SD40 Drop-In Configuration Variables List

This is the complete list of all CVs used in the SD40 Drop-In. The "Orig Value" column shows the original factory value when new or after decoder is reset. Changes to CV values are remembered without battery voltage

CV #	Orig Value	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
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	0-99	F1 Function Key Action
CV36	0	0-99	F2 Function Key Action
CV37	9	0-99	F3 Function Key [RCOUPLR]
CV38	15	0-99	F4 Function Key Action [DL On]
CV39	1	0-99	F5 Function Key Action [CRUISE]
CV40	3	0-99	F6 Function Key Action [E1]
CV41	0	0-99	F7 Function Key Action
CV42	0	0-99	F8 Function Key Action
CV43	4	0-99	F9 Function Key Action [E2]
CV44	2	0-99	F10 Function Key Action [SMOKE]
CV45	5	0-99	F11 Function Key [E3]
CV46	0	0-99	F12 Function Key Action
CV56	0	0-255	Bump Amount
CV57	0	0 - 127	Bump duration in us
CV59	3	1-15	Headlites Effect Period (x512ms)
CV60	0	0-15	Headlights Mode 0=normal/autorev
CV61	4	0-15	Headlight Front Lighting Effect
CV62	4	0-15	Headlight Rear Lighting Effect
CV63	0	0-1	Cruise Mode - 0 Norm, 1=Track
CV64	4	1-16	Cruise Track Rate (ms)
CV65	2	1-3	Cruise Track Step Size
CV200	0	0-16	RF Frequency number
CV201	3	1-15	Light Effect Period (x512ms)
CV202	4	0-15	ELITE#1 Lighting Effect
CV203	4	0-15	ELITE#2 Lighting Effect
CV204	4	0-15	ELITE#3 Lighting Effect
CV205	4	0-15	ELITE#4 Lighting Effect
CV206	0	0-255	ELITE#4 Auto-off Timer
CV207	3	0-255	DLites Flash period (x256ms)
CV208	0	0-255	DLites Mode (0=On, 1=Off)
CV209	15	0-255	DLites Flash Timeout (seconds)
CV212	3	0-255	Smoke Timeout (default = 3 minutes)
CV213	8	0-99	Function Key 13 [FCOUPLR]
CV214	6	0-99	Function Key 14 Action [E4]
CV215	99	0-99	Function Key 15 [Cruise Off]

CV Value	Function Key Action
0	No Function
1	Activate Cruise Control
2	Smoke Enable
3	Toggle ELITE#1 on/off
4	Toggle ELITE#2 on/off
5	Toggle ELITE#3 on/off
6	Toggle ELITE#4 on/off
7	Dim Headlighs on/off [Rule 17]
8	Activate Front Coupler
9	Activate Rear Coupler
10-14	reserved
15	Activate Ditch Lights
99	Deactivate Cruise Control

CV Value	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 w/speed change)
1	Tracking mode (Cruise stays on)

CV Value	Front Headlight, Rear Headlight Mode
0	Normal, autoreverse
1	Normal with rule17
2	Front headlite on always
3	Front headlite on always w/ rule 17
4	Rear headlite on always
5	Rear headlite on always w/ rule 17
6	Front & Rear both on
7	Front & Rear both on w/ rule 17
8	Swap F to R Auto Reverse
9	Swap F to R Auto Reverse w/ rule 17
10-15	reserved

r2 SEPT 2023

NEW

AirWire900®
USA-Trains
SD40 Drop-In™ Decoder
Installation Guide

AIRWIRE® 900

Drop-In Kit Contents
SD40 Drop-In Decoder
Charger Pigtail
DCC Pigtail
SD40 Install Guide
Drop-In User Guide

CVP Products
www.cvpusa.com

Before You Begin: Gather Your Tools and Optional Items

The following items are needed in addition to the Drop-In decoder. Some are optional [OPT].

14.8V 6800mAh rechargeable battery: The BAT2 from CVP is recommended. The CVP BAT2 is a 14.8V, 6800mAh, Lithium-Ion rechargeable battery.

Battery Charger: The CHARGER1 Li-Ion Smart Charger, from CVP is recommended. The Drop-In decoder comes with a plug that is spliced onto the charger.

Heatshrink Tubing: Amazon is the best place to find kits at reasonable prices. Search for KOOWIN 300. It has 300 pieces in 5 different diameters in a plastic organizer for less than $10.

Long Shank #1 Philips Screwdriver: See page 6.

3M VHB Double-Sided Tape: extra strong used for attaching the battery. It does not disintegrate like classic double sided foam tape. Get it at office supply stores, Home Depot or Amazon.

Small 6 inch Plastic Tie-Wraps: For bundling wires. Get them at Home Depot.

Styrene 1/4 inch Square Rods: Used as spacers for battery mounting. Other materials can be used as spacers too but they must not be metal. Amazon has a wide selection of styrene rods.

Soldering Iron: Bigger is not better for these jobs. We use Hakko and Weller (Apex) temperature controlled irons. They might cost more but they will last a lifetime. See the Weller W60P3-ND sold by Digikey. www.digikey.com

No-clean flux solder: This is the preferred solder for small soldering jobs. Solder joints are clean and shiny without any brown or burned rosin flux residues. Use 63/37 solder having a 0.020" diameter. The Digikey part number is WBNCC633720-4OZ. www.digikey.com

Small Wire Cutters: Diagonal wire cutters with small narrow jaws are best.

[OPT] DCC Sound Decoder: The new Phoenix PB22 or the Soundtraxx TSU4400-EMD are recommended for use with the SD40 Drop-In. Both Phoenix and Soundtraxx decoders require very little programming which is best if you are new to DCC sound decoders. The two companies also provide excellent support for their products with fast and accurate responses to our emailed questions.

Soundtraxx	https://www.soundtraxx.com
Phoenix Sound Systems	https://www.phoenixsound.com

The TCS WOW501 can be used but it requires much more setup and programming when used with AirWire. Also, it was disappointing that the company did not respond to emailed questions regarding setup of their decoder in an AirWire installation.

Do not use ESU/LOKSOUND decoders since they do not include a user programmable CV11.

[OPT] Speaker to fit fuel tank: There is no speaker included with the locomotive. A round or square 2.5 inch speaker will fit in the locomotive speaker grill. Soundtraxx, and Phoenix offer suitable speakers. Speakers can also be purchased on Amazon.

[OPT] Whip Extension Cable (WEC) is a low cost way to improve the Drop-In reception range. It is used to relocate the Drop-In's whip antenna away from noisy motors and wiring. It's about 14 inches long and comes with matching connectors that snap onto the radio module and the whip antenna.

[OPT] ALT6 Connector Cable: There is a socket on the Drop-In, labeled ALT, that offers additional lighting features. If you intend to add additional lighting, beyond what comes with the locomotive from the factory, you will need the optional cable. Order part number ALT6 direct from CVP Products or an authorized AirWire dealer.

