

- CV1** Short decoder address; 1-127 valid
- CV2** Start Voltage (useful range 0-100)
- CV3** Acceleration rate (each unit = 7mS between speed steps) 255 max.
- CV4** Deceleration rate (each unit = 7mS between speed steps) 255 max.
- CV5** Vmax, speed at highest speed step. 0=use factory default of 255
- CV6** Vmid, speed (on a scale of 1-255) at speed step 7,14, or 63. 0=use default of 127
- CV7** Decoder version number. This decoder is 38
- CV8** Manufacturer ID. NCE = 11 (0B hex)
- CV11** Packet timeout value (in ½ second increments) Time the decoder will wait before braking to a stop after running into a section of track with DC power. 0=Don't brake
- CV15** Decoder programming lock "KEY". This CV is always programmable even when "locked"
- CV16** Decoder programming lock ID. When CV15=CV16, programming is unlocked and the decoder will respond to programming commands. If CV15 is not equal to CV16 then decoder programming is locked and it will not program (except CV15) or read.
- CV17** High byte of long (4 digit) address
 - bit 6,7 always= 1
 - bits 0-5 are upper 6 bits of address
- CV18** Low byte of long (4 digit) address
- CV19** Consist address. (0 or 128 = no consist active)
 - bits 0-6 short consist address (1-127 valid)
 - bit 7 0= direction is normal, 1= direction is reversed
- CV21** Functions active in consist mode. Bit 0 controls F1, bit 1=F2, bit 2=F3, etc.
 - bit 0 - 1=function can be controlled at consist address, 0 = no consist control
- CV22** Functions active in consist mode. Bits 0,1 control FLF and FLR respectively
 - each bit 1=function can be controlled at consist address, 0 = no consist control
- CV29**
 - bit 0 1= direction of operation is reversed, 0= direction is normal
 - bit 1 1=28 speed mode (always enabled)
 - bit 2 1= analog operation mode enabled, 0 = disabled
 - bit 4 1= alternate speed table active, 0= use table defined by CV2,5,6
 - bit 5 1= use long address in CV17/18, 0= use short address CV1
 - bits 3,6,7 are ignored by the decoder
- CV30** Set this CV to 2 **on the programming track** and the decoder will reset to factory settings.
- CV33-CV40** function mapping CVs for F0-F6
- CV67-CV94** Uploadable speed table steps 1-28 (128 speed mode calculates intermediate steps)
- CV95** Reverse trim, values 1-127 add to reverse speed, values 129-255 add to forward speed
- CV116** Torque kick rate - number of 16ms periods in a row that motor is 'kicked' with voltage pulse
- CV117** Torque kick strength - how much voltage is used to kick the motor at slow speeds. Reduces to 0 as speed is increased.
- CV118** Ditch light hold time (in ¼ second increments) after F2 goes off.
- CV120-CV123** Effects configuration registers for outputs 1-4

CV NOTES: All CV numbers not listed above are ignored. This decoder supports all DCC programming methods.

Decoder Warranty

This decoder is fully factory tested and warranted against manufacturing defects for a period of 1 year. As the circumstances under which this decoder is installed can not be controlled, failure of the decoder due to installation problems can not be warranted. This includes misuse, miswiring, operation under loads beyond the design range of the decoder or short circuits in the locomotive manufacturer's factory wiring. If the decoder fails for non-warranted reasons NCE will replace the decoder, no questions asked, for \$10 U.S. plus \$2 shipping. For warranty or non-warranty replacement send the decoder (and any payment, if required) to:

NCE Warranty Center
82 East Main Street
Webster, New York 14580



05240181

NCE

The Power of DCC




Age
14+

N14A3

Dimensions: 2.6 x 0.350 x .079 inches – 66 x 8.9 x 2.0 mm

**Direct plug in to Atlas GP39-2, Intermountain SD40-2
 plus other plug-and-play N Scale locos.**

Features of this decoder::

- ✓ Silent Running™, torque compensated motor drive
- ✓ Torque Compensation for ultra smooth low speed performance
- ✓ Motor rating 3/4 Amp continuous, 0.75 Amp stall
- ✓ All four function outputs have lighting effects generators
- ✓ Select from 15 different lighting effects
- ✓ Full support for LED lighting
- ✓ Decoder programming lock mechanism



NMRA Warrant 2014-0010

p/n 5240181



8 16757 01202 5

Warning: This product contains chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.

