SD40 Drop-In Configuration Variables List

This is the complete list of all CVs used in the SD40 Drop-In. The factory settings are what the SD40 Drop-In decoder has when it is new or reset.

Note: All CV settings are remembered without battery voltage

CV #	Factory Setting	Value Range	Description
CV1	3	0-99	1-99 Primary Address
CV2	9	0-255	Motor Starting Voltage MSV
CV3	2	0-255	Motor Acceleration Rate
CV4	2	0-255	Motor Deceleration Rate
CV5	255	0-255	Maximum Motor Voltage Vmax
CV6	128	0-255	Mid-point Motor Voltage Vmid
CV8	135	135	CVP Manufacturer ID [RESET]
CV11	0	0-255	Loss of Signal Timer (seconds)
CV17	0	0-255	Loco Address Hi-Byte
CV18	0	0-255	Loco Address Lo Byte
CV29	2	0-255	Decoder configuration
CV35	0	0-15	F1 Function Key Action
CV36	0	0-15	F2 Function Key Action
CV37	0	0-15	F3 Function Key Action
CV38	15	0-15	F4 Function Key Action
CV39	1	0-15	F5 Function [Activate Cruise Control]
CV40	0	0-15	F6 Function Key Action
CV41	0	0-15	F7 Function Key Action
CV42	0	0-15	F8 Function Key Action
CV43	4	0-15	F9 Function [Toggle AUX ELITE#2]
CV44	2	0-15	F10 Function [Smoke Toggle]
CV45	3	0-15	F11 Function [Toggle CAB ELITE#1]
CV46	0	0-15	F12 Function Key Action
CV47	3	1-15	ELITE Period (x512ms)
CV48	4	0-15	CAB ELITE#1 Special Effect
CV49	4	0-15	AUX ELITE#2 Special Effect
CV50	4	0-15	-
CV51	4	0-15	-
CV52	0	0-255	-
CV53	3	1-15	DLITE Flash Rate (x250ms)
CV54	0	0-1	DLITE Mode 0=on, 1=off
CV55	15	0-255	DLITE Flash TimeOut (seconds)
CV56	0	0-255	Bump Amount
CV57	0	0 - 127	Bump duration in us
CV58	0	0-16	RF Frequency number
CV59	3	1-15	Headlites Effect Period (x512ms)
CV60	0	0-15	Headlights Mode 0=normal/autorev
CV61	4	0-15	Headlight Front Effect
CV62	4	0-15	Headlight Rear Effect
CV63	0	0-1	Cruise Mode - 0 Norm, 1=Track
CV64	4	1-16	Cuise Track Rate (ms)
CV65	2	1-3	Cruise Track Step Size

CV Value	Function Key Action
0	No Function
1	Activate Cruise Control
2	Toggle Smoke Generator on/off
3	Toggle CAB ELITE #1 on/off
4	Toggle AUX ELITE #2 on/off
5	-
6	-
7	Dim Headlighs on/off
15	Ditch Lights Flash Trigger
8-14	reserved

CV Value	Special Lighting Effects
0	Off 0%
1	Dim 6%
2	Dim 25%
3	Dim 50%
4	On 100%
5	Strato Light
6	Oscillating Light
7	FRED
8	Rotary Dome light 1
9	Gyra Light
10	Mars Light
11	Rotary Dome Light 2
12	Strobe Single Pulse
13	Strobe Double Pulse
14	Reserved
15	Random flicker

CV Value	Cruise Control Mode
0	Normal (cruise off with change)
1	Tracking mode (Cruise stays on with change)

CV Value	Head/Rear Lites Action
0	Normal, autoreverse
1	Normal with rule17
2	Front headlight on always
3	Front headlight on always with rule17
4	Rear headlight on always
5	Rear headlight on always with rule17
6	Front and Rear both on always
7	Front and Rear both on always with rule17
8	Front/Back Reversed with Auto Reverse
9	Front/Back Reversed w/ Auto Reverse & rule 17
8-15	reserved

April 2014 r4

AirWire900®

USA-Trains SD40 Drop-In™ Decoder Installation Guide

How To Disassemble Your Locomotive
Battery And Smart Charger Preparation
Decoder Installation
Optional Sound Module Installation
Quick Start Guide

AIRWIRE® 900

Drop-In Kit Contents
SD40 Drop-In Decoder
Battery Pigtail
Charger Pigtail
SD40 Install Guidel
SD40 Users Guide

CVP Products
P.O. Box 835772 Richardson, TX 75083-5772
www.cvpusa.com

How To Use This Booklet

Locomotive Disassembly and AirWire Drop-in Decoder Installation

This section starts with the simple task of attaching the appropriate sockets and plugs to the battery and the battery charger. Step-by-step instructions then show how to disassemble the USA-Trains SD40 diesel locomotive. Once the locomotive is opened up, the installation of the Phoenix P8 sound module is described followed by the rather simple task of installing the Drop-In decoder. With the installation done, a quick checkout is run and then the locomotive is reassembled.

Quick Start Instructions

This short section describes how to control the features of the SD40 Drop-In decoder using the AirWire throttle. In this section you will find the "cheat sheet" listing the throttle function key assignments for both the locomotive and P8 sound effects.

Miscellaneous Items

Useful items related to changing the Drop-In decoder address, remote frequency setting and how to reset the Drop-In decoder to its original factory settings finish out this guide

See The Drop-In Users Guide For Applications Tips

Since the SD40 Install Manual is used only during decoder installation, there is a second Drop-In Decoder Users guide. The users guide will have all of the items related to fine tuning and performance optimization as well as some interesting application tips.

Recommended Optional Items - Phoenix P8 Sound Module & Interface Adapter

The Drop-In Decoder is designed to work with the Phoenix P8 sound module. The P8 module requires their interface adapter to setup the P8 functions. If your installation will not have sound, then you may ignore all references to the P8 sound module

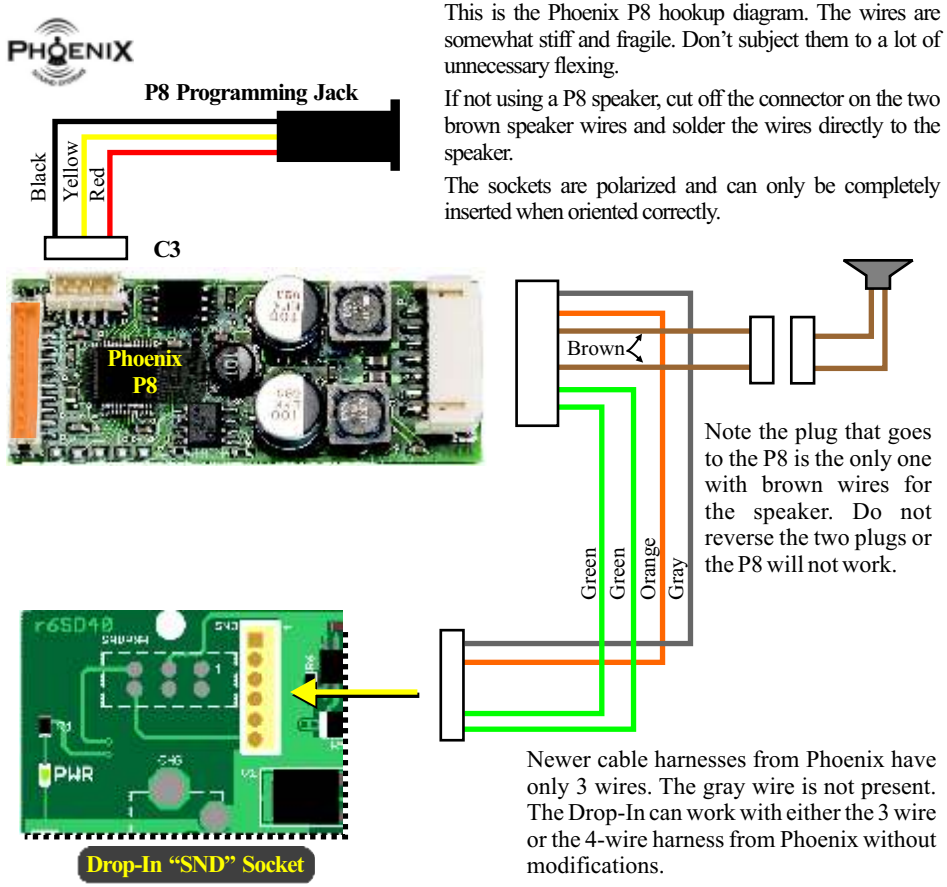
Using A Remote Charging Jack

You can mount another charging jack or use a different location than what is shown in this manual. Download the application note from the cvpusa.com website that shows how to add a remote charging jack.

