

Switching speed is controlled by CV54. The factory setting is 000 for OFF. To turn on the switching speed feature, program CV54 to a value of 001. When this feature is on, use F6 to activate and deactivate switching speed. With the feature on the throttle's target speed is effectively reduced by about 50% and the effects of accel and decel programmed into the decoder are reduced by 1/4. This is useful for yard switching operations.

Normal Direction of Travel is controlled by CV29. See your decoder manual for additional information on the settings for CV29.

Decoder Reset CV08

Decoder reset lets you reset all CV values to the initial factory settings. To reset all CV values, program CV08 to a value of 008. You also have the option of resetting all values except the 28 speed step tables. To do this, program CV08 to a value of 009.

Digitrax SoundFX™ System

Digitrax SoundFX™ lets you make your locos sound in scale like the real thing!

The SoundFX sound CVs in the range of CV140 to CV256 let you customize your decoder without having to reprogram or change the installed sound scheme.

Standard decoder CVs in the range of CV01 to CV120 operate the same as for a non-sound FX³ Digitrax decoders (they control motor and light functions etc.) CV58 is used as Master Volume, and CV60 is used to select an alternate scheme, if provided in the sound project.

Sound CV155 is provided to select Diesel engine “notching” modes. The default of CV155= 00 provides “automatic notching” that changes the diesel RPM settings at 8 distinct throttle speeds that are controlled by Sound CV132.

Sound CV155=01 selects “semi-automatic notching” mode that allows F6 ON to increase the notch from the current throttle setting and F7 ON to decrease back towards the lowest current throttle notch setting.

Sound CV155=02 selects “manual notching” mode that allows F6 ON to increase the notch setting and F7 ON to decrease the notch setting irrespective of the throttle setting, which controls just the motor speed.

The decoder's sound scheme can be reloaded using a Digitrax PR2 or PR3 programmers and a sound project file (for example AC4400.spj) from the Digitrax Sound Depot web site. Typical sound downloads take between 50 and 100 seconds depending on the project complexity and file size.

The following tables show the CVs used in this decoder version and how it is set up at the factory to operate various sounds using your throttle.



Complete Train Control

Run Your Trains, Not Your Track!

CV#	Used For	Range [default val]
01	2 Digit Address	[03]
11	Sound Time Out, 06 = Sound ends when loco address is de-selected, 00=Sound stays on after loco is de-selected	[06]
29	Configuration Registration	[06]
49	Forward Light (FOF) -Headlight	[0]
50	Reverse Light (FOR) -Reverse Light	[0]
51	Function 1	[0]
52	Function 2	[0]
58	Master Volume (F8 used for Mute)	0-15 [9]
132	Notch Rate	[127]
133	Steam Chuff/CAM config, 128=>EXT cam, 1-127=>DRIVER dia in inches	[63]
134	Steam Gear Ration Trim, 32 = 100% Ratio	[32]
135	Mute Volume	[0]
140	Prime Mover / Chuff Volume	0-64 [60]
141	Bell Volume (Min=0, Max=64)	[25]
142	Horn/Whistle Volume (Min=0, Max=64)	[60]
143	Time-Scattered Air Effects Volume	0-64 [30]
145	Misc Vols	0-64 [40]
146	Bell Ring Rate (1=24 milliseconds)	1-100 [07]
147	Air Drier Rate (1-about 2 seconds)	1-64 [02]
148	Compressor Run Rate	[30]
149	Air Compress On Time	[20]
150	Horn/Whistle Setup (Default=0, Playable Horn=1, Alternate Horn=2)	[0]
151	Auto Coupler Sequence Threshold Value-Peak speed to allow auto coupler/brake when direction change occurs and F3 is ON	0-64 [48]
152	Project Author ID, Digitrx=221	[221]
153	Project ID, Steam/SD38_2	[02]
154	Steam Blowdown / Safety Volume	0-64 [60]
155	Notching/Slip Mode: 00=Automatic, 01=Semi-Automatic, 02=Manual	[00]



Func	Used For	Notes
F0	Lights	
F1	Bell	
F2	Horn/Whistle	CV150 sets mode
F3	Coupler crash	Auto coupler/brake set by CV151 max speed
F4	Air feature disable	F4 off enables pop-off, drier and starts compressor/airpump
F5	Diesel = Dynamic brake Fans Steam = Water Pump turbine	
F6	Diesel = Notch Up Steam = Blowdown	Notch UP if CV155=01 or 02
F7	Crossing Gate Airhorn or; Diesel = Notch DOWN Steam = Wheelslip	Notch DOWN, if CV155 = 01 or 02 (Crossing Gate active if in Diesel mode and CV155=0)
F8	Mute Control	F8 ON is mute
F9	Brake squeal	
F10	Crossing Gate Airhorn Sequence	
F11	Steam = Greaser	
F12	Steam = Safety Blowoff	

Sound FX DC Operation Mode

Digitrax SoundFX decoders will operate on smooth DC power. The sound will not start until approximately 5 volts is applied to the track and there will be no “start up sound.”



