Release 2.00

M1 Diesel
Technical Reference Manual

INTRODUCTION

The M1 sound unit is a multi-function DCC decoder that supports the following:

DCC Characteristics

- 14 bit addressing
- 7 bit addressing (1-127)
- Enhanced Lighting Control
- Advanced Sound Support
- Consist Support
- 14, 28 and 128 speed steps
- Support for F0—F12 including remapping
- Operations mode support for all CV settings
- Configuration Variable Access Acknowledgement in Service mode
- Direct Address Mode Support in Service Mode including Write and Verify
- Physical Addressing and Paged CV Addressing Modes Support in Service Mode including Write and Verify (Versions 8.0 and Above)
- Analog Horn Support (Versions 8.0 and Above)

DC characteristics

- DCMaster™ uses Direct Mode for CV Programming
- All CV's programmable
- Enhanced Lighting Control
- Advanced Sound Support
- Consist Support
- Enhanced Motor Control
- Selectable DCMaster™ AUX Control

SYSTEM CVs

CV1
Primary Address

Description
The Decoders Primary Address is Stored Here
Values
Bits 0-6 contain an address with a value between 1 and 127
Initial Value
3 (Engine 3)
Related CVs
CV29 Bit 5
CV17, CV18, CV19, CV20

The decoder responds to all valid commands if the address matches the value in CV1 and CV29 Bit 5 is set to 0.

Programming CV1 will program CV19 (Consists Address) to zero and programs CV29 Bit 5 to 0 (Extended Addressing Off).

SYSTEM CVs

CV7
Manufacturer Version Number

Description
The Decoders Read Only Type/Revision is Stored Here
Values

Initial Value

Related CVs
None

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

This value cannot be modified.

000xxxxx = Diesel and xxxxx is the revision.
001xxxxx = Steam and xxxxx is the revision.

SYSTEM CVs

CV8
Manufacturer ID

Description
The Decoders NMRA Assigned Number is Stored Here. Broadway Limited is assigned ID 38.
Values

Initial Value
38
Related CVs
None

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

Writing an 8 to this location will reset all CVs back to their original manufactured values. This value itself cannot be modified.

Writing "***value***" to CV8 causes the following:

VALUE	
8	Resets all CVs back to their original manufactured values unless the unit is locked.
128	Resets Sound Pointers
254	Resets all CVs back to their original manufactured values even if the unit is locked

SYSTEM CVs

CV15
Unlock ID Code

Description
The Number is the Unlock ID
Values
0-7
Initial Value
0
Related CVs
None

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Factory new units have the unlock id code and the lock id number set to zero, allowing normal programming of all CV's. Users wishing to lock this decoder may start by programming CV16 with a recommended value of 2. Now, unlock the decoder for CV updates by writing 2 to CV15. Once all programming is completed, write a value of 0 to CV15. Now the decoder is locked. **Please note once the decoder is locked, no CV's other than CV1 or CV15 may be read or changed. The factory reset is also disabled.**

SYSTEM CVs

CV16
Lock ID Number

Description
This Number Identifies this Single Decoder.
Values
0-7
Initial Value
0
Related CVs
None

Bit 7							Bit 0
0	0	0	0	0	0	0	0

This value may only be changed when CV15 equals CV16. CV15 may always be read. The following definitions may be used when programming this number:

Lock Disabled	0
Motor Decoder	1
Sound Decoder	2
Function Decoder	3

If this feature is use, the recommendation is to program a 2 for value. **Please note once the decoder is locked, no CV's other than CV1 or CV15 may be read or changed. The factory reset is also disabled.**

SYSTEM CVs

CV17 and CV18
Extended Address

Description
This Value Contains the Decoders Extended Address and is Valid Only if CV29 Bit 5 is 1
Values
Values From 0 to 10239 are Valid
Initial Value
1100 0000 1000 0000 (Engine 128)
Related CVs
CV29 Bit 5

Bit 15							Bit 8
1	**1**	**A13**	**A12**	**A11**	**A10**	**A9**	**A8**

CV17 Extended Address MSB

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

CV18 Extended Address LSB

CV17 Valid Values are 1100 0000 thru 1110 0111
CV18 Valid Values are 0000 0000 thru 0000 0000

SYSTEM CVs

CV19
Consist Address

Description
The Decoders Consist Address is Stored Here
Values
0-255
Initial Value
0
Related CVs
CV21, CV22, CV224, CV229

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

Consist valid address are 1-127 or A6-A0 where a value of 0 breaks the consist and all received consist commands are ignored. The Dir bit selects normal or reverse directional lighting. If Dir=0 than normal directional lighting is selected. If Dir=1 than reverse directional lighting is selected. Reverse directional lighting is useful when the engine is oriented backwards in the consist.

See Consist, a technical discussion.

SYSTEM CVs

CV21
Consist Functions Type 0

Description
Determines Which Functions (F1-F8) are Allowed in the Consist
Values
0-255
Initial Value
255
Related CVs
CV19, CV22, CV223, CV229

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

The decoder responds to all functions that have a "1" set in this CV once a consist is configured. A consist is configured by CV19 programmed to a value from 1-127. A value of 0 breaks the consist. See CV19. This CV is used to configure the engine for a front, middle or end in the consist.

An example for consist number 60:

CV19=60			*DCC*	*DC*
Front Engine	CV21=255	CV22=255	CV229=133	CV223=133
Middle Engine	CV21=128	CV22=5	CV229=0	CV223=0
Rear engine	CV21=128	CV22=5	CV229=2	CV223=2

See Consist, a technical discussion.

Bit 7:	0=F8 Disabled
	1=F8 Enabled
Bit 6:	0=F7 Disabled
	1=F7 Enabled
Bit 5:	0=F6 Disabled
	1=F6 Enabled
Bit 4:	0=F5 Disabled
	1=F5 Enabled
Bit 3:	0=F4 Disabled
	1=F4 Enabled
Bit 2:	0=F3 Disabled
	1=F3 Enabled
Bit 1:	0=F2 Disabled
	1=F2 Enabled
Bit 0:	0=F1 Disabled
	1=F1 Enabled

SYSTEM CVs

CV22
Consist Functions Type 1

Description
Determines Which Functions (F0; F9-F12) are Allowed in the Consist
Values
0-255
Initial Value
255
Related CVs
CV19, CV21, CV223, CV229

Bit 7							Bit 0
nu	**nu**	**F12**	**F11**	**F10**	**F9**	**nu**	**F0**

The decoder responds to all functions that have a "1" set in this CV once a consist is configured. A consist is configured by CV19 programmed to a value from 1-127. A value of 0 breaks the consist. See CV19. This CV is used to configure the engine for a front, middle or end in the consist.

An example for consist number 60:

CV19=60			*DCC*	*DC*
Front Engine	CV21=255	CV22=255	CV229=133	CV223=133
Middle Engine	CV21=128	CV22=5	CV229=0	CV223=0
Rear engine	CV21=128	CV22=5	CV229=2	CV223=2

See Consist, a technical discussion.

Bit 7: not used
Bit 6: not used
Bit 5: 0=F12 Disabled
1=F12 Enabled
Bit 4: 0=F11 Disabled
1=F11 Enabled
Bit 3: 0=F10 Disabled
1=F10 Enabled
Bit 2: 0=F9 Disabled
1=F9 Enabled
Bit 1: not used
Bit 0: 0=F0 Disabled
1=F0 Enabled

SYSTEM CVs

CV29
Configuration Bits

Description
Decoder Configuration Feature Bits
Values
0, 1, 2, 3, 32, 33, 34 or 35
Initial Value
2 (Primary Address)
Related CVs
CV1, CV17, CV18

Bit 7							**Bit 0**
0	**0**	**EA**	**0**	**0**	**0**	**1**	**0**

Bit 5: EA (Extended Address Mode Enable)
0 = Decoder Responds to Primary Address CV1
1 = Decoder Responds to Extended Address CV17, CV18
Bit 1: 0 = 14 speed step if controller set for 14 bits
1 = 28 speed step if controller set for 28 bits
Bit 0: 0 = normal lighting for front and rear lights
1 = reverse lighting for front and rear lights

Value of 32 will cause Bit 5 to become 1

FUNCTION CVs

CV33-CV45
F0 – F12 Function Definitions (Versions 8.0 and Up)

The function keys may be programmed to perform any of the defined functions listed by setting the corresponding Function Key CV to the assigned value.

Function Controlled	**Assigned Value**
Nothing	0
Front/Rear Lights	1
Bell Sound	2
Horn Sound	3
Couple/Uncouple Sound	4
Compressor/Grid Blower Sound	5
Diesel Ramp Up	6
Diesel Ramp Down/Start Diesel Sound	7
L1 Function	8
Mute/Volume Control	9
Startup/Shutdown Sounds	10
Cooling Fan Sound	11
Air Fill/Air Release Sound	12
Brake Set/Release	13
Brake Squeal Sound	14
Fuel Fill Sound	15

FUNCTION CVs

CV33
F0 Output Function Definition

Description
Selects Which Function(s) F0 Activates
Values
0 to 255
Initial Value
1 (Front/Rear Lighting)
Related CVs
CV33—CV45; CV29, CV159, CV222, CV225, CV229

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

The front and rear light control is the default setting.

FUNCTION CVs

CV34
F1 Output Function Definition

Description
Selects Which Function(s) F1 Activates
Values
0 to 255
Initial Value
2 (Bell)
Related CVs
CV33—CV45; CV136, CV180,

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

The bell control is the default setting.

FUNCTION CVs

CV35
F2 Output Function Definition

Description
Selects Which Function(s) F2 Activates
Values
0 to 255
Initial Value
3 (Horn)
Related CVs
CV33—CV45; CV135, CV138, CV222

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

The horn control is the default setting. If a secondary horn is included in your locomotive, this function may activate it by setting a function key to the Horn2 Toggle (19) and pressing that function key. Now the horn function plays the secondary horn.

FUNCTION CVs

CV36
F3 Output Function Definition

Description
Selects Which Function(s) F3 Activates
Values
0 to 255
Initial Value
4(Couple/Uncouple)
Related CVs
CV33—CV45; CV140, CV141, CV187, CV222

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

The couple sound effect plays when moving while the uncouple arms when not moving and plays at a predetermined throttle stop (CV187) after moving

FUNCTION CVs

CV37
F4 Output Function Definition

Description
Selects Which Function(s) F4 Activates
Values
0 to 255
Initial Value
5 (Compressor/Grid Blower)
Related CVs
CV33—CV45; CV143, CV150

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

The compressor sound effect plays when stopped while the grid blower motor plays when moving. If the grid blower motor is playing while the locomotive is brought to a stop, the blower will continue playing until the function key is pressed.

FUNCTION CVs

CV38
F5 Output Function Definition

Description
Selects Which Function(s) F5 Activates
Values
0 to 255
Initial Value
6 (Diesel Ramp Up)
Related CVs
CV33—CV45; CV137, CV193—CV207

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

Repeated pressings of this function key may ramp the diesel locomotive up. If the locomotive throttle is higher than the rev level, one press will ramp the locomotive up to the throttle setting rev level. The locomotive must be moving before this function is allowed.

FUNCTION CVs

CV39
F6 Output Function Definition

Description
Selects Which Function(s) F6 Activates
Values
0 to 255
Initial Value
7 (Diesel Ramp Down/Startup)
Related CVs
CV33—CV45; CV137, CV193—CV207

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

Repeated pressings of this function key may ramp the diesel locomotive down. If the locomotive throttle is lower than the rev level, one press will ramp the locomotive down to the throttle setting rev level. The locomotive must be moving before this function is allowed. If the locomotive is stopped and the sounds are off, the sound unit is activated.

FUNCTION CVs

CV40
F7 Output Function Definition

Description
Selects Which Function(s) F7 Activates
Values
0 to 255
Initial Value
8 (L1 Control)
Related CVs
CV33—CV45; CV159 – CV164, CV222, CV225, CV226, CV229

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

Repeated pressing of this function key toggles the L1 output on and off. L1 may be configured for many different functions. See the CV's listed above.

