Econami Digital Sound Decoder

Steam Technical Reference

Software Release 1.3**

** Previous software versions included

Rev. D 11/13/2015

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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: Not used

Additional Information

Setting CV 1 to a value from 1 to 127 will determine the primary address.

The decoder processes 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.

Setting CV 1 to a new value will automatically set CV 19 (Consist Address) to 0 and set bit 5 of CV 29 to 0.

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)

CV 2: Vstart

Description

CV 2 is used to determine 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

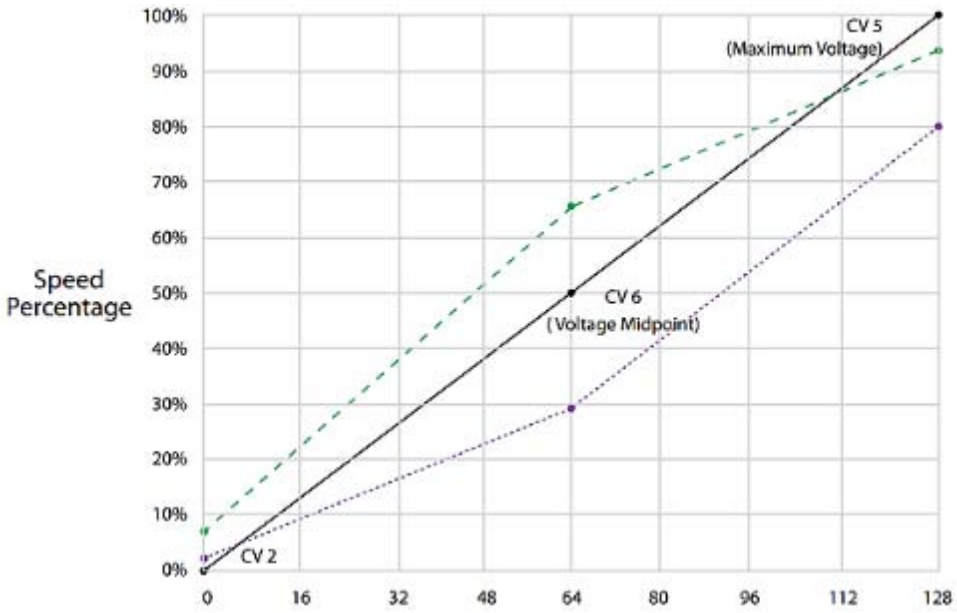
Additional Information

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

Starting voltage is calculated as:

Starting Voltage = Supply Voltage × CV 2 ÷ 255

As speed increases, the decoder will offset all points of the speed curve when CV 2 is set to a non-zero value. Illustrated below, CV 2 is used in conjunction with CV 5 (Vhigh) and CV 6 (Vmid) to configure a 3-point speed curve:



Default Value: 0
Related CVs: CV 5 (Vhigh)
CV 6 (Vmid)

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

Setting CV 3 to value from 0 to 255 will adjust the acceleration rate.

Acceleration is calculated as:

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

When CV 3 is set to 0, acceleration and active sound effects regulated by speed will respond instantly to increases in the throttle setting. When CV 3 is set to 255, the decoder will accelerate from a stop to full speed in approximately 3.8 minutes.

Setting CV 3 to a non-zero value when using 14 or 28 speed-step mode is recommended to 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

A value from 0 to 255 may be entered into CV 4 to adjust the deceleration rate.

Deceleration is calculated as:

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

When CV 4 is set to 0, deceleration and active sound effects regulated by speed will respond instantly to decreases in the throttle setting. When CV 4 is set to 255, the decoder will decelerate from full speed to a stop in approximately 3.8 minutes.

Setting CV 4 to a non-zero value when using 14 or 28 speed-step mode is recommended to 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 (F11 Brake Rate)

CV 5: Vhigh

Description

CV 5 is used to determine the voltage level applied to the motor at maximum speed.

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. Setting CV 5 to a value from 0 to 255 will adjust the voltage applied to the motor at maximum speed.

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 setting voltage to the maximum available voltage (100%).

Default Value: 0
Related CVs: CV 2 (Vstart)
CV 6 (Vmid)

CV 6: Vmid

Description

CV 6 is used to determine the voltage level applied to the motor at the middle speed step.

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. Setting CV 6 to a value from 0 to 255 will adjust the voltage applied to the motor at the middle speed step.

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 voltage setting to the maximum available voltage (100%).

Default Value: 0
Related CVs: CV 2 (Vstart)
CV 5 (Vhigh)

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

70 = Econami Decoder for Steam, Diesel, and Electric

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 = Not used
- 12 = Reset CVs 1.257-1.512 (Index Page 1)
- 13 = Reset CVs 2.257-2.512 (Index Page 2)

Manufacturer ID Code: 141

CV 10: EMF Feedback Cutout

Description

CV 10 is used to gradually reduce the effect of the 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

Entering a value from 1 to 127 into CV 10 determines the speed step at which the amount of back-EMF control is reduced to zero. Entering a value from 129 to 255 into CV 10 decreases the amount of back-EMF control according to the CV 212 back-EMF intensity setting. Entering a value of 0 or 128 will set CV 10 to 0. Values from 129-255 indicate 0-50% of the back-EMF intensity setting.

This is calculated as:

Full Speed BEMF Intensity = (CV 212 – 128) ÷ 128

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 adjust the duration occurring between each valid packet the decoder receives and determines the interval at which sound effects regulated by speed are automatically disabled.

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 determines 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 and 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 broadcast address packet, or another valid packet carrying an address that matches the decoder's active address (primary, extended, or consist).

In the event no valid packets are received during the time-out period, the decoder will deactivate all speed-related sound effects and all motor processes according to the deceleration rate determined by 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 determine the alternate power source the decoder will employ 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: Not used

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 corresponding F1-F8 functions mapped in CVs 1.257-1.384 and/or CVs 33-46 for analog mode operation.

