Warranty Information

This warranty covers substantial defects in materials and workmanship in the Drop-In decoder. It does not cover the Phoenix sound module.

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.

We do not repair or extend any CVP Products' warranties to the Phoenix modules. CVP Products does not repair Phoenix sound modules. For questions, repairs and warranty information regarding the Phoenix P8 sound module, you must contact Phoenix.

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.

Help, Repairs and Returns

If you purchased your Drop-In decoder from one of our AirWire900 dealers, please call them first. They are your best and quickest for answers to questions about G2 decoder. They are also experts in installation and offer such services should they be required.

If you purchased your Drop-In decoder ***directly*** from CVP Products, you may call the office number below. If the voice mail system answers, it is either after our normal business hours or we are busy helping other customers. Please leave a message. Be sure to leave your phone number and include the area code, along with your location. Have your instruction manuals available, your locomotive with the Drop-In decoder and a throttle before you call.

Do not send items to us for repair without first obtaining authorization. In many cases, problems are easily solved via phone or email without the need or expense to return items to us. **If we authorize** and request you to return an item, be sure to mark the "Return Material Authorization" (RMA) number on the outside of the box. **Items sent without an RMA will be refused and returned at your expense.** You are responsible for all shipping charges.

Please allow 3-6 weeks for completion of the repair. Please see the website big blue INFORMATION box for what to send us, what not to send us and the shipping address.

GP30 and Throttle Frequencies

GP30 DROP-IN RF Switch	Use T5000 Freq	Use T9000 Freq	Set RF1300 Switches
0	0	SEL1-0	Up Up Up
1	1	SEL1-1	Dn Up Up
2	2	SEL1-2	Up Dn Up
3	3	SEL1-3	Dn Dn Up
4	8	SEL0-93	na
5	9	SEL0-87	na
6	10	SEL0-81	na
7	11	SEL0-61	na
8	4	SEL1-4	Up Up Dn
9	5	SEL1-5	Dn Up Dn
A	6	SEL1-6	Up Dn Dn
B	7	SEL1-7	Dn Dn Dn
C	12	SEL0-56	na
D	13	SEL0-44	na
E	14	SEL0-33	na
F	15	SEL0-9	na

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www.cvpusa.com

January 2014 r7

AirWire® 900

Drop-In™ Decoder Users Guide

For All Drop-In™ Decoders

Quick Find Index

Includes All Errata From Prior Editions Up Through January 2014

How To Use This Manual

This guide covers all of the AirWire Drop-In Decoders. With just a few exceptions, each Drop-In Decoder has the same features. We will specify if there is a difference or a specific feature that is unique to a decoder.

The guide does not discuss Drop-In Decoder installation. Please see the installation guide for your specific locomotive. They are all available from our website in the AirWire Drop-In documentation section.

Terminology and Funny Words

The next page discusses a few terms that may be new to you. Although you can skip this section, a few minutes of reading will be worth the time.

Decoder Basic Setup

This section describes all of the basic setup information including changing the decoder address and how the decoder responds to throttle function keys. This section concludes with how to reset the decoder back to the original factory settings.

Fine Tuning and Customizing Locomotive Operation

This section has all of the details regarding the many ways in which you can customize the performance of your Drop-In decoder and locomotive. For example, with a few keystrokes on the throttle, the locomotive can be fine-tuned so that it will begin moving when the speed control is advanced to the first speed step. Perhaps you want to limit the top speed, or maybe change which throttle key controls a special feature. Maybe you want to define your own custom speed table. This section has all the details on these items plus many more.

Finally, you will be glad to know that you can always reset the decoder back to the original factory settings. It only takes a couple of throttle keystrokes.

Miscellaneous Information

This section has items that just don't fit anywhere else or those items that are seldom, if ever, used. It also includes a set of blank worksheets for you to record your favorite Drop-In Decoder settings.

This is a living document that changes with your inputs. If you find anything confusing to you, please tell us. If you have a better way to state the information, please share with us so that everybody can benefit from your experience. Your feedback will insure that AirWire900 manuals continue to be the best.

Need Help? Contact Your Dealer/Installer First!

Should you have any questions regarding AirWire or installations, your dealer is your best source of information, tips and techniques. Also, almost all dealers will do installations or can recommend good installers. It might take a little more time cost a bit more, but you'll be assured of an installation that works and works well.

A smart person reads instructions.
A genius follows instructions.

Record Sheet For Decoder CV Values

CV	Description	Loco#	Loco#	Loco#	Loco#
CV1	1-99 Primary Address				
CV2	Motor Starting Voltage				
CV3	Motor Acceleration Rate				
CV4	Motor Deceleration Rate				
CV5	Maximum Motor Voltage				
CV6	Midpoint Motor Voltage				
CV7	Software Version				
CV8	Manufacturer ID				
CV11	Loss of Signal Timer (seconds)				
CV15	Lock Key				
CV16	Lock Code				
CV17	Upper Byte Extended Address				
CV18	Lower Byte Extended Address				
CV29	Decoder Configuration				
CV35	F1 key assignment				
CV36	F2 key assignment				
CV37	F3 key assignment				
CV38	F4 key assignment				
CV39	F5 key assignment				
CV40	F6 key assignment				
CV41	F7 key assignment				
CV42	F8 key assignment				
CV43	F9 key assignment				
CV44	F10 key assignment				
CV45	F11 key assignment				
CV46	F12 key assignment				
CV47	AUX LITE Period (x250ms)				
CV48	CAB LITE Feature				
CV49	AUX LITE Feature				
CV50	AUX2 LITE Feature				
CV52	Loss of F2-on Timer (seconds)				
CV53	Ditch Light Flash Period (x250ms)				
CV54	Ditch Light Mode				
CV55	Ditch Light Flash TimeOut (seconds)				
CV56	Motor Bump Amount				
CV57	Motor Bump Frequency				
CV58	Cruise Control Mode				
CV59	Headlights Period (x250ms)				
CV60	Headlights Mode				
CV61	Front Headlight Feature				
CV62	Rear Headlight Feature				

Custom speed table entries are not shown on this sheet

Drop-In Decoder Feature Selection Tables

Function Key Assignment Options
See Page 6

F1-12 Assignment CV35-46	Value
No Function	0
BEMF Set Cruise Control	1
Toggle Smoke Generator on/off	2
Toggle Cab/#Boards on/off	3
Toggle AUX Lite on/off	4
reserved	5
reserved	6
LITES Dim	7
reserved	8-14
Ditch Light Flash Trigger	15

Front/rear Headlight Operating Modes
See Page 12

Headlights Mode CV60	Value
Normal	0
Normal with rule17	1
Front-on always	2
Front-on always with rule17	3
Rear-on always	4
Rear-on always with rule17	5
Both-on always	6
Both-on always with rule17	7
reserved	8-13
Auto-reverse	14
Auto-reverse with rule17	15

Lighting Effects
See Page 13 And 16

Lighting Effect CV48-51,61,62	Value
Off 0%	0
Dim 6%	1
Dim 25%	2
Dim 50%	3
On 100%	4
Strobe1	5
Strobe2	6
Strato	7
OSC2	8
FRED	9
Dome	10
Gyra	11
Mars	12
Rotary	13
Reserved	14
Flicker	15

Cruise Control Operating Modes
See Page 11

Cruise Control Mode CV58	Value
Normal with buzzer	0
Adjustable with buzzer	1
Normal without buzzer	2
Adjustable without buzzer	3

Some Terms and Definitions

Throughout this section there will be some terms used with which you might not be familiar. This page lists a few of these and their definition.

"CV#" is the abbreviation for Configuration Variable Number: A CV number is a unique and specific memory location, designated by the "number" into which CV values are stored that control how the decoder operates the locomotive. Rather than spell out Configuration Variable Number 1, we shorten this to CV1. So anytime you see CV1, you will know this refers to the configuration variable number 1, which is the locomotive address.

"CV Value" is the abbreviation for Configuration Variable Value:" A CV value is a number loaded into the specified memory location inside the decoder. This value controls or selects various decoder capabilities. In some cases, the value selects from a table of options such as lighting effects or which throttle key activates a locomotive function. CV values are retained inside the decoder even if the power is disconnected or another throttle is used. Thus the locomotive will operate exactly the same no matter which throttle is used. A complete listing of all CV numbers and values used in the Drop-In decoder are on page 29.

Here is a typical listing of a Drop-In Decoder configuration variable. Each CV description is in the same format. The first line gives the function controlled by the CV number. The specific number follows the textual phrase and this entire line is bold faced. The line immediately following the CV number provides the range and the value in square braces is the original factory setting.

Changing the Locomotive Address CV1
Range is 1 to 9999 when using an AirWire throttle . . . . . [3]

Setting, Loading or Programming CVs: We use these words when discussing changing the operation of the Drop-In decoder. There is nothing difficult or hard to learn about programming CVs. In fact, you aren't really programming anything - you are simply sending the decoder a number to make it perform in a certain way. In simple terms, you are changing how the decoder works. CV values are sent to the Drop-In decoder using the AirWire900 throttle - nothing else is required.