Throughout this manual, all references to the battery charger and battery are referring to the CVP Products' 14.8V Lithium battery pack and the Tenergy brand smart battery charger.

A smart person reads instructions.
A genius follows instructions.

Phoenix P8 Hookup Diagram



This is the Phoenix P8 hookup diagram. The wires are somewhat stiff and fragile. Don't subject them to a lot of unnecessary flexing.

If not using a P8 speaker, cut off the connector on the two brown speaker wires and solder the wires directly to the speaker.

The sockets are polarized and can only be completely inserted when oriented correctly.

Note the plug that goes to the P8 is the only one with brown wires for the speaker. Do not reverse the two plugs or the P8 will not work.

Newer cable harnesses from Phoenix have only 3 wires. The gray wire is not present. The Drop-In can work with either the 3 wire or the 4-wire harness from Phoenix without modifications.

The Drop-In decoder has a dedicated power switch for the P8. The P8 power switch is independent of the Drop-In decoder power switch. When turned on, the P8 is connected directly to the battery. The P8 can be powered while the Drop-In decoder is not.

Don't forget this fact when you turn the sound volume down low or off. Even if off, the P8 draws power from the battery and it will not automatically turn off.

Always use the power switch to shut off the P8.

P8 Address Setup

The P8 is programmed at the same time as the SD40 Drop-In decoder address is programmed. If for any reason, you think the P8 or the Drop-In might not be on the same address, just reprogram the decoder's locomotive address, CV1, from the throttle. When the address on the Drop-In is changed, the P8's address will also be changed. If the P8 doesn't respond to throttle commands, but the motion decoder does, repeat the programming of CV1 and make sure both power switches are turned on.

Phoenix P8 Sound Decoder Setup - See The SD40 Drop-In Decoder Users Guide

The P8 is a versatile sound decoder with many options and selections. However, there are selections that must be made to achieve the best results with the AirWire SD40 Drop-In decoder.

Detailed P8 setup instructions are contained in the Drop-In Decoder Users Guide. Also, be sure and see the P8 manual and read the help screens that are part of the Phoenix programming software.

Simple Troubleshooting Tips

These tips assume the locomotive has been operating normally for a while.

Locomotive Stops Running - But Resumes Running After A Short Rest

This is likely to be caused by overheating of the motor power drivers. If the drivers overheat, they will automatically shut down and stay off until the power is cycled off, then back on. There is no warning buzzer when this occurs. There is no harm to the decoder, but the drivers need additional ventilation.

Motor Runs For Short Period Then Stops

There are several possible reasons for this - let's start with the easy one first. Make sure the throttle is turned on, is set to the proper frequency and locomotive address. If all of these are OK, try another throttle. If it too doesn't work, then the cause is the locomotive.

Reconnect the charger and verify that the charger indicator is visible and green. If the light is red, then the battery is depleted and needs to be recharged.

Finally, it is possible that a momentary overload tripped the battery or motor driver protection circuits. Cycle the decoder power off then back on and try again. If the problem persists, there may be a problem with one or both of the locomotive motors. There is also a remote possibility of a faulty battery. Or it could be as simple as a broken wire. You need to disassemble the locomotive to check these items.

Train Stops When It Is Far Away

This is an easy one. You need to set the loss of signal timer, CV11 to a value of 0. Any other value and the locomotive will come to a halt when the throttle signal is gone and the timer has expired.

Throttle Loses Control When Locomotive Is Far Away

This is just the normal limitation of the radio system. Do not expect the throttle to control the train when it is a thousand yards away. However, if your railroad is in a large loop, then leave the throttle on its original setting and let the train come back to you. Once the train is within range, the throttle will once again regain control. Be sure and set the loss of signal timer, CV11, to 0.

Horn Won't Stay On When F2 is Pushed And Held

This is usually caused by a combination of noisy motors and distant operation and is not actually a problem Instead, it is a new automatic feature of the SD40 Drop-In decoder. There is nothing more annoying than a diesel horn that is stuck on so the SD40 Drop-In includes a special feature that prevents stuck horns. If for any reason, the SD40 Drop-In stops receiving throttle commands, and the last command was horn ON, then it will automatically issue a horn OFF command after a preset amount of time. This will occur more frequently as the locomotive moves further and further away from the throttle.

SD40 Drop-In Decoder Warranty Information

This warranty covers substantial defects in materials and workmanship in the decoder.

What This Warranty Does Not Cover

This warranty does not cover any problems which result from improper installation, modifications, battery polarity reversal, improper operation, leaking batteries, excessive battery voltages, excessive motor current draw, connections to 3rd party circuit boards, abuse, accidents, or acts of God such as excessive heat, floods, damage caused by exposure to moisture and rain, lightning, earthquakes, volcanic events, tidal waves or hurricanes.

Warranty Duration

The coverage of this warranty lasts for 90 days. After this period, standard repair rates apply. Depending on the problem, CVP reserves the right to repair or replace.

Repairs and Returns

If you purchased your decoder from one of our AirWire900 dealers, please call them first. They are your best and quickest for answers to questions about the decoder. They are also experts in installation and offer such services should it be required. If you purchased your decoder ***directly*** from CVP Products, call us first.

If you are asked to return an item to CVP for service, you must follow the instructions on the website under service and support and you must obtain an RMA. There you will find the street address plus other helpful tips about sending packages to CVP Products. **Do not send items to us for repair without first obtaining authorization.**

SD40-2 Drop-In Decoder Familiarization

This Drop-In uses a design based on the G3 decoder. Thus it will program differently and have better performance than the original Drop-In decoders.

Bottom view of board showing charger jack and power switches

* Using the ditch light header requires optional lighting kit

Attaching Battery Pack Pigtail

Lithium Battery Pack
Actual color of pack may vary

Power Plug Pigtail

WARNING: The CVP battery pack wire ends are insulated with heatshrink tubing. Remove only one piece of tubing at a time and then, only when ready to make the connection to the power plug. NEVER allow the two bare battery wires to touch.

The Lithium battery pack comes with wires that must be connected to the power plug pigtail. The pigtail is included with each Drop-In decoder. This is not difficult and no special tools are needed.

If you are using a different battery, you must properly identify the PLUS wire. If you get the polarity wrong, you will damage the Drop-In decoder and the warranty does not cover this. If you are not sure, seek help - don't guess.

Battery polarity is very important. Incorrect polarity will damage the decoder. This is not covered by the decoder warranty. For the Lithium battery, the plus wire is red. The black wire is minus. For the power plug, the plus wire is also red and the minus wire is black.

Twist the Power Plug Wires Together so they look like the picture. This helps minimize radiated noise. Once twisted together, trim both power plug wires to about 4 inches long. Next, trim the red power plug wire so it is about 1 inch shorter than the black wire.

Remove about ½ inch of the insulation from the black wire. Twist the strands together and touch a tiny bit of solder to the twisted wire. This is called tinning and keeps the twisted wires from unraveling.

