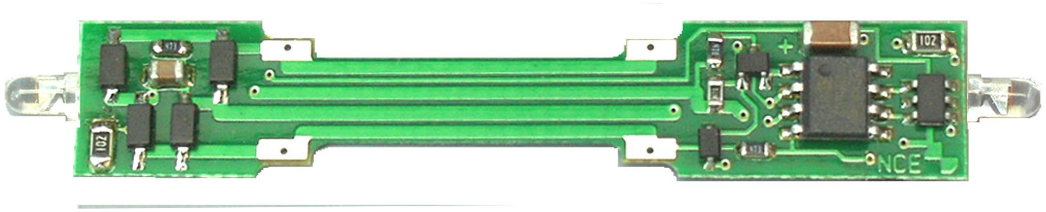
NMP15

2 Function Decoder



$29.95

Decoder version 3.5

Plug and play decoder for N-Scale Atlas MP15DC switcher

This is an EPF (extended packet format) decoder supporting:

- ✓ Silent Running ™ motor drive
- ✓ Torque Compensation for ultra smooth low speed performance
- ✓ Programmable Start, Mid and Maximum speed works for all speed modes
- ✓ Motor rating 1 Amp continuous, 1.25 Amp peak (stall)
- ✓ Both function outputs have lighting effects generators
- ✓ Select from 15 different lighting effects (Mars, strobes, beacon, flicker, etc)
- ✓ Lighting outputs can be mapped to different functions
- ✓ Uploadable speed table interpolated to 128 speed steps
- ✓ Decoder assisted consisting
- ✓ Support for all forms of DCC programming
- ✓ Decoder programming lock mechanism
- ✓ Brake on DC feature assists automatic train control

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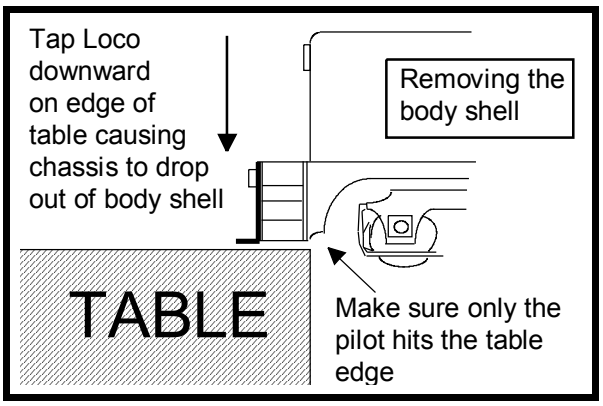
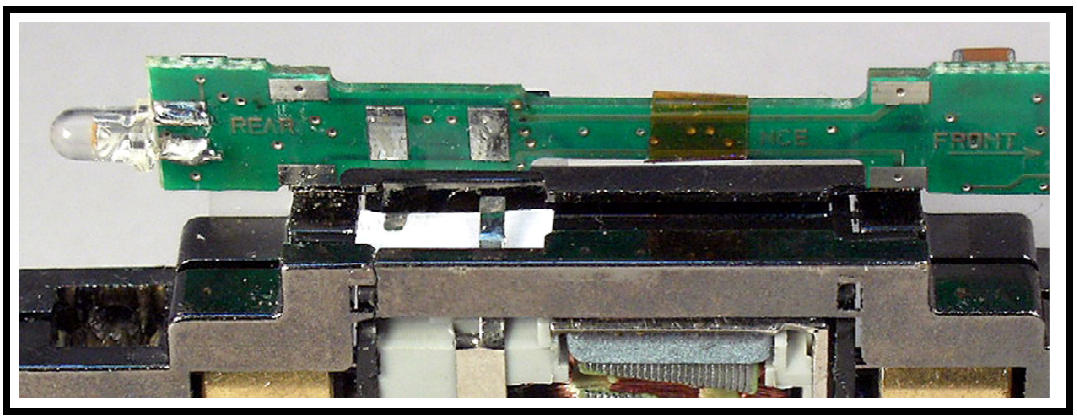
Every attempt has been made to ensure this decoder complies with all applicable NMRA Standards and Recommended Practices.

Decoder Installation:



1. Remove the locomotive shell from the chassis.
2. Remove the light shroud (if any) at the rear of the loco.
3. Remove the fuel tank if necessary to allow future separation of the frame halves.
4. Loosen and remove the two screws holding the frame halves together.
5. Lay the frame in its right side as shown in the photo below. Remove the top frame half. Place the trucks aside.
6. Remove the factory light board from the frame.
7. Orient the decoder with the motor tabs aligned with their contact pads on the decoder bottom (see photo below)



8. Fit the decoder into the left frame half while ensuring that the motor tabs line up with their contact pads on the decoder bottom. Tweezers help here.
9. Ensure that the two round frame insulators are still in place at each end of the frame before you re-install the right frame half and trucks.
10. Make sure you have everything aligned correctly and the trucks rotate freely, then install the two frame screws.
11. Test run the locomotive (see below) before replacing the light shroud and body shell.

Always test your decoder installation on a current limited programming track before trying it on full track power.

We recommend that the first "full power" testing be done on regular DC. The decoders should be driven by a good quality smooth DC power unit. Power packs with pulse power systems such as "tracking control", etc. will give unpredictable operation. Analog operation is included in your NCE decoders so you will be able to run on conventional layouts without having to remove the decoder or rewire your locomotive.

