Tsunami2™ Digital Sound Decoder

Diesel Technical Reference

Software Release 1.0

Rev. A 5/25/16

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Contents

Primary CVs

CV 1: Primary Address

Description

CV 1 is used to set the decoder's primary address from 1 to 127.

Bit 7							Bit 0
0	**A6**	**A5**	**A4**	**A3**	**A2**	**A1**	**A0**

A0-A6: Primary Address

0: Reserved

Additional Information

Entering values from 1 to 127 into CV 1 will set the primary address while in Service Mode. The decoder will ignore commands that attempt to program this CV with values outside the range of 1 to 127.

The decoder will process all valid instruction packets addressed with the value contained in CV 1 when bit 5 of CV 29 (Configuration Data 1) is set to 0.

Entering a new value into CV 1 will:

- Set the value of CV 19 (Consist Address) to 0.
- Clear the Extended Address Mode Enable bit in CV 29 (bit 5).

Bit 5 of CV 29 must be set to 1 in order for the value of CV 1 to be changed in Operations Mode. Setting bit 5 of CV 29 back to 0 will then allow the decoder to recognize the new primary address.

Default Value: 3
Related CVs: CV 17-18 (Extended Address)
CV 19 (Consist Address)
CV 29 (Configuration Data 1)

Primary CVs

CV 2: Vstart

Description

CV 2 is used to set the voltage level applied to the motor at speed-step 1.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Motor Start Voltage

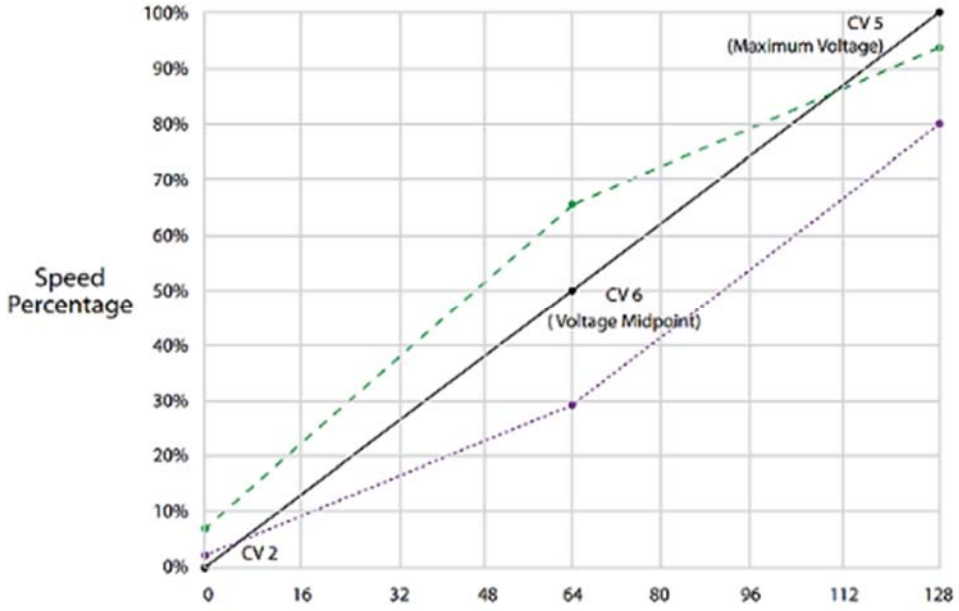
Additional Information

The motor start voltage is calculated as a fraction of the available supply voltage. Entering a value from 0 to 255 into CV 2 will adjust the starting voltage level.

Starting voltage is calculated as:

Starting Voltage = Supply Voltage × CV 2 ÷ 255

When CV 2 is set to a non-zero value, the decoder will offset all points of the speed table as speed increases. CV 2 is used in conjunction with CV 5 (Vhigh) and CV 6 (Vmid) to configure the 3-point speed table. The 3-point speed table is active when bit 4 (STE) of CV 29 is set to 0 and CVs 2, 5, and 6 are set to non-zero values.



Default Value: 0
Related CVs: CV 5 (Vhigh)
CV 6 (Vmid)
CV 29 (Configuration Data 1)

CV 3: Baseline Acceleration Rate

Description

CV 3 is used to set the decoder's acceleration rate.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Acceleration Rate

Additional Information

Entering a value from 0 to 255 into CV 3 will adjust the acceleration rate.

Acceleration is calculated as:

Seconds/Speed Step = CV 3 × 0.896 ÷ Number of Speed Steps

When the value of CV 3 is 0, acceleration will respond instantly to increases in the throttle setting. When the value of CV 3 is 255, the decoder will accelerate from a stop to full speed in approximately 3.8 minutes.

Setting CV 3 to a non-zero value in 14 or 28 speed-step mode will create a smoother acceleration response; the decoder is designed to interpolate between speed steps during acceleration when CV 3 is set to a non-zero value to eliminate erratic transitions.

Default Value: 0
Related CVs: CV 4 (Baseline Deceleration Rate)
CV 23 (Consist Acceleration Rate)
CV 24 (Consist Deceleration Rate)

CV 4: Baseline Deceleration Rate

Description

CV 4 is used to set the decoder's deceleration rate.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Deceleration Rate

Additional Information

Entering a value from 0 to 255 into CV 4 will adjust the deceleration rate.

Deceleration is calculated as:

Seconds/Speed Step = CV 4 × 0.896 ÷ Number of Speed Steps

When the value of CV 4 is 0, deceleration will respond instantly to decreases in the throttle setting. When the value of CV 4 is 255, the decoder will decelerate from full speed to a stop in approximately 3.8 minutes.

Setting CV 4 to a non-zero value in 14 or 28 speed-step mode will create a smoother deceleration response; the decoder is designed to interpolate between speed steps during deceleration when CV 4 is set to a non-zero value to eliminate erratic transitions.

Default Value: 0
Related CVs: CV 3 (Baseline Acceleration Rate)
CV 23 (Consist Acceleration Rate)
CV 24 (Consist Deceleration Rate)
CV 117 (Independent Brake Rate)

CV 5: Vhigh

Description

CV 5 is used to set the voltage level applied to the motor at maximum speed and is active when the 3-point speed table is enabled.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Maximum Voltage Value

Additional Information

Maximum voltage is calculated as a fraction of the available supply voltage. Entering a value from 0 to 255 into CV 5 will adjust the maximum speed voltage level.

Maximum voltage is calculated as:

Maximum Voltage = Supply Voltage × CV 5 ÷ 255

Values of 0 and 1 will disable the Vhigh speed table setting. A value of 255 will set the Vhigh speed table setting to the maximum available voltage (100%). CV 5 is used in conjunction with CV 2 (Vstart) and CV 6 (Vmid) to configure the 3-point speed table. The 3-point speed table is active when bit 4 (STE) of CV 29 is set to 0 and CVs 2, 5, and 6 are set to non-zero values.

Default Value: 0
Related CVs: CV 2 (Vstart)
CV 6 (Vmid)
CV 29 (Configuration Data 1)

CV 6: Vmid

Description

CV 6 is used to set the voltage level applied to the motor at the middle speed step and is active when the 3-point speed table is enabled.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Midpoint Voltage Value

Additional Information

Midpoint voltage is calculated as a fraction of the available supply voltage. Entering a value from 0 to 255 into CV 6 will adjust the mid-speed voltage level.

Midpoint voltage is calculated as:

Midpoint Voltage = Supply Voltage × CV 6 ÷ 255

Values of 0 and 1 will disable the Vmid speed table setting. A value of 255 will set the Vmid speed table setting to the maximum available voltage (100%). CV 6 is used in conjunction with CV 2 (Vstart) and CV 5 (Vhigh) to configure the 3-point speed table. The 3-point speed table is active when bit 4 (STE) of CV 29 is set to 0 and CVs 2, 5, and 6 are set to non-zero values.

Default Value: 0
Related CVs: CV 2 (Vstart)
CV 5 (Vhigh)
CV 29 (Configuration Data 1)

CV 7: Manufacturer Version (Read-Only)

Description

CV 7 contains the 8-bit software version identifier. CV 7 is read-only and cannot be modified.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Version Code
71 = Tsunami2 software version identifier

CV 8: Manufacturer ID

Description

CV 8 is used to reset CV settings to factory defaults and contains the NMRA-issued Manufacturer ID Code (141) assigned to SoundTraxx/Throttle Up! Entering a value from 8 to 13 into CV 8 will reset the CVs defined below.

Bit 7							Bit 0
1	0	0	0	1	1	0	1

Bits 0-7: CV Reset
- 8 = Full CV reset
- 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

Manufacturer ID Code: 141

CV 10: EMF Feedback Cutout

Description

CV 10 is used to gradually reduce back-EMF control as locomotive speed increases.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: EMF Feedback Cutout

Additional Information

The BEMF intensity is defined as the amount of the BEMF signal that is fed back to the motor controller to stabilize the speed of the motor. Reducing the intensity does not regulate the speed of the motor as effectively, but helps consisted locomotives from entering a 'push/pull' scenario where one locomotive is doing all the work.

Per the equation below, this CV sets the speed step at which the intensity reaches zero. When CV 10 is set to 0, only the value in CV 212 is used.

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

Default Value: 0
Related CVs: CV 212 (BEMF Feedback Intensity)
CV 213 (BEMF Sample Period)
CV 214 (BEMF Sample Aperture Time)
CV 215 (BEMF Reference Voltage)

CV 11: Packet Time-Out Value

Description

CV 11 is used to set duration in seconds that occurs from the time the decoder receives a valid packet to the time speed-related sound effects and motor processes are deactivated.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Packet Time-Out Value

Additional Information

Entering a value from 0 to 255 into CV 11 will set the packet time-out period. The time-out period is calculated in seconds as follows:

Time-Out Period = CV 11 × 0.25

A value of 0 disables the time-out period. A value of 255 sets the time-out period to approximately 1 minute. The decoder maintains an internal timer that resets each time the decoder receives a valid packet.

In the event no valid packets are received during the time-out period, the decoder will deactivate motor processes and the locomotive will decelerate according to the value of CV 4 (Baseline Deceleration Rate) or CV 24 (Consist Deceleration Rate).

Default Value: 0

CV 12: Alternate Power Source

Description

CV 12 is used to allow the decoder to operate using an analog power supply when a DCC signal is not available. Bit 3 (APS) of CV 29 (Configuration Data 1) must be set to 1 in order for an alternate power source to be used.

Bit 7							Bit 0
0	0	0	0	0	0	0	D0

D0: Alternate Power Source
0 = No alternate power source
1 = Analog power supply

0: Reserved

Default Value: 1
Related CVs: CV 29 (Configuration Data 1)

CV 13: Analog Mode Function Enable 1

Description

CV 13 is used to enable F1-F8 function assignments for analog mode operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for information regarding function mapping.

Bit 7							Bit 0
F8	F7	F6	F5	F4	F3	F2	F1

F1-F8: Analog Mode Function Enable
0 = Function disabled for analog operation
1 = Function enabled for analog operation

Additional Information
Setting bits 0-7 to 1 will enable the F1-F8 functions active in CVs 1.257-1.384 and/or CVs 33-46 for analog mode operation.

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).*

Default Value: 0
Related CVs: CV 14 (Analog Mode Function Enable 2)
CV 33-46 (Function Status CVs)
CV 241-243 (Analog Mode Function Enable 3-5)
CV 1.257-1.512 (Extended Function Mapping CVs)

CV 14: Analog Mode Function Enable 2

Description

CV 14 is used to enable F0(f), F0(r), and F9-F12 function assignments for analog mode operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for information regarding function mapping.

Bit 7							Bit 0
0	**0**	**F12**	**F11**	**F10**	**F9**	**F0(r)**	**F0(f)**

F0(f)-F0(r): Analog Mode F0 Enable
0 = Function disabled for analog operation
1 = Function enabled for analog operation

F9-F12: Analog Mode Function Enable
0 = Function disabled for analog operation
1 = Function enabled for analog operation

0: Reserved

Additional Information
Setting bits 0-7 to 1 will enable the F0(f), F0(r), F9-F12 functions active in CVs 1.257-1.384 and/or CVs 33-46 for analog mode operation.

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).*

Default Value: 3
Related CVs: CV 13 (Analog Mode Function Enable 1)
CV 33-46 (Function Status CVs)
CV 241-243 (Analog Mode Function Enable 3-5)
CV 1.257-1.512 (Extended Function Mapping CVs)

CV 15: CV Unlock Code

Description

CV 15 is used for unlocking access to the decoder's CVs.

Bit 7							Bit 0
0	0	0	0	0	D2	D1	D0

D0-D2: CV Unlock Code

0: Reserved

Additional Information

Entering a value from 0 to 7 into CV 15 determines the decoder's lock status. CV 15 can be accessed regardless of the decoder's lock status.

Locked State: If the value of CV 15 is not equal to the value of CV 16 (CV Lock ID), all CVs are locked. Read and write operations will be ignored.

Unlocked State: The decoder's CVs can be accessed only when the value of CV 15 is equal to the value of CV 16.

Note: *Bit 0 (CV Lock Enable) of CV 30 (Error Information) must be set to 1 in order for the lock feature in CVs 15 and 16 to be used.*

Default Value: 0
Related CVs: CV 16 (CV Lock ID)
CV 30 (Error Information)

CV 16: CV Lock ID

Description

CV 16 is used in conjunction with CV 15 (CV Unlock Code) to determine the decoder's lock status. CV 16 determines the lock code used to lock the decoder's CVs.