FUNCTION CVs

CV41
F8 Output Function Definition

Description
Selects Which Function(s) F8 Activates
Values
0 to 255
Initial Value
9 (Mute/Volume Control)
Related CVs
CV33—CV45; CV130 – CV134

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

Pressing this function once mutes the volume and reverses the volume control direction. Double pressings of this function cause the volume to either increase or decrease by a factor of step size (CV130). When the maximum volume is reached a sound effect plays. The sound effect is as follows:

Versions 7.0 and Lower	Couple/Uncouple Sound Effect
Versions 8.0 and Higher	Brake Squeal

FUNCTION CVs

CV42
F9 Output Function Definition

Description
Selects Which Function(s) F9 Activates
Values
0 to 255
Initial Value
10 (Startup/Shutdown Locomotive)
Related CVs
CV33—CV45; CV137, CV245

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

Pressing this function, if the locomotive is silent, enables the audio. The startup sounds plays if enabled (CV245). Pressing this function if the sound unit is active and if the locomotive is stopped (brake set), the shutdown sound will play and then the sound unit deactivates.

FUNCTION CVs

CV43
F10 Output Function Definition

Description
Selects Which Function(s) F10 Activates
Values
0 to 255
Initial Value
11 (Radiator-Cooling Fan Audio Effect)
Related CVs
CV33—CV45; CV149

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

Pressing this function toggles the radiator-cooling fan on and off.

FUNCTION CVs

CV44
F11 Output Function Definition

Description
Selects Which Function(s) F11 Activates
Values
0 to 255
Initial Value
12 (Air Release and Air Filling Audio Effects)
Related CVs
CV33—CV45; CV144, CV145

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

Pressing this function when the locomotive is stopped plays the air filling sound effects while pressing this function when the locomotive is moving plays the air release sound effects.

FUNCTION CVs

CV45
F12 Output Function Definition

Description
Selects Which Function(s) F12 Activates
Values
0 to 255
Initial Value
13 (Brake Set/Release)
Related CVs
CV33—CV45; CV146, CV147, CV151, CV191, CV192, CV209, CV210, CV227

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

Pressing this function when the locomotive is stopped plays the brake set sound effects while pressing this function when the locomotive is moving below throttle stop 5 plays the brake release sound effects. Above throttle stop 5, the brake squeal sound effect plays.

FUNCTION CVs

CV33
F0(f) Output Function Definition (Versions 7.0 and Lower)

Description
Selects Which Function(s) F0 Activates
Values
0 to 255
Initial Value
1 (Front Lamp)
Related CVs
CV33—CV46

Bit 7							Bit 0
Ramp+	GB/C	Coupler	Bell	Horn2	Horn1	RL	FL

Bit 7: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F0
1 = Diesel Motor Ramps Up

Bit 6: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F0
1 = Compressor Sound Activated by F0 if Engine Stopped
1 = Grid Blower Motor Activated by F0 if Engine Moving

Bit 5: Coupler Sound Effects
0 = Not Affected by F0
1 = Couple Sound Activated by F3 if Engine Moving
Uncouple Armed if Engine Stopped

Bit 4: Bell Sound Effects
0 = Not Affected by F0
1 = Bell Activated by F0

Bit 3: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F0
1 = Horn2/Whistle2 Activated by F0

Bit 2: Horn1 Sound Effects
0 = Not Affected by F0
1 = Horn1/Whistle1 Activated by F0

Bit 1: Rear Light Visual Effects
0 = Not Affected by F0
1 = Rear Light Visual Effect Activated by F0

Bit 0: Front Light Visual Effects
0 = Not Affected by F0
1 = Front Light Visual Effect Activated by F0

FUNCTION CVs

CV34
F0(r) Output Function Definition

Description
Selects Which Function(s) F0 Activates
Values
0 to 255
Initial Value
2 (Rear Lamp)
Related CVs
CV33—CV46

Bit 7							Bit 0
Ramp+	GB/C	Coupler	Bell	Horn2	Horn1	RL	FL

Bit 7: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F0
1 = Diesel Motor Ramps Up

Bit 6: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F0
1 = Compressor Sound Activated by F0 if Engine Stopped
1 = Grid Blower Motor Activated by F0 if Engine Moving

Bit 5: Coupler Sound Effects
0 = Not Affected by F0
1 = Couple Sound Activated by F3 if Engine Moving Uncouple Armed if Engine Stopped

Bit 4: Bell Sound Effects
0 = Not Affected by F0
1 = Bell Activated by F0

Bit 3: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F0
1 = Horn2/Whistle2 Activated by F0

Bit 2: Horn1 Sound Effects
0 = Not Affected by F0
1 = Horn1/Whistle1 Activated by F0

Bit 1: Rear Light Visual Effects
0 = Not Affected by F0
1 = Rear Light Visual Effect Activated by F0

Bit 0: Front Light Visual Effects
0 = Not Affected by F0
1 = Front Light Visual Effect Activated by F0

FUNCTION CVs

CV35
F1 Output Function Definition

Description
Selects Which Function(s) F1 Activates
Values
0 to 255
Initial Value
16 (Bell)
Related CVs
CV33—CV46

Bit 7							Bit 0
Ramp+	GB/C	Coupler	Bell	Horn2	Horn1	RL	FL

Bit 7: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F1
1 = Diesel Motor Ramps Up

Bit 6: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F1
1 = Compressor Sound Activated by F1 if Engine Stopped
1 = Grid Blower Motor Activated by F1 if Engine Moving

Bit 5: Coupler Sound Effects
0 = Not Affected by F1
1 = Couple Sound Activated by F3 if Engine Moving Uncouple Armed if Engine Stopped

Bit 4: Bell Sound Effects
0 = Not Affected by F1
1 = Bell Activated by F1

Bit 3: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F1
1 = Horn2/Whistle2 Activated by F1

Bit 2: Horn1 Sound Effects
0 = Not Affected by F1
1 = Horn1/Whistle1 Activated by F1

Bit 1: Rear Light Visual Effects
0 = Not Affected by F1
1 = Rear Light Visual Effect Activated by F1

Bit 0: Front Light Visual Effects
0 = Not Affected by F1
1 = Front Light Visual Effect Activated by F1

FUNCTION CVs

CV36
F2 Output Function Definition

Description
Selects Which Function(s) F2 Activates
Values
0 to 255
Initial Value
4(Horn1)
Related CVs
CV33—CV46

Bit 7							Bit 0
Ramp+	GB/C	Coupler	Bell	Horn2	Horn1	RL	FL

Bit 7: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F2
1 = Diesel Motor Ramps Up

Bit 6: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F2
1 = Compressor Sound Activated by F2 if Engine Stopped
1 = Grid Blower Motor Activated by F2 if Engine Moving

Bit 5: Coupler Sound Effects
0 = Not Affected by F2
1 = Couple Sound Activated by F3 if Engine Moving Uncouple Armed if Engine Stopped

Bit 4: Bell Sound Effects
0 = Not Affected by F2
1 = Bell Activated by F2

Bit 3: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F2
1 = Horn2/Whistle2 Activated by F2

Bit 2: Horn1 Sound Effects
0 = Not Affected by F2
1 = Horn1/Whistle1 Activated by F2

Bit 1: Rear Light Visual Effects
0 = Not Affected by F2
1 = Rear Light Visual Effect Activated by F2

Bit 0: Front Light Visual Effects
0 = Not Affected by F2
1 = Front Light Visual Effect Activated by F2

FUNCTION CVs

CV37
F3 Output Function Definition

Description
Selects Which Function(s) F3 Activates
Values
0 to 255
Initial Value
32 (Coupler)
Related CVs
CV33—CV46

Bit 7							Bit 0
Ramp+	GB/C	Coupler	Bell	Horn2	Horn1	RL	FL

Bit 7: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F3
1 = Diesel Motor Ramps Up

Bit 6: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F3
1 = Compressor Sound Activated by F3 if Engine Stopped
1 = Grid Blower Motor Activated by F3 if Engine Moving

Bit 5: Coupler Sound Effects
0 = Not Affected by F3
1 = Couple Sound Activated by F3 if Engine Moving Uncouple Armed if Engine Stopped

Bit 4: Bell Sound Effects
0 = Not Affected by F3
1 = Bell Activated by F3

Bit 3: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F3
1 = Horn2/Whistle2 Activated by F3

Bit 2: Horn1 Sound Effects
0 = Not Affected by F3
1 = Horn1/Whistle1 Activated by F3

Bit 1: Rear Light Visual Effects
0 = Not Affected by F3
1 = Rear Light Visual Effect Activated by F3

Bit 0: Front Light Visual Effects
0 = Not Affected by F3
1 = Front Light Visual Effect Activated by F3

FUNCTION CVs

CV38
F4 Output Function Definition

Description
Selects Which Function(s) F4 Activates
Values
0 to 255
Initial Value
8 (Grid Blower Motor and Compressor)
Related CVs
CV33—CV46

Bit 7 **Bit 0**

Volume	L1	Ramp-	Ramp+	GB/C	Coupler	Bell	Horn2

Bit 7: Volume Audio Effects
0 = Not Affected by F4
1 = Volume Increases or Decreases on a Double Press
Volume Mutes on a Single Press
Bit 6: Light One Visual Effects
0 = Not Affected by F4
1 = Visual Light One Activated
Bit 5: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F4
1 = Diesel Motor Ramps Down
Bit 4: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F4
1 = Diesel Motor Ramps Up

Bit 3: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F4
1 = Compressor Sound Activated by F4 if Engine Stopped
1 = Grid Blower Motor Activated by F4 if Engine Moving

Bit 2: Coupler Sound Effects
0 = Not Affected by F4
1 = Couple Sound Activated by F3 if Engine Moving
Uncouple Armed if Engine Stopped

Bit 1: Bell Sound Effects
0 = Not Affected by F4
1 = Bell Activated by F4

Bit 0: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F4
1 = Horn2/Whistle2 Activated by F4

FUNCTION CVs

CV39
F5 Output Function Definition

Description
Selects Which Function(s) F5 Activates
Values
0 to 255
Initial Value
16 (Ramp Diesel Engine Up)
Related CVs
CV33—CV46

Bit 7							Bit 0
Volume	L1	Ramp-	Ramp+	GB/C	Coupler	Bell	Horn2

Bit 7: Volume Audio Effects
0 = Not Affected by F5
1 = Volume Increases or Decreases on a Double Press
Volume Mutes on a Single Press

Bit 6: Light One Visual Effects
0 = Not Affected by F5
1 = Visual Light One Activated

Bit 5: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F5
1 = Diesel Motor Ramps Down

Bit 4: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F5
1 = Diesel Motor Ramps Up

Bit 3: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F5
1 = Compressor Sound Activated by F5 if Engine Stopped
1 = Grid Blower Motor Activated by F5 if Engine Moving

Bit 2: Coupler Sound Effects
0 = Not Affected by F5
1 = Couple Sound Activated by F3 if Engine Moving Uncouple Armed if Engine Stopped

Bit 1: Bell Sound Effects
0 = Not Affected by F5
1 = Bell Activated by F5

Bit 0: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F5
1 = Horn2/Whistle2 Activated by F5

FUNCTION CVs

CV40
F6 Output Function Definition

Description
Selects Which Function(s) F6 Activates
Values
0 to 255
Initial Value
32 (Ramp Diesel Engine Down)
Related CVs
CV33—CV46

Bit 7							Bit 0
Volume	L1	Ramp-	Ramp+	GB/C	Coupler	Bell	Horn2

Bit 7: Volume Audio Effects
0 = Not Affected by F6
1 = Volume Increases or Decreases on a Double Press
Volume Mutes on a Single Press
Bit 6: Light One Visual Effects
0 = Not Affected by F6
1 = Visual Light One Activated
Bit 5: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F6
1 = Diesel Motor Ramps Down
Bit 4: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F6
1 = Diesel Motor Ramps Up

Bit 3: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F6
1 = Compressor Sound Activated by F6 if Engine Stopped
1 = Grid Blower Motor Activated by F6 if Engine Moving

Bit 2: Coupler Sound Effects
0 = Not Affected by F6
1 = Couple Sound Activated by F3 if Engine Moving
Uncouple Armed if Engine Stopped