[OPT] Remote Uncouplers: The Drop-In decoder includes two sockets and drivers ready to use with the Phoenix remote uncouplers. Note: Kadee remote uncouplers **CANNOT** be used with the Drop-In.

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 no other throttle is using the same frequency. Throttles cannot share a frequency. They will jam each other preventing proper operation of their respective locomotives.

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. Disassemble the locomotive to check these items.

Train Stops When It Is Far Away
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.

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 www.cvpusa.com and click on the big red box labeled REPAIR SERVICES. There you will find the repair submission form as well as the correct address to use when sending packages to CVP Products. **Do not send items to us for repair without first obtaining authorization.**

ALT Light Connector Pinout and Example Use

Pin 1: Battery + switched

Pin 2: DLL - Ditch/Safety Light Left

Pin 3: DLR - Ditch/Safety Light Right

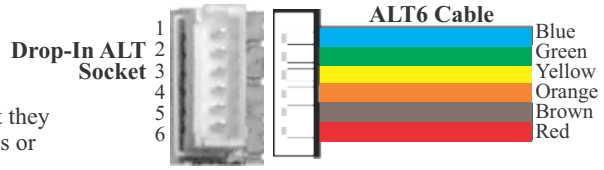
Pin 4: ELITE2

Pin 5: ELITE3

Pin 6: ELITE4

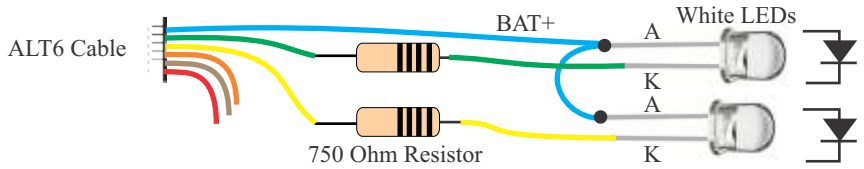
All outputs are rated at 1 Amp but they are not protected against overloads or short circuits.

For more details about using the ALT Light options, see the Drop-In User Manual. The optional ALT cable is available from CVP Products. Order part number ALT6.



All ELITE and Ditch Light outputs can be thought of as simple toggle switches to battery negative (ground). The outputs do not output a voltage when turned on. All lights connected to the ALT connector must be provided with a source of positive voltage. Battery plus voltage is available on the blue wire (pin 1) of the ALT connector.

Hookup Example - Ditch/Safety Lights. The DLL and DLR outputs are designed to drive white LEDs. LEDs will look best for ditch lights. The Ditch Light effect makes the LED fade in and out just like the ditch lights on a prototypical locomotive when activated. The DL output is turned on with the headlight function - F0; activation is with F4. On the SD40 Drop-In, the default function key assignment for DL activation is F4. However, you can change this at any time. The 750 ohm resistor is used for the 14.8V BAT2 battery. Unused wires are shortened. Make sure no bare wire is exposed.

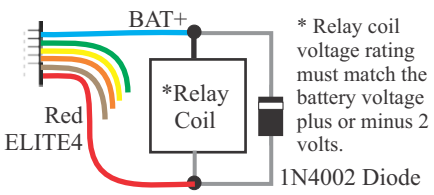


Ditch Light Flash Rate (CV207): The factory setting for CV207 is a value of 3. This sets the ditch light flash rate to about a 3/4 second on followed by a 3/4 second off. A value of one sets the highest rate or about 1/4 of a second. A value of 4 sets the rate to about 1 second. A value of 0 is rejected.

Ditch Light Mode Setting (CV208): There are 2 modes. When CV208 is set to a value of 0, the Ditch Lights are on when the headlights are turned on. When CV208 is set to a value of 1, the ditch lights turn on when they are activated. Once the flashing has timed out, they turn off.

DitchLight Timeout (CV209): The factory setting for CV209 is a value of 15 or about 15 seconds before the flashing stops. The maximum value is 255 or about 255 seconds.

Hooking Up A Relay Instead Of An LED



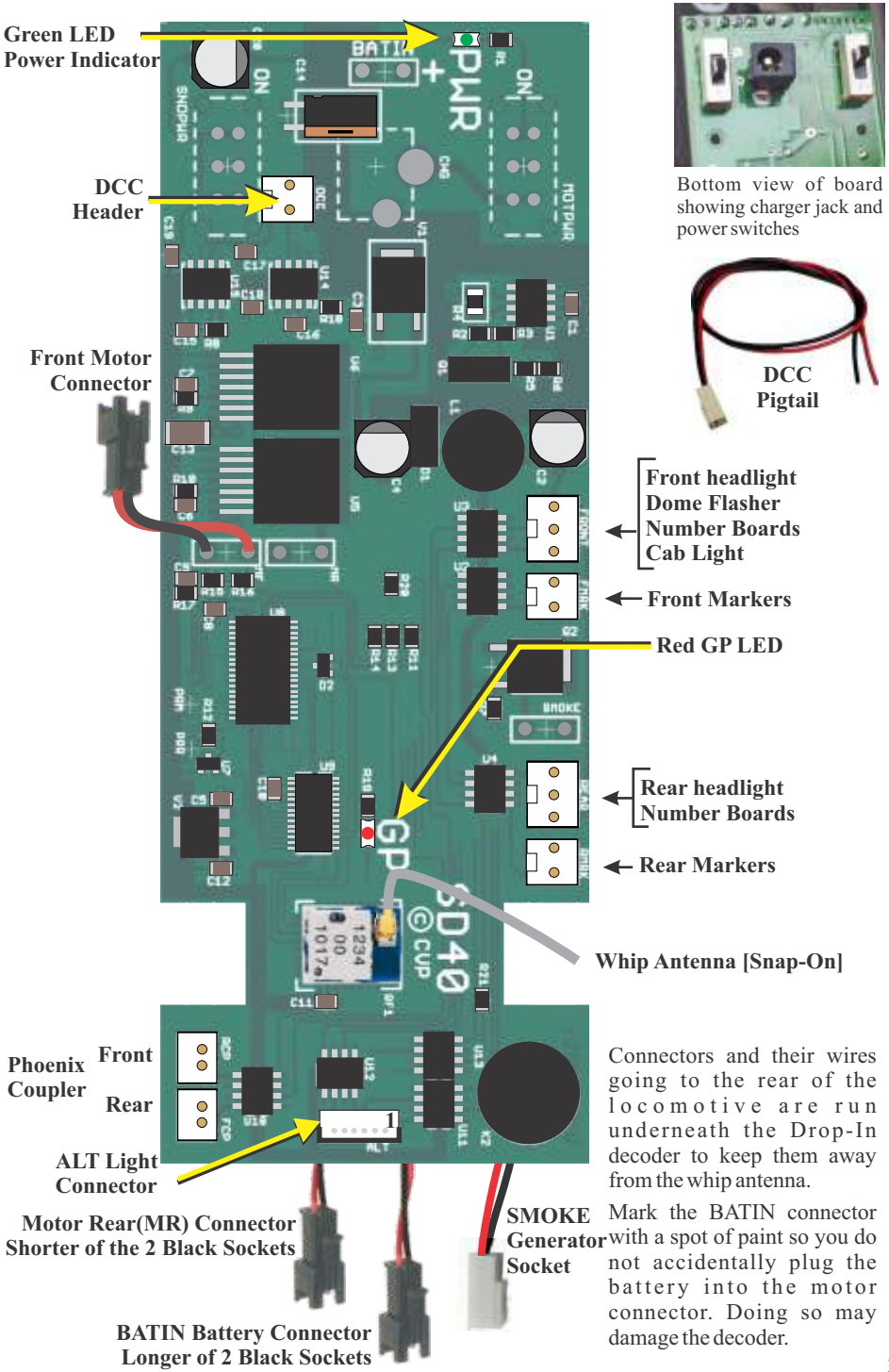
* Relay coil voltage rating must match the battery voltage plus or minus 2 volts.