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

Default Value: 0
Related CVs: CV 14 (Analog Mode Function Enable 2)
CV 33-46 (Function Status CVs)
CV 214 (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 in conjunction with CVs 1.257-1.384 (Effect Map Registers) and/or CVs 33-46 (Function Status CVs) to enable functions F0(f), F0(r), and F9-F12 for analog mode operation.

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: Not used

Additional Information

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

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

Default Value: 0
Related CVs: CV 13 (Analog Mode Function Enable 1)
CV 33-46 (Function Status CVs)
CV 214 (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: Not used

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 and 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: Not used

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 to enable the lock feature in CVs 15 and 16.*

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

Although most command stations only recognize addresses 0000-9999, 10,179 extended addresses exist (0xC000-0xE7FF).

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 setting CV 18. The decoder will ignore attempts to program these registers out-of-order or with values outside of the allowable range.

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 and a primary address is active within CV 1.

Example:

To determine the extended address:

1. Add a four-digit address to 49,152.
2. Divide the sum by 256.
3. Set CV 17 to the quotient.
4. Set CV 18 to the remainder.

Determine the value for address 7152:

1. 7,152 + 49,152 = 56,304
2. 56,304 ÷ 256 = 219 R 240 (240 = remainder)
3. Set CV 17 to 219.
4. Set CV 18 to 240.

Note: *Most command stations perform these calculations automatically when the extended address is being set. The information shown above for calculating appropriate register values have been provided for reference.*

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. Bit 7 (CDIR) is used to determine direction for consist operation. Setting bit 7 will invert direction.

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

The decoder will process valid commands 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 about 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 notably useful for distinguishing various engines and cars within the same consist. Setting a given bit to 1 will enable the active corresponding F1-F8 function assignment for advanced consist operation. Econami's default function assignments are remapped using CVs 1.257-1.384 and/or CVs 33-46.

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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 about 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: Not used

Additional information
CV 22 is notably useful for distinguishing the lead engine's headlight and backup light functions from other units within the consist. Setting a given bit to 1 will enable the active corresponding function assignment for advanced consist operation. Econami's default function assignments are remapped using CVs 1.257-1.384 and/or CVs 33-46.

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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 in conjunction with CV 3 (Baseline Acceleration Rate) to set the decoder's consist acceleration offset. The consist address must be active within CV 19 for acceleration and deceleration rates to be valid.

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

Bits 0-6 are used to adjust the consist acceleration rate and bit 7 (SIGN) is used to determine whether the value will increase or decrease the consist acceleration rate from the baseline acceleration rate. A value from 0 to 255 may be entered into CV 23 to set the consist acceleration rate. Furthermore, values from 0 to 255 are interpreted by the decoder as -127 to +127 and increase or decrease the baseline acceleration rate to create the consist acceleration offset:

0 to 127 = 0 to +127
128 to 255 = 0 to -127

Acceleration is calculated as:

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

The decoder will respond instantly to throttle changes when CV 23 is equal to a value of 0 or 128, or when the sum of CVs 3 and 23 is equal to a negative value.

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 in conjunction with CV 4 (Baseline Deceleration Rate) to set the decoder's consist deceleration offset. The consist address must be active within CV 19 for acceleration and deceleration rates to be valid.

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

Bits 0-6 are used to adjust the consist deceleration rate and bit 7 (SIGN) is used to determine whether the value will increase or decrease the consist deceleration rate from the baseline deceleration rate. A value from 0 to 255 may be entered into CV 24 to set the consist deceleration rate. Furthermore, values from 0 to 255 are interpreted by the decoder as -127 to +127 and increase or decrease the baseline deceleration rate to create the consist deceleration offset:

0 to 127 = 0 to +127
128 to 255 = 0 to -127

Deceleration is calculated as:

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

The decoder will respond instantly to throttle changes when CV 24 is equal to a value of 0 or 128, or when the sum of CVs 4 and 24 is equal to a negative value.

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 to select the 28-point custom speed table in place of a linear or 3-point speed curve.

Bit 7							Bit 0
0	**0**	**0**	**28PT**	**0**	**0**	**3PT**	**LIN**

LIN: Linear speed table enable
0 = 3-point/linear/28-point speed table enabled
1 = Linear speed table enabled

3PT: 3-point speed table enable (CVs 2, 5, and 6)
0 = Linear/28-point speed table enabled
1 = Linear/3-point speed table enabled

28PT: 28-point custom speed table enable (CVs 67-94)
0 = Linear/3-point speed table enabled
1 = 28-point speed table enabled

0: Not used

Additional Information

Any value from 0 to 255 entered into CV 25 not equal to 2 or 16 will enable the linear speed table. When bit 4 of CV 29 (Configuration Data 1) is set to 1, setting CV 25 to 16 will allow the 28-point custom speed table to be used in place of a linear or 3-point speed table. CVs 67-94 can then be used to adjust the 28-point speed table (when CV 25 = 16 and bit 4 of CV 29 is set to 1).

Setting CVs 2, 5, and 6 to non-zero values when bit 4 of CV 29 is set to 0 and CV 25 is set to 2 (default) will enable the 3-point speed table.

The decoder uses a linear speed table by default, i.e., when bit 4 of CV 29 is set to 0, the values of CVs 2, 5, and 6 are 0, and CV 25 is set to 2, speed will respond instantly to throttle changes and voltage is distributed with no variation in a straight line.

Default Value: 2
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 (when CV 12 = 1)

STE: Speed Table Enable
0 = Linear speed curve/3-point speed table (CVs 2, 5, and 6)
1 = 28-point speed table (CV 25 and CVs 67-94)

EAM: Extended Address Mode Enable
0 = Primary address enabled/set with CV 1
1 = Extended address enabled/set with CVs 17 and 18

0: Not used

Additional Information
Setting bit 0 (DIR) will invert direction.

Setting bit 1 (F0) to 0 will enable 14 speed-step mode.

Setting bit 1 to 1 will enable 28/128 speed-step mode.

When bit 2 (APS) of CV 29 is set to 1 and CV 12 (Alternate Power Source) is equal to a value of 1, a DC alternate power source will be used when a DCC signal is not present.