Service Mode is a method of changing settings within the decoder without regard to the decoders locomotive address. This is commonly used when resetting the decoder back to the original factory settings since you might not know or care what the present decoder address is. The one precaution is that any decoder that is powered up and on the same frequency will "hear" the programming commands and be changed.

OPS Mode is a method of changing settings within the decoder that requires the correct address be used. This is the recommended method of programming since it affects only the decoder with the specified address. Other decoders, sharing the same frequency, will ignore the programming commands.

Speed Step is the phrase that describes a specific setting for the throttle's speed control. Although the throttle has 3 different speed step settings (14, 28 and 128), the most common setting is 28. This means that the throttle has 28 different speed steps from step-0 which is OFF, to step-28 which is full speed. Inside the decoder, each speed step is translated into a specific motor voltage. The decoder includes several selectable features with which you can modify how the decoder interprets the throttle speed step which in turn modifies the actual motor voltage.

The throttle frequency and the decoder frequency must match in order to make any changes to the decoder.

Resetting Drop-In Decoder To Original Factory Settings

The first CV to learn is CV8. It is used to reset the Drop-In decoder to the original factory settings. We have included step-by-step procedures for the two CVP Products' throttles to perform the reset sequence.

CV8 is very special. When this CV is used, ***all*** of your changes and entries are erased and the original factory settings are restored. There is a list of the original factory settings on page 29.

This reset procedure applies only to the AirWire Drop-In decoder. It does not affect the attached P8 sound module in any way.

Resetting Decoder To Factory Defaults. CV8

Only a single value . . . . . [135]
Only the value of 135 is accepted. All other values will be ignored by the decoder. This feature may be used at any time and regardless of the present decoder address.

For The T5000 Throttle

Step-by-Step Key Sequence To Reset Decoder Using CV8

Follow these steps to reset your AirWire Decoder to its original factory settings. Remember that any Drop-In decoder sharing the frequency will also be reset. Turn off all other nearby decoders to avoid this problem. Turn on the decoder to be programmed.

- Turn on the T5000 by pushing MENU. Verify it is set to the same frequency as the decoder.

- Push MENU twice and then push 4 to select Service Programming.

- Enter the CV number of 8 by pushing, one at a time, the following keys: 8, #

- Enter the value of 135 by pushing, one at a time, the following keys: 1, 3, 5, #.

- Listen for the decoder to beep or chirp signifying the command has been sent.

- Push ESC to exit programming mode.

At this time, the decoder has been reset to factory defaults. It will be on address 3. Reset your throttle to address 3 to confirm that decoder has been reset.

For The T9000 Throttle

Step-by-Step Key Sequence To Reset Decoder Using CV8

Follow these steps to reset your AirWire Decoder to its original factory settings. The throttle and the decoder frequency must match for this type of programming. Remember that any Drop-In decoder sharing the frequency will also be reset. Turn off all other nearby decoders to avoid this problem.

- Turn on the throttle.

- Push the SPR key then the SEL key to enter the Service mode.

- One at a time, push the following keys: *, 8, *.

- One at a time, push the following keys: #, 1, 3, 5, #.

- Listen for the decoder to beep or chirp signifying the command has been sent.

- Push the SPR key to return to normal operation or cycle the throttle's power switch..

At this time, the decoder has been reset to factory defaults. It will be on address 3. Set the throttle to address 3 and confirm that the decoder has been reset.

Any nearby locomotive sharing the same frequency will also be reset to defaults. Make sure all nearby locomotives are OFF.

Drop-In Decoder CVs and Original Factory Values

CV	Description	Range	Original Setting
CV1	1-99 Primary Address	0-99	3
CV2	Motor Starting Voltage	0-255	0
CV3	Motor Acceleration Rate	0-255	2
CV4	Motor Deceleration Rate	0-255	2
CV5	Maximum Motor Voltage	0-255	255
CV6	Midpoint Motor Voltage	0-255	0
CV7	Software Version	1	1
CV8	Manufacturer ID	135	135
CV11	Loss of Signal Timer (seconds)	0-255	0
CV15	Lock Key	0-255	0
CV16	Lock Code	0-255	0
CV17	Upper Byte Extended Address	0-255	0
CV18	Lower Byte Extended Address	0-255	0
CV29	Decoder Configuration	0-255	2
CV35	F1 key assignment	0-15	0
CV36	F2 key assignment	0-15	0
CV37	F3 key assignment	0-15	0
CV38	F4 key assignment	0-15	15
CV39	F5 key assignment	0-15	1
CV40	F6 key assignment	0-15	0
CV41	F7 key assignment	0-15	0
CV42	F8 key assignment	0-15	0
CV43	F9 key assignment	0-15	0
CV44	F10 key assignment	0-15	2
CV45	F11 key assignment	0-15	3
CV46	F12 key assignment	0-15	0
CV47	AUX LITE Period (x250ms)	1-15	6
CV48	CAB LITE Feature	0-15	4
CV49	AUX LITE Feature	0-15	4
CV50	AUX2 LITE Feature	0-15	4
CV52	Loss of F2-on Timer (seconds)	0-3	2
CV53	Ditch Light Flash Period (x250ms)	1-15	3
CV54	Ditch Light Mode	0-1	0
CV55	Ditch Light Flash TimeOut (seconds)	0-255	15
CV56	Motor Bump Amount	0-255	10
CV57	Motor Bump Frequency	0-31	0
CV58	Cruise Control Mode	0-3	0
CV59	Headlights Period (x250ms)	1-15	6
CV60	Headlights Mode	0-15	0
CV61	Front Headlight Feature	0-15	4
CV62	Rear Headlight Feature	0-15	4
CV67 to CV94	Custom SpeedTable SpeedStep0	0-255	10

Phoenix P8 Configuration File Settings

You must set the MTS mode to disabled so the DCC commands work correctly.

Do not change the P8 DCC address from the factory setting of 3. All throttle commands are sent to the P8 on address 3. It does not matter what the Drop-In decoder address is.

Make sure all trigger pins are disabled since all commands come via the throttle.

The other recommended settings are self explanatory. For example, we prefer not to hear the constant tooting and ringing of the bell every time the locomotive direction changes. So, these settings are all set to 0 volume which is the same as off.

Save your configuration file under the locomotive number before disconnecting the computer interface.

P8 MTS mode	Disabled
Shutoff Delay	0
DCC Timeout	0
DCC address	3
REVUP DCC	none
REVDWN DCC	none
Bell	Manual
Bell Stop Speed	0
Stopping Bell Duration	OFF
Startup bell duration	OFF
Triggered bell duration	OFF
Autobell speed limit	OFF
Bell holdoff	0
FWD horn volume	0
REV horn volume	0
Stopping horn volume	0
Toot holdoff	0
Airpop	F11
Compressor Trigger	F6
Dynamic Brake	F9
Brake Release	F10
All Function buttons	Latched except F2
Peak Wattage	2W
Compresson Pin	Auto
Brake Release Pin	Auto
Wheel Squeel	not assigned
Airpop Pin	Auto
Track Noise	100%
Detector Pin	none

CVP Products does not provide customer support for the P8 sound module. If you have any question or problems regarding the Phoenix P8 sound module and/or its programming, please contact Phoenix directly.

Phoenix Sound Systems, Inc.
(800) 651-2444
Email: phoenixsound@phoenixsound.com

Changing Decoder Address

Changing the Decoder Address.....CV1

Range is 1 to 9999 .....[3]

The original factory setting for the decoder address is 3. You can change the address to any number from 1 to 9999. We recommend using the locomotive cab number. If you don't have a lot of locomotives, perhaps the last digit of the cab number is sufficient. What ever is used, make sure it is unique.

Do not use OPS mode programming to change the decoder address.

T5000 Step-By-Step Key Sequence To Change CV1

For this example, the address will be changed from 3 to 9812. First turn on the decoder power switch. Make sure both the throttle and the decoder are on the same frequency. Using the T5000 throttle, enter the following keystrokes to set the new address:

MENU, MENU 4	Selects service programming
1, #	Enters the CV number of 1 (Loco Address) t o be programmed
9,8,1,2,#	Enters the value of 9812 to be programmed into CV1
*	Exits programming mode

When the final # is pressed, the locomotive decoder is sent the information. The decoder acknowledges this with either or both a momentary pulse of the motor along with the several beeps. Press * to exit programming mode.

Enter the new loco number into the throttle, # 9,8,1,2,# and verify the motor operates along with the P8 sound system if it is installed.