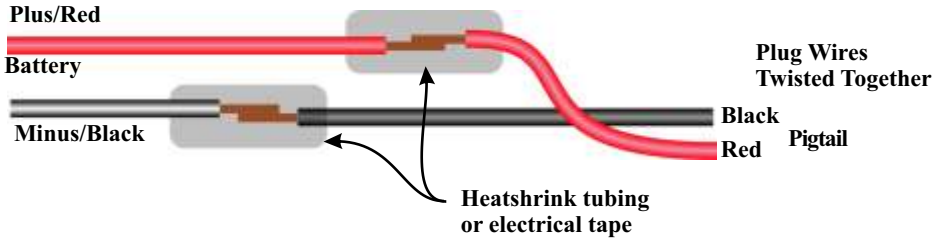
Remove about ½ inch of the insulation from the red wire. Twist the strands together and touch a tiny bit of solder to the twisted wire. This is called tinning and keeps the twisted wires from unraveling.

On the battery, start by trimming the black wire so it is one inch shorter than the red wire. Do not remove the heatshrink tubing on the red wire.

Remove about ½ inch of the insulation from the battery's black wire. Twist and tin the wire.

If you are using heatshrink tubing to insulate the solder joints, now is the time to slide a piece over the black wire - either side will work. Otherwise, use electrical tape to insulate each connection. Overlap or twist together the two black wires and solder them together. Once the solder joint has cooled, slide the heatshrink over the connection and heat it up so it shrinks around the connection. Make sure no bare wires are visible.

Remove the heatshrink tubing from the red wire. Don't forget to slide on a fresh piece of heatshrink for use later. Now overlap or twist together the two plus wires and solder them together. Once the solder joint has cooled, slide the heatshrink over the connection and heat it up to shrink it around the connection. Make sure no bare wires are visible. This completes the wiring.



Restoring The SD40 To Original Factory CV Values

There may come a time when the decoder no longer responds to what you believe is the correct frequency, or you don't know its address. The assumption for this procedure is that you **DON'T** know the SD40 Drop-In decoder frequency. This procedure will first reset the frequency as well as restore the original factory settings and address of the Drop-In decoder.

This procedure will not reset the P8 decoder.

First: Reset the frequency

1. Turn off all AirWire throttles. This is very important since it is the absence of a throttle signal, plus turning the power off and then back on (a power cycle), that allows the SD40 decoder to temporarily jump to a specific known frequency, which is frequency 0.

2. Turn off the SD40 Drop-In decoder if it was powered on.

3. Turn on the SD40 Drop-In decoder and **wait** at least one minute. At the end of the one minute, the SD40 Drop-In decoder will chirp 5 times. At the end of the chirps, the decoder will be temporarily receiving on frequency 0.

4. Turn on your throttle, and set it to frequency 0. The address doesn't matter.

5. Push MENU twice and then push 4 for SVC PROGRAM.

6. Push 8 and ENT for CV8.

7. Push 1, 3, 5 and push ENT to issue the factory reset. The decoder will chirp when the command is accepted.

8. Turn off, and then turn back on the SD40 Drop-In. The motion decoder is now set to address 3 and frequency 0. It is now exactly the same as when it left the factory. The P8 sound decoder has not been changed. To match sound and motion, you must set the address using SVC PROGRAM mode.

This completes the factory reset procedure.

Locomotive Address is 3, Locomotive Frequency is 0, see back page for other CV values.

AUX Lighting and Ditch Light Headers

There are two additional lighting outputs on the SD40 Drop-In. Both outputs are designed for using LEDs. Both provide a simple switch to battery minus when turned on. When using LEDs, the anode lead is tied to battery plus through a resistor. For a white LED, and the standard CVP 14.8V Lithium battery, the resistor value is about 1000 ohms or 1K. Lower resistor values increase the brightness.

The Ditch Light Header is a 3-pin header that offers two outputs that alternate on-off when activated. Several CVs control how the ditch lights operate after being activated. See the SD40 Users Guide for complete details about how to hookup and used the Ditch Light Header. We strongly recommend purchasing the optional lighting hookup kit, part number KK3, which provides the appropriate plug with wires already attached. See the SD40 User guide for complete information about setting up and using this output.

The AUX Light Header is a 2-pin header that provides 16 different light effects that may be applied to the attached LED. We strongly recommend purchasing the optional lighting hookup kit, part number KK2, which provides the appropriate plug with wires already attached. See the SD40 User guide for complete information about setting up and using this output.

Optional 2-pin and 3-pin headers with plenty of attached wire offer convenient plug-in connections to the 2 extra lighting headers available on the SD40 Drop-In.

If You Forget The SD40 Frequency

There may come a time when you do not remember the SD40 Drop-In decoder's assigned frequency and address. If this happens, use the following technique to reset the Drop-In frequency without changing anything else and without changing the address. If you have forgotten the address as well, you must first set the frequency and then reprogram the decoder with the desired address.

To Reset The Drop-In Decoder's Frequency

Step 1: Turn off **all** AirWire throttles. This is very important since it is the absence of any throttle signal that forces the SD40 Drop-In to temporarily jump to frequency 0. *Make sure there are no lurking locomotives, powered up and set to frequency 0. If so, their frequencies will be changed too.*

Step 2: Turn off the SD40 Drop-In if it was powered and then turn it back on.

Step 3: Wait a minimum of one minute. Listen for the 5 second count down chirp. When the chirps stop, the SD40 Drop-In is temporarily on frequency 0. You must wait the full minute before moving to step 4.

Step 4: Turn on your throttle. Set it to frequency 0.

Step 5: Push MENU twice and then push 4 to select SVC PROGRAM mode.

Step 6: Enter 58 followed by ENT.

Step 7: Enter the desired frequency number and push ENT. The decoder chirps once to indicate receipt of the new frequency. The frequency number range is 0 to 16.

Note: If you enter a frequency value larger than 16, the decoder will not accept it and, instead, will reset the frequency to 0. It still chirps even if this occurs.

Step 8: Push ESC to cancel SVC PROGRAM mode.

Step 9: Turn the Drop-In decoder power switches off, then back on. The SD40 Drop-In decoder is now on the new frequency.

Be sure to change the throttle to the new frequency by pushing MENU, then 3, then enter the decoder's new frequency number and then press ENT. Set the throttle to the decoder address and drive away.

Notes About The Forgotten Frequency Setting Technique

- The temporary jump to frequency 0 is canceled and normal operation on the original frequency resumes if a throttle is turned on that matches the present SD40 Drop-In frequency setting **within one minute** of the decoder power being turned on (before the count down chirps stop).
- If the SD40 Drop-In jumps to frequency 0 because you waited too long to turn on the throttle, just cycle the decoder power and make sure the throttle is turned on within one minute.
- The jump to frequency 0 is temporary and **nothing is changed** in the decoder. However the SD40 Drop-In will stay on frequency 0, until power is cycled or you change the frequency by setting CV58 to a new value. If you did not change the frequency, the SD40 Drop-In will revert back to its previously stored frequency when its power switch is turned off then back on.
- The SD40 Drop-In decoder will not jump to frequency 0 if a throttle having a frequency that matches the decoder is turned on within one minute of turning on the decoder even if the address is different.
- If a frequency number higher than 16 is selected, it is ignored and the decoder uses frequency 0.

You must use the Drop-In's "motor" power switch (see picture on page 16) when turning the SD40 decoder on and off for a "power cycle." If you forget and just turn off the sound decoder's power switch, the Drop-In decoder will not be reset. Best practice is to always turn on and off both power switches.

Attaching Charger Plug Pigtail To Charger

First, open up the charger box. The only items kept are the charger, the power cord, and the spare fuses. All other items are not needed and may be discarded.

Locate the charger pigtail that came with your AirWire Drop-In decoder. The pigtail is 6 inches long with stripped wires on one end and a right angle plug on the other.