When CV 25 (Speed Table Enable) is set to a value of 16, setting bit 4 (STE) of CV 29 to 1 will enable the 28-point custom speed table in place of a linear or 3-point speed table. CVs 67-94 can then be used to configure each speed point within the table. When bit 4 of CV 29 is set to 0, setting CVs 2, 5, and 6 to non-zero values will enable a 3-point speed table.

The decoder uses a linear speed table by default, i.e., when CV 25, bit 4 of CV 29, and CVs 2, 5, and 6 are all set to 0, speed will respond instantly to throttle changes and voltage will be distributed with no variation in a straight line.

Setting bit 5 (EAM) will allow the decoder to recognize the extended address configured within CVs 17 and 18. All primary address commands will be ignored when the extended address is active.

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 and set by CV 15 and CV 16

0: Not used

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

CV 31: CV Index 1 (Read-Only)

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 has been preprogrammed to a value of 16 to enable indexed CV operation, as determined by CV 32. CV 31 is read-only and cannot be modified.

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

D0-D7: CV Index MSB
16 = Indexed address (read-only)

Related CVs: CV 32 (CV Index 2)

CV 32: CV Index 2

Description

CV 32 is used for selecting the active indexed CV page and provides access to CVs exceeding CV 256.

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

D0-D7: CV Index LSB
0 = Not used (NMRA-reserved)
1 = Indexed CV Page 1 (CVs 1.257-1.512) selected
2 = Indexed CV Page 2 (CVs 2.505-2.511) selected

3-255 = Not used

Additional Information
Econami supports two indexed CV pages:

1. Index CV Page 1: CVs 1.257-1.512 (Extended Function Mapping CVs)

   Setting CV 32 to a value of 1 (default) will select Indexed CV Page 1 as the active indexed CV page. When Indexed CV Page 1 is selected, CVs 1.257-1.512 can be used for mapping function keys F0-F28 to any effect and for configuring auto-effects.

2. Index CV Page 2: CVs 2.505-2.511 (DDE Control CVs)

   Setting CV 32 to a value of 2 will select Indexed CV Page 2 as the active indexed CV page. When Indexed CV Page 2 is selected, CVs 2.505-2.511 can be used to adjust parameters of the Dynamic Digital Exhaust processor.

Setting CV 32 to values not equal to 1 or 2 will cause the decoder to ignore commands sent to CVs exceeding CV 256.

Default Value: 1
Related CVs: CV 31 (CV Index 1)
CVs 1.257-1.512 (Extended Function Mapping CVs)
CVs 2.505-2.511 (DDE Control CVs)

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, offer a secondary method of function mapping, and are not used to determine Econami's default function assignments.*

CVs 1.257-1.512 (Extended Function Mapping CVs) provide default function assignments for 28 function keys and offer comprehensive function mapping support for all of Econami'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.

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.

Function Output Map

Function Key	CV	HL Output	BL Output	Whistle	Bell	FX3 Output	FX4 Output	Dynamo	Short Whistle	Cylinder Cocks	Water Stop	Dimmer	Mute	Reserved	Reserved	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
SWH	**DYN**	**FX4**	**FX3**	**BEL**	**WH**	**BL**	**HL**

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

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

WH: Whistle
0 = Whistle disabled
1 = Whistle 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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle 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
SWH	**DYN**	**FX4**	**FX3**	**BEL**	**WH**	**BL**	**HL**

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

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

WH: Whistle
0 = Whistle disabled
1 = Whistle 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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle 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
SWH	**DYN**	**FX4**	**FX3**	**BEL**	**WH**	**BL**	**HL**

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

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

WH: Whistle
0 = Whistle disabled
1 = Whistle 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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle 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
SWH	**DYN**	**FX4**	**FX3**	**BEL**	**WH**	**BL**	**HL**

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

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

WH: Whistle
0 = Whistle disabled
1 = Whistle 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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle 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	**WS**	**CYL**	**SWH**	**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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

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	**WS**	**CYL**	**SWH**	**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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

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	**WS**	**CYL**	**SWH**	**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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

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	**WS**	**CYL**	**SWH**	**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: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

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
0	**0**	**MUT**	**DIM**	**WS**	**CYL**	**SWH**	**DYN**

DYN: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

0: Not used

Default Value: 0

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
0	**0**	**MUT**	**DIM**	**WS**	**CYL**	**SWH**	**DYN**

DYN: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

0: Not used

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
0	**0**	**MUT**	**DIM**	**WS**	**CYL**	**SWH**	**DYN**

DYN: Dynamo
0 = Dynamo disabled
1 = Dynamo enabled

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

0: Not used
Default Value: 0

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	**0**	**0**	**MUT**	**DIM**	**WS**	**CYL**	**SWH**

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

CPL: Coupler
0 = Coupler disabled
1 = Coupler enabled

0: Not used

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	**0**	**0**	**MUT**	**DIM**	**WS**	**CYL**	**SWH**

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

CPL: Coupler
0 = Coupler disabled
1 = Coupler enabled

0: Not used

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	**0**	**0**	**MUT**	**DIM**	**WS**	**CYL**	**SWH**

SWH: Short Whistle
0 = Short whistle disabled
1 = Short whistle enabled

CYL: Cylinder Cocks
0 = Cylinder cocks disabled
1 = Cylinder cocks enabled

WS: Water Stop
0 = Water stop disabled
1 = Water stop enabled

DIM: Dimmer
0 = Dimmer disabled
1 = Dimmer enabled

MUT: Mute
0 = Mute disabled
1 = Mute enabled

CPL: Coupler
0 = Coupler disabled
1 = Coupler enabled

0: Not used

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
14 = Smart firebox flicker
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 = Reserved
23 = Ash pan flicker
24 = Reserved
25 = Single-flash strobe 2

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: The output set to the dimmable headlight will be reduced to 60% brightness when you turn on the F7 dimmer function.

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

Pyle-National Gyralite: The Pyle-National Gyralite follows a wide, oval sweep pattern that oscillates at a slower rate than the Mars Light.