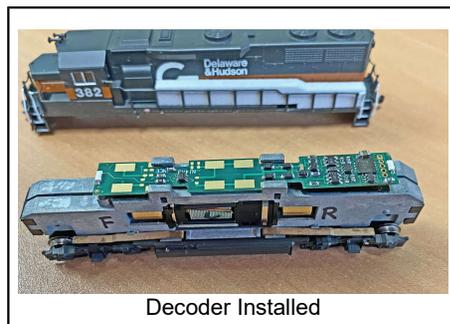
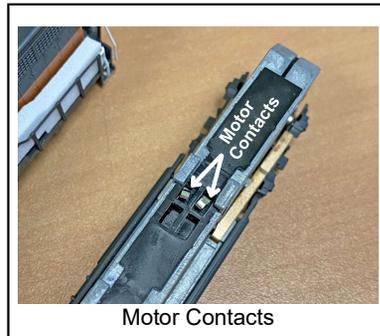
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Decoder Installation Notes:

The most important part of a successful decoder installation is proper isolation of both motor brushes from the track wiring so that they are driven only by the decoder. Failure to isolate the motor will definitely damage the decoder. Damage caused by failure to isolate the motor is not be covered by the decoder warranty. **Please note the two motor tabs in Illustration 2 and make sure they do not touch the locomotive frame.**

Installation Instructions:

1. Remove the locomotive shell from the chassis.
2. To remove the existing light board press down and slide it toward the front of the locomotive until it comes free from under the chassis clips. Leave the black plastic insulator in place.
3. Inspect the motor tabs and bend them up to ensure they will contact the bottom of the decoder. Make sure they will not short to the chassis.
4. Install the decoder by pressing it down and sliding it rearward in the locomotive in the reverse process of removing the light board.
5. Test the locomotive for correct operation. If the motor does not work check that the two motor tabs are making contact with the decoder bottom.
6. Install the body shell.



Factory default values for decoder Configuration Variables (CVs)

| CV | Default value | | Description |
|-----|---------------|-----|----------------------------|
| | decimal | hex | |
| 1 | 3 | 03 | short address |
| 2 | 0 | 00 | start voltage |
| 3 | 0 | 00 | acceleration |
| 4 | 0 | 00 | deceleration |
| 5 | 0 | 00 | maximum speed |
| 6 | 0 | 00 | mid speed |
| 7 | 38 | 26 | decoder version |
| 11 | 0 | 00 | Packet timeout value |
| 15 | 0 | 00 | Programming "key" |
| 16 | 0 | 00 | Programming "lock" |
| 17 | 192 | C0 | long address high byte |
| 18 | 0 | 00 | long address low byte |
| 19 | 0 | 00 | consist address |
| 21 | 255 | FF | consist functions F1-F8 |
| 22 | 63 | 3F | consist function FLF,FLR |
| 23 | 0 | 00 | acceleration adjust |
| 24 | 0 | 00 | deceleration adjust |
| 29 | 2 | 02 | decoder configuration |
| 30 | 0 | 00 | error/reset register |
| 33 | 1 | 01 | Output(s) controlled by F0 |
| 34 | 2 | 02 | Output(s) controlled by F0 |
| 35 | 4 | 04 | Output(s) controlled by F1 |
| 36 | 8 | 08 | Output(s) controlled by F2 |
| 37 | 16 | 10 | Output(s) controlled by F3 |
| 38 | 4 | 04 | not used |
| 39 | 8 | 08 | not used |
| 40 | 16 | 10 | not used |
| 41 | 0 | 0 | not used |
| 42 | 0 | 0 | not used |
| 67 | 0 | 0 | alt spd table step 1 |
| 68 | 0 | 0 | alt spd table step 2 |
| 69 | 0 | 0 | alt spd table step 3 |
| 70 | 0 | 0 | alt spd table step 4 |
| 71 | 0 | 0 | alt spd table step 5 |
| 72 | 0 | 0 | alt spd table step 6 |
| 73 | 0 | 0 | alt spd table step 7 |
| 74 | 0 | 0 | alt spd table step 8 |
| 75 | 0 | 0 | alt spd table step 9 |
| 76 | 0 | 0 | alt spd table step 10 |
| 77 | 0 | 0 | alt spd table step 11 |
| 78 | 0 | 0 | alt spd table step 12 |
| 79 | 0 | 0 | alt spd table step 13 |
| 80 | 0 | 0 | alt spd table step 14 |
| 81 | 0 | 0 | alt spd table step 15 |
| 82 | 0 | 0 | alt spd table step 16 |
| 83 | 0 | 0 | alt spd table step 17 |
| 84 | 0 | 0 | alt spd table step 18 |
| 85 | 0 | 0 | alt spd table step 19 |
| 86 | 0 | 0 | alt spd table step 20 |
| 87 | 0 | 0 | alt spd table step 21 |
| 88 | 0 | 0 | alt spd table step 22 |
| 89 | 0 | 0 | alt spd table step 23 |
| 90 | 0 | 0 | alt spd table step 24 |
| 91 | 0 | 0 | alt spd table step 25 |
| 92 | 0 | 0 | alt spd table step 26 |
| 93 | 0 | 0 | alt spd table step 27 |
| 94 | 0 | 0 | alt spd table step 28 |
| 95 | 0 | 0 | reverse trim |
| 116 | 0 | 0 | torque kick rate |
| 117 | 0 | 0 | torque kick strength |
| 118 | 20 | 14 | ditch light hold time |
| 120 | 1 | 01 | output 1 EFX generator |
| 121 | 2 | 02 | output 2 EFX generator |
| 122 | 0 | 00 | output 3 EFX generator |
| 123 | 0 | 00 | output 4 EFX generator |

