



**Complete Train Control**  
**Run Your Trains, Not Your Track!**

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## HO Scale

**SDH104K1B: Plug N' Play Mobile Decoder with SoundFX™**  
**Includes 28mm 32 Ohm Speaker & 330uF Capacitor**  
**1.0 Amp/1.3 Amps Peak**  
**FN04K1: 4 Function FX³ 200ma Decoder**

# SDH104K1B+FN04K1 COMBO

**Plug 'N Play for Kato SD38-2 HO Locomotives**  
**Preloaded with SD38-2 Sound Scheme**

## Features:

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- **Digitrax SoundFX™ Sound System**-Your locomotives will sound like the real thing with SoundFX
  - Customizable 8 Bit Sound**
  - 3 simultaneous voices**
  - Downloadable Sound** with Digitrax PR2 and SoundLoader software
  - 4 Megabit Sound Memory**
  - Playable F2/Whistle** with DT400 Throttle
  - 1 Watt Sound Output**
  - Cam input**-synchronized steam chuff (yes, you can install in a steam loco)
- **Smart Power Management**-no more booster or programmer shutdowns! No extra equipment needed to program or run
- **Digitrax LocoMotion®**-Proven Complete Train Control technology
  - Fine Speed control with 128 Speed Steps, Acceleration and Deceleration, User Settable Normal Direction of Travel, Switching Speed Feature, 3 Step Speed Tables, 28 Step Speed Tables, Torque Compensation and more
- **Digitrax FX³ Functions**-Control lights and functions
- **Scalable Speed Stabilization (Back EMF)**
- **SuperSonic** motor drive for silent operation
- **Plug 'N Play** design makes installation quick and easy
- **Transponder 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 (Ops Mode Read Back** is available on transponder equipped layouts, too)
- **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**

## Parts List

- |  |                     |
|--|---------------------|
| 1 SDH104K1B Mobile with Sound FX™                                    | 1 Instruction sheet |
| 1 Speaker harness with 28mm 32 Ohm speaker and 330 uF capacitor/clip |                     |
| 1 FN04K1 Function Decoder  |                     |

## 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](http://www.digitrax.com) for the latest versions, technical updates and additional locomotive-specific installation instructions.

**Figure 1:** SDH140K1B & FN04K1 Decoders

SDH104K1B: Motor and Sound Decoder



FN04K1:  
Function Decoder

SDH104K1B with FN04K1 Attached

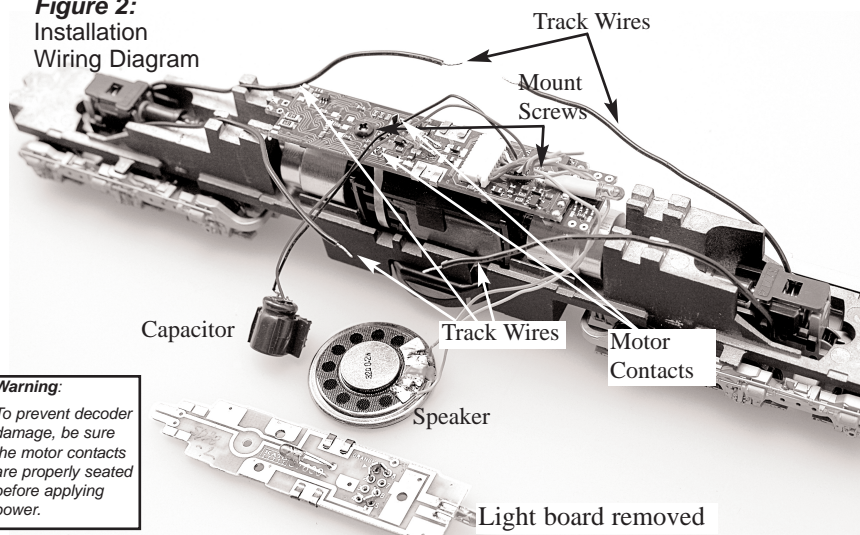


For more reliable operation  
Digitrax recommends sol-  
dering the connections  
between the two decoders.

## Installation Instructions

- 1) Carefully remove the SD38-2 couplers, shell, and side-decks as indicated on manufacturer's model assembly diagram.

