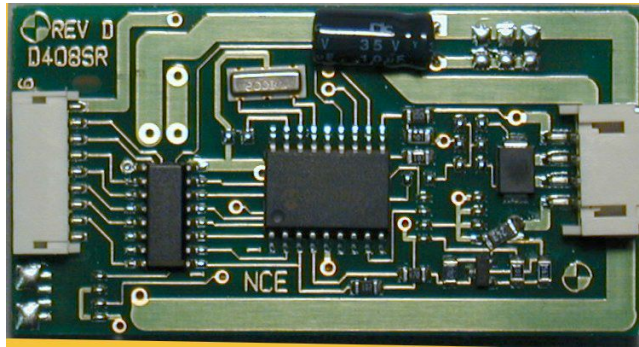# NCE
The Power of DCC

ATLO
Plug in Decoder

Decoder version 3.5

$49.95

Simple plug-in for most Atlas-O locomotives plus locomotives from Weaver and others with the 'dog bone' shaped circuit board

This is an EPF (extended packet format) decoder supporting:
- ✓ Silent Running ™ High frequency motor drive eliminates motor hum or buzz
- ✓ Torque Compensation for ultra smooth low speed performance
- ✓ Programmable Start, Mid and Maximum speed works for all speed modes
- ✓ 6 lighting "function" outputs - each rated at ½ Amp.
- ✓ Select from 15 different lighting effects (Mars, strobes, beacons, flicker, etc)
- ✓ Two or Four digit addressing
- ✓ Uploadable speed table interpolated to 128 speed steps
- ✓ 28 and 128 Speed mode operation (always works internally at 256 steps)
- ✓ Decoder assisted consisting
- ✓ Supports all forms of DCC programming
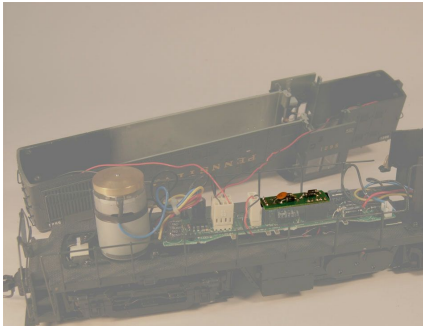- ✓ New decoder programming 'lock' mechanism

Decoder Installation Notes:

1. The first task is to remove the body shell of the diesel or open the tender if you are installing in a steam locomotive. Most body shells are secured to the frame by multiple screws. Finding ALL of these screws is not always easy.   The Atlas RS1 that we used for the photos below had 6 screws, 2 at each end and two under the cab.

2. Locate the small (1-1/2" x 5/8" - it is highlighted in the photo below) diode circuit board plugged into the main locomotive circuit board. This circuit board unplugs by lifting it straight up from the main board.

3. The ATLO decoder plugs in where you removed the diode circuit board.

4. This completes the installation of the ATLO.   We suggest just placing the body shell back on the frame without installing the screws until you test the installation. When you are satisfied that the lights work and the locomotive runs then replace the screws.
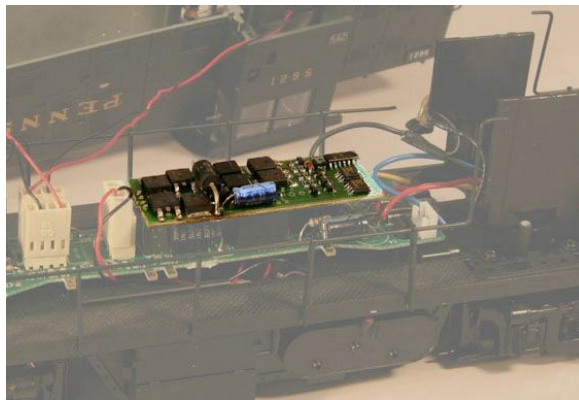

Diode board location

Before test running your newly converted locomotive on full power double check your wiring to make sure there are no pinched or broken wires. We see many decoders returned due to wires getting pinched between the body shell and frame causing shorts.

