Technical Reference

for the

MASTER SERIES
Digital Command Control

D104P2K Decoder

REVERSING HEADLIGHTS PLUS F1-F2

Dimensions:
1.95 x .65 x .125 inches
50 x 16.5 x 3.2 mm

Decoder version 2.2

$29.95

Fits LifeLike P2K GP7, GP30 and others

Easy installation... just plug it in*!

*Follow Lifelike's instructions for converting to proper light bulbs

This is an EPF (extended packet format) decoder supporting:
- √ 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)
- √ Four function outputs rated for up to 40mA incandescent bulbs (150mA when used with LEDs or optional series resistor)
- √ Auto-reversing headlights plus F1-F2.

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

Configuration Variables used by D104 Decoders

Configuration variables are the 'official' name for adjustable parameters in the decoder

CV1   **Short address**. Valid values range from 1 to 127.

CV2   **Vstart**. This value added to all speed steps of the "factory speed table", 1 count = about 1% of full voltage when using the normal speed table. If the 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. Available in 14/28 speed modes only.

CV4   **Deceleration rate** (each unit = 32mS between speed steps) 254 max. Available in 14/28 speed modes only.

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   **Long address** high order 6 bits
                bit 6,7 always= 1
                bits 0-5 are upper 6 bits of 14 bit address

CV18   **Long address** low order byte

CV19   **Consist address.** 8 bit address, when active the consist responds to all commands addressed to it the same as it would to it's normal long/short address. Note: the normal long/short 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 or 128 then the consist is inactive.
                bits 0-6   7 bit consist address (1-127)
                bit 7   0= consist direction is normal, 1= consist direction is reversed

CV23   **Acceleration adjust**. This value is added to the value in CV3 at power up or when reprogrammed

CV24   **Deceleration adjust**. This value is added to the value in CV4 at power up or when reprogrammed

CV29   **Decoder Configuration** byte
    - 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= Analog conversion enabled. 0 = disable analog mode
    - bit 4   1= use alternate (uploadable) speed table, 0= use normal speed table
    - bit 5   1= use long address (CV17,18) do not use CV1, 0= use short address CV1 not CV17,18
    - bits 3,6 and 7 are not used

Table of commonly used values for CV29

Value for CV29 decimal	hex	Long/Short Address	Uploadable/Factory Speed table	Analog Conversion	14 or 28 Speed mode
0	0	Short	Factory	no	14
2	2	Short	Factory	no	28
4	4	Short	Factory	yes	14
6	6	Short	Factory	yes	28
16	10	Short	Uploadable	no	14
18	12	Short	Uploadable	no	28
20	14	Short	Uploadable	yes	14
22	16	Short	Uploadable	yes	28
32	20	Long	Factory	no	14
34	22	Long	Factory	no	28
36	24	Long	Factory	yes	14
38	26	Long	Factory	yes	28
48	30	Long	Uploadable	no	14
50	32	Long	Uploadable	no	28
52	32	Long	Uploadable	yes	14
54	36	Long	Uploadable	yes	28

Note: If you want the locomotive to operate in the opposite direction increase the indicated value for CV29 by one. (Hex numbers are provided for Digitrax users)

UPLOADABLE SPEED TABLE CVs

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

WARRANTY

This decoder is covered by our 7 year guarantee. Details of this guarantee are available from your dealer, in our product catalog or by writing to:

NCE Corporation   1260 Creek Street Suite 105   Webster, NY 14580.

PROGRAMMING TRACK INFORMATION: This decoder uses **paged** 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 generate <u>only</u> short form and Digitrax <u>only</u> generates long form. NCE decoders respond to either type automatically.

Tip for using consists and long addresses: leave CV1 set to 3, or some other conveniently remembered address and only use the long 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 need only normal decimal numbers