**Figure 2:**  
Installation  
Wiring Diagram

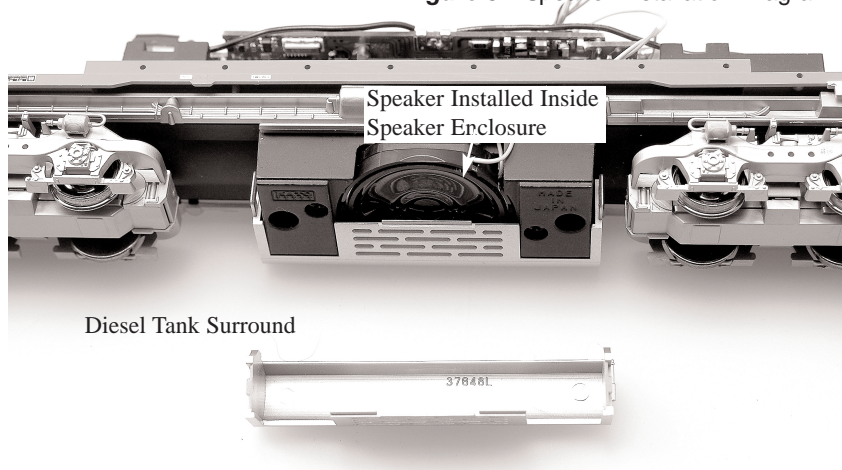


**Warning:**

To prevent decoder damage, be sure the motor contacts are properly seated before applying power.

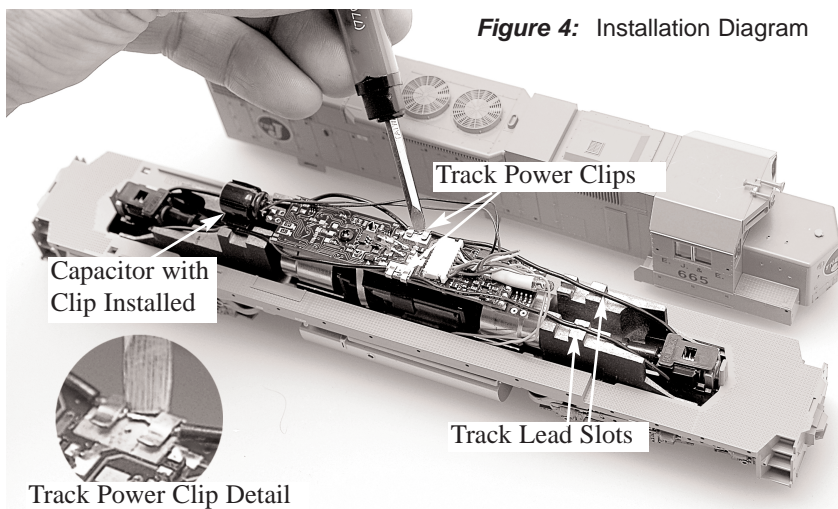
- 2) Disconnect 4 track wires from the track power clips on the light board. Unscrew and remove light board. Retain the two screws.
- 3) If the FN04K1 is not already attached to the SDH104K1B, plug it in and solder the pins to secure the two decoders together and clip the two center pins to prevent shorting to the LED leads. We recommend soldering the pins in place to ensure a secure electrical connection.
- 4) Place SDH104K1B decoder in position and use small pliers to press in 2 motor contacts. Using 2 light board screws removed earlier, secure the decoder in position.
- 5) Install the speaker by removing the 2 piece diesel tank surround. From the engineer/right hand side of the locomotive place the 28mm speaker attached to the wire harness in the speaker enclosure with the cone facing outward.

**Figure 3:** Speaker Installation Diagram



Remove any magnetic debris from the speaker. Replace diesel tank surround.

- 6) Replace side-decks and couplers.
- 7) Re-connect the 4 track wires by inserting them under the track power clips on the SDH104K1B. Be sure that the wires are retained and do not touch anything but the clips and pads. Run the track wires in the track lead slots in the casting so they do not interfere with the shell.
- 8) Install the capacitor attached to the wire harness at the rear of the casting using the plastic clip provided. Be sure no wires short to the casting. Trim back and secure any unused wires so they do not short to the decoder or frame or bind the drive shafts.
- 9) Inspect and test the installation before replacing the shell.



