

## PROGRAMMING

This decoder supports all program modes and read back features. With MRC Prodigy Advance DCC you can read its address and CV value.

CV	Description	Range	Default
CV1	Short address	1-127	3
CV2	Start voltage	0-63	10
CV3	Acceleration	0-63	0
CV4	Deceleration	0-63	0
CV5	Top voltage	0-32	32
CV6	Ultra slow speed enable for speed step1 and 2	0-1	0
CV29	Basic configuration	---	2
CV7	Manufacturer version number	---	0
CV8	Manufacturer ID	---	143
CV17	Long address upper byte	192-231	192
CV18	Long address lower byte	0-255	3
CV19	Advanced consist address	0-127	0
CV21	When CV21=0, functions follow its own address. CV21=1, functions follow the consist address	---	0
CV37	0=normal, 1=F3 and F4 exchange	0-1	0
CV39	0=normal, 1=F5 and F6 exchange	0-1	0
CV42	0=normal, 1=F8 and F12 exchange	0-1	0
CV49	All sounds off / on	0-1	1
CV50	Horn type	0-3	0
CV51	Horn volume	0-15	12
CV52	Bell type	0-3	0
CV53	Bell volume	0-15	12
CV54	Bell ring rate	0-50	3
CV55	Prime mover volume	0-15	12
CV56	Brake squeal volume	0-15	12
CV57	Dynamic brake volume	0-15	12
CV58	Air release volume	0-15	12
CV59	Air pump volume	0-15	12
CV60	Safety pop valve volume	0-15	12
CV61	Engine cooling fan volume	0-15	12
CV62	Coupling volume	0-15	12
CV64	Rail wheel clack	0-15	12
CV65	Kick start voltage	0-63	63
CV67-94	28 speed steps table while CV29.4=1	1-255	linear
CV112	Back EMF start speed adjustment	0-7	0
CV113	Back EMF Load control proportional gain Kp	0-31	20
CV114	Back EMF Load control integral gain Ki	0-31	10
CV115	Brake sound type; 2=brake sound off	0-2	0
CV117	Headlight light effect	0-15	0
CV118-119	Accessory light mode	0-15	0
CV120	Light brightness	0-255	255
CV119	ACC2 light mode	0-6	0
CV121	Air compressor mode (1=change with engine rpm)	0-1	0
CV122	Diesel Notch mode, 0=auto, 3>manual	0-3	0
CV124	Back EMF Load control intensity (0=off)	0-255	0
CV125	Programming to "1" will restore some CV's to factory settings	---	0

## SPEED TABLE CV67-CV94 FOR 28 SPEED STEPS

When CV29's bit 4 is set to "1" it will use the speed table formed by CV67-CV94 to control speed (motor voltage). It allows you to setup each speed for all 28 speed steps. First, program CV29 to 18 for short addresses (1-127) or program CV29 to 50 for long addresses (128-9999) to enable speed table control. Then set throttle to 28 speed steps and run your loco at speed step 1. Use program CV on the main to change CV67's value (1-255) to adjust step 1's speed. The kick voltage, CV65 is only applied when the speed step changes from 0 to 1. You should switch between 0 to 1 many times to check step 1's speed. When done with CV67, select speed step 2 and program CV68. CV68's value must be greater than CV67's. When done with CV67-CV94, use read back CV to make sure their values are in increasing order.

Note: When using MRC Prodigy Advance DCC to program addresses it will automatically disable the speed table (set CV29's bit 4 to "0"). Programming CV125 to 1 will also disable the speed table and re-program CV67-CV94 to a default linear speed setting.

## TROUBLE SHOOTING

**If the loco is running without sound click F12 to turn on the sound. Whenever the decoder doesn't work please use the program track to program CV# 125 with a value of 1 to restore the decoder to the factory settings. This should bring the decoder to life with address #3.** This decoder should perform well with all DCC systems. The maximum DCC output should be less than 21 V. If the locomotive does not respond to commands, it may have lost its address. Please re-program the address and program CV19 to 0 (disable consist). If it responds too slowly, you should clear its momentum by reprogramming CV3 and CV4 to zero. If step 1's speed is too high, you should program start voltage, CV2 to zero. If its top speed is too slow, program top voltage CV5 to 31. You should also clean the track to improve electrical pickup. Read your DCC system manual to learn how to program and operate the decoder. For more information about registers/CVs and their functions, please refer to the NMRA DCC Standard & Recommended Practices, RP-9.2.2. This is available directly from the NMRA or their website at [www.nmra.org](http://www.nmra.org).