The pigtail needs to be permanently attached to the charger output wires. This is not difficult and no special tools are needed.

Wire polarity is very important and reversing the polarity could damage the charger or the battery or both. On the pigtail, the plus wire is the wire with the white stripe. The minus wire is the solid black wire. The charger uses the conventional red wire for plus and black for the minus wire.

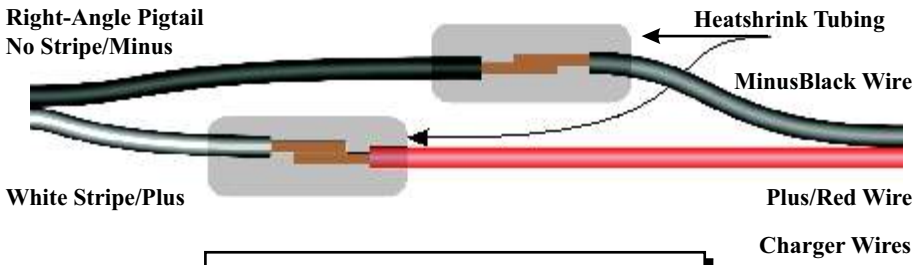
Take the pigtail and separate the 2 wires for about 2 inches. Cut the plus wire so it is 1 inch shorter than the minus wire. Remove about ½ inch of the insulation from the minus wire. Twist the strands together and touch a tiny bit of solder to the twisted wire. This is called tinning and keeps the twisted wires from unraveling.

Take the charger wires and split the red and black wires apart for about 3 inches. Cut the minus wire so it is shorter than the plus wire. Remove about ½ inch of the insulation from both the black and red ends of the wires. Twist and tin the wires.

If you are using heatshrink tubing to insulate the solder joints, now is the time to slide a piece over the minus wire - either side will work. Otherwise, use electrical tape to insulate each connection. Overlap or twist together the two minus wires and solder them together. Once the solder joint has cooled, slide the heatshrink over the connection and heat it up to shrink the tubing around the connection. Make sure no wire is visible.

Slide a piece of heatshrink over the plus wire. Overlap or twist together the two plus wires and solder them together. Once the solder joint has cooled, slide the heatshrink over the connection and heat it up to shrink the tubing around the connection. Make sure no wire is visible.

Inspect for proper polarity matching and that no bare wire is visible outside the heatshrink tubing. This completes the wiring.



Heatshrink tubing may be ordered from Mouser Electronics. Use 0.25 inch diameter tubing with part number 5174-1141. It sells for about $2 and comes in a 4 foot length. www.mouser.com

USA-Trains SD40-2 Disassembly

Warning: Many parts of the shell and chassis are fragile and easily break. Some small pieces are simply pressed into mounting holes. Especially vulnerable are the moving doors, side-frame assemblies, window and roof detail. Remove the firecracker antenna and the horn assembly from the cab roof. They are a tight friction fit so be careful not to break them. The dome flasher is glued in so just be careful when placing the locomotive on its back.



You Must Have The Proper Screwdriver

You must have a thin-shafted, #1 phillips-head screwdriver that is at least 4 inches long to reach the screws. The thin shaft is necessary to fit between the wheel and side frame. This one is from General and has a 4 inch long, narrow shaft with a #1 Philips tip. It is also magnetized which comes in handy for pulling the screws from deep recesses.

A Soft Work Surface Pays Big Dividends

Spread a couple layers of thick towels on your work surface to serve as a cushion for the locomotive. The top of the locomotive is uneven and is unstable when upside down. The towel will help prevent damage should it fall over.

Use a Foam Block To Hold Screws

Take a rectangular sheet of foam and label it B and F to represent the loco's front and back end. As each screw is removed, position it in the foam in about the same location as found on the locomotive.

Total Chassis Mounting Screw Count is 20

When all the screws are removed, there will be a total of 20 screws. When you are done, If your count doesn't match, go back and check to see which ones you missed. The next series of illustrations shows the location of the screws and have been numbered for easy reference.

This is a long locomotive and some of the screws are well hidden. Take your time and be sure to locate and remove all screws.

Remove Fuel Tank - 2 Screws

The first two screws are easy - they hold the fuel tank to the chassis. Remove the 2 screws, lift off the tank and set it aside for now. Take care not to break the small posts that center the fuel tank in the chassis.

Changing The SD40 Drop-In Decoder Address

Address changing is simple and straight forward using the T5000 throttle. Always use Service Programming mode when setting the decoder address. As long as both power switches are turned on, the P8 sound decoder will be programmed to the motion decoder address at the same time.

The decoder address and the P8 sound decoder addresses must match. Make sure both power switches on the SD40 decoder are in the on position before starting.

1. Turn on both power switches on the SD40 decoder.
2. Turn on the throttle.
3. Set the throttle frequency to match the decoder frequency [new decoders are on frequency 0].
4. Push MENU key twice. "Push" means to push and release the key.
5. Push 4 to select SVC PROGRAM.
6. Push 1 to select configuration variable (CV) number 1 and ENT.
7. Enter the desired decoder address and push ENT. The address range is 1 to 9999. Address 0 is not allowed. The address must be unique and we recommend using the locomotive cab number.
8. Upon pressing ENT, the decoder chirps 2 times for an address from 1 to 99 or 3 times for an address from 100 to 9999. Push ESC to exit the programming mode.
9. Set your throttle to the new decoder address. Set the direction and turn up the speed knob and you are in control.
10. Push the LOCO MEM key twice to store the frequency and decoder address in throttle memory by pushing the LOCO MEM key twice. This is not mandatory but does make it easier to recall the address and automatically set the proper frequency.

Changing The SD40 Drop-In Decoder Frequency

The SD40 decoder features remote frequency selection directly from the throttle. The decoder frequency is remembered even if the battery is disconnected.

17 Unique Frequencies Are Available - The frequencies are numbered from 0 to 16 for a total of 17.

Setting The Frequency - The desired frequency is stored inside the decoder in configuration variable number 58 which is abbreviated CV58. Service programming is recommended because you don't need to use or remember the locomotive address. Setting the frequency has no affect on the attached P8 decoder.

1. Set throttle to decoder's present frequency [for a new decoder, this is frequency 0].
2. Push MENU twice and then push 4 to select SVC PROGRAM mode..
3. Enter 58 followed by ENT.
4. Enter the frequency number and push ENT. The decoder chirps once to indicate receipt of the new frequency. The frequency number range is 0 to 16.

   Note: If you enter a frequency value larger than 16, the decoder will not accept it and, instead, will reset the frequency to 0. It still chirps even if this occurs.
5. Push ESC to cancel SVC PROGRAM mode.
6. Change the throttle to the new frequency. Push MENU, then 3, then enter the new frequency number, then press ENT.
7. Set the throttle to the decoder frequency and drive away.
8. Write the frequency and address on a sticky label and attach it to the locomotive. We use the bottom of the fuel tank. While you may remember the frequency next week; how about in 6 months? This record will help you remember.

   Optional: push LOCO MEM key twice to store locomotive address along with its new frequency in your T5000 throttle.

SD40 Quick-Start - *continued*

Volume Up is triggered with F7. To use this feature, push F7 to begin increasing the overall Phonenix sound volume. When the volume reaches the desired level, push F7 to stop and hold the volume setting.

Volume Down is triggered with F8. This works the same as F7 except the volume will begin to decrease when F8 is pushed. Push F8 again to stop and hold the volume setting.

Caution: if the volume is allowed to decrease to 0 or off, the volume will remain at 0 when the power is turned off. When turned back on, you may think there is a problem with the sound when in fact you simply have to push F7 to raise the volume.

Dynamic Brake is toggled with F9.

Brake release sound is triggered with F10.

Air Pop Valve sound effect is triggered with F11.

