Blunami™ Digital Sound Decoder

Steam User's Guide

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All Aboard!

Overview

Congratulations on purchasing your SoundTraxx Blunami Digital Sound Decoder (DSD) for steam locomotives! Blunami is the newest wave of SoundTraxx innovation and builds upon the previous generation of Tsunami2 to offer the highest quality sound for model railroading. This user's guide shows you how to operate Blunami and customize each decoder setting to fit your preferences, while providing some helpful troubleshooting tips along the way.

We suggest referring to the user documents listed below as you read this user's guide.

Blunami Installation Guide

Provides instructions and strategies for successful sound installations.

Blunami Steam Technical Reference

Offers a list of all included CVs and details making adjustments to settings.

Blunami Sound Selection References

Lists each included sound effect for configuring a prototypical operating experience.

Decoder Selector

Assists in selecting the correct decoder and speaker for many models in all scales.

Videos Page

Provides instructional videos and product demonstrations.

Steam Sound Samples

Offers sound file previews of exhaust chuffs and steam whistle selections.

Reference Documents

Includes helpful information such a glossary terms and specific installation information.

Technical Notes

Provides notes about wiring practices and DCC compliance tests.

CurrentKeeper Reference

Includes supplemental information about operating and programming with this device.

Factory Installed Decoders

Visit this page for specific CV values and feature information for factory installed models.

These resources can be viewed and downloaded from our website at www.soundtraxx.com.

All Aboard!

Using Blunami

The Blunami Digital Sound Decoder is designed to enhance your model railroading experience by giving you a wide variety of innovative features and incredibly realistic sound for your models. Some of the features discussed in this user's guide include Dynamic Digital Exhaust, Hyperdrive2 advanced motor control, Flex-Map function mapping technology, two volume mixers, exhaust cutoff control, independent and train brake functions, and Fireman Fred sound effects. Blunami also provides selectable whistles, bells, exhaust chuffs, airpumps, and couplers to allow more versatility in creating your ideal model railroading experience.

You can start using Blunami right out of the package without making any changes. However, you may adjust settings at any time by making changes to Configuration Variables (CVs). Most DCC decoder and command station manuals call this "programming", though this is misleading and sounds scarier than it is. At no point are you required to learn software programming! This guide will walk you through operating and adjusting Blunami to its full capacity.

Default Function Assignments

The first time you operate your Blunami decoder, you will be able to activate features and sound effects by simply pressing the appropriate key on your cab or command station console. These are "default" function assignments. The effects listed in Table A are assigned to function keys F0-F28 by default. This section describes how to activate each effect with function keys.

Note: *You can assign any effect to function keys labeled as "Not Assigned" in Table A with Flex-Map function mapping CVs. Refer to "Configuring Function Mapping" for more information about customizing function assignments.*

Note: *Pressing function keys F0-F28 will toggle functions "on" and "off" and activate effects.*

Turn On the Lights

Ensure your locomotive is in the forward direction, then turn on F0 to illuminate the headlight and spool up the dynamo. Reverse the locomotive direction to turn off the headlight and turn on the backup light. Pressing F0 a second time will turn off the dynamo, headlight, and backup light.

Turn on F7 to dim the headlight or backup light before passing oncoming trains, or while waiting on a siding. Press F7 again to return the headlight and backup light outputs to full brightness.

Table A. Default Functions

Function Key	Effect
F0(f)	Headlight, Dynamo
F0(r)	Backup Light, Dynamo
F1	Bell
F2	Whistle
F3	Short Whistle
F4	Cylinder Cocks
F5	Cutoff+
F6	Cutoff-
F7	Dimmer
F8	Mute
F9	Grade-Crossing Signal
F10	Blowdown
F11	Independent/Train Brake
F12	Brake Select
F13	Couple/Uncouple
F14	Switching Mode
F15	Wheel Chains
F16	Water Stop
F17	Fuel Loading
F18	Ash Dump
F19	Wheel Slip
F20	Injector
F21	Sander Valve
F22	Cab Chatter
F23	All Aboard/Coach Doors
F24	FX3 Function Output
F25	FX4 Function Output
F26	FX5 Function Output
F27	FX6 Function Output
F28	FX7 & FX8 Function Output

All Aboard!

Ring the Bell
Turn on F1 to ring the bell. Press F1 again to stop ringing the bell. The bell is generally rung before moving the locomotive, when approaching crossings, to alert people or equipment near the track, and as a warning signal when necessary.

Blow the Whistle
Signaling can make your operating sessions more fun! Engineers signal to notify passengers, crew, and other trains of common locomotive movements, such as stopping, moving forward, backing up, and approaching grade crossings. Blunami provides three functions for signaling. Use F2, F3, and F9 to signal prototypically while you operate, as described below.

Press and release F2 to blow the “long” whistle. Contrary to most function keys, the duration of the whistle blast is determined by how long you press F2. In other words, the whistle blast will start when you press F2, and stop when you release F2. Press F3 to issue the single “toot” of the “short” whistle. The short whistle will be the same length every time you press F3, unlike the playable whistle function (F2).

Note: *Function key F2 on the NCE Power Cab command station is on/off or “latching”, i.e., pressing F2 to turn on the function will start the whistle blast, and pressing F2 again to turn off the function will stop the whistle blast. To issue momentary whistle blasts with the NCE Power Cab, press and release the “Horn/Whistle” button instead of using F2.*

To issue the long-long-short-long grade-crossing signal automatically, turn on F9 as your locomotive approaches a grade crossing. Refer to Table B to view some more common signals.

Table B. Whistle Signals

Long = –
Short = ●

Signal	Description
– – ● –	Approaching a grade crossing: hold final blast until crossing is occupied
●	Applying brakes
– –	Releasing brakes, proceeding forward
● ● ●	When moving, stop; when stopped, back up
● ● ● ●	Request signal from trainman
– ● ● ●	Signal flagman to protect rear
– ●	Warning signal: use when approaching areas with obstructed views and when approaching/passing passenger/freight trains
–	Approaching stations, junctions, and railroad crossings at grades

Activate Cylinder Cocks
As you begin to accelerate from a stop, turn on F4 to purge the condensed water from the cylinder. The sound of the condensed water in the cylinder being expelled outwards with the steam, can be heard (“swish-swoosh”) as the engine moves.

Adjust the Exhaust Cutoff
As the locomotive continues to accelerate, less steam is needed in the cylinders to keep the train moving. The engineer moves the power reverse lever or Johnson bar closer to the center of the quadrant to shorten the amount of time steam is emitted into the cylinders.

You can shorten the exhaust cutoff of the locomotive by turning on F5. The cutoff can be shortened three times to replicate various operating conditions. Each time it is shortened the exhaust chuff will change in both pitch and length to replicate a lighter load on the locomotive.

All Aboard!

As the engine crests a grade, shorten the cutoff a fourth time to simulate drifting. The locomotive will begin to drift and the exhaust chuff will fade as the engineer closes the throttle. The snifter valve will drop and the sound of air being sucked through leaky valve packings will start.

As the engine approaches the bottom of the hill, more steam is needed to keep the train moving. Turn on F6 to decrease the cutoff and exit drifting. The snifter valve will lift and the exhaust chuff will return as the engineer slowly opens the throttle. As more steam is needed, decrease the cutoff even further by turning on F6 again. The cutoff can be lengthened three times. Each time the cutoff is decreased, the chuff will change in both pitch and length to replicate a harder working locomotive.

Apply the Independent Brake

The engineer generally applies the brakes on the locomotive during switching operations and to control slack between units. You can use the independent brake function to simulate applying the locomotive brake independently from the rest of the train.

You can simulate applying the independent brake prototypically by turning on F11 as your locomotive decelerates to a stop. Press F11 again to release the independent brake before departing. Refer to “Configuring Throttle and Braking” to set the independent brake rate and allow the independent brake function to reduce speed when activated.

Apply the Train Brake

On the prototype, air hoses are fastened to each piece of equipment to form a single braking system, referred to as the “train brake” or “automatic brake.” The train brake function allows you to simulate applying each unit’s brake at once to reduce train speed.

First turn on F12 to “move the engineers hand” from operating the independent brake handle to operating the train brake handle in the cab. This action selects the train brake in place of the independent brake. The air compressor will cycle rapidly to simulate charging the train line, and indicate that the train brake is selected. Next, turn on F11 to simulate applying the train brake. While the train brake function is turned on, pressing F11 again will release the train brakes and turn the air compressor back on to recharge the train line.

You can use F11 to activate the train brake only when the F12 brake select function is turned on. Turn off F12 to reselect the independent brake for F11 and disable the train brake. Refer to “Configuring Throttle and Braking” to set the train brake rate and allow the train brake function to reduce speed when activated.

Mute Sound Effects

Turn on F8 to mute all sound effects when you need to silence your train. The mute function allows a quick way to turn off sound effects for a phone call, for instance. Press F8 again to return all sound effect volume levels to their prior settings.

Blow Down the Boiler

There’s sure to be particle buildup in the boiler of your engine. To clean the boiler’s mud ring, turn on F10 to open the blowdown valve and blow out the sediment. Turn off F10 to close the valve.

Couple and Uncouple

Turn on F13 to engage the sound of the coupler as you add cars to your train. When you uncouple, press F13 a second time to open the knuckle and separate the glad hands.

All Aboard!

Use Switching Mode
To improve throttle control for switching operations, turn on F14 to override all momentum CVs and reduce the current throttle setting by 50%. Press F14 again to reset locomotive speed to the prior speed step and reactivate all momentum CV settings. For more information about momentum CVs, refer to “Configuring Throttle and Braking.”

Apply Wheel Chains
Turn on F15 to place chains around the locomotive wheels. Press F15 again to remove the chains from the wheels.

Activate Water Stop
When your locomotive is stopped, turn on F16 to open the water hatch and fill the tender. Turn off F16 to stop filling the tender and close the hatch before departure.

Refuel the Locomotive
While your locomotive is stopped, turn on F17 to open the coal chute doors and begin loading coal into the tender. Press F17 again before departing to stop loading coal into the tender and close the coal chute doors. These sounds can also be configured for oil fired, wood fired and coal stoker fired locomotives. For more information about selecting the fuel type, refer to “Configuring Sound Effects.”

Ash Dump
Turn on F18 to clean out the firebox and ash pan after running your locomotive for a while. Press F18 again to stop the cleaning sequence.

Activate Wheel Slip
While the locomotive is moving, turn on F19 to play the wheel slip effect. The sound of the wheel slip can be heard as short staccato bursts of exhaust chuffs, followed by the sound of the engineer backing off the throttle to regain traction. Press F19 again to reset the feature.

Operate the Injector
Turn on F20 to operate the injector and fill the boiler with water. Press F20 again to stop the injector fill sequence.

Open the Sander Valve
In the real world, wet rails can cause wheels to slip. When extra traction is needed, turn on F21 to open the sander valve. You will hear the quiet sound of sand being deposited onto the rails. Press F21 again to close the sander valve.

Listen to Cab Chatter
Turn on F22 to hear railroad radio transmissions being exchanged from inside the cab. The radio will continue to play messages at random while F22 is turned on. Press F22 again to turn off the function. The current message will finish and radio will be silent. To manually issue a new radio message, toggle the cab chatter function from off to on by pressing F22 twice.

Announce “All Aboard!”
Turn on F23 before leaving the station to issue the conductor’s “all aboard!” announcement. After the coach doors slam shut, increase the throttle and depart the station.

Turn On FX3-FX8 Lighting
If you have additional lights wired to the FX3-FX8 function outputs, use function keys F24-F28 to activate them. Depending on board format, Blunami offers up to eight lighting outputs to support Hyperlight effects. To select Hyperlight effects for lighting outputs, refer to “Configuring Lighting Outputs.”

Make an Emergency Stop
Press the emergency stop button to issue the emergency brake application and bring your train to an immediate stop.

Automatic Sound Effects
Blunami plays a variety sound effects automatically. Automatic sound effects respond prototypically to aspects of operation, such as certain functions, speed settings, and motor load changes.

Power Reverser or Johnson Bar
Changing the direction of the locomotive will automatically play the sound of the power reverser being moved forward or backward. Each time you increase or decrease the exhaust cutoff with F5 and F6, the power reverser can be heard adjusting the position of the valves.

The locomotive can also be configured with a manual reverse lever, also known as a Johnson bar. Refer to the “Configuring Sound Effects” section for more information.

Auto-Exhaust
2-cylinder exhaust for a heavy steam locomotive is the decoder’s default setting, and the chuff rate is automatically regulated by the back-EMF sensor in response to the demand on the motor. For example, the chuff volume and timbre will respond to changes in grade; the chuff becomes more rapid when the motor is spinning faster, and less rapid when the motor is slowed. To adjust the Auto-Exhaust chuff rate which synchronizes the chuff with the motion of the wheels, refer to “Configuring Sound Effects.”

The Dynamic Digital Exhaust (DDE) processor will automatically adjust the exhaust volume and timbre to simulate the engine working under varying load conditions. You can also use F5 and F6 to manually adjust the exhaust cutoff if desired, as mentioned on page 6. Refer to “Configuring Throttle and Braking” to set acceleration and deceleration rates, and refer to “Configuring Dynamic Digital Exhaust” to adjust a given parameter of the DDE processor.

Furthermore, you can select 3-cylinder or articulated type exhaust in place of 2-cylinder exhaust for a range of exhaust chuff sound effects. Refer to “Configuring Sound Effects” for details regarding exhaust selections.

Snifter Valve
Just as you start to move the locomotive, you’ll hear the Pfffffffft! of the snifter valve closing. As you come to a stop, you’ll hear the clink! of the snifter valve dropping.

Side Rod Clank
The “clanks” and “clunks” of the side rod occur with the exhaust chuff. You can use exhaust cutoff control to mute the exhaust chuff and elevate the volume of the side rod clank if desired.

Airpumps
The airpump maintains air pressure during operation. To simulate charging the train line, the pump cadence will revert to its most rapid setting when the coupler function is turned on, when

the train brake function is turned off, and every third time the independent brake function is turned on.

Blower
The blower simulates draft being maintained near the exhaust nozzle in the smokebox during operation.

Clickety-Clack
The “clickety-clack” of the locomotive running across rail joints is synchronized in proportion to locomotive speed. To adjust the clickety-clack sound effect, refer to “Configuring Sound Effects.”

Fireman Fred
Each time the engine is brought to a stop, Fireman Fred may attend to a randomly selected task (or tasks), including shoveling coal, oiling the side rods, checking the frame and more.

CV Programming Tutorial

What is a CV? Configuration Variable (CV) is the industry-adopted term for a decoder's user-adjustable memory locations. CVs allow you to adjust various decoder properties and customize your operating experience. The address, audio settings, motor control, lighting effects, and function assignments are just some of the properties you can adjust with CVs. You can modify CVs at any time and the decoder will save your settings even when the power is turned off. If reading about CV programming already has your head spinning, this tutorial will help you understand how CVs work.

At first glance, you may feel overwhelmed by the large number of CVs offered by Blunami. Don't worry! You don't need an engineering degree to customize your decoder's settings. 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.

Making adjustments is easy, and you can customize settings one CV at a time. As you become comfortable with its operation, move onto a new section and begin exploring the options and capabilities found there. Detailed information on any CV can be found in the *Blunami Steam Technical Reference*. When in doubt, you can always reset the decoder to factory defaults. Refer to "Resetting CVs (Starting Over)" for more information.

Bits and Bytes

All the bits, bytes, and other symbols used in decoder manuals as well as differences between command stations can make CV programming difficult to understand. The problem is compounded further by differences in each command station manufacturer's user interface. Put simply, each CV contains a value that can be changed, and changing the value of a CV will modify a specific decoder setting. Each CV is made up of one byte (i.e., eight bits). However, knowing a little more about how CV values are represented will help you make the right adjustments. CV values are commonly represented in the two numeric formats listed below.

Binary

Like computers, binary is the numbering system used in all DCC decoders. Binary units are called "bits" and can be represented as either 0 or 1.

Decimal

Decimal representation is the format you will probably use most often. Each CV contains a decimal value from 0 to 255.

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 both binary and decimal forms. For those more familiar with the binary method of programming, we have provided a handy-dandy conversion table in Appendix A that allows one to quickly convert between decimal, binary and hex (for some older command stations).

Programming by the Bits

Most CVs contain a single piece of data which can be represented in decimal or binary. For example, CV 128 (Master Volume) can be loaded with any value from 0 to 255 and it will always and only affect one thing – the overall volume of the decoder.

Some CVs use individual bits to control multiple features. This allows up to 8 distinct features to be controlled by a single CV. As the bit variables can take on only one of two values (0 or 1), they are usually used to control features that are either OFF or ON (i.e., disabled or enabled).

Tip: *Think of bits as light switches to turn ON or OFF various features.*

Each bit (0-7) carries a "weight" within the structure of a CV. Beginning with a bit weight of 1 for bit 0 (located farthest to the right, as CVs are interpreted from right to left) and doubling in value for each successive bit (i.e., bit 0 = 1, bit 1 = 2, bit 2 = 4, bit 3 = 8, bit 4 = 16, bit 5 = 32, bit 6 = 64., and bit 7 = 128). The sum, or total, of these bit weights represents the value entered into the CV for programming.

Note: *An alternative method to using basic addition would be to compare the bit structure (1s and 0s) to the table located in Appendix A. In this example we would locate the binary value 00100010 and use the decimal or hex value found next to it when programming the CV.*

CV Programming Tool

To make the process of calculating CV values as easy as possible, we've included an interactive CV programming tool with this manual. This tool will calculate the value to be programmed into any CV based upon the individual bits that have been turned ON or OFF. We recommend using this tool along with the bit configuration charts found in the *Tsuanmi2 Steam Technical Reference* as a guide for programming.

If viewing this document digitally (i.e. computer, tablet or smart phone) you may simply enter a "1" or "0" into any of the bit fields below. The CV value will automatically be calculated based on which bits are turned on.

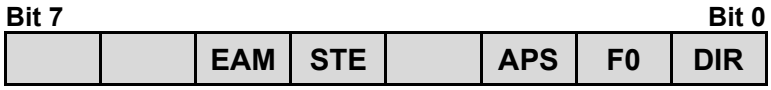
If referencing this manual in print form, write the 1s and 0s in the bit boxes and use the associated bit weights as a way to manually calculate the value, similar to the example referenced below.

BIT POSITION	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	CV VALUE
ON/OFF									0
BIT WEIGHT	128	64	32	16	8	4	2	1	

All Aboard!

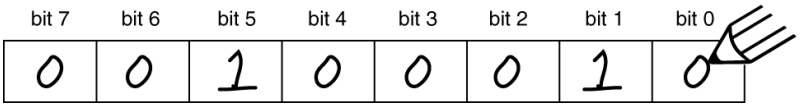
Example
Let's assume we would like to set CV 29 (Configuration Data 1) so that 28/128 speed-step mode and extended (long) addressing are enabled. We would use the following steps to calculate the value:

1. To configure these features we see that bit 1 (F0) and bit 5 (EAM) should both be ON (set to 1), with all other bits OFF (set to 0). The bits to be enabled are highlighted in the description.

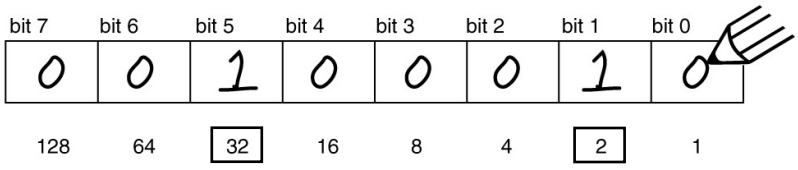


DIR: Direction
0 = Normal direction
1 = Inverted direction
F0: F0 Location
0 = 14 speed-step mode enabled
1 = 28/128 speed-step mode enabled
APS: Alternate Power Source Enable
0 = NMRA-digital only
1 = Alternate power source enabled (CV 12)
STE: Speed Table Enable
0 = 3-point speed table enabled (CVs 2, 5 & 6)
1 = Linear/28-point speed table (CV 25)
EAM: Extended Address Mode Enable
0 = Primary address enabled (CV 1)
1 = Extended address enabled (CVs 17-18)

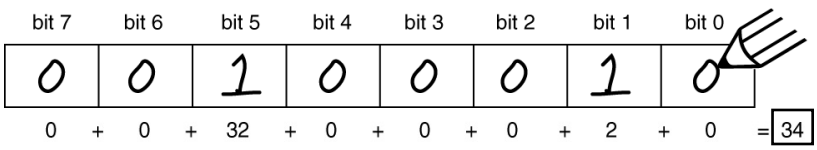
2. Write down the individual bit states (1 for ON and 0 for OFF) as shown below:



3. Next, determine the weight for each enabled bit. For this example are weights are 2 and 32.



4. Add all bit weights to obtain the value for the CV. Bit weights are only counted when the bit is ON (set to 1). If the bit is OFF (set to 0), do not add that bit weight to the total. Add 32 and 2 together to obtain the value of 34 for CV 29.