Bit 7							Bit 0
0	0	0	0	0	ID2	ID1	ID0

ID0-ID2: CV Lock Code

0: Reserved

Additional Information

Entering a value from 0 to 7 into CV 16 determines the decoder's lock status. CV 16 can be accessed regardless of the decoder's lock status.

Locked State: If the value of CV 16 is not equal to the value of CV 15 (CV Unlock Code), all CVs are locked and all read and write operations will be ignored.

Unlocked State: The decoder's CVs will only be accessible when the value of CV 15 is equal to the value of CV 16.

Note: *Bit 0 (CV Lock Enable) of CV 30 (Error Information) must be set to 1 in order for the lock feature in CVs 15 and 16 to be used.*

Default Value: 0
Related CVs: CV 15 (CV Unlock Code)
CV 30 (Error Information)

CVs 17-18: Extended Address

Description

CVs 17 and 18 contain the decoder's 14-bit extended address and are merged as a "paired" CV.

CV 17: Extended Address MSB

Bit 7							Bit 0
A15	**A14**	**A13**	**A12**	**A11**	**A10**	**A9**	**A8**

CV 18: Extended Address LSB

Bit 7							Bit 0
A7	**A6**	**A5**	**A4**	**A3**	**A2**	**A1**	**A0**

A0-A15: Extended Address Value

Additional Information

Most command stations recognize from addresses 0000-9999.

Bit 5 of CV 29 (Configuration Data 1) must be set to 1 for the decoder to recognize commands sent to the extended address.

The decoder will ignore commands sent to the primary address when bit 5 of CV 29 is set to 1. Setting bit 5 of CV 29 to 0 will enable the primary address.

CV 17 contains the most significant bits of the two-byte address and can be set to values from 192 to 231 (0xC0-0xE7).

CV 18 contains the least significant bits of the two-byte address and can be set to values from 0 to 255.

CV 17 must be set before CV 18. The decoder will ignore attempts to adjust the values of CVs 17 and 18 out-of-order.

CV 17 and CV 18 can be modified in Service Mode at any time, but cannot be modified in Operations Mode unless bit 5 of CV 29 is set to 0 (i.e., CV 1, Primary Address is enabled).

Default Value: CV 17 = 192
CV 18 = 3 (Address 0003)

Related CVs: CV 1 (Primary Address
CV 19 (Consist Address)
CV 29 (Configuration Data 1)

CV 19: Consist Address

Description

CV 19 is used to set the address and direction for advanced consist operation.

Bit 7							Bit 0
CDIR	**A6**	**A5**	**A4**	**A3**	**A2**	**A1**	**A0**

A0-A6: Consist Address Value

CDIR: Consist Direction
0 = Normal direction
1 = Inverted direction

Additional Information
Bits 0-6 (A0-A6) are used to assign the consist address from 1 to 127. Setting bit 7 (CDIR) to 1 will invert consist direction.

Entering a value from 1 to 127 will set the consist address from 1 to 127 for the normal direction. Entering a value from 129 to 255 will set the consist address from 1 to 127 for the inverted direction. Setting CV 19 to 0 or 128 will disable the consist address. When CV 19 is set to a non-zero value, the decoder will ignore throttle commands sent to the decoder's primary or extended address.

The decoder will process valid commands sent to the consist address with the following exceptions:

- Long-form CV access instructions will be ignored.
- The direction of a speed/direction command or an advanced operation command will be inverted when bit 7 (CDIR) is set to 1.

Default Value: 0
Related CVs: CV 1 (Primary Address)
CVs 17-18 (Extended Address)
CVs 21-22 (Consist Function Enable 1-2)
CV 23 (Consist Acceleration Rate)
CV 24 (Consist Deceleration Rate)
CVs 245-247 (Consist Function Enable 3-5)

CV 21: Consist Function Enable 1

Description

CV 21 is used to enable F1-F8 function assignments for advanced consist operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for more information regarding function mapping.

Bit 7							Bit 0
F8	**F7**	**F6**	**F5**	**F4**	**F3**	**F2**	**F1**

F1-F8: Consist Function Enable
0 = Function disabled for consist operation
1 = Function enabled for consist operation

Additional Information

CV 21 is commonly used to differentiate various engines and cars of the same consist. Setting bits 0-7 to 1 will enable the F1-F8 functions active in CVs 1.257-1.384 and/or CVs 33-46 for advanced consist operation.

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).*

Default Value: 0
Related CVs: CV 19 (Consist Function Enable 2)
CVs 33-46 (Function Status CVs)
CVs 245-247 (Consist Function Enable 3-5)
CVs 1.257-1.512 (Extended Function Mapping CVs)

CV 22: Consist Function Enable 2

Description

CV 22 is used to enable F0(f), F0(r), and F9-F12 function assignments for advanced consist operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for more information regarding function mapping.

Bit 7							Bit 0
0	**0**	**F12**	**F11**	**F10**	**F9**	**F0(r)**	**F0(f)**

F0(f)-F0(r): Consist F0 Enable
0 = Function disabled for consist operation
1 = Function enabled for consist operation

F9-F12: Consist Function Enable
0 = Function disabled for consist operation
1 = Function enabled for consist operation

0: Reserved

Additional information
CV 22 is commonly used to differentiate various engines and cars of the same consist. Setting bits 0-7 to 1 will enable the F0(f), F0(r), and F9-F12 functions active in CVs 1.257-1.384 and/or CVs 33-46 for advanced consist operation.

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).*

Default Value: 0
Related CVs: CV 19 (Consist Address)
CV 21 (Consist Function Enable 1)
CVs 33-46 (Function Status CVs)
CVs 245-247 (Consist Function Enable 3-5)
CVs 1.257-1.512 (Extended Function Mapping CVs)

CV 23: Consist Acceleration Rate

Description

CV 23 is used to set the consist acceleration rate. CV 19 must contain a valid consist address for the consist acceleration rate to be active.

Bit 7							Bit 0
SIGN	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Consist Acceleration Offset

SIGN: Sign
0 = Positive value
1 = Negative value

Additional Information

The value of CV 23 determines the consist acceleration rate in relation to CV 3 (Baseline Acceleration Rate). When the consist address is active, the consist acceleration rate is added to or subtracted from the decoder's baseline acceleration rate depending on the sign bit.

Entering a value from 1 to 127 into CV 23 will increase the consist acceleration rate from the baseline acceleration rate in CV 3. Entering values from 129 to 255 into CV 23 will decrease the consist acceleration rate from the baseline acceleration rate in CV 3.

Values of 0 and 128 will disable the consist acceleration rate and the decoder will use the value in CV 3.

When bit 7 (SIGN) of CV 23 is set to 0, the value added to CV 3 will be positive, where if bit 7 is set to 1, the value added to CV 3 will be negative:

0-127	128-255
0 = 0	128 = 0
1 = 1	129 = -1
.	.
.	.
.	.
127 = 127	255 = -127

Acceleration is calculated as:

Seconds/Speed Step = (CV 3 + CV 23) × 0.896 ÷ Number of Speed Steps

Default Value: 0
Related CVs: CV 3 (Baseline Acceleration Rate)
CV 4 (Baseline Deceleration Rate)
CV 19 (Consist Address)
CV 24 (Consist Deceleration Rate)

CV 24: Consist Deceleration Rate

Description

CV 24 is used to set the consist deceleration rate. CV 19 must contain a valid consist address for the consist deceleration rate to be active.

Bit 7							Bit 0
SIGN	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Consist Deceleration Offset

SIGN: Sign
0 = Positive value
1 = Negative value

Additional Information

The value of CV 24 determines the consist deceleration rate in relation to CV 4 (Baseline Deceleration Rate). When the consist address is active, the consist deceleration rate is added to or subtracted from the decoder's baseline deceleration rate depending on the sign bit.

Entering a value from 1 to 127 into CV 24 will increase the consist deceleration rate from the baseline deceleration rate in CV 4. Entering values from 129 to 255 into CV 24 will decrease the consist deceleration rate from the baseline deceleration rate in CV 4.

Values of 0 and 128 will disable the consist deceleration rate and the decoder will use the value in CV 3.

When bit 7 (SIGN) of CV 24 is set to 0, the value added to CV 4 will be positive, where if bit 7 is set to 1, the value added to CV 4 will be negative:

0-127	128-255
0 = 0	128 = 0
1 = 1	129 = -1
.	.
.	.
.	.
127 = 127	255 = -127

Deceleration is calculated as:

Seconds/Speed Step = (CV 4 + CV 24) × 0.896 ÷ Number of Speed Steps

Default Value: 0
Related CVs: CV 3 (Baseline Acceleration Rate)
CV 4 (Baseline Deceleration Rate)
CV 19 (Consist Address)
CV 23 (Consist Acceleration Rate)

CV 25: Speed Table Enable

Description

CV 25 is used in conjunction with CV 29 (Configuration Data 1) to enable the linear or 28-point speed table.

Bit 7							Bit 0
MIDSPD	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Table Identifier

MIDSPD: Reserved

Additional Information

Speed tables are disabled by default and voltage is directly proportional to the speed step.

0	=	Disabled, Speed Curves not used
1	=	Disabled, Speed Curves not used
2	=	Linear Speed Curve
3	=	Reserved
4	=	Reserved
5	=	Reserved
6	=	Reserved
7	=	Reserved
8	=	Reserved
9	=	Reserved
10	=	Reserved
11	=	Reserved
12	=	Reserved
13	=	Reserved
14	=	Reserved
15	=	Reserved
16	=	User Defined Speed Table defined by CVs 67-94

Default Value: 0
Related CVs: CV 2 (Vmid)
CV 5 (Vhigh)
CV 6 (Vmid)
CV 29 (Configuration Data 1)
CVs 67-94 (Custom Speed Table)

CV 29: Configuration Data 1

Description

CV 29 contains miscellaneous configuration bits.

Bit 7							Bit 0
0	0	EAM	STE	0	APS	F0	DIR

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)

0: Reserved

Note: *Command stations that do not support the extended address can interfere with normal operation if bit 5 of CV 29 is programmed inadvertently. In this situation, connect the decoder to a programming track and set bit 5 of CV 29 to 0.*

Default Value: 2
Related CVs: CV 1 (Primary Address)
CV 2 (Vstart)
CV 5 (Vhigh)
CV 6 (Vmid)
CV 12 (Alternate Power Source)
CVs 17-18 (Extended Address)
CV 25 (Speed Table Enable)
CVs 67-94 (Custom Speed Table)

CV 30: Error Information

Description

CV 30 is used to allow the decoder's CVs to be locked and unlocked with CV 15 (CV Unlock Code) and CV 16 (CV Lock ID).

Bit 7							Bit 0
0	0	0	0	0	0	0	LCK

LCK: CV Lock/Unlock Enable
0 = CV lock/unlock feature disabled
1 = CV lock/unlock feature enabled (CVs 15-16)

0: Reserved

Default Value: 0
Related CVs: CV 15 (CV Unlock Code)
CV 16 (CV Lock ID)

CV 31: CV Index 1

Description

CV 31 and CV 32 (CV Index 2) contain the indexed address used for accessing CVs exceeding CV 256. CV 31 contains the most significant bits of the two-byte address and enables indexed CV operation, as determined by CV 32.

Note: *Modifying the default value of CV 31 will disable indexed CV operation; CV 31 should never be programmed from its default value.*

Bit 7							Bit 0
D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D7: CV Index MSB
16 = Indexed address

Default Value: 16
Related CVs: CV 32 (CV Index 2)

Primary CVs

CV 32: CV Index 2

Description

CV 32 provides access to CVs exceeding CV 256 and is used to select the active indexed CV page. Tsunami2 supports three indexed CV pages:

1. CVs 1.257-1.512: Indexed CV Page 1
2. CVs 2.257-2.512: Indexed CV Page 2
3. CVs 3.257-3.512: Indexed CV Page 3

The value of CV 32 indicates the active indexed CV page. CVs 257-512 allow access to indexed CVs when an indexed CV page is selected in CV 32.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: CV Index LSB
1 = Indexed CV Page 1
2 = Indexed CV Page 2
3 = Indexed CV Page 3

Additional Information

Entering a value of 1 into CV 32 will select Indexed CV Page 1 as the active indexed CV page. Indexed CV Page 1 contains Flex-Map function mapping CVs:

- CVs 1.257-1.384: Effect Map Registers
- CVs 1.385-1.512: Effect Auxiliary Map Registers

Entering a value of 2 into CV 32 will select Indexed CV Page 2 as the active indexed CV page. Indexed CV Page 2 contains alternate mixer channel volume control CVs and Dynamic Digital Exhaust control CVs:

- CVs 2.289-2.320: Alternate Mixer Volume Levels
- CVs 2.503-2.512: DDE Control CVs

Entering a value of 3 into CV 32 will select Indexed CV Page 3 as the active indexed CV page. Indexed CV Page 3 contains clickety-clack CVs:

- CV 3.257: Clickety-Clack Rate
- CV 3.258: Clickety-Clack Sound Scalar

Entering a value of 0 or values from 4 to 255 into CV 32 will disable access to CVs exceeding CV 256. If your system does not allow access to CVs exceeding CV 256, contact the manufacturer for more information.