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 emits a concentrated flash of light that pulses once per timing cycle. The xenon single-flash strobe 2 emits the same flash of light as the single-flash strobe 1 effect and pulses once per timing cycle at a slightly different flash rate. Configuring each single-flash strobe effect to a function output will allow strobes 1 and 2 to flash in and out of sequence. CV 59 (Hyperlight Flash Rate) is used to modify the flash rate timing cycle.

Double-Flash Strobe: The xenon double-flash strobe effect emits two rapid flashes of light once per timing cycle. CV 59 (Hyperlight Flash Rate) is used to modify the 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 a new version of the rotary beacon. Four individual lamps are arranged in a circular pattern and flash electronically in the clockwise direction. The Stratolite flashes in a mechanical “stepped” fashion, unlike the smooth motion of the rotary beacon.

Type I and Type II Ditch Lights
Both types of ditch lights are identical when operating normally. However, if the Grade-Crossing Logic is activated, type I ditch light will revert to a steady “on” state when it’s not flashing, and type II will turn off.

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.

Smart Firebox Flicker: The smart firebox flicker effect slowly flickers from 25 to 100% brightness to simulate a fire in the firebox.

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

Auto-Dim Forward and Reverse: Setting CV 49 (Headlight Configuration) to the auto-dim forward effect will automatically dim the headlight when the locomotive is in the forward direction. Setting CV 50 (Backup Light Configuration) to the auto-dim reverse effect will automatically dim the backup light when the locomotive is in the reverse direction.

Brake Light: The brake light effect is automatically dimmed to the setting in CV 63. However, the brightness level of the brake light returns to 100% when you press the F11 brake function.

Brightness Register 1: In order to adjust the brightness level of a lighting output, first set any CV from 49 to 54 to the on/off brightness 1 effect. Then, enter a value from 0 to 255 into CV 61 to adjust the brightness level of the corresponding output from 0 to 100%.

Brightness Register 2: In order to adjust the brightness level of a second lighting output, first set any CV from 49 to 54 to the on/off brightness 2 effect. Then, enter a value from 0 to 255 into CV 62 to adjust the brightness level of the corresponding output from 0 to 100%.

Emergency Gyralite: The emergency Gyralite follows the same oscillating sweep pattern as the Gyralite, and automatically disables all other active lighting effects when turned on.

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

Phase Offset: Setting bit 5 (PHSE) will change the corresponding lighting output from Phase A to Phase B.

Grade-Crossing Logic: When enabled, the lighting effects listed in the adjacent table assume a flashing state while the crossing timer counts down. All effects revert to either an “on” or “off” state when the countdown has ended. Set bit 6 (XING) to 1 of any lighting effect CV to enable Grade-Crossing Logic. After it has been enabled, press F2 to blow the whistle as the locomotive approaches a crossing. The bell will ring and lighting effects will switch to a flashing state while the crossing hold timer counts down. When Grade-Crossing Logic is enabled, the crossing hold timer is reset and counts down every time the F2 whistle function key is pressed. The duration of the countdown can be set from 0 to 15 seconds by entering a value from 0 to 15 into CV 60 (Grade-Crossing Hold Time).

Grade-Crossing Logic	
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	Off
Ditch Light II	On
FRED	Off

LED Compensation Mode: LED Compensation Mode alters the method of sending current to the LED to balance the LED and incandescent brightness levels. Setting bit 7 to 1 of any CV from 49 to 54 adjusts the corresponding lighting output to correct the differing electro-optical properties of an LED in comparison to an incandescent bulb.

Note: *Resistors may still be necessary depending on the board format.*

Default Value: CV 49 = 1
CV 50 = 1
CVs 51-54 = 0
Related CVs: CVs 57-63 (Lighting Effect CVs)

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 outputs.

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: Not used

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 effects 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)

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.

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: Not used

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 effects 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 = Maximum flash rate
.
.
.
15 = Minimum flash rate

0: Not used

Default Value: 2
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: Not used

Additional Information

The countdown will occur when the whistle function (F2 by default) is pressed 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 any output 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 any output 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)

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: *This feature can only be enabled when CV 25 (Speed Table Enable) is set to a value of 16 and bit 4 (STE) of CV 29 (Configuration Data 1) is set to 1 to enable the 28-point custom speed table.*

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)

CVs 67-94: Custom Speed Table

Description

CVs 67-94 are used to set 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
Enable the 28-point custom speed table by setting CV 25 (Speed Table Enable) to a value of 16 and bit 4 (STE) of CV 29 (Configuration Data 1) to 1. Values from 0 to 255 may be entered into CVs 67-94 to set each speed step from 0 to 100% of the maximum throttle setting. Indicated in the adjacent table, a linear speed curve is the default setting for the 28-point speed table.

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: *This feature can only be enabled when CV 25 (Speed Table Enable) is set to a value of 16 and bit 4 (STE) of CV 29 (Configuration Data 1) is set to 1 to enable the 28-point custom speed table.*

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 provides storage for user-supplied data, such as date of purchase, serial numbers, spouse's birthday, etc. 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)

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, such as date of purchase, serial numbers, spouse's birthday, etc. 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)

CV 112: Sound Configuration 1

Description

Select 2-cylinder (default), 3-cylinder*, or articulated chuffs with CV 112. Furthermore, enabling articulated exhaust with an articulated wheel-slip mode will allow the front and rear wheels to fall in and out of sequence during operation. Values used to select the exhaust type have been represented below in decimal and binary formats.