5. Using your command station enter a value of 34 into CV 29 for programming.

Introduction to Programming

This section details CV programming modes, reading CVs, accessing indexed CVs, resetting CVs to factory defaults, and locking and unlocking CVs. Due to the varying CV programming methods used by DCC systems, we cannot provide comprehensive instructions that address every command station and must assume you understand the capabilities of your system on some level. Consult your DCC system manual or contact the manufacturer if you need more detailed programming instructions.

Configuration Variable Control CVs
CV 8: Manufacturer ID
CV 15: CV Unlock Code
CV 16: CV Lock ID
CV 30: Error Information
CV 31: CV Index 1
CV 32: CV Index 2
CVs 1.257-1.512: Indexed CV Page 1
CVs 2.257-2.512: Indexed CV Page 2

Programming Modes

Blunami supports Operations Mode and Service Mode programming.

Operations Mode

Referred to as “Ops Mode” or “programming on the main,” Operations Mode allows you to program CVs during operation even when other locomotives and rolling stock are present. Being able to program during operation simplifies re-creating prototypical scenarios. For example, you can increase the momentum of a locomotive after it couples to a train. However, because data cannot be read back from the decoder, programming on the main will not allow you to verify CV values.

Service Mode

Service Mode programming usually requires connecting the model to a dedicated programmer or placing it on a separate programming track. Blunami supports four types of Service Mode instructions:

Address Mode: CV 1 may be modified
Register Mode: CVs 1, 2, 3, 4, 7, 8, and 29 may be modified
Paged Mode: A page register is used to modify any CV indirectly
Direct Mode: All CVs may be directly modified

Reading CVs

Some command stations permit you to read the value of a CV and verify its setting in Service Mode programming. If you have trouble reading or verifying CVs, there may be a problem within the command station’s design rather than with the decoder.

Try another programming mode if you experience difficulties programming or reading CVs. Many of the newer DCC systems automatically select the appropriate programming mode and only require you to enter the CV number and desired value. However, some DCC systems may restrict the number of available CVs. If you’re having difficulty determining the programming modes supported by your DCC system, refer to the manual or contact the manufacturer.

Note: *Blunami does not require a programming track booster, such as the PTB-100.*

Indexed CVs

The term “indexed CVs” tends to cause confusion and consternation. Simply put, indexed CVs are located on ‘pages’ to help manage the total number of CVs. This is required by the NMRA DCC Standard and works like this:

Indexed CVs are accessed with the use of two CVs: CV 31 enables indexing when set to a value of 16 (the default value) and CV 32 selects the desired indexed page. You do not need to type “1.” Into the command station when programming indexed CVs.

Because of the number of features and options contained within Blunami decoders, three pages of indexed CVs are provided:

To access CVs 1.257-1.512:

1. Ensure CV 31 is set to a value of 16.
2. Enter a value of 1 into CV 32 to select Indexed CV Page 1.
3. Select CVs 257-512 from your command station.

To access CVs 2.257-2.512:

1. Ensure CV 31 is set to a value of 16.
2. Enter a value of 2 into CV 32 to select Indexed CV Page 2.
3. Select CVs 257-512 from your command station.

To access CVs 3.257-3.512:

1. Ensure CV 31 is set to a value of 16.
2. Enter a value of 3 into CV 32 to select Indexed CV Page 3.
3. Select CVs 257-512 from your command station.

To make things easier, Blunami CVs are grouped by like function as follows:

CVs 1.257-1.512 are used for configuring Flex-Map function mapping CVs. CVs 1.257-1.384 are used for function mapping CVs and CVs 1.385-1.512 are used for automatic effect configuration. Refer to “Configuring Function Mapping” for more information.

CVs 2.257-2.512 are used for adjusting alternate mixer channel volume levels and configuring Dynamic Digital Exhaust CVs. CVs 2.289-2.320 are for alternate mixer CVs and CVs 2.503-2.512 for DDE control CVs. Refer to “Configuring Throttle and Braking,” “Configuring Sound Effects” and “Configuring Dynamic Digital Exhaust” for more information.

CVs 3.257-3.512 are used for adjusting the clickety-clack rate of the clickety-clack and rail joints sound effects. Refer to “Configuring Sound Effects” for more information.

Resetting CVs (Starting Over)

Occasionally, a programming error may occur and the decoder might not respond as you would've expected. Usually, this is caused by one or more CVs inadvertently being programmed to the wrong value. The CVs can be quickly reset to their factory default values. Follow the steps below to perform either a full or partial CV reset:

1. Turn on track power to the decoder. If you have a SoundTraxx CurrentKeeper™ or another device that maintains power, allow at least two minutes for charging before programming.
2. Enter one of the following values into CV 8 (Manufacturer ID) to perform a full or partial CV reset:

CV 8: Manufacturer ID
8 = Reset All CVs
9 = Reset CVs 1-128
10 = Reset CVs 129-256
11 = Reset CVs 1.257-1.512
12 = Reset CVs 2.257-2.512
13 = Reset CVs 3.257-3.512

3. Turn off track power to the decoder. Wait 5 seconds then return power to the decoder. If you have installed a SoundTraxx CurrentKeeper or another device that maintains track power, ensure that the device is fully discharged (usually about 3-4 minutes) before returning power.
4. Wait about 10 seconds after returning power to the decoder. All lights (headlight, backup light or effect lights), as well as the decoder's error light, will flash 16 times to indicate CVs have been successfully reset. Blunami will respond to primary address 3 after all CVs, or CVs 1-128 have been reset.

Note: *Continue cycling power to the decoder if the CV reset is unsuccessful. If you are unable to reset CV values, continue to "Locking and Unlocking CVs" to verify the decoder is not locked.*

Locking and Unlocking CVs

Locking and Unlocking CVs
CV 15: CV Unlock Code
CV 16: CV Lock ID
CV 30: Error Information

The CV lock/unlock feature is designed to secure the decoder and prevent the inadvertent programming of CVs. For example, if you have installed a function decoder in addition to the sound decoder, you may wish to lock the CVs in one decoder while programming the other.

To use the CV lock feature implemented in CVs 15 and 16, bit 0 of CV 30 must first be set to 1 (the default value is 0). This is to avoid accidently locking the decoder when the CV lock feature is not needed.

CV 15 is the unlock code and may be programmed to any value from 0 to 255 regardless of whether the decoder is locked or unlocked. CV 16 is the lock code and may be set to any value from 0 to 7. CV 16 can only be programmed 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 cannot be programmed in either Operations Mode or Service Mode. Further, a locked decoder cannot be reset to its factory defaults until it is unlocked. Blunami decoders are shipped from the factory with all CVs unlocked, that is, CV 15 and 16 are both set to 0.

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 use the CV locking feature for a multi-decoder installation in one model, each decoder must first have its lock code set prior to the installation of any other decoders. 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. If you accidentally set the lock code of the two decoders to the same value 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.

Follow the steps below to lock and unlock CVs:

1. Enter a value of 1 into CV 30 (Error Information) to enable the CV lock/unlock feature.
2. Enter a value from 0 to 7 into CV 16 to set the lock code.
3. To unlock CVs, set CV 15 to the same value as CV 16.
4. To lock CVs, set CV 15 to a different value than CV 16 to unlock CVs.

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 code of 1, sound decoders to a lock code of 2, and function decoders to a lock code of 3. Keeping CV 15 set to 0 will guarantee the decoder stays locked until you are ready to begin programming.

If You Forget the Lock Code

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

1. Place the model on the programming track and enter a value of 0 into CV 15.
2. Try reading the value of CV 16. If the value is not read back, CVs are locked.
3. Enter a value of 1 into CV 15 and try reading the value of CV 16 again.
4. If the value is not read back, enter a value of 2 into CV 15 and try again.
5. Enter values 3-7 into CV 15 until the value of CV 16 is read back and CVs are unlocked.

If you still can't identify the lock code, there may be a problem with the installation, programming track, or decoder. Contact SoundTraxx Customer Support if this occurs.

If you do not have access to a programming track with read-back capabilities (or are uncertain as to whether it is working properly), you can also use Operations Mode to discover the lock code by alternately programming CV 15 and setting another CV to a value where there is a known response. For example, changing CV 128 (Master Volume Control) will provide auditory feedback as to whether the decoder is unlocked by virtue of a change in sound level. Thus, you would begin by setting CV 15 to 0 and then setting CV 128 to 0. If the volume does not reduce to 0, the decoder is locked. Then set CV 15 to 1 and try programming CV 128 again. Repeat this process until you find a value for CV 15 that results in a change in sound volume as you change CV 128.

Troubleshooting Tip: *If you are not using the CV Lock feature, it can be accidentally activated by inadvertently programming CV 15 or 16 with a non-default value (if bit 0 in CV 30 = 1). If you have a decoder that is otherwise working properly (i.e., making sound and responding to throttle 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.*

Basic Programming

Configuring the Address

Like all DCC decoders, Blunami responds to primary address 3 right out of the package. Address control CVs allow you to set primary and extended addresses or your choice, which can be useful when matching the decoder's address with the number on the locomotive, for instance.

Address Control CVs
CV 1: Primary Address
CVs 17-18: Extended Address

Since most command stations will guide you through the process simply follow their instructions for programming your decoder address. We've included information about the CVs used to configure your decoder's address for those who have older command stations or models that does not provide prompts for this process.

Setting Addresses

Blunami recognizes either the primary address (also known as the short address) in CV 1 or the extended (long) address in CVs 17-18. 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, so 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.

Programming Notes: *You can set the primary and extended addresses in Service Mode (on the programming track) at any time. Some DCC systems also allow you to set the address in Operations Mode according to the following restrictions:*

- *If the decoder's primary address is enabled (bit 5 of CV 29 set to 0), only the extended address can be changed in Operations Mode.*
- *If the decoder's extended address is enabled (bit 5 of CV 29 set to 1), only the primary address can be changed in Operations Mode.*

Primary Address

The Primary address is commonly referred to as the "short" or "2-digit" address. Enter a value from 1 to 127 into CV 1 to set the primary address. All SoundTraxx decoders are set to primary address 3 by default. When selecting the locomotive with your DCC throttle, only enter "3" into the method used to select locomotives. Entering "03" or "0003" can inadvertently choose the extended address, which is not configured as the decoder's default address type.

Extended Address

Often referred to as the "long" or "4-digit" 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 *Blunami Steam Technical Reference* for details).

After setting the extended address, set bit 5 of CV 29 (Configuration Data 1) to 1 to enable its usage. If bit 5 of CV 29 is set to 0, the decoder will continue to respond to the primary address. Continue to "Configuring the Decoder" for more information about CV 29.

Configuring the Decoder

CV 29 controls a variety of important settings. It determines locomotive direction, speed-step mode, alternate power source, speed tables, and the decoder address.

Decoder Configuration CVs
CV 29: Configuration Data 1

Configuring CV 29

This is the first CV that you'll encounter which will need to be programmed by the bits. Refer to the "CV Programming Tutorial" for an interactive guide to programming multiple features in a single CV.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	0	EAM	STE	0	APS	F0	DIR

DIR: Locomotive Direction

Bit 0 (DIR) is used to determine locomotive direction. Setting bit 0 to 1 will invert direction commands, and the decoder will interpret forward as reverse, and reverse as forward. 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 dismantling the locomotive a second time.

F0: F0 Location (Speed-Step Mode Select)

Bit 1 (F0) is used to determine the number of speed steps within the throttle range. 14, 28, and 128 speed-step modes are available, and 28/128 speed-step mode has been enabled by default. Select the highest number of speed steps supported by your command station for the most refined throttle operation.

APS: Alternate Power Source (Analog Mode)

Setting bit 2 (APS) to 1 will allow the decoder to use an analog power source when a DCC signal is not present. Entering a value of 1 into CV 12 (Alternate Power Source) will enable analog mode (disabled by default). Refer to "Configuring for Analog Mode Operation" for more information.

STE: Speed Table Enable

Setting bit 4 (STE) to 1 will select a linear or 28-point custom speed table in place of the 3-point speed table. Refer to "Configuring Throttle and Braking" for more information.

EAM: Primary or Extended Address

Bit 5 (EAM) is used for selecting the active address. Setting bit 5 to 0 will enable the primary address. Set the primary address with CV 1 (Primary Address). CVs 17 and 18 (Extended Address) are used to set the extended address. Set bit 5 of CV 29 to 1 to enable the extended address. Refer to the previous section, "Configuring the Address," for more information about setting the extended address.

Refer to Table C on the following page to view decimal values for CV 29.

Table C. CV 29 Reference					
Address Type	**Speed Table**	**Analog Mode**	**Speed Steps**	**Direction**	**CV Value**
Primary “Short” (CV1)	No	No	14	Normal	0
Primary “Short” (CV1)	No	No	14	Reversed	1
Primary “Short” (CV1)	No	No	28/128	Normal	2
Primary “Short” (CV1)	No	No	28/128	Reversed	3
Primary “Short” (CV1)	No	Yes	14	Normal	4
Primary “Short” (CV1)	No	Yes	14	Reversed	5
Primary “Short” (CV1)	No	Yes	28/128	Normal	6
Primary “Short” (CV1)	No	Yes	28/128	Reversed	7
Primary “Short” (CV1)	Yes	No	14	Normal	16
Primary “Short” (CV1)	Yes	No	14	Reversed	17
Primary “Short” (CV1)	Yes	No	28/128	Normal	18
Primary “Short” (CV1)	Yes	No	28/128	Reversed	19
Primary “Short” (CV1)	Yes	Yes	14	Normal	20
Primary “Short” (CV1)	Yes	Yes	14	Reversed	21
Primary “Short” (CV1)	Yes	Yes	28/128	Normal	22
Primary “Short” (CV1)	Yes	Yes	28/128	Reversed	23
Extended “Long” (CV 17:18)	No	No	14	Normal	32
Extended “Long” (CV 17:18)	No	No	14	Reversed	33
Extended “Long” (CV 17:18)	No	No	28/128	Normal	34
Extended “Long” (CV 17:18)	No	No	28/128	Reversed	35
Extended “Long” (CV 17:18)	No	Yes	14	Normal	36
Extended “Long” (CV 17:18)	No	Yes	14	Reversed	37
Extended “Long” (CV 17:18)	No	Yes	28/128	Normal	38
Extended “Long” (CV 17:18)	No	Yes	28/128	Reversed	39
Extended “Long” (CV 17:18)	Yes	No	14	Normal	48
Extended “Long” (CV 17:18)	Yes	No	14	Reversed	49
Extended “Long” (CV 17:18)	Yes	No	28/128	Normal	50
Extended “Long” (CV 17:18)	Yes	No	28/128	Reversed	51
Extended “Long” (CV 17:18)	Yes	Yes	14	Normal	52
Extended “Long” (CV 17:18)	Yes	Yes	14	Reversed	53
Extended “Long” (CV 17:18)	Yes	Yes	28/128	Normal	54
Extended “Long” (CV 17:18)	Yes	Yes	28/128	Reversed	55

Note: *Values in Table C are shown in decimal format. If your command station requires hex inputs, you will need to convert. Refer to Appendix A for conversions.*

Configuring Throttle and Braking

You can use throttle and braking control CVs to customize the decoder's throttle and braking settings to your operating preferences. This section details setting acceleration and deceleration rates, automatically calibrating Dynamic Digital Exhaust (DDE) load compensation, setting braking rates for the independent brake and train brake functions, adjusting speed table settings, and enabling motor trim scaling factors.

If this is overwhelming at first glance, 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.

Throttle and Braking Control CVs

CV 2: Vstart
CV 3: Baseline Acceleration Rate
CV 4: Baseline Deceleration Rate
CV 5: Vhigh
CV 6: Vmid
CV 25: Speed Table Enable
CV 29: Configuration Data 1
CV 32: CV Index 2
CV 66: Forward Motor Trim
CVs 67-94: Custom Speed Table
CV 95: Reverse Motor Trim
CV 117: Independent Brake Rate
CV 118: Train Brake Rate
CV 2.503: DDE Load Offset
CV 2.504: DDE Load Slope
CV 2.512: DDE Load Sensitivity

Setting the Start Voltage

Blunami 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.

Setting Momentum Rates

Blunami provides two CVs to simulate the momentum due to train weight. CV 3 (Baseline Acceleration Rate) controls how fast the locomotive responds to increases in throttle settings. CV 4 (Baseline Deceleration Rate) controls how fast the locomotive will respond to decreases in the throttle setting.

Both CVs can be programmed with any value from 0 to 255, with 255 corresponding to the slowest acceleration or deceleration 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. Setting acceleration and deceleration rates can allow the speed of the locomotive to match the sound effects regulated by Dynamic Digital Exhaust.

When using 14 or 28 speed-step mode, configuring acceleration and deceleration rates will improve the decoder's throttle response. This allows the locomotive to speed up and slow down without lurching from one speed step to the next.

Basic Programming

Calibrating DDE Load Compensation

Blunami features a cutting-edge new version of our already revolutionary Dynamic Digital Exhaust! We highly recommend you automatically calibrate Dynamic Digital Exhaust settings before adjusting throttle and braking control CVs. This will create an amazingly accurate representation of prototypical operation. You can automatically calibrate DDE according to the specifics of your installation and model. This will allow the decoder to produce more prototypical exhaust chuff responses when encountering changes in both grade and number of cars, during operation. To adjust all DDE settings provided by Blunami, refer to "Configuring Dynamic Digital Exhaust."

Follow the steps below to automatically calibrate DDE load compensation:

1. Ensure CV 31 (CV Index 1) is set to a value of 16 (default).
2. Enter a value of 2 into CV 32 to select Indexed CV Page 2. This allows you to adjust DDE control CVs by accessing CVs 2.503-2.512 from your command station.
3. We suggest running the locomotive at a moderate speed for a minute or two before continuing. If there is any build-up of lubrication or oil in the motor, this will provide better results during the calibration procedure.
4. Set the throttle to speed-step 1.
5. When your locomotive is on level track, enter a value of 255 into CV 503 (DDE Load Offset) to automatically calibrate the nominal low-speed load level.
6. Increase the throttle to an appropriate moderate speed for your layout (generally between speed-step 25 and speed-step 40).
7. When your locomotive is on level track, enter a value of 255 into CV 504 (DDE Load Slope) to automatically calibrate the nominal high-speed load level.

Note: If, after the calibration is complete, you feel the need to increase or decrease the sensitivity, you can do this with CV 2.512.

Setting Braking Rates

Although you can activate the independent brake and train brake sound effects with function keys by default, CV 117 (Independent Brake Rate) and CV 118 (Train Brake Rate) allow you to use the independent brake and train brake functions (F11) to reduce locomotive speed and simulate actually applying brakes during operation. We recommend setting CV 3 (Baseline Acceleration Rate) to a minimum value of 45 before setting braking rates to allow for smoother operation when the brakes are applied and released.

Braking Rate CV Values
0 = CV 4 + 0 (Disabled)
1 = CV 4 + 1
↓
127 = CV 4 + 127
128 = CV 4 + 0 (Disabled)
129 = CV 4 – 1
↓
255 = CV 4 – 127

The values of CVs 117 and 118 are added to the value of CV 4 (Baseline Deceleration Rate) and determine how quickly your locomotive decelerates when brakes are applied. Enter values from 0 to 127 into CVs 117 and 118 to set longer braking rates, and enter values from 129 to 255 to set shorter braking rates. The independent brake and train brake functions will not reduce locomotive speed when CVs 117 and 118 are set to values of 0 or 128.

Note: *When consisting with active momentum and braking rates, ensure the values of CVs 3, 4, 117, and 118 are the same for all units.*

Set the Independent Brake Rate

The independent brakes on prototype locomotives are applied separately from the rest of the train, generally during switching operations and to control slack between units. CV 117 determines the deceleration rate that will bring the locomotive to a stop when the independent brake function is turned on. Turning off the independent brake function will release brakes and allow the locomotive to accelerate back to the prior throttle setting. Enter a value from 0 to 255 into CV 117 to set the independent brake rate:

Seconds/Speed Step = (CV 4 + CV 117) × 0.896 ÷ Number of Speed Steps

Note: *The brake select/trainline charge function (F12 by default) must be turned off for the independent brake rate to be activated with the independent/train brake function (F11 by default).*

Set the Train Brake Rate

On a prototype locomotive, the train brake controls the brakes for each locomotive and car in the train and is the braking method most commonly used to reduce speed. CV 118 determines the deceleration rate that will bring the locomotive to a stop when the train brake function is turned on. Turning off the train brake function will release brakes, cycle the air compressor for 15 seconds, and allow the locomotive to accelerate back to the prior throttle setting. Enter a value from 0 to 255 into CV 118 to set the train brake rate:

Seconds/Speed Step = (CV 4 + CV 118) × 0.896 ÷ Number of Speed Steps

Note: *The brake select/trainline charge function (F12 by default) must be turned on for the train brake rate to be activated with the independent/train brake function (F11 by default).*

Example: Prototypical Braking

Blunami has more ways to prototypically operate your model, and the independent and train brake functions are a great example! The steps below will guide you through setting recommended momentum and braking rates and using the independent brake and train brake functions prototypically while you operate:

1. Enter a value of 45 into CV 3 to allow the locomotive to accelerate in sequence with the exhaust chuff sound effects regulated by Dynamic Digital Exhaust.
2. Enter a value of 75 into CV 4 to set the deceleration rate that allows the locomotive to coast to a stop without any of the brakes being applied.
3. Because independent brakes are most often applied when running only a locomotive, you may want to set CV 117 to a value of 178 for a more rapid braking rate.
4. Because an entire train takes longer to bring to a stop than just a locomotive, you may want to set CV 118 to a value of 100 for a more gradual braking rate.
5. When running a light locomotive or a consist of only locomotives, apply the independent brake with the independent brake function (F11 by default). The brake select function (F12 by default) must be turned off for the independent brake to be applied.
6. When running a complete train, apply the train brake with the train brake function (F11 by default). The brake select function must be turned on for the train brake to be applied (F12 by default). Turning on the brake select function will cycle the air compressor to simulate charging the train line.
7. While you can also stop the train with the Emergency Stop button, this will halt the train instantly and could cause a derailment.