A relay or a solenoid can be driven by the ALT outputs. Just be sure the relay coil voltage rating is close to the battery voltage.

Always install a diode across the relay or solenoid coil. The banded end connects to the relay coil that connects to the battery plus wire. The diode's other end goes to the relay coil that connects to the LED driver.

ELITE #4 output has the added feature of an automatic shutoff timer. You can set the automatic timeout to turn off the relay, from 1 to 255 seconds (~4 minutes) after it is turned on. The timer is controlled by CV206. A value of 0 disables the timer and allows manual on and off control.

SD40-2 Drop-In Decoder Familiarization



Connectors and their wires going to the rear of the locomotive are run underneath the Drop-In decoder to keep them away from the whip antenna.

Mark the BATIN connector with a spot of paint so you do not accidentally plug the battery into the motor connector. Doing so may damage the decoder.

Attaching Charger Plug Pigtail To Charger

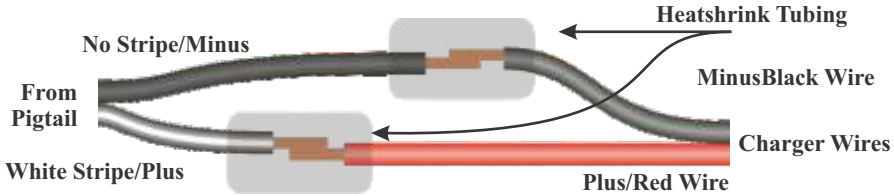
The charging pigtail needs to be permanently attached to the charger output wires. First, open up the charger box. Inside will be the charger with alligator clips and the AC power cord.

Locate the charger pigtail that came with your AirWire Drop-In decoder. The 2-conductor pigtail comes with stripped wires on one end and a right angle plug on the other.

Wire polarity is very important. On the pigtail, the plus wire is the wire with the white stripe. The minus wire is the solid black wire. On the charger, the red wire is plus and black is 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 insulation from the plus wire. Twist the strands together and apply solder to the twisedt end of the plus wire. This is called tinning and keeps the twisted wires from unraveling. Next, 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.

Take the charger wires and split the red and black wires apart for about 3 inches. Cut off the alligator clips and cut the minus (black) wire so it is 1 inch shorter than the plus (red) wire. Remove about ½ inch of the insulation from both the black and red ends of the wires. Twist and tin the wires. Solder the charger pigtails to the charge pigtails. Insulate the solder joints with heatshrink tubing.



Verify Battery Pack Connector Polarity

Locate The Drop-In BATIN Socket. Mark this socket with an easy to see spot of paint.

The motor connector and the battery connectors look the same. Be careful. DO NOT accidentally plug the battery into the motor connector. The Drop-In decoder will be damaged.

Check The Battery Pack For Proper Polarization. The CVP BAT2 battery pack has a mating plug that is properly polarized for the Drop-In battery input socket. The drawing shows the red and black wire orientation for both the plug and the socket. Orient the battery plug and the Drop-In battery socket as if they were to be inserted. Confirm the wire colors and connector orientation match the picture below. Notice that the socket's release lever is pointing away from you.

CVP'S BATT2 Battery Pack

Never remove the plug from the battery. Doing so voids the warranty.

If you are using a different brand of battery, you must verify the polarity is correct before plugging it into the Drop-In decoder. Get help if you are not sure.

Assigning Throttle Function Keys To Drop-In Actions

Use this step-by-step sequence to assign or change what a function or action throttle key does. The assignment and the action are stored in the decoder's memory even if power is turned off.

The SD40 Drop-In decoder has many memory locations so we use the term CV# where # is a specific memory location. So CV40 means Drop-In decoder memory location number 40. The value stored at this location dictates what the Drop-In decoder does when it receives a throttle's function key command.

Always start by thinking through what you want your throttle to do to the Drop-In decoder. For this example, here's what is wanted:

"On the throttle, I want the 6 key to turn on the smoke generator."

Notice the underline of the important items: which throttle key is to be used, and what the decoder action will be when that key is pushed. For this example, F6 is the throttle's 6 key. Now you are ready to set the Drop-In decoder so that it performs the desired action when F6 is pressed.

Step 1: Find F6 in the assignment table.

From the table, the Drop-In decoder uses CV40 for F6 .

Step 2: Find the desired action in the action table and note the value. This will be what is stored in CV40.

For this example, since the smoke generator is to be toggled, which means turned on and off, the CV value of 2 is to be used.

Step 3: Turn on the Drop-In decoder's power. Set your throttle to the decoder's frequency and locomotive address if it has not yet been set. This is very important since if either the frequency or the locomotive address is wrong, the decoder will not hear the throttle's OPS PROGRAM command.

Step 4: OPS PROGRAM CV40 to a value of 2. The decoder will chirp indicating it heard and accepted the command. Escape out of OPS PROGRAM and verify that the decoder's action is correct when the 6 key is pressed on the throttle.

This same sequence is used to assign or change what the function keys will do.

Function Key Assignment Table

Function Key Assignment	CV#
F1 Function Action CV	CV35
F2 Function Action CV	CV36
F3 Function Action CV	CV37
F4 Function Action CV	CV38
F5 Function Action CV	CV39
F6 Function Action CV	CV40
F7 Function Action CV	CV41
F8 Function Action CV	CV42
F9 Function Action CV	CV43
F10 Function Action CV	CV44
F11 Function Action CV	CV45
F12 Function Action CV	CV46
F13 Function Action CV	CV213
F14 Function Action CV	CV214
F15 Function Action CV	CV215

Function Key Action Table

CV Value	Function Key Action
0	No Function
1	Activate Cruise Control
2	Toggle Smoke On/Off
3	Toggle ELITE#1 on/off
4	Toggle ELITE#2 on/off
5	Toggle ELITE#3 on/off
6	Toggle ELITE#4 on/off
7	Dim Headlights on/off
8	Activate Front Coupler
9	Activate Rear Coupler
10-14	reserved
15	Activate Ditch Lights
99	Deactivate Cruise Control

The SD40 factory wiring combines the interior cab light, the dome flasher and the front and rear number boards. All will turn on when ELITE#1 is on (F6 is the default function key setting).