Bit 7							Bit 0
ARTEX	**WSLP1**	**WSLP0**	**3CYL**	**0**	**0**	**0**	**0**

Decimal values for CV 112 are defined as follows:

Bit 0-Bit 7: Articulated Exhaust and Wheel-Slip Mode Enable
- 0 = 2-cylinder exhaust enabled (default)
- 16 = 3-cylinder exhaust enabled
- 128 = Articulated exhaust enabled with wheel-slip disabled
- 160 = Articulated exhaust enabled with slow wheel-slip rate
- 192 = Articulated exhaust enabled with medium wheel-slip rate
- 224 = Articulated exhaust enabled with fast wheel-slip rate

Binary values for bits 4-7 are defined as follows:

3CYL: 3-Cylinder Exhaust Enable
- 0 = Disabled
- 1 = 3-cylinder exhaust enabled

WSLP0-WSLP1: Articulated Wheel-Slip Mode Select
- 00 = Disabled (default)
- 01 = Slow wheel-slip rate
- 10 = Medium wheel-slip rate
- 11 = Fast wheel-slip rate

ARTEX: Articulated Exhaust Enable
- 0 = Disabled
- 1 = Articulated exhaust enabled

0: Not used

Additional Information

2-cylinder exhaust is enabled by default and allows the decoder to produce four chuffs every wheel rotation. Enabling 3-cylinder exhaust will allow the decoder to produce six chuffs every wheel rotation. Enabling articulated exhaust will allow the decoder to produce eight chuffs every wheel rotation, and enabling an articulated wheel-slip mode will offset the chuff cadence.

Default Value: 0
Related CVs: CVs 112-199 (Sound Control CVs)

* Not included in software releases prior to version 1.3

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 = 0.25 seconds
.
.
.
255 = 63.75 seconds

Additional Information
The time-out period is calculated as:

Time-Out Period = CV 113 × 0.25

Default Value: 0
Related CVs: CVs 112-199 (Sound Control CVs)

CV 114: Engine Exhaust Control

Description

CV 114 is used to adjust the cadence of the automatic exhaust chuff sound effect.

Bit 7							Bit 0
EX7	**EX6**	**EX5**	**EX4**	**EX3**	**EX2**	**EX1**	**EX0**

EX0-EX7: Auto-Exhaust Chuff Rate
0 = Auto-Exhaust disabled
1 = Slowest chuff rate
.
.
.
255 = Fastest chuff rate

Additional Information

Entering a value from 1 to 255 will adjust the chuff rate of the automatic exhaust sound effect to simulate various drive wheel sizes.

Default Value: 57
Related CVs: CVs 112-199 (Sound Control CVs)

CV 117: F11 Brake Rate

Description

CV 117 is used to set the F11 brake deceleration offset that occurs when the F11 brake function is turned on. The F11 brake rate is adjusted in relation to CV 4 (Baseline Deceleration Rate).

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

D0-D6: F11 Brake Rate Value

SIGN: Sign
0 = Positive value
1 = Negative value

Additional Information

Bits 0-6 are used to adjust the F11 brake rate and bit 7 (SIGN) is used to determine whether the value will increase or decrease the deceleration rate from the baseline deceleration rate. A value from 0 to 255 may be entered into CV 117 to set the F11 brake rate. Furthermore, values from 0 to 255 are interpreted by the decoder as -127 to +127 and increase or decrease from the baseline deceleration rate to create the F11 brake deceleration offset:

0 to 127 = 0 to +127
128 to 255 = 0 to -127

Setting CV 117 to a value of 0 or 128 will disable the brake function. The F11 brake rate is calculated as:

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

Default Value: 0
Related CVs: CV 4 (Baseline Deceleration 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 speed step (absolute) or a percentage of maximum speed (proportional).

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

MRS: Max Recovery Speed

0 = Disabled
1 = Absolute limiting: speed-step 1
.
.
.
127 = Absolute limiting: speed-step 127
128 = Disabled
129 = Proportional limiting: 0% of maximum speed
.
.
.
255 = Proportional limiting: 100% of maximum speed

Additional Information

Values 1-127 and 129-255 determine whether the max engine recovery speed is defined as absolute or proportional:

Absolute Limiting: Entering a value from 1 to 127 will designate the recovery speed as a fixed speed step from 1 to 127.

Proportional Limiting: Entering a value from 129 to 255 will designate the recovery speed as a percentage (0-100%) of the maximum speed according to the following calculation:

% of Max Speed = (CV 119 − 128) ÷ 127

A value of 0 or 128 indicates that CV 119 is disabled and the motor will immediately resume the prior speed setting after power losses.

Default Value: 204
Related CVs: CVs 209-218 (Advanced Motor Control CVs)

CV 120: Whistle Select

Description

CV 120 is used to select one of 16 whistle sound effects that will be activated with the long and short whistle functions (F2 and F3 by default). For a list of whistle sound effects and corresponding values, refer to the packaging or the *Econami Steam Sound Effect Reference.*

Bit 7							Bit 0
0	**0**	**0**	**0**	**WS3**	**WS2**	**WS1**	**WS0**

WS0-WS3: Whistle Select
0 = Whistle 1
.
.
.
15 = Whistle 16

0: Not used

Default Value: 0
Related CVs: CV 121 (Auxiliary Whistle Select)
CV 129 (Whistle Mixer Channel Volume Control)

CV 121: Auxiliary Whistle Select

Description

CV 121 is used for selecting one of 16 alternate whistle sound effects.

Bit 7							Bit 0
0	**0**	**0**	**AW4**	**AW3**	**AW2**	**AW1**	**AW0**

AW0-AW4: Auxiliary Whistle Select
0 = Alternate whistle disabled
1 = Alternate whistle 1
.
.
.
16 = Alternate whistle 16

0: Not used

More Information

Bits 0-3 (AW0-AW3) are used to select the alternate whistle sound effect activated by the long (F2 by default) and short (F3 by default) whistle functions. When the alternate whistle is enabled and the short whistle function is turned off, the long whistle function is used to activate the whistle sound effect. When the alternate whistle is enabled and the short whistle function is turned on, the long whistle function is used to activate the alternate whistle sound effect.