Default Value: 1
Related CVs: CV 31 (CV Index 1)
CVs 1.257-1.512 (Extended Function Mapping CVs)
CVs 2.289-2.320 (Alternate Mixer Volume Levels)
CVs 2.503-2.512 (DDE Control CVs)
CV 3.257 (Clickety-Clack Rate)
CV 3.258 (Clickety-Clack Sound Scalar)

CVs 33-46: Function Status CVs

Function Status CVs 33-46 can be used to map a limited range of effects to functions F0-F12 and are included to remain consistent with NMRA Standards for DCC Configuration Variables (S-9.2.2, p.7).

Note: *CVs 33-46 are set to values of 0 by default, are a secondary method of function mapping for those wishing to use the Legacy Function Mapping associated with the prior generation of Tsunami products, and are not used to determine Tsunami2's default function assignments.*

CVs 1.257-1.512 (Flex-Map Function Mapping CVs) provide function assignments for 28 function keys and offer comprehensive function mapping support for all of Tsunami2'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.

Note: *The use of Legacy Function Mapping and Flex-Map Function Mapping together may produce undesirable results and is not recommended.*

Effects mapped to CV 33 (F0(f) Output Location) can be activated in the forward direction only and effects mapped to CV 34 (F0(r) Output Location) can be activated in the reverse direction only. This output is bidirectional only when same effect has been mapped to both CVs. The function mapping table provided below indicates the values used for mapping functions to effects. All provided effects cannot be mapped to all F0-F12 functions keys.

Legacy Function Output Map

Function Key	CV	HL Output	BL Output	Airhorn	Bell	FX3 Output	FX4 Output	Dynamic Brake	Short Airhorn	Straight-to-8	General Service	Dimmer	Mute	HEP Mode	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

CV 33: F0(f) Output Location

Description

CV 33 is used to map a given effect to the F0(f) function key. The enabled effect will be activated when the F0(f) function is turned on. Disabled effects will have no relation to the F0(f) function key.

Bit 7							Bit 0
SAH	**DYN**	**FX4**	**FX3**	**BEL**	**AH**	**BL**	**HL**

HL: Headlight Output
0 = Headlight disabled
1 = Headlight enabled

BL: Backup Light Output
0 = Backup light disabled
1 = Backup light enabled

AH: Airhorn
0 = Airhorn disabled
1 = Airhorn enabled

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

Default Value: 0

CV 34: F0(r) Output Location

Description

CV 34 is used to map a given effect to the F0(r) function key. The enabled effect will be activated when the F0(r) function is turned on. Disabled effects will have no relation to the F0(r) function key.

Bit 7							Bit 0
SAH	**DYN**	**FX4**	**FX3**	**BEL**	**AH**	**BL**	**HL**

HL: Headlight Output
0 = Headlight disabled
1 = Headlight enabled

BL: Backup Light Output
0 = Backup light disabled
1 = Backup light enabled

AH: Airhorn
0 = Airhorn disabled
1 = Airhorn enabled

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

Default Value: 0

CV 35: F1 Output Location

Description

CV 35 is used to map a given effect to the F1 function key. The enabled effect will be activated when the F1 function is turned on. Disabled effects will have no relation to the F1 function key.

Bit 7							Bit 0
SAH	**DYN**	**FX4**	**FX3**	**BEL**	**AH**	**BL**	**HL**

HL: Headlight Output
0 = Headlight disabled
1 = Headlight enabled

BL: Backup Light Output
0 = Backup light disabled
1 = Backup light enabled

AH: Airhorn
0 = Airhorn disabled
1 = Airhorn enabled

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

Default Value: 0

CV 36: F2 Output Location

Description

CV 36 is used to map a given effect to the F2 function key. The enabled effect will be activated when the F2 function is turned on. Disabled effects will have no relation to the F2 function key.

Bit 7							Bit 0
SAH	**DYN**	**FX4**	**FX3**	**BEL**	**AH**	**BL**	**HL**

HL: Headlight Output
0 = Headlight disabled
1 = Headlight enabled

BL: Backup Light Output
0 = Backup light disabled
1 = Backup light enabled

AH: Airhorn
0 = Airhorn disabled
1 = Airhorn enabled

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

Default Value: 0

CV 37: F3 Output Location

Description

CV 37 is used to map a given effect to the F3 function key. The enabled effect will be activated when the F3 function is turned on. Disabled effects will have no relation to the F3 function key.

Bit 7							Bit 0
DIM	**GS**	**ST8**	**SAH**	**DYN**	**FX4**	**FX3**	**BEL**

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

0: Reserved

Default Value: 0

CV 38: F4 Output Location

Description

CV 38 is used to map a given effect to the F4 function key. The enabled effect will be activated when the F4 function is turned on. Disabled effects will have no relation to the F4 function key.

Bit 7							Bit 0
DIM	**GS**	**ST8**	**SAH**	**DYN**	**FX4**	**FX3**	**BEL**

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

0: Reserved

Default Value: 0

CV 39: F5 Output Location

Description

CV 39 is used to map a given effect to the F5 function key. The enabled effect will be activated when the F5 function is turned on. Disabled effects will have no relation to the F5 function key.

Bit 7							Bit 0
DIM	**GS**	**ST8**	**SAH**	**DYN**	**FX4**	**FX3**	**BEL**

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

0: Reserved

Default Value: 0

CV 40: F6 Output Location

Description

CV 40 is used to map a given effect to the F6 function key. The enabled effect will be activated when the F6 function is turned on. Disabled effects will have no relation to the F6 function key.

Bit 7							Bit 0
DIM	**GS**	**ST8**	**SAH**	**DYN**	**FX4**	**FX3**	**BEL**

BEL: Bell
0 = Bell disabled
1 = Bell enabled

FX3: FX3 Output
0 = FX3 disabled
1 = FX3 enabled

FX4: FX4 Output
0 = FX4 disabled
1 = FX4 enabled

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

0: Reserved

Default Value: 0

CV 41: F7 Output Location

Description

CV 41 is used to map a given effect to the F7 function key. The enabled effect will be activated when the F7 function is turned on. Disabled effects will have no relation to the F7 function key.

Bit 7							Bit 0
BRK	**HEP**	**MUT**	**DIM**	**GS**	**ST8**	**SAH**	**DYN**

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

HEP: HEP Mode (Head-end Power)
0 = HEP Mode disabled
1 = HEP Mode enabled

BRK: Independent/Train Brake
Default Value: 0
0 = Independent/train brake disabled
1 = Independent/train brake enabled

0: Reserved

CV 42: F8 Output Location

Description

CV 42 is used to map a given effect to the F8 function key. The enabled effect will be activated when the F8 function is turned on. Disabled effects will have no relation to the F8 function key.

Bit 7							Bit 0
BRK	HEP	MUT	DIM	GS	ST8	SAH	DYN

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

HEP: HEP Mode (Head-end Power)
0 = HEP Mode disabled
1 = HEP Mode enabled

BRK: Independent/Train Brake
0 = Independent/train brake disabled
1 = Independent/train brake enabled

0: Reserved

Default Value: 0

CV 43: F9 Output Location

Description

CV 43 is used to map a given effect to the F9 function key. The enabled effect will be activated when the F9 function is turned on. Disabled effects will have no relation to the F9 function key.

Bit 7							Bit 0
BRK	**HEP**	**MUT**	**DIM**	**GS**	**ST8**	**SAH**	**DYN**

DYN: Dynamic Brake
0 = Dynamic brake disabled
1 = Dynamic brake enabled

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

HEP: HEP Mode (Head-end Power)
0 = HEP Mode disabled
1 = HEP Mode enabled

BRK: Independent/Train Brake
0 = Independent/train brake disabled
1 = Independent/train brake enabled

0: Reserved

Default Value: 0

CV 44: F10 Output Location

Description

CV 44 is used to map a given effect to the F10 function key. The enabled effect will be activated when the F10 function is turned on. Disabled effects will have no relation to the F10 function key.

Bit 7							Bit 0
CPL	**BRK**	**HEP**	**MUT**	**DIM**	**GS**	**ST8**	**SAH**

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

HEP: HEP Mode (Head-end Power)
0 = HEP Mode disabled
1 = HEP Mode enabled

BRK: Independent/Train Brake
0 = Independent/train brake disabled
1 = Independent/train brake enabled

CPL: Coupler
0 = Coupler disabled
1 = Coupler enabled

0: Reserved

Default Value: 0

CV 45: F11 Output Location

Description

CV 45 is used to map a given effect to the F11 function key. The enabled effect will be activated when the F11 function is turned on. Disabled effects will have no relation to the F11 function key.

Bit 7							Bit 0
CPL	**BRK**	**HEP**	**MUT**	**DIM**	**GS**	**ST8**	**SAH**

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

HEP: HEP Mode (Head-end Power)
0 = HEP Mode disabled
1 = HEP Mode enabled

BRK: Independent/Train Brake
0 = Independent/train brake disabled
1 = Independent/train brake enabled

CPL: Coupler
0 = Coupler disabled
1 = Coupler enabled

0: Reserved

Default Value: 0

CV 46: F12 Output Location

Description

CV 46 is used to map a given effect to the F12 function key. The enabled effect will be activated when the F12 function is turned on. Disabled effects will have no relation to the F12 function key.

Bit 7							Bit 0
CPL	**BRK**	**HEP**	**MUT**	**DIM**	**GS**	**ST8**	**SAH**

SAH: Short Airhorn
0 = Short airhorn disabled
1 = Short airhorn enabled

ST8: Straight-to-8
0 = Straight-to-8 disabled
1 = Straight-to-8 enabled

GS: General Service
0 = General Service disabled
1 = General Service enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

HEP: HEP Mode (Head-end Power)
0 = HEP Mode disabled
1 = HEP Mode enabled

BRK: Independent/Train Brake
0 = Independent/train brake disabled
1 = Independent/train brake enabled

CPL: Coupler
0 = Coupler disabled
1 = Coupler enabled

0: Reserved

Default Value: 0

Lighting Effect CVs

CVs 49-54: Hyperlight Effect Select

Description

CVs 49-54 are used to configure up to six lighting outputs with Hyperlight lighting effects and other lighting features. Bit definitions for CVs 49-54 are identical.

CV 49: Headlight Configuration (F0(f) by default)
CV 50: Backup Light Configuration (F0(r) by default)
CV 51: FX3 Configuration (F24 by default)
CV 52: FX4 Configuration (F25 by default)
CV 53: FX5 Configuration (F26 by default) **
CV 54: FX6 Configuration (F27 by default) **

** Available on select formats

Bit 7							Bit 0
LED	**XING**	**PHSE**	**EF4**	**EF3**	**EF2**	**EF1**	**EF0**

EF0-EF4: Hyperlight Effect Select

0 = On/off output
1 = Dimmable 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 = Type I ditch light
10 = Type II ditch light
11 = Flashing rear-end device (FRED)
12 = Engine exhaust flicker
13 = Firebox flicker (steam)
14 = Smart firebox flicker (steam)
15 = Dyno-light
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 = Electrical arcing (electric)
23 = Ash pan flicker (steam)
24 = Reserved
25 = Single-flash strobe 2

Lighting Effect CVs

PHSE: Phase Select
0 = Phase A
1 = Phase B

XING: Grade-Crossing Logic Enable
0 = Grade-Crossing Logic disabled
1 = Grade-Crossing Logic enabled

LED: LED Compensation Mode Enable
0 = Incandescent-compatible outputs enabled
1 = LED-compatible outputs enabled

Additional Information

On/Off Output
The on/off lighting effect provides on/off control for the corresponding function.

Dimmable On/Off Headlight
This reduces the brightness of the dimmable headlight to the level set in CV 63.

Mars Light
This effect replicates the famous figure-eight sweep pattern of the Mars Light warning beacon.

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 at a slightly different rate.

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.

Lighting Effect CVs

Ditch Lights I and II
Ditch lights 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.

Exhaust Flicker
The exhaust flicker effect simulates a light flickering inside the cab. The flicker becomes more rapid and brighter as the locomotive emits higher volumes of exhaust to produce more power. The brightness of the flicker ranges from 0% to 100% in proportion to locomotive speed.

Firebox Flicker
The firebox flicker effect flickers at random to simulate the fire burning fuel in the firebox.

Dyno-Light
This effect for diesel locomotives softly fades the lamp brightness on and off to simulate the heating and cooling of the bulb filament.

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

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
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 sweep pattern as the Gyralite, and will automatically disable all active lighting effects.

Electrical Arcing (Electric)
The electrical arcing effect flickers on and off to simulate the varying connection between the pantograph and overhead wire.

Lighting Effect CVs

Ash Pan Flicker (Steam)
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
Add a value of 64 to enable Grade-Crossing Logic. Turing on the long airhorn 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. Flashing Hyperlight effects will return to an on or off state after the countdown ends. 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).

Flashing Effect On/Off State	
Hyperlight Effect	**On/Off State**
Mars Light	On
Gyralite	On
Oscillating Headlight	On
Single-Flash Strobe 1	Off
Single-Flash Strobe 2	Off
Double-Flash Strobe	Off
D312 Rotary Beacon	Off
Prime Stratolite	Off
Ditch Light I	On
Ditch Light II	Off
FRED	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.*

Default Value: CVs 49-54 = 15

CV 57: Forward Direction Enable

Description

CV 57 (Forward Direction Enable) and CV 58 (Reverse Direction Enable) are used to determine the directionality of the FX lighting outputs. Use CV 57 to enable a lighting output for the forward direction.

