Technical Reference

for the

MASTER SERIES
Digital Command Control

D104-EU Decoder

REVERSING HEADLIGHTS PLUS F1-F3

Dimensions:
1.9 x .65 x .18 inches
49 x 16.5 x 5 mm

Decoder version 2.1, 2.2, 2.3

$34.95

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

, Convenient wire harness compatible with industry standard 9 pin harnesses from Lenz, SystemOne, Digitrax, etc.
, Four digit address (long)
, Uploadable speed table with programmable motor drive frequency
, 128 Speed mode operation
, Decoder assisted consisting
, All forms of operations mode programming (programming on the mainline)
, Programmable Start Voltage works for all speed modes
, Motor rating 1.3 Amp continuous, 2 Amp peak (stall)
, Five function outputs rated for up to 40mA incandescent bulbs (150mA when used with LEDs or optional series resistor)
, EU version - auto-reversing headlights plus F1-F3.

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

Last revised: 20 May 1998

Configuration Variables used by D104 Decoders

CV1 normal 7 bit loco (short) address; 1-127 valid
CV2 vstart, value added to all speed steps of "standard speed table", 1 count
= .89% of full voltage when using the normal speed table. If uploadable
speed table is used the percentage varies with the frequency of PWM
motor control in CV9.
CV3 acceleration rate (each unit = 32mS between speed steps) 254 max.
CV23 is added to this value on power up]
CV4 deceleration rate (each unit = 32mS between speed steps) 254 max.
CV23 is added to this value on power up
CV7 Manufactuer ID. North Coast = 11
CV8 Decoder version number. This decoder is 16 which means ver. 1.6
CV9 PWM frequency. This CV determinesthe total PWM period for the
uploadable speed table. Each unit = 128uS this allows a frequency of
30hz to 279hz.   279hz comes from using each speed = 1 count this
yields: max speed = 28*128us for a 3.58mS period which equals 279hz.
CV17 high byte of 14 bit address
bit 6,7 always= 1
bits 0-5 are upper 6 bits of 14 bit address
CV18 low byte of 14 bit address (lower 8 bits)
CV19 8 bit address for consist, when active the consist responds to all
commands addressed to it the same as it would to it's normal 8 or 14 bit
address. Note: the normal 8/14 bit address is still active for all
non-speed/direction commands (especially useful for headlight and other
function controls of individual locomotives while in consist).   If the consist
address is set to 0 then the consist is inactive.
bits 0-6   7 bit consist address (1-127)
bit 7   0= direction is normal, 1= direction is reversed
CV23 acceleration rate adjust (each unit = 32mS between speed steps) this
value is added to the value in CV3 at power up or when reprogrammed
CV24 deceleration rate adjust (each unit = 32mS between speed steps) this
value is added to the value in CV4 at power up or when reprogrammed
CV29 - bit 0   1= direction of operation is reversed, 0= direction is normal
- bit 1 1= use 28 speeds mode, 0= 14 speed mode
- bit 2 1= DC conversion enabled. 0 = disable DC mode
- bit 3   not used
- bit 4 1= use alternate (uploadable) speed table, 0= use normal
speed table
- bit 5 1= use 14 bit address in CV17,18 (do not use CV1),
0= use CV1 not CV17,18
- bit 6 not used
- bit 7 not used

UPLOADABLE SPEED TABLE VARIABLES
CV66   Speed step 0 of uploadable table (Must be 0 for proper operation
CV67-CV94 Speed step 1 to 28 of uploadable speed table

PROGRAMMING TRACK INFORMATION: This decoder complies with NMRA RP-9.2.3 for both paged mode and register mode programming.

Ops mode programming (Programming on the Mainline):   Decoders do not respond to the long form ops mode programming instructions at their consist address (per RP-9.2.1). Use the short form to modify consist momentum.   Lenz command stations <u>only</u> generate short form and Digitrax <u>only</u> generates long form. North Coast, System One, Dynatrol and Ramtraxx use both types automatically.   This is to avoid setting CV29 while in a consist then later wondering why the decoder now only responds to it's long address rather than the short or vice-versa.

Tip for using consists and extended addresses: leave CV1 set to 3, or some other conveniently remembered address and only use the extended address (CV17, CV18) set to your desired value. This avoids mixing up normal 'short' addresses with consist addresses.

Factory default values for decoder Configuration Variables (CVs)
Digitrax users: Use hex values all other systems use normal decimal numbers

