Technical Reference

POWE RHOUSE ™
Digital Command Control

DA102-EU

Plug and Play Decoder

<u>AUTO-REVERSING HEADLIGHT</u>

Dimensions:
2.85 x .70 x .123 inches
72 x 17.5 x 3.5 mm

$29.95

This decoder is designed for easy installation in:

**Atlas RS1, RS3, C424, C425, GP7, RSD4/5, RSD12, C30-7, U23B, U33C, U36C
Athearn "Genesis" series locomotives; SD70, SD75, SD80, etc
Kato GP35, SD40, C44-9W Stewart AS16, F3A, F3B, F7A, F7B, F9A, F9B, U25B**

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

1) Convenient "Plug and Play" form factor provides easy "bolt in" installation
2) Four digit address (long)
3) Uploadable speed table with programmable motor drive frequency
4) 128 Speed mode operation
5) Decoder assisted consisting
6) All forms of operations mode programming (programming on the mainline)
7) Programmable Start Voltage works for all speed modes
8) Motor rating 1.3 Amp continuous, 2 Amp peak (stall)
9) Two function outputs rated for up to 40mA incandescent bulbs (150mA when used with LED or optional 22 Ohm series resistor)
10) EU version - reversing headlight
11) Provision for up to 3 extra user installed function outputs (F1-F3)

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

Configuration Variables used by DA102 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

CV64 - Headlight configuration, 0=normal, 1=Headlight acts as a Mars light

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		Description	CV	Default value in		Description
	decimal	hex			decimal	hex	
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
64	0	0	Headlight Configuration	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:

1) Remove the shell from your locomotive and carefully note the location of the wire connections to the existing circuit board.
2) Remove the ten (usually black) wire retaining boots and their respective wires from the circuit board
3) Unclip the circuit board from the plastic motor mount bosses (some circuit boards are screwed to the bosses)
4) Be sure to install the decoder with the component side down and with the arrow marked "REAR" pointing toward the rear of the locomotive.
5) Attach the locomotive wires to the decoder in the same relative positions as they were on the original circuit board. If you are comfortable using a soldering iron we

recommend soldering the wires instead of using the plastic boots for long term

6) Ensure the decoder is properly seated on the motor bosses (replace the screws if it was originally screwed in place.
7) A good time to test the locomotive is before replacing the body shell. 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.
8) Always test your decoder installation on a 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 .
9) 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 North Coast Engineering decoders so you will be able to run on conventional layouts without having to remove the decoder or rewire your locomotive.
10) After successful testing is complete replace the body shell and you are ready to run.

DA102EU decoder connection diagram
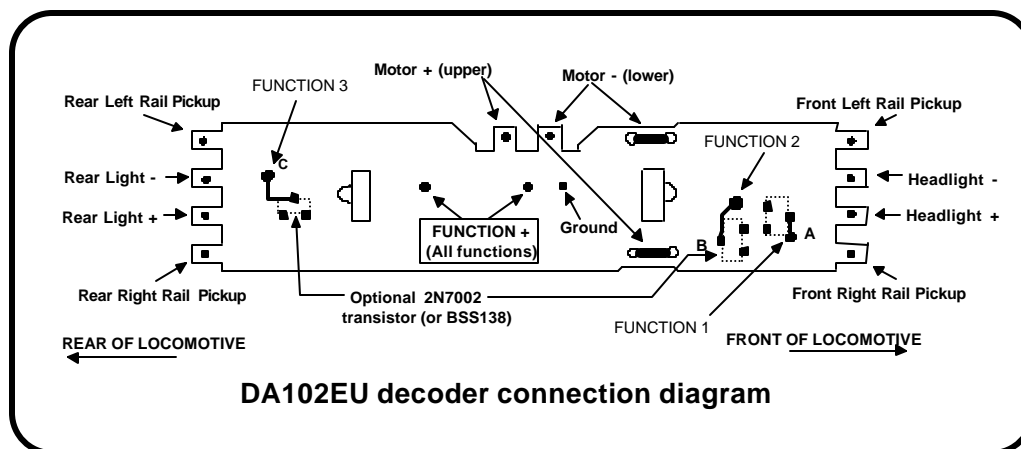
Functions & Bulbs
Due to the high in-rush current of incandescent grain-of-wheat type bulbs (about 10 times the normal operating current) function outputs are rated at 40mA each. We recommend Miniatronics part number 18-014-10 (2.4mm diameter 14 volt/30mA) or number 18-712-10 (1.7mm diameter 12 volt/30mA) 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.

The DA102 ships from the factory with **two** function outputs, Headlight and Function1. Optionally you may add up to three additional function outputs by installing separately purchased transistors on the "back" of the circuit board.   (We recommend using 2N7002DICT or BSS138 MOSFET transistors from Digikey Electronics 1-800-DIGIKEY). The optional transistor locations are indicated at A, B and C in the above diagram. The actual function output is at the hole indicated by the function arrow.

Usage with Athearn 1.5 volt bulbs
Athearn SD7x series locomotives are supplied with 1.5 volt 15mA bulbs. We suggest placing two bulbs and a 560 ohm 1/4 watt resistor all in series (there are 2 bulbs per headlight). We don't recommend using the bulbs in parallel.