T9000 Step-by-Step Key Sequence To Change CV1

For this example, the address will be changed from 3 to 9812. First turn on the decoder power switch. Using the T9000 throttle, enter the following keystrokes to set the new address:

SPR	selects service mode
SEL	confirms that service mode is wanted
,1,	tells which CV is to be changed
#,9,8,1,2,#	loads the number of 9812 into the selected CV
SPR	exits service mode

When the final # is pressed, the locomotive decoder is sent the information. The decoder acknowledges this with both a momentary pulse of the motor along with the several beeps.

Press SPR to exit the service mode, or simply turn the throttle power switch off then back on. Either way exits the service mode.

Verify the locomotive is on the new decoder address. Enter the new number into the throttle and verify the motor operates along with the P8 sound system if it is installed.

Beware that using service mode programming to change the decoder address will also change the address of any decoder that shares the same frequency and is powered on. Make sure all nearby locomotives are OFF.

Function Key To Decoder Action Assignment

Function Key to CV Number Assignment . . . . . CV35 through CV46

Range is 0 to 15 . . . . . [see below]

There are 13 function keys on a standard AirWire Throttle numbered from 0 to 12. With the exception of the 0 key, each function key can be assigned to activate or trigger a specific feature on the Drop-In decoder. The 0 key is dedicated to control of the headlights.

This page lists the CV number that corresponds to a specific throttle key. What the key does is determined by the value for the specific CV. The second list on this page shows what can be activated or triggered.

The range of values for CV35 to CV46 is 0 to 15 with each value selecting some feature on the Drop-In decoder. A value of 0 means the key is not assigned to a Drop-In decoder feature. The original factory setting for each CV is shown.

This listing does not apply to the P8 sound module which has its own assignment list.

Key	CV#	Factory Value	Key	CV#	Factory Value
F1	CV35	0	F7	CV41	0
F2	CV36	0	F8	CV42	0
F3	CV37	0	F9	CV43	0
F4	CV38	15	F10	CV44	2
F5	CV39	1	F11	CV45	3
F6	CV40	0	F12	CV46	0

Features That Can Be Assigned to the Drop-In Function Keys

The features from which to select and assign to a throttle function key are listed below. The same feature may be assigned to multiple function keys. Function 0 is special and is used to activate the headlights and can not be changed.

CV Value	Feature
0	No function or not assigned
1	Activate cruise control
2	Toggle smoke generator
3	Toggle Cab Light and Number board
4	Toggle AUX light
5	reserved, not used
6	reserved, not used
7	Dim headlights
8 thru 14	reserved not used
15	Activate ditch lights

In summary, the factory assignments for the function keys perform the following AirWire Drop-In decoder actions: F4 triggers the ditchlight flashing; F5 activates cruise control; F10 toggles the smoke generator; and F11 toggles the cab and number board lights.

You can set the decoder so that two or more different function keys activate the same Drop-In decoder effect. This applies to all decoder functions except function 0.

Headlights can only be controlled by function 0.

Phoenix P8 Setup

Recommended P8 Function Key Assignments

F1	Bell	Toggles Bell on/Off	Latched
F2	Horn	Push for horn, release to stop	Momentary
F3	Coupler clang	Push to trigger sound	Latched
F4	Grade Crossing	Push to trigger grade crossing horn	Latched
F5	Station Announce	Push to trigger sound	Latched
F6	Compressor	Push to trigger sound	Latched
F7	Volume Up	Push starts vol ramp up, push to stop ramp	Latched
F8	Volume Down	Push starts vol ramp down, push to stop ramp	Latched
F9	Dynamic Brake	Push to trigger sound	Latched
F10	Brake Release	Push to trigger sound	Latched
F11	Air Pop Valve	Push to trigger sound	Latched
F12	Shut down	Toggle Prime Mover Shutdown or startup	Latched

Throttle Activation of Sound Effects

The P8 has 12 different sound effects that may be activated from the throttle. Since the throttle also uses the same keys to control the AirWire Drop-In decoder features, it is possible to trigger a motion control effect that also triggers a sound effect that is not wanted. For example, you don't want to shut down the sound module each time you turn on the bell. Likewise you don't want to turn off the cab lights each time you blow the horn. The table above shows our recommended P8 function key assignments that are a good match to the AirWire Drop-in decoder feature assignments. You may change these at any time to suit your requirements so consider this setup as a good starting point that allows both products to work together.

A Word About Latched/Momentary Sound Effects

The P8 DCC function key assignment screen has a check box for latched or momentary. For example, the F2 throttle key is designed to work with a diesel horn. When pushed, the horn sounds; when released, the horn stops. Thus it is a momentary key - push to turn on and release to turn off.

On the other hand, if the check box for the F-key is changed to latched, it sets up the sound effect to be triggered on each push of the key. This is great for momentary sounds. However there is a problem when using this mode. Occasionally, the P8 may trigger an additional extraneous sound effect in addition to the desired effect. If this bothers you, then set each of the P8 assignments to momentary. This prevents this action but you may need to push the key twice to trigger a sound. Experiment and pick the setting that you like.

Use the P8 computer interface to make these assignments and change the type of activation.

Before Disconnecting the Computer Interface - Save The P8 Configuration

Since there are so many options and effects from which to choose, we recommend saving the P8 configuration to your PC. That way, should you ever want to load another P8 with the same settings, you can simply retrieve the configuration file from your PC and load everything at once.

Save the P8 configuration on your computer before disconnecting the computer interface cable.

If you wish to use another Phoenix Brand sound decoder with the Drop-In, be sure and obtain the matching wiring harness directly from Phoenix. See the Phoenix website for more information.

Phoenix P8 Setup

The P8 wiring harnesses is available only from Phoenix. See page 28.

Phoenix P8 Sound Decoder Setup

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 Drop-In decoder. This section only lists those options. For more details on the P8 options, see the P8 manual and read the help screens that are part of the Phoenix programming software. Once again, you can not hurt anything with these settings and you can always reset the decoder to the factory settings.

You Need the Phoenix Optional Computer Interface for the P8

The Computer Interface is an optional accessory that enables complete customization of all sounds. The Computer Interface consists of a CD and USB Interface for use with Windows 2000, XP and Vista. The CD contains software to customize sounds from the Phoenix Sound library. It allows fine tuning of all effects without having to open up the locomotive. We strongly recommend getting this accessory if you do not already have it.

Using The P8 Computer Interface

Insert the plug into the P8 programming jack you mounted in the fuel tank and turn on the P8 power switch. The Drop-In power switch can remain off unless you want to operate the P8 from the throttle.

On your PC, start the Phoenix software and verify that it is extracting parameters from the P8 mounted in the locomotive. Once the parameters are loaded, the software brings up the main screen from which all changes are made.

You can download the CVP recommended settings for the P8 from the Phoenix website. Load the file into the P8 decoder and you'll be ready to go. Or use the procedure below to manually change the P8 to our recommended settings.

Setting Up The P8 for 100% DCC Operation

As delivered the P8 is not completely set up for DCC operation so making the following changes will insure proper operation with the Drop-In decoder and the AirWire throttle. You find a complete listing of all P8 settings that we like on the next page. Your choices may be different so please experiment and determine what best fits your railroad and operation requirements. Don't forget to record your settings as described below.

There are not many items that need to be changed. However, while you have the computer plugged in you might wish to experiment with some of the other P8 options. Any changes made are stored inside the P8 even with the power turned off.

Option	Setting	Action
MTS Mode	Disabled	Not used with DCC and can cause issues if on
Shutoff Delay	0	Sound never shuts off
DCC Timeout	0	DCC mode never times out
DCC Address	3	Always use address 3 - Do not change it
REVUP DCC	none	Not assigned to any throttle key
REVDWN DCC	none	Not assigned to any throttle key
Stopping bell duration	0	Feature disabled
Startup bell duration	0	Feature disabled
Forward horn volume	0	Feature disabled
Toot hold-off	0	Feature disabled

All P8 changes are made using the computer interface. If you keep the Drop-In power switch on during changes, you can activate the effect from the throttle and verify it is what you want. See the Phoenix P8 documentation for how to setup the interface and make the changes.

Setting Drop-In Decoder Frequency Selector Switch

You will need access to the decoder if you wish to change the operating frequency. The Drop-In Decoder has a total of 16 frequencies from which to choose. The table below shows the Drop-In frequency switch setting, the T5000 frequency number and the T9000 frequency number.

Change Frequencies Carefully - Watch And Count

When changing the decoder's frequency, each click of the switch is followed by a chirp. This tells you that the decoder's frequency has been changed. The little switch's arrow is small so use a bright light, good reading glasses, a jewelers screwdriver and count the chirps as the arrow is moved. Use the red GP light as your final check that the frequency and address match before closing up the shell.