Description of function mapping CVs:

Function mapping can change which outputs are controlled by a function command from your handheld cab. It is possible to have one command control several outputs. In the table below each row corresponds to a function mapping CV and each column indicates an output number. The **bold** number in a column is the factory default. Programming the CV to the value under an output number will change that output to be controlled by that function number. In the table below the factory value of CV35 is 4 which means F1 will control Output #3. If you want F1 to control output 4 program CV35 to 8. If you want F1 to control both outputs 3 and 4 add the two values for those outputs together (4+8=12) and program CV35 with 12.

Note in this decoder CV33 and CV34 operate identically. These CVs do not make the headlight directional...directionality is provided in the EFX configuration CV for each output.

Factory default function mapping values

| | Output Number | | | |
|-------------|---------------|----------|----------|----------|
| | 4 | 3 | 2 | 1 |
| CV33 F0 Fwd | 8 | 4 | 2 | 1 |
| CV34 F0 Rev | 8 | 4 | 2 | 1 |
| CV35 F1 | 8 | 4 | 2 | 1 |
| CV36 F2 | 8 | 4 | 2 | 1 |

Factory default setting for CV33-36 is shown in bold

Configuration of CV29 settings:

Table of commonly used values for CV29

| Value for CV29 | Long/Short Address | Uploadable/Factory Speed table | Analog Conversion |
|----------------|--------------------|--------------------------------|-------------------|
| 2 | Short | Factory | no |
| 6 | Short | Factory | yes |
| 18 | Short | Uploadable | no |
| 22 | Short | Uploadable | yes |
| 34 | Long | Factory | no |
| 38 | Long | Factory | yes |
| 50 | Long | Uploadable | no |
| 54 | Long | Uploadable | yes |

Note: If you want the locomotive and lights to operate in the opposite direction increase the indicated value for CV29 by one.

Fine tuning locomotive operation

The factory settings normally provide good performance for most locomotives in HO-Scale. You may want to improve or fine tune performance by adjust the starting characteristics or top speed .

There are 6 CVs that define:

- The voltage at which the motor starts
- How often and how hard the motor gets an extra "kick" at slow speeds to keep it turning.
- The maximum motor speed
- The mid speed range response characteristics or 'speed curve'.
- Compensation for a motor that runs faster in one direction

Torque compensation kick rate - CV116:

How frequently the motor is 'kicked' at slow speed. . The smaller the number the more often the motor gets a brief voltage 'kick'. A value of 1 applies kicks continuously. Most HO locos work well with values of 1-4. Factory default is 0 (off). The maximum practical value is about 8.