## Customizing Your Decoder

Your Digitrax decoder is ready to run and will operate 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 sound.

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 SD 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 an SD38-2 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 decoder installation and programming techniques and examples visit the [www.digitrax.com](http://www.digitrax.com)

## Changing the Decoder Address

The first CV most people change is the decoders address. This lets you independently control each loco with its own unique address. Digitrax decoders are





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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 or on the main line.
2. Enter the programming mode using your DCC system/throttle. On DT400 press **PROG** until you see “Pd” if using a programming track or “Po” if using the main line.
3. Use your throttle to choose the address you want to set up for the decoder. On the DT400 use the left knob to dial AD2 for two digit programming, use the right knob to dial up the address, click the right knob to change to AD4 for programming 4 digit addresses.
4. Complete address programming. On DT400 press **ENTER**. **Note:** CV29 must also be programmed to enable 4 digit addressing, this is done automatically by the DT300 & DT400 but not on earlier throttles.

## Using this decoder in other locomotives

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The sound project loaded into this decoder is for an SD38-2 diesel locomotive.

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

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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

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Momentum is part of the LocoMotion System. Acceleration is controlled by CV03 and deceleration by CV04. Both come from the factory set to 000/x00. A range of 000/x00 to 031/x1F is available for both accel and decel. We recommend that you try CV03:003/x03 and CV04:000/x00 as a starting point for experimenting with momentum.

## Speed Tables-How the Loco Responds to the Throttle

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With Digitrax LocoMotion, there are two types of speed tables: 3 Step Tables and High Resolution 28 Step Tables. Please see your Digitrax 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/x00 at the factory. All have a range of val-



ues from 000/x00 to 255/xFF. 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
<b>Switcher</b> Concentrated low speed. Limited top speed	002/x02	038/x26	064/x50
<b>Road Switcher</b> Prototypical top speed w/evenly distributed curve from 0 to top speed	002/x02	048/x30	098/x62
<b>Mainline Loco</b> Quick increase to cruising speed then levels off to prototypical top speed.	002/x02	128/x80	154/x9A

## **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/x00 for OFF. To turn on the switching speed feature, program CV54 to a value of 001/x01. When this feature is on, use F6 to activate and deactivate switching speed. When switching speed is ON and F6 is ON, the switching speed feature is on. 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.

**Scaleable Speed Stabilization (Back EMF)** intensity, or droop, is controlled by CV57. The factory setting for this feature is 006/x06 which is suitable for most locos. You can adjust this value in the range of 000/x00 for OFF to 015/x0F for the maximum effect. Consult your Digitrax Decoder Manual for info about CVs 55 & 56 and their effects on scaleable speed stabilization. The factory setting for both CV55 & CV56 is 000/x00.

## **SuperSonic Silent Operation and Torque Compensation**

The factory settings in the decoder provide silent, smooth operation of your locomotive under most conditions. For more information about these settings, please see the Digitrax Decoder Manual or our website.

## **Digitrax Transponding CV61**

**Digitrax Transponding** is controlled by CV61. The initial factory set value is 000/x00 for OFF. To turn on transponding, program CV61 to a value of 002/x02. This allows you to use Digitrax transponding to keep track of your



rolling stock. When transponding is enabled, the front light of the locomotive may flicker slightly to indicate transponding signal is being communicated. For optimal transponding operation, we recommend that you hook up the forward and rear lights as shown above.

## Decoder Reset CV08

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**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/x08. 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/x09.

## Digitrax SoundFX™ System

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Digitrax SoundFX™ lets you make your locos sound 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 FX<sup>3</sup> 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 programmer and a sound project file (for example SD38\_2.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.



