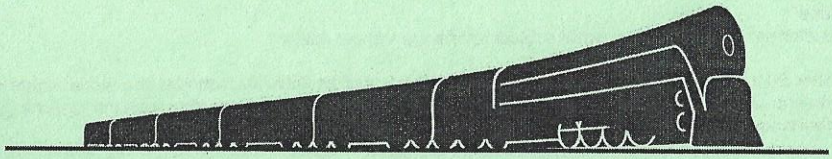

S-Helper Service Inc.®

DIGITAL SOUND DECODER BY

SOUNDTRAXX™

DIGITAL SOUND DECODER FOR THE S-HELPER F7

OWNER'S MANUAL

Part Number 001199

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ALL ABOARD!

Congratulations on the purchase of your S-Helper Service® Digital Sound Decoder (DSD), manufactured by SoundTraxx™. Properly installed, the Digital Sound Decoder will provide all the pleasures of high quality, digital onboard sound and the benefits of today's DCC (Digital Command Control) technology. With the proper tools, basic modeling skills and common sense, equipping a locomotive with sound is not difficult. It may, however, be a new experience for you, and you will find that successive installations will go more quickly than the first. Please note that while each decoder is tested thoroughly before it is shipped, we cannot control the correctness or quality of the installation. It is imperative that you follow the directions.

If this is your first decoder installation, this Owner's Manual will provide you with all the information you need to get started. A Quick Start Guide is provided which includes installation instructions for the Digital Sound Decoder. SoundTraxx also provides the **Version 2.00 Decoder Technical Reference** (PN 140069) written for the experienced user who wishes to have a complete reference for advanced programming techniques. This can be purchased from SoundTraxx or obtained free from the SoundTraxx website, at http://www.soundtraxx.com/dcc/docs.html.

FEATURES AND SPECIFICATIONS

SoundTraxx, the leader in Digital Sound technology, has designed the Digital Sound Decoder exclusively for S-Helper Service. It is designed to be installed onboard your S-Helper Service locomotive in conjunction with a miniature speaker to provide the ultimate in realism and control. The decoder integrates a full-featured digital sound system, a Hyperlight™ and a DCC decoder into a single electronic module. The modeler is thus freed of the expense and frustration of trying to fit multiple pieces of equipment into an often space limited locomotive. Specially designed plug-in connections make installation a snap.

Decoder Features

- *Compatible with NMRA DCC Standards and Recommended Practices as defined by S-9.1, S-9.2, RP-9.1.1, RP-9.2.1, RP-9.2.2, RP-9.2.3 and RP-9.2.4.*
- *Supports short address mode for compatibility with 'simple' systems.*
- *Supports extended address mode for assigning any locomotive number up to 9,999.*
- *Supports advanced consist addressing.*
- *Supports 'Operation Mode Programming', allowing CVs to be changed on the mainline without using a programming track.*

Throttle Features

- *Supports 14, 28 and 128 speed step modes.*
- *Programmable acceleration, deceleration and starting voltage for prototypical starting and stopping.*
- *Use of standard and alternate speed tables*
- *The Digital Sound Decoders are suitable for engines or multiple-unit consists whose total stall current does not exceed 4 Amps.*

CAUTION: The S-Helper Digital Sound Decoders are designed to work at track voltages between 7.5 and 16 volts maximum. On most command stations, this corresponds to a track setting of N or HO. Do NOT use the O or G scale settings!

Operating your DSD at voltages greater than 16 volts will void your warranty, produce excessive heat and possible permanent damage to the decoder. It is suggested that track voltages be set to no more than 14 volts to avoid exceeding the recommended operating range.

Lighting Features

- *One function output for Headlight (Default = F0(f)).*
- *One function output for Mars Warning Beacon (Default = F5).*
- *One function output for Numberboard Lights (Default = F3).*
- *One function output for Red Classification Lights (Default = F6).*
- *One function output for Green Classification Lights (Default = F7).*
- *Supports "Rule 17" operation.*
- *100mA Current Sink Capacity·*

Diesel Sound Features

- *Engine Exhaust and Turbo Whine (if appropriate)*
- *Three Selectable Airhorns, representing popular single-chime, three-chime, and 5-chime airhorns (Default = F2)*
- *Bell (Default = F1)*
- *Dynamic Brakes (Default = F4)*
- *Separate Volume Controls for each sound effect*
- *1-Watt Audio Amplifier*

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, sound volume 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 perhaps a bit of a brain-cramp! Take an aspirin and relax.

> ***The Digital Sound 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 CVs into various subsystems so it is only necessary to change a few CV's at a time. As you become comfortable with the decoder'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 **Version 2.00 Decoder Technical Reference** available from the SoundTraxx website for free.

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 on the various decoder manuals (including this one) mean. The problem is compounded further by differences in each command station manufacturer's user interface. For those users unfamiliar with such terms, a short math lesson 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.

