SoundTraxx Accessory Decoder

User's Guide For the Blackstone Models Open Platform Passenger Coach and Long Caboose Lighting Decoder

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All Aboard!

Overview

Congratulations on the purchase of your SoundTraxx lighting decoder for Blackstone Models Long Caboose and Open Platform Coaches. This user's guide will walk you through the various aspects of programming your decoder, as well as some tips for troubleshooting. For instructions on wiring and a wiring diagram please refer to the decoder's packaging.

Technical Bulletins and Application Notes covering various topics are also published from time to time, and these may be downloaded free of charge from our website at www.soundtraxx.com.

Operation

Using Your SoundTraxx Lighting Decoder

Your SoundTraxx decoder has been shipped with all CVs pre-programmed so you can begin using it in your model right out of the box without any programming at all. Install your lighting decoder according to the installation instructions that were included with the product. The default function assignments are as follows:

Mobile Decoders

Function Key	*Effect*
F0	**Hyperlight Lighting Output**
F5	**Interior Lights**
F6	**Hyperlight Lighting Output**
F7	**Dimmer**

While these are the default settings, you may wish to make changes to the function mapping later. For now, simply set your model on the track, select address 3, and press F5 to light the interior. As you can see, no programming is necessary to enjoy your lighting decoder, but you will probably wish to change the address to the number of the individual coach or caboose. Alternatively you can assign a consist address that makes up the train ID for a string of passenger coaches. The following section will introduce you to CVs and how and why you may wish to change them.

Basics of Programming

Programming the CVs

What is a CV?

CV stands for Configuration Variable, which is the industry-adopted term for a decoder's user-programmable memory locations. CVs allow you to customize individual decoder properties such as the address, momentum, throttle response, and much more. Once a CV has been programmed, the setting will be permanently remembered even after the power has been turned off. A CV can be modified as often as necessary by simply reprogramming it with a new value.

With the large number of CVs available, first inspection of the available options may cause confusion and little panic! Relax. As you have already seen the decoder has been shipped with all CVs pre-programmed so you can begin using your locomotive immediately without having to worry about what adjustments to make.

The following paragraphs break the decoder's CVs into various subsystems so it is only necessary to change a few CV's at a time. As you become comfortable with it's operation, move onto a new section and begin exploring the options and capabilities found there. For more technically inclined users, detailed information on any CV can be found in the **Coach and Caboose Lighting Decoder Technical Reference.**

Bits and Bytes

One of the most confusing aspects of programming a CV is figuring out what all the different bits, bytes and x's found in the various decoder manuals mean. The problem is compounded further by differences in each command station manufacturer's user interface. For users unfamiliar with such terms, a short math lesson (ugh!) is in order before proceeding:

Each decoder CV stores a numeric value that can be represented in one of three forms:

Decimal - This is the form everyone is familiar with and we use in our day-to-day lives. Numbers are represented as a sequence of digits composed of the numerals 0,1,2,3,4,5,6,7,8, and 9.

Hexadecimal - Also referred to as simply "hex", this is a more specialized number representation that, in addition to 0 through 9, also uses the characters A-F. It has the advantage that a given decimal number can be more compactly represented. For example, the decimal number 127 converts to a simple 7F in hex (one less digit). This allows user interfaces with a limited number of digits (i.e., the LCD on your cab) to display a wider range of numbers.

Binary - Binary numbers get their name from the fact they use only two digits 0 and 1 called 'bits' and is the fundamental number system used by all computers including the ones found inside a digital decoder. Because there are only two bit values, it takes more digits to represent a number using binary. The decimal number 127, for example, is written as 01111111 in binary notation. A ‘byte’ is a binary number made up of eight bits. And a ‘nibble’ is half a byte or four bits. Really! We didn’t make that up.

Coincidentally, each CV is made up from one byte or eight bits and can store any number between 0 and 255. Most of the CVs contain a single piece of data that can be easily represented in any of the three forms, i.e., CV 3, the acceleration rate, can be loaded with any value from 0 to 255 and it always affects the same thing - the acceleration rate.

On the other hand, some CVs use individual bits to control different features. This allows up to eight individual features to be controlled by a single CV and is done to conserve the number of CVs. As the bit variables can take on only one of two values (0 and 1) they are usually used for simple variables that are either On or Off, enabled or disabled or something similar. Unfortunately, bit variables are difficult to represent in any form other than binary and still preserve any meaning. Because most DCC system user interfaces don’t use binary representation, these numbers are the most difficult to work with and require a tedious series of additions to convert to the decimal or hex form used by most systems.

We have tried to use the decimal number system in this manual when describing the proper values to program into a given CV; however, you will occasionally find values listed in the Technical Reference in binary, hex and decimal values. Hex numbers can be distinguished from a decimal number by noting a 0x prefix. Thus 0x10 is the hex version of sixteen and not ten as one might guess. Binary numbers are represented using a ‘b’ suffix. 100b is really the number four and not one hundred. To further assist the math-impaired, we have provided a handy-dandy conversion table in Appendix A that allows one to quickly convert between decimal, hex and binary.