Default Value: 0
Related CVs: CV 120 (Whistle Select)
CV 129 (Whistle Mixer Channel Volume Control)

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. For a list of bell sound effects and corresponding values, refer to the packaging or the *Econami Steam Sound Effect Reference.*

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

BS0-BS2: Bell Select
- 0 = Bell 1: slow
- 1 = Bell 1: medium-slow
- 2 = Bell 1: medium
- 3 = Bell 1: medium-fast
- 4 = Bell 1: fast
- 5 = Bell 2: slow
- 6 = Bell 2: medium-slow
- 7 = Bell 2: medium
- 8 = Bell 2: medium-fast
- 9 = Bell 2: fast
- 10 = Bell 3: slow
- 11 = Bell 3: medium-slow
- 12 = Bell 3: medium
- 13 = Bell 3: medium-fast
- 14 = Bell 3: fast
- 15 = Bell 4: slow
- 16 = Bell 4: medium-slow
- 17 = Bell 4: medium
- 18 = Bell 4: medium-fast
- 19 = Bell 4: fast
- 20 = Bell 5: slow
- 21 = Bell 5: medium-slow
- 22 = Bell 5: medium
- 23 = Bell 5: medium-fast
- 24 = Bell 5: fast
- 25 = Bell 6: slow
- 26 = Bell 6: fast

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

0: Not used

Default Value: 2
Related CVs: CV 130 (Bell Mixer Channel Volume Control)

CV 123: Exhaust Select

Description

CV 123 is used to select one of four exhaust chuff sound effects.

Bit 7							Bit 0
0	**0**	**0**	**0**	**0**	**0**	**EX1**	**EX0**

EX0-EX1: Exhaust Select
- 0 = Light
- 1 = Medium
- 2 = Heavy
- 3 = Geared

0: Not used

Default Value: 0
Related CVs: CV 131 (Exhaust Chuff Mixer Channel Volume Control)

CV 124: Airpump Select

Description

CV 124 is used to select an airpump sound effect.

Bit 7							Bit 0
0	0	0	0	0	0	APS1	APS0

APS: Airpump Select
- 0 = Single-phase
- 1 = Cross-compound
- 2 = Dual single-phase
- 3 = Dual cross-compound
- 4 = Vacuum pump*

0: Not used

Additional Information

The selected airpump sound effect plays continuously during operation. The pump cadence is automatically adjusted in response to F11 brake and coupler activity and simulates air pressure building and releasing.

The airpump plays at its most rapid cadence for the first 30 seconds of operation and regresses to a 10 to 15 second cycle thereafter, varying at random. It is automatically reset to its most rapid cadence after two minutes of operation, when the coupler function is turned on, or every third time the F11 brake function is turned on.

Default Value: 0
Related CVs: CV 132 (Airpump Mixer Channel Volume Control)

* Not included in software releases prior to version 1.3

CV 125: Dynamo Select

Description

CV 125 is used to select one of four dynamo sound effects.

Bit 7							Bit 0
0	**0**	**0**	**0**	**0**	**0**	**DY1**	**DY0**

DY0-DY1: Dynamo Select
0 = Dynamo 1
1 = Dynamo 2
2 = Dynamo 3
3 = Dynamo 4

0: Not used

Default Value: 0
Related CVs: CVs 49-54 (Hyperlight Effect Select)
CV 133 (Dynamo Mixer Channel Volume Control)

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: Coupler Release Function Polarity
0 = Coupler release activated when function is turned on
1 = Coupler release activated when function is turned off

0: Not used

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 glad hand release.

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

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 (75%)
Related CVs: CVs 129-150 (Mixer Channel Volume Control)

CVs 129-150: Mixer Channel Volume Control

Description

CVs 129-150 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: Mixer Channel Volume Control
0 = 0% of master volume
.
.
.
255 = 100% of master volume

CV	Sound Effect	Default Value
129	Whistle	225
130	Bell	85
131	Exhaust Chuff	180
132	Airpump	65
133	Dynamo	65
134	Blower	25
135	Side Rod Clank	80
136	Cylinder Cocks	100
137	Coupler	128
138	Reserved	0
139	Brake Squeal	100
140	Brake Release	70
141	Reserved	0
142	Johnson Bar	64
143	Reserved	0
144	Blowdown	255
145	Blower Draft	25
146	Water Stop	50
147	Reserved	0
148	E-Brake App.	70
149	Glad Hand Release	150
150	“All Aboard!”/Coach Doors*	192

Additional Information

Setting CVs 129-150 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 will adjust the whistle volume level to 50% of the master volume level, i.e., the whistle volume will be set to 25% of the maximum volume level.

Related CVs: CV 128 (Master Volume)

* Not included in software releases prior to version 1.3

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.

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: Not used

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.

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: Not used

Default Value: 5
Related CVs: CV 150 (“All Aboard!”/Coach Doors Mixer Channel Volume Control)

* Not included in software releases prior to version 1.3

CV 196: Brake Squeal Sensitivity

Description

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

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

D0-D7: Brake Squeal Sensitivity
0 = Brake squeal disabled
1 = 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 squeal 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 (F11 Brake Rate)
CV 139 (Brake Squeal Mixer Channel Volume Control)

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	ACC	ABK	ABL	0

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

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

ACC: Auto-Cylinder Cocks Enable
0 = Disabled
1 = Enabled

0: Not used

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**	**ACC**	**ABK**	**ABL**	**0**

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

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

ACC: Auto-Cylinder Cocks Enable
0 = Disabled
1 = Enabled

0: Not used

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

CV 199: Cylinder Cocks On Time

Description

CV 199 is used to adjust the duration that elapses from the time the engine is started and the auto-cylinder cocks sound effect is automatically turned on to the time it is automatically turned off.