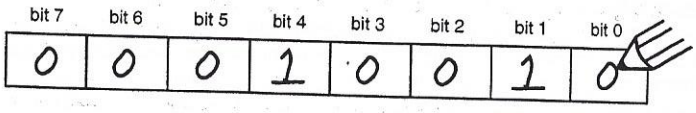
Coincidentally, each CV is made up from one byte or eight bits and can store any number between 0 and 255. Most of the CVs contain a single piece of data that can be easily represented in any of the three forms. i.e., CV 3, the acceleration rate, can be loaded with any value from 0 to 255 and it always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

Whenever possible, we have tried to use the decimal number system in this manual when describing the proper values to program into a given CV. Throughout this manual, a hex number 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 from left to right 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 **Version 2.00 Decoder Technical Reference,** we see that bit 4 and bit 1 should be set to 1 and all other bits are cleared to zero. Starting with bit 7 and working to the right, we write down the individual bit values and get:



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.

Programming Methods

There are two methods for changing the 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. The Digital Sound Decoder is an advanced decoder and supports 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.

Note: The Digital Sound Decoder imposes the restriction that CV 1 cannot be changed in this mode to prevent accidental modification of the locomotive's address during operation.

Reading CVs
Certain command stations also allow you to read a CV during Service Mode Programming, which is useful to verify its current setting. If you have trouble reading or verifying CVs, the problem may be due to the design of your command station and not the decoder itself. This decoder and all other decoders communicate back to the command station using what's called an acknowledgment pulse, which is defined in NMRA RP-9.2.3 as "an increased load on the programming track of at least 60mA for at least 5ms." Like most decoders, the Digital Sound Decoder generates the acknowledgment pulse by momentarily applying power to the motor. You can often visually verify that the decoder is properly responding to your programmer by observing a slight twitch in the motor shaft when a read or write command is given.

If your decoder is otherwise working properly (i.e., responds properly on the mainline to speed and direction commands) but your command station is having troubles reading CV data from the decoder, it may be due to incompatibilities between the electrical requirements of the Digital Sound Decoder (which are different from conventional decoders due to the added audio circuitry) and the electrical characteristics of your programming track. In such an event, we suggest you simply go ahead and program the data into the CVs anyway. Usually the decoder will accept the data and function properly when placed back on the main track. You can also try a different programming mode. If your system supports it, the best way to program the CVs is Operations Mode, as it allows you to immediately see or hear the results of your changes.

It is important to realize that not all programming modes will program all CVs. Additionally, the specific programming mode you use will depend upon the type of DCC system you are using. Some of the newer DCC systems can automatically select the proper programming mode so all you need to do is specify the CV number and its new value. On the other hand, some systems support only a few of the programming modes and may restrict which CVs you can program. If in doubt, refer to your DCC system's manual or contact the manufacturer to determine which methods they support.

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.

Step 1: Configuring the Address
The first group of CVs you will want to change are those that set the 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 1 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 locomotive'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. *Note: The primary address can only be set in service mode.*

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 **Version 2.00 Decoder 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.

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:

Locomotive Direction - Causes the decoder to invert direction commands so that the locomotive runs in reverse when it receives a command to move forward and vice-versa. This operating mode is most useful for setting up diesel engines that ran with the long hood section forward. However, it is also useful for electronically correcting installations where the motor wires were accidentally reversed and avoids tearing apart the locomotive a second time.

Speed Step Mode Selection - As it is a digital system, the decoder splits the throttle voltage over

Table A. Quick-Reference Table for CV29 Values

Address Type	Use Speed Tables?	Speed Steps	Locomotive Direction	CV 29 Value
Primary (CV1)	No	14	Normal	0
Primary (CV1)	No	14	Reversed	1
Primary (CV1)	No	28/128	Normal	2
Primary (CV1)	No	28/128	Reversed	3
Primary (CV1)	Yes	14	Normal	16
Primary (CV1)	Yes	14	Reversed	17
Primary (CV1)	Yes	28/128	Normal	18
Primary (CV1)	Yes	28/128	Reversed	19
Extended (CV17:18)	No	14	Normal	32
Extended (CV17:18)	No	14	Reversed	33
Extended (CV17:18)	No	28/128	Normal	34
Extended (CV17:18)	No	28/128	Reversed	35
Extended (CV17:18)	Yes	14	Normal	48
Extended (CV17:18)	Yes	14	Reversed	49
Extended (CV17:18)	Yes	28/128	Normal	50
Extended (CV17:18)	Yes	28/128	Reversed	51

its minimum and maximum range into discrete speed steps. The decoder can be configured so there are 14, 28 or 128 individual speed steps. The largest number of steps will give the smoothest throttle response. Be aware that not all DCC systems have the ability to control 28 or 128 speed steps and your choice will depend upon the capabilities of your command station.

Speed Table - Sets the decoder to use speed tables specified by CV 25 (see "Configuring the Throttle", below).

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 7).

To assist the novice user, we have created Table A that lists the correct value for CV 29 to get the desired operating modes. 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 **Version 2.00 Decoder Technical Reference** for more details. Remember, table values are in decimal. If your command station uses Hexadecimal, you will need to convert the value shown using
Appendix A.