When working with individual bits such as in CV 29, we suggest the following procedure for determining the correct value to program. Referring to the CV description, write down the value desired for each individual bit. Consider for example, the case of CV 29. We would like to set this CV so that speed tables are enabled and the 28 speed-step mode is in effect. Referring to the Technical Reference, we see that bit 4 and bit 1 should be set to 1 and all other bits are cleared to zero. Remembering that we are dealing with binary, write down the individual bit values and we get:

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0	0	0	1	0	0	1	0

We then look up the binary value 00010010b in Appendix A and see that it corresponds to the decimal value 18 (0x12 in hex). This is the value to use when programming the CV.

Basics of Programming

If you don't have the conversion chart available, you can also calculate the value in the following manner. Reading from right to left, each bit has a decimal value associated with it, beginning with a 1 and doubling this value as you go from bit 0 to bit 7. This value is only counted when the bit is a '1'. Looking at the figure below, you can see that using this method, bit 1 has a value of 2 and bit 4 has a value of 16. Adding these two numbers together gives the correct decimal value of 18.

	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	
	0	0	0	1	0	0	1	0	
When bit is set to 1, value =	128	64	32	16	8	4	2	1	
Therefore:	0 +	0 +	0 +	16 +	0 +	0 +	2 +	0	= 18

Programming Methods

There are two methods for changing the decoder's CVs:

Service Mode Programming - This programming mode usually requires the locomotive to be placed on a special programming track or connected to a dedicated programmer. Your decoder can support four types of service mode instructions:

Address Mode - Can change CV 1 (Primary Address) only.
Register Mode - Can change CVs 1,2,3,4,7,8 and 29 only.
Paged Mode - Uses a page register to indirectly modify any CV.
Direct Mode - Can directly change any CV.

Operations Mode Programming - Sometimes called 'Ops Mode' or 'Programming on the Main', this programming mode allows the CVs to be changed while the locomotive is operating on the layout even when other locomotives are present. The neat thing about this mode is that the CVs can be changed in the middle of operation allowing the engineer for example, to increase the momentum rate of a locomotive after it couples to a train. The main disadvantage of operations mode programming is that the CV data cannot be read back to verify its value.

Programming and Reading CVs

Although your decoder will accept any changes you make on a programming track the decoder will not successfully read back a CV value because there is no motor load on to the decoder. Decoders generate a current pulse to the motor to create an acknowledgement. Without the motor load the command station has no way of receiving the acknowledgement from the decoder. Furthermore, the Super Capacitor interferes with the read back process.

To verify that the decoder has accepted the programming watch the interior lights for a 'blip' (a quick change in brightness). This is the lighting decoder's way of showing an acknowledgement pulse. It is also important to understand that when you attempt to program on a programming track you must first wait for the capacitor to fully discharge or else it cannot program the CVs in the decoder. Simply remove the model from the mainline and wait for the lights to turn off. This will indicate the SuperCap has discharged. (This usually takes between 35 and 120 seconds depending on the values you have in CV 55 and 56 as well as how many bulbs you have on the outputs.)

Programming Procedure

As each DCC system is different, the procedure for programming a CV will vary depending upon the system. Unfortunately, we cannot provide detailed instructions to cover every command station and have to assume that you have some level of understanding regarding it's capabilities and operating procedures. For specific programming procedures, please consult your DCC system manual.

Locking and Unlocking CVs

The CV Lock/Unlock is a relatively new feature available in some DCC decoders which allows you to program a decoder without the danger of overwriting the programming in another. This especially useful in installations where multiple decoders are used. For example, if you have installed a function decoder in addition to the mobile decoder, you may wish to lock the CVs after programming to prevent accidentally programming one or the other.

CV 15 and 16 are used for locking and unlocking the decoder. To use the CV Lock feature implemented in CV 15 and 16, Bit 0 of CV 30 must first be set to 1 (the default value is 0). This is to avoid inadvertently locking the decoder when the CV Lock feature is not needed.

CV 15 is the Unlock Code and may be programmed to any value between 0 and 255 regardless of whether the decoder is locked or unlocked. CV 16 is the Lock Code and may be set to any value between 0 and 7 but only when the decoder is unlocked. Attempts to program CV 16 with a value greater than 7 will be ignored.

The decoder is unlocked when the value in CV 15 matches the value in CV 16. Otherwise the decoder is locked and can not be programmed in either operations mode or service mode. Further, a locked decoder can not be reset to its factory defaults until it is first unlocked. These decoders are shipped from the factory with all CVs unlocked, that is, CV 15 and 16 are both set to 0.

☛ Note that if the decoder is unlocked, changing the value in CV 16 will instantly lock the decoder. You must then set CV 15 to the same value as was just programmed into CV 16 to unlock the decoder again.

If you decide to use the CV Locking feature for a multi-decoder installation, each decoder installed inside that locomotive must first have its Lock Code in CV 16 set prior to installation of any other decoders. Otherwise, all the decoders will have the same Lock Code and the feature will not work. The easiest way to go about this is to first install one decoder and program its Lock Code. Then install the next decoder and program its Lock Code. Since the first decoder is now locked it will be unaffected by the programming of the second decoder (unless you accidentally set the Lock Code of the two decoders to the same value. If this happens you will need to disconnect one decoder and start over). Continue in this manner until all decoders have been installed and their Lock Codes have been set.