Basic Programming

Setting the 3-Point Speed Curve

By default, track voltage is distributed to the decoder with no variation in a straight line and the decoder responds instantly to the throttle setting. You can designate the amount of voltage applied at the first, middle, and last speed step with CV 2 (Vstart), CV 5 (Vhigh), and CV 6 (Vmid) to compensate for track power or throttle control inefficiencies. First, set bit 4 (STE) of CV 29 to 0. Then enter values from 1 to 255 into CVs 2, 5, and 6 to set the 3-point speed curve. Each value is equivalent to roughly 0.5% of the total supply voltage. Use the calculations below to determine starting, mid-point, and maximum voltage settings:

Vstart, Vmid, Vhigh = Supply Voltage × CV Value ÷ 255

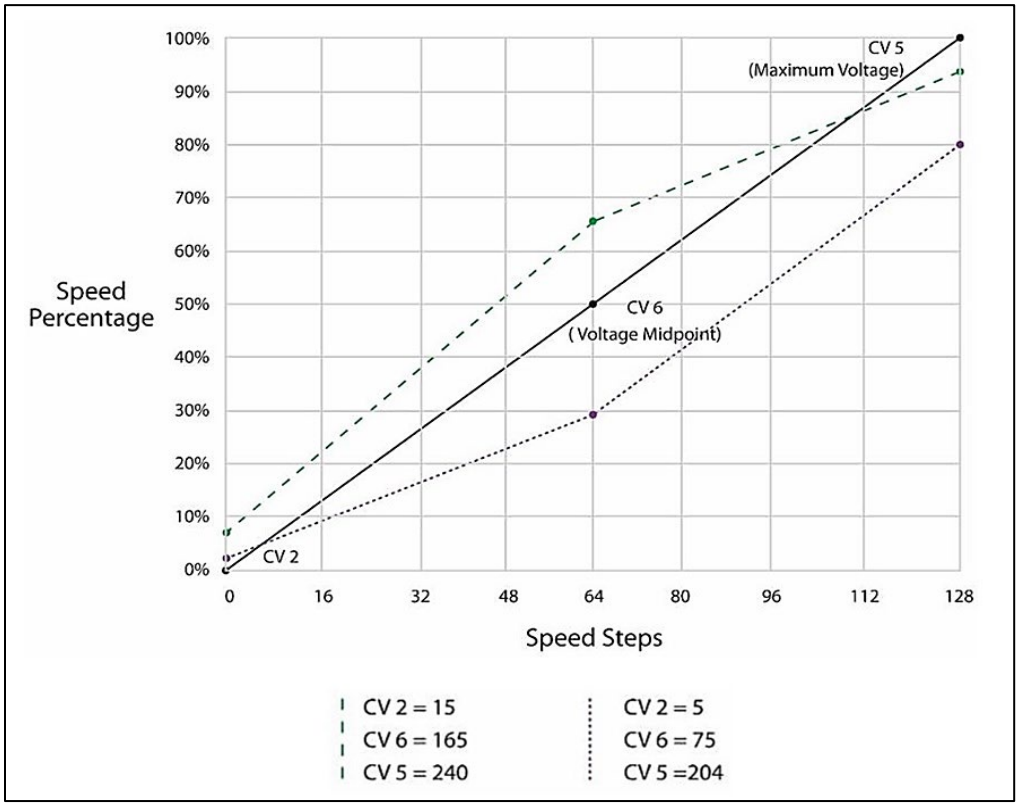
Note: *Use CV 218 (Analog Mode Motor Start Voltage) to set the starting voltage level for analog mode operation. Refer to "Configuring for Analog Mode Operation" for more information.*

If your system supports Operations Mode, refer to the steps below for an alternative method of setting the 3-point speed curve:

1. Place the unit on the mainline and set the throttle to speed-step 1, and then increase the value of CV 2 until the model responds to your preferred starting voltage.
2. Set the throttle to a medium speed step, and then increase the value of CV 6 until the model responds to your preferred mid-speed voltage.
3. Set the throttle to the maximum speed step, and then increase the value of CV 5 until the model responds according to your preferred high-speed voltage level.

Use the 3-Point Speed Curve

The figure shown below gives an example of how CVs 2, 5, and 6 can be used to change voltage levels during operation.



Setting the Custom Speed Table

Blunami offers a custom speed table with 28 adjustable speed points. The 28-point custom speed table is disabled by default. However, you can enable it with CV 25 (Speed Table Enable) and CV 29 (Configuration Data 1), and then adjust each speed point with CVs 67-94 (Custom Speed Table). This allows you to speed-match one locomotive to another, set a prototypical speed range, compensate for design flaws in the driveline, or improve switching operations by setting more speed steps to lower speeds and fewer speed steps to higher speeds.

CVs 67-94 correspond to speed points 1-28. Table D shows default values for CVs 67-94, which create a linear speed table when the custom speed table is enabled. Enter values from 0 to 255 into CVs 67-94 adjust each speed point from 0% to 100% of the maximum throttle setting.

The decoder interpolates between speed steps for more refined throttle control when 28/128 speed-step mode is active. Each speed point of the custom speed table corresponds to a number of speed steps. In 14 speed-step mode, each speed point is equivalent to 0.5 speed steps. In 28 speed-step mode, each speed point is equivalent to one speed step. In 128 speed-step mode each speed point is equivalent to 4.5 speed steps.

Table D. 28-Point Speed Table Settings

CV	Value	% of Throttle
67	9	4
68	18	7
69	27	11
70	36	14
71	45	18
72	55	22
73	64	25
74	73	29
75	82	32
76	91	36
77	100	39
78	109	43
79	118	46
80	127	50
81	137	54
82	146	57
83	155	61
84	164	64
85	173	67
86	182	71
87	191	75
88	200	78
89	209	82
90	219	86
91	228	89
92	237	93
93	246	96
94	255	100

Note: *All 28 speed points of the custom speed table must be set when using 14, 28, or 128 speed-step mode to prevent an unpredictable response from the motor when accelerating and decelerating.*

Follow the steps below in reference to Table D to enable the 28-point custom speed table and adjust each speed point with CVs 67-94:

1. Designate each speed point of the 28-point speed table as a percentage from 0% to 100% of the maximum speed.
2. Enter each speed point's percentage into the equation below to determine values for CVs 67-94:

   CV Value = 255 × (% ÷ 100)

3. Enter CV values for speed points 1-28 into CVs 67-94 to configure the 28-point custom speed table.
4. Set bit 4 (STE) of CV 29 to 1 to enable speed tables.
5. Enter a value of 16 into CV 25 to enable the 28-point custom speed table.

Setting Motor Trim

CV 66 (Forward Motor Trim) and CV 95 (Reverse Motor Trim) are used to “trim” the forward and reverse drive voltages when the 28-point custom speed table is enabled. Setting motor trim can help compensate for speed differences between forward and reverse directions. For instance, if the throttle setting is the same in both directions and the locomotive appears to be moving faster in reverse, you can use CVs 66 and 95 to correct the speed difference.

Entering values from 0 to 255 into CVs 66 and 95 will multiply the forward and reverse drive voltages by a scaling factor. Enter values from 1 to 127 to decrease speed. Enter values from 129 to 255 to increase speed. Entering a value of 0 or 128 into CVs 66 and 95 will set the scaling factor to 1 and will not modify the decoder’s drive voltage.

Note: *Bit 4 (STE) of CV 29 (Configuration Data 1) must be set to 1 for the motor trim scaling factors in CVs 66 and 95 to modify forward and reverse drive voltages.*

Motor Trim Values
0 = Disabled
1 = Voltage × 0.008
↓
127 = Voltage × 0.99
128 = Disabled
129 = Voltage × 1.008
↓
255 = Voltage × 1.99

Configuring Lighting Outputs

Blunami provides up to eight lighting outputs (depending on the board format). Lighting output control CVs allow you to enable Hyperlight effects, Grade-Crossing Logic, phase offset, and LED Compensation Mode for each lighting output, determine lighting output direction, adjust the flash rate of flashing Hyperlight effects, and set lighting output brightness levels.

Lighting Output Control CVs
CV 49: Headlight Configuration
CV 50: Backup Light Configuration
CV 51: FX3 Configuration
CV 52: FX4 Configuration
CV 53: FX5 Configuration*
CV 54: FX6 Configuration*
CV 55: FX7 Configuration*
CV 56: FX8 Configuration*
CV 57: Forward Direction Enable
CV 58: Reverse Direction Enable
CV 59: Hyperlight Flash Rate
CV 60: Grade-Crossing Hold Time
CV 61: Brightness Register 1
CV 62: Brightness Register 2
CV 63: Dimmer Level
CV 64: Master Brightness Level
*Available on select formats

Enabling Hyperlight Effects and Features

You can use CVs 49-56 to enable Hyperlight lighting effects and features for the headlight, backup light, and FX3-FX8 lighting outputs. This section details each Hyperlight effect and feature and shows you how to customize lighting outputs to fit your operating preferences.

On/Off Output

The on/off lighting effect provides on/off control for the corresponding function. Use this effect when the function output is being utilized to drive external electronics such as a low power relay to control a smoke generator or a servo motor.

Dimmable On/Off Headlight

The output set to the dimmable headlight will be reduced to the brightness setting in CV 63 when you turn on the dimmer function (F7 by default).

Mars Light

The Mars light warning beacon follows the famous figure-eight sweep pattern and oscillates more rapidly than the Gyralite.

Pyle-National Gyralite

The Pyle-National Gyralite is similar to the Mars Light, but oscillates in a circular or elliptical pattern.

Oscillating Headlight

The dual-oscillating headlight generates two beams that follow each other in a tight, circular sweep pattern.

Single-Flash Strobes 1 and 2

The xenon single-flash strobe 1 effect flashes once during each flash rate timing cycle. The xenon single-flash strobe 2 flashes once during each flash rate timing cycle, but at a slightly faster rate.

This effect allows you to mimic warning lights found on many Amtrak locomotives as well as remote control operated (or “RCO”) locomotives.

Table E. Hyperlight Effect Select

Value	Lighting Effect
0	On/Off Output
1	Dimmable On/Off Headlight
2	Mars Light
3	Pyle-National Gyralite
4	Oscillating Headlight
5	Single-Flash Strobe 1
6	Double-Flash Strobe
7	Western-Cullen D312 Rotary Beacon
8	Prime Stratolite
9	Ditch Light Type I
10	Ditch Light Type II
11	Flashing Rear End Device (FRED)
12	Engine Exhaust Flicker (Diesel)
13	Firebox Flicker (Steam)
14	Smart Firebox Flicker (Steam)
15	Dyno-Light (Steam)
16	Auto-Dim Forward
17	Auto-Dim Reverse
18	Brake Light
19	On/Off – Brightness 1
20	On/Off – Brightness 2
21	Emergency Gyralite
22	Reserved
23	Ash Pan Flicker (Steam)
24	Reserved
25	Single-Flash Strobe 2

+32	Phase Offset (Phase B)
+64	Grade-Crossing Logic
+128	LED Compensation Mode

Basic Programming

Double-Flash Strobe
The xenon double-flash strobe effect emits two rapid flashes of light during each flash rate timing cycle.

Western-Cullen D312 Rotary Beacon
The Western-Cullen D312 Rotary Beacon effect follows a revolving reflector and bulb assembly flash-pattern.

Prime Stratolite
The Stratolite is made up of four individual lamps arranged in a circular pattern. The Stratolite flashes in a clockwise direction in a mechanical “stepped” fashion, unlike the smooth motion of the rotary beacon.

Ditch Lights Type I and II
Ditch lights type I and II flash together by default. When Grade-Crossing Logic is enabled, ditch light I assumes a steady “on” state before and after the crossing hold timer countdown. Conversely, ditch light II will remain off before and after the crossing hold timer countdown. To configure alternating ditch lights, set one lighting output to ditch light I or II and enable Grade-Crossing Logic, and then set a second lighting output to the same ditch light and enable Grade-Crossing Logic and phase offset.

FRED (Flashing Rear End Device)
The FRED effect is a flashing red taillight that indicates the rear of the train.

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

Smart Firebox Flicker
This effect produces a random flicker whose intensity is synchronized with the sound of Fireman Fred shoveling coal. Whenever Fred ‘opens’ the firebox door and begins shoveling, the lighting effect increases in brightness and then returns to a subdued level when the firebox doors are ‘closed’.

Dyno-Light
The dyno-light effect synchronizes the lamp brightness with the output of the dynamo to simulate the spool-up and shut off of the dynamo, and the heating and cooling of the bulb filament. The brightness increases as the dynamo speeds up and decreases as it slows down.

Auto-Dim Forward and Reverse
The auto-dim forward effect will automatically dim lighting outputs to the dimmer level in CV 63 when in the forward direction, and the auto-dim reverse effect will automatically dim lighting outputs to the dimmer level in CV 63 when in the reverse direction and when stopped.

Brake Light
The brake light effect is dimmed to the brightness setting in CV 63 when active. The brake light brightness level will be automatically set to 100% when you turn on the independent or train brake function (F11 by default).

On/Off Brightness 1 and 2

On/Off Brightness effects 1 and 2 allow you to independently adjust the level of up to 2 lighting outputs. You can accurately recreate low brilliance lighting effects on your model such as class lights, lit number boards or marker lamps. The on/off brightness 1 and 2 effects will set lighting outputs to the brightness levels of CVs 61 and 62, respectively.

Emergency Gyralite

The emergency Gyralite follows the same oscillating sweep pattern as the Gyralite, and will automatically disable all active lighting effects.

Ash Pan Flicker

The ash pan flicker effect slowly flickers from 25% to 100% brightness to simulate the glowing embers that filter into the ash pan from the firebox.

Phase Offset

Add a value of 32 to the value of flashing Hyperlight effects to set the corresponding lighting output to Phase B from Phase A. Flashing effects set to Phase B will flash opposite of flashing effects set to Phase A, i.e., Phase A turns off when Phase B turns on, and Phase A turns on when Phase B turns off.

Grade-Crossing Logic

Grade-Crossing Logic allows you to set up lighting functions, the bell, and whistle to automatically simulate encountering grade crossings. Add a value of 64 to enable Grade-Crossing Logic. Turning on the whistle function (F2 by default) or the grade-crossing signal function (F9 by default) will start the crossing hold timer countdown and allow lighting effects to assume a flashing state. Shown in Table F, flashing Hyperlight effects will return to an on or off state after the countdown ends. Practice activating Grade-Crossing Logic as your locomotive approaches a grade crossing. You can adjust the crossing hold timer countdown from 0 to 15 seconds by entering a value from 0 to 15 into CV 60 (Grade-Crossing Hold Time).

To allow the bell to ring during the crossing hold timer countdown, enable the grade-crossing bell feature in CV 122 (Bell Select). Refer to “Configuring Sound Effects” for more information about the grade-crossing bell.

Refer to Table F located on the next page for a list of Hyperlight effects commonly configured with Grade Crossing Logic (including alternating ditch lights) and corresponding CV values.

Table F. Commonly Configured Hyperlight Effects					
Effect Type	CV Value				Grade Crossing Logic Effect State
	Crossing Logic Off		Crossing Logic On		
	Phase A	Phase B	Phase A	Phase B	
Mars Light	2	34	66	98	On
Pyle-National Gyralite	3	35	67	99	On
Oscillating Headlight	3	36	68	100	On
Single-Flash Strobe 1	5	37	69	101	Off
Single-Flash Strobe 2	25	57	89	131	Off
Double-Flash Strobe	6	38	70	102	Off
D312 Rotary Beacon	7	39	71	103	Off
Prime Stratolite	8	40	72	104	Off
Ditch Light I	9	41	73	105	On
Ditch Light II	10	42	74	106	Off
FRED	11	43	75	107	Off

LED Compensation Mode

The brightness of an incandescent bulb is determined by voltage, whereas an LED's brightness is determined by current. LED Compensation Mode alters the method of sending current to the LED to balance the LED and incandescent brightness levels. Add a value of 128 to enable LED Compensation Mode for the corresponding lighting output.

Note: *Enabling LED Compensation Mode will not change the output voltage. Resistors may still be necessary depending on the board format and drive voltage of the LED.*

Basic Programming

Adjusting Lighting Output Settings

After configuring Hyperlight effects and features with CVs 49-56, adjust CV 57 (Forward Direction Enable), CV 58 (Reverse Direction Enable), CV 59 (Hyperlight Flash Rate), CV 61 (Brightness Register 1), CV 62 (Brightness Register 2), CV 63 (Dimmer Level), and CV 64 (Master Brightness Register) to customize lighting output direction, the Hyperlight flash rate, and brightness levels.

Enable Lighting Output Direction

CV 57 determines the lighting outputs active in the forward direction, and CV 58 determines lighting outputs active in the reverse direction. Table G shows values used to enable lighting outputs for the forward and reverse directions. To enable lighting outputs for the forward direction, add the values of your preferred lighting outputs and enter the sum into CV 57. To enable lighting outputs for the reverse direction, add the values of your preferred lighting outputs and enter the sum into CV 58.

Table G. CVs 57-58 Values

Lighting Output	CV Value
Headlight	+1 to enable
Backup Light	+2 to enable
FX3 Output	+4 to enable
FX4 Output	+8 to enable
FX5 Output	+16 to enable
FX6 Output	+32 to enable
FX7 Output*	+64 to enable
FX8 Output*	+128 to enable

The headlight is disabled in the reverse direction and the backup light is disabled for the forward direction by default.

Note: *For 8 function decoders CV 57 is set to 253 by default and CV 58 is set to 254 by default.*

Set the Hyperlight Flash Rate

Adjust the flash rate of flashing Hyperlight effects from the fastest setting to the slowest setting by entering a value from 0 to 15 into CV 59.

Crossing Hold Time

CV 60 will enable the crossing light effect to remain flashing for a determined length of time. A value of 0-15 corresponds to 0-15 seconds after the whistle is released.

Adjust Brightness Registers 1 and 2

Adjust the brightness level of lighting outputs set to the on/off brightness 1 effect from 0% to 100% by entering a value from 0 to 255 into CV 61. Adjust the brightness level of lighting outputs set to the on/off brightness 2 effect from 0% to 100% by entering a value from 0 to 255 into CV 62.

Adjust the Dimmer Level

Adjust the brightness level of the dimmer function (F7 by default) from 0% to 100% by entering a value from 0 to 255 into CV 63. The dimmer level is set to 60% brightness by default.

Adjust the Master Brightness Level

Adjust the brightness level of all lighting outputs from 0% to 100% by entering a value from 0 to 255 into CV 64. CV 64 adjusts the brightness levels of lighting outputs set to on/off brightness 1 or on/off brightness 2 from the brightness levels of CV 61 and CV 62, respectively. This does not eliminate the need for resistors. Due to the nature of certain lighting effects, values below 100 may diminish its overall effectiveness.

Example: Gyralite with Grade Crossing Logic and Firebox Flicker

This example details using CV 51 (FX3 Configuration) and CV 52 (FX4 Configuration) to enable a Gyralite effect with Grade-Crossing Logic and a Firebox Flicker effect. Follow the steps below to set the FX3 lighting output to an on/off output with a Gyralite effect in Grade-Crossing logic and the Firebox Flicker effect to FX4.

1. Add the CV values for Grade-Crossing Logic (64) and Gyralite effects (3):

   64 + 3 = 67

2. Enter a value of 67 into CV 51 to set the FX3 lighting output to a Gyralite and enable the Grade-Crossing Logic. Add a value of 128 for LED Compensation Mode, if using LEDs.
3. Enter a value of 13 into CV 52 to set the FX4 lighting output to Firebox Flicker effect. Add a value of 128 for LED Compensation Mode, if using LEDs.

Now “light off” the fire in the firebox by turning on FX4 (F25 by default) and watch the intensity of the fire change as fuel is burned.