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 kicked a slow speeds to keep it turning smoothly.
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 N locos work well with values of 2-4. Factory default is 0 (off). The maximum practical value is about 8.

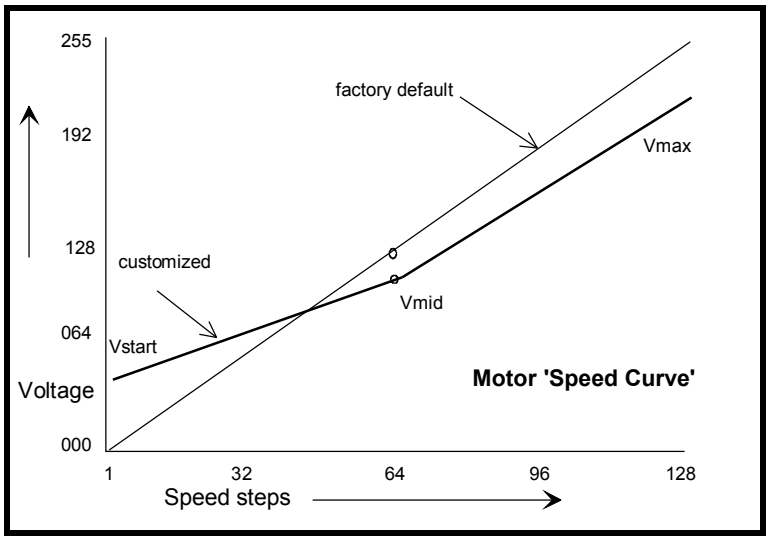
Torque compensation kick strength - CV117:
How hard the motor is 'kicked' at slow speed. Typical adjustment is 4 to 25 The larger the number the more voltage is applied in each 'kick'. The strength of these kicks fade out ratiometrically as speed is increased providing a smooth transition to normal motor 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 'customized' line. If you set Vstart larger than 0 you'll will 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 CV117 you will want to increase CV6 by a proportional 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.



Effects programming (and function mapping) examples

Mars Light:
What we want to do:

Use output 2 (yellow wire) for a Mars light.
It is to be on in the forward direction only

How to do it:

Set Output 2 is to be activated by F1, set CV35 to 2
Make sure F0 no longer controls output 2, set CV34 to 0)
Configure output 2 as a forward only Mars light. Set CV121 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 o r 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 (F0f).
CV121 - Lighting effect configuration for output 2 (F0r).

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 dierectional in real life.

bit weight	128	64	32	16	8	4	2	1
bit name	LED[1]	---	Effect configuration				REV[2]	FWD[3]

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	Gyralight	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

1 - Functions are designed to use 12-16 volt 30-40ma incandescent lamps. If you are using a white LED (with 1K 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

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 CV34 is 2 which means F0 will control Output #2. If you want F1 to control output 2 program CV35 to 2. If you want F1 to control both outputs 1 and 2 add the two values for those outputs together (1+2=3) and program CV35 with 3.

Note in this decoder CV33 and CV34 operate identically. They are not directional...directionality is provided in the EFX configuration CV for each output.

Factory default function mapping values

	OUTPUT NUMBER	
	2	**1**
CV33 F0 Fwd	2	**1**
CV34 F0 Rev	**2**	1
CV35 F1	2	1
CV36 F2	2	1
CV37 F3	2	1

Factory default values for decoder Configuration Variables (Cvs)

CV	Default value decimal	hex	Description
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	**35**	23	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	**6**	06	decoder configuration
30	**0**	00	error/reset register
33	**1**	01	Output(s) controlled byF0
34	**2**	02	Output(s) controlled byF0
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	
39	**8**	08	
40	**16**	10	
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

CV	Default value decimal	hex	Description
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

Configuration of CV29 settings:
Table of commonly used values for CV29

Value for CV29 decimal	hex	Long/Short Address	Uploadable/Factory Speed table	Analog (DC) operation	Speed mode
0	2	Short	Factory	no	28/128
6	6	Short	Factory	yes	28/128
18	12	Short	Uploadable	no	28/128
22	16	Short	Uploadable	yes	28/128
34	22	Long	Factory	no	28/128
38	26	Long	Factory	yes	28/128
50	32	Long	Uploadable	no	28/128
54	36	Long	Uploadable	yes	28/128

Hex numbers are provided for early Digitrax users
Notes:

- If you want to reverse the direction of travel on DCC increase the value for CV29 by one (this also reverses all directional lighting).
- If you want to reverse the DC direction reverse the track pickup wires.

Configuration Variables used by V3.5 Decoders

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 35 which means version 3.5
CV8 Manufactuer 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-CV37 function mapping CVs for F0-F3
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-CV121 Effects configuration registers for outputs 1 and 2

CV NOTES: All CV numbers not listed above may be programmed but not used by the decoder. This decoder supports all DCC programming methods.

Formula for computing the long address if using a Lenz SET01 or SET02:
If using a Lenz SET01, SET02, SET90, SET100 or other entry level system, use paged programming mode and see below for programming long addresses.
CV17 = 192 + (the whole number portion of the long address divided by 256)
CV18 = the remainder after the long address is divided by 256
CV29 = 34 if analog mode disabled, 38 if analog mode enabled

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 shortciruits 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
899 Ridge Road
Webster, New York 14580

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