Drop-In	T5000 #	T9000	Drop-In	T5000 #	T9000
	0	SEL-1 0		8	SEL-0 93
	1	SEL-1 1		9	SEL-0 87
	2	SEL-1 2		10	SEL-0 81
	3	SEL-1 3		11	SEL-0 61
	4	SEL-1 4		12	SEL-0 56
	5	SEL-1 5		13	SEL-0 44
	6	SEL-1 6		14	SEL-0 33
	7	SEL-1 7		15	SEL-0 9

Note The T9000 Different Command Used for Drop-In Frequencies - 8 to F

You will be delighted to know that your T9000 is already capable of accessing the new frequencies. The T9000 has an undocumented command that is used to set it to the new frequencies. Note that there is no direct match between the T9000's new frequencies and the Drop-In decoder's switch setting. Be sure to set the decoder first and then enter the frequency on the T9000 throttle. Push SEL 0, enter the numeric number shown below and then push #. Verify that the decoder's red GP light turns on.

GP30 Locos Are Different!

The GP30 Drop-In frequency selector switch is incorrectly wired. A corrected table, showing frequency vs switch setting, is on the back cover of this booklet. It only applies to the GP30 Drop-In.

Fine Tuning Control of Locomotive Speed

There are several features with which you can modify how the locomotive behaves to speed commands. Slow speed control is related to the motor starting voltage (MSV) as well as a feature called motor bumping and speed curves. This section describes each of these items in detail. All changes are stored inside the decoder. This allows any locomotive to always have the same performance, regardless of which throttle is used.

Motor Starting Voltage Value CV2
Range is 0-255 . . . . . [255]

The MSV is the value to which the motor voltage jumps when the throttle is set to the first speed step, speed step 1. You can decide if you wish the motor to be moving at a good rate of speed or just barely moving by changing the MSV. A small MSV value means only a small extra increase in motor voltage. A larger MSV value means the motor receives a higher motor voltage. A value of 128 equals have of the maximum voltage and a value of 255 equals the maximum voltage

Motor Bumping for Even Better Slow Speed Starting Performance

Before the advent of supersonic pulse motor drive, motors were driven with much slower pulses - usually around 60Hz. These pluses were perfect for vibrating the motor such that it started at very low voltage. However, the motor drive created a very loud buzzing sound that nobody liked. Users loved the slow speed motor performance but hated the buzzing sound. However, your Drop-In decoder features a unique method to get the motor turning at a very low value that mimics the low frequency drive without the annoying buzz. We call it motor bump.

There are two CVs for this feature, the motor bump value, CV56 and the motor bump frequency CV57.

Motor Bump Value CV56
Range is 0-255 . . . . . [10]

This value sets the amount of momentary motor voltage increase, called a bump, applied at each speed step to the help motor overcome friction. It helps get the motor rotating at a lower voltage and/or a lower speed step. The bump is not always present. The rate at which the bump is applied is set by CV57.

When the bump occurs, the motor briefly receives a higher than normal voltage. This “bumps” the motor up to a higher voltage then returns to the normal motor voltage. A value of 0 turns off the motor bump. A value of 128 will literally apply half of full speed to the motor. Since the bump is momentary, it has a different effect than the motor starting voltage (CV2) which is a constant, fixed amount applied only at speed step 1.

Motor Bump Frequency CV57
Range is 0-31 . . . . . [0]

This value selects from among a set of frequencies at which the bump value, in CV56 is applied to the motor. A value of 0 disables the bump completely, no matter what is set in CV56.

A bump frequency value of 1 sets the frequency to 250Hz. A value of 4 sets the frequency to 60Hz. A value of 8 sets the frequency to about 31Hz. Low frequency values are not very useful although you can experiment and see if you like the effect and they can cause the motor to literally growl at very slow speeds.

For you math wizards, who want to know how the motor bump frequency and CV57 are related, the bump frequency is equal to the reciprocal of the CV57 value multiplied by 0.004seconds.

Experimenting With Motor Bumping

The factory setting for the bump amount is 10. Don’t change the bump value yet. Change CV57 to a value of 2 and observe the effect. Watch and listen for how the different frequencies change the locomotive performance at low throttle settings.

For another test, try putting the MSV to a value of 0. Now experiment with the bumping frequencies and values. You may be surprised that you can achieve the same smooth slow speed control without any motor starting voltage. The bumping of the motor actually replaces the MSV.

Drop-In Decoder Protection and Safeguards

There are several safeguards built into the Drop-In decoder. This table lists the various drivers and the protection level. The reset method describes how to reset a driver whose protection has tripped.

Driver or Output	Protected	Reset Method
Motor Drivers		
Excessive Current	Yes	Direction change or power cycle
Short Circuit	Yes	Direction change or power cycle
Over Heating	Yes	Power cycle after allowing cool down time
Low Voltage	Yes	None - recharge the battery
CVP’s 4.4A-hr Battery		
Excessive current	Yes (5A)	Power cycle
Overheating	Yes	Power cycle after allowing cool down time
Excess charge current	Yes	None - use proper charger
Low voltage lockout	Yes	None Recharge the battery
Headlights, Ditch-Lightes, Cab Interior, #-boards, AUX Light Driver		
Excessive Current	Yes	Auto
Short to BAT +	Limited	None, may cause damage
Short to BAT-	Limited	None, may cause damage
Smoke Generator Driver		
Excessive current	Partial	Driver is oversized for protection
Short to Bat-	Yes	None
Short to Bat+	No	Can damage driver
Drop-In Circuit Board Bat Input		
Catastrophic Short Circuit	Yes	Replace automotive-type fuse

WARNING
There is no protection against battery polarity reversal. Follow the hookup diagrams to insure the connectors go to the proper battery wires.

Do not allow water to contact the decoder or allow condensation to collect inside the decoder. This will certainly cause the receive range to be much lower and may actually damage or destroy the decoder.

The automotive fuse may be replaced with a lower rated fuse if desired.

WARNING - Maximum Battery Voltage Allowed Is 18V
The Drop-In decoder is designed specifically for 14.8V Lithium Battery Packs. Higher voltages will harm the decoder. A fully charged battery pack will be as much as 2 or 3 volts higher than its rated output voltage. Do not use any battery pack that can exceed 18 volts when fully charged. Doing so will damage the decoder and is not covered under any warranty.

Run Time And Battery Charge Life

How Long Do The Batteries Last?

This is a very common question that does not have a simple answer. This is because the answer depends on many factors such as: type of railroad, locomotive condition, temperature, how the railroad is operated, how many cars are pulled, how many hills and so on.

A rough idea of the battery life can be determined by dividing the battery rating which is in Amp-hours (Ahr) by the motor current. For example, the CVP recommended battery pack is rated at 4.4 Amp-hours. In other words, the battery will last about 1 hour if the locomotive pulls 4.4 Amps. Fortunately, the locomotive motors will seldom get close to that value. Under normal operating conditions, you can expect up to 3 or 4 hours from one charge.

The Motor Is The Primary Battery Drain

When running on straight and level track at about half of top speed, the twin motors of the USA-Trains will pull between 1.0 and 1.5 amps. There is also a brief but high current draw when the locomotive initially begins moving.

Locomotive speed also affects battery drain. The faster the locomotive speed, the faster the battery drain. Slow down and your battery will last longer.

If the speed is constant, but more cars are added, the faster the battery drain. But there is a limit to the number of cars that may be pulled.

Lugging down the motor by forcing to haul too many cars up the hill will very quickly drain the battery. Instead, use multiple locomotives or helpers. Your batteries will last much longer. Also, slower running decreases the battery drain. You can also limit the number of cars.

Smoke Generator And Battery Drain

There is one other item that can quickly drain the battery - the smoke generator. The little smoke generator consumes about a half amp when running. Fortunately, the Drop-In decoder has a built in timer that shuts off the generator after about 2 minutes. This will insure that it will automatically turn off should you forget. So, unless you keep retriggering the generator, its current draw will be minimized.

Lighting And Battery Drain

Each USA-Trains locomotive has different light configurations. For example, the GP30 use all incandescent bulbs where as the SD70MAC uses mostly LEDs. So if your locomotive has lots of incandescent bulbs, these will consume as much as a half amp of current. To maximize battery life, turn off all unused lights or lights that are not easily seen. For example, the number-board lights will hardly be noticeable in broad daylight - so turn them off and save a bit of power..

Recharging The Battery

When you are finished using the locomotive, turn off both Drop-In power switches and plug in the charger. If the power switches are not off, the battery can not be charged. Check that the charger indicator light is red which says it is charging. The charger will shut off automatically and the indicator will change to green when the battery is fully charged.

Once the battery is charged, you can unplug the charger. However, there is no harm leaving the charger plugged into the locomotive.

The Drop-In decoder power switches must be in the off position in order to recharge the battery.

Acceleration and Deceleration Rates

Motor Acceleration Rate CV3

Range is 0-255 . . . . . [2]

This CV sets the rate of change of locomotive speed when the throttle speed is increased. This is called the acceleration rate. Small values mean the rate of change is fast. A higher value leads to a slower rate of change.