SoundTraxx TSU4400 Setup

All Soundtraxx decoder setup is done using your AirWire T6000 or T5000 wireless controller. No other equipment is required. Except for the loco address number, all programming is done using OPS mode programming [OPS PROGRAM].

CV1 Decoder Address: ONLY use **Service Mode Programming** [SVC PROGRAM] for setting or changing the decoder address. Dependent upon the address number, the wireless controller will automatically program CV1, CV17, CV18 and CV29 with the proper values.

CV123 Prime Mover: As delivered from the factory the default prime mover sound is incorrect for the SD40 locomotive. We recommend using the EMD645-Turbocharge sound. Using OPS mode programming, enter CV number of 123. The value to enter is 5. Once entered, the prime mover will restart with the classic sound of a tubocharged EMD645.

CV128 Master Volume: As delivered from the factory, the master volume default setting is 128 which as about half of the maximum volume. To make the volume louder, program a larger value into CV128 up to the maximum of 255. The change takes effect immediately.

CV 114 Auto-Notching Sensitivity: As delivered from the factory, the sensitivity is set to a value of 7. This means each notch of the 8 notches in the prime mover power selector covers 7 speed steps. With this setting, the prime mover will be at notch 8 (maximum RPM) at speed step 56 out of 128 steps (7x8). Changing the value of CV114 allows compression or expansion of the speed step vs notch setting. For example, a value of 14 means notch 8 will be reached at speed step 112 out of 128 (14x8). Experimentation is the best method to select auto-notching value that works best for your railroad.

CV8 Reset Decoder To Original Settings: Using OPS programming, program CV8 to a value of 8. Invoking this master reset command will change all CV values back to their original factory settings. There are subsets of the master reset that are cover specific groups of CVs. See the technical reference for details.

Function Key Assignments: The table of default throttle function key assignments for the TSU4400 sound effects and SD40 Drop-In are shown below. They can be changed at any time.

Tsunami2 Diesel Technical Reference: There are literally hundreds of different TSU4400 settings and configurations. Download the technical reference from the Soundtraxx website.

Key	TSU Sound Effect	SD40 Drop-In
F0(fwd)	Head light	Headlight
F0(rev)	Backup Light	Backup Light
F1	Bell	Unassigned
F2	Horn	Unassigned
F3	Short Horn	Rear Coupler
F4	Dynamic Brake	Ditch Lights
F5	Manual Notch Up	Cruise Control On
F6	Manual Notch Down	CAB/#board/Dome
F7	Dimmer	Unassigned
F8	Mute	Unassigned
F9	Grade-Crossing Horn	ELITE#2
F10	Advance to Notch 8	Smoke Generator
F11	Train Brake	ELITE#3

Key	TSU Sound Effect	SD40 Drop-In
F12	Brake Select	Unassigned
F13	Coupler	Front Coupler
F14	Half-speed	ELITE#2
F15	Momentum Off	Cruise Control Off
F16	Handbrake	Unassigned
F17	HEP Mode	Unassigned
F18	Fuel Load	Unassigned
F19	General Svc	Unassigned
F20	Notch Idle	Unassigned
F21	Steam Gen	Unassigned
F22	Sander Valve	Unassigned
F23	All Aboard	Unassigned
F24-F28	FX3-FX8	Unassigned

Soundtraxx Technical Support

CVP does not provide technical support for the Soundtraxx sound decoder. If you have any TSU4400 troubles contact Soundtraxx. They will be happy to help.

(970)259-0690 support@soundtraxx.com

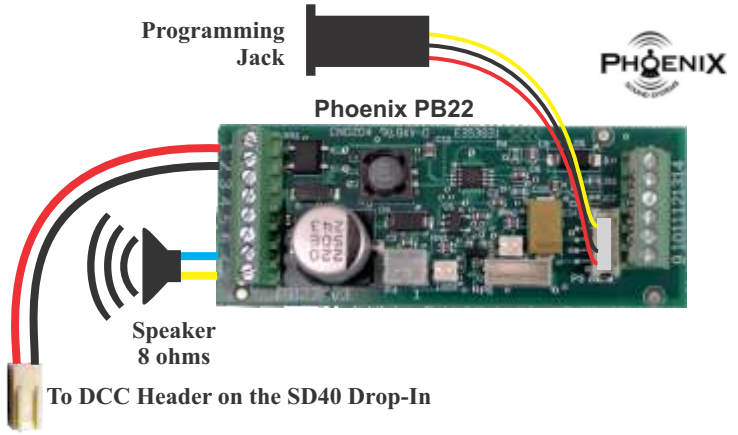
[OPT] Sound Decoder Hookup

If your installation will not be using a sound module, you can skip this section and proceed to the disassembly section.

Your AirWire SD40 includes a built-in DCC sound decoder driver. It has plenty of power and works with popular 3rd party large scale DCC sound decoders like Phoenix PB22 or Soundtraxx TSU4400. Both will be shown since their installation is nearly identical. Of the two, the Phoenix PB22 has the most powerful sound amplifier.

You may use the lighting outputs from the sound decoder. Although LEDs are the preferred low power light source, incandescent bulbs can also be used. **Do not use the sound decoder's motor drive output.** There is insufficient power from the Drop-In to do so and this might damage the Drop-In decoder.

Hookup is very simple using the DCC pigtail that came with your Drop-In decoder. Attach the DCC pigtail to the sound decoder track inputs. The speaker connects to the speaker output terminals. Phoenix also has a programming jack which is recommended to be installed. The Soundtraxx TSU4400-EMD does not have a programming jack so the proper version must be ordered. See the boxed notes below.



Order The Correct Soundtraxx Decoder

For the Soundtraxx decoder, you must order the correct version. For the SD40 locomotive, get the EMD version of the TSU4400. After the decoder is installed, simple CV programming will be done to select the correct EMD-645 turbocharged prime mover.

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.

Phoenix PB22 Setup

All setup programming is done using the Phoenix PC software and down loaded to the PB22 decoder via the programming cable/adapter. The one exception is the locomotive number which can be programmed using your T6000 or T5000 wireless controller. Obtain the PC software directly from Phoenix.

Before using the PB22, you must change the DCC timeout to a value of 0. This will disable the timeout. Without this change, if the locomotive is turned on without a throttle turned on, the prime mover will rev up to full throttle and stay there.

Out of the box, the PB22 has a fairly good set of features already to go. You can use it as is and have good sound effects.