Diesel Engine Shutdown is triggered with F12. This will initiate the shut down sequence for the diesel engine. You can manually restart the engine by simply pushing F12 again. Note that if the throttle speed setting is not idle, the diesel automatically restarts. This applies when the locomotive is standing still too. Any change of the speed control will automatically restart the diesel engine.

The table below the combined list of recommended function key assignments for the Drop-In decoder and the P8 sound module. Black is the effect for the Drop-In decoder and red is the effect for the P8.

Please review your P8 manual for detailed information on its features and settings.

Throttle Key	Loco Effect – Sound Effect
0	Toggle Headlights On/Off and Auto-Dim at Idle
1	Toggle Bell On/Off
2	Manual Horn Activation
3	Trigger Coupler Clank Sound
4	Trigger Grade Crossing Horn effect
5	Enable Cruise Control [change speed to disable]
	Trigger Station Announcement
6	Trigger Compressor Sound Effect
7	Volume Up (push to begin increasing, push to stop)
8	Volume Down (push to begin decreasing, push to stop)
9	Toggle Dynamic Brake Sound Effect
*0	Toggle Smoke Generator [2 minute max time on]
	Trigger Brake Release Sound
*1	Toggle Cab Interior and Number Board Lights On/Off
	Trigger Air Pop valve
*2	Toggle Engine Shutdown or Startup Sound Effect

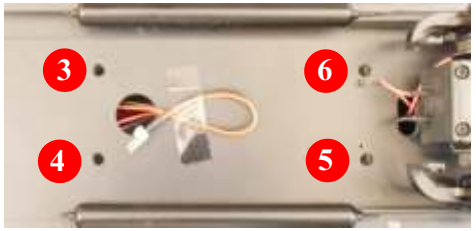
Power Must Be On When Reprogramming Sound Module

Both Drop-In power switches must be ON before plugging in the programming plug.

SD40-2 Disassembly

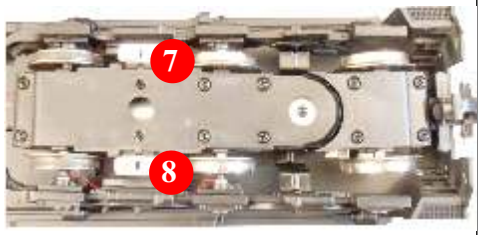
Center Chassis - Under Fuel Tank [4 Screws]

These are easy to see and get to. All of these screws are located in the deep hollow tubes and you will need the long, thin-shafted screw driver. As each screw is removed, place it into the foam block. The wire and plug will be removed later and can stay in there present position for now.



Rear End [2 Screws]

These two screws are well hidden underneath the truck. A bright light will help you spot the holes. To get the screwdriver into the hole, slip it between the side frame and the middle wheel. The red circle shows where the hole is. It may help to slightly rotate the truck to better expose the holes.



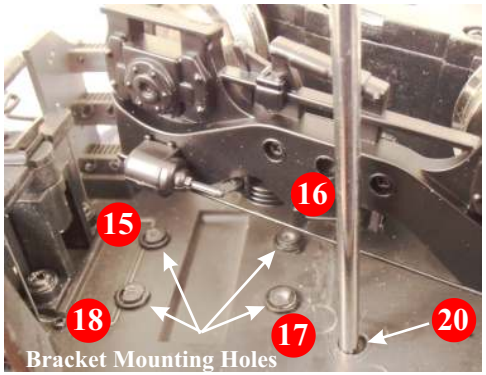
Cab and Front Truck [12 screws]

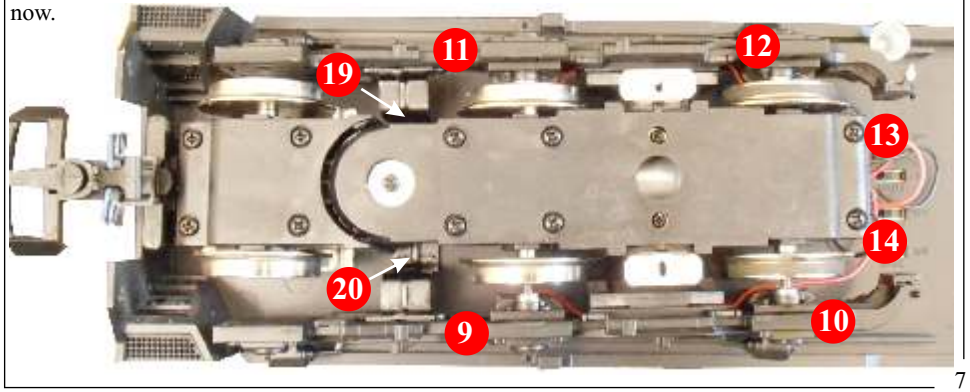
Remove the 4 small screws that hold the cab to the chassis. The side frame obscures the screws in the picture but they can be easily seen and reached. These are smaller screws than the chassis screws - don't loose them.

Rotate the truck and locate the two screws directly underneath the rear of the truck. These are in deep hollow tubes and can't be seen in this picture. Don't accidentally remove the truck cover plate screws visible next to #13 and #14 indicators.

There is a black metal brace that obscures the openings for #15 and #16. In addition, a slotted bracket, screwed to the chassis, holds the front wheels. As a result, the truck and wheels can't be rotated far enough to expose the screw holes. Therefore, this bracket must be removed in order to swing the truck far enough to expose the holes for #15 and #16.

Remove the 4 screws holding the slotted bracket. These are different looking screws - don't loose them. With the bracket free, rotate the entire truck including the front wheels to expose the openings of the hollow tubes. If needed, use gentle pressure to get the screwdriver into the hole. Rotate the truck in the opposite direction to get to the last screw. Leave the bracket loose for now.

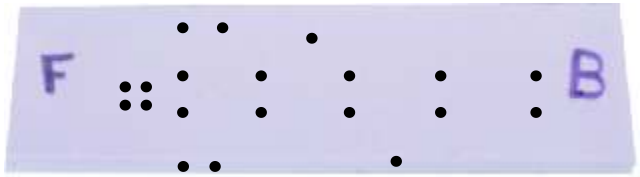




USA-Trains SD40-2 Disassembly

Check Your Screw Count - 16 Total Screws [or 20 if you count the bracket]

With all screws now removed, take a moment and compare your count and foam board holder to the one below. The total count is 20 which includes the cab, slotted frame and fuel tank screws. If your count is different, you've missed some. Go back and find the missing screws and remove them. If all screws are not removed, the top shell and bottom chassis can not be separated.



Separating the Top Shell and Bottom Chassis

Make sure you use the towel so as not to break the top shell detail. While the unit is on its wheels, grab the top shell at each end and gently pull straight up. Lift the shell off the chassis. If it doesn't easily separate, you may have missed a screw.

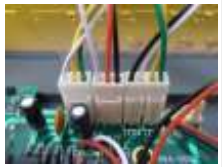
Lay the shell down next to the top portion. Take care not to pull any wires loose. In our unit, the smoke unit wiring was tight and the top shell could not lie directly on its back. Remove the tape holding the smoke-unit wires to the shell.

Unscrew Transistor From Front Weight

There is a transistor mounted to the front lead weight. Remove the screw and the washer to separate the device from the weight. The screw and washer are no longer needed and may be discarded.

Unplug All Connectors and Remove The Old SD40 Circuit Board

Unplug all the connectors from the main board. Unplug the smoke generator, motor and pickup wires from the main board. The motor and pickup connections are made with a large black plugs and sockets. Press down on the tab to release it. Don't pull on the wires. Untape the speaker wire from the bottom of the chassis so the wire and connector can be removed.



Unplug the lighting cables that go from the main board to the cab and to the rear of the locomotive. There are two sets for each end of the locomotive.

Set the top shell aside for now.