Step 3: Configuring the Throttle
There are eight CVs that characterize the decoder's throttle response and 28 more used to create a custom speed table:

CV 2, VStart
CV 3, Acceleration Rate
CV 4, Braking Rate
CV 9, Motor PWM period
CV 25, Speed Table Select
CV 29, Configuration Data
CV 66, Forward Trim
CV 95, Reverse Trim
CV 67-94, Loadable Speed Table

This may sound like a lot of CVs but don't worry; it's not necessary to change all of them if you don't want to. We've already talked about speed step selection in CV 29 (Step 2).

Set the Start Voltage
The decoder provides CV 2, Vstart, to set the starting voltage that is applied to the motor at Speed Step 1 and is used to compensate for inefficiencies in the locomotive's motor and driveline. CV 2 may be programmed with any value between 0 and 255 with each step in value being about 0.5% of the maximum available motor voltage. To calculate the value of CV 2, you can use the formula:

$$CV\ 2 = 255 \times \frac{\text{Desired Starting Voltage}}{\text{Maximum Motor Voltage}}$$

If your DCC system supports Operations Mode Programming, an alternative method for setting Vstart is to turn your throttle to the first speed step and then use the operations mode programming feature to increase the value in CV 2 until the locomotive just begins to move.

Set the Acceleration and Braking Rates
The decoder provides two CVs to simulate the momentum due to train weight. CV 3, Acceleration Rate, controls how fast the locomotive responds to increases in throttle settings and CV 4, Braking Rate, controls how fast the locomotive will respond to decreases in the throttle setting. Both CVs can be programmed with any value between 0 and 255 with 255 corresponding to the *slowest* acceleration or braking rate. Lower settings yield a more responsive locomotive, which is useful for switching. When both CVs are set to 0, the locomotive will respond nearly instantly to any throttle changes. A setting of 255, on the other hand, will require *several minutes* for a

locomotive to reach full speed from a standing stop!

If you are using 14 or 28 Speed Step modes, setting CV 3 and CV 4 to any value greater than 0 will also improve the decoder's throttle response. While it is accelerating or braking, the decoder interpolates between speed steps so in effect, your locomotive will respond as if it were being controlled with 128 speed steps. No more sudden lurching from one speed step to another!

Select the Speed Table

The decoder provides 14 preset and one loadable speed table that can be used for several purposes:

1. Speed matching one locomotive to another.
2. Changing the feel of the throttle. For example, you could configure a switching locomotive so there are more speed steps available at lower speeds for switching and fewer steps at high speeds where the locomotive is seldom operated.
3. Compensating for an improperly designed driveline so the locomotive will operate within its prototypical speed range.

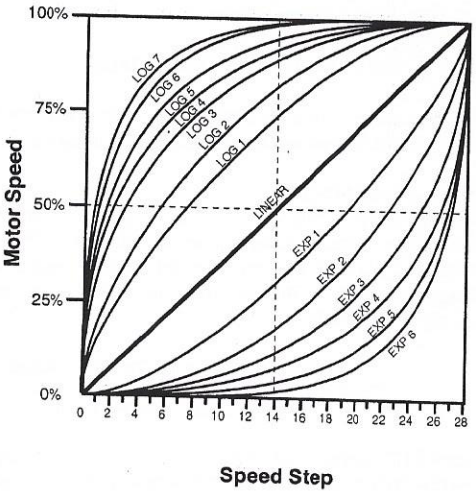
Preset Speed Tables

CV 25, Speed Table Select, is used to select which speed curve will be used by the DSD. CV 25 may be programmed with any value between 2 and 15 to select one of the preset speed curves shown in Table B. The exact throttle response for each curve is shown graphically below.

In order for the speed table selection in CV 25 to take effect, bit 4 of CV 29 must be set to 1. Refer to the previous section "Configuring the Decoder" or the **Version 2.00 Decoder Technical Reference** to determine the correct value for CV 29.

Table B. Speed Table Selection

CV 25	Speed Curve Type
2	Straight Line
3	Logarithmic Curve 1
4	Logarithmic Curve 2
5	Logarithmic Curve 3
6	Logarithmic Curve 4
7	Logarithmic Curve 5
8	Logarithmic Curve 6
9	Logarithmic Curve 7
10	Exponential Curve 1
11	Exponential Curve 2
12	Exponential Curve 3
13	Exponential Curve 4
14	Exponential Curve 5
15	Exponential Curve 6
16	User Loadable Speed Table



Set the User Loadable Speed Curve

The User Loadable Speed Table allows you to create virtually any throttle response curve you can imagine. You will first need to design and program the Loadable Speed Table. The Loadable

Speed Table consists of 28 data points contained in CVs 67 through 94, each defining the *percentage* of motor voltage applied at a give speed step. Each data point can contain a value of 0 to 255 corresponding to 0 to 100% of available motor voltage.