Bit 7							Bit 0
0	0	FX6	FX5	FX4	FX3	BL	HL

HL: Headlight Forward Enable
0 = Headlight output disabled in forward direction
1 = Headlight output enabled in forward direction

BL: Backup Light Forward Enable
0 = Backup light output disabled in forward direction
1 = Backup light output enabled in forward direction

FX3-FX6: FX3-FX6 Forward Enable
0 = FX output disabled in forward direction
1 = FX output enabled in forward direction

0: Reserved

Additional Information

Setting bits 0-5 to 1 will enable the corresponding lighting output for the forward direction. A given lighting output can be made bidirectional by setting corresponding bits of CVs 57 and 58. Refer to indexed CVs 1.257-1.512 (Extended Function Mapping CVs) for information regarding mapping functions to lighting outputs.

Default Value: 253
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 58 (Reverse Direction Enable)
CVs 1.257-1.512 (Extended Function Mapping CVs)
Default Value: CV 49 = 1
CV 50 = 1
CVs 51-54 = 0
Related CVs: CVs 57-64 (Lighting Effect CVs)

CV 58: Reverse Direction Enable

Description

CV 58 (Reverse Direction Enable) and CV 57 (Forward Direction Enable) are used to determine the directionality of the FX outputs. Use CV 58 to enable a lighting output for the reverse direction.

Bit 7							Bit 0
0	0	FX6	FX5	FX4	FX3	BL	HL

HL: Headlight Reverse Enable
0 = Headlight output disabled in reverse direction
1 = Headlight output enabled in reverse direction

BL: Backup Light Reverse Enable
0 = Backup light output disabled in reverse direction
1 = Backup light output enabled in reverse direction

FX3-FX6: FX3-FX6 Reverse Enable
0 = FX output disabled in reverse direction
1 = FX output enabled in reverse direction

0: Reserved

Additional Information
Setting bits 0-5 to 1 will enable the corresponding lighting output for the reverse direction. A given lighting output can be made bidirectional by setting corresponding bits of CVs 57 and 58. Refer to indexed CVs 1.257-1.512 (Extended Function Mapping CVs) for information regarding mapping functions to lighting outputs.

Default Value: 254
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 57 (Forward Direction Enable)
CVs 1.257-1.512 (Extended Function Mapping CVs)

CV 59: Hyperlight Flash Rate

Description

CV 59 is used to set the flash rate of all enabled flashing Hyperlight effects.

Bit 7							Bit 0
0	0	0	0	FR3	FR2	FR1	FR0

FR0-FR3: Hyperlight Flash Rate Select
0 = Fastest flash rate
.
.
.
15 = Slowest flash rate

0: Reserved

Default Value: 3
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 60 (Grade-Crossing Hold Time)

CV 60: Grade-Crossing Hold Time

Description

CV 60 is used to set the duration of the crossing hold countdown from 0 to 15 seconds.

Bit 7							Bit 0
0	0	0	0	HT3	HT2	HT1	HT0

HT0-HT3: Hold Time Select
0 = 0 seconds
.
.
.
15 = 15 seconds

0: Reserved

Additional Information

The countdown will occur when the long airhorn function (F2 by default) or grade crossing horn is turned on to activate Grade-Crossing Logic. Setting bit 6 to 1 of CVs 49-54 (Hyperlight Effect Select) will enable Grade-Crossing Logic.

Default Value: 4
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 57 (Forward Direction Enable)
CV 58 (Reverse Direction Enable)
CV 59 (Hyperlight Flash Rate)

CV 61: Brightness Register 1

Description

CV 61 is used to adjust the brightness level of lighting outputs set to the on/off brightness 1 effect.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Brightness Level 1
0 = 0% Brightness
.
.
.
255 = 100% Brightness

Default Value: 153
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 63 (Dimmer Level)

CV 62: Brightness Register 2

Description

CV 62 is used to adjust the brightness level of lighting outputs set to the on/off brightness 2 effect.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Brightness Level 2
0 = 0% Brightness
.
.
.
255 = 100% Brightness

Default Value: 153
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 63 (Dimmer Level)

CV 63: Dimmer Level

Description

CV 63 is used to adjust the brightness level of the on/off dimmable headlight effect. The brightness of the headlight will be automatically dimmed to the value of CV 63 when the dimmer function (F7 by default) is turned on.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Dimmer Level
0 = 0% Brightness
.
.
.
255 = 100% Brightness

Default Value: 153
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 61 (Brightness Register 1)
CV 62 (Brightness Register 2)

CV 64: Master Brightness

Description

CV 64 is used to adjust the brightness level of all lighting outputs.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Master Brightness Level
0 = 0% Brightness
.
.
.
255 = 100% Brightness

Additional Information

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 (Brightness Register 1) and CV 62 (Brightness Register 2), respectively.

Default Value: 255
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 61 (Brightness Register 1)
CV 62 (Brightness Register 2)

Speed Table CVs

CV 66: Forward Motor Trim

Description

CV 66 is used to determine the scaling factor that will increase or decrease the forward drive voltage.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Forward Trim Scalar

0 = Disabled
1 = Voltage × 0.008
.
.
.
127 = Voltage × 0.91
128 = Disabled
129 = Voltage × 1.09
.
.
.
255 = Voltage × 1.91

Additional Information

Values from 0 to 255 may be entered into CV 66 to determine the scaling factor for the forward drive voltage. Entering a value of 0 or 128 will disable the forward trim scalar. Entering a value from 1 to 127 will multiply the forward drive voltage by 0.008-0.91. Entering a value from 129 to 255 will multiply the forward drive voltage by 1.09-1.91.

Note: *Bit 4 (STE) of CV 29 (Configuration Data 1) must be set to 1 to enable the forward trim scaling factor in CV 66. Also, CV 25 cannot be set to either 1 or 0.*

Default Value: 128
Related CVs: CV 25 (Speed Table Enable)
CV 29 (Configuration Data 1)
CVs 67-94 (Custom Speed Table)
CV 95 (Reverse Motor Trim)

Speed Table CVs

CVs 67-94: Custom Speed Table

Description

CVs 67-94 are used to configure the 28-point custom speed table.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Speed Table Data
0 = 0% throttle
.
.
.
255 = 100% throttle

CV	Speed Point	% of Speed	CV Value
67	1	4	9
68	2	7	18
69	3	11	27
70	4	14	36
71	5	18	45
72	6	22	55
73	7	25	64
74	8	29	73
75	9	32	82
76	10	36	91
77	11	39	100
78	12	43	109
79	13	46	118
80	14	50	127
81	15	54	137
82	16	57	146
83	17	61	155
84	18	64	164
85	19	67	173
86	20	71	182
87	21	75	191
88	22	78	200
89	23	82	209
90	24	86	219
91	25	89	228
92	26	93	237
93	27	96	246
94	28	100	255

Additional Information
Entering values from 0 to 255 into CVs 67-94 will set each point of the 28-point custom speed table from 0% to 100% of the maximum throttle setting. The 28-point speed table is linear by default.

Related CVs: CV 25 (Speed Table Enable)
CV 29 (Configuration Data 1)
CV 66 (Forward Motor Trim)
CV 95 (Reverse Motor Trim)

CV 95: Reverse Motor Trim

Description

CV 95 is used to determine the scaling factor that will increase or decrease the reverse drive voltage.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Reverse Trim Scalar

0 = Disabled
1 = Voltage ÷ 0.008
.
.
.
127 = Voltage ÷ 0.99
128 = Disabled
129 = Voltage × 1.09
.
.
.
255 = Voltage × 1.99

Additional Information

Values from 0 to 255 may be entered into CV 95 to determine the scaling factor for the reverse drive voltage. Entering a value of 0 or 128 will disable the reverse trim scalar. Entering a value from 1 to 127 will decrease the reverse drive voltage by 0.008-0.99. Entering a value from 129 to 255 will increase the reverse drive voltage by 1.09-1.99.

Note: *Bit 4 (STE) of CV 29 (Configuration Data 1) must be set to 1 to enable the reverse trim scaling factor in CV 95. Also, CV 25 cannot be set to either 1 or 0.*

Default Value: 128
Related CVs: CV 25 (Speed Table Enable)
CV 29 (Configuration Data 1)
CVs 67-94 (Custom Speed Table)
CV 66 (Forward Motor Trim)

User Information CVs

CV 105: User Identifier 1

Description

CV 105 indicates the software's major revision code and provides storage for user-supplied data. This CV has no other effect on decoder operation.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: User Identifier Data

Additional Information

This CV may be programmed with any value from 0 to 255. CV 105 will return to the software's major revision code when the decoder is reset to factory settings.

Default Value: Varies by software revision
Related CVs: CV 106 (User Identifier 2)

User Information CVs

CV 106: User Identifier 2

Description

CV 106 indicates the software's minor revision code. This CV may be used to provide storage for user-supplied data. This CV has no other effect on decoder operation.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: User Identifier Data

Additional Information

This CV may be programmed with any value from 0 to 255. CV 106 will return to the software's minor revision code when the decoder is reset to factory settings.

Default Value: Varies by software revision
Related CVs: CV 105 (User Identifier 1)

Sound Control CVs

CV 112: Sound Configuration 1

Description

CV 112 is used to enable the low-pressure alarm bell and the emergency stop idle sequence.

Bit 7							Bit 0
0	0	0	0	0	0	ABE	ESTP

ESTP: Emergency Stop Idle Enable
0 = Emergency stop engine shutdown
1 = Emergency stop engine idle

ABE: Alarm Bell Enable
0 = Low-pressure alarm bell disabled
1 = Low-pressure alarm bell enabled

0: Reserved

Default Value: 3
Related CVs: CVs 112-208 (Sound Control CVs)

CV 113: Quiet Mode Time-Out Period

Description

CV 113 is used to set the quiet mode time-out period. When the throttle is set to zero and all functions are off all sound effects will automatically deactivate after the quiet mode time-out period elapses. Setting CV 113 to a non-zero value will adjust the time-out period and allow sound effects to be reactivated only when the decoder is addressed.

Bit 7							Bit 0
QM7	QM6	QM5	QM4	QM3	QM2	QM1	QM0

QM0-QM7: Quiet Mode Time-Out Period
0 = Disabled
1 = 1 second
.
.
.
255 = 255 seconds

Additional Information

Entering a value from 1 to 255 into CV 113 will adjust the quiet mode time-out period from 1 second to 255 seconds. Entering a value of 0 into CV 113 will disable the quiet mode time-out period.

Default Value: 0
Related CVs: CVs 112-208 (Sound Control CVs)

CV 114: Engine Exhaust Control

Description

CV 114 is used to adjust the auto-notching sensitivity level, enable engine interlock, enable auto-start, and select from four dynamic braking modes. Decimal values for bits 0-3 (AN0-AN3) and binary values for bits 4-7 (LOCK, ASTRT, and DB0-DB1) are defined as follows:

Bit 7							Bit 0
DB1	**DB0**	**ASTRT**	**LOCK**	**AN3**	**AN2**	**AN1**	**AN0**

AN0-AN3: Auto-Notching Sensitivity
0 = Auto-notching disabled
1 = 1 speed step/notch
.
.
.
15 = 15 speed steps/notch

LOCK: Engine Interlock Enable
0 = Engine interlock disabled
1 = Engine interlock enabled

ASTRT: Auto-Start Enable
0 = Auto-start disabled
1 = Auto-start enabled

DB0-DB1: Dynamic Braking Mode Select
00 = Normal operation (default)
01 = Idle speed (notch 1)
10 = Half-speed (notch 4)
11 = Full speed (notch 8)

Additional Information

Entering values from 1 to 15 into bits 0-3 (AN0-AN3) will:

- Enable auto-notching
- Designate the number of speed steps contained within each engine RPM notch
- Allow the prime mover to start when the throttle is increased from zero unless bit 0 in CV 112 is set to 1.

Values from 1 to 15 specify the number of speed steps within each engine RPM notch from 1 to 15. For example, when CV 114 is set to 15 and 128 speed-step mode is in use, increasing the throttle from zero to speed-step 91 will heighten the engine RPM from idle (notch 1) to notch 8.

Setting bits 0-3 to 0 will disable auto-notching and enable manual notching.

Setting bit 4 (LOCK) to 1 will enable engine interlock. When engine interlock is enabled, the prime mover must be started prior to setting the locomotive into motion, and cannot be turned off during movement; locomotive speed must be zero for the prime mover to be started and shut off, respectively.

Setting bit 5 (ASTRT) to 1 will enable auto-start. Auto-start allows the prime mover to be started automatically when the decoder receives track power. For DCC operation, the prime mover will not start upon receiving track power when bit 5 is set to 0 and auto-start is disabled. For analog mode (DC) operation, the prime mover will start when the decoder receives track power regardless of bit 5, i.e., auto-start cannot be disabled with CV 114 in analog mode.

Bits 6-7 (DB0-DB1) are used to select from four dynamic braking modes. When bits 6-7 are equal to a non-zero value, turning on the dynamic brake function (F4 by default) will set the engine RPM sound effect from its current state to a designated notch setting.