It is a good idea to set up a standardized system so you don't forget the Lock Code settings. You might, for example, set all motor decoders to a CV Lock Value of 1, sound decoders to a value of 2 and function decoders to a value of 3. Keeping CV 15 set to 0 will guarantee the decoder stays locked until you are ready to begin programming.

Example: Let's say you will be installing a motor decoder, a sound decoder and a function decoder in one locomotive. Using the previously described system, you would first install the motor decoder and set its Lock Code by programming CV 16 to 1. Since CV 15 is currently set to 0 (the default value), the decoder is immediately locked. Now install the sound decoder and set its Lock Code by programming CV 16 to 2. Since CV 15 is still set to 0, this decoder is also immediately locked. Now install the function decoder and set its Lock Code by programming CV 16 to 3. At this point, all three decoders are installed and locked. Starting with the motor decoder, set CV 15 (the Unlock Code) to 1 to unlock and program the motor decoder. When you are finished set CV 15 to 2 and program the sound decoder. Finally, set CV 15 to 3 and program the function decoder. When you are done, set CV 15 back to 0 to lock all the decoders.

If You Forget the Lock Code

As there are only eight possible combinations, you can easily determine a forgotten Lock Code setting using trial and error with the following procedure:

Place the model on the programming track and set CV 15 to 0, then attempt to set CV 16 to 0. If the decoder's lights flash then it is unlocked. If it does not flash its lights then it is locked. If the decoder is locked set CV 15 to 1 and then try setting CV 16 to 1. If the decoder's lights flash it is unlocked. If it remains locked continue the exercise with values 2-7 until CV 16 causes the decoder to flash its lights. Once the lights have flashed the decoder is unlocked and you can make any CV changes you desire.

Troubleshooting Tip

Be aware that even if you are not planning to use the CV Lock feature, it can still be accidentally activated by inadvertently programming CV 15 or 16 with a non-default value. If you have a decoder that is otherwise working (i.e. responding to function commands) but has suddenly stopped accepting CV changes, then first run through the procedure under *"If you Forget the Lock Code"* to determine if the decoder has been locked.

Resetting the CVs or Starting Over

Occasionally, something goes wrong and the decoder will not respond as expected. Usually, this is caused by one or more CVs being programmed to the wrong value. The CVs can be quickly reset to their factory default values using the following procedure.

1. Program CV 30 to 2 (or CV 8 to 8) using either Service Mode or Operations Mode

2. Place the model on a powered section of track. If it is already on the mainline, cycle power to the decoder by turning power to the track off and then back on. (Remember you must allow the capacitor to discharge.)

3. After power is restored to the track there should be no indication of activity.

4. After a six-second time period, the interior light will blink 16 times indicating that the CVs were successfully reset.

5. The decoder should now respond to short address 3 just as it did when it was first unpacked.

6. If you cannot get the decoder to reset, check to see that it has not been inadvertently locked (see "If You Forget the Lock Code" in the previous section).

Basic Programming

Step 1: Configuring the Address

The first group of CVs you will want to change are those that set your Lighting decoder's address:

CV 1, Primary Address
CV 17:18, Extended Address

The decoder may be set up to recognize either the primary address (also called the short address), which provides a range of 1 to 127 or the extended (long) address, which has a range of 0001 to 9999! Whether you use the primary or extended address will first depend on whether or not your DCC system uses extended addressing (not all of them do - if in doubt, see your command station owner's manual.) Second, it will depend on your preferences and the numbering scheme you use for setting your decoder addresses. The extended address has the advantage that you can use all four digits of a caboose or coach's road number for the decoder address making it easy to remember. Be aware that some DCC systems do not support the full range of available addresses.

Primary Address

To use the primary address, simply set CV 1 to the desired address between 1 and 127.

Programming Notes: Both the primary and extended address may be changed at any time using service mode.

Some DCC systems will also allow the decoder address to be modified using operations mode programming (consult your system manual for details). Please note that when programming in operations mode, the following restrictions apply:

If the decoder's primary address is enabled (i.e., CV 29, bit 5 is 0), only the extended address may be changed using operations mode programming.

If the decoder's extended address is enabled (i.e., CV 29, bit 5 is 1), only the primary address may be changed using operations mode programming.

Extended Address

The extended address is actually made up of two CVs, 17 and 18. Unless you are an experienced user, you should not try to program these CVs individually as a specific protocol is required in order for the decoder to accept the new data (See the Technical Reference for details). Since most command stations that support extended addressing will automatically generate the correct protocol, simply follow their instructions for setting the extended address.

Basic Programming

Once the extended address is stored in CV 17 and 18, bit 5 of CV 29 must be set to 1 so the decoder will recognize the extended address format. Otherwise, the decoder will continue to respond only to its primary address. See the next section, Configuring the Decoder.