In 28 speed-step mode, each data point directly corresponds to a speed step. In 128 speed-step mode, each data point corresponds to every four and a half speed steps. The motor voltage for intermediate steps is interpolated by the decoder to produce a smooth curve. In 14 speed-step mode, alternate (odd numbered) data points correspond to speed steps 1-14. Important: all 28 data points must be programmed *even for 14 speed-step mode* or an unpredictable throttle response may occur while accelerating or braking.

To create a speed curve, begin by assuming the decoder will be operated in 28 speed-step mode. Don't worry if you are using another mode - the decoder will automatically take care of the translation between modes.

1. Start by making a table containing 28 entries - one entry for each speed step.
2. For each entry, record the desired throttle response as a percentage of full speed. i.e., 0 to 100%
3. Compute and record the CV value for each step using the following formula:

$$\text{CV Value} = 255 \times \frac{\text{Percentage of Full Speed (from Step 2)}}{100}$$

4. Program CV 67 with the value computed in step 3 for the first data entry (Speed Step 1)
5. Program CV 68 with the value computed in step 3 for the second data entry (Speed Step 2)
6. Repeat step 5 for each of the remaining 26 CVs from CV 69 to CV 94 until they have been programmed with their respective values.
7. Set CV 25 to 16 to select the user loadable speed table.

Table C. Calculating the User Loadable Speed Table

CV#	Speed Step	% Full Speed	CV Value
67	1	4	9
68	2	7	18
69	3	11	27
70	4	14	36
71	5	18	45
72	6	22	55
73	7	25	64
74	8	39	73
75	9	32	82
76	10	36	91
77	11	39	100
78	12	43	109
79	13	46	118
80	14	50	127
81	15	54	137
82	16	57	146
83	17	61	155
84	18	64	164
85	19	67	173
86	20	71	182
87	21	75	191
88	22	78	200
89	23	82	209
90	24	86	219
91	25	89	228
92	26	93	237
93	27	96	246
94	28	100	255

8. Set bit 4 of CV 29 to 1 to enable speed table use. Refer to the previous section "Configuring the Decoder" to determine the correct value for CV 29.

Table C may be followed as an example and lists the CV values for a straight-line response.

Adjust the Forward and Reverse Trim

The decoder provides two CVs for adjusting or 'trimming' the forward and reverse speeds.

CV 66, Forward Trim
CV 95, Reverse Trim

These CVs multiply all data points in the speed tables by a factor of n/128 (n is the CV value) allowing the overall speed curve to be adjusted up or down without reloading all 28 data points again. These CVs will not have any effect when the speed tables are disabled (i.e., CV 29, bit 4 = 0)

These CVs may contain any value between 0 and 255 Trim values between 129 and 255 will increase speed curve values between 100% and 200% in approximately 1% steps. Trim values between 1 and 127 will decrease speed curve values between 1% and 99%. A value of 128 yields a scaling factor of 1.0 and has no effect on the speed curve. Using different values for the forward and reverse trim will yield different forward and reverse speeds.

Adjust the Motor Drive Frequency

Virtually all DCC decoders, including the decoder, drive the locomotive motor using a technique called Pulse-Width-Modulation or PWM. PWM works by alternately switching the motor from full off to full on. If the motor is switched fast enough, the speed can be controlled by varying the ratio between the time the motor is on and the time the motor is off. One drawback to PWM is that it can cause the locomotive to buzz, sometimes quite loudly, at low speeds.

To mitigate some of this noise, the decoder provides CV 9, Motor PWM Period to control the frequency at which the motor is switched on and off. By adjusting this CV, one can usually find a drive frequency that is quieter than others.

CV 9 can be programmed with any value between 0 and 230. A CV value between 170 and 190 works well for most locomotives.

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 Enable
CV 22, Consist F0 Function Enable

Consists Explained

A consist is a group of locomotives that are setup to respond to throttle commands as a single unit. Consists make it easy for one operator to run a double headed steam train or a multi-unit diesel lash-up for example. The consist CVs allow the decoder to recognize a new address assigned to the consist without changing its primary or extended addresses. Additionally, they allow each locomotive in the consist to be run as a single unit but with different function properties allowing for example, the horn to blow only on the lead engine.

Consist Address

Each locomotive in the consist is assigned the same consist address by programming CV 19 with the consist address between 1 and 127. If a locomotive is facing backwards in the consist, it should be programmed with the same consist address plus 128. If the forward facing locomotives are set to consist address 60 for example, the backwards engine must be set to 60+128 = 188. Failure to do this will turn the consist into an angry pushme-pullyou as all locomotives will try to move forward from the perspective of their own cab and a few pulled couplers might result!

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 to 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 engine 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)).

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.