Torque compensation kick strength - CV117:

How hard the motor is 'kicked' at slow speed. Typical adjustment is 4 to 32 The larger the number the more voltage is applied in each 'kick'. The strength of these kicks fade out ratiometrically as speed is increased providing a smooth transition to normal motor operation. Factory default is 0 (off), usable range 0-50.

Start Voltage - CV2 (Vstart): We prefer using Operations Mode Programming (Program on the Main) to set the Torque Compensation (CV116/117) *before setting CV2* so the locomotive is **just able** to maintain movement at speed step 1. CV2 can then be used to "trim" the starting voltage.

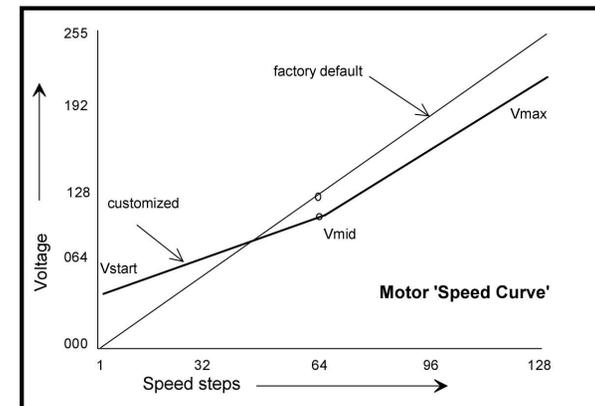
Vmax - CV5: If your locomotive runs too fast you can use CV5 to lower its maximum speed. Setting CV5 to 255 uses the maximum possible voltage to run the motor when full speed is requested. Set CV5 to a smaller value to reduce the top speed. A value of 128 will yield approximately ½ full voltage to the motor at top speed. 192 will provide about ¾ full voltage. All speeds from the middle speed step to the maximum will be proportionally reduced (see diagram). If CV5 is set to 0 the decoder will use 255 for maximum speed. Always make sure CV5 is greater than CV6 to avoid erratic operation.

Vmid - CV6: CV6 determines how the motor responds through its middle speed ranges to advancement of the throttle. If you set CV6 lower than half the maximum speed you'll have smaller increases in motor speed through the lower speed ranges. Then, as you hit the upper speed ranges there will be larger increases between speed steps. In the diagram below you can see this best illustrated by the factory default line. If you set Vstart larger than 0 you'll most likely want to raise Vmid so a reasonable slope is maintained in the 'speed curve'. If CV6 is set to 0 the decoder will use 127 as the value. If you use high values in CV57 you will want to increase CV6 by aproportional amount to keep a smooth acceleration curve.

Reverse trim (also forward trim) - CV95:

Values from 1-127 make decoder run **faster in reverse** than forward. 1 is one speed step faster in reverse, 2 is two steps faster, etc.

Values from 129-255 make decoder run **faster in forward** than reverse. 129 is one speed step faster in forward, 130 is 2 speed steps faster, etc. 0 and 128 add nothing to either direction.



Function mapping and effects programming examples

Ditch lights:

What we want to do:

- ➔ Use outputs 2 and 3 (yellow and green wires) for the left and right ditch lights
- ➔ They will be controlled by F2 which is the HORN button on most DCC systems
- ➔ They should continue flashing for 5 seconds after the HORN button is released

How to do it:

- ✓ Program outputs 3 and 4 to both be activated by F2. Set the F2 mapping CV (CV36) to 12. We get the value of 12 by adding the 'values for output 3 and output 4 on the F2 line of the **CV mapping table** on page 6.
- ✓ Program outputs 3 and 4 for ditch light operation. Set CV122 to 56 and CV123 to 60. Using these values the lights will be 'qualified' by the headlight AND function 2. The headlight must be on for the ditch lights to be activated by F2. Type 1 ditch lights are on constantly on when the headlight is on and alternately flash when the horn is blown. Type 2 ditch lights are normally off until the horn is blown. This example is for the more common Type 1. If you prefer Type 2 use EFX values 52 and 48 instead of 60 and 56.
- ✓ CV118 sets the amount of time the ditch lights stay flashing after the horn (F2) is deactivated. The time is measured in 1/4 second intervals, for a hold time of 5 seconds put a value of 20 in the CV118.
- ✓ One last thing: Set CV35 to 0 so output 3 is not also controlled by F1