Step 2: Configuring the Decoder

The next CV you will want to change is **CV 29, Decoder Configuration Byte.** CV 29 is one of those complicated bit variables mentioned earlier and is used in conjunction with other CVs to set a multitude of decoder characteristics including Direction, Speed Step Mode Selection, and Alternate Power Mode Enable.

Bit 7 **Bit 0**

0	0	EAM	RES	ACK	APS	F0	DIR

Direction - Causes the decoder to invert direction commands so that the coach's lights run in reverse when it receives a command to move forward and vice-versa. This is only if you are using the F0(f) and/or F0(r) outputs on the decoder. It will not affect the FX5 or FX6 outputs.

Speed Step Mode Selection - As it is a digital system, your decoder splits the throttle voltage over its minimum and maximum range into discrete speed steps. The decoder can be configured so there are 14, 28 or 128 individual speed steps. Since not all DCC systems have the ability to control 28 or 128 speed steps, your choice will depend upon the technical capabilities of your command station. Running your decoder in the wrong speed step mode will make the F0 lighting outputs flash on and off.

Primary or Extended Address - Sets the decoder to recognize its primary address in CV 1 or extended address in CV 17:18 (see "Configuring the Address", page 13).

Alternate (Analog) Power Mode - Enables the decoder to work with an alternate power mode (such as DC operation) as set by CV 12 when a DCC signal is not present.

To assist the novice user, we have created Table A on page 16 that lists the correct value for CV 29 to get the desired operating modes.

To use the table, simply find the row that has the modes you want and program CV 29 with the listed value.

The advanced user should refer to the Technical Reference for more details. Remember, table values are in decimal. If your command station uses Hex (Hexadecimal), you will need to convert the value shown using Appendix A.

Step 3: Configuring the Lighting Outputs

SoundTraxx Lighting decoders have up to four function outputs used for controlling the car lights.

Each can be set for a variety of effects or as simple on/off lights. In addition, you can use the Grade Crossing Logic to automatically activate the selected lighting effect when you activate function 2.

There are eight CVs for customizing the lighting effects:

CV 49, Headlight Configuration
CV 50, Backup Light Configuration
CV 51, FX5 Light Configuration
CV 52, FX6 Light Configuration
CV 55, F0 (f and r) LED Brightness
CV 56, FX5 and FX6 LED Brightness
CV 60, Grade Crossing Effect Hold Time.

Setting the Hyperlight Effects

Each lighting output has a corresponding CV that determines its operating characteristics:

Bit 7							Bit 0
LED	R17	XING	PHSE	HYPERLIGHT SELECTION			

Hyperlight Select - Each output can be programmed to one of several Hyperlight™ Lighting Effects as listed in Table A (pg 15). Most effects are self-descriptive and primarily warning beacons used for diesel locomotives. Some effects, such as the Mars Light, were used in some steam engines as well.

Dimmable Headlight - The function output is normally an on/off output. If the output is on, the output level will be reduced about 60% whenever the dimmer function is on.

Mars Light - This effect simulates the sweeping figure-8 pattern of this popular warning beacon.

Pyle National Gyralite - The Gyralite is similar to the Mars Light, but generates a slow, wide, oval headlight sweep pattern.

Dual Oscillating Headlights - Similar in appearance to the common twin-sealed-beam headlight, the oscillating headlight uses a moving reflector to sweep the headlight beam in a tight circular motion.

Single and Dual Strobes - The Strobe effects simulate the white-hot burst of light associated with the Xenon Strobe.
Western-Cullen D312 Rotary Beacon - This effect provides a spectacular rendition of the revolving reflector and bulb assembly of the prototype warning beacon found atop many diesels of the 60’s and 70’s.

Prime Stratolite - The Stratolite was a newer version of the rotary beacon, with the prototype consisting of a revolving reflector with four individual lamps arranged in a circular pattern which are electronically flashed in a clockwise sequence. The Stratolite flashes in a rather mechanical ‘stepped’ fashion, as opposed to the smooth motion of the Rotary Beacon.

Type I and Type II Ditch Lights - These are identical when operating. However, if the grade crossing logic is enabled, the Type I ditch light will revert to a steady on state when it is not flashing whereas the Type II lights will turn off.

Exhaust Flicker - This effect produces a random flicker whose intensity increases with locomotive speed. This effect is best used by placing a red/orange LED in the firebox or in the smokestack. As the locomotive increases speed, it will glow brighter, imitating an increase in sparks and exhaust gases.

Firebox Flicker (coal potbelly stove flicker) - This effect produces a random flicker whose intensity resembles a burning fire and can be used with a lamp placed in the coal stove area of your coach. The effect is improved when two lights are used, one yellow and one red or orange and each connected to a separate function output.

Dyno-Light - This effect for steam locomotives synchronizes the lamp brightness to the “output” of the dynamo such that the lamp brightness gradually increases as the dynamo builds up speed.

Phase Select - Alters the timing of the effect so that it is 180 degrees out of phase with the other effects. This allows you to have two light effects that blink back and forth if desired. Set one effect to phase A and the other to phase B.