Feature/Function	Recommended
DCC Timeout	0 [disabled]
Speed From DCC	Enabled
MTS Detection	Disabled
All "pins" and Triggers	Set to None
Fwd Horn Volume	0 [disabled]
Rev Horn Volume	0 [disabled]
Stopping Horn Volume	0 [disabled]
Bell Mode	Manual
Stopping Bell Speed	0 [disabled]
Stopping Bell Duration	0 [disabled]
Startup Bell Duration	0 [disabled]
Coupler Play Speed	0

But there are one other change we recommend. Turn off the automatic horn tooting and bill ringing when the locomotive moves. These are most annoying; the locomotive begins to move.

To make any changes in the PB22, you must use Phoenix programming software on your PC. While you're at it, why not make all the recommended changes shown in the table.

F-Key	PB22 Diesel	SD40 Drop-In
0	*Not Supported*	Toggle Headlights on/off
1	Toggle Bell	*not assigned*
2	Sound Horn	*not assigned*
3	Coupler Clank	Activate Rear Coupler
4	Grade-crossing Horn	Activate Ditch Lights
5	"All Aboard!"	Activate Cruise Control
6	*not assigned*	Toggle CAB/#board/Flasher
7	Volume Up	*not assigned*
8	Volume Down	*not assigned*
9	Brake Screech	Toggle ELITE#2
10	Brake Release DCC	Toggle Smoke Generator
11	Air Pop	Toggle ELITE#3
12	Shutdown Prime-mover	*not assigned*
13	*Not Supported*	Activate Front Coupler
14		Toggle ELITE#4
15		Deactivate Cruise Control
16		*not assigned*
17		*not assigned*
18		*not assigned*
19 - 28		*not assigned*

Function Keys

The table of throttle function key assignments to sound effects works well for the and the SD40 Drop-In and the Phoenix PB22.

You may download a CVP diesel configuration file from the Phoenix website that sets up these and other features in the PB22 sound module.

Remember that you must use the computer interface to make changes in the PB22.

Finally, if you don't like our recommend settings, please change them. Experiment! You can't hurt anything and you can always reset them back to their original factory settings at any time.

Phoenix Technical Support

CVP does not provide technical support for the Phoenix sound module. If you have any PB22 troubles contact Phoenix. They will be happy to help you out.

(800) 651-2444 phoenixsound@phoenixsound.com

Restoring SD40 Drop-In To Original Factory Settings

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. If you made any changes to the Drop-In decoder, these will all be cleared and reset to the original factory settings.

This procedure will not reset the sound decoder.

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. Bring up the T6000 hidden menu - page 2. Push 4 for SVC PROGRAM.

6. Push 8 and ENT for CV8.

7. Push 1, 3, 5 then 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 sound decoder has not been changed. To match sound and motion, program the desired loco number into both decoders using SVC PROGRAM mode.

Reset Commands Are Unique To The Decoder

An AirWire reset command will have no effect on the attached sound decoder. Likewise, a sound decoder reset will have no effect on an AirWire decoder.

SD40 Drop-In Decoder Quick-Start Guide

Speed and direction are controlled from the throttle. Use the throttle's knob to change speed. To change direction, push the direction key on the T6000 or push down on the T5000 speed knob. "Forward" direction is defined as if you were sitting in the locomotive cab.

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. Marker lights turn red, depending on the direction of travel.

The dome flasher, cab interior and number boards are turned on and off with Function 6.

Smoke generator is turned on and off with F10. To activate F10, first push the * key followed by the 0 key on the T6000 or 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.

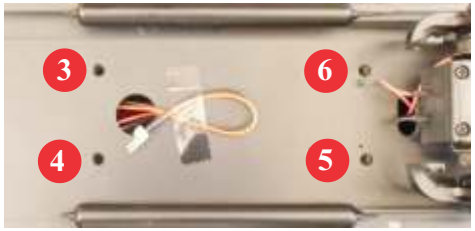
Phoenix Couplers (if installed) are activated by F3 for the rear coupler and F13 for the front coupler.

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.

SD40-2 Disassembly

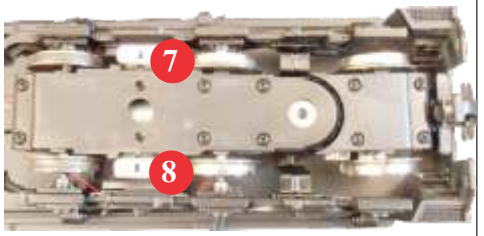
Center Chassis - Under Fuel Tank [4 Screws]

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. Remove the tape from the speaker connector which will be removed later.



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.

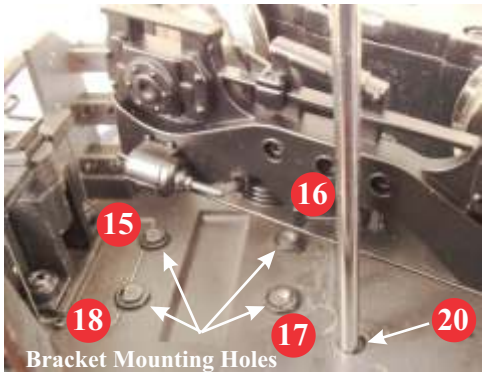


Cab and Front Truck [12 screws]

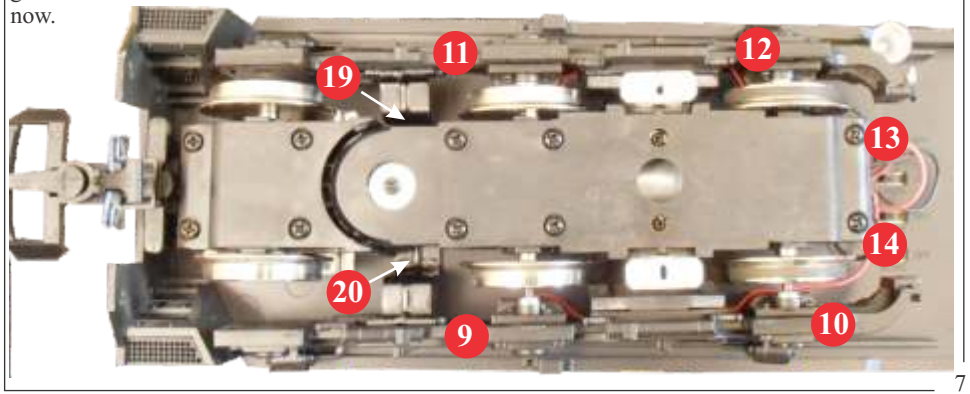
Remove the 4 small screws that hold the cab to the chassis. The side frame obscures the screws in the picture but they can be easily seen and reached. These are smaller screws than the chassis screws - don't loose them.

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.