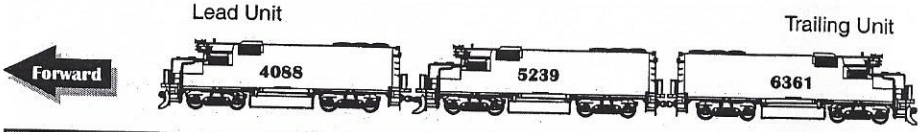
Use Table D to calculate the correct value for CV 21 and 22. Begin by determining which functions you want active in the consist and circle the number below it. When you are done, add up all the circled numbers in the first row and program the total into CV 21. Add up all the circled numbers in the second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

Table D. Consist Function Enable

CV#	F0 (f)	F0 (r)	F1)	F2	F3	F4	F5	F6	F7	F8
21			1	2	4	8	16	32	64	128
22	1	2								

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

Consist Example
Consider a common diesel lash-up consisting of three engines, #4088, #5239 and #6361. Let's suppose we wish to operate these three engines as a single unit with consist address 40. The dynamic brake (F4) and audio mute (F8) functions should work on all engines. However, we want the headlight (F0(f)), horn (F2) and bell (F1) to only work on the lead unit, #4088, and the backup light (F0(r)) to work only on the trailing unit,#6361. Additionally, the trailing unit is reverse facing.



Engine Address	4088	5239	6361
Direction	Normal	Normal	Reverse
CV 19	40	40	168
CV 21	139	136	136
CV 22	1	0	2

Engine 4088.
This is the lead engine. Because it is facing forward, CV19 is simply programmed with 40, the new consist address. Using the Consist Function Enable Table, we program CV 21 with the sum of the values corresponding to F1, F2, F4 and F8 or 1 + 2 + 8 + 128 = 139. Likewise, CV22 is programmed to 1, the value corresponding to F0(f).

Engine 5239.
This is the middle engine. Because it is also facing forward, CV19 is programmed with the new

consist address or 40. Using the Consist Function Enable Table again, we program CV 21 with the sum of the values corresponding to F4 and F8 or 8 + 128 = 136. CV22 is programmed to 0 since no lights are needed on this engine.

Engine 6361.
This is the trailing engine. Because it is facing backwards, CV19 is programmed with the new consist address, 40 + 128 = 168. Using the Consist Function Enable Table, we program CV 21 with the sum of the values corresponding to F4 and F8 or 8 + 128 = 136. CV22 is programmed to 2, the value corresponding to the backup light, F0(r).

Step 5: Function Mapping
Function Mapping Explained
Function mapping allows the decoder to be reconfigured so that sound effects and function outputs can respond to a different function key input. This is especially useful for users who have throttles with less than eight function keys as now they can pick and choose what effects they can control instead of being restricted to an arbitrary assignment.

There are 10 function mapping CVs - eight CVs, 35-42 are used to assign output control to function keys 1 through 8 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 locomotive is moving forward. CV 34 controls which outputs are on when F0 is on *and* the locomotive 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 locomotive direction.

Not all keys can control all outputs or effects. Table E shows which functions can be mapped to which outputs. Note that a function key can be set up to control more than one output and also an output can 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.

Table E. DSD Function Mapping

Function Key	Control CV	Headlight	Backup Light*	Airhorn	Bell	Number Boards	Mars Light	Dynamic Brake	Red Classification Lights	RPMs (+)	RPMs (-)	Dimmer	Mute	Green Classification
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
F8	42							1	2	4	8	16	32	64

*** Backup Light not used in F7 model.**

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: Configuring the Lighting Outputs

Depending on the model, the decoder has two to six function outputs used for controlling the locomotive lights. Most can be set for a variety of special lighting effects or simple on-off lights. In addition, you can use the Grade Crossing Logic to automatically activate the selected lighting effect when the horn or whistle is blown.

The decoder provides up to five CVs for customizing the light effects:

CV 49, Headlight Control Mode
CV 52, Mars Light Control Mode (FX2)
CV 59, Flash Rate & Hold Time

Setting the Hyperlight Effects

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

Hyperlight Select - The headlight and FX2 output can be programmed to one of 15 Hyperlight™ Lighting Effects as listed in Table F. Most effects are self-descriptive. A few may need some additional comment:

- The dimmable headlight is normally an on/off output. When the output is on, the power level will be reduced to 60% whenever the dimmer function (F7) is on.
- Type I and II Ditch lights are identical when operating. However, when the grade crossing logic is enabled, the Type I ditch will revert to a steady on state when it is not flashing whereas the Type II lights will turn off.
- The engine exhaust effect produces a random flicker whose intensity is proportional to the engine RPMs and is useful for imitating unmuffled exhaust gases and sparks.

Phase Select – Alters the timing of the effect so that the effect is either in sync with the other effects (phase A) or 180 degrees out of phase (phase B). This allows you to have two lights that flash back and forth if desired.

Grade Crossing Logic - Causes the lighting effect to become active only when the horn (F2) has been sounded. 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, FRED and flicker effects will not be affected. When the horn function is released, 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 Mode - Converts the headlight and backup light to independent, non-directional lights. When this mode is active, the headlight is controlled as if it were FX1, Function 3 and the backup light as FX2 or Function 5.

To set the effect, use Table F on the following page to look up the required setting for each output mode and simply program the corresponding CV with that value. If you wish to use 'Rule 17' mode, add 64 to the table value. Use CV 49 to set the headlight, CV 50 for the backup light, CV 51 for Numberboard Lights and CV 52 for the Mars Light. Note that not all decoders will support all lighting outputs or CVs. Refer to the instruction sheet that came with your decoder for more information.