Grade Crossing Logic - Causes the lighting effect to become active only when function 2 has been activated (and the corresponding lighting function key is also on). A typical use would be to cause the ditch lights to flash at a grade crossing. The grade crossing logic can be used with almost all the Hyperlight effects. The on/off, dimmable headlight, Dyno-Light, FRED, exhaust flicker, and firebox flicker effects will not be affected. The other effects will either turn off (strobes and beacons) or revert to a steady on state (mars light, ditch lights, etc.) as appropriate to prototype practice.

Rule 17 Headlight Operation - Converts the headlight and backup light to independent, non-directional functions. When enabled, the headlight is controlled as if it were FX5, Function 5 and the backup light as FX6, Function 6.

Basic Programming

LED Compensation Mode - SoundTraxx Lighting Decoder's Hyperlight effects can be used with either incandescent bulbs or LEDs. However, because of their differences in brightness characteristics, some lighting effects will appear less life-like when initially set up with an LED. To correct this, the LED compensation mode should be enabled which will improve the contrast of the lighting effect by automatically adjusting the function output level to correct for the different brightness characteristics of an LED.

To set the Hyperlight configuration CVs, proceed as follows:

1. First find the CV value in Table G on the next page for the desired lighting effect and operating mode.
2. If you wish to enable Rule 17 Mode, add 64 to the table value shown, otherwise, proceed to Step 3.
3. If you're using incandescent bulbs, skip to Step 4. If you are using LEDs, enable the LED Compensation Mode by adding 128 to the sum computed in Step 2.
4. Program the sum computed in Step 3 into the CV corresponding to the appropriate function output. Use CV 49 to set the headlight, CV 50 for the backup light.

Setting the LED Brightness

CVs 55 and 56 set the overall brightness of the lighting outputs. This can be helpful to decide how bright you want your marker lamps, coal stove flickering fire, or rear end marker lights for your car. It can also be helpful to make the charge on the capacitor last longer. The capacitor will stay charged for around 30 seconds when you have the decoder set to the default of 100% brightness, but if you lower this to 50% the capacitor will stay charged for over 90 seconds. This can be helpful for analog operation where you may have short station stops, and want the lights to stay lit while stopped at the station.

CV 55 adjusts the F0 (f and r) outputs while CV 56 adjusts the FX5 and FX6 outputs. The number entered into CV 55 or 56 will be the overall percentage of brightness. For example a value of 50 would make the lights half as bright as the default, which is 100. A value of 100-255 will set the output to 100% brightness while a value of 0 will disable the output.

Setting the Flash Rate and Hold Time

CV 59 is used to adjust the flash rate of the Hyperlight effect and has a range of 0-15 with 15 being the slowest flash rate. When the Grade Crossing Logic feature is enabled, CV 60 is used to adjust the length of time (in seconds) an effect will remain active after the whistle key is released. CV 60 can be programmed with any value between 0 and 15.

Example, Mars Light with Grade Crossing Logic

In this example, we will configure the headlight output for use with an incandescent bulb as a Mars Light with Grade Crossing Logic enabled. Following the steps outlined above, we proceed as follows:

Basic Programming

1. We first look up the initial CV value in Table A for a Mars Light under the column labeled 'Crossing Logic On' and find it is 34 for Phase A and 50 for Phase B. Since we are only setting up one light, we do not care about the Phase and choose the value for Phase A, 34.
2. Since we are not using Rule 17, we skip to Step 3.
3. Since we are not using LEDs, we skip to Step 4.
4. CV 49 (Headlight Configuration) is programmed with the value found in Step 1 or 34.

Lastly, we need to set the grade crossing hold time to about six seconds by programming CV 60 to 6.

Table A. Hyperlight Control Mode Settings

Effect Type	CV Value			
	Crossing Logic Off		Crossing Logic On	
	Phase A	Phase B	Phase A	Phase B
On-off	0	16	32	48
Dimmable	1	17	33	49
Mars Light	2	18	34	50
Gyralite	3	19	35	51
Oscillating Headlight	4	20	36	52
Single Flash Strobe	5	21	37	53
Double Flash Strobe	6	22	38	54
D312 Rotary Beacon	7	23	39	55
Prime Stratolite	8	24	40	56
Type I Ditch Light	9	25	41	57
Type II Ditch Light	10	26	42	58
FRED	11	27	43	59
Exhaust Flicker	12	28	44	60
Firebox Flicker	13	29	45	61
Reserved				
Dyno-Light	15	31	47	63

Step 4: Configuring for Consist Operation

The decoder supports advanced consist operations, which use three related CVs:

CV 19, Consist Address
CV 21, Consist Function Control 1
CV 22, Consist Function Control 2

Consists Explained

In a traditional sense a consist is a group of locomotives that are set up to respond to throttle command as a single unit. For the purpose of lighting decoders however, setting up a consist can also be helpful. This can allow you to light an entire fleet of passenger cars that you can have set to one single consist address, for example the train's ID. The consist CV (19) allows the decoders to recognize a new address assigned to the consist without changing its primary or extended address. Additionally, they allow each car to operate under the same address, but limit certain function properties to only some cars in the consist. For example, if you had a passenger train of five cars you would want the interior lights to turn on in all five, but you may want only the rear car to have its marker lights lit designating the end of the train.