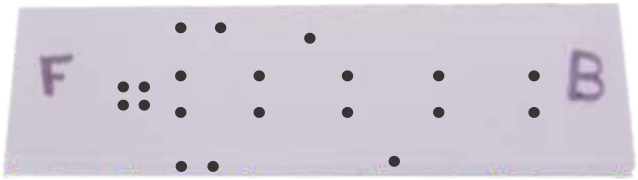
Remove the 4 screws holding the slotted bracket. These are different looking screws - don't loose them. With the bracket free, rotate the entire truck including the front wheels to expose the openings of the hollow tubes. If needed, use gentle pressure to get the screwdriver into the hole. Rotate the 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 top shell down next to the chassis. Take care not to pull any wires loose. In our unit, the smoke unit wiring was tight and the 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 large black plugs and sockets. Press down on the tab to release it. Don't pull on the wires. Remove the speaker wire from the bottom of the chassis. The speaker connector can be discarded.

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.

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.

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. Turn off the sound decoder since the frequency CV is a shared CV.

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 at least one full minute.

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

Step 5: Activate the T6000 hidden menu page 2. Push 4 to select SVC PROGRAM mode.

Step 6: Enter 2,0,0, 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 switch off, then back on. The SD40 Drop-In decoder is now on the new frequency. Also berify the throttle is on the new frequency and drive away.

Turn On Throttle First Then Turn On Locomotive

To avoid any surprises, first turn on the throttle, and select the appropriate loco number and frequency. Then power up the locomotive. When the decoder is powered on it will receive its throttle data so the lost frequency countdown will never commence. Even if the throttle is turned off, but the loco is remains powered, the countdown will never commence.

It is the combination of first turning on loco power without ever receiving its throttle data that initiates the 60 second countdown.

Overlapping CVs - Drop-In and TSU-4400-EMD

There are several CVs used in the Drop-In that are also used in the Soundtraxx TSU-4400 but they have different meanings and functions. Changing a CV with both units powered on will reprogram **both** the Drop-In decoder as well as the TSU-4400.

Always turn off the Sound Power Switch if you **only** want to program the Drop-In.

Assuming you want to change a TSU-4400 CV, first verify it is not used on the Drop-In decoder. Check the Drop-In CV list on the back page of this booklet. If the TSU-4400 CV is not listed, then you may program it knowing it will have no effect on the Drop-In. However, if the same CV is used on the Drop-In, then a special programming sequence must be followed.

First step is to know the current value for the Drop-In CV. The original factory value is shown in the ORIG VALUE column of the Drop-In CV List. If you have never changed the CV, just make a note of the value. If you have changed a CV value, consult your notes to determine the value used.

1. Program the desired value into the TSU-4400 CV. (It also programs the Drop-In CV).
2. Turn off the Drop-In's SNDPWR switch. This turns off the TSU-4400.
3. Program the Drop-In CV back to the desired value. Since the TSU-4400 is turned off, it will not get the programming command
4. Turn the Drop-In's SNDPWR switch back on.

Changing The Drop-In & Sound Decoder Addresses

These steps assume the locomotive and sound decoder are on their original factory settings.

Address changing is simple and straight forward using the T6000 or T5000 wireless controller. Always use Service Programming mode when setting the decoder address. As long as both Drop-In power switches are turned on, the sound decoder will be programmed to the same address as the Drop-In decoder. This procedure assumes Drop-In and sound decoder are still on factory settings.

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

1. Turn on the throttle. Be sure the throttle frequency is set to 0.

2. Turn on both power switches on the SD40 decoder.

3. Bring up the hidden menus on your T6000. Push MENU once then push and hold the ENT key until the first page of the menu appears. Push MENU again to bring up page 2 of the menu.

4. Push 4 to select SVC PROGRAM.

5. Push 1 to select configuration variable (CV) number 1 and ENT.

6.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.

7. 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.

8. Set your throttle to the new decoder address. Set the direction and turn up the speed knob and you are in control.

Changing The SD40 Drop-In Decoder Frequency

These steps assume the locomotive is still on its original factory frequency setting of 0.

There are 17 Unique Frequencies Available - The frequencies are numbered from 0 to 16 for a total of 17. It is recommended that the frequency be derived from the cab number. Either the first or the last set of digits can be used. That makes it easy to recall the frequency if you forget. Otherwise, place a label on the bottom of the locomotive.

Setting The Frequency - The desired frequency is stored inside the decoder in configuration variable number 200 which is abbreviated CV200. Service programming is recommended because a locomotive address is not needed.

> *The Drop-In and the sound decoders share some CV numbers with CV200 being a good example. Be sure to turn off the sound power switch so as not to accidentally change a sound decoder shared CV.*

1. Turn on the throttle. If not already set, set the throttle to frequency 0.

2. Turn on the Drop-In decoder's power switch.

3. Verify the the sound decoder power switch is off.

4. Bring up the T6000 hidden menu page 2. Push 4 to select SVC PROGRAM mode.

5. Enter 2,0,0 followed by ENT.

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

7. Push ESC to cancel SVC PROGRAM mode.

8.Change the throttle to the new frequency. Verify the loco number is correct.

9. Power on the sound decoder and drive away.

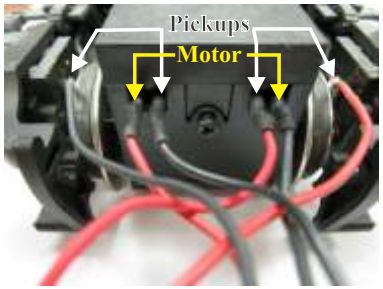
USA-Trains SD40 Disassembly

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 wiring connectors away from the chassis. If the truck is turned right side up, don't allow the swiveling part of the truck to drop down below the main truck or the drive shaft may disconnect. If it does, you'll have to disassemble the main truck to reconnect it.



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

Remove the Front Truck Pickup Wires and Socket

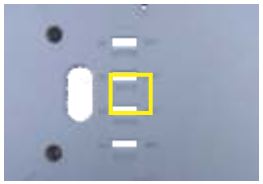
The track pickup wires are no longer required and can be removed from the truck. The pickup wires are a set of 4 wires attached to a black socket. The motor wires are 2 wires connected to a black plug. Do not confuse the pickup wires with the motor wires.

First pull the pickup wires from the pins on the truck case. Cut the other two wires from the side-frame pickups. The pickup wires can be discarded. When done, there will only be the two motor wires connected to the outside pins of the motor case. Don't reinstall the front truck yet.

Remove the Rear Truck Pickup Wires

Temporarily remove the rear truck mounting screw and washer. Notice the rear truck has the same set of connectors and wires for the motor and pickup wires. Remove the pickup wires from the rear truck as was done on the front. Reattach the rear truck when finished.

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

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

You might wish to temporarily attach one of the screws to the front wheel's slotted bracket at this time.

Battery Mounting

This installation makes use of the CVP BAT2 Lithium battery pack.