Bit 1: Bell Sound Effects
0 = Not Affected by F6
1 = Bell Activated by F6

Bit 0: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F6
1 = Horn2/Whistle2 Activated by F6

FUNCTION CVs

CV41
F7 Output Function Definition

Description
Selects Which Function(s) F7 Activates
Values
0 to 255
Initial Value
64 (L1 Visual Effects)
Related CVs
CV33—CV46

Bit 7							Bit 0
Volume	L1	Ramp-	Ramp+	GB/C	Coupler	Bell	Horn2

Bit 7: Volume Audio Effects
0 = Not Affected by F7
1 = Volume Increases or Decreases on a Double Press
Volume Mutes on a Single Press
Bit 6: Light One Visual Effects
0 = Not Affected by F7
1 = Visual Light One Activated
Bit 5: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F7
1 = Diesel Motor Ramps Down
Bit 4: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F7
1 = Diesel Motor Ramps Up

Bit 3: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F7
1 = Compressor Sound Activated by F7 if Engine Stopped
1 = Grid Blower Motor Activated by F7 if Engine Moving

Bit 2: Coupler Sound Effects
0 = Not Affected by F7
1 = Couple Sound Activated by F3 if Engine Moving
Uncouple Armed if Engine Stopped

Bit 1: Bell Sound Effects
0 = Not Affected by F7
1 = Bell Activated by F7

Bit 0: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F7
1 = Horn2/Whistle2 Activated by F7

FUNCTION CVs

CV42
F8 Output Function Definition

Description
Selects Which Function(s) F8 Activates
Values
0 to 255
Initial Value
128 (Volume Audio Effect)
Related CVs
CV33—CV46

Bit 7							Bit 0
Volume	L1	Ramp-	Ramp+	GB/C	Coupler	Bell	Horn2

Bit 7: Volume Audio Effects
0 = Not Affected by F8
1 = Volume Increases or Decreases on a Double Press
Volume Mutes on a Single Press
Bit 6: Light One Visual Effects
0 = Not Affected by F8
1 = Visual Light One Activated
Bit 5: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F8
1 = Diesel Motor Ramps Down
Bit 4: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F8
1 = Diesel Motor Ramps Up

Bit 3: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F8
1 = Compressor Sound Activated by F8 if Engine Stopped
1 = Grid Blower Motor Activated by F8 if Engine Moving

Bit 2: Coupler Sound Effects
0 = Not Affected by F8
1 = Couple Sound Activated by F3 if Engine Moving
Uncouple Armed if Engine Stopped

Bit 1: Bell Sound Effects
0 = Not Affected by F8
1 = Bell Activated by F8

Bit 0: Horn2 Sound Effects (If Model Has This Effect)
0 = Not Affected by F8
1 = Horn2/Whistle2 Activated by F8

When the maximum volume is reached a sound effect plays. The sound effect is as follows:

Versions 7.0 and Lower	Couple/Uncouple Sound Effect
Versions 8.0 and Higher	Brake Squeal

FUNCTION CVs

CV43
F9 Output Function Definition

Description
Selects Which Function(s) F9 Activates
Values
0 to 255
Initial Value
16 (Shutdown and Startup Audio Effect)
Related CVs
CV33—CV46

Bit 7 **Bit 0**

Brakes	Air	Radiator	Sht/Str	L1	Ramp-	Ramp+	GB/C

Bit 7: Brakes Effects
0 = Not Affected by F9
1 = If Engine at Throttle Stop Zero:
Set Air Brake Effect
If Engine not at Throttle Stop Zero:
Release Air Brake Effect Activated

Bit 6: Air Release/Air Filling Effects
0 = Not Affected by F9
1 = If Engine is Moving, Air Release Effect Activated
If Engine is Stopped, Air Filling Effect Activated

Bit 5: Radiator Cooling Fan
0 = Not Affected by F9
1 = Radiator Cooling Fan Effect Activated

Bit 4: Shut Down or Start Up Diesel Engine Sound Effects
0 = Not Affected by F9
1 = If at Idle, Play Shutdown Sound Effect
If not at Idle, ignored.
1= If Silent (Shutdown) than Play Startup Sound Effect

Bit 3: Light One Visual Effects
0 = Not Affected by F9
1 = Visual Light One Activated

Bit 2: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F9
1 = Diesel Motor Ramps Down

Bit 1: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F9
1 = Diesel Motor Ramps Up

Bit 0: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F9
1 = Compressor Sound Activated by F9 if Engine Stopped
1 = Grid Blower Motor Activated by F9 if Engine Moving

FUNCTION CVs

CV44
F10 Output Function Definition

Description
Selects Which Function(s) F10 Activates
Values
0 to 255
Initial Value
32 (Radiator Cooling Fan)
Related CVs
CV33—CV46

Bit 7							Bit 0
Brakes	Air	Radiator	Sht/Str	L1	Ramp-	Ramp+	GB/C

Bit 7: Brakes Effects
0 = Not Affected by F9
1 = If Engine at Throttle Stop Zero:
Set Air Brake Effect
If Engine not at Throttle Stop Zero:
Releaser Air Brake Effect Activated

Bit 6: Air Release/Air Filling Effects
0 = Not Affected by F10
1 = If Engine is Moving, Air Release Effect Activated
If Engine is Stopped, Air Filling Effect Activated

Bit 5: Radiator Cooling Fan
0 = Not Affected by F10
1 = Radiator Cooling Fan Effect Activated

Bit 4: Shut Down or Start Up Diesel Engine Sound Effects
0 = Not Affected by F10
1 = If at Idle, Play Shutdown Sound Effect
If not at Idle, ignored
1= If Silent (Shutdown) than Play Startup Sound Effect

Bit 3: Light One Visual Effects
0 = Not Affected by F10
1 = Visual Light One Activated

Bit 2: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F10
1 = Diesel Motor Ramps Down

Bit 1: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F10
1 = Diesel Motor Ramps Up

Bit 0: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F10
1 = Compressor Sound Activated by F10 if Engine Stopped
1 = Grid Blower Motor Activated by F10 if Engine Moving

FUNCTION CVs

CV45
F11 Output Function Definition

Description
Selects Which Function(s) F11 Activates
Values
0 to 255
Initial Value
64 (Air Release and Air Filling Audio Effects)
Related CVs
CV33—CV46

Bit 7 **Bit 0**

Brakes	Air	Radiator	Sht/Str	L1	Ramp-	Ramp+	GB/C

Bit 7: Brakes Effects
0 = Not Affected by F9
1 = If Engine at Throttle Stop Zero:
Set Air Brake Effect
If Engine not at Throttle Stop Zero:
Release Air Brake Effect Activated

Bit 6: Air Release/Air Filling Effects
0 = Not Affected by F11
1 = If Engine is Moving, Air Release Effect Activated
If Engine is Stopped, Air Filling Effect Activated

Bit 5: Radiator Cooling Fan
0 = Not Affected by F11
1 = Radiator Cooling Fan Effect Activated

Bit 4: Shut Down or Start Up Diesel Engine Sound Effects
0 = Not Affected by F11
1 = If at Idle, Play Shutdown Sound Effect
If not at Idle, ignored
1= If Silent (Shutdown) than Play Startup Sound Effect

Bit 3: Light One Visual Effects
0 = Not Affected by F11
1 = Visual Light One Activated

Bit 2: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F11
1 = Diesel Motor Ramps Down

Bit 1: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F11
1 = Diesel Motor Ramps Up

Bit 0: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F11
1 = Compressor Sound Activated by F11 if Engine Stopped
1 = Grid Blower Motor Activated by F11 if Engine Moving

FUNCTION CVs

CV46
F12 Output Function Definition

Description
Selects Which Function(s) F12 Activates
Values
0 to 255
Initial Value
128 (Brake Audio Effects)
Related CVs
CV33—CV46

Bit 7							Bit 0
Brakes	Air	Radiator	Sht/Str	L1	Ramp-	Ramp+	GB/C

Bit 7: Brakes Effects
0 = Not Affected by F9
1 = If Engine at Throttle Stop Zero:
Set Air Brake Effect
If Engine not at Throttle Stop Zero:
Release Air Brake Effect Activated

Bit 6: Air Release/Air Filling Effects
0 = Not Affected by F12
1 = If Engine is Moving, Air Release Effect Activated
If Engine is Stopped, Air Filling Effect Activated

Bit 5: Radiator Cooling Fan
0 = Not Affected by F12
1 = Radiator Cooling Fan Effect Activated

Bit 4: Shut Down or Start Up Diesel Engine Sound Effects
0 = Not Affected by F12
1 = If at Idle, Play Shutdown Sound Effect
If not at Idle, ignored
1= If Silent (Shutdown) than Play Startup Sound Effect

Bit 3: Light One Visual Effects
0 = Not Affected by F12
1 = Visual Light One Activated

Bit 2: Ramp Diesel Motor Down Sound Effects
0 = Not Affected by F12
1 = Diesel Motor Ramps Down

Bit 1: Ramp Diesel Motor Up Sound Effects
0 = Not Affected by F12
1 = Diesel Motor Ramps Up

Bit 0: Grid Blower Motor and Compressor Sound Effects
0 = Not Affected by F12
1 = Compressor Sound Activated by F12 if Engine Stopped
1 = Grid Blower Motor Activated by F12 if Engine Moving

SOUND CVs

CV130
Master Volume Sound Increment

Description
This Value is the Increment/Decrement Amount for Master Volume
Values
0 to 16
Initial Value
2
Related CVs
CV42, CV133

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

The decoder's analog potentiometer (volume control) increases or decreases the volume of the sound. The change between the 16 available steps may be set from 0 to 16. Every press of the volume toggle switch will result in a volume change incrementing or decrementing by this value.

SOUND CVs

CV131
Analog Sound Unit Startup (Turn-On) Voltage

Description
This Value Sets the Decoders Sound Turn-On Voltage
Values
0 to 255
Initial Value
56
Related CVs
CV132, CV133

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

The sound unit has a minimum power requirement necessary to play all sound effects. Many factors contribute to what the necessary voltage is such as the power source, the startup volume (CV133) and system loading. Lowering this value will instruct the sound unit to start the audio effects at a lower voltage. **Note: Care should be taken with this value. Lowering this value too low will result in the unit not being able to function at all. If this occurs, set this value to a larger number or the initial value and reprogram the value in service mode.**

SOUND CVs

CV132
Analog Sound Unit Shutdown (Turn-Off) Voltage

Description
This Value Sets the Decoders Sound Turn-Off Voltage
Values
0 to 255
Initial Value
54
Related CVs
CV131, CV133

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

The sound unit is instructed to play the shutdown effect and turn off all effects at this value. The shutdown effect only plays from the idle condition. Many factors contribute to what this actual voltage is such as the power source, system volume, individual volumes (CV133, CV135—CV161) and system loading. Lowering this value will instruct the sound unit to play the shutdown effect at a lower voltage. **Note: Care should be taken with this value. Lowering this value too low will result in the unit not being able to play the shutdown effect and terminate all effects properly. The sound unit could abruptly shut off. If this occurs, set this value to a larger number or the initial value.**

SOUND CVs

CV133
Sound Unit Master Volume

Description
This Value Sets the Power Up Master Sound Effects Volume
Values
0 to 16
Initial Value
16
Related CVs
CV130

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

The decoder's analog potentiometer (volume control) increases or decreases the volume of the sound. The change between the 16 available steps may be set from 0 to 16. Every press of the volume toggle switch will result in a volume change incrementing or decrementing by this value. This value is the decoder's power up value. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV135
Horn Volume

Description
This Value Controls the Horn Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's horn sound effect volume is variable from 0 to 255%. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV136
Bell Volume

Description
This Value Controls the Bell Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's bell sound effect volume is variable from 0 to 255%. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV137
Diesel Volume

Description
This Value Controls the Startup, Rev Levels and Shutdown Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's diesel engine sound effect volume is variable from 0 to 255%. A higher value increases the volume while a lower value decreases the volume. This value controls a group of sounds: diesel startup, diesel rev levels and diesel shutdown sound effects.