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

D0-D7: Cylinder Cocks On Time
0 = Auto-cylinder cocks disabled
1 = 1 second
.
.
.
255 = 255 seconds

Default Value: 5
Related CVs: CV 136 (Cylinder Cocks Mixer Channel Volume Control)
CV 197 (Analog Mode Auto-Sound Enable)
CV 198 (DCC Mode Auto-Sound Enable)

CVs 209-218: Advanced Motor Control Registers

Description

CVs 209-218 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 209-218 (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 209-218 (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 209-218 (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 209-218 (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: Not used

Additional Information

Values from 0 to 31 may be entered into bits 0-4 (D0-D4) to specify the T1 time period (ms) that occurs between back-EMF measurements. The T1 time period is calculated as:

T1 = 2ms + 1ms × CV 213

Default Value: 9
Related CVs: CVs 209-218 (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: Not used

Additional Information

Values from 0 to 15 may be entered into bits 0-3 (D0-D3) to specify the T2 time period (ms) that occurs during back-EMF voltage readings when all motor control has been disabled. The T2 time period is calculated as:

$$T2 = 0.5ms + 0.250ms \times CV\ 214$$

Default Value: 6
Related CVs: CVs 209-218 (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 = Track voltage supply
1-59 = Not used
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 209-218 (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: Not used

Default Value: 0
Related CVs: CVs 209-218 (Advanced Motor Control CVs)

* Not included in software releases prior to version 1.3

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 209-218 (Advanced Motor Control CVs)

CV 218: Analog Mode Motor Start Voltage

Description

CV 218 is used to determine the starting voltage level applied to the motor in analog mode. The motor start voltage is calculated as a fraction of the available supply voltage.

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 starting voltage applied to the motor during analog mode operation. Starting voltage is calculated as:

Starting Voltage = Supply Voltage × CV 218 ÷ 255

Entering a value of 0 will set the starting voltage to zero. Entering a value of 255 will set the starting voltage to the maximum available voltage (100%).

Default Value: 7
Related CVs: CV 12 (Alternate Power Source)
CV 29 (Configuration Data 1)
CVs 209-218 (Advanced Motor Control CVs)

7-Band Equalizer CVs

CV 225: Equalizer Control Register

Description

CV 225 is used for presetting the boost/cut 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 (Boost/Cut Controls).

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

EQ0-EQ2: Equalizer Presets
- 0 = Flat (equalizer 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 = Not used
- 6 = Not used
- 7 = User-adjustable (CVs 226-232)

0: Not used

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 boost/cut 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 226-232 (Cut/Boost Controls)

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

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

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

Note: *CV 225 (Equalizer Control Register) must be set to a value of 7 for CVs 226-232 (Boost/Cut Controls) to be programmed.*

Default Value: 128
Related CVs: CV 225 (Equalizer Control Register)

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: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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)

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: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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)

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: Not used

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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)

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: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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)

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: Not used

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

Default Value: 0
Related CVs: CV 19 (Consist Address)
CVs 21-22 (Consist Function Enable 1-2)
CVs 33-46 (Function Status CVs)
CVs 245-246 (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 constitute Indexed CV Page 1. Indexed CV Page 1 has been preprogrammed to provide function key assignments and automatic effects and is available for function mapping and auto-effect configuration by default.

Note: *CV 32 (CV Index 2) must be set to a value of 1 (default) to select Indexed CV Page 1 (CVs 1.257-1.512) as the active indexed CV page.*

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

1. CVs 1.257-1.384 (Effect Map Registers) are used to assign function keys F0-F28 to any of Econami's effects.
2. CVs 1.385-1.512 (Effect Auxiliary Map Registers) are used for configuring any of Econami's effects to be activated automatically in response to direction and movement during operation.

CVs 1.257-1.384 (Effect Map Registers) and CVs 1.385-1.512 (Effect Auxiliary Map Registers) are arranged according to three effect types:

1. **Physical** effects are effects configured to lighting outputs. Econami supports up to six lighting outputs. Refer to CVs 49-54 (Hyperlight Effect Select) for more information regarding configuring lighting outputs.
2. **Logical** effects are effects that modify other aspects of operation when activated. For example, the F11 brake and mute functions are logical effects because they modify momentum and sound effect volume when you turn on the corresponding function keys.
3. **Sound** effects are sound-related only and are generated continuously, controlled by a function key, and/or respond to actions that occur during operation, such as stopping, starting, switching direction, or changing speeds.

CVs 1.257-1.512 are listed on the following page, showing each associated effect.

CVs 1.257-1.512: Extended Function Mapping CVs	
Physical Effect Map Registers	**Physical 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
Logical Effect Map Registers	**Logical Effect Auxiliary Map Registers**
CV 1.273: Dimmer	CV 1.401: Dimmer
CV 1.274: Mute	CV 1.402: Mute
CV 1.275: Brake Function	CV 1.403: Brake Function
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
CVs 1.282-1.284: Reserved	CVs 1.410-1.412: Reserved
CV 1.285: Drift Mode On	CV 1.413: Drift Mode On
CV 1.286: Drift Mode Off	CV 1.414: Drift Mode Off
CVs 1.287-1.296: Reserved	CVs 1.415-1.424: Reserved
Sound Effect Map Registers	**Sound Effect Auxiliary Map Registers**
CV 1.297: Whistle	CV 1.425: Whistle
CV 1.298: Bell	CV 1.426: Bell
CV 1.299: Dynamo	CV 1.427: Dynamo
CV 1.300: Short Whistle	CV 1.428: Short Whistle
CV 1.301: Cylinder Cocks	CV 1.429: Cylinder Cocks
CV 1.302: Water Stop	CV 1.430: Water Stop
CV 1.303-1.304: Reserved	CV 1.431-1.432: Reserved
CV 1.305: Coupler	CV 1.433: Coupler
CV 1.306: Coupler Release	CV 1.434: Coupler Release
CVs 1.307-1.310: Reserved	CVs 1.435-1.438: Reserved
CV 1.311: “All Aboard!”/Coach Doors*	CV 1.439: “All Aboard!”/Coach Doors*
CV 1.312: Blowdown	CV 1.440: Blowdown
CVs 1.313-1.319: Reserved	CVs 1.441-1.447: Reserved
CV 1.320: Johnson Bar	CV 1.448: Johnson Bar
CV 1.321: E-Brake App.	CV 1.449: E-Brake App.
CVs 1.322-1.384: Reserved	CVs 1.450-1.512: Reserved

* Not included in software releases prior to version 1.3

CVs 1.257-1.384: Effect Map Registers

Description

CVs 1.257-1.384 are used for mapping function keys F0-F28 to any of Econami's effects. CV 32 (CV Index 2) must be set to a value of 1 when accessing CVs 1.257-1.512.

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.