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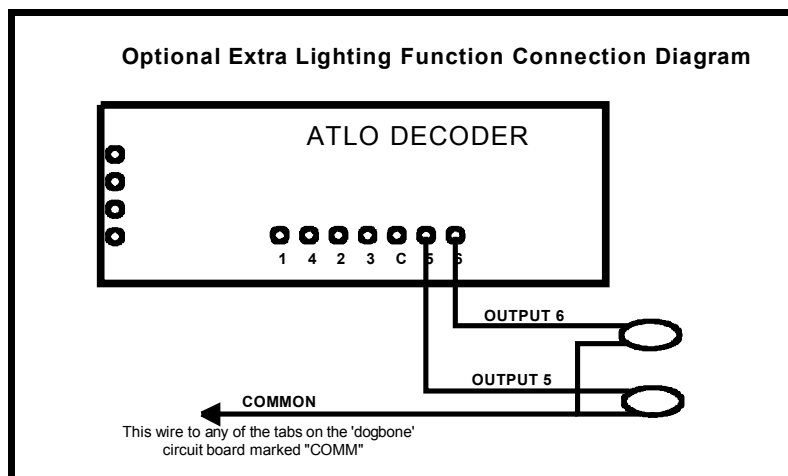

Decoder installed

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

Optional Extra Lighting Function Connection Diagram

ATLO DECODER

1 4 2 3 C 5 6

OUTPUT 6

OUTPUT 5

COMMON

This wire to any of the tabs on the 'dogbone'
circuit board marked "COMM"

Connnecting the extra lighting functions to the light board:

Below is a photo of the lighting outputs of the "dog-bone" light board in your locomotive. If extra lights are not already connected in the loco then you can add additional lighting features. We have brought out F1 and F2 of the decoder to the terminals indicated below. These terminals are where the factory connects marker/classification lights if the locomotive is so equipped.

The white "bulbs" in the photo below illustrate the connections for wiring the additional lights.

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 .

Start Voltage - CV2 (Vstart):

This is the amount of voltage sent to the motor when first starting up. We set CV2 so the locomotive is *almost* able to maintain movement at speed step 1. We then use CV116 and 117 to apply enough torque compensation to keep it turning on speed step 1. Typical values for CV2 are in the range of 0-35. For the Atlas RS1 we used 0.

Torque compensation kick rate - CV116:

How *frequently* the motor is 'kicked' at slow speed. Typical adjustment is 2 to 4. The smaller the number the more often the motor gets a brief voltage 'kick'. Factory default is 0 (off). A value of 1 applies kicks continuously. The maximum practical value is about 6. For the Atlas RS1 we used 3.

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 ratio metrically as speed is increased providing a smooth transition to normal motor operation. Factory default is 0 (off), usable range 0-50. For the Atlas RS1 we used 50.

Vmax - CV5:
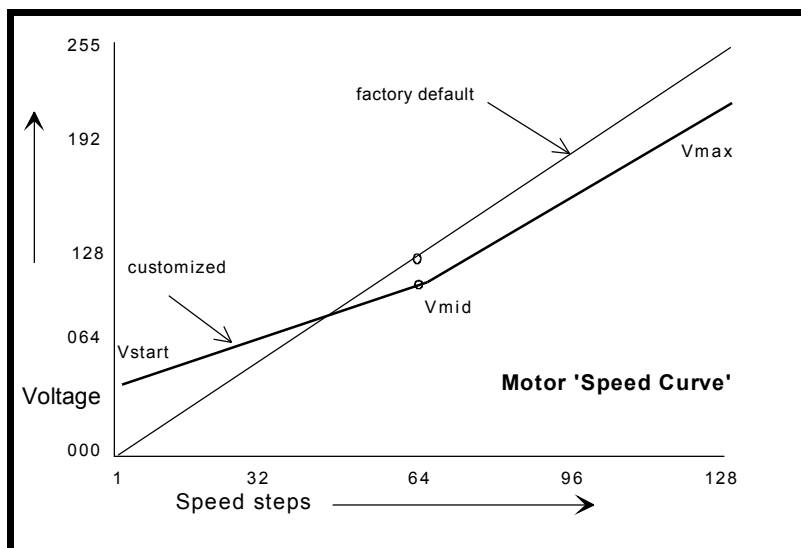If your locomotive runs too fast you can use CV5 to lower its maximum speed. Setting CV5 to 255 uses the maximum possible voltage to run the motor when full speed is requested. Set CV5 to a smaller value to reduce the top speed. A value of 128 will yield approximately ½ full voltage to the motor at top 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. For the Atlas RS1 we used 180.