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. CV 59 is also used to set the Grade Crossing Logic Hold Time, that is, the time an effect will remain flashing after the horn function is released (if the crossing logic is enabled) and has a range of 0-15 seconds.

To calculate the value of CV 59, use the formula:

CV 59 = Flash Rate + (Hold Time X 16)

For example, to set a flash rate of 3 and a hold time of 2 seconds, we calculate CV 59 = 3 + (2 X 16) = 3+ 32 = 35.

Table F. 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
Engine Exhaust Flicker	12	28	44	60
Firebox Flicker	13	29	45	61
Smart Firebox Flicker	14	30	46	62

Configure Lighting Control Mode
The decoder supports two modes of headlight operation:

Automatic Direction Control
The headlight is turned on and off using the F0 function. The decoder automatically switches the light on depending upon locomotive direction.

For automatic direction control, the headlight is mapped to F0(fwd) by setting CV 33 to 1. See **Function Mapping on** page 14.

"Rule 17" Headlight Operation
This is the more prototypical form of operation and requires the engineer to manually switch each light on or off individually. Thus, it is possible for both lights to be on at the same time.

For Rule 17 Operation, the headlight is mapped to both F0(fwd) and F0(rev) by setting CV 33 and 34 to 1. The F0 key will now control the headlight in both directions.

Step 7: Configuring the Sound Effects

Bell Settings
The decoder provides two CVs for setting the bell sound effect:

CV 114, Bell Ring Rate
CV 114 controls how fast the bell will ring. There are 16 settings, with 0 being the fastest ring rate and 15 being the slowest rate.

CV 121, Bell Volume
CV 121 can be set to any value between 0 and 255, with the minimum volume being 0 (sound is off) and the maximum is 255. The default is 128 or 50% volume.

Airhorn Settings
The decoder provides two CVs for setting the air horn sound effect:

CV 115, Airhorn Selection
CV 115 selects a single chime, three chime or five chime airhorn. (See Table G.)

CV 120, Airhorn Volume
CV 120 can be set to any value between 0 and 255, with the minimum volume being 0 (sound is off) and the maximum is 255. The default is 192 or 75% volume.

Table G.
CV 115, Airhorn Selection

Whistle/Horn	CV Value
Single Chime	0
3-Chime	1
5-Chime	2

Dynamic Brake Settings
The decoder provides one CV for setting the dynamic brake effect:

CV 123, Dynamic Brake Volume
CV 123 can be set to any value between 0 and 255, with the minimum volume being 0 (sound is off) and the maximum is 255. The default is 128 or 50% volume.

Diesel Exhaust Settings
The decoder provides two CVs for setting the Diesel Exhaust sound effect:

CV116, Engine Exhaust Control
CV 116 is used to select between manual or automatic engine notching and in the case of the latter, the number of speed steps needed to advance the engine rpm notches.

Manual Notching
Manual notching allows the engineer to use the function keys to step the engine rpms up or down independent of the locomotive speed and is more prototypical than automatic notching. With manual notching you can for example, simulate the sound of a train crawling up a hill with diesels running at full power!

Manual notching is selected by setting CV 116 to 0. Additionally, you will have to remap two function keys to the RPM(+) and RPM(-) functions (see **Function Mapping**, page 14). We suggest using the F5 key for RPM (+) and the F6 key for RPM (-) which is accomplished by programming CV 39 to 32 and CV 40 to 64. Of course, you can use other function keys as your needs dictate as well.

Manual Notching with Interlock
This mode interlocks the engine rpms and the throttle setting such that

- Locomotive cannot be moved unless the diesel engine has been started.
- Engine cannot be shut off unless locomotive speed is zero.

Besides the fun of forcing the engineer to follow an operating protocol, this mode is also useful in preventing inadvertent engine shutoff while the engine is moving. Interlocked Manual notching is selected by setting CV 116 to 16.

Automatic Notching
When automatic notching is enabled, the engine will startup when the throttle is first increased. It will increase in proportion to the throttle speed. The engine rpms may be shutoff by pressing your command station's emergency stop button once.

Automatic notching is selected by programming CV 116 with any value between 1 and 15 corresponding to the number of speed step changes (in 128 speed-step mode) needed to advance the rpms one notch. Thus, a CV setting of 8, will advance the rpms one notch at speed steps 8,16, 24... etc, until it reaches maximum rpms at speed step 64.

CV 122, Engine Exhaust Volume
CV 122 can be set to any value between 0 and 255, with the minimum volume being 0 (sound is off) and the maximum is 255. The default is 128 or 50% volume.

Hints for Diesel Engine Sound
If you plan to use automatic notching with 14 or 28 speed step modes, we recommend setting CV 116 with a minimum value of at least three for 28 speed step mode and at least six for 14 speed-step mode.