Next, turn on F24 (by default) to enable the FX3 output. It will remain in a steady “on” state until your locomotive approaches a grade crossing and the whistle function (F2 by default) is turned on to activate Grade-Crossing Logic. The FX3 output will then change from a constant “on” state to a Gyralite effect. The FX3 output will revert to a steady “on” state after the crossing hold timer countdown ends.

Example: Headlight and Backup Light Direction

This example details using CVs 57 and 58 to configure the directionality of the headlight and backup light outputs. Follow the steps below to turn the headlight and the backup lights on regardless of direction:

1. Note the bit definitions and the decimal value of each bit for CVs 57 and 58 (See Table G.). Bits 0-5 correspond to lighting outputs.
2. Setting all bits (0-5) to 1 in CV 57 will enable all lights in the forward direction. To do this, simply add the decimal values of all the outputs:

   1 + 2 + 4 + 8 + 16 + 32 = 63

3. Enter a value of 63 into CV 57 to enable all lights in the forward direction.
4. Setting all other bits (0-5) to 1 in CV 58 will enable all lights in the reverse direction. To do this, simply add the decimal values of all the outputs:

   1 + 2 + 4 + 8 + 16 + 32 = 63

5. Enter a value of 63 into CV 58 to enable all lights in the reverse direction.

Configuring Sound Effects

Sound control CVs allow you to fully customize the decoder's sound effects to fit your preferences. All sound effects included in Blunami are recordings from actual locomotives and simulate the reality of operating a steam locomotive.

This section shows you how to:

1. Select different fuel types, exhaust chuffs, whistles, bells, dynamos, airpumps, and couplers in place of the default sound effects.
2. Customize engine exhaust control such are 2-cylinder, 3-cylinder and articulated exhaust chuff.
3. Adjust the chuff rate.
4. Adjust the volume levels of primary and alternate sound effect mixer channels, and enable quiet mode.

Sound Control CVs

CV 112: Sound Configuration 1
CV 113: Quiet Mode Time-Out Period
CV 114: Engine Exhaust Control
CV 120: Whistle Select
CV 121: Alternate Whistle Select
CV 122: Bell Select
CV 123: Exhaust Select
CV 124: Airpump Select
CV 125: Dynamo Select
CV 126: Coupler Select
CV 128: Master Volume
CVs 129-160: Primary Mixer Volume Levels
CVs 2.289-2.320: Alternate Mixer Volume Levels

Selecting Sound Effects

You can select exhaust chuffs, whistles, alternate whistles, bells, airpumps, dynamos, and couplers with sound effect select CVs.

Select the Primary Whistle

Enter a value from 0 to 89 into CV 120 (Whistle Select) to select your desired primary whistle. Refer to the *Tsuanmi2 Steam Sound Selection Reference* for a complete list of whistles included with your decoder. Turn on the whistle function (F2 by default) to blow the whistle and press the function key again to stop the whistle blast.

CV 120: Whistle Select
0 = Primary whistle 1
1 = Primary whistle 2
↓
89 = Primary whistle 90

Select the Alternate Whistle

Use CV 121 (Alternate Whistle Select) to select an alternate whistle in place of the primary whistle. The alternate whistle is disabled by default. However, when enabled, turning on the short whistle function (F3 by default), and then turning on the whistle function (F2 by default) will issue the alternate whistle sound effect; turn off the whistle function to stop the whistle blast.

CV 121: Alternate Whistle Select
0 = Disabled (default)
1 = Alternate whistle 1
2 = Alternate whistle 2
↓
90 = Alternate whistle 90

Remember, you can activate the alternate whistle with the whistle function *only* when the short whistle function is turned on. Set CV 121 to a value from 1 to 90 to select the alternate whistle; the alternate whistle is disabled when CV 121 is set to a value of 0.

Note: *CV 121 is set to 0 by default disable the alternate whistle. By default, the short whistle function will issue the short whistle blast.*

Basic Programming

Select the Bell

Each decoder version has a selection of bells with pre-configured ring rates. Refer to the *Tsuanmi2 Steam Sound Selection Reference* to determine the range of values. For each bell, a range of up to 5 values is available. Within that range, higher values correspond to faster ring rates.

Enter the desired value into CV 122 and turn on the bell function (F1 by default) to ring the bell. Press the function key again to stop the bell from ringing. Add a value of 128 to enable the grade-crossing bell. Enabling the grade-crossing bell in CV 122 allows the bell to ring during the crossing hold timer countdown after activating Grade-Crossing Logic with the whistle function (F2 by default). For more information about Grade-Crossing Logic, refer to “Configuring Lighting Outputs.”

Select the Exhaust

Enter a value from 0 to 9 into CV 123 (Exhaust Select) to select your desired exhaust chuff. The exhaust chuff is automatically regulated by Dynamic Digital Exhaust and auto-exhaust. You can also manage exhaust cutoff control with the cutoff+ (F5 by default) and cutoff- (F6 by default) functions. Refer to the *Tsuanmi2 Steam Sound Selection Reference* for a complete list of exhaust chuffs included with your decoder.

CV 123: Exhaust Select
0 = Exhaust chuff 1
1 = Exhaust chuff 2
↓
9 = Exhaust chuff 10

Select the Airpump

Enter a value from 0 to 9 into CV 124 (Airpump Select) to select your desired airpump. The selected airpump sound effect plays continuously during operation. The cadence is automatically adjusted in response to independent/train brake and coupler activity and simulates air pressure building and being released.

The airpump plays at a rapid cadence for the first 30 seconds of operation and regresses to a 10 to 15 second cycle thereafter, varying at random. It is automatically reset to its most rapid cadence after two minutes of operation, when the coupler function (F13 by default) is turned on, every third time the independent/train brake function (F11 by default) is turned on, and when the train brake function is turned off. The airpump will cycle at an increased rate for 30 seconds to simulate the train line charging when the brake select function (F12 by default) is turned on. Refer to the *Tsuanmi2 Steam Sound Selection Reference* for a complete list of airpumps included with your decoder.

CV 124: Airpump Select
0 = Single-phase 1
1 = Single-phase 2
2 = Cross-compound 1 “Shay”
3 = Cross-compound 2 (default)
4 = Cross-compound 3
5 = Cross-compound 4
6 = Dual airpump: Cab Forward “whistling” cross-compound
7 = Dual airpump: single-phase
8 = Dual airpump: cross-compound
9 = Vacuum pump

When the vacuum pump is selected, the sound of air being drawn out of the vacuum brake system will only be heard once per revolution of the driving wheels.

Select the Dynamo

CV 125 (Dynamo Select) is used to select one of seven dynamo sound effects. Set CV 125 to a value from 0 to 7 to select your preferred dynamo. Each decoder offers multiple sound choices including double and triple dynamo options. Refer to the *Tsuanmi2 Steam Sound Selection Reference* for a complete list of dynamos included with your decoder.

CV 125: Dynamo Select
0 = Dynamo 1
1 = Dynamo 2
2 = Dynamo 3 (default)
↓
7 = Dynamo 8

Basic Programming

Select the Coupler

Enter a value from 0 to 2 into CV 126 (Coupler Select) to select your desired coupler. Activate the coupler selected in CV 126 with the couple (F13 by default) and uncouple (F13 by default). Add a value of 128 to invert the uncouple function polarity. Inverting the uncouple function polarity allows the uncouple sound effect to be activated when you turn off the uncouple function.

CV 126: Coupler Select
0 = Medium coupler (default) 1 = Heavy coupler 2 = Link-and-pin coupler
Inverted Uncouple Polarity: CV 126 + 128

The uncouple function polarity bit must be set in CV 126 in order to activate the uncouple sound effect by turning off the uncouple function. For example, when the couple and uncouple functions are mapped to the same function key and the uncouple function polarity is inverted in CV 126, turning on the couple function with the function key will activate the couple sound effect, and turning off the uncouple function with the function key will activate the uncouple sound effect. If the couple and uncouple functions are not mapped to the same function key and the uncouple function polarity is not inverted in CV 126, turning on the couple function will activate the couple sound effect, and turning on the uncouple function will activate the uncouple sound effect. To map effects to function keys F0-F28, Refer to “Configuring Function Mapping.”

Basic Programming

Customizing the Steam Engine

CV 112 (Sound Configuration 1) and CV 114 (Engine Exhaust Control) are used to customize engine sound effects to fit your operating preferences.

CV 112: Select Fuel Types

You can use CV 112 to select coal, wood or oil as the fuel type. Selecting the oil fuel type option will disable the ash dump function (F18 by default).

Fuel Type Select
CV 112 + 0 = Hand-shoveled Coal (default)
CV 112 + 1 = Wood
CV 112 + 2 = Oil
CV 112 + 3 = Coal Stoker

CV 112: Select Injectors

Add a value of 4 to CV 112 to select the lifting injector in place of the non-lifting injector (default). The injector function (F20 by default) and automatic Fireman Fred task will activate the selected injector sound effect.

CV 112: Select Johnson Bar or Power Reverser

The power reverser is enabled by default; therefore, add a value of 0 to select. To select the power reverser add a value of 8 to CV 112.

CV 112: Enable 3-Cylinder or Articulated Exhaust

You can use CV 112 to enable articulated or 3-cylinder exhaust in place of 2-cylinder exhaust (default):

- 2-cylinder = four chuffs each wheel rotation (0 = default)
- 3-cylinder = six chuffs each wheel rotation (Add a value of 16 to enable)
- Articulated = eight chuffs each wheel rotation (Add 128 to enable)

You can also select wheel-slip modes for articulated exhaust. When a slow, medium, or fast wheel-slip rate is selected with articulated exhaust enabled in CV 112, the chuff will be offset to simulate the front and rear wheels slipping in and out of sequence.

Exhaust Configuration
CV 112 + 0 = 2-cylinder exhaust (default)
CV 112 + 16 = 3-cylinder exhaust
CV 112 + 128 = Articulated exhaust, wheel slip disabled
CV 112 + 160 = Articulated exhaust, slow wheel-slip mode
CV 112 + 192 = Articulated exhaust, medium wheel-slip mode
CV 112 + 224 = Articulated exhaust, fast wheel-slip mode

CV 114: Adjust the Chuff Rate

Adjust the cadence of the exhaust chuff to match your locomotive's wheel rotations with CV 114. Entering values from 1 to 255 into CV 114 will determine the chuff rate. High values indicate more rapid chuffs, and low values indicate less rapid chuffs. CV 114 should merely be used to bring the chuff rate in line with wheel rotations. Setting CV 114 to a value of 0 will disable Auto-Exhaust.

Exhaust Chuff Rate
0 = Auto-Exhaust disabled
1 = Slowest chuff rate
↓
57 = Default
↓
255 = Fastest chuff rate

Place the locomotive on level track and increase the throttle from zero. If the chuff rate does not match the wheel rotations, enter higher or lower values into CV 114 until synchronized. The decoder will automatically adjust the cadence of the chuff to compensate for changes in motor load and speed.

Basic Programming

Adjusting Volume Levels

Volume control CVs allow you to set the master volume level for all sound effects, set the volume level of each sound effect, and enable quiet mode. Values from 0 to 255 may be programmed into any of the volume mixer CVs (Master Volume, Primary Mixer or Alternate Mixer) to set the volume level from 0% to 100%.

Adjust the Master Volume Level

CV 128 (Master Volume) is used to adjust the volume level of all enabled sound effects, i.e., all mixer channels. Values from 0 to 255 may be programmed into CV 128 to set the volume level from 0% to 100%.

Adjust Primary Mixer Volume Levels

CVs 129-160 (Primary Mixer Volume Levels) are used for setting the volume level of each sound effect, similar to a modern sound studio mixing board. Like CV 128 (Master Volume), values from 0 to 255 may be programmed into mixer channel CVs to adjust volume levels.

For the best sound quality, optimize the volume levels by first determining the sound effect that should be the loudest. The whistle, for instance, usually creates the loudest sound. Then, adjust the volume levels of the remaining of the sound effects relative to the whistle. When you have all the sound effects to their respective volume levels, adjust the overall volume level with CV 128 as needed.

Adjusting volume levels calls for a certain level of prudence to avoid “clipping” or “limiting,” which occurs when the sum of two or more signals exceeds the capacity of the output channel. Clipping is the clicking or popping sounds you may have heard through a pair of broken headphones or speakers. To avoid clipping, consider the sounds you play at the same time and make sure their volume levels aren’t set too high. For example, the whistle should be as loud as possible without causing clipping. If you start to hear some distortion, lower the volume level accordingly.

Note: *Be sure that your speaker is rated to match the audio amplifier of your decoder. Ratings for each format are available on the packaging and at www.soundtraxx.com. Failure to do so could cause severe damage to your speaker.*

Refer to Table H on the next page to view default values for CVs 128-160.

Table H. Primary Mixer Volume Levels		
CV	**Sound Effect**	**Default Value**
129	Whistle	225
130	Bell	85
131	Exhaust Chuff	180
132	Airpump	65
133	Dynamo	35
134	Blower	25
135	Side Rod Clank	50
136	Cylinder Cocks	100
137	Coupler	128
138	Train Brake Apply/Release	65
139	Independent Brake Apply	100
140	Independent Brake Release	70
141	Snifter Valve	65
142	Johnson Bar/Power Reverser	64
143	Safety Valve	225
144	Blowdown	150
145	Reserved	0
146	Water Stop	50
147	Injector	65
148	E-Brake App.	70
149	Glad Hand Release	150
150	All Aboard/Coach Doors	192
151	Reserved	0
152	Valve Packing	15
153	Clickety-Clack	15
154	Sander Valve	5
155	Fuel Loading	65
156	Firing	65
157	Wrenches/Frame Check	50
158	Oil Can/Grease Gun	40
159	Ash Dump	50
160	Cab Chatter	60

Adjust Alternate Mixer Volume Levels

Blunami includes an alternate volume mixer that can be selected in place of the primary volume mixer. This allows you to set two volume levels for each sound effect. This can be useful if you need quieter or louder volume settings for different operating situations, such as one group of settings for your home layout and another for your club layout.

CVs 2.289-2.320 are used to set the alternate volume levels of each sound effect. Turning on the alternate mixer function will set sound effect volumes to alternate mixer channel volume levels in place of the primary mixer channel volume levels in CVs 129-160. The default values for alternate mixer sound effects are set to half of the primary mixer default values. Follow the steps below to enable the alternate mixer in place of the primary mixer:

1. Ensure CV 31 (CV Index 1) is set to a value of 16.
2. Enter a value of 1 into CV 32 (CV Index 2) to select Indexed CV Page 1 as the active indexed CV page.
3. Enter a value of 28 into CV 284 to map the alternate mixer function to function key F28. (You can use any function key, but for the purpose of this example, F28 is FX7 & FX8 by default. This is a good key to use if these outputs are not being used.)
4. Turn on the alternate mixer function with F28 to enable the alternate mixer volume levels in CVs 2.289-2.320 in place of the primary mixer volume levels in CVs 129-160.
5. To adjust the alternate volume level of each sound effect, enter a value of 2 into CV 32 to select Indexed CV Page 2 as the active indexed CV page.
6. Adjust CVs 2.289-2.320 to set each sound effect to your preferred volume level. By default, the sound values for the Alternate Mixer are set to 50% of the Primary Mixer Volume levels.
7. Turn off the alternate mixer function with F28 to re-enable the primary mixer volume levels in CVs 129-160.

Note: *To access Indexed CV Page 1 and Indexed CV Page 2 with CVs 257-512, CV 31 (CV Index 1) must be set to a value of 16 (default) and CV 32 (CV Index 2) must be set to a value of 1 or 2.*

Refer to Table I on the next page to view default values for CVs 2.289-2.320.

Table I. Alternate Mixer Volume Levels		
CV	**Sound Effect**	**Default Value**
2.289	Whistle	112
2.290	Bell	42
2.291	Exhaust Chuff	90
2.292	Airpump	32
2.293	Dynamo	17
2.294	Blower	12
2.295	Side Rod Clank	25
2.296	Cylinder Cocks	50
2.297	Coupler	64
2.298	Train Brake Apply/Release	32
2.299	Independent Brake Apply	50
2.300	Independent Brake Release	35
2.301	Snifter Valve	32
2.302	Johnson Bar/Power Reverser	32
2.303	Safety Valve	112
2.304	Blowdown	75
2.305	Reserved	0
2.306	Water Stop	25
2.307	Injector	32
2.308	E-Brake App.	35
2.309	Glad Hand Release	75
2.310	All Aboard/Coach Doors	96
2.311	Reserved	0
2.312	Valve Packing	7
2.313	Clickety-Clack	7
2.314	Sander Valve	2
2.315	Fuel Loading	32
2.316	Firing	32
2.317	Wrenches/Frame Check	25
2.318	Oil Can/Grease Gun	20
2.319	Ash Dump	25
2.320	Cab Chatter	30

Enable Quiet Mode

You can enable quiet mode and set the quiet mode time-out period with CV 113 (Quiet Mode Time-Out Period). When CV 113 is set to a non-zero value, all sound effects will automatically turn off after the time-out period elapses when the throttle is set to zero and all functions are off. Entering values from 0 to 255 into CV 113 will set the time-out period from 1 seconds to 255 seconds. Use the equation below to calculate the quiet mode time-out period:

Time-Out Period = CV 113 × 1 sec.

Configuring Automatic Sounds

With corresponding automatic sound CVs, you can configure auto-effects for DCC and analog mode operation. Auto-sound CVs can help compensate for lack of function control in analog mode. This is most useful in DCC mode if you have limited function control. You can enable automatic effects if you're unable to activate them with function keys.

Automatic Sound CVs

CV 193: Auto-Bell On Set Point
CV 194: Auto-Bell On Time
CV 195: Coach Door Count
CV 196: Brake Sensitivity
CV 197: Analog Mode Auto-Sound Enable
CV 198: DCC Mode Auto-Sound Enable
CV 199: Cylinder Cocks On Time
CVs 201-208: Fireman Fred Probability CVs
CV 3.257: Clickety-Clack Configuration
CV 3.258: Clickety-Clack Sound Scalar

Enabling Automatic Sound Effects

CV 197 (Analog Mode Auto-Sound Enable) is used for enabling automatic sound for analog mode, and CV 198 (DCC Mode Auto-Sound Enable) is used for enabling automatic sound for DCC mode. The CV values and sound effects for both registers are identical, i.e., the value for enabling the auto-bell in analog mode is the same as the auto-bell value for DCC.

Table J shows values for CVs 197 and 198 used to enable automatic effects. For each auto-sound effect you want to enable, add the CV values together and program the sum into CV 197 for analog mode, or into CV 198 for DCC mode.

Table J. Auto-Sounds

Value	Sound Effect
+2	Auto-Bell
+4	Auto-Brake
+8	Auto-Cylinder Cocks

Enable the Auto-Bell

In addition to CVs 197 and 198, you will need to set CVs 193 (Auto-Bell On Set Point) and 194 (Auto-Bell On Time) to configure the auto-bell sound effect. CV 193 is used to determine the speed step at which the bell sound effect will be automatically turned on and CV 194 (Auto-Bell On Time) is used to adjust the duration in seconds that elapses before the bell sound effect will be automatically turned off. CV 193 may be programmed with values from 1 to 126 to set the auto-bell speed step from 1 to 126, i.e., each value corresponds to a speed step (1 = speed-step 1; 2 = speed-step 2; 108 = speed-step 108, etc.). Then program CV 194 to determine when the bell will stop ringing. Program a value from 1 to 255 into CV 194 to set the duration from 1 to 255 seconds.

Enable the Auto-Brake

You can adjust the auto-brake sensitivity with CV 196 (Brake Sensitivity). In DCC mode, the decoder interprets this as the rate of throttle decrease. In analog mode, the decoder interprets it as the rate of voltage decrease. Values from 1 to 255 determine the brake sound effect's sensitivity. A value of 1 will activate the brake in response to decreases of 0.10 speed steps/second. A value of 255 will activate the brake in response to decreases of 25.5 speed steps/second:

CV Value = Speed Steps/Second ÷ 10

We suggest using trial and error when determining the auto-brake sensitivity. In other words, program CV 196 with higher and lower values and then increase and decrease the throttle setting until the auto-brake is activated according to your preferences. A value of 0 will trigger the brakes whenever the locomotive is decelerating.

N**ote:** *The best results when using the Auto-Brake feature will occur with some momentum programed using CV 3 (Baseline Acceleration Rate) and CV4 (Baseline Deceleration Rate).*
Enable the Auto-Cylinder Cocks

Enable the Auto-Cylinder Cocks

In addition to CVs 197 and 198, you will need to set CV 199 (Cylinder Cocks On Time) to configure the auto-cylinder cocks sound effect.

CV 199 (Cylinder Cocks On Time) is used to adjust the duration the automatic cylinder cocks sound effect remains active after the engine is started. Entering values from 1 to 255 into CV 199 will adjust the duration from 1 to 255 seconds. The cylinder cocks sound effect will automatically turn off when the time period has elapsed. A value of 0 will disable automatic cylinder cocks.