SOUND CVs

CV138
Horn2 Volume

Description
This Value Controls the Horn2 Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's horn2 sound effect volume is variable from 0 to 255%. A higher value increases the volume while a lower value decreases the volume. **Note: This sound effect is not used in most engines.**

SOUND CVs

CV140
Couple Volume

Description
This Value Controls the Couple Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's couple sound effect volume is variable from 0 to 255%. The couple sound effect only plays if the engine is moving and the function is pressed. This sound effect may be activated with a DCC Function or AUX with a DCMaster. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV141
Uncouple Volume

Description
This Value Controls the Uncouple Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's uncouple sound effect volume is variable from 0 to 255%. The uncouple sound effect plays once after it is armed. The process of arming is: press the function with engine stopped, upon engine moving the uncouple sound effect plays. This sound effect may be activated with a DCC Function or AUX with a DCMaster. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV142
Wheel Flange Volume

Description
This Value Controls the Wheel Flange Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's wheel flange sound effect volume is variable from 0 to 255%. The wheel flange sound effect only plays if the engine is moving and is also a random sound effect when moving. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV143
Compressor Volume

Description
This Value Controls the Compressor Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's compressor sound effect volume is variable from 0 to 255%. The compressor sound effect only plays if the engine is stopped. This sound effect may be activated with a DCC Function or AUX with a DCMaster™ and is also a random sound effect when stopped. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV144
Manual Air Release Volume

Description
This Value Controls the Manual Air Release Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's manual air release sound effect volume is variable from 0 to 255%. This sound effect may be activated with a DCC Function only if the engine is moving and is also a random sound effect when stopped. A higher value increases the volume while a lower value decreases the volume.

CV145
Air Filling Volume

Description
This Value Controls the Air Filling Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's air filling sound effect volume is variable from 0 to 255%. The air filling sound effect only plays if the engine is stopped. This sound effect may be activated with a DCC Function and is also a random sound effect when stopped. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV146
Brake Set Volume

Description
This Value Controls the Brake Set Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133, CV191, CV209, CV227

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

The decoder's brake set sound effect volume is variable from 0 to 255%. The brake set sound effect only plays if the track voltage falls below the analog brake set voltage (CV191) for analog mode or pressing the Function for DCC. In DCC mode the brake set effect plays when the current speed step matches or is lower than the DCC Brake Set Throttle Stop (CV209). A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV147
Brake Release Volume

Description
This Value Controls the Brake Release Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133, CV192, CV210, CV227

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

The decoder's brake release sound effect volume is variable from 0 to 255%. The brake release sound effect only plays if the track voltage is increased above the analog brake set voltage (CV192) for analog mode or pressing the Function for DCC. In DCC mode the brake release effect plays when the current speed step matches or is higher than the DCC Brake Release Throttle Stop (CV210). A higher value increases the volume while a lower value decreases the volume.

CV148
Spit Valve Volume

Description
This Value Controls the Spit Valve Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's spit valve sound effect volume is variable from 0 to 255%. The spit valve sound effect is a random sound that only plays when the engine is stopped. A higher value increases the volume while a lower value decreases the volume.

CV149
Radiator Cooling Volume

Description
This Value Controls the Radiator Cooling Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's radiator cooling sound effect volume is variable from 0 to 255%. The radiator cooling sound effect plays if the DCC Function is on. This sound effect is also a random sound effect when the engine is stopped. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV150
Grid Blower Motor Volume

Description
This Value Controls the Grid Blower Motor Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's grid blower motor sound effect volume is variable from 0 to 255%. The grid blower motor sound effect plays if the DCC Function is on when the engine is moving. A higher value increases the volume while a lower value decreases the volume.

SOUND CVs

CV151
Brakes Squeal Volume

Description
This Value Controls the Brakes Squeal Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133, CV227

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

The decoder's brake squeal sound effect volume is variable from 0 to 255%. In analog and DCC mode, the brakes squeal sound effect plays if the change in track voltage (analog mode [CV184]) or the speed steps (DCC Mode [CV185]) exceeds the preset threshold. The brakes squeal sound effect plays if the DCC Function is enabled (CV227). A higher value increases the volume while a lower value decreases the volume.

CV152
Fuel Fill Volume

Description
This Value Controls the Fuel Fill Sound Effects Volume
Values
0 to 255
Initial Value
100
Related CVs
CV133

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

The decoder's fuel fill sound effect volume is variable from 0 to 255%. The fuel fill sound effect plays once at a random time after the engine becomes stopped from a moving condition. A higher value increases the volume while a lower value decreases the volume.

Lighting CVs

CV159
System Lighting

Description
This Value Controls System Lighting Functions
Values
0-255
Initial Value
2
Related CVs
CV209, CV210, CV227; CV191, CV192

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

The decoder's visual lighting effects for the front and rear light are configured here. Rule 17 lighting may be enabled or disabled by writing a "0" or a "1" to Value. In addition, separate bits allow for independent control of Rule 17 for DCC or DC.

Rule 17 Lighting

Rule 17 Lighting says "Headlights shall be dimmed when standing at stations or waiting on side tracks for an oncoming train". When rule 17 lighting is enabled, the headlight will be noticeable dimmed at appropriately times.

DCC Rule 17 Lighting

For DC operators, the lights will dim per rule 17 when the brake set sound effect plays (CV209). The lights will return to normal brightness when the brake release sound plays (CV210). In addition, CV227 allows for disabling the brake set and brake release. Disabling these automatic effects does disable rule 17 lighting. Only CV159 can disable rule 17 lighting.

DC Rule 17 Lighting

For DC operators, the lights will dim per rule 17 when the brake set sound effect plays (CV191). The lights will return to normal brightness when the brake release sound plays (CV192).

Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: 0=DC Rule 17 Lighting Enabled
1=DC Rule 17 Lighting Disabled
Bit3: Not used
Bit2: Not used
Bit1: L1 Inactive State
0=Off (Ditch Lights Off)
1=50% Duty Cycle On (Ditch Lights On)
Bit0: 0=DCC Rule 17 Lighting Enabled
1= DCC Rule 17 Lighting Disabled

Lighting CVs

CV160
L1 Light Definition

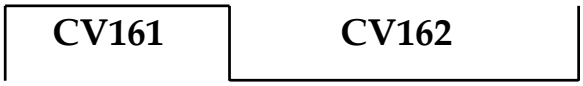
Description
This Value Sets the Function Type and Definition for Output L1
Values
0 to 3
Initial Value
Varies With Each Locomotive
Related CVs
CV161, CV162, CV163, CV164, **CV220, CV225**

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

The decoder's visual lighting effects for L1 output may be one of three types. Each defined type then uses 2 to 4 of the next 4 CV's allowing uses definition of all the parameters. **CV220** must be configured to enable L1 for analog modes. **CV225** must be configured to enable L1 for DCC modes. CV220 allows for L1 activating by the Horn for ditch lights. The ditch lights may be type 1, 2 or 3. The lighting CV's varies with each locomotive.

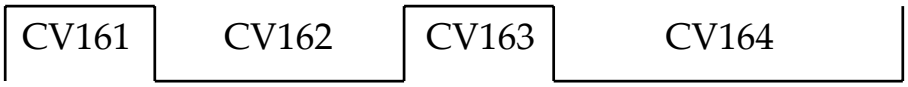
Type 0: Output is disabled.

Type 1: Duty Cycle Strobe. CV161 defines the on time and CV162 defines the off time. Time is measured in 1/32 seconds per count.



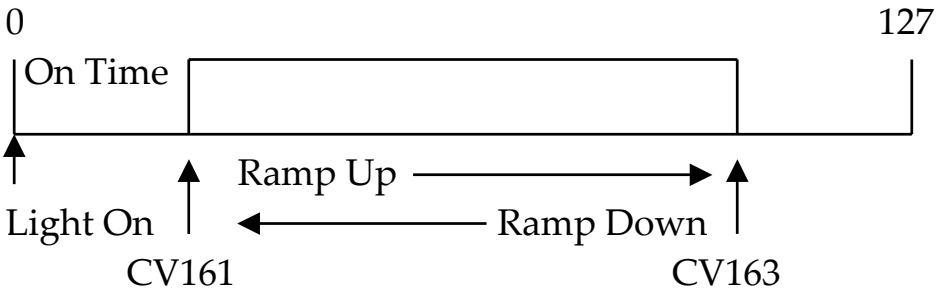
Example: CV160=1
CV161=32 for 1 second on
CV162=64 for 2 seconds off

Type 2: Double Pulsed Duty Cycle Strobe. CV161 defines the on time one; CV162 defines off time one; CV163 defines on time two; CV164 defines off time two. Time is measured in 1/32 seconds per count.



Example: CV160=2
CV161=8 for .25 seconds for on time one
CV162=16 for .5 seconds for off time one
CV163=16 for .5 seconds for on time two
CV164=64 for 2 seconds for off time two

Type 3: Ramped Duty Cycle. CV161 defines the start of the on time within the period; CV162 defines the ramp up time; CV163 defines the end of the on time within the period; CV164 defines the ramp down time. The period is 127 counts. CV161 < CV163 and both should be less than 128. CV162 and CV164 can be any range from 0 to 255.



The time between 0 and CV161 represents the total time the light is turned on over one period. The actual period time (0 to 127) is 11.6ms. CV162 is a ramp up timer determining how many periods elapse before the On Time is increased by one. Once CV161 increases to CV163 value, the ramp down begins. CV164 is a ramp down timer determining how many periods elapse before the On Time is decreases by one. Once CV163 decreases to CV161, the ramp up cycle repeats, etc.

Soft Strobe Example:
CV160=3
CV161=10
CV162=100
CV163=127
CV164=100

Ditch Light Example:
CV160=3
CV161=0
CV162=10
CV163=180
CV164=10

Lighting CVs

CV161
L1 Parameter One

Description
This Value is a Light Parameter, Dependant on CV160
Values
Dependant on Type
Initial Value
10
Related CVs
CV160, CV162, CV163, CV164

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Type 0: Not Used
Type1: Sets the On Time; Valid Values 0-255
Type2: Sets On Time One; Valid Values 0-255
Type3: Sets the Start Point for Power On; Valid Values 0-255
CV161<CV163

Lighting CVs

CV162
L1 Parameter Two

Description
This Value is a Light Parameter, Dependant on CV160
Values
Dependant on Type
Initial Value
10
Related CVs
CV160, CV161, CV163, CV164

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Type 0: Not Used
Type1: Sets the Off Time; Valid Values 0-255
Type2: Sets Off Time One; Valid Values 0-255
Type3: Sets the Ramp Up Time; Valid Values 0-255
Time measured in 11.6ms per count

Lighting CVs

CV163
L1 Parameter Three

Description
This Value is a Light Parameter, Dependant on CV160
Values
Dependant on Type
Initial Value
180
Related CVs
CV160, CV161, CV162, CV164

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Type 0: Not Used
Type1: Not Used
Type2: Sets On Time Two; Valid Values 0-255
Type3: Sets the End Point for Power On; Valid Values 0-255
CV163>CV161

Lighting CVs

CV164
L1 Parameter Four

Description
This Value is a Light Parameter, Dependant on CV160
Values
Dependant on Type
Initial Value
20
Related CVs
CV160, CV161, CV162, CV163

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Type 0: Not Used
Type1: Not Used
Type2: Sets Off Time Two; Valid Values 0-255
Type3: Sets the Ramp Down Time; Valid Values 0-255
Time measured in 11.6ms per count

SETUP CVs

CV180
Bell Ring Interval

Description
This Value Controls the Time Interval Between Bell Strikes
Values
0-120
Initial Value
Varies With Each Bell Sound Effect
Related CVs

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

The decoder's bell ring interval allows the user to customize the time duration between bell strikes. Increasing this value will increase the time between bell strikes. This value is updated in operations mode. Turn on the bell and change this value and hear the bell ring interval change. This CV varies with each locomotive.

SETUP CVs

CV181
Horn Fade In Control

Description
This Value Controls the Fade-In of the Horn
Values
0-255
Initial Value
Varies
Related CVs
CV182, CV183

Bit 7							Bit 0
0	0	0	0	0	0	0	0

The decoder's background effects volumes are decreased when a horn effect starts to play. This value controls the rate of which the background fades out while the horn fades in. This CV varies with each locomotive.