In most cases, users prefer a *slower* rate of change for the acceleration rate. Common values are 3, 4 and 5. The default value of 2 means there is about half a second of delay when the speed is increased. High values will result in extremely long delays for speed changes to take effect which are generally uncomfortable for users. The value applies equally in the forward and reverse directions.

Motor Deceleration Rate CV4

Range is 0-255 . . . . . [2]

This CV sets the rate of change of speed upon when the throttle speed is decreased. This is called the deceleration rate. Small values mean the rate of change is faster. A higher value leads to a slower rate of change.

In most cases, users prefer a *faster* deceleration rate compared to the acceleration rate. The factory default of 2 is seldom changed. The default value of 2 means there is about half a second of delay when the speed is increased. High values will result in extremely long delays for speed changes to take effect. If you imagine your favorite locomotive speeding towards another train, you will want to be able to quickly stop the train. This is why the factory setting of 2 is seldom changed. Users want to slowly start the train, but quickly stop it. The value applies equally in the forward and reverse directions.

Training Mode - Teaching Operators Not To Reverse With Locomotive Moving

If CV3 or CV4 are set to 0, a special failsafe feature is activated. If you change locomotive direction, without first stopping the loco, the decoder's buzzer will turn on and stay on until the power switch is turned off. This is a great way to teach operators to always stop before changing the direction switch. If you don't want this feature, use a value of 1 or higher in CV3 and CV4.

Beware Of Large Values

Large values for acceleration or deceleration rates will result in very slow response to throttle changes. Extreme values will result in the locomotive never starting, or, never stopping - neither of which is very comfortable.

Speed Curves, Maximum Speeds And Speed Matching

CV5 and CV6 set the relationship between the throttle position and the speed of the locomotive. Most users consider these two CVs to be the best ones with which to match the speeds of two locomotives that will be run together as a pair. Experiment with these two CVs to become familiar with how they affect the performance of your locomotive. In the graph below, the factory setting for CV5 and CV6 creates curve #1 which is the straight line that goes from off to 100%.

Speed matching of two different locomotives is much easier with these two CVs. Use them to control the locomotive speed at specific at a specific throttle setting. You may also use these two CVs to set the maximum top speed or to stretch out the slow speed control range.

The original factory setting for both CV5 and CV6 is 0 which means they have no affect and the throttle position to locomotive speed is a straight line from 0 speed to full speed. This is curve #1 on the graph below.

Set Maximum Motor Voltage CV5

Range is 0-255 . . . . . [255]

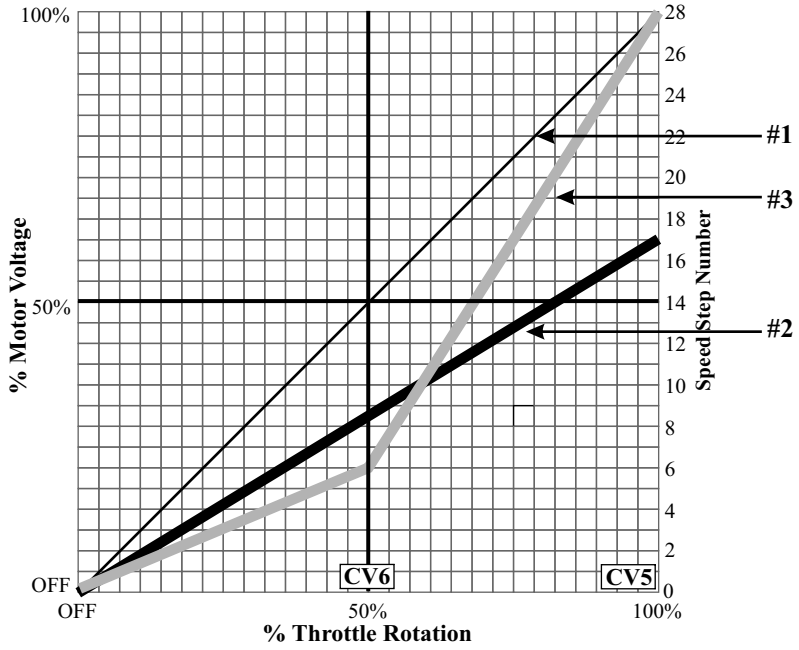
CV5 is used to set the maximum motor voltage, which is also its top speed, when the throttle is turned full on. This means that full battery voltage is applied to the motor if a value of 255 is used. Anything lower than 255 and the top voltage is reduced. A value of 128 is ½ of maximum voltage.

CV5 is easy to explain as it simply sets the highest speed at which the locomotive will run when the throttle is turned full on. For example, to reduce the top speed to about ¾ of the maximum, set CV5 to a value that is ¾ of 255 - which is about 190. Load this value into CV5 and notice that at max throttle, the speed is now lower. On the graph below, this is curve #2.

Set Mid-Point Motor Voltage CV6

Range is 0-255 . . . . . [0]

CV6 sets the locomotive motor voltage, which is also its speed, when the throttle is half way up to full speed. A value of 0 means this feature is not used. For example, curve #3 is created by setting CV6 to a value of 55 which means that at mid throttle setting, the locomotive speed is only about 25% of maximum.



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 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 dissassemble 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. Both of these conditions can interfere with the receipt of horn activation and deactivation commands. There is nothing more annoying than a diesel horn that is stuck on. So, the Drop-In decoder has a new feature which solves this annoying problem. If for any reason, the Drop-In decoder 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. The time is set by CV52 which has a factory setting of 2 which is about 2 seconds. See page 21 for more information about changing this time.

Poor Reception Or Interference

The AirWire receiver operates in an unlicenced band shared by many other transmitters. These transmitters can and will create interference, intermittent throttle operation or complete failure of one or more of your throttle's frequencies. The sources of these external interfering signals can be from your own home or from adjacent homes and businesses. They can also be from other wireless throttles and controllers.

Here's a list of devices known to have caused interference problems to AirWire900 equipment: wireless devices attached to computers, TV/Radio/Entertainment-center, remote controls, cordless telephones, alarm systems, baby monitors, unlicenced personal communication devices, lawn sprinkler controllers, remote starter switches, cordless light switches, outdoor lighting controllers, toys, wireless headphones, and games. Of course, if you have additional wireless throttles, make sure each is on its own frequency. Two throttles on the same frequency will jam each other.

If you find a strong interfering signal on one or more of your frequencies, don't use those frequencies. Simply select another, different frequency.

CV29 Decoder Configuration

Note: For most installation, there is no need to change CV29 from the original factory value of 2.

Decoder Configuration CV29

Range 0-255. . . . . [2]

This is a multipurpose CV whose value sets several options at once. To use the table at the bottom of this page, select the line having the options setup that you wish to use. Load the CV29 value shown.

Address: This tells the decoder if the address range is from 1 to 99, called a ***short*** **address**, or from 100 to 9999, called a ***long*** **address**. The default is a short address. When a long address is programmed into the decoder, this value is automatically changed. The long address is stored in CV17 and CV18.

Note: The AirWire throttle automatically sets CV17, CV18 and CV29 when loading a decoder address.

 # Steps: Sets the decoder to provide either 14 or 28 speed steps from off to full power. The original factory setting is 28 steps. The throttle speed step setting must match the #steps selected by CV29. This setting has nothing to do with the throttle setting. Changing the throttle speed step setting DOES NOT change the decoder.

Motor Direction: Allows the motor direction to be reversed from default. Normally this is not needed and the factory setting is considered the "normal" setting.

Speed Table: Selects either the standard or the user specified speed table.

CV29 Value: This is the value used to select the options in that row.

CV29 Table of Values and Options

The original factory setting for CV29 is 2 which selects the bold faced entries.

Address Type	Speed Table	# Steps	Motor Direction	CV29 Value	Notes
Short	Standard	14	Normal	0	Standard speed table
Short	Standard	14	Reversed	1	Standard speed table
Short	Standard	**28**	**Normal**	**2**	**Standard speed table**
Short	Standard	28	Reversed	3	Standard speed table
Short	Custom	14	Normal	16	Custom speed table
Short	Custom	14	Reversed	17	Custom speed table
Short	Custom	28	Normal	18	Custom speed table
Short	Custom	28	Reversed	19	Custom speed table
Long	Standard	14	Normal	32	Standard speed table
Long	Standard	14	Reversed	33	Standard speed table
Long	Standard	28	Normal	34	Standard speed table
Long	Standard	28	Reversed	35	Standard speed table
Long	Custom	14	Normal	48	Custom speed table
Long	Custom	14	Reversed	49	Custom speed table
Long	Custom	28	Normal	50	Custom speed table
Long	Custom	28	Reversed	51	Custom speed table

Don't let this page scare you. This CV is setup automatically when using AirWire throttles. However, if you are not using an AirWire throttle, then this table will be needed to set up some of the decoder options especially long addresses. Refer to your throttle manual for

Cruise Control Options

Cruise control is just like your car's cruise control. Once activated, the locomotive will maintain the same average speed independent of the load or the terrain. It will cruise up hill and down hill, as well as snake through tight curves and turnouts at the same speed.