Modifying Automatic Sound Effects

Sound control CVs additionally allow you to modify automatic sound effects, such as the coach door slams that occur after the conductor's "all aboard!" announcement, the clickety-clack rate, and the various Fireman Fred tasks that occur when the locomotive is stopped.

Adjust the Coach Door Count

Enter a value from 0 to 15 into CV 195 (Coach Door Count) to adjust the random number of coach door slams that occur with the all aboard/coach doors function. Turn on the all aboard/coach doors function while the locomotive is stopped to activate the conductor's "all aboard!" announcement, followed by the random number of coach doors slams determined by the value of CV 195.

CV 195: Coach Door Count
0 = 0 door slams
1 = 1 door slam
↓
5 = 5 door slams (default)
↓
15 = 15 door slams

Customize the Clickety-Clack

Follow the steps below to adjust clickety-clack CVs:

1. Ensure CV 31 (CV Index 1) is set to a value of 16.
2. Enter a value of 3 into CV 32 (CV Index 2) to select Indexed CV Page 3 as the active indexed CV page, and enable access to clickety-clack CVs.
3. Refer to the following information when accessing CV 3.257 and CV 3.258 from your command station to customize the clickety-clack sound effect.

You can set the number of axles per truck and number of trucks per car with CV 3.257 (Clickety-Clack Rate) to adjust the clickety-clack rate according to the specifics of your model. This allows you customize the clickety-clack sound effect to simulate various prototypes.

CV 3.257: Clickety-Clack Configuration Values
1 = 2 axles/truck, 1 truck/car
2 = 3 axles/truck, 1 truck/car
5 = 2 axles/truck, 2 trucks/car (default)
6 = 3 axles/truck, 2 trucks/car

For example, a bobber caboose has one truck with two axles, whereas some passenger cars have two trucks with three axles. To simulate a bobber caboose, enter a value of 1 into CV 3.257. For a passenger car, enter a value of 6 into CV 3.257.

CV 3.258 (Clickety-Clack Sound Scalar) allows you to fine-tune the frequency of clickety-clack sound effects by setting the proportion between speed step and scale speed. Scale speed is calculated in feet per second (ft/s). Higher values allow faster scale speeds and increase the clickety-clack frequency, and lower values allow

CV 3.258: Clickety-Clack Sound Scalar
0 = Disabled
1 = 0.01ft/s
↓
128 = 1ft/s (default)
↓
255 = 2ft/s

slower scale speeds and reduce the clickety-clack frequency.
Enter a value from 1 to 255 into CV 3.258 to adjust the scale speed from 0.01ft/s to 2ft/s. A value of 0 will disable the clickety-clack sound effects. You can also use the equation below to calculate scale speed:

Scale Speed (ft/s) = (Speed Step × CV 3.258) ÷ 100

Adjust Fireman Fred Event Probability

Fireman Fred keeps busy when the locomotive is stopped by performing tasks, such as adding fuel to the firebox, refueling the tender, tightening nuts and bolts with his wrench, checking the frame with his hammer, using his oil can and grease gun, filling the tender with water, operating the injector, increasing the blower, or even causing the safety valve to pop! A new Fireman Fred task occurs every 10-30 seconds after the locomotive has been stopped for two minutes.

Table K. Fireman Fred Probability CVs

Event Probability CV	Default
CV 201: Firing Event Probability	128
CV 202: Water Stop Event Probability	0
CV 203: Wrenches Frame Check Event Probability	32
CV 204: Oil Can Grease Gun Event Probability	32
CV 205: Cab Chatter Event Probability	0
CV 206: Injector Event Probability	128
CV 207: Blower Event Probability	128
CV 208: Safety Valve Event Probability	32

You can use CVs 201-208 (Fireman Fred Probability CVs) to adjust the frequency of each Fireman Fred task scheduled to occur while the locomotive is stopped. Entering values from 0 to 255 into CVs 201-208 will adjust the probability for the associated tasks from 0% to 100%. Refer to Table H to view each event probability CV and corresponding default values.

Example: Adjusting Fireman Fred Event Probability

Follow the steps below to configure Fireman Fred probability CVs:

1. To allow Fireman Fred to add more fuel to the firebox periodically, enter a value of 100 into CV 201.
2. You can simulate refilling the tender with water at the appropriate times with the water stop function (F16 by default). To prevent Fireman Fred from filling the tender automatically, enter a value of 0 into CV 202 to disable the automatic water stop sound sequence.
3. To allow Fireman Fred to tighten nuts and check the frame on the locomotive periodically, enter a value of 64 into CV 203.
4. To allow Fireman Fred to use his oil can and grease gun at the same rate as his wrench, enter a value of 64 into CV 204.
5. You can turn on the radio to hear cab chatter with the cab chatter function (F22 by default). To disable the automatic Fireman Fred cab chatter sound effect, enter a value of 0 into CV 205.
6. You can operate the injector at the appropriate times with the injector function (F20 by default). To prevent Fireman Fred from operating the injector automatically enter a value of 0 into CV 206 to disable the automatic injector sound sequence.
7. To increase the blower regularly, enter a value of 125 into CV 207.
8. To allow the safety valve to release regularly, enter a value of 100 into CV 208.

Sound Configuration Example

The following example details using sound control CVs to customize steam sound effects to fit your operating preferences. It describes how to modify the exhaust chuff, select different whistles, bells, airpumps, dynamos, and couplers in place of default settings, and adjust the cylinder cocks on time and coach door count.

Example: Modifying Steam Sound Effects

This example shows you how to customize sound effects, such as the exhaust chuff, whistle, bell, airpump, dynamo coupler, all aboard/coach doors, and cylinder cocks, with the following sound control CVs:

CV 112: Sound Configuration 1
CV 114: Engine Exhaust Control
CV 120: Whistle Select
CV 121: Alternate Whistle Select
CV 122: Bell Select
CV 123: Exhaust Select
CV 124: Airpump Select
CV 125: Dynamo Select
CV 126: Coupler Select
CV 195: Coach Door Count
CV 199: Cylinder Cocks On Time

1. First, modify the operation of the steam locomotive with CV 112. For this example, select oil as fuel type, the lifting injector sound effect, and the power reverser for articulated exhaust with a fast wheel-slip rate:
    a. Add a value of 2 to select oil as the fuel type. Add a value of 4 to select the lifting injector. Add a value of 8 to select the power reverser. Add a value of 128 to enable articulated exhaust. Add a value of 96 to select the fast wheel-slip mode for articulated exhaust:

    2 + 4 + 8 + 128 + 96 = 238

    b. Enter a value of 238 into CV 112.
2. Next, adjust the exhaust chuff rate to match the locomotive wheel rotation with CV 114. To do this, set the throttle to a non-zero speed step (speed step 5 in 128 speed step mode works well) and enter values 1-255 into CV 114 until the chuff rate is synchronized with the wheel rotations.
3. After adjusting CVs 112 and 114 to modify the exhaust, select a different exhaust chuff with CV 123. Entering a value from 0 to 9 into CV 123 will select exhaust chuffs 1-10. To select exhaust chuff 8, enter a value of 7 into CV 123.
4. You can select a different primary whistle for the whistle function (F2 by default) with CV 120. Entering a value from 0 to 89 into CV 120 will select whistles 1-90. To select whistle 15, enter a value of 14 into CV 120.
5. You can use CV 121 to enable the alternate whistle. Entering a value from 1 to 90 into CV 121 will select whistles 1-90 for the alternate whistle. When an alternate whistle is selected in CV 121, turning on the short whistle function (F3 by default), and then turning on the whistle function (F2 by default) will issue the alternate whistle selection. To select whistle 1 for the alternate whistle, enter a value of 1 into CV 121.
6. You can select different bells and bell ring rates, and enable the grade-crossing bell with CV 122. Most bell selections have five ring rate options: slow, medium-slow, medium, medium-fast, and fast. Entering values from 0 to 53 into CV 122 will select each ring rate for bells 1-12. Adding a value of 128 to CV 122 will enable the bell selection to ring during the crossing hold countdown, after Grade-Crossing Logic is activated. Refer to “Configuring Lighting Outputs” for more information about Grade-Crossing Logic.

a. A value of 31 will select bell 7 with a fast ring rate for the bell function (F1 by default), and a value of 128 will enable bell 7 for the grade-crossing bell. To determine the value of CV 122, add the values together:

31 + 128 = 159

b. To select bell 7 with a fast ring rate for the bell function and enable the grade-crossing bell, enter a value of 159 into CV 122.

7. You can select a different airpump with CV 124. Entering a value from 0 to 9 into CV 124 will select different airpumps. To select airpump 5, enter a value of 4 into CV 124.
8. You can select different dynamos with CV 125. Entering a value from 0 to 7 into CV 125 will select dynamos 1-8. To select dynamo 5, enter a value of 4 into CV 125.
9. You can select a different coupler with CV 126. Entering values from 0 to 2 into CV 126 will select the medium, heavy, and link-and-pin couplers. To allow the uncouple sound effect to be activated when the couple/uncouple function (F13 by default) is turned off, add a value of 128 to CV 126.

    a. A value of 1 will select the heavy coupler and a value of 128 will allow the couple and uncouple sound effects to be activated with the same function key. To determine the value of CV 126, add the values together.

    1 + 128 = 129

    b. To select the heavy coupler and invert the uncouple function polarity, enter a value of 129 into CV 126.

10. You can adjust the number of coach door slams that occur with the all aboard/coach doors function (F23 by default) with CV 195. Entering a value from 1 to 15 into CV 195 will set the possible number of coach door slams. To randomly produce up to eight coach door slams, enter a value of 8 into CV 195.
11. Set CV 199 to a value of 5 to set the cylinder cocks on time to five seconds.

Advanced Programming

Configuring Audio Control

Blunami features a high-pass filter and 7-band equalizer, allowing you to adjust frequency responses according to your installation. You can use audio control CVs to fine-tune sound responses by setting the high-pass filter cutoff frequency, selecting preset equalizer frequency responses for a range of speaker sizes, and customizing the cut/boost settings of the equalizer's frequency levels, and setting up reverb. Audio control CVs can also be used to make two identical engines sound a little different, lending you a bit more realism.

Audio Control CVs
CVs 161-192: Reverb Mixer
CV 224: High-Pass Filter Cutoff Frequency
CV 225: Equalizer Control Register
CV 226: 62Hz Cut/Boost
CV 227: 125Hz Cut/Boost
CV 228: 250Hz Cut/Boost
CV 229: 500Hz Cut/Boost
CV 230: 1kHz Cut/Boost
CV 231: 2kHz Cut/Boost
CV 232: 4kHz Cut/Boost
CV 233: Reverb Control Register
CV 234: Reverb Output Level
CV 235: Reverb Delay Time
CV 236: Reverb Feedback Level

Adjusting the High-Pass Filter

CV 224 (High-Pass Filter Cutoff Frequency) is used to set the cutoff frequency of the high-pass output filter.

Cutoff Frequency Values
0 = Disabled
1 = 20Hz
↓
20 = Default value
↓
255 = 1kHz

The audio output of the decoder includes many low (or bass) frequencies that may not be able to be reproduced by the speaker(s) in many installations. However, power is still applied to the speaker, regardless of whether or not the sound can be heard. This power has a significant impact on the 'hold-up' time of the decoder when it encounters track power glitches (such as turn-outs and dirty track). You can improve the hold-up by setting this CV to increasingly higher values. Start with a low value, increasing it until a change in the audio signal is observed, and then decreasing it by a small percentage (i.e. 10%).

Adjusting the high-pass filter doesn't require any modification to the volume settings. Entering a value from 1 to 255 into CV 224 will adjust the high-pass filter cutoff frequency from 20Hz to 1kHz. A value of 0 will disable the high-pass filter.

About the 7-Band Equalizer

An equalizer, also called an "EQ," is similar to what you might use on a home stereo system to "boost" and "cut" sound levels. Equalizers are typically used to adjust the amplitude of audio signals at specific frequencies, which can correct the sound response of a device. If you aren't familiar with "dB," it stands for "decibel," a logarithmic unit used to measure power or intensity. In this case, dB is used to measure sound pressure and pertains to frequency response. A speaker is limited to the lowest frequency that can be reproduced. This is determined primarily by the size of the speaker. For example, reproducing a low frequency sound at a high volume requires moving more air, and hence, a larger speaker diaphragm.

Also keep in mind that the electromagnet underneath the speaker-cone will react to even the deepest bass. This means that a small speaker will still technically respond to low frequency signals, but you might not be able to hear the sound very well because not enough air is able to move through the speaker. In this case, though you may be able to hear it better, turning up the volume isn't likely to improve the low frequency sound quality, and could cause clipping if the speaker-cone is being pushed beyond its physical capabilities. Removing the inaudible, low frequency sound, or "cutting" frequency levels, will allow the speaker to operate within the limitations of its audio range.

Advanced Programming

Setting EQ Frequency Levels

CV 225 (Equalizer Control Register) is used primarily for setting the frequency levels of the equalizer to accommodate a range of speaker sizes. Enter a value from 1 to 4 into CV 225 to select preset cut/boost levels to match the diameter of your speaker diaphragm (smaller than 1" to larger than 4"). When CV 225 is set to a value of 7, you can enter values from 0 to 255 into CVs 226-232 (Cut/Boost Controls) to adjust the cut/boost of each band's frequency level from +12dB to -12dB. CVs 226-232 are set to values of 128 by default, which indicates a flat response (0dB).

Refer to Table L on the next page to configure EQ Frequency Level CVs 225-232.

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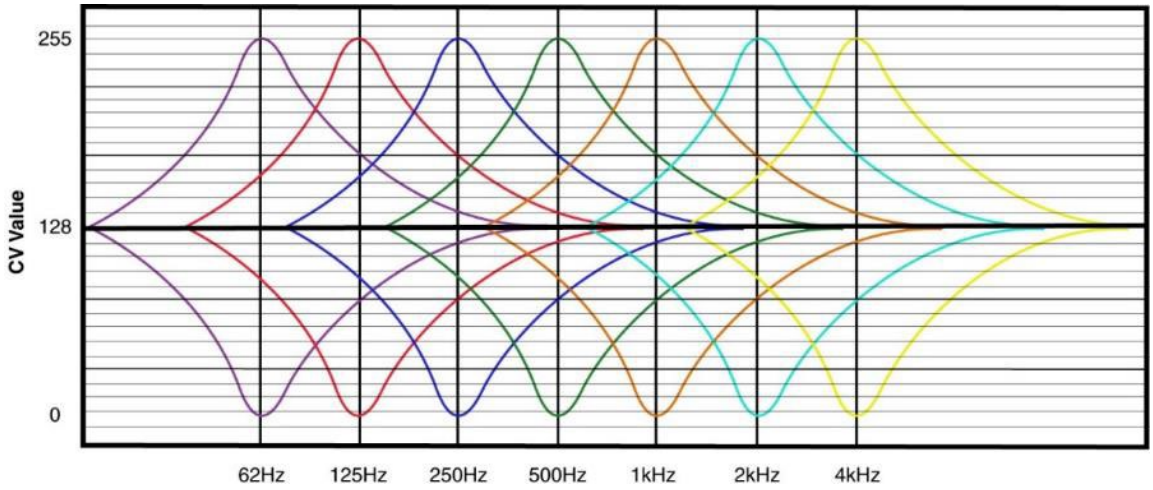
Table L. CV 225: EQ Control Register								*Cut/boost values for CVs 226-232 shown in red
CV Value	**Description**	**62Hz** CV 226	**125Hz** CV 227	**250Hz** CV 228	**500Hz** CV 229	**1kHz** CV 230	**2kHz** CV 231	**4kHz** CV 232
0	Flat	0dB 128	0dB 128	0dB 128	0dB 128	0dB 128	0dB 128	0dB 128
1	Micro Speaker (smaller than 1”)	-12dB 0	-12dB 0	+7.12 200	+3dB 160	+1.5dB 140	+0.8dB 132	0dB 128
2	Small Speaker (1” to 2”)	-6dB 60	-3dB 96	+4.1dB 168	+3dB 160	0dB 128	0dB 128	+0.8dB 132
3	Medium Speaker (2” to 4”)	-3dB 96	+4.1dB 168	+2.3dB 148	+1.1dB 136	0dB 128	0dB 128	0dB 128
4	Large Speaker (larger than 4”)	+6dB 192	+3dB 160	+1.5dB 140	0dB 128	0dB 128	0dB 128	0dB 128
7	Custom EQ Levels	+/-12dB 0-255	+/-12dB 0-255	+/-12dB 0-255	+/-12dB 0-255	+/-12dB 0-255	+/-12dB 0-255	+/-12dB 0-255

The graph below indicates the minimum-to-maximum frequency response for each band. Notice the overlap from one frequency band to the next. Keep in mind that adjusting the response with one CV will raise or lower the sounds of nearby frequencies as well.



Making adjustments while sounds are playing is the easiest way to set the EQ because you can listen to each response. Because of this, we recommend programming this feature on the mainline. Start with CV 226 and make adjustments until you’re satisfied with each band’s frequency response. Depending upon the speaker you’re using, adjusting the lowest frequency bands may have little or no effect. If this is the case, the audio frequencies are out of the speaker’s range, and we suggest that you set the CV to 0 (-12dB).

CV Value	Cut/Boost
255	+12dB
224	+9dB
192	+6dB
160	+3dB
128	0dB
96	-3dB
64	-6dB
42	-9dB
0	-12dB

Note: *Setting the cut/boost levels in CVs 226-232 to values that are too high may result in poor sound responses or damage the speaker. Ensure that equalizer settings do not exceed your speaker’s power rating to avoid this.*

Setting Reverb

The reverb effect allows you to add a bit of 'presence' to sound effects. CV 233 (Reverb Control Register) allows you to choose between preset reverb options for sound effects or select user-adjustable reverb. CV 234 (Reverb Output Level), CV 235 (Reverb Delay Time), and CV 236 (Reverb Feedback Gain Level) are used to set up reverb for the sound effects assigned to CVs 161-192 (Reverb Mixer).

Note: *Making big adjustments within reverb control CVs can easily result in unpleasant results. We recommend you take your time and experiment with small changes first when configuring this feature.*

Reverb Control Register

CV 233 allows you to select reverb presets or user-adjustable reverb. Setting CV 233 to reverb presets will automatically adjust CVs 234-236.

User-adjustable reverb works by simulating the effect created when a sound wave is heard with a delayed version of the sound that has been reflected off another hard surface. The decoder's reverb is designed to produce an effect due to early sound reflections off a nearby surface such as a rock cut or canyon wall. User-adjustable reverb provides three controls plus a reverb mixer.

CV 233: Reverb Control Register	
CV Value	**Reverb Preset**
0	Disabled
1	Short Reverb (default)
2	Medium Reverb
3	Long Reverb
4	Short Echo
5	Long Echo
6	Extra Long Echo
7	User-Adjustable

Reverb Output Level

CV 234 determines the amount of reverb signal that is mixed back with the original audio signal, and may be set to a value from 0 (minimum) to 255 (maximum).

Reverb Delay Time

CV 235 determines the overall reverb delay time from 0 to 255 milliseconds. CV 235 may be set to a value from 0 (zero delay) to 255 (maximum delay). The reverb delay time is calculated as:

Delay Time = CV 235 × 1ms

Longer delay times correspond to a greater distances between the sound source and the reflecting surfaces and will generally result in increased reverb.

Reverb Feedback Level

CV 236 specifies the percentage of the reverb's output that is mixed back into the input and creates the effect of multiple sound reflections, each diminishing in amplitude over time. CV 236 may be set to a value from 0 to 255 to adjust the amount of feedback from 0% to 100%.

Note: *High feedback settings (greater than a value of 200) should be avoided, as they can result in strange sounding effects. Adjust this CV starting with a low initial value and increase in small steps.*

Advanced Programming

Reverb Mixer

Adjusting CVs 161-192 allows you to apply the reverb effect to desired sound effects. There are reverb inputs for each sound effect that control the percentage of the original audio level that will be mixed into the reverb. Each send level may be set from 0 to 255 to adjust the percentage from 0% to 100%.

CVs 161-192: Reverb Mixer		
CV	**Sound Effect**	**Default Value**
161	Whistle	96
162	Bell	0
163	Exhaust Chuff	0
164	Airpump	0
165	Dynamo	0
166	Blower	0
167	Side Rod Clank	0
168	Cylinder Cocks	0
169	Coupler	0
170	Train Brake Apply/Release	0
171	Independent Brake Apply	0
172	Independent Brake Release	0
173	Snifter Valve	0
174	Johnson Bar/Power Reverser	0
175	Safety Valve	0
176	Blowdown	0
177	Reserved	0
178	Water Stop	0
179	Injector	0
180	E-Brake App.	0
181	Glad Hand Release	0
182	All Aboard/Coach Doors	0
183	Reserved	0
184	Valve Packing	0
185	Clickety-Clack	0
186	Sander Valve	0
187	Fuel Loading	0
188	Firing	0
189	Wrenches/Frame Check	0
190	Pneumatic Oilers	0
191	Ash Dump	0
192	Cab Chatter	0

Advanced Programming

How to Adjust Reverb Control CVs

Setting up the reverb involves a bit of trial and error and is best done while the sounds are playing, using Operations Mode programming to make the adjustments. Start by setting CV 233 to 7 to enable the user-adjustable reverb. Next, set CVs 234-236 to a nominal value. We like to start with the settings of 64 for CV 234, 255 for CV 235, and 64 for CV 236. Then determine the sounds you wish to apply reverb to and try setting the corresponding reverb mixer CV (CV 161-192) to a value between 96 and 192. If you are using multiple reverb inputs, each can be set to a different value so that more or less reverb is added to a particular sound effect as desired. With the recommended reverb control settings, you should notice a definite amount of reverb added to the sound and can begin making further adjustments.