SETUP CVs

CV182
Horn Fade Out Control

Description
This Value Controls the Fade-Out of the Horn
Values
0-255
Initial Value
Varies
Related CVs
CV181, CV183

Bit 7							Bit 0
0	0	0	0	0	0	0	0

The decoder's background effects volumes are increased while a horn effect begins termination. This value controls the rate of which the background fades in while the horn fades out. This CV varies with each locomotive.

SETUP CVs

CV183
Horn Fade In Level

Description
This Value Controls the Fade-In of the Horn
Values
0-255
Initial Value
Varies
Related CVs
CV181, CV182

Bit 7							Bit 0
0	0	0	0	0	0	0	0

The decoder's background effects volumes decrease when a horn effect starts fading in. This value controls the background fade level for the horn fade in. This CV varies with each locomotive.

SETUP CVs

CV184
Analog Brake Control

Description
This Value Controls Analog Brake Effect Activation
Values
0-255
Initial Value
64
Related CVs

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

The decoder's brake squeal effect plays when a track voltage threshold is met. The threshold is met when the track voltage decreases fast enough to meet this threshold (CV184). This effect will not play unless the engine reaches Rev Level Two or greater. Increasing this value decreases the brake sensitivity.

SETUP CVs

CV185
DCC Brake Control

Description
This Value Controls DCC Brake Effect Activation
Values
0-255
Initial Value
20
Related CVs
CV186, CV227

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

The decoder's brake squeal effect plays when a speed step threshold is met. The threshold is met when the speed step decreases fast enough to meet this threshold (CV185). Increasing this value decreases the brake sensitivity. Clearing bit1 of CV227 disables the brake squeal sound effect.

SETUP CVs

CV186
DCC Brake Timer

Description
This Value Controls DCC Brake Effect Activation
Values
0-255
Initial Value
1
Related CVs
CV185

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

The decoder's brake squeal effect plays when a speed step threshold is met (CV185). The threshold is met when the speed step decreases fast enough to meet this threshold (CV185). This value determines when the current speed step is sampled. Increasing this value decreases brake sensitivity.

SETUP CVs

CV187
DCC Uncouple Throttle Stop

Description
This Value Controls When the Uncouple Effect Plays
Values
0-255
Initial Value
3
Related CVs

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

The decode plays the uncouple sound effects at this value of throttle stop if the uncouple sound is armed. Arm the uncouple effects by activating the uncouple Function when the engine is stopped.

SETUP CVs

CV188
Pitch Shift

Description
This Value Controls the Total Pitch of all Sound Effects
Values
0-255
Initial Value
128
Related CVs

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

The decoder's sound effects pitch is controlled by this value. Increasing this value increases all sound effect pitches. This value is updated in operations mode. Turn on the bell or set the horn to the bell (CV35 = 4). With the horn or bell on constantly, change this value and hear the pitch shift.

SETUP CVs

CV190
Analog Sound Setup

Description
This Value Contains Various Analog Sound Setup Features
Values
0-255
Initial Value
1-7; 12
Related CVs
CV131, CV132, CV191, CV192, CV193, CV194, CV195, CV200

Bit 7 **Bit 0**

D7	D6	D5	D4	D3	D2	D1	D0

This value is write Only. Prior to writing this value, use the DCMaster™ and save the desired track voltage. The voltage is saved by Muting the sounds, than Pressing AUX. The current track voltage is saved for later storage. Writing the following **value** to CV190 indicates where the saved voltage is applied.

Value	What is saved	Destination of Saved Track Voltage
12	Analog Rev Hysteresis	**CV200**
7	Analog Rev Three Voltage	**CV195**
6	Analog Rev Two Voltage	**CV194**
5	Analog Rev One Voltage	**CV193**
4	Analog Brake Release Voltage	**CV192**
3	Analog Brake Set Voltage	**CV191**
2	Shut Down Voltage	**CV132**
1	Sound Start Up Voltage	**CV131**

SETUP CVs

CV191
Analog Brake Set Voltage

Description
This Value Sets the Track Voltage for Brake Set Sound Effect
Values
0-255
Initial Value
70
Related CVs
CV146, CV192

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

The decoder's analog brake set sound effect is activated when the track voltage reaches this value. Increasing this value increases the track voltage threshold needed before the brake set sound effect plays. **Note: This value must be lower than the analog brake release voltage CV192.**

SETUP CVs

CV192
Analog Brake Release Voltage

Description
This Value Sets the Track Voltage for Brake Release Sound Effect
Values
0-255
Initial Value
77
Related CVs
CV147, CV191

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

The decoder's analog brake release sound effect is activated when the track voltage reaches this value. Increasing this value increases the track voltage threshold needed before the brake release sound effect plays. **Note: This value must be higher than the analog brake set voltage CV191.**

SETUP CVs

CV193
Analog Rev Level One Voltage

Description
This Value Sets the Track Voltage for Rev Level One Sound Effect
Values
0-255
Initial Value
79
Related CVs
CV137, CV194, CV195, CV200

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

The decoder's rev level one sound effect is activated when the track voltage reaches this value. Increasing this value increases the track voltage threshold needed before the diesel changes to rev level one sound effect. The track voltage must be decreased below this value by the amount set in CV200 or Rev Level Hysteresis before returning to the idle sound effect. **Note: This value must be lower than rev level two (CV194) and higher than the analog brake release voltage (CV192).**

SETUP CVs

CV194
Analog Rev Level Two Voltage

Description
This Value Sets the Track Voltage for Rev Level Two Sound Effect
Values
0-255
Initial Value
88
Related CVs
CV137, CV193, CV195, CV200

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

The decoder's rev level two sound effect is activated when the track voltage reaches this value. Increasing this value increases the track voltage threshold needed before the diesel changes to rev level two sound effect. The track voltage must be decreased below this value by the amount set in CV200 or Rev Level Hysteresis before returning to the rev level one sound effect. **Note: This value must be lower than rev level three (CV195) and higher than the rev level one voltage (CV193).**

SETUP CVs

CV195
Analog Rev Level Three Voltage

Description
This Value Sets the Track Voltage for Rev Level Three Sound Effect
Values
0-255
Initial Value
112
Related CVs
CV137, CV193, CV194, CV200

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

The decoder's rev level three sound effect is activated when the track voltage reaches this value. Increasing this value increases the track voltage threshold needed before the diesel changes to rev level three sound effect. The track voltage must be decreased below this value by the amount set in CV200 or Rev Level Hysteresis before returning to the rev level two sound effects. **Note: This value must be higher then the rev level two voltage (CV194).**

SETUP CVs

CV200
Analog Rev Level Hysteresis

Description
This Value Sets the Track Voltage Rev Level Sound Effect Delta
Values
0-255
Initial Value
2
Related CVs
CV137, CV193, CV194, CV195

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

The decoder's rev level sound effects change at a set track voltage. Due to track voltage fluctuations, a minimal change below the selected Rev Level value inhibits these track voltage fluctuations from causing rev level sound effect changes. Increasing this value decreases this occurrence. **Note: Making this value too large may inhibit rev downs.**

SETUP CVs

CV201
DCC Rev Level One Throttle Stop

Description
This Value Sets the Throttle Stop for Rev Level One Sound Effect
Values
0-255
Initial Value
4
Related CVs
CV137, CV202, CV203

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

The decoder's rev level one sound effect is activated when the throttle stop reaches this value. Idle sound effect is activated when the throttle stop falls below this value. **Note: If the DCC controller is unable to send a value higher that this value, the rev level sound effect will never play.**

Example: Decoder is set for 28 speed steps and CV201 is set for 30. The value 30 never is reached, thus this rev level sound effect never plays.

SETUP CVs

CV202
DCC Rev Level Two Throttle Stop

Description
This Value Sets the Throttle Stop for Rev Level Two Sound Effect
Values
0-255
Initial Value
12
Related CVs
CV137, CV201, CV203

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

The decoder's rev level two sound effect is activated when the throttle stop reaches this value. Rev level one sound effect is activated when the throttle stop falls below this value. **Note: If the DCC controller is unable to send a value higher that this value, the rev level sound effect will never play.**

Example: Decoder is set for 28 speed steps and CV201 is set for 30. The value 30 never is reached, thus this rev level sound effect never plays.

SETUP CVs

CV203
DCC Rev Level Three Throttle Stop

Description
This Value Sets the Throttle Stop for Rev Level Three Sound Effect
Values
0-255
Initial Value
20
Related CVs
CV137, CV201, CV202

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

The decoder's rev level three sound effect is activated when the throttle stop reaches this value. Rev level two sound effect is activated when the throttle stop falls below this value. **Note: If the DCC controller is unable to send a value higher that this value, the rev level sound effect will never play.**

Example: Decoder is set for 28 speed steps and CV201 is set for 30. The value 30 never is reached, thus this rev level sound effect never plays.

SETUP CVs

CV208
DCC Cab Light Throttle Stop

Description
This Value Sets the Throttle Stop for Turning off the Cab Light
Values
0-255
Initial Value
3
Related CVs

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

The decoder's Cab light is turned off at this value. A throttle stop below this value will turn on the Cab light.

SETUP CVs

CV209
DCC Brake Set Throttle Stop

Description
This Value Sets the Throttle Stop for the Brake Set Sound Effect
Values
0-128
Initial Value
0
Related CVs
CV227

Bit 7							Bit 0
0	0	0	0	0	0	0	0

`The decoder's sound effect for brake set plays at this throttle stop if this effect is enabled.

SETUP CVs

CV210
DCC Brake Release Throttle Stop

Description
This Value Sets the Throttle Stop for the Brake Release Sound Effect
Values
0-128
Initial Value
2
Related CVs
CV227

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

The decoder's sound effect for brake release plays at this throttle stop if this effect is enabled.

CONTROL CVs

CV220
Analog Control One

Description
This Value Contains Various Analog Control Bits
Values
0-255
Initial Value
3
Related CVs
CV160, CV221

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

Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: 0=L1 Does not Activate on Bell or Horn
1=L1 Activates on Bell or Horn (See CV221)
Bit3: Not used
Bit2: Not used
Bit1: 0=L1 Disabled
1=L1 Enabled
Bit0: 0=Front and Rear Lights Disabled
1=Front and Rear Lights Enabled

CONTROL CVs

CV221
Analog Control Two

Description
This Value Contains Various Analog Control Bits
Values
0-255
Initial Value
0
Related CVs
CV220

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: Not used
Bit3: Not used
Bit2: Not used
Bit1: Not used
Bit0: 0=Horn Activates L1 (See Bit 4 CV220)
1=Bell Activates L1 (See Bit 4 CV220)

CONTROL CVs

CV222
Analog AUX Select for DCMaster™

Description
This Value Sets the Function for AUX on the DCMaster™
Values
0-255
Initial Value
0
Related CVs
CV220

Bit 7							Bit 0
0	0	0	0	0	0	0	0

AUX Control	Value
Compressor/Grid Blower	**0**
Coupler Sound Effects	**1**
Front/Rear Light Control	**2**
L1 Light Control	**3**

Writing 0 allows the AUX key to play the compressor if the brake is set and the grid blower motor when the brake is cleared
Writing 1 allows the AUX key to play the coupler sound effect
Writing 2 allows the AUX to control the front and rear lights if CV220 bit 0 is set.
Writing 3 allows the AUX to control L1 if CV220 bit 1 is set and CV220 bit 4 is cleared.

CONTROL CVs

CV223
DC Extended Consist Control

Description
This Value Controls Extended DC Consist Lighting
Values
0-255
Initial Value
135
Related CVs
CV19, CV21, CV22, CV221, CV222, CV224

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

Bit7: AUX Disabled=0; AUX Enabled=1
Bit6: Horn Disabled=0; Horn Enabled=1
Bit5: Bell Disabled=0; Bell Enabled=1
Bit4: Not used
Bit3: Not used
Bit2: L1 Disabled=0; L1 Enabled=1
Bit1: Front Light Disabled=0; Front Light Enabled=1
Bit0: Rear Light Disabled=0; Rear Light Enabled=1

See Consist, a technical discussion

CONTROL CVs

CV224
DC Easy Consist™

Description
This Value Allows Convenient DC Consist Configuration
Values
1,2,3
Initial Value
0
Related CVs
CV19, CV21, CV22, CV221, CV222, CV223

Bit 7							Bit 0
0	0	0	0	0	0	0	0

The easy consist feature sets the decoder CV19 for consist 60 forward facing engine. Select 1, 2 or 3 for value to set the consist position.