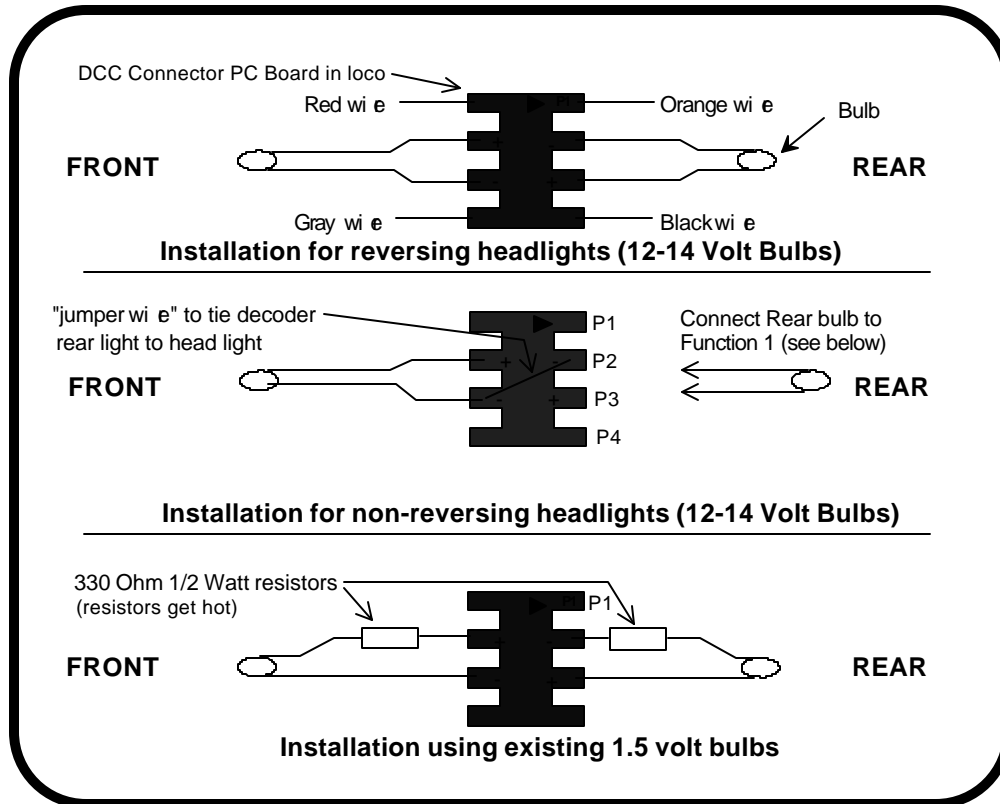| CV	Default value in decimal	hex	Description	CV	Default value in decimal	hex	Description
1	3	3	short address	74	23	17	alt spd table step 8
2	4	4	start voltage	75	27	1B	alt spd table step 9
3	0	0	acceleration	76	31	1F	alt spd table step 10
4	0	0	deceleration	77	36	24	alt spd table step 11
9	195	C3	PWM 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:

This decoder is designed to plug straight in to locomotives with an NMRA 8 pin medium DCC socket.   For locomotives without current limiting to 1.5 volt bulbs such as LifeLike GP7 or GP30 follow LifeLike's directions (included with the locomotive) for replacing the bulbs with the proper lamps for DCC operation. In the GP7/30 remove the two screws holding the existing PC board, discard the PC board and replace it with the D104P2K decoder. Do *not* use the two screws to mount the decoder as the body shell will center the decoder on the frame. **Caution: to avoid short circuits place a piece of ELECTRICAL TAPE between the decoder and the locomotive frame. Also, make sure there are no pinched wires bewteen the decoder and frame or between the decoder and connector pins.**
You will find the GP7 and GP 30 locomotives run long hood forward like later protoytpes. If you wish to have the locomotive run long hood forward add 1 to whatever value is in CV29 (read CV29 on the programming track and put the same value, plus one, back in to CV29). NOTE: this will not affect the direction the locomotive runs on an analog DC layout.

These decoders come from the factory with analog mode enabled.   If you run your locomotive on a regular DC layout the power pack should be a good quality <u>smooth</u> 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.

HEADLIGHTS

LifeLike included only 1.5 volt bulbs with their GP7 and GP30 locomotives. Follow their directions for installing 12-14 volt bulbs. We recommend Miniatronics #18-712-10[12v], #18-014-10 [14v] or Chicago Miniature white LEDs (Digikey [phone 800-344-4539] part number CMD204UWC). If you use an LED a 1K 1/4 Watt series resistor is required with each LED.

DCC Connector PC Board in loco
Red wire — Orange wire — Bulb
FRONT — REAR
Gray wire — Black wire

Installation for reversing headlights (12-14 Volt Bulbs)

"jumper wire" to tie decoder rear light to head light — P1
P2
FRONT — P3
P4
Connect Rear bulb to Function 1 (see below)
REAR

Installation for non-reversing headlights (12-14 Volt Bulbs)

330 Ohm 1/2 Watt resistors (resistors get hot) — P1
FRONT — REAR

Installation using existing 1.5 volt bulbs

About the extra function outputs:

Due to the high in-rush current of incandescent grain-of-wheat type bulbs (about 10 times their normal operating current) function outputs are rated at 40mA each. We recommend the Miniatronics part number mentioned above. If you wish to use 50-100mA rated lamps we recommend 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 100mA continuous if used with LEDs or other low in-rush devices.

Adding extra lights

Grain-of-Wheat Bulbs

B
Function 2
D104P2K
DCC "PLUG"
"common" connection for lights
Function 1
A
PIN 1

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.