Like any sound effect, it is possible to over-adjust a particular setting within the reverb control CVs and create an artificial sounding effect. Make adjustments in small steps and let your ears be the judge!

Configuring Dynamic Digital Exhaust

Dynamic Digital Exhaust (DDE) is one of the most fun effects featured in Blunami.

When the locomotive encounters a grade. DDE responds to this by increasing the intensity and volume of the exhaust chuff to simulate the locomotive exerting more power. Similarly, the demand on the motor is lifted when the locomotive starts drifting downhill, which reduces the intensity and volume of the exhaust chuff.

DDE Control CVs
CV 2.503: DDE Load Offset
CV 2.504: DDE Load Slope
CV 2.505: Side Rod Clank Low Volume Limit
CV 2.506: Side Rod Clank High Volume Limit
CV 2.507: DDE Exhaust Low Volume Limit
CV 2.508: DDE Exhaust High Volume Limit
CV 2.509: DDE Attack Time Constant
CV 2.510: DDE Release Time Constant
CV 2.511: DDE Throttle Sensitivity
CV 2.512: DDE Load Sensitivity

CVs 2.503-2.512 are used to adjust parameters of the DDE processor. DDE control CVs allow the engine sound effects to be modified in response to motor process load and/or speed during operation. You may need to modify default settings to fit the specifics of your installation and locomotive. This section details using DDE control CVs to fine-tune your operation.

Note: *To access Indexed CV Page 2 with CVs 2.257-2.512, CV 31 (CV Index 1) must be set to a value of 16 (default) and CV 32 (CV Index 2) must be set to a value of 2.*

Calibrating DDE Load Sensing

CV 2.503 (DDE Load Offset) is used to set the DDE processor's nominal low-speed load level, and serves as a reference point for the minimum amount of load required to move the model. Entering values from 1 to 254 into CV 2.503 will set the DDE load offset. Entering lower values into CV 2.503 will result in greater load levels. Entering greater values into CV 2.503 will result in lower load levels. Entering a value of 0 into CV 2.503 will disable the DDE load offset.

CV 2.504 (DDE Load Slope) is used to set the DDE processor's nominal high-speed load level, and serves as the reference point for track speed. Entering values from 1 to 254 into CV 2.504 will set the DDE load slope. Entering lower values into CV 2.504 will result in greater load levels. Entering greater values into CV 2.504 will result in lower load levels. Entering a value of 0 into CV 2.504 will disable the DDE load slope.

We highly recommend automatically calibrating the DDE load offset and DDE load slope. Enter a value of 255 into CV 2.503 at speed-step 1, then enter a value of 255 into CV 2.504 at the average operating speed for your layout will automatically calibrate DDE load compensation. Ensure the locomotive is on level track when entering values of 255 into CVs 2.503 and 2.504. Refer to "Configuring Throttle and Braking" to automatically calibrate DDE load compensation.

Follow the steps below:

1. Ensure CV 31 (CV Index 1) is set to a value of 16 (default).
2. Enter a value of 2 into CV 32 to select Indexed CV Page 2. This allows you to adjust DDE control CVs by accessing CVs 2.503-2.512 from your command station.
3. We suggest running the locomotive at a moderate speed for a minute or two before continuing. If there is any build-up of lubrication or oil in the motor, this will provide better results during the calibration procedure.
4. Set the throttle to speed-step 1.
5. When your locomotive is on level track, enter a value of 255 into CV 503 (DDE Load Offset) to automatically calibrate the nominal low-speed load level.

6. Increase the throttle to an appropriate moderate speed for your layout (generally between speed-step 25 and speed-step 40).
7. When your locomotive is on level track, enter a value of 255 into CV 504 (DDE Load Slope) to automatically calibrate the nominal high-speed load level.

Note: If, after the calibration is complete, you feel the need to increase or decrease the sensitivity, you can do this with CV 2.512.

Adjusting DDE Volume Limits

CV 2.505 (DDE Side Rod Clank Low Volume Limit), CV 2.506 (DDE Side Rod Clank High Volume Limit), CV 2.507 (DDE Exhaust Low Volume Limit), and CV 2.508 (DDE Exhaust High Volume Limit) are used to set low and high volume limits for the side rod clank and exhaust chuff sound effects that fluctuate according to the load sensed by the DDE processor. Rather than merely adjusting the volume level, adjusting CVs 2.505-2.508 allows you to attenuate and boost the sound of the exhaust and side rod clank from each effect's mixer channel volume level. CV 2.506 and CV 2.507 are used to specify the side rod and exhaust sound response at low loads. CV 2.505, the side rod clank low volume limit, and CV 2.508, the exhaust high volume limit, are used to specify the sound response at high loads.

During acceleration and when the locomotive is operating under high loads, CV 2.508 will determine the maximum boost in exhaust volume and CV 2.505 will determine the maximum reduction in rod clank volume. A value from 0 to 255 may be programmed into each CV. Under very high loads, the exhaust volume will be amplified by +12dB when CV 2.508 is set to 255 and the rod clank volume will be attenuated by -12dB when CV 2.505 is set to 255. A value of 0 indicates sound volume will not be adjusted in response to throttle increases. During deceleration and when the locomotive is operating under very low loads, CV 2.507 determines the maximum attenuation in exhaust volume and CV 2.506 will determine the maximum boost in side rod clank volume. Under very low load levels, the rod clank volume will be amplified by +12dB when CV 2.506 is set to 255 and the exhaust volume will be reduced by -12dB when CV 2.507 is set to 255.

In summary, CVs 2.505-2.508 allow you to adjust each sound effect's low and high volume limits to match your preference. For instance, setting CV 2.507 to a value of 64 and CV 2.508 to a value of 255 will make the exhaust 12 dB louder during acceleration and under very high loads, but will only attenuate it by 3dB during deceleration. You can try this with the side rod clank volume as well by programming CVs 2.505 and 2.506 with the same values.

Adjusting DDE Time Constants

CV 2.509 (DDE Attack Time Constant) and CV 2.510 (DDE Release Time Constant) are used to determine how quickly the DDE processor reacts to changes in load and speed. CV 2.509 determines the duration of time that elapses from when the decoder receives a new throttle command (or senses a change in load) to the time the DDE processor begins to reshape the audio signal. CV 2.510 determines the duration of time that elapses between changes in the way the DDE processor reshapes the audio signal based upon increasing or decreasing throttle commands or changes in load.

Entering a value from 1 to 255 into CVs 2.509 and 2.510 will adjust the DDE attack and release time constants from minimum to maximum. Entering a value of 0 into CVs 2.509 and 2.510 will set both DDE time constants to an "instant" response.

Adjusting DDE Sensitivity Levels

CV 2.511 (DDE Throttle Sensitivity) is used to adjust the correlation between the throttle setting and the exhaust chuff sound effect. Simply put, when the throttle setting is much greater than the current locomotive speed, the load is very high. Conversely, when the throttle is much less than the current locomotive speed, the load is very low. As such, the DDE processor modifies the timbre and volume of sound effects in response to the throttle only when acceleration and deceleration rates are set in CV 3 (Baseline Acceleration Rate) and CV 4 (Baseline Deceleration Rate). You may enter a value from 0 to 255 into CV 2.511 to adjust the DDE throttle sensitivity level. Entering a value of 0 into CV 2.511 will disable DDE throttle sensing. Setting CV 2.511 to 255 indicates that the cadence and volume of the exhaust chuff sound effect will be most sensitive to the changes in throttle setting.

CV 2.512 (DDE Load Sensitivity) is used to adjust the correlation between motor load and exhaust chuff sound effects. As the motor is impeded during operation, the DDE processor will adjust the timbre and volume of exhaust chuff and rod clank sound effects according to the value of CV 2.512. You may enter a value from 0 to 255 into CV 2.512 to adjust the DDE load sensitivity level. Entering a value of 0 into CV 2.512 will disable DDE load sensing and sound effects will not be modified when the motor is impeded. Setting CV 2.512 to 255 indicates that the exhaust chuff sound effect will be most sensitive to changes in motor load.

Note: *DDE Load Sensing is disabled if back-EMF is disabled in CV 217.*

Configuring Function Mapping

Function mapping CVs allow you to reassign any effect to any function key, enable effects to respond automatically to direction and movement changes, map an effect to the emergency stop button, and gives you the option of using NMRA "Legacy" function mapping. It's easy to customize function assignments to fit any operating preference with Flex-Map function mapping technology!

Function Mapping CVs
CV 31: CV Index 1
CV 32: CV Index 2
CVs 33-46: Function Status CVs
CV 57: Forward Direction Enable
CV 58: Reverse Direction Enable
CVs 1.257-1.385: Effect Map Registers
CVs 1.385-1.512: Effect Auxiliary Map Registers

Note: *To access Indexed CV Page 1 with CVs 257-512, CV 31 (CV Index 1) must be set to a value of 16 (default) and CV 32 (CV Index 2) must be set to a value of 1 (default).*

Function Mapping with Flex-Map Technology

To complement the decoder's wide range of effects, Blunami puts you in control of all function assignments. Flex-Map CVs determine default function assignments for Blunami, and allow you to customize function keys and effects according to a simple and versatile format.

Customize Function Assignments

CVs 1.257-1.384 (Effect Map Registers) are used for function mapping. Each effect corresponds to a CV. The value of each CV determines the F0-F28 function key used to control that effect. Follow the steps below to use CVs 1.257-1.384 for customizing function assignments:

1. Ensure CV 31 (CV Index 1) is set to a value of 16.
2. Enter a value of 1 into CV 32 (CV Index 2) to select Index CV Page 1 as the active indexed CV page and enable access to CVs 1.257-1.384.
3. Access CVs 257-384 from your command station.
4. Enter a value from 0 to 28 into CVs 257-384 to map the corresponding effect to function keys F0-F28.

To completely disable (or un-map) an effect, set the corresponding effect's CV to a value of 255.

Value = Function Key
0 = F0
1 = F1
↓
28 = F28
29-254 = Reserved
255 = Effect Disabled

Refer to Tables M and N on the next page for a list of CVs 1.257-1.384 and corresponding effects along with default function assignments.

Table M. CVs 1.257-1.384
Effect Map Registers
CV 1.257: Headlight
CV 1.258: Backup Light
CV 1.259: FX3 Effect
CV 1.260: FX4 Effect
CV 1.261: FX5 Effect
CV 1.262: FX6 Effect
CV 1.263: FX7 Effect
CV 1.264: FX8 Effect
CVs 1.265-1.272: Reserved
CV 1.273: Dimmer
CV 1.274: Mute
CV 1.275: Independent/Train Brake
CV 1.276: Half-Speed
CV 1.277: Momentum Override
CV 1.278: Grade-Crossing Signal
CV 1.279: Forward Whistle Signal
CV 1.280: Reverse Whistle Signal
CV 1.281: Stop Whistle Signal
CV 1.282: Reserved
CV 1.283: Brake Select/Trainline Charge
CV 1.284: Alternate Mixer
CV 1.285: Cutoff+
CV 1.286: Cutoff-
CV 1.287: Wheel Slip
CVs 1.288-1.296: Reserved
CV 1.297: Whistle
CV 1.298: Bell
CV 1.299: Dynamo
CV 1.300: Short Whistle
CV 1.301: Cylinder Cocks
CV 1.302: Water Stop
CV 1.303: Reserved
CV 1.304: Cab Chatter
CV 1.305: Couple
CV 1.306: Uncouple
CV 1.307: Reserved
CV 1.308: Wheel Chains
CV 1.309: Sander Valve
CV 1.310: Reserved
CV 1.311: All Aboard/Coach Doors
CV 1.312: Blowdown
CV 1.313: Fuel Loading
CV 1.314: Ash Dump
CV 1.315: Injector
CVs 1.316-1.319: Reserved
CV 1.320: Johnson Bar/Power Reverser
CV 1.321: E-Brake App.
CVs 1.322-1.384: Reserved

Table N. Default Function Assignments

F0-F28	Effect	CV	Value
F0(f)	Headlight	1.257	0
F0(r)	Backup Light	1.258	0
F0	Dynamo	1.299	0
F1	Bell	1.298	1
F2	Whistle	1.297	2
F3	Short Whistle	1.300	3
F4	Cylinder Cocks	1.301	4
F5	Cutoff+	1.285	5
F6	Cutoff-	1.286	6
F7	Dimmer	1.273	7
F8	Mute	1.274	8
F9	Grade-Crossing Signal	1.278	9
F10	Blowdown	1.312	10
F11	Independent/Train Brake	1.275	11
F12	Brake Select/Trainline Charge	1.283	12
F13	Couple	1.305	13
F13	Uncouple	1.306	13
F14	Half-Speed	1.276	14
F14	Momentum Override	1.277	14
F15	Wheel Chains	1.308	15
F16	Water Stop	1.302	16
F17	Fuel Loading	1.313	17
F18	Ash Dump	1.314	18
F19	Wheel Slip	1.287	19
F20	Injector	1.315	20
F21	Sander Valve	1.309	21
F22	Cab Chatter	1.304	22
F23	All Aboard/Coach Doors	1.311	23
F24	FX3 Output	1.259	24
F25	FX4 Output	1.260	25
F26	FX5 Output	1.261	26
F27	FX6 Output	1.262	27
F28	FX7 Output	1.263	28
F28	FX8 Output	1.264	28

Advanced Programming

Enabling Automatic Effects

To provide more versatility, Flex-Map function mapping CVs allow you to configure automatic effects that respond to direction and movement. Follow the steps below to enable automatic effects with CVs 1.385-1.512 (Effect Auxiliary Map Registers):

1. Ensure CV 31 is set to a value of 16.
2. Enter a value of 1 into CV 32.
3. Access CVs 385-512 from your command station and refer to the descriptions and CV values below to enable automatic effects.

Forward-Driving: Effect is turned on when the locomotive is moving in the forward direction.

Reverse-Driving: Effect is turned on when the locomotive is moving in the reverse direction.

Forward-Standing: Effect is turned on when the locomotive is stopped in the forward direction.

Reverse-Standing: Effect is turned on when the locomotive is stopped in the reverse direction.

Note: *CVs 1.385-1.512 can be set to allow any combination of auto-effect enable. For instance, a value of 10 will allow the effect to turn on in the reverse direction regardless of movement, and a value of 3 will allow the effect to turn on when the locomotive is in motion regardless of direction.*

Table O. Auto-Effect Enable

CV Value	Active When
0	Never Active - Disabled
1	Forward-Driving
2	Reverse-Driving
3	Driving
4	Forward-Standing
5	Forward
6	Forward-Standing, Reverse-Driving
7	Forward, Reverse-Driving
8	Reverse-Standing
9	Reverse-Standing, Forward-Driving
10	Reverse
11	Reverse, Forward-Driving
12	Standing
13	Standing, Forward-Driving
14	Standing, Reverse-Driving
15	Continuously Active

Mapping Effects to the Emergency Stop Button

Any effect can be mapped to the emergency stop button with CVs 1.385-1.512. Follow the steps below to map an effect to the emergency stop button:

1. Ensure CV 31 is set to a value of 16.
2. Enter a value of 1 into CV 32.
3. Enter a value of 16 into CVs 385-512 to map the corresponding effect to the emergency stop button.

Note: *Mapping a function to the E-Stop button will not change the emergency stop functionality of the throttle or command station. It will still stop the motor regardless of the effect that has been mapped to it.*

Refer to Table P and Q on the next page for a list of CVs 1.385-1.512 and corresponding effects and any default values.

Advanced Programming

Table P. CVs 1.385-1.512
Effect Auxiliary Map Registers
CV 1.385: Headlight
CV 1.386: Backup Light
CV 1.387: FX3 Effect
CV 1.388: FX4 Effect
CV 1.389: FX5 Effect
CV 1.390: FX6 Effect
CV 1.391: FX7 Effect
CV 1.392: FX8 Effect
CVs 1.393-1.400: Reserved
CV 1.401: Dimmer
CV 1.402: Mute
CV 1.403: Independent/Train Brake
CV 1.404: Half-Speed
CV 1.405: Momentum Override
CV 1.406: Grade-Crossing Signal
CV 1.407: Forward Whistle Signal
CV 1.408: Reverse Whistle Signal
CV 1.409: Stop Whistle Signal
CV 1.410: Reserved
CV 1.411: Brake Select/Trainline Charge
CV 1.412: Alternate Mixer
CV 1.413: Cutoff+
CV 1.414: Cutoff-
CV 1.415: Wheel Slip
CVs 1.416-1.424: Reserved
CV 1.425: Whistle
CV 1.426: Bell
CV 1.427: Dynamo
CV 1.428: Short Whistle
CV 1.429: Cylinder Cocks
CV 1.430: Water Stop
CV 1.431: Reserved
CV 1.432: Cab Chatter
CV 1.433: Couple
CV 1.434: Uncouple
CV 1.435: Reserved
CV 1.436: Wheel Chains
CV 1.437: Sander Valve
CV 1.438: Reserved
CV 1.439: All Aboard/Coach Doors
CV 1.440: Blowdown
CV 1.441: Fuel Loading
CV 1.442: Ash Dump
CV 1.443: Injector
CVs 1.444-1.447: Reserved
CV 1.448: Johnson Bar/Power Reverser
CV 1.449: E-Brake App.
CVs 1.450-1.512: Reserved

Table Q. CVs 1.385-1.512 Defaults	
CV	**Value**
CV 1.448: Johnson Bar/Power Reverser	5
CV 1.449: E-Brake App.	16

Flex-Map Function Mapping Examples

The following examples detail using CVs 1.257-1.512 for function mapping, enabling automatic effects, and mapping an effect to the emergency stop button. Before accessing CVs 257-512, ensure CV 31 is set to a value of 16, and enter a value of 1 into CV 32.

Example: Mapping Steam Functions

Adjusting CVs 1.257-1.384 (Effect Map Registers) to customize function assignments for steam locomotives is simple. Refer to Table L if needed. In this example, we will configure the grade-crossing signal and the cylinder cock functions with only two CVs:

1. We want to map the grade-crossing signal to function key F4. Set CV 1.278 to a value of 4 to map the grade-crossing signal to function key F4 (4 = F4). Now you can activate the whistle with F2, the short whistle with F3, and the grade-crossing signal with F4.
2. Now we need to re-map the cylinder cocks (F4 by default) effect next to the blowdown function (F10 by default). Program CV 1.301 to a value of 9 to map the cylinder cocks effect to function key F9 (9 = F9). This will allow you to clear the cylinders of condensed water with F9 and blow down the boiler with F10.

Example: Setting Up Automatic Signals

You may want to use CVs 1.384-1.512 to enable automatic forward, reverse, and stop whistle signals. The following example details setting CV 1.407 (Forward Whistle Signal Auxiliary Map Register), CV 1.408 (Reverse Whistle Signal Auxiliary Map Register), and CV 1.409 (Stop Whistle Signal Auxiliary Map Register) to enable automatic whistle signals:

1. Enter a value of 1 into CV 1.407 to enable automatic forward signals when the locomotive is forward-driving.
2. Enter a value of 2 into CV 1.408 to enable automatic reverse signals when the locomotive is reverse-driving.
3. Enter a value of 12 into CV 1.409 to enable automatic stop signals when the locomotive is standing (regardless of direction).

Example: Mapping the Emergency Gyralite to the Emergency Stop Button

You may want to map the emergency Gyralite to add a lighting effect to the emergency brake application effect. The following example details setting the emergency Gyralite to the FX3 lighting output, and mapping the FX3 effect to the emergency stop button:

1. Enter a value of 21 into CV 51 (FX3 Configuration) to set the emergency Gyralite to the FX3 lighting output. Refer to “Configuring Lighting Outputs” for more information.
2. Enter a value of 255 into CV 1.259 (FX3 Effect Map Register) to disable function control for the FX3 lighting output.
3. To map the emergency Gyralite to the emergency stop button, enter a value of 16 into CV 1.387 (FX3 Effect Auxiliary Map Register).

NMRA Legacy Function Mapping

CVs 33-46 (Function Status CVs) are function mapping CVs stated in the NMRA Standards for DCC Configuration Variables (S-9.2.2). CVs 35-46 are used to assign effects to function keys F1-F12, and CVs 33 and 34 are used to assign effects to the F0 function key. If the same effect is selected for both reverse and forward F0 functions, that effect will turn on when the F0 function key is turned on regardless of locomotive direction.