Consist Address

Each car in the consist is assigned the same consist address by programming CV 19 with the consist address between 1 and 127.
To deactivate the consist address and restore normal operation, CV 19 must be reprogrammed to 0.

Note that when the consist address is set, the decoder will continue to respond to instructions sent to its primary or extended address except for speed and direction data.

The decoder will not respond to operations mode programming commands sent to its consist address. These commands must always be used with the primary or extended address.

Consist Function Enable

CV 21 and 22 allow you to define how each car individually responds to function commands sent to the consist address. When the consist is enabled, CV 21 controls which of functions 1-8 are active and CV 22 controls the F0 function for forward (F0(f)) and reverse (F0(r)), as well as functions 9-12.

CV 21 and 22 take effect only when the consist address is set. When function commands are used with the decoder's primary or extended address, all functions will continue to work regardless of the settings of CV 21 and 22.

Basic Programming

Use Table B to calculate the correct value for CV 21, and Table C to calculate the correct value for CV 22. Begin by looking at Table B and determining which functions you want active in the consist and circle the number below it. When you are done, add up all the circled numbers in the row and program the total into CV 21.

Table B. Consist Function Control 1

CV#	F1	F2	F3	F4	F5	F6	F7	F8
21	1	2	4	8	16	32	64	128

Now look at Table C and do the same: add up all the circled numbers in the row and program CV 22 with the sum.

Table C. Consist Function Control 2

CV#	F0(f)	F0(r)	F9	F10	F11	F12
22	1	2	4	8	16	32

Note that each decoder in the consist will require a different set of values for CV 21 and 22 depending upon your requirements.

Step 5: Function Mapping

Function Mapping Explained

Function mapping allows the decoder to be reconfigured so that function outputs can respond to a different function key input. This is especially useful for users who have throttles with less than six function keys as now they can pick and choose what effects they can control instead of being restricted to an arbitrary assignment.

There are 14 function mapping CVs - twelve CVs, 35-46 are used to assign output control to function keys 1 through 12 respectively.

The other two CVs, 33 and 34 are both for the F0 function. CV 33 controls which outputs are on when F0 is on and the car is moving forward. CV 34 controls which outputs are on when F0 is on and the car is moving in reverse. If the same output is selected in both CV 33 and CV 34, that function will turn on when the F0 function is on regardless of the cars direction.

Not all keys can control all outputs or effects. The table below shows which functions can be mapped to which outputs. Note that a function key can be set up to control more than one output.

Function Mapping Table

Function Key	Control CV	FX 0F	FX 0R	Xing Logic	RESERVED	FX5	FX6	RESERVED	RESERVED	RESERVED	RESERVED	Dimmer	RESERVED	RESERVED	RESERVED	RESERVED
F0 (f)	33	**1**	2	4	8	16	32	64	128							
F0 (r)	34	1	**2**	4	8	16	32	64	128							
F1	35	1	2	4	8	16	32	64	128							
F2	36	1	2	**4**	8	16	32	64	128							
F3	37				1	2	4	8	16	32	64	128				
F4	38				1	2	4	8	16	32	64	128				
F5	39				1	**2**	4	8	16	32	64	128				
F6	40				1	2	**4**	8	16	32	64	128				
F7	41							1	2	4	8	**16**	32	64	128	
F8	42							1	2	4	8	16	32	64	128	
F9	43							1	2	4	8	16	32	64	128	
F10	44								1	2	4	8	16	32	64	128
F11	45								1	2	4	8	16	32	64	128
F12	46								1	2	4	8	16	32	64	128

Bold Numbers indicate default settings.

Basic Programming

An output can be also be controlled by more than one function key. In the second case, if an output is mapped to two function keys, either key will turn that output on, however, the output will not turn off until both function keys have been turned off.

To determine the correct CV value,

1. Find the column in the Function-Mapping Table corresponding to the function or sound effect output you wish to control.
2. Next locate the row corresponding to the function key you wish to use for controlling the selected output.
3. Note the number located in the box at the intersection of the row and column you have selected.
4. Program the CV listed in the row chosen in step 2 with the value found in step 3.

Step 6: Analog Mode

Analog Mode

Your SoundTraxx lighting decoder is designed to be used in both Analog (DC) and DCC Modes. The decoder has been defaulted to have analog mode operation enabled, but it is a good idea to understand how these features are enabled should any CVs be changed. Fist, CV 12 must be set to a value of 1 or the decoder will no recognize DC voltage. Next bit 2 in CV 29 must be enabled. Finally the lighting outputs that you wish to have light up in analog must be turned on through CVs 13 and 14. Again, all these CVs have been defaulted to operate in analog mode..

Analog Mode Operation

When analog mode is enabled, you may control your decoder using an ordinary power-pack.

The throttle must be turned up to around 4 volts to provide sufficient voltage to power up the decoder's capacitor and internal circuitry. At this point, you will begin to see the lights turn on.

When operating in analog mode, be careful not exceed the decoder's input voltage rating of 27 volts. When your track voltage exceeds 21 volts, the decoder will automatically shut down and begin flashing Error Code 10 on all of its lighting outputs. When you see this condition, back down on the throttle immediately.