<b>CV#</b>	<b>Used For</b>	<b>Factory default Value</b>
<b>01</b>	<b>2 Digit Address</b>	<b>03</b>
<b>11</b>	<b>Sound Time Out, 06=Sound ends when loco address is de-selected, 00=Sound stays on after loco is de-selected</b>	<b>06</b>
<b>29</b>	<b>Configuration Register</b>	<b>06</b>
<b>49</b>	<b>Forward Light (F0F)-Headlight</b>	<b>0</b>
<b>50</b>	<b>Reverse Light (F0R)-Reverse Light</b>	<b>0</b>
<b>51</b>	<b>Function 1</b>	<b>0</b>
<b>52</b>	<b>Function 2</b>	<b>0</b>
<b>58</b>	<b>Master Volume Control</b>	<b>0</b>
<b>60</b>	<b>Select Sound Scheme</b>	<b>0</b>
<b>132</b>	<b>Notch Rate</b>	<b>127</b>
<b>135</b>	<b>Mute Volume</b>	<b>0</b>
<b>140</b>	<b>Prime Mover Volume (Min=0, max=64)</b>	<b>60</b>
<b>141</b>	<b>Bell Volume (Min=0, max=64)</b>	<b>25</b>
<b>142</b>	<b>Horn/Whistle Volume (Min=0, max=64)</b>	<b>60</b>
<b>143</b>	<b>Time-Scattered Air Effects Volume (Min=0, max=64)</b>	<b>30</b>
<b>146</b>	<b>Bell Ring Rate</b>	<b>07</b>
<b>147</b>	<b>Air Drier Rate</b>	<b>02</b>
<b>148</b>	<b>Compressor Run Rate</b>	<b>30</b>
<b>149</b>	<b>Air Compressor On Time</b>	<b>20</b>
<b>150</b>	<b>Horn/Whistle Setup (Default=0, Playable Horn=1, Alternate Horn=2)</b>	<b>0</b>
<b>151</b>	<b>Auto Coupler Sequence Threshold Value- Peak speed to allow auto coupler/brake when direction change occurs and F3 is ON</b>	<b>48</b>
<b>152</b>	<b>Project Author ID, Digitrax=221</b>	<b>221</b>
<b>153</b>	<b>Sound Project ID, AC4400=02</b>	<b>02</b>
<b>155</b>	<b>Notching Mode: 00=Automatic, 01=Semi-Automatic, 02=Manual</b>	<b>00</b>

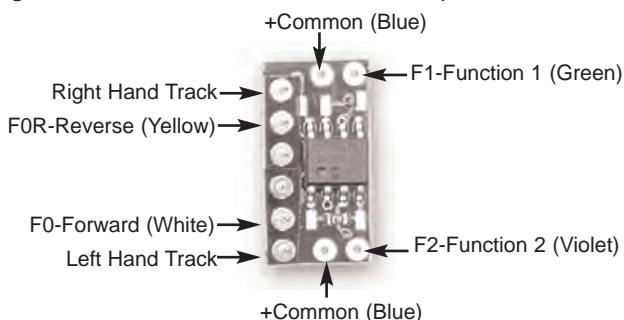
For additional information about sound CVs visit [www.digitrax.com/soundcvs](http://www.digitrax.com/soundcvs)

Func	Used For	Notes
<b>F0</b>	<b>Lights</b>	
<b>F1</b>	<b>Bell</b>	
<b>F2</b>	<b>Horn/Whistle</b>	<b>CV150 sets mode</b>
<b>F3</b>	<b>Coupler crash</b>	<b>Auto coupler/brake set by CV151 max speed</b>
<b>F4</b>	<b>Air feature disable</b>	<b>F4 off means pop-off and drier are enabled</b>
<b>F5</b>	<b>Dynamic Brake Fans</b>	
<b>F6</b>	<b>Air blowoff</b>	<b>Notch UP if CV155=01 or 02</b>
<b>F7</b>	<b>Crossing Gate Airhorn Sequence</b>	<b>Notch DOWN, if CV155=01 or 02</b>
<b>F8</b>	<b>Mute Control</b>	<b>F8 ON is mute</b>
<b>F9</b>	<b>Brake squeal</b>	
<b>F10</b>	<b>Crossing Gate Airhorn Sequence</b>	

## Function Control Using the FN04 Function Decoder

The SDH104K1B has no native function control ability. The FN04K1 and other Digitrax function decoders can be used in conjunction with the sound and motor decoder if function control is to be used. The LEDs on the SDH104K1B will not work unless a separate function decoder is installed.

**Figure 5:** FN04K1 Function Decoder Outputs







FN04K1 is set up to control the forward and reverse lights on the locomotive through the white lead and yellow lead using Function 0 (F0F-forward and F0R-reverse) for directional lighting. Functions F1(Green) and F2(Violet) are available on the FN04. To use these functions, solder a wire from the pad for the function you wish to use to the lamp (or other device) you wish to control. The Blue/+Common pad works the same way as the blue wire on the harness and is provided here for convenience. The wire colors indicated are the standard industry color code (you can use any color you like). These colors are important if you plan to use function remapping.