Remove The Main Circuit Board

Remove the 3 tiny screws holding the main circuit board and remove it. Be sure to save the screws to mount the Drop-In decoder. The main board is no longer needed and may be discarded.

SD40 Drop-In Decoder Quick-Start Guide

The quick-start page assumes the locomotive decoder is on the original factory setting of address 3 and frequency 0. If you have changed either of these, then be sure and use your settings on the throttle. This page also assumes you have used the recommended settings for the P8 sound module. See the Drop-In users manual for details.

Now that the locomotive is reassembled, its time to begin exploring some of its new features and capabilities.

As you become familiar with your locomotive performance, you will undoubtably want to make changes as well as fine tune its operation. For complete details about all the options available, see the SD40 Users Guide.

Locomotive Motion Control

Speed and direction are controlled from the throttle. Use the throttle's knob to change speed. To change direction, push down on the speed knob. "Forward" direction is defined as if you were sitting in the locomotive cab.

Cruise control activation is easy. Once the locomotive is running at the desired speed, push the 5 key on the throttle - abbreviated as F5 - to activate cruise control. A beep will be heard when cruise control is activated. To deactivate cruise control simply change the speed or direction. A beep will be heard when cruise control is deactivated. At very slow speeds, you may hear a double beep. This means that the locomotive is going too slow for reliable cruise control so you need to increase the speed slightly and push F5 again.

Locomotive Lighting and Smoke Generator Control

Headlights, and marker lights are toggled on and off with the throttle's 0 key. This is "Function 0" which we shorten to F0 The headlights automatically switch between front and rear when direction key is pushed.

The dome flasher, cab interior and number boards are turned on and off with Function 11 or F11. To activate F11, first push the * key followed by the 1 key on the T5000 throttle.

Smoke generator is turned on and off with F10. To activate F10, first push the * key followed by the 0 key on the T5000. Once turned on, the smoke generator has an automatic timeout. However, if the smoke fluid has run out, the locomotive's own smoke generator controller will turn off even if the decoder's timer has not run out.

Phoenix P8 Sound Effects Control

The table on the next page assumes you have used the recommended configuration file or have set up the P8 to match our recommended settings. These settings are described in the Drop-In decoder operation manual. If you have not yet configured the P8, the sound effects and throttle activation keys will not match and the sound may shut off after only a few minutes of operation. This is normal if the configuration has not been changed - it is not a Drop-In or sound module problem.

Bell is toggled on and off by F1. Toggle means push and release the F1 key to turn on the bell. To turn off the bell, push F1 again.

Horn is activated by F2. This is a momentary activation which means push to turn on and release to turn off. There is an automatic timer tied to the horn activation. Sometimes, when the horn is activated, it does not receive the turn off command. This can be caused by motor noise, distance from the throttle or momentary jamming. To prevent the horn from being stuck on, the Drop-In decoder will automatically shut off the horn.

Engine rev up and down is controlled by the speed knob.

Coupler clang is triggered by F3. Trigger means the sound effect is transitory and sounds each time the key is pressed.

Grade crossing horn is triggered by F4. This is a 15 second recording of a complete grade crossing horn sequence.

"All Aboard" station announcement is triggered by F5.

Compressor start up is triggered by F6. The sound effects runs for a few seconds and then shuts off.

Reassembly And Final Notes

Carefully pickup the shell and lower it onto the chassis. Make sure all wires are INSIDE and BETWEEN the mounting posts. Don't allow a wire to fall on the outside of the post or you risk pinching it when the top half is mated to the bottom half. Look on both sides of the locomotive. Make sure you can't see any wires. If you did a good job of taping the light wires, they will clear all the mounting posts and you will not break a wire when installing the screws. Make sure the antenna favors bending towards the rear of the locomotive.

The chassis will seat itself correctly and easily when everything is aligned. Make sure the front motor connector is not sitting on top of the weight. Inspect all around. If resistance is encountered, check for wires, plugs or sockets that may not be between the mounting posts. Watch for wires that lie on top of the screw mounting tubes. These are difficult to spot and if missed, the screw will pierce the wire and most likely break it.

Once the two halves are together, it is time to reinstall all the screws. The first task is to remove the two screws holding the fuel tank. Lift it off enough to insert the two screws into the their mounting holes and tight. To start the screw, first turn it slightly counter-clockwise to get it seated in the threads, then turn it clockwise to tighten. Do not over tighten.

Before putting the fuel tank back in place, tape the speaker and programming wires so they will not touch the back of the speaker. Next, put the fuel tank back in place and insert its screws.

Finish the reassembly by installing all the remaining screws. Take care because this is where most of the damage to plastic detail takes place. The rough handling and rushing to finish spells disaster for the tiny details. The most common items to pop off or break at this stage are window shades, steps and window detail.

If You Accidentally Break A Wire

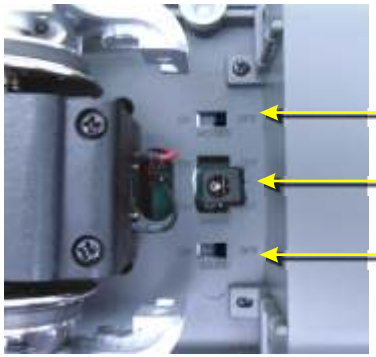
If you accidentally break the wire, splice it back together, solder the joint and then cover it with tape or heat-shrink tubing. Never leave wires uninsulated. You risk damaging the decoder and locomotive.

Charge The Battery

The battery is charged only when both power switches are in the off position.

Once the locomotive is back together, turn off the power switches, plug in the charger and let the battery charge for about 4 hours. If using the CVP smart charger, the charger will shut off automatically when the battery is fully charged.

Always store the locomotive with the battery fully charged. This will prolong its life and provide years of enjoyment.



Power Switches And Charger Jack

Drop-In Power Switch [shown OFF]

Battery Charger Jack

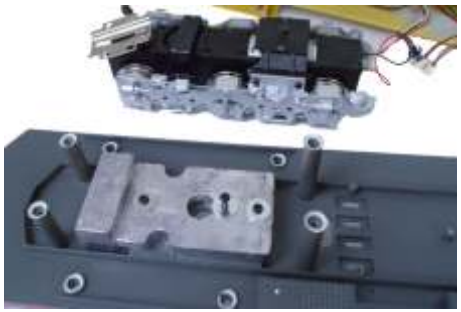
Sound Decoder Power Switch [shown OFF]

Slide Switch Actuator Towards Truck = ON

Slide Switch Actuator Towards Fuel Tank = OFF

USA-Trains SD40 Disassembly

Remove The Front Truck



The front truck and the connecting wires are in the way of the work that needs to be done to enlarge the switch holes in the bottom of the chassis.

This is a 6 wheel truck with the front wheel set attached to the slotted guide bracket that was previously unscrewed from the chassis.

Turn the locomotive right side up. Remove the screw and washer holding the truck to the chassis. Gently pull the truck and the motor connector away from the chassis.

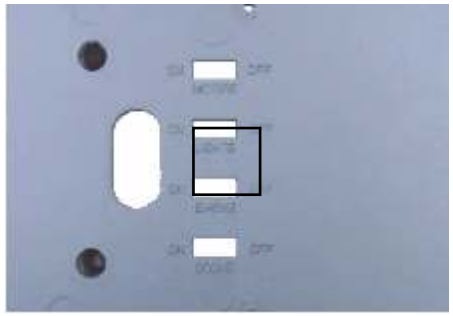
So as not to lose the truck mounting screw and washer, place them into the hole from which the transistor was removed.

Enlarge Switch Opening In Chassis Floor

Look at the bottom of the Drop-In board. Note the two switches and jack. The switches fit the outside switch holes in the locomotive floor. However, the area for the charging jack needs to be enlarged.