Decimal values used for selecting dynamic braking modes are provided below and must be added to the value of CV 114:

0 = Normal: Dynamic brake application only (default)
64 = Idle speed: Dynamic brake sets RPM to notch 1
128 = Half-speed: Dynamic brake sets RPM to notch 4
192 = Full speed: Dynamic brake sets RPM to notch 8

Default Value: 39
Related CVs: CVs 112-208 (Sound Control CVs)
CVs 2.503-2.512 (DDE Control CVs)

CV 116: Dynamic Brake Rate

Description

CV 116 is used to set the dynamic brake deceleration offset that occurs when the dynamic brake sound is in the 'high' state. The dynamic brake function cannot be used to bring the locomotive to a stop; the locomotive will decelerate to speed-step 8 when the dynamic brake rate in CV 116 is activated.

Bit 7							Bit 0
SIGN	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Dynamic Brake Rate Value

SIGN: Sign
0 = Positive value
1 = Negative value

Additional Information

Bits 0-7 are used to adjust the dynamic brake rate in relation to the value of CV 4 (Baseline Deceleration Rate).

Bit 7 (SIGN) determines if the dynamic brake rate is lesser or greater than the baseline deceleration rate and/or independent/train brake rate. Entering values from 0 to 127 will increase the dynamic brake rate. Entering values from 129 to 255 will decrease the dynamic brake rate. The dynamic brake function will not impede the motor when CV 116 is set to a value of 0 or 128. The dynamic brake rate is calculated as:

Seconds/Speed Step = (CV 4 + CV 116) × 0.896 ÷ Number of Speed Steps

Default Value: 0
Related CVs: CV 4 (Baseline Deceleration Rate)
CV 117 (Independent Brake Rate)
CV 118 (Train Brake Rate)

CV 117: Independent Brake Rate

Description

CV 117 configures the motive effect of the independent brake. When the independent brake rate is set to any value other than 0 or 128, the locomotive comes to a stop when the independent brake is on. The independent brake is *on* when the train brake select function is off and the brake function is on. The rate at which the locomotive decelerates is equal to the combined rate from CVs 4 and 24 plus the independent brake rate value.

Bit 7							Bit 0
SIGN	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Independent Brake Rate Value

SIGN: Sign
0 = Positive value
1 = Negative value

Additional Information

Bits 0-7 are used to adjust the independent brake rate in relation to the value of CV 4.

Bit 7 (SIGN) determines if the independent brake rate is lesser or greater than the baseline deceleration rate. Entering values from 0 to 127 will increase the independent brake rate from the baseline deceleration rate. Entering values from 129 to 255 will decrease the independent brake rate from the baseline deceleration rate. The independent brake function will not impede the motor when CV 117 is set to a value of 0 or 128.

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

Default Value: 0
Related CVs: CV 4 (Baseline Deceleration Rate)
CV 116 (Dynamic Brake Rate)
CV 118 (Train Brake Rate)

CV 118: Train Brake Rate

Description

CV 118 configures the motive effect of the train brake. When the train brake rate is set to any value other than 0 or 128, the locomotive comes to a stop when the train brake is on. The train brake is *on* when the train brake select function is on and the brake function is on. The rate at which the locomotive decelerates is equal to the combined rate from CVs 4 and 24 plus the independent brake rate value.

Bit 7							Bit 0
SIGN	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Train Brake Rate Value

SIGN: Sign
0 = Positive value
1 = Negative value

Additional Information

Bits 0-7 are used to adjust the train brake rate in relation to the value of CV 4 (Baseline Deceleration Rate).

Bit 7 (SIGN) determines if the train brake rate is added or subtracted to the baseline deceleration rate in CV 4. Entering values from 0 to 127 in CV 118 will increase the train brake rate from the baseline deceleration rate in CV 4. Entering values from 129 to 255 into CV 118 will decrease the train brake rate from the baseline deceleration rate in CV 4. The train brake function will not stop the locomotive when CV 118 is set to a value of 0 or 128.

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

Default Value: 0
Related CVs: CV 4 (Baseline Deceleration Rate)
CV 117 (Independent Brake Rate)

CV 119: Max Engine Recovery Speed

Description

CV 119 is used to designate the speed to which 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 current throttle setting (proportional limiting).

Bit 7							Bit 0
MRS	**MRS**	**MRS**	**MRS**	**MRS**	**MRS**	**MRS**	**MRS**

MRS: Max Recovery Speed

0 = Disabled
1 = Speed-step 1 (absolute limiting)
.
.
.
127 = Speed-step 127 (absolute limiting)
128 = Disabled
129 = 1% of throttle setting (proportional limiting)
.
.
.
255 = 100% of throttle setting (proportional limiting)

Additional Information

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 by the command station. Otherwise, the decoder will resume from the speed step defined by CV 119.

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 -128 × Speed Step) ÷ 127

Entering a value of 0 or 128 into CV 119 will disable the recovery speed setting and the prime mover will start at speed-step 0 following power losses.

Default Value: 204
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 120: Airhorn Select

Description

CV 120 is used to select one of a large selection of airhorn sound effects for the long and short airhorn functions (F2 and F3 by default). For a list of airhorn sound effects and corresponding values, refer to the product packaging or the website.

Bit 7							Bit 0
0	**0**	**HS5**	**HS4**	**HS3**	**HS2**	**HS1**	**HS0**

HS0-HS5: Airhorn Select

0 = Airhorn 1
1 = Airhorn 2
.
.
. = Number of horns varies (refer to the website for available selections)

0: Reserved

Default Value: Varies
Related CVs: CV 121 (Auxiliary Airhorn Select)
CV 129 (Airhorn Primary Mixer Channel)

CV 121: Alternate Airhorn Select

Description

CV 121 is used for selecting one of a large number of alternate airhorn sound effects. For a list of airhorn sound effects and corresponding values, refer to the product packaging or the website.

Bit 7							Bit 0
0	**0**	**AH5**	**AH4**	**AH3**	**AH2**	**AH1**	**AH0**

AH0-AH5: Alternate Airhorn Select
0 = Alternate airhorn disabled
1 = Replaces Short Airhorn with Alternate airhorn 1
.
.
.
= Number of horns varies (refer to the website for available selections)

0: Reserved

More Information

Bits 0-5 (AH0-AH5) are used to select the alternate airhorn sound effect. When the alternate airhorn is enabled, the short airhorn function is disabled. When the alternate airhorn is enabled and the short airhorn function is turned on, the long airhorn function is used to activate the alternate airhorn sound effect.

Default Value: 0
Related CVs: CV 120 (Airhorn Select)
CV 129 (Airhorn Primary Mixer Channel)

CV 122: Bell Select

Description

CV 122 is used for configuring the bell sound effect and ring-rate, and for enabling the selected bell to ring during the crossing-timer countdown when Grade-Crossing Logic is activated. Refer to CVs 49-54 (Hyperlight Effect Select) for more information regarding Grade-Crossing Logic. The number of available bells and bell types will vary with each decoder version. For a list of bell sound effects and corresponding values, refer to the website.

Bit 7							Bit 0
BXING	**0**	**BS5**	**BS4**	**BS3**	**BS2**	**BS1**	**BS0**

BS0-BS5: Bell Select

BXING: Grade-Crossing Bell Enable
0 = Disabled
1 = Enabled

0: Reserved

Default Value: Varies
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 60 (Grade-Crossing Hold Time)
CV 130 (Bell Primary Mixer Channel)

CV 123: Prime Mover Select

Description

CV 123 is used to select one of up to nine prime mover sound effects (varies by version).

Bit 7							Bit 0
0	0	0	0	PM3	PM2	PM1	PM0

PM0-PM3: Prime Mover Select
- 0 = Prime mover 1
- 1 = Prime mover 2
- 2 = Prime mover 3
- 3 = Prime mover 4
- 4 = Prime mover 5
- 5 = Prime mover 6
- 6 = Prime mover 7
- 7 = Prime mover 8
- 8 = Prime mover 9

0: Reserved

Default Value: Varies
Related CVs: CV 131 (Prime Mover Primary Mixer Channel)

CV 124: Air Compressor Select

Description

CV 124 is used to select an air compressor sound effect. For a list of air compressors and corresponding values, refer to the website.

Bit 7							Bit 0
0	0	0	0	0	0	CS1	CS0

CS0-CS1: Air Compressor Select
0 = Air Compressor 1
1 = Air Compressor 2
2 = Air Compressor 3
3 = Air Compressor 4

0: Reserved

Additional Information

The selected air compressor sound effect cycles on and off continuously when the prime mover is on.

Default Value: Varies
Related CVs: CV 132 (Air Compressor Primary Mixer Channel)

CV 126: Coupler Select

Description

CV 126 is used to select the coupler sound effect that will be activated by the couple/uncouple functions (F13 by default).

Bit 7							Bit 0
CRP	**0**	**0**	**0**	**0**	**0**	**CPL1**	**CPL0**

CPL0-CPL1: Coupler Select
0 = Medium coupler
1 = Heavy coupler
2 = Link-and-pin

CRP: Uncouple Function Polarity
0 = Uncouple when function is turned on
1 = Uncouple when function is turned off

0: Reserved

Additional Information

By default, bit 7 (CRP) is set to 1 and the couple and uncouple functions are mapped to F13; turning on F13 will activate the coupling sound effect and turning off F13 will activate the uncoupling sound effect.

When bit 7 is set to 0 and the couple and uncouple functions are mapped to the same function key, turning on the function key will activate the coupling sound effect and turning off the function key will have no effect.

When bit 7 is set to 0 and the couple and uncouple functions are mapped to separate function keys, turning on the couple function key will activate the coupling sound effect and turning on the uncouple function key will activate the uncoupling sound effect. Turning off the couple and uncouple function keys will have no effect.

The link-and-pin coupler does not include the uncouple or glad hand release.

Default Value: 128
Related CVs: CV 137 (Coupler Primary Mixer Channel)

CV 128: Master Volume

Description

CV 128 is used to set the volume level of all sound channels.

Bit 7							Bit 0
VOL7	VOL6	VOL5	VOL4	VOL3	VOL2	VOL1	VOL0

VOL0-VOL7: Master Volume
0 = 0% volume
.
.
.
255 = 100% volume

Default Value: 192
Related CVs: CVs 129-160 (Primary Mixer Volume Levels)
CVs 2.289-2.320 (Alternate Mixer Volume Levels)

CVs 129-160: Primary Mixer Volume Levels

Description

CVs 129-160 are used in conjunction with CV 128 (Master Volume) to set the volume level of each sound effect.

Bit 7							Bit 0
MIX7	MIX6	MIX5	MIX4	MIX3	MIX2	MIX1	MIX0

MIX0-MIX7: Primary Mixer Channel Volume
0 = 0% of master volume
.
.
.
255 = 100% of master volume

Additional Information

Setting CVs 129-160 to a value from 0 to 255 will adjust the corresponding sound effect's volume level from the master volume level in CV 128. For example, if CV 128 is set to 50% volume (CV 128 = 128), setting CV 129 to a value of 128 would adjust the airhorn volume level to 50% of the master volume level, i.e., the airhorn volume would be set to 25% of the maximum volume level.

Mixer channel CVs with corresponding default values are listed on the following page.

Related CVs: CV 128 (Master Volume)

Sound Control CVs

CVs 129-160: Primary Mixer Volume Levels		
CV	**Sound Effect**	**Default Value**
129	Airhorn	225
130	Bell	85
131	Prime Mover	150
132	Air Compressor	100
133	Dynamic Brake	125
134	Radiator Fans	75
135	Alarm Bell	60
136	Reserved	0
137	Coupler	128
138	Train Brake Apply/Release	128
139	Independent Brake Apply	100
140	Independent Brake Release	70
141	Reserved	0
142	Reserved	0
143	Poppet Valve	60
144	Steam Generator	50
145	Cab Doors	128
146	Reserved	0
147	Relay Clicks	128
148	E-Brake App.	70
149	Glad Hand Release	150
150	All Aboard/Coach Doors	192
151	Reserved	0
152	Reserved	0
153	Clickety-Clack	150
154	Sander Valve	10
155	Fuel Loading	50
156	Air Conditioner	20
157	Wrenches	50
158	Pneumatic Oilers	40
159	Toilet Flush	20
160	Cab Chatter	60

CVs 161-192: Reverb Mixer

Description

CVs 161-192 are used to determine the volume level of sound effects applied to the reverb effect.

Bit 7							Bit 0
RMX7	RMX6	RMX5	RMX4	RMX3	RMX2	RMX1	RMX0

RMX0-RMX7: FX Bus Send Level
0 = 0% volume
.
.
.
255 = 100% volume

Additional Information
Refer to CVs 233-236 (Reverb Control CVs) for more information.

Reverb mixer channel CVs are listed on the following page.

Related CVs: CVs 224-236 (Audio Control CVs)

Sound Control CVs

CVs 161-192: Reverb Mixer		
CV	**Sound Effect**	**Default Value**
161	Airhorn	96
162	Bell	0
163	Prime Mover	0
164	Air Compressor	0
165	Dynamic Brake	0
166	Radiator Fans	0
167	Alarm Bell	0
168	Reserved	0
169	Coupler	0
170	Train Brake Apply/Release	0
171	Independent Brake Apply	0
172	Independent Brake Release	0
173	Reserved	0
174	Reserved	0
175	Poppet Valve	0
176	Steam Generator	0
177	Cab Doors	0
178	Reserved	0
179	Relay Clicks	0
180	E-Brake App.	0
181	Glad Hand Release	0
182	All Aboard/Coach Doors	0
183	Reserved	0
184	Reserved	0
185	Clickety-Clack	0
186	Sander Valve	0
187	Fuel Loading	0
188	Air Conditioner	0
189	Wrenches	0
190	Pneumatic Oilers	0
191	Toilet Flush	0
192	Cab Chatter	0

CV 193: Auto-Bell On Set Point

Description

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. Also CV 197 (Analog Mode Auto-Sound Enable) and CV 198 (DCC Mode Auto-Sound Enable) must have bit 2 set to 1.