**CAUTION:** *When adding function wires, be very careful that the wires you add do not come into contact with any other pads or components on the board where they might create a short circuit.*

All four function outputs can be set up with Digitrax FX<sup>3</sup> lighting effects or as standard on/off functions with the following operational qualifiers:

1. Forward or Reverse direction of travel, or
2. Whether F0 is on or off, or
3. Both direction of travel and whether F0 is on or off, or
4. Whether the locomotive is stopped or moving.

## **Function Remapping**

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Function remapping allows you to program the function outputs of your decoder to be controlled by selected function keys on your throttle. Please consult the Digitrax Decoder Manual or website for information on function remapping.

## **Master Light Switch**

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Each of the four function outputs can be programmed to turn on and off with the F0 ON/OFF key on your throttle, creating a Master Light Switch. The CV values for creating this effect are listed in the Digitrax Decoder Manual in the section: *Setting up FX & FX<sup>3</sup> Effects On Function Outputs*. plugs into the decoder. This 9 pin connector has been adopted by other companies in the DCC industry, too.

## **Sound FX DC Operation Mode**

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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.”

## **Sound FX Troubleshooting**

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### **If the sound does not start in the decoder**

1. Make sure you have selected the locomotive on a throttle. The sound will not run unless the locomotive is addressed in the system.



2. Check your installation to make sure the decoders are 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. For impedances below 32ohms (e.g. 8 to 30 ohms) set the volume setting lower to ensure the 1 watt output rating is not exceeded.

### **If the LEDs do not respond to F0:**

1. Be sure the locomotive address you are using to send the command is actually the address programmed into the decoder.
2. Make sure you have good electrical connections between the FN04K1 to the SDH104K1B. We recommend soldering these connections for best reliability.

**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 on the programming track,** this may be due to your system using Direct Bit mode for Service Mode readback. This creates difficulty reading two decoders in a locomotive that may have different data or responses. Since the SDH104K1B and FN04 are actually two decoders, you’ll need to use standard direct mode for reading back CV values on the programming track. Of course you can always just re-program the CV value into a CV to get the desired results. OPs mode is recommended for programming all CVs except CV01, CV17 & CV18 (2 digit and 4 digit addresses).

## **Warranty & Repair**

All warranties on Digitrax products are limited to refund of purchase price, repair or replacement at Digitrax’s sole discretion. Except as expressly stated in the full warranty statement, there are no warranties, express or implied, including but not limited to any warranties of merchantability or fitness for a particular purpose. For complete warranty details see [www.digitrax.com](http://www.digitrax.com).

**Damaged decoders should be returned directly to Digitrax for repair.**

**Incorporates elements of US Patents 6220552, 6545886, 6729584, 6747579, other patents pending.**

*Digitrax, Inc. is not responsible for unintentional errors or omissions in this document.*



## SDH104K1B+FN04K1 Combo

Plug 'N Play Sound/Mobile Decoder + Function Decoder  
for Kato HO SD38-2

### Go Beyond DCC With



**Complete  
Train  
Control**

#### Main Station

Starter Sets  
LocoNet®  
Power Supplies



Your Digitrax LocoNet® Starter Set  
is just the beginning  
of an exciting trip!  
Pick the one  
that's right  
for you!



**LocoNet®  
The Digitrax  
Difference**

#### Locomotive Shops

Mobile Decoders  
Function Decoders  
SoundFX™ Decoders



#### More Fun For Everyone

Add More Boosters,  
Advanced & Simple Throttles,  
Power Supplies,  
Universal Panels,  
IR and/or Radio  
for more trains and operators.

Universal  
Panels



Boosters



Throttles



#### Maintenance Of Way

Make your  
layout more  
fun & simpler  
to operate!

Automatic  
Reversing &  
Power  
Management

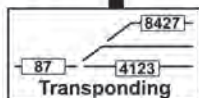
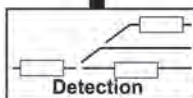
Stationary  
Decoders

Signals

#### Computer Controls

Computer Interface  
Programmer

#### It All Adds Up To Complete Train Control



Made in U.S.A.



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