Cruise Mode and Buzzer Sound Mode Select CV58

Range is 0 to 3 . . . . . [0]

In simple terms, you select from one of 2 modes of operation and whether you the want the buzzer to chirp as the locomotive goes in and out of cruise mode.

CV58 = 0 selects cruise mode 0 and includes the buzzer. It is the original factory setting.

Cruise mode 0, when activated, will hold the locomotive speed constant and independent of the load, grade or track curves. If the throttle speed is change, up or down, or the direction is reversed, cruise control is deactivated. Mode 0 is easy to use. Once the train reaches the desired speed, push F5 on the throttle to enable cruise. The decoder's buzzer will beep once to tell you it has enabled cruise mode. Any change of the throttle's speed knob, up or down, or you reverse direction, this will turn off cruise control. Two beeps of the buzzer tells you the cruise mode is turned off. To reactivate it, simply press F5 again.

CV58 = 1 selects cruise mode 1and includes the buzzer.

Cruise mode-1 is unique in that once cruise is active, you may change the cruising speed without deactivating cruise control. This allows fine tuning of the cruise speed, higher or lower. As with the other mode, push F5 to enable cruise mode. The decoder's buzzer will beep once to tell you it has enabled cruise mode. In this mode, you can make changes to the initial speed using the throttle speed knob. You may increase or decrease the speed. Taking the throttle to 0 or reversing the direction will turn off cruise mode. Two beeps of the buzzer tells you the cruise mode is turned off. To turn it back on, just push F5 again.

CV58 = 2 selects cruise mode 0 but the buzzer is silent.

CV58 = 3 selects cruise mode 1 but the buzzer is silent.

Speed Regulation Limits: Cruise control can only regulate motor speed within the range that the motor normally operates. If the locomotive struggles and lugs down, stalls or slips, cruise control will not help. Once the locomotive begins to slip, no amount of extra energy will help. The result will be hotter drivers and a hotter motor. The solution is to use a helper engine to push the train to the top of the hill.

Response Time: Cruise control senses speed changes in the motor and increases or decreases the drive signal going to the motor. Speed changes caused by hills and valleys usually result in gentle changes that the decoder has no problem with in maintaining a constant speed. However any significant or rapid change, such as out of gauge track, may result in slight delay before the previous speed is resumed.

A Binding Mechanism: The Drop-In decoder checks the motor speed about 40 times per second so it tends to somewhat less sensitive to binding and other mechanical issues. For best results, fix the binding; don't depend on the decoder to solve mechanical issues.

Stalling, or Slipping: If the locomotive can't climb a hill without slipping or stalling, then the cruise mode should not be used. The locomotive simply doesn't have sufficient pulling power. All the decoder can do is apply maximum power to the motor and the motor will do what it can. If the wheels slip, then the decoder will drive the motor at maximum speed while the wheels slip the entire way. Not only will the battery quickly drain but it might also activate the overload or overheating protection for the motor drivers.

Cruise Control and Multi-Unit Consists: If locomotives are in a multiunit consist, cruise-control may not work perfectly and the locos may fight each other. However, if all locos are relatively closely matched, cruise mode 1 may be the best mode. Experiment to determine which cruise mode works best for your fleet.

Customizing Headlight Operations

The Drop-In decoder allows the front headlight and the rear backup light to operate in several different modes. These modes control if and when the headlight dims and how the headlight and backup light operate. For example, the headlight and backup light can both be on at the same time or the headlight can remain on, independent of the direction of travel. Both headlight and rear light can be turned on at the same time too.

Headlight Operation CV60

Range is 0-15 . . . . . [0]

As with all setup options, the desired operating mode is selected from a table and the appropriate number is stored in CV60 of the decoder's memory. The mode can be changed at any time.

CV60 only affects the headlight and the backup light operating modes. It has no effect on any other locomotive light.

Normal Operation: The front headlight turns on at full brightness and the selected effect, if any, is applied. Normal operation also includes default headlight autoreverse. Autoreverse means that the front headlight is on when the throttle is set for the forward direction and off when set for the reverse direction. Conversely, when using autoreverse, the rear backup light is off when in the throttle is set for the forward direction and on when set for the reverse direction .

Reversed-Autoreverse: This mode flips the meaning of the front and rear lights. Setting the throttle to forward turns on the rear backup light. Setting the throttle to reverse turns on the front headlight.

Auto-Dim Headlight Mode [rule 17]: When this option is selected, the headlight automatically dims when the throttle is set to zero speed. When dimmed, the headlight glows at a reduced brightness and without any special effects. Turning up the speed knob automatically restores the headlight and its assigned lighting effect to full brightness. This feature is optimized for white LEDs. Locomotives that use incandescent bulbs for headlights may appear very dim when using this feature.

Effect	CV60 Value
Normal, autoreverse	0
Normal, autoreverse, with auto-dim	1
Headlight always on	2
Headlight always on, with auto-dim	3
Backup light always on	4
Backup light always on, with auto-dim	5
Headlight and Backup light both on	6
Headlight and Backup light both on, with auto-dim	7
Unused values	*8-13*
Reversed autoreverse	14
Reversed autoreverse with auto-dim	15

Other Decoder CVs

Stuck Horn Timer CV52

Range 0-3 .....[2]

There is nothing more annoying than a diesel horn that is stuck on. So, the Drop-In decoder has a new feature which solves this annoying problem. If for any reason, the Drop-In decoder 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. A setting of from 1 to 3 sets the timer to wait from 1 to 3 seconds before issue the OFF command once the radio signal is lost. If the setting is 0, this feature is disabled.

Loss of Signal Timer CV11

Range 0-255 . . . . . [0]

Determines the amount of time the locomotive will continue to run once the throttle commands are no longer received. There may be several reasons for this to occur. For example, you may have changed the throttle's address to control another loco. Or, perhaps the locomotive is out of range of the throttle or perhaps the throttle has been turned off. The number entered is about the number of seconds before the locomotive stops. For example, a CV value of 20 means the locomotive will stop 20 seconds after it no longer is receiving throttle commands. The original factory value is 0 which means the locomotive will maintain its last received command forever; the timer never "times out."

Lock Key CV15

Range 0-255 .....[0]

This CV is used as the key to "unlock" the decoder for programming. The number entered into CV15 must match the number entered into CV16 to unlock the decoder to allow programming of a single CV. The original factory setting is 0 which matches the original factory setting of CV16 allowing programming to take place.

Lock Code CV16

Range 0-255 .....[0]

If the lock code is changed from the original factory setting of 0, then the decoder is locked and no programming will be accepted except for CV15 (or the factory reset command). If a number matching the number in CV16 is programmed into CV15, then the decoder will be temporarily unlocked and ready for programming of a single CV. Once locked, a decoder can only be unlocked with the matching lock key or reset back to the original factory settings. Unless you anticipate user trying to change the decoder without your permission, we recommend leaving the decoder unlocked.

Using The Lock and Key CVs

Once you have completed the setting of all CVs, the decoder can be locked by setting CV16 to a number between 1 and 255. Once locked, the decoder can not be programmed. However, the decoder will allow programming of CV15, the key, but the value loaded into CV15 must match the value in CV16 to unlock the decoder. If it doesn't match, the value is rejected and the decoder remains locked. When CV15 is set to the same number as CV16, the decoder is temporarily unlocked and one more CV number may be changed. When the programming has been changed, CV15 is erased and the decoder is relocked.

If you expect to make multiple changes in CV values, you should permanently unlock the decoder. To do this, program CV15 and CV16 to a value of 0. This permanently unlocks the decoder.

If You Forget Your Lock Code

Unfortunately, if you have locked the decoder and no longer remember the code, your only choice is to reset the decoder to the original factory settings. This unlock the decoder. The downside is that you now must reload all your settings. This is the reason we recommend writing down your favorite settings for locomotives. Use the blank worksheets at the end of this book for this purpose.

Custom Speed Table Worksheet

Speed Step	CV#	Linear	Curve A	Curve B	Yours
0	**0**	**0**	**0**	**0**	
1	67	9	10	0	
2	68	18	50	2	
3	69	27	87	4	
4	70	36	109	6	
5	71	46	124	10	
6	72	55	139	12	
7	73	64	152	15	
8	74	73	167	17	
9	75	82	180	20	
10	76	91	191	25	
11	77	100	200	28	
12	78	109	209	35	
13	79	118	215	40	
14	80	128	220	45	
15	81	137	225	50	
16	82	146	229	60	
17	83	155	233	70	
18	84	164	237	80	
19	85	173	240	90	
20	86	182	243	100	
21	87	191	246	115	
22	88	200	248	125	
23	89	209	250	140	
24	90	219	252	160	
25	91	228	253	180	
26	92	237	254	200	
27	93	246	254	225	
28	94	255	255	255	

Be sure to load the custom speed table before activating and using it. If the custom speed table has not been loaded, the factory setting is 10 for all speed steps.