Bit 7							Bit 0
0	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Auto-Bell On Set Point
0 = Auto-bell disabled
1 = Speed-step 1
.
.
.
127 = Speed-step 127

0: Reserved

Default Value: 1
Related CVs: CV 194 (Auto-Bell On Time)
CV 197 (Analog Auto-Sound Enable)
CV 198 (DCC Auto-Sound Enable)

CV 194: Auto-Bell On Time

Description

CV 194 is used to set the duration in seconds that elapses from the time the bell sound effect is automatically turned on to the time it is turned off. CV 193 (Auto-Bell On Set Point) is used to determine the speed step at which the bell sound effect is turned on. Also CV 197 (Analog Mode Auto-Sound Enable) and CV 198 (DCC Mode Auto-Sound Enable) must have bit 2 set to 1.

Bit 7							Bit 0
D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D7: Auto-Bell On Time
0 = Auto-bell disabled
1 = 1 second
.
.
.
255 = 255 seconds

Default Value: 15
Related CVs: CV 193 (Auto-Bell On Set Point)
CV 197 (Analog Mode Auto-Sound Enable)
CV 198 (DCC Auto-Sound Enable)

CV 195: Coach Door Count

Description

CV 195 is used to set the maximum number of coach door slams that will occur when the all aboard/coach doors function (F23 by default) is turned on. From the range defined by the value of CV 195, a random number of coach door slams will be issued when the all aboard/coach doors function is turned on.

Bit 7							Bit 0
0	0	0	0	CD3	CD2	CD1	CD0

CD0-CD3: Coach Doors
0 = Disabled
1 = 1 slam
.
.
.
15 = 15 slams

0: Reserved

Default Value: 5
Related CVs: CV 150 (All Aboard/Coach Doors Primary Mixer Channel)

CV 196: Brake Sensitivity

Description

CV 196 is used to adjust the automatic brake activation point. The value of CV 196 sets the rate of throttle decrease that will activate the brake sound effect.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Brake Sensitivity

0 = 0.10 speed steps/second

.

.

.

.

255 = 25.5 speed steps/second

Additional Information

The value of CV 196 indicates the rate of throttle decrease required for the brake sound effect to be automatically activated and is calculated as:

CV Value = Speed Steps/Second ÷ 10

Default Value: 3

Related CVs: CV 4 (Baseline Deceleration Rate)
CV 117 (Independent Brake Rate)
CV 139 (Independent Brake Apply Primary Mixer Channel)
CV 140 (Train Brake Apply Primary Mixer Channel)

CV 197: Analog Mode Auto-Sound Enable

Description

CV 197 is used to enable automatic sound effects for analog mode operation.

Bit 7							Bit 0
0	0	0	0	0	ABK	ABL	0

ABL: Auto-Bell Enable
0 = Disabled
1 = Enabled

ABK: Auto-Brake Enable
0 = Disabled
1 = Enabled

0: Reserved

Default Value: 0
Related CVs: CV 12 (Alternate Power Source)
CV 29 (Configuration Data 1)

CV 198: DCC Mode Auto-Sound Enable

Description

CV 198 is used to enable automatic sound effects in DCC mode.

Bit 7							Bit 0
0	0	0	0	0	ABK	ABL	0

ABL: Auto-Bell Enable
0 = Disabled
1 = Enabled

ABK: Auto-Brake Enable
0 = Disabled
1 = Enabled

0: Reserved

Default Value: 0
Related CVs: CV 12 (Alternate Power Source)
CV 29 (Configuration Data 1)

CV 200: Poppet Valve Release Rate

Description

CV 200 is used to adjust the duration that occurs between each subsequent “pop!” of the automatic poppet valve sound effect.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Poppet Valve Release Rate
0 = Poppet valve disabled
1 = Fastest release rate
.
.
.
255 = Slowest release rate

Default Value: 25
Related CVs: CV 143 (Poppet Valve Primary Mixer Channel)

CVs 201-208: Fireman Ed Probability CVs

Description

CVs 201-208 are used to determine how frequently each Fireman Ed task will occur during operation. Each Fireman Ed task is contained within an event probability CV:

CV 201: Cab Doors Event Probability
CV 202: Fuel Loading Event Probability
CV 203: Wrenches Event Probability
CV 204: Pneumatic Oilers Event Probability
CV 205: Cab Chatter Event Probability
CV 206: Toilet Flush Event Probability
CV 207: Air Conditioner Event Probability
CV 208: Relay Clicks Event Probability

Bit 7							Bit 0
D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D7: Event Probability
0 = 0% probability
.
.
.
255 = 100% probability

Additional Information

Entering values from 0 to 255 into CVs 201-208 will adjust the probability for the associated tasks from 0% to 100%.

Fireman Ed tasks will occur:

- When the throttle has been set to zero for two minutes
- When the general service function is turned off for two minutes
- 10-30 seconds after the previous task has concluded, when throttle remains at zero and general service function is off.

Default Value: CV 201 = 128
CV 202 = 0
CV 203 = 128
CV 204 = 128
CV 205 = 64
CV 206 = 32
CV 207 = 128
CV 208 = 128

Related CVs: CVs 57-64 (Lighting Effect CVs)

Advanced Motor Control CVs

CVs 209-220: Advanced Motor Control Registers

Description

CVs 209-220 are used to adjust aspects of advanced motor processes and optimize back-EMF control algorithms to complement a given installation.

CV 209: PID Kp Parameter

Description

CV 209 is used to set the Kp coefficient. Values from 0 to 255 may be entered to specify a gain factor for the proportional coefficient of the PID motor control equation.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Kp Coefficient

Default Value: 48
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 210: PID Ki Parameter

Description

CV 210 is used to set the Ki coefficient. Values from 0 to 255 may be entered to specify a gain factor for the integral coefficient of the PID motor control equation.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Ki Coefficient

Default Value: 16
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 211: Low-Speed Compensation

Description

CV 211 is used to specify the gain value that is applied to the PID motor equation at low speeds to compensate for irregularities that occur during low-speed operation. Values from 0 to 255 may be entered to adjust low-speed motor operation.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Gain Value
0 = Disabled
1 = Minimum gain value
.
.
.
255 = Maximum gain value

Additional Information

Increasing the gain value will allow the motor to start running 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. The gain value also advances the starting point at which the PWM is applied to the motor when CV 211 is set to high values. 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.

Default Value: 180
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 212: BEMF Feedback Intensity

Description

CV 212 is used to set the back-EMF motor control intensity. Values from 0 to 255 may be entered to specify the percentage of back-EMF error (n/255) that is fed back from the control loop. Setting CV 212 to a value of 0 will disable load compensation.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: BEMF Feedback Intensity

Default Value: 255
Related CVs: CV 10 (EMF Feedback Cutoff)
CVs 209-220 (Advanced Motor Control CVs)

CV 213: BEMF Sample Period

Description

CV 213 is used to set the back-EMF sample period.

Bit 7							Bit 0
0	0	0	D4	D3	D2	D1	D0

D0-D4: BEMF Sample Period

0: Reserved

Additional Information

Values from 0 to 31 may be entered into bits 0-4 (D0-D4) to set the BEMF Sample Period that specifies the time period in mS (milliseconds) between measurements.

Default Value: 9
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 214: BEMF Sample Aperture Time

Description

CV 214 is used to set the back-EMF sample aperture time.

Bit 7							Bit 0
0	0	0	0	D3	D2	D1	D0

D0-D3: BEMF Sample Aperture Time

0: Reserved

Additional Information

Values from 0 to 15 may be entered into bits 0-4 (D0-D4) to set the BEMF Sample Aperture Time Period that specifies the time period in mS (milliseconds) that the aperture is open.

Default Value: 6
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 215: BEMF Reference Voltage

Description

CV 215 is used to set the back-EMF reference voltage.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: BEMF Reference Voltage

0-59 = Reserved
60 = 6.0 volts (minimum)
.
.
.
255 = 25.5 volts

Additional Information

A value from 60 to 255 may be entered into CV 215 to specify the baseline reference voltage by 0.10 volt increments from a minimum of 6 volts. The decoder is designed with a minimum track reference of 6 volts and will ignore values lower than 60. A value of 0 indicates that track voltage is used.

Default Value: 150
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 216: Motor Speed Step Deadband

Description

CV 216 is used to determine the speed step at which voltage is first applied to the motor output to put the locomotive into motion.

Bit 7							Bit 0
0	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D6: Motor Speed Step Deadband
0 = Disabled
1 = Speed-step 1
.
.
.
127 = Speed-step 127

0: Reserved

Default Value: 0
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 217: Motor Control Register

Description

CV 217 is used to enable back-EMF control and auto-stop.

Bit 7							Bit 0
0	0	0	0	STP	0	BEMF	0

BEMF: Back-EMF Enable
0 = Back-EMF disabled
1 = Back-EMF enabled

STP: Auto-Stop Enable
0 = Auto-stop disabled
1 = Auto-stop enabled

Additional Information

Setting bit 1 (BEMF) to 1 will enable back-EMF motor control.

Setting bit 3 (STP) to 1 will enable the auto-stop feature. When auto-stop is enabled, direction commands will bring the motor to a full stop for a duration of 500ms before the decoder changes locomotive direction.

Default Value: 10
Related CVs: CVs 209-220 (Advanced Motor Control CVs)

CV 218: Analog Mode Motor Start Voltage

Description

CV 218 is sets the track voltage in analog mode at which voltage is first applied to the motor.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Analog Mode Motor Start Voltage

Additional Information

A value from 0 to 255 may be entered into CV 218 to adjust the analog mode motor start voltage. Starting voltage is calculated as:

Starting Voltage = (CV 218 ÷ 10) + 6V

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.

Default Value: 15
Related CVs: CV 12 (Alternate Power Source)
CV 29 (Configuration Data 1)
CVs 209-220 (Advanced Motor Control CVs)

CV 219: Analog Mode Engine Start Voltage

Description

CV 219 is provided for adjusting the track Voltage in analog mode at which the engine exhaust sound begins. This feature is intended for use only when BEMF (see CV217) is disabled. If using BEMF, ensure CV 219 is set to 0. If BEMF is disabled, increasing the value in this CV will 'delay' the start of the engine exhaust sound to a higher track voltage than the track voltage at which the motor is first powered. The actual relation of this CV to the effect is a given as a percentage of the motor voltage output, i.e., if the CV is set to 128 (50% of 256), then the exhaust sound will first begin to play when a 50% voltage is applied to the motor.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Analog Mode Engine Start Voltage

Default Value: 15
Related CVs: CV 12 (Alternate Power Source)
CV 29 (Configuration Data 1)
CVs 209-220 (Advanced Motor Control CVs)

CV 220: Constant Brake Distance

Description

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.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Constant Brake Distance

Additional Information

Entering a value from 1 to 255 into CV 220 will adjust the constant brake distance proportionally to the value in CV 220, i.e., if the stopping distance = 1 foot with a value of 64 in CV 220, then a value of 128 would result in a stopping distance of 2 feet.. Entering a value of 0 into CV 220 will disable the constant brake distance feature, as will disabling Back-EMF in CV 217.

Default Value: 0
Related CVs: CV 4, CV 217
CVs 116-118

Audio Control CVs

CV 224: High-Pass Filter Cutoff Frequency

Description

CV 224 is used to adjust the cutoff frequency of the decoder's high-pass output filter.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Cutoff Frequency

0 = High-pass filter disabled
1 = 20Hz
.
.
.
255 = 1kHz

Additional Information

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.

Default Value: 20
Related CVs: CVs 224-236 (Audio Control CVs)

CV 225: Equalizer Control Register

Description

CV 225 is used for presetting the cut/boost levels of the 7-band equalizer to accommodate a range of speaker sizes or to allow each band of the equalizer to be adjusted according to CVs 226-232 (Cut/Boost Controls).

Bit 7							Bit 0
0	0	0	0	0	EQ2	EQ1	EQ0

EQ0-EQ2: Equalizer Presets
- 0 = Flat (disabled)
- 1 = Micro speaker (smaller than 1”)
- 2 = Small speaker (from 1” to 2”)
- 3 = Medium speaker (from 2” to 4”)
- 4 = Large speaker (larger than 4”)
- 5 = Reserved
- 6 = Reserved
- 7 = User-adjustable (CVs 226-232)

0: Reserved

Additional Information

Setting CV 225 to a value from 1 to 4 will adjust the 7-band equalizer frequency response according to speaker size.

Setting CV 225 to a value of 7 allows the cut/boost levels of the 7-band equalizer to be adjusted using CVs 226-232. Setting CV 225 to a value of 0 will disable the equalizer, i.e., all frequency levels will be set to 0dB (flat).