Values: 0 = Consist Disabled
1 = Front Engine
Front light, L1 and AUX enabled (CV223)
Horn and Bell enabled
2 = Middle Engine
All lights and AUX disabled (CV223)
Horn and Bell disabled
3 = Rear Engine
Front light enabled (CV223)
Horn and Bell disabled

The consist may be disabled by setting CV19 to zero or CV224 to zero. The AUX function setup (CV222) for DCMaster™ is honored in the consist. Using the Easy Consist™ feature allows a quick programming of a basic consist.

Front Engine

All lights are active accept the reverse light. The AUX function is enabled when the consist is addressed. The Horn and Bell are enabled. If a change in the AUX function key is required, modify CV222. If a change in the lighting or Horn or Bell is required modify CV223.

Middle Engine

All lights are inactive. The AUX function is disabled. The Horn and Bell are disabled. If a change in the AUX function key is required, modify CV222. If a change in the lighting or Horn or Bell is required modify CV223.

Rear Engine

Only the forward light is active. The Horn, Bell and AUX are disabled. If a change in the AUX function key is required, modify CV222. If a change in the lighting or Horn or Bell is required modify CV223.

See Consist, a technical discussion

CONTROL CVs

CV225
DCC Control One

Description
This Value Contains Various DCC Control Bits
Values
0-255
Initial Value
3
Related CVs
CV160, CV226

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

Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: 0=L1 Does not Activate on Bell or Horn
1=L1 Activates on Bell or Horn (See CV226)
Bit3: Not used
Bit2: Not used
Bit1: 0=L1 Disabled
1=L1 Enabled
Bit0: 0=Front and Rear Lights Disabled
1=Front and Rear Lights Enabled

CONTROL CVs

CV226
DCC Control Two

Description
This Value Contains Various DCC Control Bits
Values
0-255
Initial Value
0
Related CVs
CV225

Bit 7							Bit 0
0	0	0	0	0	0	0	0

Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: Not used
Bit3: Not used
Bit2: Not used
Bit1: Not used
Bit0: 0=Horn Activates L1 (See Bit 4 CV225)
1=Bell Activates L1 (See Bit 4 CV225)

CONTROL CVs

CV227
DCC Control Three

Description
This Value Contains Various DCC Control Bits
Values
0-255
Initial Value
3
Related CVs
CV130, CV160

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

Bit7: Not used
Bit6: Not used
Bit5: Not used
Bit4: Not used
Bit3: Not used
Bit2: Not used
Bit1: 0=Brake Squeal Disabled on Quick Decelerations
1=Brake Squeal Automatic on Quick Decelerations
Bit0: 0=Brake Set and Brake Release Disabled on Throttle Stop Zero Transitions
1=Brake Set and Brake Release Automatic on Throttle Stop Zero Transitions

CV228
DCC Startup Timer

Description
This Value Contains the DCC Startup Timer
Values
0-255
Initial Value
1
Related CVs

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

On power up, the decoder will wait this much time in seconds to detect the DCC system. If this value is too low, DC mode will start the system resulting in strange behavior. The initial value is 1 second.

CONTROL CVs

CV229
DCC Extended Consist Lighting

Description
This Value Controls Extended DCC Consist Lighting
Values
0-255
Initial Value
135
Related CVs
CV19, CV21, CV22

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

Bit7: Cab Disabled=0; Cab Enabled=1
Bit6: Not used
Bit5: Not used
Bit4: Not used
Bit3: Not used
Bit2: L1 Disabled=0; L1 Enabled=1
Bit1: Front Light Disabled=0; Front Light Enabled=1
Bit0: Rear Light Disabled=0; Rear Light Enabled=1

See Consist, a technical discussion

CONTROL CVs

CV230
DCC Easy Consist™

Description
This Value Allows Convenient DCC Consist Configuration
Values
1,2,3
Initial Value
0
Related CVs
CV19, CV21, CV22, CV229

Bit 7							Bit 0
0	0	0	0	0	0	0	0

The easy consist feature sets the decoder CV19 for consist 60 forward facing engine. Select 1, 2 or 3 for value to set the consist position.

Values: 0 = Consist Disabled
1 = Front Engine
All consist function keys enabled (CV21, CV22)
All lights except the rear light enabled (CV229)
2 = Middle Engine
All consist function keys except F0, F8 and F9 disabled (CV21, CV22); All lights disabled (CV229)
3 = Rear Engine
All consist function keys except F0, F8 and F9 disabled (CV21, CV22)
Only front light enabled (CV229)

The consist may be disabled by setting CV19 to zero or CV230 to zero. No CV's may be changed when the consist is addressed. The engine in a consist must be addressed when modifying its CV. All function keys are honored by addressing the engine. Additionally, function keys enabled by CV21 and CV22 are honored by addressing the consist. Using the Easy Consist™ feature allows a quick programming of a basic consist.

Front Engine

All lights are active accept the reverse light. If a change in this lighting is required, modify CV299 for the appropriate lighting changes. All functions keys are enable when the consist is addressed. If a change in active function keys are required, modify CV21 and CV22.

Middle Engine

All lights are inactive. If a change in this lighting is required, modify CV299 for the appropriate lighting changes. All functions keys are disabled except F0 (Headlight), F8 (Mute-Volume) and F9 (Startup) when the consist is addressed. If a change in active function keys are required, modify CV21 and CV22.

Rear Engine

Only the forward light is active. If a change in this lighting is required, modify CV299 for the appropriate lighting changes. All functions keys are disabled except F0 (Headlight), F8 (Mute-Volume) and F9 (Startup) when the consist is addressed. If a change in active function keys are required, modify CV21 and CV22.

See Consist, a technical discussion

CONTROL CVs

CV240
Random Sound Effect Generator Occurrence

Description
This Value Contains the DCC Startup Timer
Values
1-30
Initial Value
24
Related CVs

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

This value determines how often random sound effects occur. Increasing this value decreases the occurrences of random sound effects.

CONTROL CVs

CV245
General System Controls

Description
This Value Contains General Bits as Defined
Values
0-255
Initial Value
1
Related CVs

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

These bit value control the following:

D3 – 0=Analog Horn On (Frequency Shifted)
1=Analog Horn Off (Frequency Shifted)
D0 – 0=Horn Alternative Ending Disabled
1=Horn Alternative Ending Enabled

Note: D3 In Versions 8.0 and Above

CONTROL CVs

CV248
Enhanced DC Motor Startup Delay

Description
This Value Contains the Motor Startup Delay
Values
0-63
Initial Value
8
Related CVs

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

This value creates a powerup motor delay. Decreasing this value causes a delay in when the motor receives power. This value allows closer synchronization between sounds and user actions.

CONTROL CVs

CV249
Enhanced DC Motor Control Momentum

Description
This Value Contains the Motor Momentum
Values
0-255
Initial Value
2
Related CVs

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

This value creates a motor delay in responding to track voltage changes. Increasing this value slows the response to changing track voltages while decreasing this value increases the response to changing track voltages. This value allows closer synchronization between sounds and user actions. Only the motor response is slowed by this value.

CONTROL CVs

CV250
Enhanced DC Motor Track Voltage Momentum

Description
This Value Contains the Track Voltage Momentum
Values
1-255
Initial Value
10
Related CVs

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

This value creates a delay in the digitally filtered track voltage. Increasing this value slows the response to changing track voltages while decreasing this value increases the response to changing track voltages. Sound and motor response varies with the change in this value.

CONTROL CVs

CV251
Enhanced DC Motor Control Vmax

Description
This Value Contains the Motor Finish Track Voltage
Values
0-255
Initial Value
144
Related CVs
CV 252, CV253

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

Vmax is the track voltage that once reached allows 100% track power to the motor. Increasing Vmax means a higher track voltage is needed before all track power is supplied to the motor. Decreasing Vmax means full power to the motor at a lower track voltage.

Note: Vmax must be greater than Vmin.

See Advanced DC Motor Control

CONTROL CVs

CV252
Enhanced DC Motor Control Vmin

Description
This Value Contains the Motor Start Track Voltage
Values
0-255
Initial Value
80
Related CVs
CV 251, CV253

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

Vmin defines the track voltage that applies the lowest or starting motor power. The power applied at this voltage is the Dmin. Valid values for Vmin is from 0-255. Decreasing Vmin means a higher track voltage becomes necessary before the train begins to move. Increasing Vmin means the train begins to move at a lower track voltage. Vmin and Dmin work together to determine the initial motor power at the start voltage for train movement.

Note: Vmin must be less than Vmax.

See Advanced DC Motor Control

CONTROL CVs

CV253
Enhanced DC Motor Control Dmin

Description
This Value Contains the Motor Start Duty Cycle
Values
0-255
Initial Value
50
Related CVs
CV 251, CV252

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

Dmin defines the minimal duty cycled responsible for Vmin motor power. Increasing this value will cause more motor power at Vmin while decreasing this value causes less motor power at Vmin.

See Advanced DC Motor Control

DCC REV UP/REV DOWN

Synopsis

The diesel engine may have its engine throttled up or down at any throttle stop other than zero. Speed step zero resets manual throttle control back to automatic throttle control. Under automatic throttle control the Rev Levels change according to CV201 (Throttle Stop Rev One), CV202 (Throttle Stop Rev Two) and CV203 (Throttle Stop Rev Three).

Manual

Once the throttle stop is greater than zero, manual mode may be activated. Pressing F5 causes the diesel engine to rev up one level per press. The manual mode is honored until the speed step exceeds the throttle stop set for CV201, CV202 or CV203, depending on the current diesel motor rev level. Once the speed step exceeds the throttle stop setting for the current rev level, automatic mode is activated.

> **Example:** Power engine and start (F9). Set speed step to one. Press F5 twice. Notice the rev level changes to rev level two. Increase the speed steps until CV203 is exceeded. The diesel now automatically revs to throttle stop three. Automatic mode is now engaged. The diesel now honors CV201, CV202 and CV203.

Pressing F6 causes the diesel to rev down one level per press. The manual mode is honored until the speed step falls below the throttle stop set for CV201, CV202 or CV203, depending on the current diesel motor rev level. Once the speed step falls below the throttle stop setting for the current rev level, automatic mode is activated.

> **Example:** Power engine and start (F9). Set speed step to 60. Wait for the diesel to reach rev level three. Press F6 once. Notice the rev level changes to rev level two. Decrease the speed step below CV202's value. The diesel now automatically revs to throttle stop one. Automatic mode is now engaged. The diesel now honors CV201, CV202 and CV203.

> **Example:** Set to speed step One. Press F5 three times. Wait until the diesel reaches rev level three. Press F6. Notice that the diesel revs done to idle. Automatic mode is activated when F6 is pressed because the speed step is below rev three throttle stop CV203.

Advanced DC Motor Control

Dc operation with sounds creates a dilemma. The train usually will start moving at a very low track voltage, to low to power a loudspeaker with high quality sounds. A higher voltage of operation for the motor is an acceptable solution. About 6-7 volts is necessary before this sound system can function, producing loud, high quality sounds, ***with*** the motor powered and the train beginning to move. This advanced motor controller gives acceptable motor control at the necessary power levels, ***allowing the sound system to start at a much lower voltage***, keeping the motor from stealing the power from the sound system until enough power exists to move the train without the sounds degrading or shutting off. Also, more overall power is diverted to the motor at top speeds. The maximum train speed is higher with this advanced DC motor controller.

The DC motor controller may be altered by changing the power curve. CV251, CV252 and CV253 control the slope, intercept and initial motor power. Altering these values changes the trains startup behavior relative to track voltage and at what voltage full track power is applied to the motor.

