Technical Reference

for the

N103 Decoder

AUTO-REVERSING HEADLIGHTS PLUS F1

Dimensions:
1.00 x 0.34 x .18 inches
26 x 8.6 x 4.6 mm

Decoder version 2.3

$39.95

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

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

Configuration Variables used by N103 Decoders

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

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

CV 2 **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.

CV 3 **Acceleration rate** (each unit = 32mS between speed steps) 254 max. Available in 14/28 speed modes only.

CV 4 **Deceleration rate** (each unit = 32mS between speed steps) 254 max. Available in 14/28 speed modes only.

CV 9 **PWM frequency**. This CV determines the 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.

CV 17 **Long address** high order 6 bits
> bit 6,7 always= 1
> bits 0-5 are upper 6 bits of 14 bit address

CV 18 **Long address** low order byte

CV 19 **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

CV 23 **Acceleration adjust**. This value is added to the value in CV3 at power up or when reprogrammed

CV 24 **Deceleration adjust**. This value is added to the value in CV4 at power up or when reprogrammed

CV 29 **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

PROGRAMMING 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 "hard wire" into HO or N-Scale locomotives.

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.

When using this decoder with Soundtraxx DSX sound units give both decoders the same long address and use OPS (program on the mainline) mode programming to set the CVs of both decoders.   The sound control CVs of the DSX do not "overlap" with the CVs in the N103 decoder.

Always make sure the motor connections are fully isolated from the locomotive frame and be sure to test the installation on the programming track before placing the loco on the main track. Some locomotives have internal motor shorts that don't show up when running the locomotive on DC power. The programming track limits the current to the decoder in case anything is wired incorrectly.   If you can't read the decoder on the programming track (use **paged** mode) there probably is a wiring error.

Last revised: 20 December 1999

Programming Notes:
If you wish to test the decoder by programming before installation use a 100 Ohm resistor connected to the orange and gray wires, then connect the red and black wires to the programming track or programming terminals of your command station. The 100 Ohm resistor simulates the motor load so the command station can read the CVs. This decoder remembers the state of all functions during power outages. Some command stations (most notably the Digitrax Chief) do not make sure all functions are turned off when the programming track is in use. If you have trouble programming, turn off the headlight and other functions.

Headlights:
Many locomotives have 1.5 volt bulbs installed. You may use a 470 to 680 Ohm (1/2 Watt or more) resistor in line with the bulb to help reduce the voltage to 1.5 volts. We find this produces a *lot* of heat in the resistor possibly melting the body shell of the locomotive. We prefer replacing the 1.5 volt bulbs with 12 or 14 volt bulbs and 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. We also recommend placing all bulbs in a short length of brass tube glued (5 minute epoxy works best here) behind the headlight lens of the locomotive. Don't glue the bulb into the tube, just slip it in, this makes it easy to get the body shell off for service while leaving the lights connected tothe decoder.

About the 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.

Make sure the motor is isolated from the frame!