Function keys F0-F28 that have been mapped to effects in CVs 1.257-1.384 can be enabled for analog mode and advanced consist operation by setting the corresponding function enable bits in CVs 13-14, 21-22, 241-242, and 245-246.

Default Function Assignments

F0(f):	Headlight	CV 1.257 = 0
F0(r):	Backup Light	CV 1.258 = 0
F0:	Dynamo	CV 1.299 = 0
F1:	Bell	CV 1.298 = 1
F2:	Whistle	CV 1.297 = 2
F3:	Short Whistle	CV 1.300 = 3
F4:	Cylinder Cocks	CV 1.301 = 4
F5:	Drift Mode On	CV 1.285 = 5
F6:	Drift Mode Off	CV 1.286 = 6
F7:	Dimmer	CV 1.273 = 7
F8:	Mute	CV 1.274 = 8
F9:	Xing Signal	CV 1.278 = 9
F10:	Blowdown	CV 1.312 = 10
F11:	Brake Function	CV 1.275 = 11
F13:	Coupler	CV 1.305 = 13
F13:	Coupler Release	CV 1.306 = 13
F14:	Half-Speed	CV 1.276 = 14
F14:	Mom. Override	CV 1.277 = 14
F16:	Water Stop	CV 1.302 = 16
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

* Not included in software releases prior to version 1.3

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 (default)
1 = Effect mapped to emergency stop button

0: Not used

Additional Information

When bit 0 (FWDD) is set to 1, the corresponding effect will be active when the locomotive is moving in the forward direction.

When bit 1 (REVD) is set to 1, the corresponding effect will be active when the locomotive is moving in the reverse direction.

When bit 2 (FWDS) is set to 1, the corresponding effect will be active when the locomotive is in the forward direction and stopped with the throttle set to zero.

When bit 3 (REVS) is set to 1, the corresponding effect will be active when the locomotive is in the reverse direction and stopped with the throttle set to zero.

Setting bit 4 (ESTP) to 1 will map the corresponding effect to the emergency stop button. The emergency stop button will perform the same utility irrespective of the effect mapped to it.

All Effect Auxiliary Map Registers 1.385-1.512 are set to 0 by default, excluding the following CVs:

CV 1.448 = 5: Johnson Bar = Forward-Driving/Standing
CV 1.449 = 16: Emergency Brake Application = Emergency Stop Button

Indexed CV Page 2

CVs 2.505-2.511: DDE Control CVs

Description

CVs 2.505-2.511 constitute Indexed CV Page 2. Indexed CV Page 2 is used to adjust parameters of the Dynamic Digital Exhaust (DDE) processor. The DDE processor modifies the decoder's sound envelope in response to motor speed during operation. Values from 0 to 255 may be entered into CVs 2.505-2.511 to adjust the given DDE parameter.

Note: *CV 32 (CV Index 2) must be set to a value of 2 to select Indexed CV Page 2 (CVs 2.505-2.511) as the active indexed CV page.*

CV 2.505: DDE Side Rod Clank Low Volume Limit

Description

CV 2.505 is used to determine the maximum attenuation level of the side rod clank sound effect when the motor is operating at high speeds. The side rod clank 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 Side Rod Clank Low Volume Limit
0 = 0dB
1 = -0.047dB
.
.
.
255 = -12dB

Default Value: 255
Related CVs: CV 128 (Master Volume)
CVs 129-150 (Mixer Channel Volume Control)
CVs 2.505-2.511 (DDE Control CVs)

CV 2.506: DDE Side Rod Clank High Volume Limit

Description

CV 2.506 is used to determine the maximum amplification level of the side rod clank sound effect when the motor is operating at low speeds. The side rod clank 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 Side Rod Clank High Volume Limit

0 = 0dB
1 = +0.047dB
.
.
.
255 = +12dB

Default Value: 255
Related CVs: CV 128 (Master Volume)
CVs 129-150 (Mixer Channel Volume Control)
CVs 2.505-2.511 (DDE Control CVs)

CV 2.507: DDE Exhaust Low Volume Limit

Description

CV 2.507 is used to determine the maximum attenuation level of the exhaust sound effect when the motor is operating at low speeds. The exhaust 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 Exhaust Low Volume Limit

0 = 0dB
1 = -0.047dB
.
.
.
255 = -12dB

Default Value: 255
Related CVs: CV 128 (Master Volume)
CVs 129-150 (Mixer Channel Volume Control)
CVs 2.505-2.511 (DDE Control CVs)

CV 2.508: DDE Exhaust High Volume Limit

Description

CV 2.508 is used to determine the maximum amplification level of the exhaust sound effect when the motor is operating at high speeds. The exhaust 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 Exhaust High Volume Limit

0 = 0dB
1 = +0.047dB
.
.
.
255 = +12dB

Default Value: 255
Related CVs: CV 128 (Master Volume)
CVs 129-150 (Mixer Channel Volume Control)
CVs 2.505-2.511 (DDE Control CVs)

CV 2.509: DDE Attack Time Constant

Description

CVs 2.509 and 2.510 are used to determine the DDE attack and release time constants, 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.

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

D0-D7: DDE Attack Time Constant
0 = 0ms
1 = 1ms
.
.
.
255 = 255ms

Default Value: 10
Related CVs: CVs 2.505-2.511 (DDE Control CVs)

CV 2.510: DDE Release Time Constant

Description

CVs 2.509 and 2.510 are used to determine the DDE attack and release time constants, 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.

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

D0-D7: DDE Release Time Constant

0 = 0ms
1 = 1ms
.
.
.
255 = 255ms

Default Value: 10
Related CVs: CVs 2.505-2.511 (DDE Control CVs)

CV 2.511: DDE Throttle Sensitivity

Description

CV 2.511 is used to adjust the correlation between throttle setting and speed-related sound effects. The DDE processor modifies the cadence and volume of sound effects that play continuously during operation in response to changes in the throttle setting. CV 2.511 determines how sensitive the sound response is to changes in the throttle setting.

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 2.505-2.511 (DDE Control CVs)