When using automatic notching mode, you may notice the diesel sound lags the locomotive speed. This is because it takes a finite and prototypical amount of time for the diesel engine to spin up and down. Unfortunately, model locomotives accelerate and brake much faster than their life-size counterparts and the illusion of realism begins to fade when the engine is pulled into a siding with the diesel running at full power. The easy solution to this dilemma is to use the Acceleration (CV 3) and Braking (CV 4) CVs to electronically slow the model locomotive's throttle response. A CV setting of 10 or so should do the trick. Of course, you'll have to learn to compensate for the added momentum and allow yourself plenty of stopping room but then that's half the fun!

Step 8: Miscellaneous Settings

CV 11, Packet Timeout Period
CV 11 is used to insure that the DSD receives periodic updates from the command station to prevent runaway trains. If the timeout period set by CV 11 elapses without receiving any commands, the decoder will shut off the motor and if the Quiet Bit is enabled (see below) also turn off the sounds effects. CV 11 may be set to any value from 1 to 255 corresponding to a timeout period of 10 to 2550 seconds (42 minutes). Setting CV 11 to 0 will disable the time out feature.

CV 113, Sound Control Modes
CV 113 sets the Quiet Bit:

Quiet Bit - The Quiet bit allows you to choose whether the sound effects are active all the time, or only when the decoder is being used. If the Quiet Bit is ON, sound will be activated to the decoder when it is addressed and will turn off after the packet timeout period has expired (see CV11 above).
Use Table H to determine the proper value for CV 113.

Table H.
CV 113, Sound Control Modes

Quiet Bit	CV Value
Off	0
On	1
Off	2
On	3

Step 9. Resetting 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 using either Service Mode or Operations Mode.
2. Place locomotive on a powered section of track. If locomotive is already on the mainline, cycle power to the decoder by turning power to the track off and then back on.
3. You should immediately observe the red and green classification lights flashing together. If not, repeat step 1 and 2.
4. After about five seconds, the red and green classification lights will flash back and forth at an increased rate indicating that the CVs have been reset.
5. You may wait another 25 seconds for the DSD to resume normal operation or bypass the waiting period by turning power to the locomotive off and then back on.
6. The decoder should now respond to short address 3 just as it did when it was first unpacked.

Trouble Shooting

If you should have any difficulties with the operation of your 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 Step 9) and try again.

Locomotive doesn't run but was working

- Address has been accidentally changed.
- Consist address (CV 19) was accidentally set.
- CV 29 has been changed to select other address.
- Acceleration and braking CVs set to very high values.
- Broken motor wire or track pickup wire.

Locomotive never ran

- See all the above.
- Decoder wired incorrectly.
- Locomotive is not on DCC-powered track. Note: The DSD will not work on DC layouts.

Locomotive makes sound but motor stops working

- Address on cab doesn't match decoder address.
- Motor current too high - lower track voltage.

Locomotive runs but makes no sound

- Mute function (F8) is on.
- Another function is re-mapped to the Mute function.
- Sound Volume CVs (120-123) have been set to zero.
- Speaker wire is broken.
- Speaker is burned out.

Locomotive runs in a consist but lights and sound effects don't work

- Consist functions are disabled. Set CV 21 and 22 to activate desired functions (see page 13).

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.

Locomotive just sits and flashes its red and green classification lights.

- CVs are being reset to defaults. Wait 30 seconds and the DSD should respond to address 3.

Sound works for a while then quits

- Amplifier is overheating, lower sound volume.
- Amplifier is overheating, lower track voltage.
- Speaker is damaged. Replace speaker.

Speaker sounds 'crackly'.

- Sound volume is too high for speaker.
- Speaker is not properly baffled.
- Speaker wire is loose.
- Speaker is damaged.

Functions 5, 6, 7 and 8 do not work

- Program CV 30 to 4.

Command Station cannot program CVs above 99.

- CVs 112 to 123 may be programmed as if they were CVs 49 through 60 by setting CV 30 to 1. When CV 30 = 1, the data in CV 49-60 will be temporarily replaced by data in CV 112-123. The original data in CV 49-60 remains unchanged and can be restored by setting CV 30 back to 0. Table J shows the relationship between the two sets of CVs. Example: to program CV 120 (whistle volume), set CV 30 to 1, then program CV 57 to the new value. The original data in CV 57 will not change but CV 120 will. When you are finished, set CV 30 back to 0.

Table I. Alternate CV Selection

CV Acessed when CV 30=0	CV Acessed when CV 30=1
CV 49	CV 112
CV 50	CV 113
CV 51	CV 114
CV 52	CV 115
CV 53	CV 116
CV 54	CV 117
CV 55	CV 118
CV 56	CV 119
CV 57	CV 120
CV 58	CV 121
CV 59	CV 122
CV 60	CV 123

Obtaining Technical Support

We're here to help! If you have a specific problem or question, please contact our technical support staff. Before calling, please have the following information ready:

- Model Number
- Software Version Number (identified on the product packaging or by reading CV 7)
- Hardware Version (identified on product packaging)
- Make and Model of your Command Station