Remove The Rear Weight and Trim The Mounting Post

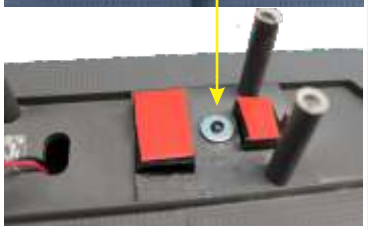
Remove the rear weight from the locomotive by unscrewing the two outer screws. The center screw holds the truck - do not remove it. Remove the weight and discard. The screws may also be discarded.

The weight's plastic spacer 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.

Originally we recommended 3M doublesided foam tape. However, this tape cannot withstand hot temperatures and will soon disintegrate. VHB tape, also by 3M is much better and preferred. It has no foam core - it is a solid piece of sticky tape. It is a bit thinner. But it's holding power is superb.

The battery is installed after first mounting some solid plastic rectangular rods with hot-melt glue. The styrene rods need to be 1/4 inch thick. This will insure the truck mounting screw is not touched by the bottom of the battery. The front piece is 1.4 inches wide. The rear piece is 3/4 inch wide. The VHB tape is placed on top of the rod. Remove the orange protective layer. Position the battery so it is snug against the rear mounting posts. Then press the battery firmly onto the tape.

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



Phoenix PB22 Programming Jack Mounting

Skip This Step If Using A Soundtraxx Decoder

The PB22 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 too 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 the next step, the fuel tank is fitted with the optional speaker for use with sound modules. If your locomotive will not be using a sound module, skip this step and proceed to page 12.

Reassembly *(continued)*

The top shell will seat itself correctly and easily onto the chassis 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 off the fuel tank and insert the two screws into the their mounting holes and tighten. 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.

To access the screws behind the fuel tank, first remove it. Install the two chassis screws. Before putting the fuel tank back in place, roll up and tape the speaker wires to the bottom of the chassis. The wires must not touch the back of the speaker. Put the fuel tank back in place and reinsert 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 like windshield wipers.

If You Accidentally Break A Wire

If you accidentally break a 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.

Final Lighting Checks

1. Turn on your throttle. Set it to frequency 0 and address 3 and forward (triangle points right). Set the speed to 0. Set the direction to forward (right pointing triangle).

2. Turn on both Drop-In power switches. The ON position is when the slide switch is towards the cab.

3. Push the throttle's 0 key (F0) to turn on the headlight. Provided the throttle is set for forward, the headlights will be on, the front markers will be off and the rear markers will be red. Change throttle direction to reverse and confirm that the rear headlights turn 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.

4. Push the 6 key (F6). The cab interior light, the front/rear number boards and the dome flasher all will turn on. Push F6 again to turn them off.

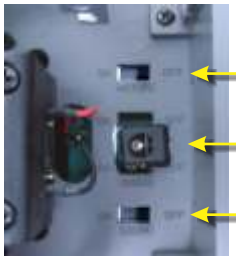
5. Push the * key then push the 0 key (F10). Listen carefully for the small fan to start running in the smoke generator. Push * and 0 again to turn it off. Since there is no fluid in the generator, be sure and turn it off.

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.


Slide Switch Actuator
Towards Fuel Tank = OFF

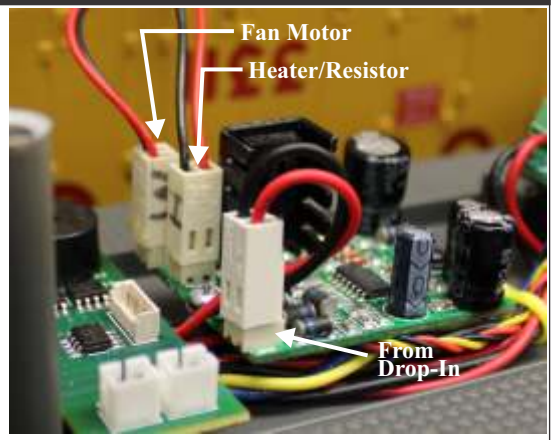


Connect The Smoke Unit

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. Use a marker to mark the headers.

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

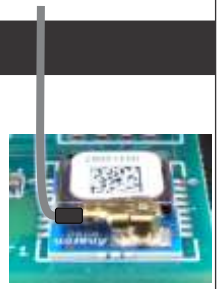


Our unit had very loose plugs. Take care when handling the shell to avoid disconnecting them.

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 tubing portion of the connector. Straighten out any kinks so that it favors a vertical orientation and stays upright by itself. The gold connector on the antenna freely rotates on the radio module.

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



For Longer Range - Consider The WEC

The whip antenna can be unsnapped from the radio module and snapped onto a Whip Extension Cable (WEC). The other end of the WEC snaps onto the radio module. The WEC is about 14 inches long which is of sufficient length to move the antenna far away from noisy motors and wiring.

It OK to bundle the WEC cable with other wiring. The cable's shield protects against noise pickup. Use tie-wraps secure the cable.

Just about any location away from noisy wiring works best to mount the antenna. It can be mounted on the outside of the shell. Non-metallic paint can be used to disguise the antenna.

Orienting the whip vertical is usually the best. However, horizontal also works. Try both and pick the one that provides the best range for your railroad.

Prepare Lighting Wires For Reassembly

As delivered from the factory, most of the shell's lighting wires are loosely taped inside the shell. It is suggested to twist the front set of wires and the back set of wires into front and back bundles for easier handling before plugging in the connectors. Bend the wire bundle down towards the Drop-In board. The wires need to remain clear of and between the mounting posts as the shell is placed on top of the chassis. Use some VHB tape to help keep the wires held in place until the shell is permanently fastened down.

As the shell is lowered to the chassis watch the wires. Reposition the wires as needed to keep them between the posts. Check on both sides of the shell. Look for exposed wires and fix them.

continued on the next page

Speaker Mounting *continued*

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 is fast.

Center the speaker in the grill opening before gluing.

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. Place a small amount of glue around gaps between the speaker and the mounting area for best sound reproduction. Verify the speaker's magnet is below the top edge of the fuel tank. If not, the fuel tank cannot be reinstalled. Seat aside the tank for now. The speaker will be wired later.

Preparing the Sound Decoder

It is easier to attach the 4 wires to the sound decoder before it is permanently installed.

DCC Pigtail: Do not shorten the pigtail. Strip off about 1/4 inch of insulation from both wires of the DCC pigtail. Tightly twist the strands. Heat the wire with your soldering iron then apply a small amount of rosin-core or no-clean solder to the wires. This process is called tinning and prevents the wires from fraying. Do this to both the red and black wires. Connect the two wires to the proper terminals as shown on page 5.