Mars Light:

What we want to do:

- ➔ Use output 3 (marked A on decoder) for a Mars light.
- ➔ It is to be on in the forward direction only

How to do it:

- ✓ Output 3 is already activated by F1 (factory default setting of CV35=4).
- ✓ Configure output 3 as a forward only Mars light. Set CV122 to 9. We get the value of 9 by using 8 (Mars Light) plus 1 (output operates only in forward direction)

Rule 17 lighting:

Rule 17 refers to how the locomotive engineer operates the locomotive headlights during the running of the train. The rule varies from road to road but generally requires the dimming of the headlight(s) when in a siding waiting to meet another train, passing through passenger stations or moving within yard limits.

What we want to do:

- ➔ Use output 1 for the Headlight
- ➔ The headlight is to be on bright in both directions of locomotive travel
- ➔ We also want to be able dim the headlight
- ➔ Use output 2 for the rear light. It is to come on in reverse, off in forward

How to do it:

- ✓ Output 1 is already activated by F0 (factory default setting of CV33 =1).
- ✓ Configure output 1 as a standard output, on in both directions, yet dimmable when F4 is activated. Set CV120 to 32 (20 hex). You can optionally set CV120 to 36 is you want F8 to control the dimming instead of F4.
- ✓ Configure the rear light to be on in reverse and off in forward operation: Set CV121 to 2

Switcher:

What we want:

- ➔ Headlights that dim in the opposite direction that the locomotive is travelling
- ➔ Use output 1 as Headlight and output 2 as Rearlight

How to do it:

- ✓ Outputs 1 and 2 are already activated by F0 due to the factory default settings.
- ✓ Configure output 1 as bright in forward, dim in reverse. Set CV120 to 44 (2C hex)
- ✓ Configure output 2 as bright in reverse, dim in forward. Set CV121 to 40 (28 hex)

Description of EFX configuration CVs

CV120 - Lighting effect configuration for output 1 (white wire).

CV121 - Lighting effect configuration for output 2 (yellow wire).

CV122 - Lighting effect configuration for output 3 (green wire).

CV123 - Lighting effect configuration for output 4 (violet wire).

Each output wire can select from 15 different lighting effects by using its associated EFX configuration CV. Pick the value for the CV from the table below, add 1 or 2 if you want the effect to be directional (footnotes 2 and 3), then add 128 if you are using a white LED for the effect. Ditch lights should not be made directional, they're not directional in real life.

| Value for CV | Description of lighting effect | Hex (for Digitrax users) |
|--------------|--|--------------------------|
| 0 | Standard on/off function output | 0 |
| 4 | Firebox flicker (brighter when accelerating) | 4 |
| 8 | Mars light | 8 |
| 12 | Rotary Beacon | 0C |
| 16 | Gyalight | 10 |
| 20 | Double Strobe | 14 |
| 24 | Strobe A | 18 |
| 28 | Strobe B (alternates with Strobe A) | 1C |
| 32 | Dim when F0 and F4 on, otherwise bright | 20 |
| 36 | Dim when F0 and F8 on, otherwise bright | 24 |
| 40 | Dim in forward, bright in reverse | 28 |
| 44 | Dim in reverse, bright in forward | 2C |
| 48 | Type 2 Right Ditch light, effect on if F2 on, output off otherwise | 30 |
| 52 | Type 2 Left Ditch light, effect on if F2 on, output off otherwise | 34 |
| 56 | Type 1 Right Ditch light, effect on if F0 and F2 on, bright if F0 on and F2 off, off if F0 off | 38 |
| 60 | Type 1 Left Ditch light, effect if F2 and F0 on, bright if F0 on and F2 off, off if F0 off | 3C |

bit weight

bit name

| | | | | | | | |
|------------------|-----|----------------------|----|---|---|------------------|------------------|
| 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| LED ¹ | --- | Effect configuration | | | | REV ² | FWD ³ |

1 - Functions are designed to use 12-16 volt 30-40ma incandescent lamps. If you are using a white LED (with 1k-3.9k limiting resistor) add 128 to the CV value.

2 - If you want the function to be active only in the reverse direction add 2 to the CV value

3 - If you want the function to be active only in the forward direction add 1 to the CV value