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. For the Atlas RS1 we used 100. ..

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 .

Factory default values for decoder Configuration Variables (CVs)

CV	Default value decimal	hex	Description		CV	Default value decimal	hex	Description
1	3	03	short address		74	0	0	alt spd table step 8
2	0	00	start voltage		75	0	0	alt spd table step 9
3	0	00	acceleration		76	0	0	alt spd table step 10
4	0	00	deceleration		77	0	0	alt spd table step 11
5	0	00	Maximum speed		78	0	0	alt spd table step 12
6	0	00	Mid speed		79	0	0	alt spd table step 13
17	192	C0	long address high byte		80	0	0	alt spd table step 14
18	0	00	long address low byte		81	0	0	alt spd table step 15
19	0	00	consist address		82	0	0	alt spd table step 16
21	255	FF	consist functions F1-F8		83	0	0	alt spd table step 17
22	63	3F	consist function FLF,FLR		84	0	0	alt spd table step 18
23	0	00	acceleration adjust		85	0	0	alt spd table step 19
24	0	00	deceleration adjust		86	0	0	alt spd table step 20
29	2	02	decoder configuration		87	0	0	alt spd table step 21
30	0	00	reset register		88	0	0	alt spd table step 22
33	1	01	Output(s) controlled byF0		89	0	0	alt spd table step 23
34	64	20	Output(s) controlled byF0		90	0	0	alt spd table step 24
35	2	02	Output(s) controlled by F1		91	0	0	alt spd table step 25
36	4	04	Output(s) controlled by F2		92	0	0	alt spd table step 26
37	8	8	Output(s) controlled by F3		93	0	0	alt spd table step 27
38	2	02	Output(s) controlled by F4		94	0	0	alt spd table step 28
39	4	04	Output(s) controlled by F5		95	0	0	Reverse trim
40	16	10	Output(s) controlled by F6		116	0	0	Kick rate
41	4	04	Output(s) controlled by F7		117	0	0	Kick strength
42	0	0	Output(s) controlled by F8		118	20	14	Ditch light hold time
43	0	0	Output(s) controlled by F9		119	255	FF	EFX page access
44	0	0	Output(s) controlled by F10		120	1	01	Output 1 EFX generator
45	0	0	Output(s) controlled by F11		121	0	02	Output 2 EFX generator
46	0	0	Output(s) controlled by F12		122	0	00	Output 3 EFX generator
67	0	0	alt spd table step 1		123	0	00	Output 4 EFX generator
68	0	0	alt spd table step 2		124	0	00	Output 5 EFX generator
69	0	0	alt spd table step 3		125	0	00	Output 6 EFX generator
70	0	0	alt spd table step 4		126	64	40	Output 7 EFX generator
71	0	0	alt spd table step 5		127	0	00	Output 8 EFX generator
72	0	0	alt spd table step 6					
73	0	0	alt spd table step 7					

Table of commonly used values for CV29

Value for CV29	Long/Short Address	Uploadable/Factory Speed table	Analog (DC) operation	Speed mode
0	Short	Factory	no	28/128
6	Short	Factory	yes	28/128
18	Short	Uploadable	no	28/128
22	Short	Uploadable	yes	28/128
34	Long	Factory	no	28/128
38	Long	Factory	yes	28/128
50	Long	Uploadable	no	28/128
54	Long	Uploadable	yes	28/128

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   Manufacturer ID. NCE = 11 (0B hex)

CV11   Packet time-out 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 F LF 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-CV46 function mapping CVs for F0-F12

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 16 ms 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-CV128 Effects configuration registers for outputs 1-8

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

Formula for computing the long address if using a Lenz System:
If using a Lenz SET01, SET02, SET90, SET100 or other entry level system, use paged programming mode and see the note below for programming long addresses.
CV17 = 192 + (the whole number portion of the long address divided by 256)
CV18 = the remainder of the long address 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 short circuits in the locomotive manufacturer's factory wiring. If the decoder fails for non-warranted reasons NCE will replace D408 decoders, no questions asked, for $25 US 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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