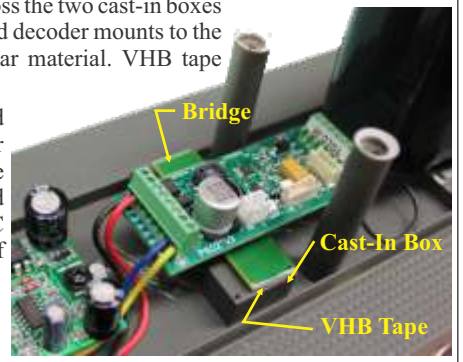
Speaker Wires: Cut two 12 inch lengths of stranded #24 AWG wire. Larger wire is OK but it will be stiff and hard to work with. Insulation color is not important and both can be the same color. In the pictures, the red and black wires are the DCC pigtail. The blue and yellow wires are for the speaker. Strip back both ends of each wire about 1/2 inch. Tightly twist the strands and tin the ends. Loosely twist the two colored wires together. Connect the two wires to the decoder's speaker terminals. The speaker wires will be soldered to the speaker later.

Mount The Sound Decoder

SOUND DECODER (horizontally mounted)

It is best to attach a thin piece of plastic to bridge across the two cast-in boxes where the sound decoder will be mounted. The sound decoder mounts to the bridge. Use a piece of thin styrene or other similar material. VHB tape attaches the bridge to the boxes.

Once the bridge is ready, it is time to mount the sound decoder. First route the DCC pigtail and the speaker wires underneath the bottom left corner of the smoke generator. Push the speaker wires through the round hole next to the smoke generator. Route the DCC pigtail up towards the front cab. Use a small piece of VHB tape to keep the DCC pigtail flat on the floor.



Speaker Hookup And Fuel Tank Mounting

Turn the locomotive on its back. Position the fuel tank next to the chassis. Pull the speaker wires towards the speaker. Solder the two wires to the speaker. There is no polarity associated with the two wires. Any excess wire can be coiled up and taped to the chassis. Be sure the wires will not touch the speaker cone when the tank is reinstalled.

The optional Phoenix programming cable is pushed through the hole in the chassis floor. Plug the programming cable into the Phoenix decoder programming socket - P3. (See page 3.)

Reattach the fuel tank to the chassis. Insert the two screws that hold the tank to the chassis. *There are two screws hidden by the fuel tank to hold the chassis to the shell. You can leave them out if desired.*

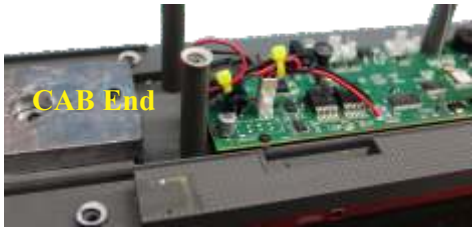
SD40 Drop-In Decoder Installation

Be sure to mark the BATIN connector with a spot of paint to distinguish it from the rear motor connector. Accidentally swapping the two connectors will damage the decoder.

First, push the power switch actuators towards the center of the board to turn them off. Place the decoder onto the mounting posts. Make sure the charging jack and power switches fit through the holes and the decoder is flush to the mounting posts. Check that the three connectors from the bottom of the Drop-In are routed towards the smoke generator board. Make sure all wires are between the mounting posts. Use the 3 screws from the old circuit board to mount the Drop-In.

Cab End Connector Attachments

First plug the DCC pigtail into the DCC connector. It only fits one way. You may have to rearrange the routing of the pigtail to insure there is sufficient wire length so as not to strain the connectors.



Next plug in the front motor connector. It too only fits one way.

Neatness counts and insures none of the wires are punctured when the shell and the chassis are mated. Use small tie-wraps (yellow so they stand out) to hold and position the wires. Make sure the wires and connector are away from the cab end's weight. The wires must be between the mounting posts. **If the area around the weight is not kept clear of all wires and connectors the shell will not seat properly on the chassis.**

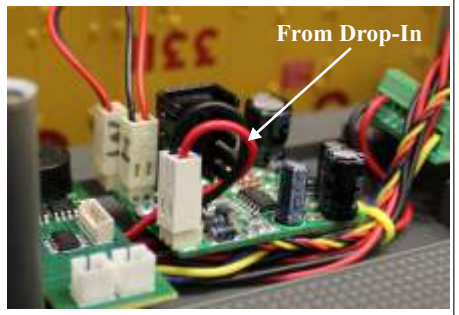
Rear End Connector Attachments

Before making the connections, inspect the routing of the wires. They must be under the lower left corner of the smoke generator.

First connect the rear motor to the rear motor connector. Double check that you have not accidentally swapped the motor and battery connectors.

SD40 Drop-In Installation and Hookup *continued*

Next connect the white smoke socket to the smoke generator. There are several similar headers on the smoke generator. Use the lower left header labeled "INPUT."



The other two smoke generator headers plug into the smoke units on the shell. They can remain unplugged for now. But, notice the markings on the plugs. M = fan motor and H = heater resistor.

Finally plug in the battery into the BATIN connector. Double check that you have not accidentally swapped the motor and battery connectors. Make sure all wires stay between the mounting posts.

Quick Check

Before connecting the lights, and reassembling the locomotive, perform a quick check of the Drop-In decoder and the sound module.

If the battery is brand new, it might not have much of a charge. Connect the charger to the Drop-In and charge the battery for about 15 minutes. This will provide sufficient power for the test and setup.

It is assumed both the Drop-In and the sound module are on the original factory settings. This means loco number 3 and frequency 0.

Always turn on the throttle first. Set it up for loco number 3 and frequency 0.

Now turn on both Drop-In power switches by sliding them towards the front of the locomotive. Verify the green PWR LED is on solid. Verify the red GP LED is on solid. The PB22 sound module status LEDs will turn on and you will hear the prime mover startup routine. Push function 1 (abbreviated F1) on the throttle by pressing the 1 key. The bell will start ringing. Push F1 again to turn it off. Push F2 to sound the horn. It will sound for as long as the key is depressed. Release the key to stop the horn.

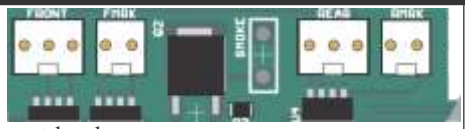
Don't worry if the sounds don't match the locomotive model. These will be changed when the initial sound decoder setup is done a little later.

Verify the throttle direction is set for forward (right pointing triangle) and increase the speed value to 2 or 3. The locomotive will begin to move forward. Set the speed back to 0. Push the direction key. Note the left pointing triangle. Turn up the speed value again. The locomotive will move in the opposite direction.

Forward and reverse are relative to the movement of the cab with you sitting in the engineer's seat. With the direction set "forward" (right pointing triangle), the cab will move "forward."

Connect the Lights

This will take a couple of minutes, so don't rush - take your time. Orient the chassis with the cab to the left and place the cab shell upside down on the towel and close to the chassis.



Plug the 3-wire front headlight plug into the left most header labeled FRONT.

Plug the 2-wire front marker plug into the header labeled FMRK.

Plug the 3-wire rear headlight plug into the header labeled REAR.

Plug the 2-wire rear marker plug into the header labeled RMKR.

Check that all 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 to the right.