Vmin

Vmin defines the track voltage that applies the lowest or starting motor power. Valid values for Vmin is from 0-255. The distance between Vmin and Vmax (Vmax > Vmin) distributes motor power from Dmin (Applied Duty Cycle) at Vmin until Vmax where 100% of the power from the track is applied.

Note: Vmin < Vmax. Too low a value for Vmin may cause the sound unit to reset when power is supplied to the motor.

Vmax

Vmax is the track voltage that once reached allows 100% track power to the motor. Valid values for Vmax is from 0-255. Increasing Vmax means a higher track voltage is needed before all track power is supplied to the motor. Decreasing Vmax means full power to the motor at a lower track voltage.

Note: Vmax > Vin. Too high a value for Vmax may not allow the train to reach full speed.

Dmin

Dmin defines the minimal duty cycled responsible for Vmin motor power. Valid values are from 1 to 63. The initial value is 44. Increasing this value will cause more motor power at Vmin while decreasing this value causes less motor power at Vmin.

Note: Too high a value for Dmin may cause the sound unit to reset when power is supplied to the motor

Advanced DC Motor Control

Figure one illustrates a motor connected directly to track power and a motor connected to the advanced motor controller. The sound unit supplies full sound volume at about 5.5 volts. Motor power is supplied around 6 volts. Between 6 volts and 12 volts, the sound unit monitors the track voltage and proportionately increase or decreases the motor power as noted by the slope of the enhanced curve in figure one. At about 12 volts, all power is applied to the motor. The train motor is now for all practically purposes, connected directly to the track. Note that 100% power is not applied. The loss is due to the power control device. You will note that the maximum train speed will be faster with the enhanced DC motor controller than most DC decoders. This loss illustrated in the curve is much less with the enhanced DC motor controller.

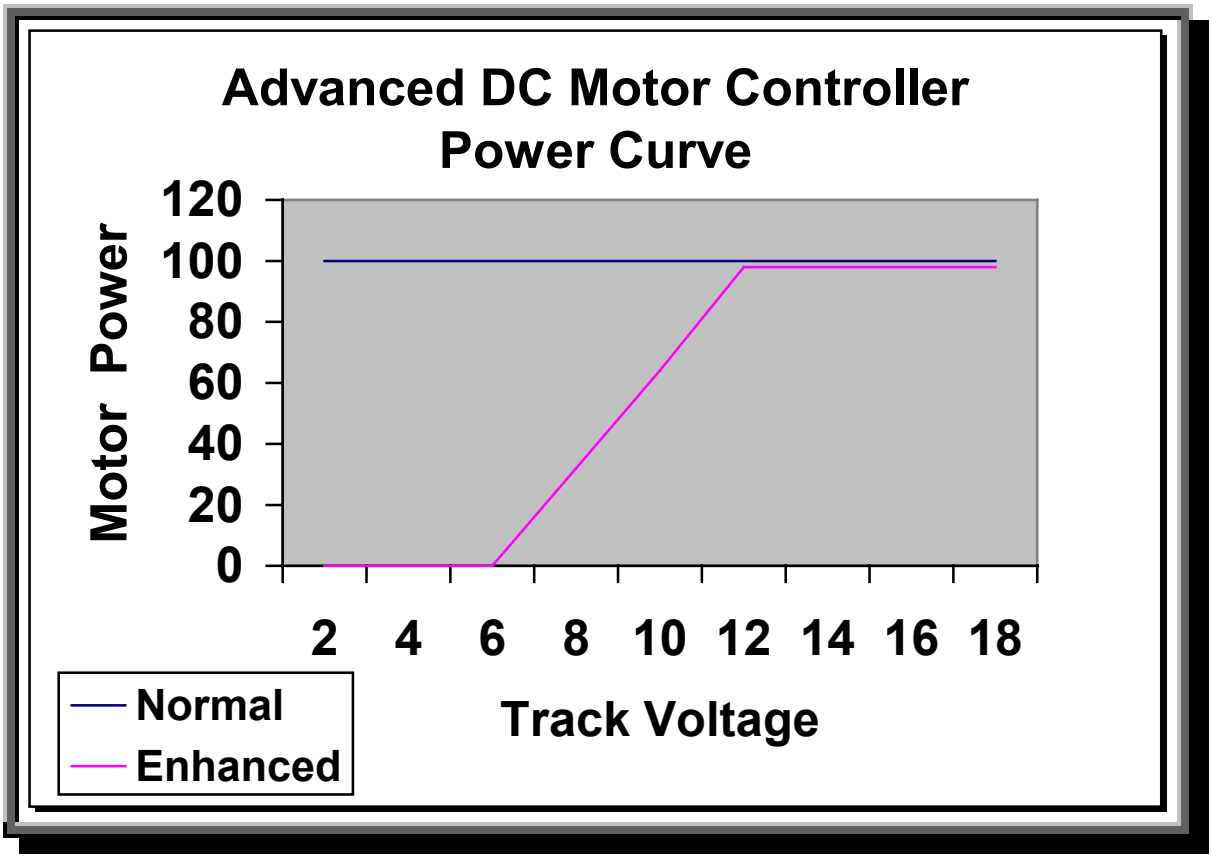


Figure 1

SYSTEM CVs

CV	Description	Initial	Yours
1	Primary Address	3	
7	Manufacturer Version	?	
8	Manufacturer ID	38	
15	Unlock ID Code	0	
16	Lock ID Number	0	
17	Extended Address MSB	192	
18	Extended Address LSB	128	
19	Consist Address	0	
21	Consist Functions Type 0	255	
22	Consist Functions Type1	255	
29	Configuration Bits	2	

FUNCTION CVs

CV	Description	Initial	Yours
33	F0(f) (Front Lamp)	1	
34	F0(r) (Rear Lamp)	2	
35	F1 (Bell)	16	
36	F2 (Horn)	4	
37	F3 (Coupler)	32	
38	F4 (Grid Blower Motor and Compressor)	8	
39	F5 (Ramp Diesel Engine Up)	16	
40	F6 (Ramp Diesel Engine Down)	32	
41	F7 (L1 Visual Effects)	64	
42	F8 (Master Analog Volume)	128	
43	F9 (Shutdown and Startup)	16	
44	F10 (Radiator Cooling Fan)	32	
45	F11 (Air Release and Air Filling)	64	
46	F12 (Brakes)	128	

**** Note: Function Key Assignments for Revision 1.0 through 7.0**

FUNCTION CVs

CV	Description	Initial	Yours
33	F0 (Lights)	1	
34	F1 (Bell)	2	
35	F2 (Horn)	3	
36	F3 (Coupler)	4	
37	F4 (Grid Blower Motor and Compressor)	5	
38	F5 (Ramp Diesel Engine Up)	6	
39	F6 (Ramp Diesel Engine Down)	7	
40	F7 (L1 Visual Effects)	8	
41	F8 (Master Analog Volume)	9	
42	F9 (Shutdown and Startup)	10	
43	F10 (Radiator Cooling Fan)	11	
44	F11 (Air Release and Air Filling)	12	
45	F12 (Brakes)	13	

**** Note: Function Key Assignments for Revision 8.0 and Higher**

Sound CVs

CV	Description	Initial	Yours
130	Master Volume Sound Increment	2	
131	Analog Sound Unit Startup Voltage	56	
132	Analog Sound Unit Shutdown Voltage	54	
133	Sound Unit Master Volume	15	
135	Horn Volume	100	
136	Bell Volume	100	
137	Diesel Volume	100	
138	Horn2 Volume	100	
140	Couple Volume	100	
141	Uncoupler Volume	100	
142	Wheel Flange Volume	100	
143	Compressor Volume	100	
144	Manual Air Release Volume	100	
145	Air Filling Volume	100	
146	Brake Set Volume	100	
147	Brake Release Volume	100	
148	Spit Valve Volume	100	
149	Radiator Cooling Volume	100	
150	Grid Blower Motor Volume	100	
151	Brake Squeal Volume	100	
152	Fuel Fill Volume	100	

LIGHTING CVs

CV	Description	Initial	Yours
159	System Lighting	2	
160	L1 Light Definition	1	
161	L1 Parameter 1	10	
162	L1 Parameter 2	10	
163	L1 Parameter 3	180	
164	L1 Parameter 4	20	

Setup CVs

CV	Description	Initial	Yours
180	Bell Ring Interval	Varies	
181	Horn Fade In	1	
182	Horn Fade Out	26	
183	Horn Fade In Level	1	
184	Analog Brake Control	64	
185	DCC Brake Control	20	
186	DCC Brake Timer	1	
187	Uncouple Throttle Stop	3	
188	Pitch Shift	128	
190	Analog Sound Setup	x	
191	Analog Brake Set Voltage	70	
192	Analog Brake Release Voltage	77	
193	Analog Rev Level One Voltage	79	
194	Analog Rev Level Two Voltage	88	
195	Analog Rev Level Three Voltage	112	
200	Analog Rev Level Hysteresis	2	
201	DCC Rev Level One Throttle Stop	4	
202	DCC Rev Level Two Throttle Stop	12	
203	DCC Rev Level Three Throttle Stop	20	
208	DCC Cab Light Throttle Stop	3	
209	DCC Brake Set Throttle Stop	0	
210	DCC Brake Release Throttle Stop	2	

Control CVs

CV	Description	Initial	Yours
220	Analog Control One	3	
221	Analog Control Two	0	
222	Analog AUX Select for DCMaster™	0	
223	DC Extended Consist Control	135	
224	DC Easy Consist™	0	
225	DCC Control One	3	
226	DCC Control Two	0	
227	DCC Control Three	3	
228	DCC Start Up Timer	1	
229	DCC Extended Consist Lighting	135	
230	DCC Easy Consist™	0	
240	Random Sound Generator Occurrence	24	
245	General System Controls	1	
248	Enhanced DC Motor Startup Delay	8	
249	Enhanced DC Motor Control Momentum	2	
250	Enhanced DC Motor Track Voltage Momentum	10	
251	Enhanced DC Motor Control Vmax	144	
252	Enhanced DC Motor Control Vmin	80	
253	Enhanced DC Motor Control Dmin	50	

DCC CVs

CV	Description	Initial	Yours
1	Primary Address	3	
7	Manufacturer Version	?	
8	Manufacturer ID	38	
15	Unlock ID Code	0	
16	Lock ID Number	0	
17	Extended Address MSB	192	
18	Extended Address LSB	128	
19	Consist Address	0	
21	Consist Functions Type 0	255	
22	Consist Functions Type1	255	
29	Configuration Bits	2	

**** Note: See Function CV's for F0 Through F12**

DCC CVs

CV	Description	Initial	Yours
130	Master Volume Sound Increment	2	
133	Sound Unit Master Volume	15	
135	Horn Volume	100	
136	Bell Volume	100	
137	Diesel Volume	100	
138	Horn2 Volume	100	
140	Couple Volume	100	
141	Uncouple Volume	100	
142	Wheel Flange Volume	100	
143	Compressor Volume	100	
144	Manual Air Release Volume	100	
145	Air Filling Volume	100	
146	Brake Set Volume	100	
147	Brake Release Volume	100	
148	Spit Valve Volume	100	
149	Radiator Cooling Volume	100	
150	Grid Blower Motor Volume	100	
151	Brake Squeal Volume	100	
152	Fuel Fill Volume	100	
159	System Lighting	2	
160	L1 Light Definition	1	
161	L1 Parameter 1	10	
162	L1 Parameter 2	10	
163	L1 Parameter 3	180	
164	L1 Parameter 4	20	

DCC CVs

CV	Description	Initial	Yours
180	Bell Ring Interval	Varies	
181	Horn Fade In	1	
182	Horn Fade Out	26	
183	Horn Fade In Level	1	
185	DCC Brake Control	20	
186	DCC Brake Timer	1	
187	Uncouple Throttle Stop	3	
188	Pitch Shift	128	
201	DCC Rev Level One Throttle Stop	4	
202	DCC Rev Level Two Throttle Stop	12	
203	DCC Rev Level Three Throttle Stop	20	
208	DCC Cab Light Throttle Stop	3	
209	DCC Brake Set Throttle Stop	0	
210	DCC Brake Release Throttle Stop	2	
225	DCC Control One	3	
226	DCC Control Two	0	
227	DCC Control Three	3	
228	DCC Start Up Timer	1	
229	DCC Extended Consist Lighting	135	
230	DCC Easy Consist™	0	
240	Random Sound Generator Occurrence	24	
245	General System Controls	1	