Note: *CVs 33-46 are set to values of 0 by default, are a secondary method of function mapping, and are not used to determine Blunami's default function assignments.*

CVs 1.257-1.512 (Extended Function Mapping CVs) provide default function assignments for 28 function keys and offer comprehensive function mapping support for all of Blunami's effects in an uncomplicated and versatile format. However, mapping an effect to a function key (F0(f), F0(r), or F1-F12) using CVs 33-46 will override the corresponding function assignment mapped within CVs 1.257-1.384. As a result, the use of Legacy Function Mapping and Flex-Map Function Mapping together may produce undesirable results and is not recommended.

Table R. Function Output Map

Function Key	CV	HL Output	BL Output	Whistle	Bell	FX3 Output	FX4 Output	Dynamo	Short Whistle	Cylinder Cocks	Water Stop	Dimmer	Mute	Reserved	Ind./Train Brake	Coupler
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

Configuring Hyperdrive2

Advanced Motor Control CVs
CV 10: EMF Feedback Cutout
CV 119: Max Engine Recovery Speed
CV 209: PID Kp Parameter
CV 210: PID Ki Parameter
CV 211: Low-Speed Compensation
CV 212: BEMF Feedback Intensity
CV 215: BEMF Reference Voltage
CV 216: Motor Speed-Step Deadband
CV 217: Motor Control Register
CV 220: Constant Brake Distance

Blunami features Hyperdrive2 advanced motor control, providing high-frequency and high resolution pulse-width modulation (PWM) for silent motor control and a back-electromotive force (back-EMF) sensor to improve low-speed operation and maintain constant speeds. Load compensation and a proportional-integral (PI) control loop allows Blunami to regulate motor speed in response to back-EMF measurements.

Setting Engine Recovery Speed

Use CV 119 (Max Engine Recovery Speed) to designate the speed the motor will resume after momentary power losses. The recovery speed can be determined as a fixed speed step (absolute limiting) or a fraction of the throttle setting (proportional limiting).

The locomotive speed will start at speed-step 0 after power losses when CV 119 is set to a value of 0 or 128. CV 119 is set to a value of 204 by default. Entering a value from 1 to 127 will designate the recovery speed as a fixed speed step from 1 to 127 (absolute limiting). If the recovery speed step in CV 119 is greater than the last speed step before power loss, the decoder will resume the throttle setting being received from the command station.

CV 119: Max Engine Recovery Speed
0 = Disabled
1 = Speed-step 1
↓
127 = Speed-step 127 (absolute limiting)
128 = Disabled
129 = 1% of throttle setting (proportional limiting)
↓
255 = 100% of throttle setting (proportional limiting)

Entering a value from 129 to 255 will designate the recovery speed as a fraction of the current throttle setting (proportional limiting). Higher values indicate higher speed settings. The decoder calculates the recovery speed after power losses as:

Recovery Speed = (CV 119 × Speed Step) ÷ 127

Adjusting Low-Speed Operation

CV 211 (Low-Speed Compensation) is used to compensate for irregularities (if any) that occur during low-speed operation. You may enter values from 0 to 255 into CV 211 to specify the “gain value” that will be applied to the PID motor equation at low speeds.

Increasing the gain value will allow the motor to operate smoother at lower speeds. When CV 211 is set to a value of 255, the effect is applied across the first nine speed steps; the gain value has a decreasing effect upon the motor as speed steps increase. This helps compensate for motors that are more difficult to start.

In the event that you have an efficient motor that already spins at minimal voltages, it is possible that setting the gain value too high could elevate the locomotive’s minimum speed, and/or cause a stutter at low speeds while the control loop attempts to slow the motor. If you notice this, reduce the value of CV 211. We suggest setting CV 211 to the lowest value that will still improve low-speed operation.

Advanced Programming

Control Loop Coefficients

Blunami compensates for load changes in response to back-EMF voltage readings that compare motor load to locomotive speed. When a variation between them occurs, a proportional-integral (PI) control loop adjusts the motor voltage to compensate for the difference so that the locomotive's speed remains consistent. Adjust the PI control loop with CV 209 (PID Kp Parameter) and CV 210 (PID Ki Parameter).

Kp Coefficient

CV 209 is used for adjusting the proportional gain of the control loop, and compensates for dynamic changes in the motor load based on the contrast between the throttle setting and motor speed. CV 209 may be programmed with a value from 0 to 255. Higher values indicate higher levels of compensation. However, values that are too high may lead to inconsistencies in motor control.

Ki Coefficient

CV 210 is used for adjusting the integral gain of the control loop, and compensates for static changes in motor load by applying a correction based on the integral difference between the throttle setting and the current motor speed. CV 210 may be set to a value from 0 to 255. Higher values indicate higher levels of compensation and a more sensitive control loop. We suggest setting CV 210 to the lowest value that still provides optimal performance; setting CV 210 to values that are too high may lead to oscillations in locomotive speed.

Note: *Setting CVs 209 and 210 to values of 0 will disable the control loop and is not recommended.*

Strategy for Optimizing Hyperdrive2

Finding the right combination of CV settings requires some experimenting and patience. Be aware that these settings will inherently vary between locomotives. If you happen to make an adjustment to an advanced motor control CV that compromises operation in some way, you can reset CV settings back to their default values with CV 8 (Manufacturer ID). Refer to "Introduction to Programming" for more information.

Use your CV settings as starting points when configuring other locomotives. Adjusting a particular setting can actually degrade performance, and therefore changes should be made in small increments until you find your preferred result. And remember, the decoder's default settings should provide satisfactory performance for most situations.

Example: Adjusting the Control Loop

We suggest the following procedure to help fine-tune the CV settings:

1. Make sure all the Hyperdrive2 CVs are set to default values.
2. Set CV 2 (Vstart), CV 5 (Vhigh), and CV 6 (Vmid) to 0.
3. With the locomotive on level track, set the throttle to speed-step 20 (while operating in 128 speed step mode).
4. Increase the value of CV 209 until the locomotive's speed becomes varied and choppy.
5. Reduce the value of CV 209 until speed is consistent, smooth, and without variance.
6. Increase the value of CV 210 until you notice the locomotive's speed begin to oscillate.
7. Reduce the value of CV 210 until the oscillation stops.

Advanced Programming

Setting the Load Compensation Curve

CV 10 (EMF Feedback Cutout) and CV 212 (Back-EMF Feedback Intensity) are used to control the amount of load compensation applied to the motor across the throttle range. CV 212 can be set to a value from 0 to 255 to determine the amount of load compensation that is initially applied to the motor. A value of 0 disables load compensation altogether, while a value of 255 corresponds to 100% compensation. CV 10 determines the degree that the load compensation is reduced as the throttle speed is increased.

When CV 10 is set to 0, the amount of load compensation is constant over the entire speed range, according to the value of CV 212. Setting CV 10 between 1 and 126 will determine the speed step at which the load compensation is reduced to 0. Setting CV 10 between 128 and 255 will select a partial load compensation reduction at full speed. The minimum load compensation level at speed-step 128 is calculated and illustrated as follows:

BEMF Intensity = CV 212 x (1 – (speed step ÷ CV 10)) ÷ 255

In general, you will want to have full load compensation at low speeds that will gradually reduce to 0 at top speed. Set CV 10 to 126 to achieve this. When operating in a consist, you may need to reduce the value in CV 212 to reduce the low speed load compensation, and therefore avoid pitting the locomotives against each other.

BEMF Reference Voltage

CV 215 (BEMF Reference Voltage) allows you to change the reference voltage for the back-EMF to match the voltage on your track. By matching the back-EMF reference voltage of the decoder with your track voltage, your locomotive will run smoother and more consistently. CV 215 may be programmed with any value from 60 to 255 to set the back-EMF reference Voltage from 6 to 25.5 volts.

If you are planning to consist the model with other models equipped with SoundTraxx decoders (such as Tsunami or MC1 and MC2 DCC Mobile Decoders), make sure that the value entered in CV 215 is equal to the observed voltage of the track output from your command station, so that the reference voltage is identical to your other decoders. To set this CV, simply take the observed voltage on your track and multiply it by 10 to calculate the programming value. For example, 12.5 Volts would be represented as a CV value of 125.

Setting the Motor Speed-Step Deadband

CV 216 (Motor Speed-Step Deadband) determines the speed step at which voltage is first applied to the motor to set the locomotive in motion. Entering values from 1 to 126 into CV 216 will set the motor speed-step deadband from speed-step 1 to speed-step 126. Setting CV 216 to higher values will allow the locomotive to remain stationary as the throttle is increased from zero.

Example: Motor Speed Step Deadband and Automatic Whistle Signals

Refer to the following example to configure automatic forward-driving and reverse-driving whistle signals using CV 216:

1. To enable automatic forward-driving whistle signals, set CV 1.407 (Forward Whistle Signal Auxiliary Map Register) to a value of 1.
2. To enable automatic reverse-driving whistle signals, set CV 1.408 (Reverse Whistle Signal Auxiliary Map Register) to a value of 2.
3. To allow forward-driving and reverse-driving whistle signals to be issued after the throttle is increased from zero and before the locomotive begins to move, set CV 216 to a value of 2. The locomotive will begin to move at speed-step 2.

Enabling Back-EMF and Auto-Stop

CV 217 (Motor Control Register) is used to enable back-EMF for smooth Hyperdrive2 motor control and the auto-stop features. Back EMF is enabled by default to better regulate the operation of the motor. Disabling back-EMF control will deactivate all back-EMF regulated automatic features including Dynamic Digital Exhaust and constant brake distance.

The auto-stop feature is also enabled by default to provide smoother operation during sudden changes in direction of travel. Auto-stop will bring the locomotive to a stop for 500ms before changing direction. Disabling this feature will cause the model to change directions instantly when the direction button is pressed on your throttle.

Constant Brake Distance

CV 220 determines the fixed distance over which the locomotive will decelerate to a stop after setting the throttle to zero. Constant Brake Distance enables the train to be stopped in a set fixed distance regardless of speed.

Entering a value from 1 to 255 into CV 220 will adjust the constant brake distance from minimum to maximum. Entering a value of 0 into CV 220 will disable the constant brake distance feature, as will disabling Back-EMF in CV 217.

The Constant Brake Distance feature is only activated when the throttle is set to speed step 0. The value entered in CV 220 is a portion of available stopping distance and not a unit of time or distance. Each model may require different values in CV220 to obtain the same stopping distance due to difference in gear ratios, motor RPMs and driveline disparities.

The feature works best when CV 3 Baseline Acceleration Rate and CV 4 Baseline Deceleration Rate are set to values greater than 0. This added momentum allows the throttle to be quickly reduced to speed step 0, enabling the Constant Brake Distance feature, while the locomotive continues to travel at speed.

When activated, the feature will override all braking rates set in CV 116, CV117 and CV 118 along with the Baseline Deceleration Rate in CV 4. Any throttle increase in from speed step 0 will turn off the feature and the locomotive will accelerate back to the desired speed step set by the throttle.

Configuring Advanced Consist Operation

A consist is made up of several units that are coupled together to operate as a complete train. In model railroading, “Advanced Consisting” means that the decoder is used to configure the consist, instead of the command station. Consists allow an easy way for a single operator to run a steam locomotive double header, for example. You can use advanced consist CVs to determine the decoder’s consist address, set consist acceleration and deceleration rates, enable function keys F0-F28, and configure automatic effects.

Advanced Consist CVs
CV 19: Consist Address
CV 21: Consist Function Enable 1
CV 22: Consist Function Enable 2
CV 23: Consist Acceleration Rate
CV 24: Consist Deceleration Rate
CV 245: Consist Function Enable 3
CV 246: Consist Function Enable 4
CV 247: Consist Function Enable 5

Setting the Consist Address

Entering a value from 1 to 127 into CV 19 (Consist Address) will set the consist address from 1 to 127 for all units in the forward direction. Entering values from 129 to 255 into CV 19 will set the consist address from 1 to 127 for all units in the reverse direction (more common in diesel operations). Because the consist address is specific to direction, ensure all units are correctly oriented. Entering a value of 0 or 128 into CV 19 will disable the consist address.

After setting the consist address, the decoder will still respond to the active primary or extended address for all commands except speed and direction data. The decoder will not recognize programing commands sent to the consist address in Operations Mode, and will only respond to programing commands sent to the decoder’s primary or extended address.

Enabling Consist Functions

CV 21 (Consist Function Enable 1), CV 22 (Consist Function Enable 2), CV 245 (Consist Function Enable 3), and CV 246 (Consist Function Enable 4) allow you to enable functions for advanced consist operation when a valid consist address is active in CV 19.

Note: *You can enable the effects mapped to function keys in CVs 1.257-1.384 (Effect Map Registers) for advanced consist operation with CVs 21, 22, 245, and 246. Refer to “Using Blunami” to default function assignments for F0-F28, and refer to “Configuring Function Mapping” to customize Flex-Map function mapping CVs.*

Follow the steps on the next page to enable functions for advanced consist operation.

Advanced Programming

Consist Function Enable 1-4

The following procedure details enabling effects mapped to F0(f), F0(r), and F1-F28 for advanced consist operation:

1. Circle the CV values associated with your preferred F0-F28 function keys.
2. For each CV, add the values together and record the sum in the space provided. You should have four total CV values for enabling your preferred function keys when finished.
3. Enter each value into CVs 21, 22, 245, and 246 to enable your preferred functions for advanced consist operation.

CV 21: Consist Function Enable 1

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	F8	F7	F6	F5	F4	F3	F2	F1
CV Value	128	64	32	16	8	4	2	1

CV 21 Value = _____

CV 22: Consist Function Enable 2

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	0	0	F12	F11	F10	F9	F0(r)	F0(f)
CV Value	0	0	32	16	8	4	2	1

CV 22 Value = _____

CV 245: Consist Function Enable 3

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	F20	F19	F18	F17	F16	F15	F14	F13
CV Value	128	64	32	16	8	4	2	1

CV 245 Value = _____

CV 246: Consist Function Enable 4

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	F28	F27	F26	F25	F24	F23	F22	F21
CV Value	128	64	32	16	8	4	2	1

CV 246 Value = _____

Advanced Programming

Setting Consist Momentum Rates

CVs 23 (Consist Acceleration Rate) and 24 (Consist Deceleration Rate) are used to set the acceleration and deceleration rates for consists when a valid consist address is active. Like CVs 3 (Baseline Acceleration Rate) and 4 (Baseline Deceleration Rate), CVs 23 and 24 are used to determine the time it will take the consist to accelerate to full speed from a stop and come to a stop from full speed. Values from 0 to 255 may be programmed into each CV, though they are interpreted by the decoder as values from -127 to +127. Furthermore, values from 0 to 127 are interpreted as 0 to +127, whereas values from 128 to 255 are interpreted as 0 to -127.

Consist acceleration and deceleration values from -127 to +127 are then added to the baseline acceleration and deceleration rates. In other words, the value of CV 23 is added to the value of CV 3 to create the consist acceleration *offset*, and the values of CVs 24 and 4 are added to create the consist deceleration *offset*. For example, if the value of CV 3 is 100, programming CV 23 with a value of 200 would adjust, or *offset*, the consist acceleration rate by -73, making the combined value of CVs 3 and 23 equal to 27.

When the sum of CVs 23 and 3 equals 255, it will take approximately 3.8 minutes for the consist to accelerate to full speed from a complete stop. Likewise, when the sum of CVs 24 and 4 is 255, it will take 3.8 minutes to come to a complete stop from full speed. Programming values of 0 and 128 into CVs 23 and 24 will have no effect on acceleration or deceleration. Also, if the sums of CVs 23 and 3 and CVs 24 and 4 are each equal to 255, programming CVs 23 and 24 with positive values will not change the consist acceleration or deceleration rate because CV registers cannot contain values exceeding 255. Similarly, if CVs 3 and 4 are set to 0, programming CVs 23 and 24 with values from 128 to 255 (0 to -127) will have no effect because CV registers cannot contain negative values.

Enabling Consist Automatic Effects

To provide more versatility, CV 247 (Consist Function Enable 5) can be used in conjunction with Flex-Map function mapping CVs to allow automatic effect configuration for advanced consist operation. Automatic effects will respond to direction and movement when enabled. Table S shows the CV values for configuring effects to respond according to the following circumstances:

Forward-Driving: Effect is turned on when the consist is moving in the forward direction.

Reverse-Driving: Effect is turned on when the consist is moving in the reverse direction.

Forward-Standing: Effect is turned on when the consist is stopped in the forward direction.

Reverse-Standing: Effect is turned on when the consist is stopped in the reverse direction.

Emergency Stop: Effect is turned on when the consist receives an Emergency Stop command.

Note: *CV 247 can be set to allow any combination of auto-effect enable. For instance, a value of 10 will allow the effect to turn on in the reverse direction regardless of movement, and a value of 3 will allow the effect to turn on when the consist is in motion regardless of direction.*

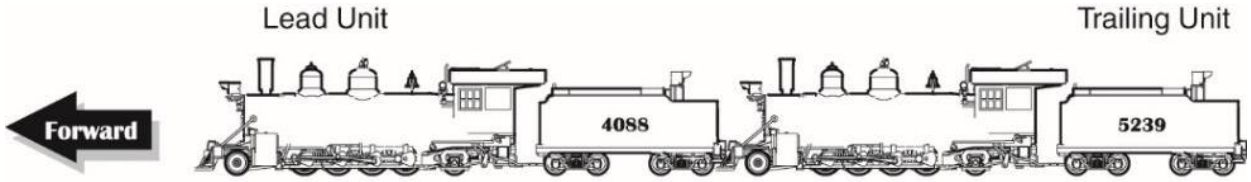
Table S. CV 247 Auto-Effect Enable

CV Value	Active When
0	Never Active - Disabled
1	Forward-Driving
2	Reverse-Driving
3	Driving
4	Forward-Standing
5	Forward
6	Forward-Standing, Reverse-Driving
7	Forward, Reverse-Driving
8	Reverse-Standing
9	Reverse-Standing, Forward-Driving
10	Reverse
11	Reverse, Forward-Driving
12	Standing
13	Standing, Forward-Driving
14	Standing, Reverse-Driving
15	Continuously Active
16	Emergency Stop Button pressed

Advanced Programming

Consist Example

Let's say you have a double-header consisting of two engines, shown as Nos. 4088 and 5239 below. Suppose you want to operate them as a single unit with consist address 40, meaning both engines will be consisted in the forward direction.



You will probably want to enable F8 and F11 for both units so you can mute sound effects and apply the brakes. However, you probably only want to enable the headlight, whistle, short whistle, and bell for the lead engine and enable the backup light for the trailing engine. In summary, this means enabling functions F0(f), F1, F2, F3, F8, and F11 for engine No. 4088, and enabling F0(r), F8 and F11 for engine No. 5239.

Table T. Consist Example

No. 4088 Direction: Normal		**No. 5239** Direction: Normal	
CV 19 Value	40	CV 19 Value	40
CV 21 Value	135	CV 21 Value	128
CV 22 Value	17	CV 22 Value	18

Lead Engine No. 4088:

1. Program CV 19 with a value of 40 to set the consist address.
2. Determine the CV values for CVs 21 and 22. Remember, you want to enable the bell, whistle, short whistle, and mute function using CV 21 and the headlight and F11 brake function using CV 22.
3. To enable F1, F2, F3, and F8, add the corresponding CV 21 bit values together: 1 + 2 + 4 + 128 = 135.
4. Program CV 21 with a value of 135 to enable the bell, whistle, short whistle, and mute function.
5. Do the same to enable F0(f) and F11 using CV 22: 1 + 16 = 17.
6. Program CV 22 with a value of 17 to enable the headlight and the F11 brake function.

Trailing Engine No. 5239:

1. Program CV 19 with a value of 40 to set the consist address.
2. For the trailing unit, enable the mute function using CV 21 and the backup light and brake function using CV 22.
3. To enable F8, program CV 21 with a value of 128 (total value of bit 7).
4. To enable F0(r) and F11, add the corresponding CV 22 bit values together: 2 + 16 = 18.
5. Program CV 22 with a value of 18 to enable the backup light and F11 brake function.

Miscellaneous Features

Configuring Analog Mode Operation

Although Blunami is designed to be operated with a DCC system, you can still use it with a conventional powerpack on a DC layout. The decoder operates entirely in response to track voltage when analog mode is enabled. Keep this in mind when configuring analog mode operation to take full advantage of the features offered by Blunami.

Note: *Analog mode is disabled by default.*

Analog Mode CVs
CV 12: Alternate Power Source
CV 13: Analog Mode Function Enable 1
CV 14: Analog Mode Function Enable 2
CV 29: Configuration Data 1
CV 218: Analog Mode Motor Start Voltage
CV 219: Analog Mode Engine Start Voltage
CV 241: Analog Mode Function Enable 3
CV 242: Analog Mode Function Enable 4
CV 243: Analog Mode Function Enable 5

Enabling Analog Mode

To enable analog mode, first enter a value of 1 into CV 12 (Alternate Power Source), then set bit 2 (APS) of CV 29 (Configuration Data 1) to 1. This will allow the decoder to receive an analog power source when a DCC signal is not available. For more information about adjusting the settings of CV 29, refer to “Configuring the Decoder.”