In the picture to the left, the area to be enlarged is outlined by the yellow box. Working from the bottom side of the chassis, use a motor tool with an abrasive or routing bit to enlarge this area so the jack simply drops through. The jack must not bind. Nobody can see the hole so neatness doesn't count.

Turn the chassis right side up and temporarily mount the Drop-In board. The board must fit flush to the mounting posts and the jack must not bind in the opening. When you get a good fit, remove the Drop-In, clean away the debris and proceed on to the next step.



Reattach The Front Truck

With the hole enlarged and the Drop-In board fitting neatly into the locomotive, the front truck can be reattached to the chassis bottom.

Push the motor wire through the oval cutout and use the washer and screw to mount the truck. Make sure it doesn't bind.

Do not attach the front wheel's slotted bracket at this time. It will be reattached once the installation is completed.

You can remove and discard the track sliders since they are no longer required. In addition, the sideframe pickup wires can be cut at the sideframe. The pickup wiring and plug can be discarded.

Battery Mounting

This installation makes use of the standard CVP Lithium battery pack. The small size yet high power capacity makes for a simple installation.

Remove The Rear Weight and Trim The Mounting Post

Remove the rear weight from the locomotive by unscrewing the two outer screws. The center screw holds the truck - do not remove it. Remove the weight and discard. The screws may also be discarded.

The weight's inner mounting post, the one closest to the center of the loco must be removed. Use your flush-cutting wire cutters to trim the mounting post flush to the floor. .

The battery is mounted to the floor using double-stick foam tape. Be sure to apply several layers (4 layers in photo) of tape so the battery does not obstruct or sit on the truck mounting screw. Mount the battery to the left of the rear mounting posts and onto the tape and press down firmly. For added strength, a small dab of hot melt glue can also be used but keep the glue away from the truck mounting screw.

Do not force the battery between the two rear mounting posts. Doing so will push them out of alignment. As a result, the top and bottom halves will not fit together properly.

Phoenix P8 and Smoke Generator PCB Mounting

Disconnect the cables from the P8 sound module.

Flip the module over with the headers face down. Apply a small piece of double sided foam tape as shown. This helps even out the bumpy bottom of the P8 board.

Apply another piece of foam tape along the length of the board as shown.

Plug in the main cable (has brown, green and orange wires) and orient the board so the cable goes towards the front of the locomotive.

Mount the P8 module so that it doesn't foul the opening for the motor wires.

Mount the smoke generator control module back into its original position. Route the P8 wires under the smoke module towards the front of the locomotive.

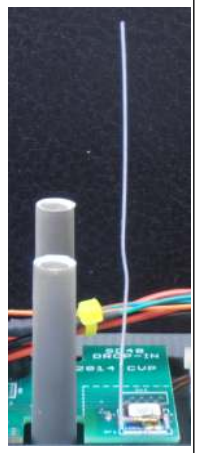
Push the brown speaker plug and the brown wires through the large round hole in the chassis bottom

The next step is to mount the speaker and P8 programming jack into the fuel tank.

Align The Antenna

For best range and operation, the whip antenna must be vertically oriented. Gently bend the antenna vertical at the point where it exits the gray tubing portion of the connector. Straighten out any kinks so that it favors a vertical orientation and will bend towards the rear of the locomotive when the shell is reattached.

The antenna must be clear of any wires. Use twist ties or tie wraps to bundle the wires and force them away from the antenna and radio module. The image on the previous pages shows how the loco should look with all wires favoring the side opposite the radio module.



Take care not to snap off the antenna. If it does come off, center it over the connector and push straight down to snap it back on.

Initial Check

As delivered from the factory, the Drop-In decoder is set to locomotive address 3 and frequency 0. Also, if your P8 is new and unused it will be on address 3.

1. Turn on your throttle. Set it to frequency 0 and address 3. Set the speed to 0.

2. Turn on both Drop-In power switches. The ON position is when the slide switch is towards the cab. With both switches on, the Drop-In decoder's green PWR LED will be on. With the throttle on, the red GP LED will also be on.

3. You will hear the Phoenix P8 module turn on (if installed).

4. Slowly turn up the throttle until you see the motor attempt to move. Verify that both motors turn in the same direction and that forward (right arrow on throttle) corresponds to forward motion relative to the locomotive's cab.

5. Push the throttle's 0 key to turn on the headlight and the marker lights. For the SD40, the markers are red for the opposite direction of travel. So if the direction is forward, the forward headlight will be on and the rear marker lights will be red. Change throttle direction to reverse and confirm that the rear headlight turns on, the rear marker lights turn off, the front headlight turns off and the front marker lights turn on red. Push 0 to turn off the headlights.

6. Push the * key followed by the 0 key which is function 10. Listen carefully for the small fan to start running in the smoke generator. Push * and 0 again to turn it off. Since there is no fluid in the generator, be sure and turn it off.

7. Push the * key followed by the 1 key which is function 11. The cab, number boards and the dome flasher will turn on.

8. If you have installed the Phoenix sound decoder, push the 2 key and the P8 horn will sound.

The most common problems found at this stage are easy to fix.

Green Power LED doesn't turn on: Make sure the Drop-In decoder power switch is on. The power LED does not turn on even though the sound module is operating OK.

Red GP LED flashes slowly: This is your indication that the throttle's frequency doesn't match the decoder's frequency. Set the throttle's frequency to 0.

Locomotive moves backwards instead of forwards: The front motor connection is closest to the fuse. The rear motor connection is closest to the radio module. Swap these two connections to fix the direction problem.

Sound decoder makes no sound: First confirm that the plug having the brown, green and orange wires is firmly plugged into the sound decoder. Next check that the speaker is plugged in. Next confirm the sound power switch in on. Also push and release F7 on the throttle to set maximum volume. If the sound module remains silent, it may need to be reprogrammed via the programming cable. Wait until the locomotive is fully assembled before doing this.

Connect The Smoke Unit

The smoke unit consists of a fan and a heater-resistor each with their own set of wires and plugs. These must plug into the smoke control unit and into the correct headers. Before starting, remove the tape holding the wires to the inside of the shell.

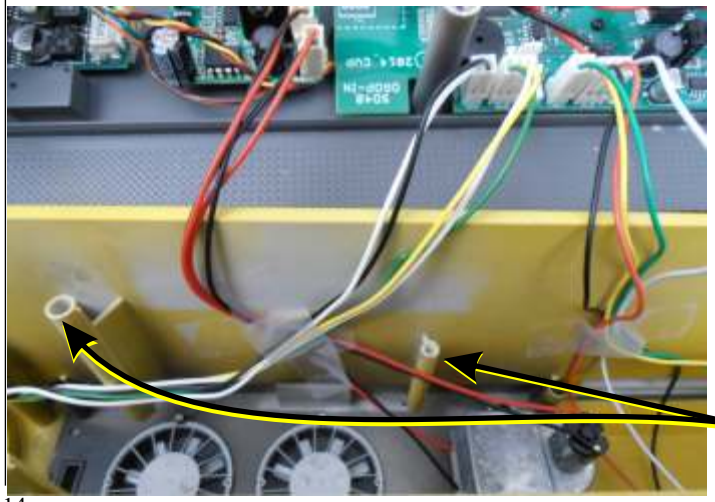
Note where the wires originate. The fan motor is easy to see and that set of wires should be plugged in first. Move the bundle of the other wires towards the center of the loco and insert the plug.

The other plug goes to the heater-resistor and it plugs into the header labeled RESISTOR on the smoke control unit.

On our loco, the headers didn't fit tightly so take care when handling the cab so they don't pull off.

Fasten Lighting Wires To Shell

Use some tape to fasten the wires to the upper sides of the shell. Keep the wires away from the mounting posts. The wires need to stay in place as the shell is placed on top of the chassis. This will also keep the wires away from the antenna.