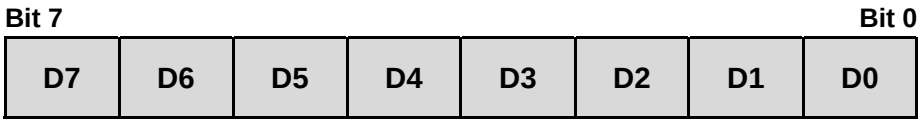
Default Value: 0
Related CVs: CVs 224-236 (Audio Control CVs)

CVs 226-232: Cut/Boost Controls

Description

The frequency levels of the equalizer are divided into seven bands, ranging from 62Hz to 4kHz. Modify each band's frequency response from -12dB (cut) to +12dB (boost) by entering values from 0 to 255 into the following CVs:

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



D0-D7: Cut/Boost Level
0 = -12dB cut
.
.
.
127 = -0.95dB cut
128 = 0dB (flat)
129 = +0.95dB boost
.
.
.
255 = +12dB boost

Note: *A value of 7 must be entered into CV 225 (Equalizer Control Register) to enable CVs 226-232 (Cut/Boost Controls).*

Default Value: CV 226 = 128
CV 227 = 128
CV 228 = 128
CV 229 = 128
CV 230 = 128
CV 231 = 128
CV 232 = 128

Related CVs: CVs 224-236 (Audio Control CVs)

CV 233: Reverb Control Register

Description

CV 233 is used to select from preset reverb settings or select the user-adjustable option, as defined by CVs 234-236 and CVs 161-192 (Reverb Mixer).

Bit 7							Bit 0
0	0	0	0	0	RV2	RV1	RV0

RV0-RV2: Reverb Presets
- 0 = Disabled
- 1 = Light Reverb
- 2 = Medium Reverb
- 3 = Heavy Reverb
- 4 = Short Echo
- 5 = Long Echo
- 6 = Reserved
- 7 = User-adjustable (CVs 234-236)

Default Value: 1
Related CVs: CVs 161-192 (Reverb Mixer)
CVs 224-236 (Audio Control CVs)

CV 234: Reverb Output Level

Description

CV 234 is used to determine the amount of reverb signal that is mixed back with the original audio signal.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Reverb Output Level

0 = 0%
.
.
.
128 = 50%
.
.
.
255 = 100%

Additional Information

Entering values from 0 to 100 will adjust the reverb output level from 0% to 100%.

Default Value: 0
Related CVs: CVs 161-192 (Reverb Mixer)
CVs 224-236 (Audio Control CVs)

CV 235: Reverb Delay Time

Description

CV 235 is used to determine the overall reverb delay time from 0 to 255ms.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Reverb Delay Time
0 = Minimum delay time
.
.
.
255 = Maximum delay time

Additional Information

A longer delay time corresponds to a greater distance between the sound source and the reflecting surfaces and will generally result in an increased level of reverb. Reverb delay time is calculated as:

Delay Time = CV 235 × 1ms

Default Value: 0
Related CVs: CVs 161-192 (Reverb Mixer)
CVs 224-236 (Audio Control CVs)

CV 236: Reverb Feedback Gain Level

Description

CV 236 is used to determine the percentage of the reverb output that is mixed back into the input and creates the effect of multiple sound reflections, each diminishing in amplitude over time.

Bit 7 **Bit 0**

D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: Reverb Feedback Gain Level

0 = 0% feedback

.

.

.

64 = 25% feedback (d

.

.

.

255 = 100% feedback

Additional Information

High feedback settings (greater than a value of 200) should be avoided, as they can create some undesirable effects. Adjust this CV starting with a low initial value and increase in small steps.

Default Value: 0
Related CVs: CVs 161-192 (Reverb Mixer)
CVs 224-236 (Audio Control CVs)

Analog Function Enable CVs

CV 241: Analog Mode Function Enable 3

Description

CV 241 is used to enable F13-F20 function assignments for analog mode operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for more information about function mapping.

Bit 7							Bit 0
F20	**F19**	**F18**	**F17**	**F16**	**F15**	**F14**	**F13**

F13-F20: Analog Mode Function Enable
0 = Function disabled for analog mode operation
1 = Function enabled for analog mode operation

Additional Information

When a given bit is set to 1 in CV 241, the active F13-F20 function mapped to a corresponding effect within CVs 1.257-1.384 will be enabled for analog mode operation. Any function key can be mapped to any effect with CVs 1.257-1.384.

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).*

Default Value: 0
Related CVs: CV 13-14 (Analog Mode Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 242-243 (Analog Mode Function Enable 4-5)
CVs 1.257-1.512 (Extended Function Mapping CVs)

Analog Function Enable CVs

CV 242: Analog Mode Function Enable 4

Description

CV 242 is used to enable F21-F28 function assignments for analog mode operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for more information about function mapping.

Bit 7							Bit 0
F28	**F27**	**F26**	**F25**	**F24**	**F23**	**F22**	**F21**

F21-F28: Analog Mode Function Enable
0 = Function disabled for analog mode operation
1 = Function enabled for analog mode operation

Additional Information

When a given bit is set to 1 in CV 242, the active F21-F28 function mapped to a corresponding effect within CVs 1.257-1.384 will be enabled for analog mode operation. Any function key can be mapped to any effect with CVs 1.257-1.384.

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).*

Default Value: 0
Related CVs: CV 13-14 (Analog Mode Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 241 and 243 (Analog Mode Function Enable 3 and 5)
CVs 1.257-1.512 (Extended Function Mapping CVs)

Analog Function Enable CVs

CV 243: Analog Mode Function Enable 5

Description

CV 243 is used in conjunction with CVs 1.385-1.512 (Effect Auxiliary Map Registers) to enable automatic effects for analog mode operation.

Bit 7							Bit 0
0	0	0	0	REVS	FWDS	REVD	FWDD

FWDD: Forward-Driving
0 = Disabled
1 = Effect active when moving in forward direction

REVD: Reverse-Driving
0 = Disabled
1 = Effect active when moving in reverse direction

FWDS: Forward-Standing
0 = Disabled
1 = Effect active when stopped in forward direction

REVS: Reverse-Standing
0 = Disabled
1 = Effect active when stopped in reverse direction

0: Reserved

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).*

Default Value: 0
Related CVs: CV 13-14 (Analog Mode Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 241-242 (Analog Mode Function Enable 3-4)
CVs 1.257-1.512 (Extended Function Mapping CVs)

Consist Function Enable CVs

CV 245: Consist Function Enable 3

Description

CV 245 is used to enable F13-F20 function assignments for advanced consist operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for more information about function mapping.

Bit 7							Bit 0
F20	**F19**	**F18**	**F17**	**F16**	**F15**	**F14**	**F13**

F13-F20: Consist Function Enable
0 = Function disabled for consist operation
1 = Function enabled for consist operation

Additional Information

When a given bit is set to 1 in CV 245, the active F13-F20 function mapped to a corresponding effect within CVs 1.257-1.384 will be enabled for consist operation. Any function key can be mapped to any effect with CVs 1.257-1.384.

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).*

Default Value: 0
Related CVs: CV 19 (Consist Address)
CVs 21-22 (Consist Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 246-247 (Consist Function Enable 4-5)
CVs 1.257-1.512 (Extended Function Mapping CVs)

Consist Function Enable CVs

CV 246: Consist Function Enable 4

Description

CV 246 is used to enable F21-F28 function assignments for advanced consist operation. Refer to CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) for more information about function mapping.

Bit 7							Bit 0
F28	**F27**	**F26**	**F25**	**F24**	**F23**	**F22**	**F21**

F21-F28: Consist Function Enable
0 = Function disabled for consist operation
1 = Function enabled for consist operation

Additional Information

When a given bit is set to 1 in CV 246, the active F21-F28 function mapped to a corresponding effect within CVs 1.257-1.384 will be enabled for consist operation. Any function key can be mapped to any effect with CVs 1.257-1.384.

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).*

Default Value: 0
Related CVs: CV 19 (Consist Address)
CVs 21-22 (Consist Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 245 and 247 (Consist Function Enable 3 and 5)
CVs 1.257-1.512 (Extended Function Mapping CVs)

Consist Function Enable CVs

CV 247: Consist Function Enable 5

Description

CV 247 is used in conjunction with CVs 1.385-1.512 (Effect Auxiliary Map Registers) to enable automatic effects and map an effect to the emergency stop button for advanced consist operation. The emergency stop button will bring the motor to a stop regardless of effect mapping.

Bit 7							Bit 0
0	**0**	**0**	**ESTP**	**REVS**	**FWDS**	**REVD**	**FWDD**

FWDD: Forward-Driving
0 = Effect is function controlled only
1 = Effect active when moving in forward direction

REVD: Reverse-Driving
0 = Effect is function controlled only
1 = Effect active when moving in reverse direction

FWDS: Forward-Standing
0 = Effect is function controlled only
1 = Effect active when stopped in forward direction

REVS: Reverse-Standing
0 = Effect is function controlled only
1 = Effect active when stopped in reverse direction

ESTP: Emergency Stop Button
0 = Emergency brake application sound effects enabled
1 = Effect mapped in CVs 1.385-1.512 (bit 4: ESTP) enabled

0: Reserved

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).*

Default Value: 16
Related CVs: CV 19 (Consist Address)
CVs 21-22 (Consist Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 245-246 (Consist Function Enable 3-4)
CVs 1.257-1.512 (Extended Function Mapping CVs)

Indexed CV Page 1

CVs 1.257-1.512: Extended Function Mapping CVs

Description

CVs 1.257-1.512 are used for mapping any F0-F28 function key to any effect, customizing effects to activate in response to direction and movement changes, and mapping an effect to the emergency stop button.

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).*

Indexed CV Page 1 is divided into two sets of CVs:

1. CVs 1.257-1.384 (Effect Map Registers) are used for function mapping.
2. CVs 1.385-1.512 (Effect Auxiliary Map Registers) are used for customizing effects to activate in response to direction and movement changes and mapping an effect to the emergency stop button.

CVs 1.257-1.384: Effect Map Registers
Each effect corresponds to a CV. Each CV determines the function key used to control that effect. Values 0-28 correspond to function keys F0-F28. A value of 255 will disable that effect.

0 = F0
1 = F1
↓
28 = F28
29-254 = Reserved
255 = Effect disabled

CVs 1.385-1.512: Effect Auxiliary Map Registers
Each effect corresponds to a CV. Each CV determines how the effect responds to direction and movement changes during operation, or if the effect is mapped to the emergency stop button.

Refer to the following page to view each effect and each corresponding CV.

Indexed CV Page 1

CVs 1.257-1.512: Extended Function Mapping CVs	
Effect Map Registers	**Effect Auxiliary Map Registers**
CV 1.257: Headlight	CV 1.385: Headlight
CV 1.258: Backup Light	CV 1.386: Backup Light
CV 1.259: FX3 Effect	CV 1.387: FX3 Effect
CV 1.260: FX4 Effect	CV 1.388: FX4 Effect
CV 1.261: FX5 Effect	CV 1.389: FX5 Effect
CV 1.262: FX6 Effect	CV 1.390: FX6 Effect
CVs 1.263-1.272: Reserved	CVs 1.391-1.400: Reserved
CV 1.273: Dimmer	CV 1.401: Dimmer
CV 1.274: Mute	CV 1.402: Mute
CV 1.275: Independent/Train Brake	CV 1.403: Independent/Train Brake
CV 1.276: Half-Speed	CV 1.404: Half-Speed
CV 1.277: Momentum Override	CV 1.405: Momentum Override
CV 1.278: Grade-Crossing Signal	CV 1.406: Grade-Crossing Signal
CV 1.279: Forward Whistle Signal	CV 1.407: Forward Whistle Signal
CV 1.280: Reverse Whistle Signal	CV 1.408: Reverse Whistle Signal
CV 1.281: Stop Whistle Signal	CV 1.409: Stop Whistle Signal
CV 1.282: Reserved	CV 1.410: Reserved
CV 1.283: Brake Select	CV 1.411: Brake Select
CV 1.284: Alternate Mixer	CV 1.412: Alternate Mixer
CV 1.285: RPM+	CV 1.413: RPM+
CV 1.286: RPM-	CV 1.414: RPM-
CVs 1.287-1.296: Reserved	CVs 1.415-1.424: Reserved
CV 1.297: Airhorn	CV 1.425: Airhorn
CV 1.298: Bell	CV 1.426: Bell
CV 1.299: Dynamic Brake	CV 1.427: Dynamic Brake
CV 1.300: Short Airhorn	CV 1.428: Short Airhorn
CV 1.301: Straight-to-Eight	CV 1.429: Straight-to-Eight
CV 1.302: General Service	CV 1.430: General Service
CV 1.303: HEP Mode	CV 1.431: HEP Mode
CV 1.304: Cab Chatter	CV 1.432: Cab Chatter
CV 1.305: Couple	CV 1.433: Couple
CV 1.306: Uncouple	CV 1.434: Uncouple
CV 1.307: Reserved	CV 1.435: Reserved
CV 1.308: Handbrake	CV 1.436: Handbrake
CV 1.309: Sander Valve	CV 1.437: Sander Valve
CV 1.310: Reserved	CV 1.438: Reserved
CV 1.311: All Aboard/Coach Doors	CV 1.439: All Aboard/Coach Doors
CV 1.312: Steam Generator	CV 1.440: Steam Generator
CV 1.313: Fuel Loading	CV 1.441: Fuel Loading
CVs 1.314-1.320: Reserved	CVs 1.442-1.448: Reserved
CV 1.321: E-Brake App.	CV 1.449: E-Brake App.
CVs 1.322-1.384: Reserved	CVs 1.450-1.512: Reserved

CVs 1.257-1.384: Effect Map Registers

Description

CVs 1.257-1.384 are used for mapping function keys F0-F28 to effects.