You can keep a custom table in the decoder and switch back and forth between the standard table and the custom table using CV29.

Resetting the decoder to the original factory setting erases all custom speed curve values.

Special Headlight Effects

There are a variety of special lighting *effects* that can be applied to the Drop-In decoder's headlight drivers as well as the other light drivers. To apply an effect, simply load the CV value shown into the appropriate CV number that controls the desired lamp driver.

The front and rear headlights can have independent effects applied to them. If the effect has a repeating pattern, CV59 is used to set the timing for that pattern.

Front Headlight Effect. CV61

Range is 0-15 . . . . . [4]

Rear Headlight Effect CV62

Range is 0-15 . . . . . [4]

The following table summarizes the lighting effects and the CV value to activate the lighting effect. Also shown is whether the period CV applies to these effects. All of these effects are optimized for LED lighting.

Lighting Effect	CV Value	CV59 Applies
Off, 0%	0	No
Dim, 6%	1	No
Dim, 25%	2	No
Dim, 50%	3	No
On, 100% - Full Brightness	4	No
Strobe Type-1 (single pulse)	5	Yes
Strobe Type-2 (double pulse)	6	Yes
"Stratolite" rotary beacon	7	Yes
Oscillating light	8	Yes
Flashing Rear End Device (FRED)	9	Yes
Dome flasher simulated	10	Yes
Gyra Light simulated circular pattern	11	Yes
Mars light simulated figure 8 pattern	12	Yes
Rotary light simulation	13	Yes
reserved	*14*	*na*
Random flicker	15	No

Front/Rear Headlights Period CV59

Range is 0-15 . . . . . [6]

The period CV controls the rate or **period** of a repeating pattern. Examples of repeating patterns that apply to light effects are Mars and Gyra lights. The period range is 1 to 15 and is in units of 1/4 second. For example a period value of 4 gives a repeating pattern of about once per second. Bigger numbers represent slower repeat times. The period CV does not apply when the selected effect is either full bright, dim or random flickering.

All Lighting Effects Are Optimized For High Brightness LEDS

Headlight Lighting Effects Examples and Tips

This page describes a few examples of headlight effects and some interesting combinations of headlight effects.

Front Headlight With Mars Light

This is relatively easy. First, lookup the CV that controls the front headlight effect which is CV61. Next, look up the value for CV61 to implement the Mars light. From the lighting effects table the desired action is a value of 12. Use your throttle to load the value of 12 into CV61. Once loaded, the effect becomes active the moment you turn on the headlights. The Mars effect only applies to the front headlight. If the locomotive direction set to reverse, the front headlight goes out and the rear headlight turns on steady at 100% brightness since CV62 has not been changed.

Changing the Mars Light Period

Now let's change the period of the Mars light and slow it way down. From the table on the adjacent page the CV that controls the headlight period is CV59. A value of 10 will be used which will be a very slow rate of 2.5 seconds - (10 x 0.25s). Use your throttle to load a value of 10 into CV59.

Turn on the front headlight again and observe the change in Mars light pattern.

Front Headlight With Mars Light and Auto-Dimming

CV60 is used to change the operating mode of the two headlights. Auto-dimming is a headlight operating mode that means that when the locomotive speed is at idle, the headlights will automatically dim. If there is an effect applied to the headlight, it will be turned off. The moment the speed is increased, the headlight comes on at full brightness and with whatever effect is active. For this example, simply load CV60 with a value of 1. This value sets up normal, autoreversing operation as well as auto-dimming when the locomotive is stopped.

Multi-Unit Consist With Directional Lighting For Leading and Trailing Units

In this example, there are 3 locomotives that are consisted together. The locomotives all face the same direction. The desire is for the leading unit to have the front headlights on, when in the forward direction and its rear headlight off when going in the reverse direction. For the trailing unit, only the rear headlight is on when going in the reverse direction and the front headlight is off when going forward. The middle unit has the headlights turned off. The CV numbers and their values are shown for the leading and trailing locomotives. All locomotives share the same frequency.

Leading Locomotive	CV#	Value	Trailing Locomotive	CV#	Value
Headlight Mode	CV60	0	Headlight Mode	CV60	0
Front Headlight Effect	CV61	4	Front Headlight Effect	CV61	0
Rear Headlight Effect	CV62	0	Rear Headlight Effect	CV62	4

You may notice a faint glow from some of the locomotive lights even when turned off. This is normal and is a result of the original factory wiring inside the locomotive. There is no harm and it will only be noticeable if running at night in the dark.

Building A Custom Speed Table

The Drop-In decoder allows you to have your own custom speed table. A speed table is nothing more than a lookup table that takes a throttle's speed step number and uses it to find the matching motor voltage or speed value. Most users can obtain the desired locomotive response using CV5 and 6. However, the custom speed table feature is used for special occasions and for standard installations is not used at all. Feel free to load your own table to customize how your locomotive responds to throttle speed commands.

Speed Table Entries

The motor speed value is represent by a whole number percentage of 255. Allowed speed values are between 0 and 255 with 0 being off and 255 being 100% full speed. Thus, half speed would be 255 divided by two which is 128. Only whole numbers are allowed.

Since there are 28 speed steps available from the throttle, the Drop-In decoder has 28 separate CVs that hold each of the 28 motor speed values. Each entry represents a single speed step that is sent to the locomotive.

Speed Table Worksheet

We have provided a worksheet for use in preparing the custom speed table. Also, there are 3 examples curves provided. These examples are graphed: linear, curve A and curve B. The actual speed values used to create these curves are listed on the next page. Use the provided columns to record your entries. Loading the table is discussed in the throttle operation manual.

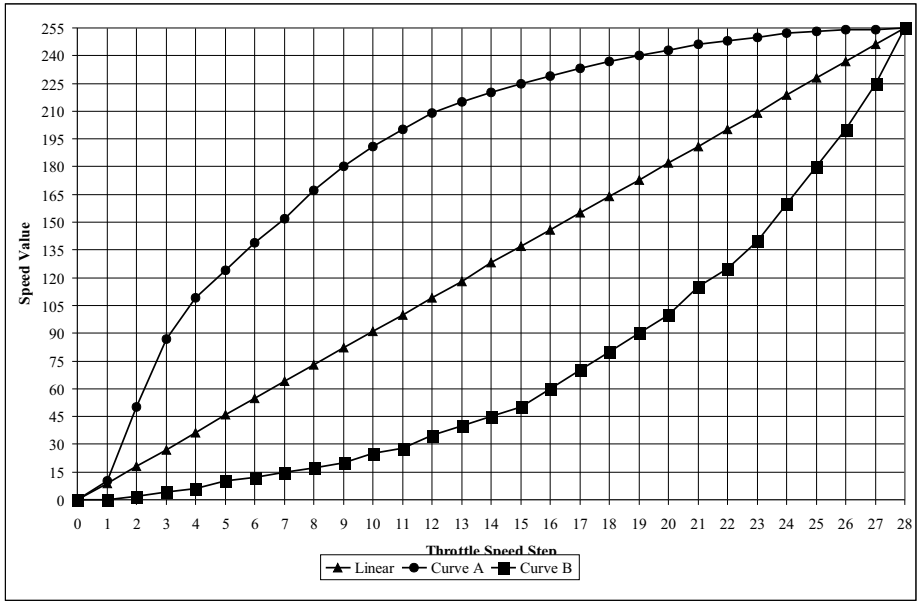
Activating The Custom Speed Table - Locomotive Address Is From 1 to 99

To activate and use the custom speed table, set CV29 to a value of 18 if the locomotive address is two digits or less.

Activating The Custom Speed Table - Locomotive Address Is From 100 to 9999

To activate and use the custom speed table, set CV29 to a value of 50 if the locomotive address is more than two digits.

Custom Speed Curve Examples



Circuit Details For AUX Light Outputs

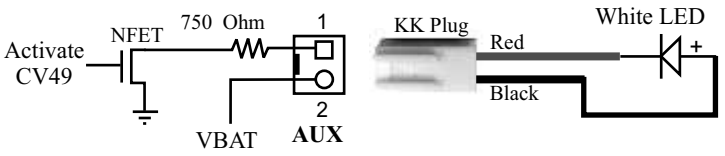
This reference page shows the different circuits used for the Drop-In Decoder AUX lighting outputs. This information is provided for those who need additional information about the decoders lighting circuit especially if the desire is to modify it. The circuits are arranged by USA-Trains type locomotive.

Note there is no protection for the source voltage pin. In most cases, this connects directly to the battery voltage. If this pin is accidentally shorted out, you can damage the Drop-In decoder. Be careful and wire correctly.