SDH164D Troubleshooting

If the sound does not start in the decoder

1. Make sure you have selected the locomotive address on a throttle. The sound will not run unless the locomotive is addressed in the system.
2. Check your installation to make sure the decoder is installed properly.

If the sound output sounds distorted

1. Check the speaker cone for magnetic debris that may have collected there. Debris on the speaker will cause a loss of sound quality and must be removed.
2. Be sure that the CV58 volume is not set at a level that is too high for the speaker being used. For impedances below 32ohms (e.g. 8 to 30 ohms) set this volume setting lower to ensure the 1 watt output rating is not exceeded.

If the sound in your decoder shuts down after you stop it and you are not using a Digitrax system for control. On some DCC systems decoders are not addressed by DCC packets after the locomotive is set to 0 speed. In this case after the CV11 timeout elapses (6 second default), sound will “shutdown.” To defeat this feature, set CV11=00 to remove the timeout and shutdown. *To make sounds, the decoder must have a command addressed to it at least once.*

If you have trouble reading back CV's on the programming track, this may be due to insufficient current draw on the SDH164D function leads. Of course you can always just re-program the CV value into a CV to get the desired results, even though reading CV's does not work.

OPS mode is recommended for writing to (programming) all CVs except CV01, CV17 & CV18 (2 digit and 4 digit addresses). If a second DCC decoder is present that is not Sound FX compatible then correct read back of CV data is not possible, since the NMRA CV read back was not designed for multiple decoder read back.

The SDH164D plays a Diesel scheme, but I want the default steam scheme. If the factory scheme has not been erased, program CV60 to a value of 0 to re-select the Steam scheme. Alternatively set CV60 to 01 to change to the SD38-2 sound scheme.

I have loaded a new scheme but the CV's and Functions are not what I expected. Load the sound project you programmed and then select the “view>project description” menu and then read the text file on the screen that defines how that project in particular uses CV's and Functions for sound generation and configuration.

My speaker does not have a polarity mark as shown in Figure3. Speaker Polarity is simply used to ensure when more than one speaker is being used that they can be wired or “phased” so the input causes the diaphragm to move in the same direction. It can be ignored in a single speaker case.

Warranty & Repair

Digitrax gives a one year “No Worries” Warranty against manufacturing defects and accidental customer damage on all Digitrax products.

That's it! A simple, straightforward warranty with no tricky language!

Visit www.digitrax.com for complete warranty details and instructions for returning items for repair.

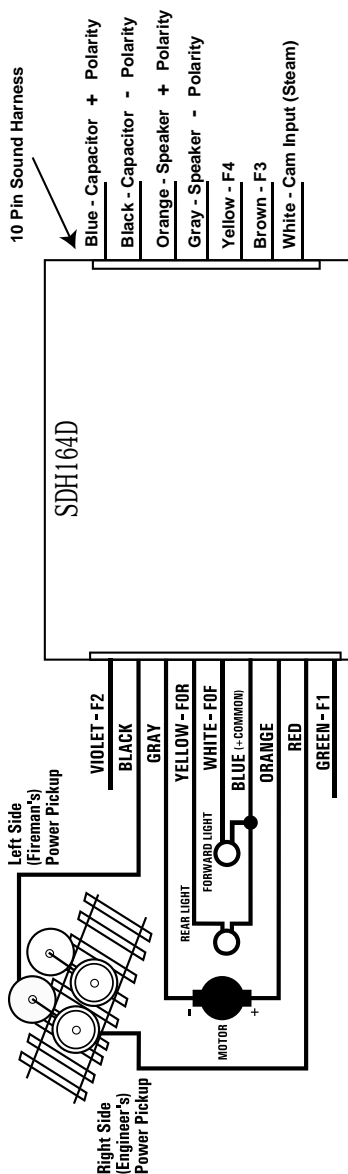


Figure 3: SDH164D: connection diagram



SDH164 Sound and Function Decoder

Wired Sound+Function Decoder
for HO and Large scale locomotives

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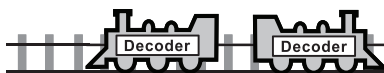
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SoundFX™ Decoders



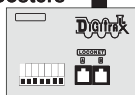
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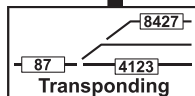
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