Land:	S-Helper Service, Inc., 77 Cliffwood Avenue, 7C, Cliffwood, NJ 07721
Phone:	In the U.S.A. 1-800-465-0303, outside the U.S.A. (732) 441-0555
Fax:	(732) 441-0751
Internet mail:	robin@showcaseline.com
WWW Site:	http://www.showcaseline.com
Hours:	Monday-Friday, 9:00AM to 4:00PM, Eastern Standard Time

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
DECODER CV USAGE SUMMARY TABLE

CV #	Description	Default Value
CV 1	Primary Address	3
CV 2	Vstart	7
CV 3	Baseline Acceleration Rate	0
CV 4	Baseline Braking Rate	0
CV 7	Manufacturer Version	Varies
CV 8	Manufacturer ID	141
CV 9	PWM Period	180
CV 11	Packet time-out value	0
CV 17,18	Extended address	0003
CV 19	Consist Address	0
CV 21	Consist Function Active 1	0
CV 22	Consist Function Active 2	0
CV 23	Consist acceleration rate	0
CV 24	Consist Braking Rate	0
CV 25	Speed Table/Mid range speed select	0
CV 29	Configuration Data 1	2
CV 30	Error information	0
CV 33	FL (f) Output location	1
CV 34	FL (r) Output location	2
CV 35	F1 Output location	8
CV 36	F2 Output location	4
CV 37	F3 Output location	2
CV 38	F4 Output location	8
CV 39	F5 Output location	4
CV 40	F6 Output location	16
CV 41	F7 Output location	64
CV 42	F8 Output location	32
CV 49	HL Hyperlight Select	01
CV 50	BL Hyperlight Select*	01
CV 51	FX1 Hyperlight Select*	01
CV 52	FX2 Hyperlight Select	02
CV 59	Flash rate/Hold time	66
CV 66	Forward Trim	128
CV 67-94	Speed Table	See Table C
CV 95	Reverse Trim	128
CV 112	Sound Configuration 1 (Auto enable)	1
CV 113	Sound Configuration 2 (Control Modes)	2
CV 114	Sound Configuration 3 (Bell Ring Rate)	4
CV 115	Sound Configuration 4 (Horn Select)	1
CV 116	Sound Configuration 5 (Exhaust Control)	8
CV 120	Whistle/Horn Volume	192
CV 121	Bell Volume	128
CV 122	Exhaust Volume	128
CV 123	Background Sound Volume	128

* Not used in F7

SERVICE AND WARRANTY POLICY

LIMITED NINETY DAY WARRANTY

The Digital Sound Decoder is warranted by S-Helper Service to be operative and free of defects in materials and workmanship for a period of ninety (90) days after original purchase date. Defective Digital Sound Decoders which are received by S-Helper Service during the warranty period will be repaired or replaced free of charge at the option of S-Helper Service.

Exclusions

This warranty does not cover damage resulting from negligent installation, improper operation, over voltage or over current damage, failure to follow instructions, misuse, unauthorized repairs or modifications, accidents, damage while in transit to service location, fire, Floods, and other acts of God.

Due to their fragile nature, onboard locomotive speakers are not covered by this warranty. Speakers that are factory installed in S-Helper Service locomotives are warranted to be operational at time of sale. In the event a factory-installed speaker is damaged, please contact S-Helper Service for information on replacing the speaker.

Warranty Procedure

The product must be returned, postage prepaid and insured to the factory for repair. It is advisable to write or phone the factory for advice before returning the product for service. Include name, street address (We cannot ship to P.O. Boxes!), daytime phone number, and description of problem. After repairing product we will ship it to your home at no cost to you.

Important!: In general it is only necessary to return the Digital Sound Decoder for repair, and is usually not necessary to return the locomotive. We recommend that before you return anything for repair, you contact us for direction on what to return. Under no circumstances should you send any item not manufactured by S-Helper Service to us without prior authorization, as we cannot assume any liability for their safe return.

Limits of Liability

The foregoing shall constitute the sole and exclusive remedy of any owner of this product for breach of warranty including the implied warranties of merchantability and fitness. IN NO EVENT SHALL S-HELPER SERVICE BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES OR FOR THE REPRESENTATIONS OF RETAIL SELLERS.

Non-Warranty Repairs

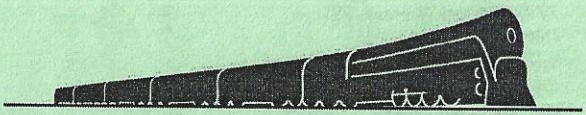
Digital Sound Decoders needing repairs after exceeding the warranty period or damaged during installation, will be repaired at modest cost for parts and labor. The product will be returned to the address specified with a C.O.D. charge for service, shipping and handling, unless other method of payment has been arranged.

For Prompt Factory Service, mail to:

S-Helper Service, Inc.
77 Cliffwood Avenue, 7C
Cliffwood, NJ 07721
1-800-465-0303
Outside the U.S.A. 1-732-441-0555
Fax: 732-441-0751

Revision A

COMPATIBLE WITH
THE NMRA DCC STANDARDS
AND RECOMMENDED
PRACTICES



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