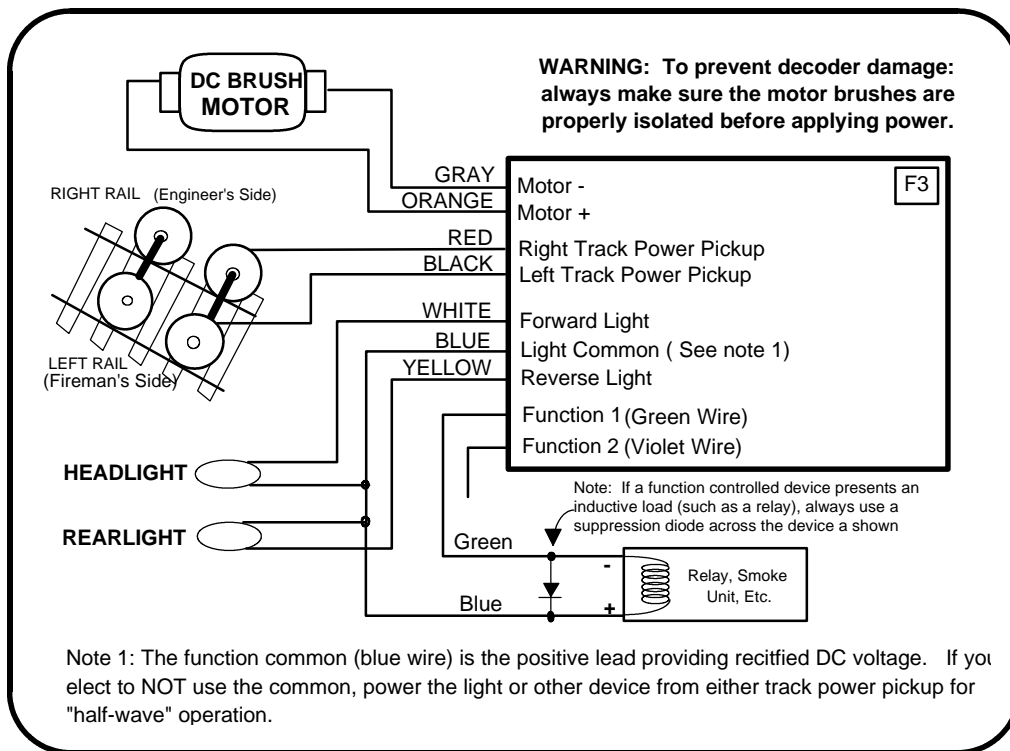| CV	Default value in decimal	hex	Description	CV	Default value in decimal	hex	Description
1	3	3	short address	74	23	17	alt spd table step 8
2	4	4	start voltage	75	27	1B	alt spd table step 9
3	0	0	acceleration	76	31	1F	alt spd table step 10
4	0	0	deceleration	77	36	24	alt spd table step 11
9	195	C3	PWM frequency	78	39	27	alt spd table step 12
17	192	C0	long address high byte	79	44	2C	alt spd table step 13
18	0	0	long address low byte	80	50	32	alt spd table step 14
19	0	0	consist address	81	55	37	alt spd table step 15
23	0	0	acceleration adjust	82	60	3C	alt spd table step 16
24	0	0	deceleration adjust	83	64	40	alt spd table step 17
29	6	6	decoder configuration	84	71	47	alt spd table step 18
30	0	0	error register	85	77	4D	alt spd table step 19
				86	86	56	alt spd table step 20
66	0	0	alt spd table step 0	87	93	5D	alt spd table step 21
67	2	2	alt spd table step 1	88	103	67	alt spd table step 22
68	4	4	alt spd table step 2	89	112	70	alt spd table step 23
69	5	5	alt spd table step 3	90	123	7B	alt spd table step 24
70	9	9	alt spd table step 4	91	135	87	alt spd table step 25
71	12	0C	alt spd table step 5	92	150	96	alt spd table step 26
72	16	10	alt spd table step 6	93	168	A8	alt spd table step 27
73	20	14	alt spd table step 7	94	195	C3	alt spd table step 28

Installation Notes:
The most important part of a successful decoder installation is proper isolation of <u>both</u> motor brushes from the track so that they are driven <u>only</u> 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 guarantee.

To separate the 9 pin wire harness from the decoder: Firmly grip the decoder by the sides, at the connector end with one hand. W ith your other hand firmly grip all 9 wires between your thumb and forefinger about 3/4" back from the plug. Pull gently and evenly , it is important to evenly distribute the force across all 9 wires.   Try a small side-to-side rocking rocking motion if the plug is reluctant to come out of the decoder.
(installation notes continued)

Before test running your newly converted locomotive on full power double check your wiring to make sure the motor is fully isolated and that 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 an current limited programming track before trying it on full track power. If you have a Digitrax or MRC system that does not provide a current limited programming use a 100 Ohm resistor in series with one of the track leads and listen for the "click" that verifies correct operation as you program the decoder .

We recommend that the first "full power" testing be done on regular DC.   If the pickup polarity is reversed you will want to correct this for proper analog mode operation.   The decoders should be driven by a good quality smooth DC power unit.   Power packs

DC BRUSH MOTOR

WARNING: To prevent decoder damage: always make sure the motor brushes are properly isolated before applying power.

RIGHT RAIL   (Engineer's Side)

LEFT RAIL (Fireman's Side)

GRAY — Motor -
ORANGE — Motor +
RED — Right Track Power Pickup
BLACK — Left Track Power Pickup
WHITE — Forward Light
BLUE — Light Common (See note 1)
YELLOW — Reverse Light
Function 1 (Green Wire)
Function 2 (Violet Wire)

F3

HEADLIGHT

REARLIGHT

Note: If a function controlled device presents an inductive load (such as a relay), always use a suppression diode across the device a shown

Green

Blue

- +

Relay, Smoke Unit, Etc.

Note 1: The function common (blue wire) is the positive lead providing recitfied DC voltage.   If you elect to NOT use the common, power the light or other device from either track power pickup for "half-wave" operation.

with pulse power systems such as "tracking control", etc. will give unpredictable operation.   Analog operation is included in your North Coast Engineering decoders so you will be able to run on conventional layouts without having to remove the decoder or rewire your locomotive.

Due to the high in-rush current of incandescent grain-of-wheat type bulbs (about 10 times the normal operating current) function outputs are rated at 40mA each. We recommend Miniatronics part number 18-014-10 (2.4mm diameter 14 volt/30mA) or number 18-712-10 (1.7mm diameter 12 volt/30mA) bulbs for good results.   If you wish to use 50-150mA rated lamps use a 22 ohm 1/4 Watt resistor in series with each bulb (this will also greatly extend bulb life).   The function outputs are rated at 150mA continuous if used with LEDs other low in-rush devices.