☛ **Important:** Your decoder will work best in analog mode when using a high quality, electronically regulated power pack, preferably one that supplies smooth, filtered DC power. Older rheostat style power packs and pulse power packs will result in erratic and unreliable operation and should not be used with the decoder. If your power pack provides a Pulse power switch, leave it in the 'Off' position.

Analog Mode Options

As discussed earlier CVs 13 and 14 must be set up to activate the functions to turn on in analog mode.

Analog Function Enables

CV 13, Analog Function Enable 1
CV 14, Analog Function Enable 2

These CVs allow you to force a function input to the ON state whenever your decoder switches over to analog mode. This is most useful for turning on lighting effects when running on a DC powered layout.

Basic Programming

To enable any of Functions F1 thru F8, refer to Table D below and circle the numbers corresponding to the function inputs you want to enable. Then add up the circled numbers and program this value into CV 13.

Table D. Analog Function Enable 1

CV#	F1	F2	F3	F4	F5	F6	F7	F8
13	1	2	4	8	16	32	64	128

Similarly, to enable Function F9 thru F8 or F0, refer to Table E below and circle the numbers corresponding to the function inputs you want turned on. Then add up the circled numbers and program this value into CV 14.

Table E. Analog Function Enable 2

CV#	F0(f)	F0(r)	F9	F10	F11	F12
14	1	2	4	8	16	32

Note that when you enable a particular function input for analog mode operation, it has the same effect as pressing the equivalent function key on your DCC cab. The Mobile Decoder's function mapping settings will ultimately determine which output or sound effect is activated by the enabled function. Assuming you have not changed the default function mapping, then enabling the F0(f) function in analog mode will turn on the F0(f) output.

Troubleshooting

Troubleshooting

If you should have any difficulties with the operation of your SoundTraxx Lighting Decoder, first check this section for hints on trouble shooting. We have found that most problems are caused by an errant CV value and are easily corrected. When all else fails, try resetting the CV values back to their defaults (see the section 'Basic Programming') and try again.

Lights flicker on and off

Decoder is in 14 speed step mode and command station is set to 28 speed steps.

Lights do not work

Decoder is in 28/128 speed step mode and command station is set to 14 speed steps.
Function mapping is improperly set.
Burned out light bulbs.
If using 1.5 volt micro-bulbs, resistor value is too large.
Broken lamp wires.

If you are still having difficulties, contact our customer service department for guidance.

SoundTraxx Service Department
210 Rock Point Drive
Durango, CO 81301
Telephone (970) 259-0690
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Email: support@soundtraxx.com