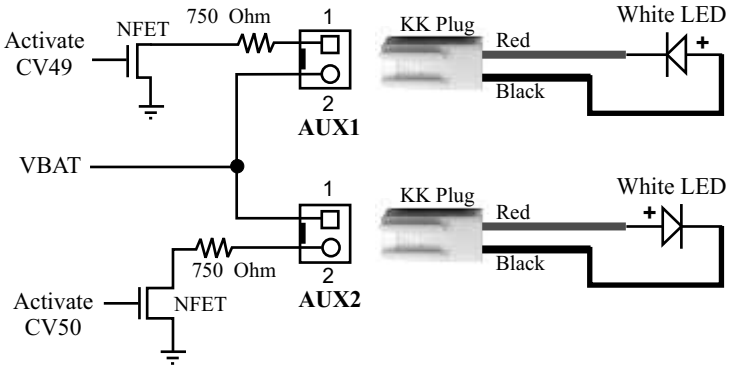
Don't use incandescent bulbs. They consume too much current and the voltage rating will be incorrect. Use LEDs only.

The CV controlling the lighting effect is shown. Note there are two AUX outputs for the GP30 and two different effect CVs. The GND symbol shown to the indicates a connection to battery minus.

F3A/B, GP7/9, SD70MAC *[corrected June 2012]*

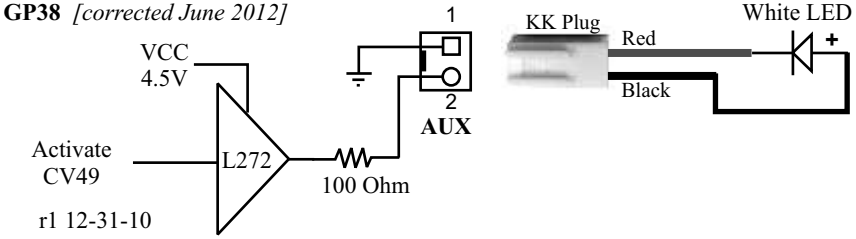


GP30 *[corrected June 2012]*



Note that LED orientation is different depending on which AUX output is used

GP38 *[corrected June 2012]*



The GP38 AUX driver circuit is different than the others. Notice that the power supply is actually 4.5V and not the battery voltage. This is why the 100 ohm resistor is used. The AUX driver is designed for white LEDs and not incandescent bulbs. The 100 ohm resistor limits the maximum current to about 20mA.

Customizing Ditch/Safety Light Operation

Not all locomotives feature ditch lights. As of this printing, only the SD70MAC has factory installed ditch lights.

Ditch Light Customizing - SD70MAC Specific

The factory settings for the Drop-In decoder turn on both of the ditch lights when the headlights are turned on. F4 is assigned to initiate ditch light flashing. When activated with F4, the ditch lights begin to alternately flash on and off. The flash rate is about a ½ second on followed by a ½ second off. This flashing continues for about 15 seconds. Any time when the ditch lights are flashing, pushing F4 resets the timer for another 15 seconds of flashing. Once the timer expires, the ditch lights return to both on. Turning off the headlight with F0 turns off the ditch lights and terminates the flashing effect if it was active.

To force an early termination of the flashing, just turn off the headlights. Doing so will stop the flashing.

There are several CVs used to customize Ditch Light operations.

Ditch Light Flash Rate CV53

Range is 0-15 . . . . . [3]

The value sets the rate or frequency at which ditch lights flash when activated. 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. The original factory setting sets the flash rate to about ¾ of a second.

Ditch Light Mode CV54

There are only two values, 0 and 1 . . . . . [0]

A value of zero sets the ditch lights to turn on with the headlights. This is the original factory value. A value of 1 keeps the ditch lights off until they are activated and begin flashing. Once the flashing has timed out, the ditch lights turn off.

Ditch Light Timeout CV55

Range is 0 to 255 . . . . . [15]

This value sets the length of time, in seconds, for the duration of the ditch light flashing once triggered.

Ditch Lights Enabled by Turning On Headlights - F0

Enable the ditch lights by turning on the headlights. Select the ditch light mode to determine how the ditch lights appear before and after the flashing is activated.

If you want the ditch lights to both com one with headlights, use mode 0. The ditch lights return to both on after the flashing sequence terminates. They will turn off when the headlights turn off.

If you want the ditch lights to stay **off** until flashing is triggered, use mode 1. They turn back off after the flashing sequence terminates.

Cab Light/Number Board and Aux Lighting Effects

The USA-Trains factory lamp wiring is notorious for being unique to each locomotive. In most cases, there are odd combination of lamps tied together. For example, the USA-Trains SD70MAC has combined the front cab interior lights and the front number boards wired together. Since these lights are wired together, any lighting effect loaded into CV48 will apply to both sets of lights. The factory setting is therefore 100% bright. Of course you could load a random flicker effect and claim there is a lively party going on in the cab.

As with the headlights, there is also a period CV used to control any of the repeating pattern effects applied to these lights.

The AUX lighting effect is used to control the optional lights connected to the AUX light driver.

Cab Interior/Number Boards Lighting Effect CV48

Range is 0-15 . . . . . [4]

The value of 4 is the original factory setting which is 100% brightness. This value is selected from the effects table which is the same as the headlight effects. It is repeated again on this page for your convenience.

AUX Light Driver Effect CV49

Range is 0-15 . . . . . [4]

The value of 4 is the original factory setting which is 100% brightness. This value is selected from the effects table which is the same as the headlight effects. It is repeated again on this page for your convenience.

CAB/AUX Period CV47

Range is 0-15 . . . . . [6]

The period CV controls the rate or **period** of a repeating pattern. Examples of repeating patterns that apply to light effects are Mars and Gyra lights. The period range is 1 to 15 and is in units of 1/4 second. For example a period value of 6 gives a repeating pattern of about once per second and a half. Bigger numbers represent slower repeat times. The period CV does not apply when the selected effect is either full bright, dim or random flickering.

Lighting Effect	CV Value	CV47 Applies
Off, 0%	0	No
Dim, 6%	1	No
Dim, 25%	2	No
Dim, 50%	3	No
On, 100% - Full Brightness	4	No
Strobe Type-1 (single pulse)	5	Yes
Strobe Type-2 (double pulse)	6	Yes
“Stratolite” rotary beacon	7	Yes
Oscillating light	8	Yes
Flashing Rear End Device (FRED)	9	Yes
Dome flasher simulated	10	Yes
Gyra Light simulated circular pattern	11	Yes
Mars light simulated figure 8 pattern	12	Yes
Rotary light simulation	13	Yes
reserved	*14*	*na*
Random flicker	15	No

Using The AUX Lighting Output

Each Drop-In decoder has at least one auxiliary light driver and some have two. These are labeled either AUX or AUX1/AUX2. Like the other lights, the AUX output can have a special lighting effect assigned to it.

The AUX drivers are for white LED use which look best for all lighting effects. Do not use an incandescent bulb since the lighting effects look poor and the bulbs consume a lot of power.

The AUX driver can be assigned to any function key. See page 6 for how to set up the decoder to respond to the desired throttle function key.

Making Connections

We offer a 2-wire plug with 12 inches of wire that matches the decoder’s AUX header. The part number is KK2. Use this plug to connect the Drop-In decoder’s AUX output to an LED.

The plug is polarized. The hookup diagrams on the next page show how to connect LEDs to the AUX lighting outputs.

When using the AUX lighting output, do not use a resistor in series with the LED - the resistor is built into the Drop-In decoder.

The AUX output can have one of the many lighting effects assigned to it. Set he CV value to your choice of the lighting effects. The factory setting is 4 which is 100% bright when the AUX output is activated.

Some decoders offer more than one AUX output. As of this printing, only the GP30 Drop-In has two independent AUX outputs.

AUX Light Driver Effect #1 . . . . . CV49

Range is 0-15 . . . . . [4]

AUX Light Driver Effect #2 (if present). CV50

Range is 0-15 . . . . . [4]

Output Current Limit For AUX Output

Except for the GP38 Drop-In (see page 18), the source voltage for the AUX output is the battery voltage. There is a 750 ohm current limit in the circuit. With the recommend 14.8V Lithium battery, the maximum output current allowed for a white LED is about 16mA. This value is more than enough for the LED to glow brightly.

The transistor driver for the AUX output is protected against over current and overheating. However, don’t depend on it to protect against faulty LED hookup.

The next page shows the circuits used on the various decoders for the AUX light drivers.

If Your Loco Lighting Connectors Are Different...

These instructions are written for the latest production runs of locomotives. We have learned that earlier production runs may have different lighting connectors and circuits so the Drop-In may not connect directly. An application note has been written to show some simple modifications to the Drop-In suitable for the older locomotives. For more information, download a copy from the CVP website - www.cvpusa.com

Do Not Use Incandescent Bulbs - Use LEDs Only