Operating in Analog Mode

When analog mode is enabled, the decoder will be inoperative until track voltage is received from the powerpack. Increasing the throttle setting to roughly 6 Volts will deliver enough voltage to power the decoder’s internal circuitry and activate automatic sound effects while the locomotive is stopped. Increasing the throttle setting to roughly 8 Volts will set the locomotion in motion. You may use the throttle to control locomotive speed from this point. Keep in mind that you can only change direction when the locomotive is stopped. To improve low-voltage operation, the decoder automatically adjusts motor processes and sound effect volume in response to back-EMF voltage measurements to compensate for changes in motor load. Refer to “Configuring Hyperdrive2” for more information about motor control.

Note: *Do not exceed the input voltage rating of the decoder as stated on the product packaging. This will permanently damage the decoder! Decrease the throttle setting to zero immediately if this occurs. Refer to “Troubleshooting” to view each error code.*

Enabling Analog Mode Functions

When operating in analog mode, the effects mapped to function keys F0-F28 will turn on automatically when track voltage is received, and will stay on until track voltage is removed. CV 13 (Analog Mode Function Enable 1), CV 14 (Analog Mode Function Enable 2), CV 241 (Analog Mode Function Enable 3), and CV 242 (Analog Mode Function Enable 4) allow you to enable functions in analog mode. The decoder will automatically turn on all functions enabled for analog mode when track voltage is received.

Note: *You can enable the effects mapped to function keys in CVs 1.257-1.384 (Effect Map Registers) for analog mode operation with CVs 13, 14, 241, and 242. Refer to “Using Blunami” to default function assignments for F0-F28, and refer to “Configuring Function Mapping” to customize Flex-Map function mapping CVs.*

Follow the steps on the next page to enable functions for analog mode operation.

Miscellaneous Features

Analog Mode Function Enable 1-4

The following procedure details enabling effects mapped to F0(f), F0(r), and F1-F28 for analog mode operation:

1. Circle the CV values associated with your preferred effects mapped to function keys F0-F28.
2. For each CV, add the values together and record the sum in the space provided. You should have four total CV values for enabling your preferred function keys when finished.
3. Enter each value into CVs 13, 14, 241, and 242 to enable your preferred functions for analog mode operation.

CV 13: Analog Mode Function Enable 1

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	F8	F7	F6	F5	F4	F3	F2	F1
CV Value	128	64	32	16	8	4	2	1

CV 13 Value = _____

CV 14: Analog Mode Function Enable 2

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	0	0	F12	F11	F10	F9	F0(r)	F0(f)
CV Value	0	0	32	16	8	4	2	1

CV 14 Value = _____

CV 241: Analog Mode Function Enable 3

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	F20	F19	F18	F17	F16	F15	F14	F13
CV Value	128	64	32	16	8	4	2	1

CV 241 Value = _____

CV 242: Analog Mode Function Enable 4

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function	F28	F27	F26	F25	F24	F23	F22	F21
CV Value	128	64	32	16	8	4	2	1

CV 242 Value = _____

Miscellaneous Features

Enabling Analog Mode Automatic Effects

To provide more versatility, CV 243 (Analog Mode Function Enable 5) can be used in conjunction with Flex-Map function mapping CVs to allow automatic effect configuration for analog mode operation. Automatic effects will respond to direction and movement when enabled. Table U shows the CV values for configuring effects to respond according to the following circumstances:

Forward-Driving: Effect is turned on when the locomotive is moving in the forward direction.

Reverse-Driving: Effect is turned on when the locomotive is moving in the reverse direction.

Forward-Standing: Effect is turned on when the locomotive is stopped in the forward direction.

Reverse-Standing: Effect is turned on when the locomotive is stopped in the reverse direction.

Note: *CV 243 can be set to allow any combination of auto-effect enable. For instance, a value of 10 will allow the effect to turn on in the reverse direction regardless of movement, and a value of 3 will allow the effect to turn on when the locomotive is in motion regardless of direction.*

Table U. CV 243 Auto-Effect Enable

CV Value	Active When
0	Never Active - Disabled
1	Forward-Driving
2	Reverse-Driving
3	Driving
4	Forward-Standing
5	Forward
6	Forward-Standing, Reverse-Driving
7	Forward, Reverse-Driving
8	Reverse-Standing
9	Reverse-Standing, Forward-Driving
10	Reverse
11	Reverse, Forward-Driving
12	Standing
13	Standing, Forward-Driving
14	Standing, Reverse-Driving
15	Continuously Active

Set the Analog Mode Start Voltage

CV 218 (Analog Mode Motor Start Voltage) can be used to set the track voltage level at which power is applied to the motor to avoid the “motor-boating” effects that sometimes occur when using marginal powerpacks.

Entering a value of 0 into CV 218 will set the starting voltage to 6V. Entering a value of 255 into CV 218 will set the starting voltage to the maximum setting. Set CV 218 to the lowest value that still achieves desired results. The motor will not start when the voltage level in CV 218 is set to an excessively high value.

Note: *Starting the motor at too low a voltage can cause the voltage from the powerpack to sag, resulting in a condition where the decoder loses power when attempting to power the motor.*

Starting Voltage = (CV 218 ÷ 10) + 6V

Set the Analog Mode Engine Start Voltage

CV 219 is used to adjust the voltage level applied to activate exhaust chuff sound effects in analog mode. The engine exhaust start voltage is calculated as a fraction of the minimum voltage required to power the decoder (6V). Starting voltage is calculated as:

Starting Voltage = (CV 219 ÷ 10) + 6V

Entering a value of 0 into CV 219 will set the engine start voltage level to 6V. Entering a value of 255 into CV 219 will set the engine start voltage level to the maximum setting.

Miscellaneous Features

CV 218 (Analog Mode Motor Start Voltage) determines the voltage level applied to start the motor in analog mode. Set CV 218 to a value greater than the value of CV 219 to ensure exhaust chuff sound effects are activated prior to motor start. If the engine start voltage level in CV 219 is greater than the motor start voltage level in CV 218, exhaust chuff sound effects will be activated when the motor start voltage is reached.

Note: *Blunami preforms better in analog mode when a higher quality, electronically regulated powerpack is used to supply filtered DC power. Using older rheostat-style or pulse powerpacks will make operation erratic and should not be used to power Blunami-equipped installations in analog mode. If your powerpack has a pulse power switch, make sure that it is turned off.*

Operating With a CurrentKeeper™

Your Blunami has been designed to operate far more efficiently than previous generations of SoundTraxx DSDs giving you more reliable operations over dirty track, isolated frogs or other electrical imperfections than ever before. If your model has limited electrical pick-up or you desire to add more energy storage to the installation, a SoundTraxx CurrentKeeper can be used with any Blunami decoder to provide added reliability. Refer to the *Blunami Installation Guide* for more information about how to connect a CurrentKeeper to the various styles of decoders.

The CurrentKeeper is designed to work with most decoder installations without the need to adjust any CVs. Occasionally, there are a few features and operating scenarios that warrant a minimal amount of programming for optimal operation. For more information including how to optimize the decoder for use with a CurrentKeeper in analog (DC) mode and how to limit the duration of operation of the model when it's being powered by the CurrentKeeper, please refer to the *"CurrentKeeper Reference"* found on our website.

Troubleshooting

Sorting Out Decoder Difficulties

If you have any difficulties operating your Blunami Digital Sound Decoder, refer to this section first before doing anything else. We find that most problems are caused by errant CV values and can be easily corrected. We suggest you perform your diagnostics with the decoder on the programming track. If you are unable to locate the CV that is causing the problem, try resetting the CV values back to their defaults. Refer to “Resetting CVs and Starting Over” in the “Introduction to Programming” section for more information.

The locomotive was running, but isn’t anymore

- The decoder’s address has been accidentally changed.
- CV 19 (Consist Address) has been inadvertently set.
- CV 29 (Configuration Data 1) has been programmed to select other address.
- CV 3 (Baseline Acceleration Rate) and/or CV 4 (Baseline Deceleration Rate) have been set to values that are too high.
- Broken motor wire or track pickup wire.

Tip: *Check the decoder’s pilot light to confirm that track power is present.*

The locomotive isn’t running, and never has

- Refer to the information above.
- The decoder has been wired incorrectly.

The locomotive is running, but isn’t producing sound

- The mute function (F8 by default) is turned on.
- Another function has been remapped to the mute function.
- Volume control CVs (CVs 128-160) have been set to zero.
- The speaker wire is broken.
- The speaker needs to be replaced.

The locomotive is running in a consist, but without sound and lighting

- The consist functions are disabled. Refer to “Consist Function Enable” under the section “Configuring for Advanced Consist Operation” to set functions for consist operation.

The lights are alternating on and off as speed steps are changed

- The decoder is set to 14 speed-step mode, while the command station is set to 28 or 128 speed-step mode.

The lights aren’t working

- Refer to default function assignments to ensure that the correct button on your throttle is being pressed to activate the effect output.
- The function mapping CVs have been improperly configured.
- CV 64 (Master Brightness) has been set to a value of 0.
- Lightbulbs or LEDs are burned-out.
- If using 1.5 volt micro-bulbs, the resistor value is too large.
- The lamp wires are broken.

Troubleshooting

The locomotive is sitting and both headlights are flashing

- Refer to the following section, “Error Codes.”

Sound works for a while, and then stops working

- The amplifier is overheating. Lower the volume and verify that properly rated speakers are installed.
- The decoder is overheating. Check for short circuit conditions in the track pick-up wires.
- The speaker is damaged. Replace speaker.

A “crackly” sound is coming from the speaker

- The volume has been set too high for the speaker to successfully reproduce the audio signal.
- The speaker is not baffled properly.
- The speaker wire is loose.
- The speaker is damaged. Replace speaker.

The decoder cannot be programmed

- The incorrect address is selected or the address is unknown while programming on the main in Operations Mode. Move the model to a dedicated programming track and use Service Mode programming to read and write CVs.
- A PowerPax™ programing track booster is being used in-line with your command station’s programming track output. Remove this non-compliant device from the programming track output to allow for reading and writing of all CVs.
- All CVs are locked. Refer to “Locking and Unlocking CVs” in the “Introduction to Programming” section for more information regarding unlocking CVs.

Troubleshooting Tip: *If the above trouble shooting steps have proven to be unsuccessful in resolving your issue, we recommend that you remove the decoder from the model and test its functionality with a decoder tester or separate motor/speaker/lights. This will help to isolate which component (locomotive, speaker, lights, motor, decoder, etc.) could be causing the issue.*

Diagnostic Lamps

There is one blue and one red LED mounted on the circuit board that act as diagnostic indicators and that may help you identify and resolve problems.

Pilot Light

The blue pilot light indicates that the decoder is receiving power. If this light is not illuminated, it may indicate an improperly wired decoder. It could also indicate a loose wire, poor track pickups, no output from the command station, or another wiring problem on your layout.

Fault Light

When the decoder encounters a fault, the red fault light and all installed lighting will flash an allotted number of times to report an error code. The number of times the light flashes corresponds to a specific error.

Note: *The fault light is connected in series with the decoder’s FX6 output (F27 by default) and will illuminate in a steady “on” state when that function is on. This is not an error code but can be used to check for proper operation of the fault light on a decoder.*

Troubleshooting

Error Codes

Error codes indicate problems that are easily solved. The decoder's error codes are shown below for reference.

Error 10: Over-Voltage Fault
Voltage is monitored during normal operation to automatically deactivate sound and motor processes when voltage exceeds the decoder's voltage limit. Settings resume when the voltage is reduced to within limits and will vary between decoder models.

Note: *The decoder's absolute maximum voltage input varies with decoder model, generally between 22 and 27 volts! Refer to the decoder's packaging for actual voltage limits as exceeding these limits may cause permanent damage to the decoder.*

Error 12: Motor Overload Fault
The motor current is monitored during normal operation to automatically deactivate motor processes when the current exceeds the decoder's rating. Power is returned to the motor after 100ms. The motor remains inactive if current-overload persists.

Error 16: CV Reset
This code indicates that a CV reset has occurred and all settings have been reset to default.

Additional Error Codes
Although rare, the decoder may also report the following error codes, which cannot be remedied by the user and require factory repair:

Error 5: EEROM Checksum Failure
Error 6: EEROM Data Integrity Failure

If you're still having difficulties, please contact our Customer Support Department:

SoundTraxx Customer Support Department
141 Burnett Drive
Durango, CO 81301, USA
Phone: (970) 259-0690
Email: support@soundtraxx.com
Monday-Friday, from 9am to 5:30pm (Mountain Time).

Appendix A: Decimal-Hex-Binary Conversions

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: Blunami Steam CV Reference

Primary CVs
CV 1: Primary Address
CV 2: Vstart
CV 3: Baseline Acceleration Rate
CV 4: Baseline Deceleration Rate
CV 5: Vhigh
CV 6: Vmid
CV 7: Manufacturer Version (Read-Only)
CV 8: Manufacturer ID
CV 10: EMF Feedback Cutout
CV 11: Packet Time-Out Value
CV 12: Alternate Power Source
CV 13: Analog Mode Function Enable 1
CV 14: Analog Mode Function Enable 2
CV 15: CV Unlock Code
CV 16: CV Lock ID
CVs 17-18: Extended Address
CV 19: Consist Address
CV 21: Consist Function Enable 1
CV 22: Consist Function Enable 2
CV 23: Consist Acceleration Rate
CV 24: Consist Deceleration Rate
CV 25: Speed Table Enable
CV 29: Configuration Data 1
CV 30: Error Information
CV 31: CV Index 1 (Read-Only)
CV 32: CV Index 2
CV 33: F0(f) Output Location
CV 34: F0(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
Lighting Effect CVs
CV 49: Headlight Effect Select
CV 50: Backup Light Effect Select
CVs 51-56: FX3-FX8 Effect Select
CV 57: Forward Direction Enable
CV 58: Reverse Direction Enable
CV 59: Hyperlight Flash Rate
CV 60: Grade-Crossing Hold Time
CV 61: Brightness Register 1
CV 62: Brightness Register 2
CV 63: Dimmer Level
CV 64: Master Brightness
Speed Table CVs
CV 66: Forward Motor Trim
CVs 67-94: Custom Speed Table
CV 95: Reverse Motor Trim
User Information CVs
CV 105: User Identifier 1
CV 106: User Identifier 2
Sound Control CVs
CV 112: Sound Configuration 1
CV 113: Quiet Mode Time-Out Period
CV 114: Engine Exhaust Control

Sound Control CVs (Continued)
CV 117: Independent Brake Rate
CV 118: Train Brake Rate
CV 119: Max Engine Recovery Speed
CV 120: Whistle Select
CV 121: Alternate Whistle Select
CV 122: Bell Select
CV 123: Exhaust Select
CV 124: Airpump Select
CV 125: Dynamo Select
CV 126: Coupler Select
CV 128: Master Volume
CVs 129-160: Primary Mixer Volume Levels
CVs 161-192: Reverb Mixer
CV 193: Auto-Bell On Set Point
CV 194: Auto-Bell On Time
CV 195: Coach Door Count
CV 196: Brake Squeal Sensitivity
CV 197: Analog Mode Auto-Sound Enable
CV 198: DCC Mode Auto-Sound Enable
CV 199: Cylinder Cocks On Time
Advanced Motor Control CVs
CV 209: PID Kp Parameter
CV 210: PID Ki Parameter
CV 211: Low-Speed Compensation
CV 212: BEMF Feedback Intensity
CV 213: BEMF Sample Period
CV 214: BEMF Sample Aperture Time
CV 215: BEMF Reference Voltage
CV 216: Motor Speed Step Deadband
CV 217: Motor Control Register
CV 218: Analog Mode Motor Start Voltage
CV 219: Analog Mode Engine Start Voltage
CV 220: Constant Brake Distance
Audio Control CVs
CV 224: High-Pass Filter Cutoff Frequency
CVs 225-232: Equalizer Control CVs
CVs 233-236: Reverb Control CVs
Analog Function Enable CVs
CV 241: Analog Mode Function Enable 3
CV 242: Analog Mode Function Enable 4
CV 243: Analog Mode Function Enable 5
Consist Function Enable CVs
CV 245: Consist Function Enable 3
CV 246: Consist Function Enable 4
CV 247: Consist Function Enable 5
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CVs 1.257-1.384: Effect Map Registers
CVs 1.385-1.512: Effect Auxiliary Map Registers
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CVs 2.289-2.320: Alternate Mixer Volume Levels
CV 2.503: DDE Load Offset
CV 2.504: DDE Load Slope
CV 2.505: DDE Side Rod Clank Low Volume Limit
CV 2.506: DDE Side Rod Clank High Volume Limit
CV 2.507: DDE Exhaust Low Volume Limit
CV 2.508: DDE Exhaust High Volume Limit
CV 2.509: DDE Attack Time Constant
CV 2.510: DDE Release Time Constant
CV 2.511: DDE Throttle Sensitivity
CV 2.512: DDE Load Sensitivity
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CVs 3.257-3.258 Clickety-Clack Effect

Appendix C: License Agreement

Please read this license agreement carefully before opening your Blunami Digital Sound Decoder packaging. Breaking the seal on the packaging indicates you have accepted the license terms detailed herein. If you received the Blunami Digital Sound Decoder pre-installed from your dealer, using the product indicates your acceptance of the license terms detailed herein. If you do not agree with the terms, return the unopened package to the dealer within thirty (30) days to receive a refund of purchase.

SoundTraxx Software License Agreement

SoundTraxx provides the computer software/firmware embedded within the Blunami Digital Sound Decoder and any modifications, updates, revisions or enhancements received by you from SoundTraxx or its dealers and licenses its use within the terms set below:

A. You are granted a nonexclusive, nontransferable license to use the software/firmware included with your Blunami sound system only with the Blunami sound system hardware that you purchased.

B. Title and ownership of the software/firmware, sound recordings, documentation and accompanying materials, if any, and all associated intellectual property rights remain with SoundTraxx.

C. The structure, organization, and code of the software/firmware are the valuable properties of SoundTraxx. You may not make copies of the hardware, software/firmware, code, or any portions thereof. You are not to modify, adapt, translate, reverse engineer, de-compile, disassemble or create derivative works based on the hardware or software/firmware.

D. Unauthorized copying of the software/firmware or documentation, or failure to comply with the above restrictions, will result in automatic termination of this Agreement. This Agreement does not grant you any intellectual property rights.

Appendix D: Service and Warranty Policy

90-Day Safety-Net Service Warranty

All SoundTraxx Digital Sound Decoders are tested thoroughly during production and are warranted to be operational and free of manufacturing defects before shipment. However, in the event an error occurs during installation, SoundTraxx will cover the repair under the conditions of our Safety-Net Service Warranty. If you damage the Digital Sound Decoder or it fails to operate within the first ninety (90) days, SoundTraxx will repair or replace the product free-of-charge under the following conditions:

A. The original sales receipt confirming purchase from an authorized SoundTraxx dealer must accompany the product. The date-of-purchase shown on the receipt must be within the last 90 days. SoundTraxx will return the original receipt with your repaired unit.

B. The product must show no signs of damage of which resulted from unauthorized repairs or modifications. This includes, but is not limited to:

- Removal of the shrink tubing from the decoder
- Drilled or enlarged circuit board holes
- A cut or trimmed circuit board

C. The Digital Sound Decoder must be returned properly packaged and insured, with postage paid; SoundTraxx is not responsible for products lost or damaged in transit.

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 SOUNDTRAXX BE LIABLE FOR SPECIAL OR CONSEQUENTIAL DAMAGES OR FOR THE REPRESENTATIONS OF RETAIL SELLERS.

Visit www.soundtraxx.com/support to view complete warranty information.

Contacting Support

Our service department is available Monday-Friday, from 9am to 5:30pm (Mountain Time).

SoundTraxx Customer Support Department
141 Burnett Drive
Durango, CO 81301, USA
Phone: (970) 259-0690
Email: support@soundtraxx.com

Appendix E: Declaration of Conformity

Declaration of Conformity

We, Throttle Up! Corp., dba SoundTraxx, 141 Burnett Drive, Durango, Colorado USA, declare in sole responsibility that the following products:

Product Description
Blunami Digital Sound Decoder

Model Numbers
BLU-1100, BLU-2200, BLU-21PNEM8, BLU-PNP8, BLU-4408

Part Numbers
884606, 884607, 884608, 884609

comply with all relevant regulations of the following directive:

2014/30/EU Electromagnetic Compatibility (EMC Directive)

and that the following harmonized standards have been applied:

EN 55014-1:2006 + A1: 2009 Part 1: Emissions
EN 55014-2:1997 + A2: 2008 Part 2: Immunity