DC CVs

CV	Description	Initial	Yours
15	Unlock ID Code	0	
16	Lock ID Number	0	
19	Consist Address	0	
29	Configuration Bits	2	
130	Master Volume Sound Increment	2	
131	Analog Sound Unit Startup Voltage	56	
132	Analog Sound Unit Shutdown Voltage	54	
133	Sound Unit Master Volume	15	
135	Horn Volume	100	
136	Bell Volume	100	
137	Diesel Volume	100	
138	Horn2 Volume	100	
140	Couple Slack Volume	100	
141	Uncouple Volume	100	
142	Wheel Flange Volume	100	
143	Compressor Volume	100	
144	Manual Air Release Volume	100	
145	Air Filling Volume	100	
146	Brake Set Volume	100	
147	Brake Release Volume	100	
148	Spit Valve Volume	100	
149	Radiator Cooling Volume	100	
150	Grid Blower Motor Volume	100	
151	Brake Squeal Volume	100	
152	Fuel Fill Volume	100	

DC CVs

CV	Description	Initial	Yours
159	System Lighting	2	
160	L1 Light Definition	1	
161	L1 Parameter 1	10	
162	L1 Parameter 2	10	
163	L1 Parameter 3	180	
164	L1 Parameter 4	20	
180	Bell Ring Interval	Varies	
181	Horn Fade In	1	
182	Horn Fade Out	26	
183	Horn Fade In Level	1	
184	Analog Brake Control	64	
188	Pitch Shift	128	
190	Analog Sound Setup	x	
191	Analog Brake Set Voltage	70	
192	Analog Brake Release Voltage	77	
193	Analog Rev Level One Voltage	79	
194	Analog Rev Level Two Voltage	88	
195	Analog Rev Level Three Voltage	112	
200	Analog Rev Level Hysteresis	2	
220	Analog Control One	3	
221	Analog Control Two	0	
222	Analog AUX Select for DCMaster™	0	
223	DC Extended Consist Control	135	
224	DC Easy Consist™	0	
240	Random Sound Generator Occurrence	24	

DC CVs

245	General System Controls	1	
248	Enhanced DC Motor Startup Delay	8	
249	Enhanced DC Motor Control Momentum	2	
250	Enhanced DC Motor Track Voltage Momentum	10	
251	Enhanced DC Motor Control Vmax	144	
252	Enhanced DC Motor Control Vmin	80	
253	Enhanced DC Motor Control Dmin	50	

Decimal to Binary Primer

Setting CV's

Setting the CV's requires knowledge of conversion between binary and decimal. The following examples demonstrates the conversion process from binary to decimal after determining which bits in a CV need to be "1" and which needs to be "0". The tables are also useful for converting binary to decimal.

Reading CV's

The tables are also useful for converting decimal to binary when reading the CV's in service mode. After reading the CV, use the tables to determine which bits are "1" and which bits are "0". Once the bit patterns are identified, find the CV in this manual to determine what functions are controlled by the bits.

Bit 7							**Bit 0**
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
128	64	32	16	8	4	2	1

Consider a binary number 10001011

128+0+0+0+8+0+2+1=139

Consider a binary number 00011101

0+0+0+16+8+4+0+1=29

CVxx read is 39. Table lookup is: 00100111

Decimal to Hexadecimal Conversion

Dec	Hex	Oct	Bin
0	0	000	00000000
1	1	001	00000001
2	2	002	00000010
3	3	003	00000011
4	4	004	00000100
5	5	005	00000101
6	6	006	00000110
7	7	007	00000111
8	8	010	00001000
9	9	011	00001001
10	A	012	00001010
11	B	013	00001011
12	C	014	00001100
13	D	015	00001101
14	E	016	00001110
15	F	017	00001111

Dec	Hex	Oct	Bin
16	10	020	00010000
17	11	021	00010001
18	12	022	00010010
19	13	023	00010011
20	14	024	00010100
21	15	025	00010101
22	16	026	00010110
23	17	027	00010111
24	18	030	00011000
25	19	031	00011001
26	1A	032	00011010
27	1B	033	00011011
28	1C	034	00011100
29	1D	035	00011101
30	1E	036	00011110
31	1F	037	00011111

Dec	Hex	Oct	Bin
32	20	040	00100000
33	21	041	00100001
34	22	042	00100010
35	23	043	00100011
36	24	044	00100100
37	25	045	00100101
38	26	046	00100110
39	27	047	00100111
40	28	050	00101000
41	29	051	00101001
42	2A	052	00101010
43	2B	053	00101011
44	2C	054	00101100
45	2D	055	00101101
46	2E	056	00101110
47	2F	057	00101111

Dec	Hex	Oct	Bin
48	30	060	00110000
49	31	061	00110001
50	32	062	00110010
51	33	063	00110011
52	34	064	00110100
53	35	065	00110101
54	36	066	00110110
55	37	067	00110111
56	38	070	00111000
57	39	071	00111001
58	3A	072	00111010
59	3B	073	00111011
60	3C	074	00111100
61	3D	075	00111101
62	3E	076	00111110
63	3F	077	00111111

Dec	Hex	Oct	Bin
64	40	100	01000000
65	41	101	01000001
66	42	102	01000010
67	43	103	01000011
68	44	104	01000100
69	45	105	01000101
70	46	106	01000110
71	47	107	01000111
72	48	110	01001000
73	49	111	01001001
74	4A	112	01001010
75	4B	113	01001011
76	4C	114	01001100
77	4D	115	01001101
78	4E	116	01001110
79	4F	117	01001111

Dec	Hex	Oct	Bin
80	50	120	01010000
81	51	121	01010001
82	52	122	01010010
83	53	123	01010011
84	54	124	01010100
85	55	125	01010101
86	56	126	01010110
87	57	127	01010111
88	58	130	01011000
89	59	131	01011001
90	5A	132	01011010
91	5B	133	01011011
92	5C	134	01011100
93	5D	135	01011101
94	5E	136	01011110
95	5F	137	01011111

Decimal to Hexadecimal Conversion

Dec	Hex	Oct	Bin
96	60	140	01100000
97	61	141	01100001
98	62	142	01100010
99	63	143	01100011
100	64	144	01100100
101	65	145	01100101
102	66	146	01100110
103	67	147	01100111
104	68	150	01101000
105	69	151	01101001
106	6A	152	01101010
107	6B	153	01101011
108	6C	154	01101100
109	6D	155	01101101
110	6E	156	01101110
111	6F	157	01101111

Dec	Hex	Oct	Bin
112	70	160	01110000
113	71	161	01110001
114	72	162	01110010
115	73	163	01110011
116	74	164	01110100
117	75	165	01110101
118	76	166	01110110
119	77	167	01110111
120	78	170	01111000
121	79	171	01111001
122	7A	172	01111010
123	7B	173	01111011
124	7C	174	01111100
125	7D	175	01111101
126	7E	176	01111110
127	7F	177	01111111

Dec	Hex	Oct	Bin
128	80	200	10000000
129	81	201	10000001
130	82	202	10000010
131	83	203	10000011
132	84	204	10000100
133	85	205	10000101
134	86	206	10000110
135	87	207	10000111
136	88	210	10001000
137	89	211	10001001
138	8A	212	10001010
139	8B	213	10001011
140	8C	214	10001100
141	8D	215	10001101
142	8E	216	10001110
143	8F	217	10001111

Dec	Hex	Oct	Bin
144	90	220	10010000
145	91	221	10010001
146	92	222	10010010
147	93	223	10010011
148	94	224	10010100
149	95	225	10010101
150	96	226	10010110
151	97	227	10010111
152	98	230	10011000
153	99	231	10011001
154	9A	232	10011010
155	9B	233	10011011
156	9C	234	10011100
157	9D	235	10011101
158	9E	236	10011110
159	9F	237	10011111

Dec	Hex	Oct	Bin
160	A0	240	10100000
161	A1	241	10100001
162	A2	242	10100010
163	A3	243	10100011
164	A4	244	10100100
165	A5	245	10100101
166	A6	246	10100110
167	A7	247	10100111
168	A8	250	10101000
169	A9	251	10101001
170	AA	252	10101010
171	AB	253	10101011
172	AC	254	10101100
173	AD	255	10101101
174	AE	256	10101110
175	AF	257	10101111

Dec	Hex	Oct	Bin
176	B0	260	10110000
177	B1	261	10110001
178	B2	262	10110010
179	B3	263	10110011
180	B4	264	10110100
181	B5	265	10110101
182	B6	266	10110110
183	B7	267	10110111
184	B8	270	10111000
185	B9	271	10111001
186	BA	272	10111010
187	BB	273	10111011
188	BC	274	10111100
189	BD	275	10111101
190	BE	276	10111110
191	BF	277	10111111

Decimal to Hexadecimal Conversion

Dec	Hex	Oct	Bin
192	C0	300	11000000
193	C1	301	11000001
194	C2	302	11000010
195	C3	303	11000011
196	C4	304	11000100
197	C5	305	11000101
198	C6	306	11000110
199	C7	307	11000111
200	C8	310	11001000
201	C9	311	11001001
202	CA	312	11001010
203	CB	313	11001011
204	CC	314	11001100
205	CD	315	11001101
206	CE	316	11001110
207	CF	317	11001111

Dec	Hex	Oct	Bin
208	D0	320	11010000
209	D1	321	11010001
210	D2	322	11010010
211	D3	323	11010011
212	D4	324	11010100
213	D5	325	11010101
214	D6	326	11010110
215	D7	327	11010111
216	D8	330	11011000
217	D9	331	11011001
218	DA	332	11011010
219	DB	333	11011011
220	DC	334	11011100
221	DD	335	11011101
222	DE	336	11011110
223	DF	337	11011111

Dec	Hex	Oct	Bin
224	E0	340	11100000
225	E1	341	11100001
226	E2	342	11100010
227	E3	343	11100011
228	E4	344	11100100
229	E5	345	11100101
230	E6	346	11100110
231	E7	347	11100111
232	E8	350	11101000
233	E9	351	11101001
234	EA	352	11101010
235	EB	353	11101011
236	EC	354	11101100
237	ED	355	11101101
238	EE	356	11101110
239	EF	357	11101111

Dec	Hex	Oct	Bin
240	F0	360	11110000
241	F1	361	11110001
242	F2	362	11110010
243	F3	363	11110011
244	F4	364	11110100
245	F5	365	11110101
246	F6	366	11110110
247	F7	367	11110111
248	F8	370	11111000
249	F9	371	11111001
250	FA	372	11111010
251	FB	373	11111011
252	FC	374	11111100
253	FD	375	11111101
254	FE	376	11111110
255	FF	377	11111111

DCC Function Keys

Function Key	Description
F0	Front/Rear Lighting
F1	Bell
F2	Horn
F3	**Not Moving:** Arm Coil Uncouple **Moving:** Plays Coil Couple
F4	**Not Moving:** Plays Compressor **Moving:** Plays Grid Blower Motor
F5	Ramp Up Diesel Rev Level
F6	Ramp Down Diesel Rev Level
F7	L1 Control
F8	**Double Press:** System Volume Up or Down **Single Press:** All Sounds Muted Except Horn/Bell
F9	Startup or Shutdown
F10	Radiator Cooling Fan
F11	**Not Moving:** Air Filling **Moving:** Air Release
F12	**Throttle Stop Zero:** Brake Set **Throttle Stop One:** Brake Release

DCMaster™ Control

Key	Description
Bell	Bell
Horn	Horn
Aux	**AUX Function Select:** Compressor/Grid Blower Coupler Sound Effects Front/Rear Light Control L1 Light Control
Vol	**Double Press:** System Volume Up or Down **Single Press:** All Sounds Muted Except Horn/Bell