Appendix A

Decimal-Hex-Binary Conversion Table

DECIMAL	HEX	BINARY (76543210)	DECIMAL	HEX	BINARY (76543210)	DECIMAL	HEX	BINARY (76543210)	DECIMAL	HEX	BINARY (76543210)
0	00	00000000	64	40	01000000	128	80	10000000	192	C0	11000000
1	01	00000001	65	41	01000001	129	81	10000001	193	C1	11000001
2	02	00000010	66	42	01000010	130	82	10000010	194	C2	11000010
3	03	00000011	67	43	01000011	131	83	10000011	195	C3	11000011
4	04	00000100	68	44	01000100	132	84	10000100	196	C4	11000100
5	05	00000101	69	45	01000101	133	85	10000101	197	C5	11000101
6	06	00000110	70	46	01000110	134	86	10000110	198	C6	11000110
7	07	00000111	71	47	01000111	135	87	10000111	199	C7	11000111
8	08	00001000	72	48	01001000	136	88	10001000	200	C8	11001000
9	09	00001001	73	49	01001001	137	89	10001001	201	C9	11001001
10	0A	00001010	74	4A	01001010	138	8A	10001010	202	CA	11001010
11	0B	00001011	75	4B	01001011	139	8B	10001011	203	CB	11001011
12	0C	00001100	76	4C	01001100	140	8C	10001100	204	CC	11001100
13	0D	00001101	77	4D	01001101	141	8D	10001101	205	CD	11001101
14	0E	00001110	78	4E	01001110	142	8E	10001110	206	CE	11001110
15	0F	00001111	79	4F	01001111	143	8F	10001111	207	CF	11001111
16	10	00010000	80	50	01010000	144	90	10010000	208	D0	11010000
17	11	00010001	81	51	01010001	145	91	10010001	209	D1	11010001
18	12	00010010	82	52	01010010	146	92	10010010	210	D2	11010010
19	13	00010011	83	53	01010011	147	93	10010011	211	D3	11010011
20	14	00010100	84	54	01010100	148	94	10010100	212	D4	11010100
21	15	00010101	85	55	01010101	149	95	10010101	213	D5	11010101
22	16	00010110	86	56	01010110	150	96	10010110	214	D6	11010110
23	17	00010111	87	57	01010111	151	97	10010111	215	D7	11010111
24	18	00011000	88	58	01011000	152	98	10011000	216	D8	11011000
25	19	00011001	89	59	01011001	153	99	10011001	217	D9	11011001
26	1A	00011010	90	5A	01011010	154	9A	10011010	218	DA	11011010
27	1B	00011011	91	5B	01011011	155	9B	10011011	219	DB	11011011
28	1C	00011100	92	5C	01011100	156	9C	10011100	220	DC	11011100
29	1D	00011101	93	5D	01011101	157	9D	10011101	221	DD	11011101
30	1E	00011110	94	5E	01011110	158	9E	10011110	222	DE	11011110
31	1F	00011111	95	5F	01011111	159	9F	10011111	223	DF	11011111
32	20	00100000	96	60	01100000	160	A0	10100000	224	E0	11100000
33	21	00100001	97	61	01100001	161	A1	10100001	225	E1	11100001
34	22	00100010	98	62	01100010	162	A2	10100010	226	E2	11100010
35	23	00100011	99	63	01100011	163	A3	10100011	227	E3	11100011
36	24	00100100	100	64	01100100	164	A4	10100100	228	E4	11100100
37	25	00100101	101	65	01100101	165	A5	10100101	229	E5	11100101
38	26	00100110	102	66	01100110	166	A6	10100110	230	E6	11100110
39	27	00100111	103	67	01100111	167	A7	10100111	231	E7	11100111
40	28	00101000	104	68	01101000	168	A8	10101000	232	E8	11101000
41	29	00101001	105	69	01101001	169	A9	10101001	233	E9	11101001
42	2A	00101010	106	6A	01101010	170	AA	10101010	234	EA	11101010
43	2B	00101011	107	6B	01101011	171	AB	10101011	235	EB	11101011
44	2C	00101100	108	6C	01101100	172	AC	10101100	236	EC	11101100
45	2D	00101101	109	6D	01101101	173	AD	10101101	237	ED	11101101
46	2E	00101110	110	6E	01101110	174	AE	10101110	238	EE	11101110
47	2F	00101111	111	6F	01101111	175	AF	10101111	239	EF	11101111
48	30	00110000	112	70	01110000	176	B0	10110000	240	F0	11110000
49	31	00110001	113	71	01110001	177	B1	10110001	241	F1	11110001
50	32	00110010	114	72	01110010	178	B2	10110010	242	F2	11110010
51	33	00110011	115	73	01110011	179	B3	10110011	243	F3	11110011
52	34	00110100	116	74	01110100	180	B4	10110100	244	F4	11110100
53	35	00110101	117	75	01110101	181	B5	10110101	245	F5	11110101
54	36	00110110	118	76	01110110	182	B6	10110110	246	F6	11110110
55	37	00110111	119	77	01110111	183	B7	10110111	247	F7	11110111
56	38	00111000	120	78	01111000	184	B8	10111000	248	F8	11111000
57	39	00111001	121	79	01111001	185	B9	10111001	249	F9	11111001
58	3A	00111010	122	7A	01111010	186	BA	10111010	250	FA	11111010
59	3B	00111011	123	7B	01111011	187	BB	10111011	251	FB	11111011
60	3C	00111100	124	7C	01111100	188	BC	10111100	252	FC	11111100
61	3D	00111101	125	7D	01111101	189	BD	10111101	253	FD	11111101
62	3E	00111110	126	7E	01111110	190	BE	10111110	254	FE	11111110
63	3F	00111111	127	7F	01111111	191	BF	10111111	255	FF	11111111

Appendix B

List of Configuration Variables (CVs)

The following is a quick reference list of CVs used by Tsunami. See the Tsunami Technical Reference for detailed information about their uses.

CV 1	**Primary Address Control**
CV 7	**Manufacturer Version ID (Read Only)**
CV 8	**Manufacturer ID**
CV 11	**Packet Time Out Value**
CV 12	**Power Source Conversion**
CV 13	**Analog Function Enable 1**
CV 14	**Analog Function Enable 2**
CV 15	**CV Unlock Register**
CV 16	**CV Lock ID Code**
CV 17,18	**Extended Address**
CV 19	**Consist Address**
CV 21	**Consist Function Group 1**
CV 22	**Consist Function Group 2**
CV 29	**Configuration Register 1**
CV 30	**Error Information/Alternate Mode Selection**
CV 33	**FL(f) Output Location**
CV 34	**FL(r) Output Location**
CV 35	**F1 Output Location**
CV 36	**F2 Output Location**
CV 37	**F3 Output Location**
CV 38	**F4 Output Location**
CV 39	**F5 Output Location**
CV 40	**F6 Output Location**
CV 41	**F7 Output Location**
CV 42	**F8 Output Location**
CV 43	**F9 Output Location**
CV 44	**F10 Output Location**
CV 45	**F11 Output Location**
CV 46	**F12 Output Location**
CV 49-52	**Hyperlight Effect Select (for FL(f), FL(r), Function 5, 6)**
CV 55	**F0 (f and r) LED Brightness**
CV 56	**FX5 and FX6 LED Brightness**
CV 59	**Flash Rate**
CV 60	**Crossing Hold Time**
CV 62	**Transponding Control**
CV 64	**Analog Mode Max Motor Voltage**
CV 105	**User Identifier #1**
CV 106	**User Identifier #2**

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