Mounting Posts

Phoenix P8 Programming Jack and Speaker Mounting

Phoenix P8 Programming Jack Installation

The Phoenix P8 sound module uses a programming jack to connect it to a PC for editing and downloading of sound files. For fast mounting, use quick-set epoxy or hot-melt glue. First, remove and discard the nut from the black programming jack - the fuel tank wall is to thick for the jack's threads. Bend the wires at the small plug so the nut will slip over them.

Programming Jack Location and Mounting

The programming jack is installed into the side of the fuel tank at the location of the round fuel sight glass. This location was selected due to the short length of the P8 programming cable and jack. There is a plastic cover over the hole which is easily popped out. The 5/16 inch drill bit will have no trouble enlarging the hole for the jack. Remove all burrs from around the hole.

Push the small plug and wire through the fuel tank hole. Use either epoxy or hot-melt glue to permanently mount the jack.

Speaker Mounting in Fuel Tank

Although the fuel tank is not the best place for a speaker, it does make for a fast and easy installation.

Newer speakers from Phoenix include a two wire plug pre-attached to the speaker. If yours is different, solder the wires to the speaker before mounting it. Hot melt glue is the quickest method to mount the speaker although some people prefer silicone adhesive which takes longer to dry. We like hot-melt glue simply because it fills gaps and hardens within a couple of minutes

Center the speaker in the grill opening. Place the hot melt glue nozzle into the speaker's corner mounting hole and squirt out a blob of glue. Slowly pull the nozzle from the hole while continuing to dispense glue. This builds up a small glue "post" that holds the speaker securely to the fuel tank.

Once the "post" has cooled, squirt a bit more on top of the speaker flange to hold everything in place. Finally, place a small amount of glue around gaps between the speaker and the mounting area for best sound reproduction.

Reattach the fuel tank to the chassis. First, push the programming cable up through the large round hole in the chassis floor. Next, push the speaker plug through the same hole. Insert the two screws that hold the tank to the chassis.

Your are on the home stretch and the next few steps will go quickly.

Connect P8 and Install The Drop-In Decoder

Connect Speaker and Programming Plug

Route the plug and programming wires back towards the P8. Carefully insert the plug into the small socket on the P8. It only goes one way. Connect the speaker plug to its socket. Force the extra length of speaker wire down into the fuel tank. It will be permanently fastened down later.

Mount SD40 Drop-In

Next, verify that both power switches on the Drop-In decoder are off. The actuators will be towards the rear of the locomotive when off. Place the decoder onto the mounting posts. Make sure the jack and switches fit through the holes and the decoder is flush to the mounting posts.

Verify the wires from the speaker and programing jack are clear of the mounting posts. Use the 3 screws from the old circuit board to mount the Drop-In.

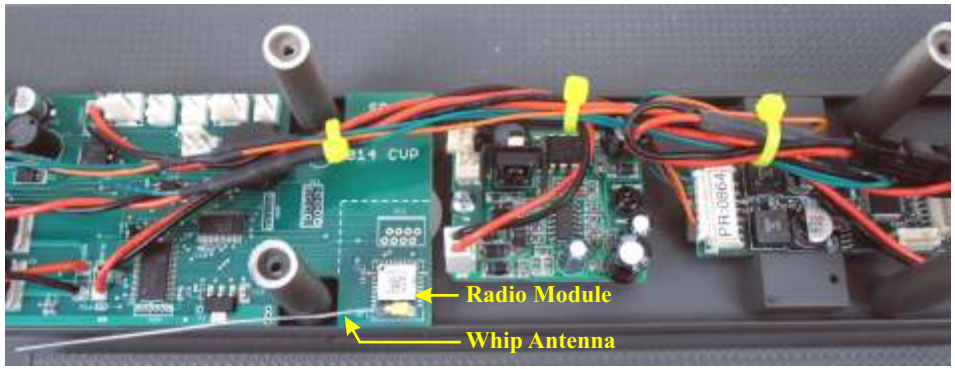
Plug In Front Motor, Rear Motor, Smoke Generator And Battery

The next set of steps involves making plug-in connections and routing cables. Plug in the front and rear motor connectors. Connect the battery to the battery socket. Plug the white socket into the smoke generator header. Be sure to select the one labeled input.

Neatness Counts As you plug in and bundle the wires, move them towards the outer edge and away from the radio module. Make sure all wires stay between the mounting posts.

Use tie wraps or twist-ties for a neat and professional installation.

Keep all wires away from the radio antenna and module.



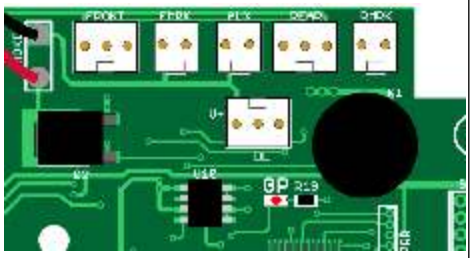
Keep all wires away from radio module and antenna.

Make sure area around the weight is kept clear of all wires and connectors or the shell will not properly seat on the chassis.

Plug In The Light Connectors

This will take a few minutes so don't rush - take your time. Orient the chassis with the cab to left. Next, place the cab shell upside down on the towel next to the chassis with the cab portion to the left. Align the cab and chassis together using the attachment posts.

Starting with the 3-wire front headlight plug, insert it into the left most header on the Drop-In. It is labeled FRONT.



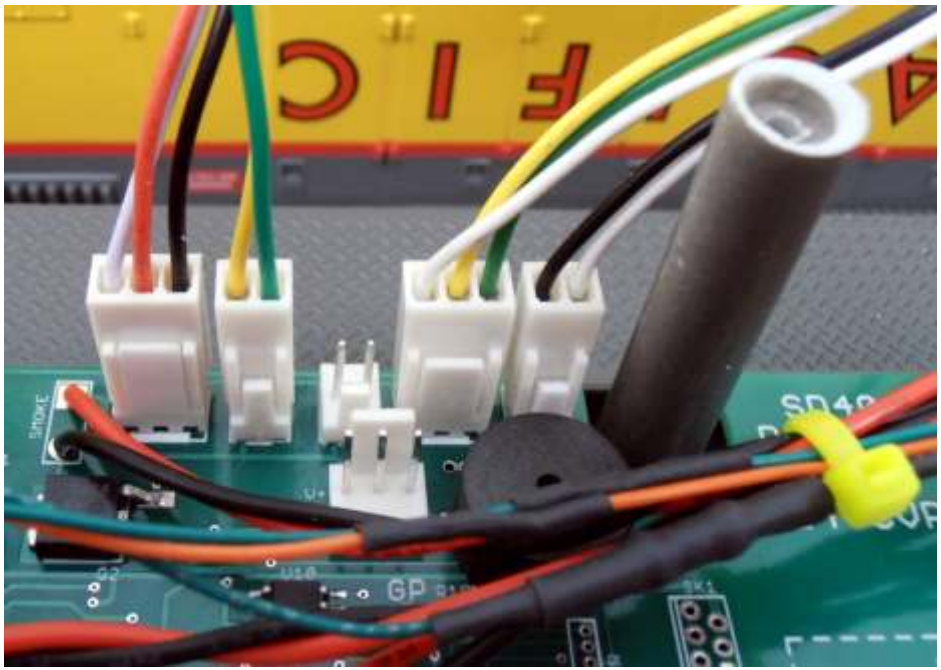
Take the 2-wire plug coming from the front of the locomotive and plug it into the header labeled FMRK.

Now take the 3-wire plug coming from the rear of the locomotive and plug it into the header labeled REAR.

Finally, take the 2-wire plug coming from the rear of the locomotive and plug it into the header labeled RMKR.

Check that the header pins go into the plug. It is easy for the pins to miss the plug.

When completed, your installation will look like the image below.



The other two lighting connectors are discussed on page 22 as well as the SD40 Drop-In Users Guide.