Bit 7							Bit 0
FK7	FK6	FK5	FK4	FK3	FK2	FK1	FK0

FK0-FK7: Function Key (F0-F28)
0 = F0
.
.
.
28 = F28
29-254 = Reserved
255 = Effect disabled

Additional Information

Setting CVs 1.257-1.384 to a value from 0 to 28 will map the designated effect to the corresponding F0-F28 function key. Values from 29-254 are reserved for future expansion. Setting CVs 1.257-1.384 to a value of 255 will disable function-control for the corresponding effect.

CV 57 (Forward Direction Enable) and CV 58 (Reverse Direction Enable) are used to determine the directionality of lighting outputs. Programming CVs 57 and 58 will control the directionality of the corresponding function key mapped to the given lighting output effect in CVs 1.257-1.262 (Physical Effect Map Registers). The headlight is enabled in the forward direction and the backup light is enabled in the reverse direction by default.

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Default Function Assignments			
F0-F28	**Effect**	**CV**	**Value**
F0(f)	Headlight	CV 1.257	0
F0(r)	Backup Light	CV 1.258	0
F1	Bell	CV 1.298	1
F2	Airhorn	CV 1.297	2
F3	Short Airhorn	CV 1.300	3
F4	Dynamic Brake	CV 1.299	4
F5	RPM+	CV 1.285	5
F6	RPM-	CV 1.286	6
F7	Dimmer	CV 1.273	7
F8	Mute	CV 1.274	8
F9	Grade-Crossing Signal	CV 1.278	9
F10	Straight-to-Eight	CV 1.301	10
F11	Independent/Train Brake	CV 1.275	11
F12	Brake Select	CV 1.283	12
F13	Couple	CV 1.305	13
F13	Uncouple	CV 1.306	13
F14	Half-Speed	CV 1.276	14
F14	Momentum Override	CV 1.277	14
F15	Handbrake	CV 1.308	15
F16	HEP Mode	CV 1.303	16
F17	Fuel Loading	CV 1.313	17
F18	General Service	CV 1.302	18
F19	Not Assigned	Not Assigned	19
F20	Steam Generator	CV 1.312	20
F21	Sander Valve	CV 1.309	21
F22	Cab Chatter	CV 1.304	22
F23	All Aboard/Coach Doors	CV 1.311	23
F24	FX3 Output	CV 1.259	24
F25	FX4 Output	CV 1.260	25
F26	FX5 Output	CV 1.261	26
F27	FX6 Output	CV 1.262	27
F28	Not Assigned	Not Assigned	28

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CVs 1.385-1.512: Effect Auxiliary Map Registers

Description

CVs 1.385-1.512 are used for configuring automatic effects and mapping an effect to the emergency stop button. A given effect can be configured to respond automatically to changes in direction (forward/reverse) and movement (driving/standing) during operation. The emergency stop button will perform the same utility irrespective of the effect mapped to it. CV 32 (CV Index 2) must be set to a value of 1 when accessing CVs 1.257-1.512.

Bit 7							Bit 0
0	0	0	ESTP	REVS	FWDS	REVD	FWDD

FWDD: Forward-Driving
0 = Effect activated by function key only
1 = Effect active when moving in forward direction

REVD: Reverse-Driving
0 = Effect activated by function key only
1 = Effect active when moving in reverse direction

FWDS: Forward-Standing
0 = Effect activated by function key only
1 = Effect active when stopped in forward direction

REVS: Reverse-Standing
0 = Effect activated by function key only
1 = Effect active when stopped in reverse direction

ESTP: Emergency Stop Button
0 = Emergency brake application sound effects (default)
1 = Effect mapped to emergency stop button

0: Reserved

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CVs 2.289-2.320: Alternate Mixer Volume Levels

Description

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 volume to alternate mixer channel volume levels in place of the primary mixer channel volume levels in CVs 129-160 (Primary Mixer Volume Levels).

Note: *To access 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 2.*

Bit 7							Bit 0
MIX7	**MIX6**	**MIX5**	**MIX4**	**MIX3**	**MIX2**	**MIX1**	**MIX0**

MIX0-MIX7: Alternate Mixer Channel Volume
0 = 0% volume
.
.
.
255 = 100% volume

Related CVs: CV 128 (Master Volume)
CVs 129-160 (Primary Mixer Volume Levels)

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CVs 2.289-2.320: Alternate Mixer Volume Levels		
CV	**Sound Effect**	**Default Value**
2.289	Airhorn	112
2.290	Bell	42
2.291	Prime Mover	75
2.292	Air Compressor	50
2.293	Dynamic Brake	62
2.294	Radiator Fans	37
2.295	Alarm Bell	30
2.296	Reserved	0
2.297	Coupler	64
2.298	Train Brake Apply/Release	64
2.299	Independent Brake Apply	50
2.300	Independent Brake Release	35
2.301	Reserved	0
2.302	Reserved	0
2.303	Poppet Valve	30
2.304	Steam Generator	25
2.305	Cab Doors	64
2.306	Reserved	0
2.307	Relay Clicks	64
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	Reserved	0
2.313	Clickety-Clack	75
2.314	Sander Valve	5
2.315	Fuel Loading	25
2.316	Air Conditioner	10
2.317	Wrenches	25
2.318	Pneumatic Oilers	20
2.319	Toilet Flush	10
2.320	Cab Chatter	30

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CVs 2.503-2.512: DDE Control CVs

Description

CVs 2.503-2.512 are used to adjust parameters of the Dynamic Digital Exhaust (DDE) processor. Configuring DDE CVs allows the engine exhaust sound effects to be modified in response to motor load and/or speed during operation.

Note: *To access 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 2.*

CV 2.503: DDE Load Offset

Description

The value of CV 2.503 determines the minimum load required by the motor to move the model.

Bit 7							Bit 0
D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**

D0-D7: DDE Load Offset

Additional Information

Entering values from 1 to 254 into CV 2.503 will set the DDE load offset. Increasing the value in CV2.503 will modify the operation of the DDE processor such that the locomotive will sound like it is under a lighter load. Decreasing the value in CV 2.503 will modify the DDE processor such that the locomotive will sound like it is under a heavier load.

Entering a value of 255 into CV 2.503 will tell the DDE processor that the locomotive is currently operating under a ‘no-load’ condition. Use the following steps:

1. Set the throttle to speed-step 1.
2. Ensure the locomotive is running on level track (with no external loads, such as rolling stock), then enter a value of 255 into CV 2.503.

After setting CV 2.503 to 255, the CV will be reprogrammed with a value corresponding to the measured load.

CV 2.512 (DDE Load Sensitivity) is set to 0 by default. In order to hear the changes made to CV 2.503, CV 2.512 must be set to a non-zero value (ex., 32).

Default Value: 60
Related CVs: CV 128 (Master Volume)
CVs 129-160 (Primary Mixer Volume Levels)
CVs 2.503-2.512 (DDE Control CVs)

CV 2.504: DDE Load Slope

Description

The value of CV 2.504 determines the load required to increase the speed of the motor.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Load Slope

Additional Information

Increasing the value in CV2.504 will modify the operation of the DDE processor such that the locomotive will sound like it is under a lighter load. Decreasing the value in CV 2.504 will modify the DDE processor such that the locomotive will sound like it is under a heavier load.

Entering a value of 255 into CV 2.504 will tell the DDE processor that the locomotive is currently operating under a 'no-load' condition. Use the following steps:

1. Increase the throttle to a moderate speed for your layout (generally between speed-step 25 and speed-step 40).
2. Ensure the locomotive is running on level track (with no external loads, such as rolling stock), then enter a value of 255 into CV 2.504.

After setting CV 2.504 to 255, the CV will be reprogrammed with a value corresponding to the measured load.

CV 2.512 (DDE Load Sensitivity) is set to 0 by default. In order to hear the changes made to CV 2.504, CV 2.512 must be set to a non-zero value (ex., 32).

Default Value: 150
Related CVs: CV 128 (Master Volume)
CVs 129-160 (Primary Mixer Volume Levels)
CVs 2.503-2.512 (DDE Control CVs)

CV 2.507: DDE Prime Mover Low Volume Limit

Description

CV 2.507 is used to determine the maximum attenuation level of the prime mover sound effect when the motor is operating at light loads. The prime mover low volume limit setting will be added to the corresponding mixer channel setting.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Prime Mover Low Volume Limit
0 = 0dB
1 = -0.047dB
.
.
.
255 = -12dB

Default Value: 0
Related CVs: CV 128 (Master Volume)
CVs 129-160 (Primary Mixer Volume Levels)
CVs 2.503-2.512 (DDE Control CVs)

CV 2.508: DDE Prime Mover High Volume Limit

Description

CV 2.508 is used to determine the maximum amplification level of the prime mover sound effect when the motor is operating at high loads. The prime mover high volume limit setting will be added to the corresponding mixer channel setting.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Prime Mover High Volume Limit
0 = 0dB
1 = +0.047dB
.
.
.
255 = +12dB

Default Value: 255
Related CVs: CV 128 (Master Volume)
CVs 129-160 (Primary Mixer Volume Levels)
CVs 2.503-2.512 (DDE Control CVs)

CV 2.509: DDE Attack Time Constant

Description

CV 2.509 is used to determine the DDE attack time constant, i.e., how quickly sound effects are modified in response to speed changes. CV 2.509 determines the duration (ms) that elapses from the time the decoder receives a new throttle command to the time the DDE processor begins to reshape the audio signal. Longer response times (lower values) may help to 'smooth out' the DDE response.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Attack Time Constant
0 = Quickest response time
.
.
.
.
255 = Slowest response time

Default Value: 215
Related CVs: CVs 2.503-2.512 (DDE Control CVs)

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CV 2.510: DDE Release Time Constant

Description

CV 2.510 is used to determine the DDE release time constant, i.e., how quickly sound effects are modified in response to speed changes. CV 2.510 determines the duration (ms) that elapses from the time the DDE processor begins to reshape the audio signal (after receiving a new throttle command) to the time sound effects have been modified accordingly. Longer response times (lower values) may help to 'smooth out' the DDE response.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Release Time Constant
0 = Quickest response time
.
.
.
.
255 = Slowest response time

Default Value: 215
Related CVs: CVs 2.503-2.512 (DDE Control CVs)

CV 2.511: DDE Throttle Sensitivity

Description

CV 2.511 is used to adjust the correlation between the throttle setting and speed-related sound effects. When the decoder has momentum programmed, this CV sets how much the load signal is affected by the model accelerating/decelerating.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Throttle Sensitivity
0 = Disabled
1 = Minimum sensitivity
.
.
.
255 = Maximum sensitivity

Additional Information

Setting CV 2.511 to 0 will disable DDE throttle sensing. Setting CV 2.511 to 255 indicates that the cadence and volume of speed-related sound effects will be most sensitive to the throttle setting.

Default Value: 10
Related CVs: CVs 2.503-2.512 (DDE Control CVs)

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CV 2.512: DDE Load Sensitivity

Description

CV 2.512 is used to adjust the correlation between the throttle setting and motor load sensing. When the decoder has momentum programmed, this CV sets how much the load signal is affected by the model accelerating/decelerating.

Bit 7							Bit 0
D7	D6	D5	D4	D3	D2	D1	D0

D0-D7: DDE Load Sensitivity
0 = Disabled
1 = Minimum sensitivity
.
.
.
255 = Maximum sensitivity

Additional Information

Setting CV 2.512 to 0 will disable DDE load sensing and sound effects will not be modified in response to changes in motor load. Setting CV 2.512 to 255 indicates that the sound and motor responses will be most sensitive to changes in load.

Default Value: 0
Related CVs: CVs 2.503-2.512 (DDE Control CVs)

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CV 3.257: Clickety-Clack Configuration

Description

CV 3.257 is used to set the number of axles per truck and number of trucks per car for the clickety-clack sound effect. CV 3.257 determines the frequency of the clickety-clack sound effect and allows you to simulate various locomotives and rolling stock.

Note: *To access Indexed CV Page 3 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 3.*

Bit 7							Bit 0
0	**0**	**0**	**0**	**TR1**	**TR0**	**AX1**	**AX0**

AX0-AX1: Axles per Truck
01 = 2 axles per truck
10 = 3 axles per truck

TR0-TR1: Trucks per Car
00 = 1 truck per car
01 = 2 trucks per car

0: Reserved

Default Value: 5
Related CVs: CV 3.258 (Clickety-Clack Sound Scalar)

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CV 3.258: Clickety-Clack Sound Scalar

Description

CV 3.258 is used to set the frequency of the clickety-clack sound effect. The value of CV 3.258 determines the proportion between the speed step and the scale speed (feet per second) used to configure the frequency of the clickety-clack sound effect.

Note: *To access Indexed CV Page 3 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 3.*

Bit 7							Bit 0
SS7	SS6	SS5	SS4	SS3	SS2	SS1	SS0

SS0-SS7: Clickety-Clack Sound Scalar

Additional Information

Higher values indicate higher scale speeds and increase the frequency of the clickety-clack sound effect. Entering a value from 1 to 255 into CV 3.258 will adjust the clickety-clack frequency from 0.01ft/s to 2ft/s. Scale speed (ft/s) is calculated as:

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

Entering a value of 0 into CV 3.258 will disable the clickety-clack effect.

Default Value: 180
Related CVs: CV 3.257 (Clickety-Clack Rate)