## FCC COMPLIANCE

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions. (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

## RETURN PROCEDURE

This decoder carries a 6 month warranty against factory defects. This warranty **does not** include abuse, misuse, neglect, improper installation, or any modifications made to this decoder, including but not limited to the removal of the NMRA plug if applicable. If it should become necessary to return the decoder for warranty repair/replacement, **please include a copy of the original sales receipt.** Please include a letter (printed clearly) with your name, address, daytime phone number, and a detailed description of the problem you are experiencing. Please also include a check or a money order for \$11.00 to cover return shipping and handling. If the decoder is no longer considered under warranty, then please include a check or a money order for \$35.00 to cover the cost of repair or replacement and return shipping and handling. **Be certain to return the decoder only.**

**Any questions regarding Warranty Policy can be directed to our Customer Service Department by calling 732-225-6360 between the hours of 8:30am and 6:00pm EST, or by emailing: [rrtech@modelrectifier.com](mailto:rrtech@modelrectifier.com)**

Send the decoder to:

Model Rectifier Corporation  
Attn: Parts & Service  
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Printed in USA



## HO Gauge DCC Diesel Sound Decoder

Fits Many Atlas/Kato/Athearn/Intermountain Locomotives

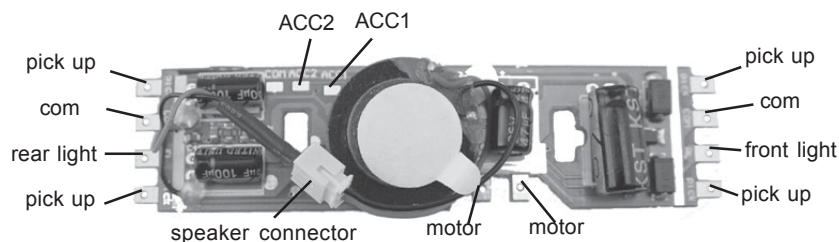
Item #0001619/1620/1621/1622/1623/1624

Thank you for purchasing our most advanced 16 bit DCC locomotive sound decoder. Combined with any DCC System, MRC Blackbox or Tech 6, our true live capture digital sound decoder will make your model railroad come to life.

- Synchronized prime mover sounds
- 1.5 amp capacity
- 4 different types of horns and bells
- Adjustable individual sound volumes (16 levels)
- Programmable either 2-digit or 4-digit addresses
- Programmable start voltage and top voltage
- Programmable acceleration and deceleration rates
- Programmable 14, 28, 128 speed steps
- Back EMF load control
- Service brake and dynamic brake sync with sound
- Supports read back address and CV values
- Advanced speed table control CV67-CV94
- Kick start voltage control CV65
- Easy function mapping
- 17 light effects: ditch lights, mars light, gyra light, strobe light, prime strobe light and on/off
- 28 accessory functions (F1-F28)
- Supports advanced consisting (CV19)
- Supports programming on the main (OPS mode)
- Compatible with NMRA DCC standards
- Complies with Part 15 of FCC Rules
- Speaker included
- Dimensions: 73.0mm x 17.8mm x 7.7mm

## INSTALLATION

For newer locomotives with a circuit board and wires, simply remove the old circuit board and follow the diagram to install the decoder. Hook up the front headlight to the tabs marked as FL and COM. Hook up the rear headlight to the tabs marked as RL and COM. For accessory light, hook up to ACC and COM.



The motor terminals must be isolated from the wheel pickups. The four pickup wires go to pickup tabs. The motor wires go to motor tabs.

You can use speaker sizes from 18mm to 28mm. The larger speaker the better sound quality. For locos with tight space, an 18mm can be mounted on the decoder. If your loco has space for a larger speaker we recommend you use 28mm speaker for a better sound quality. Always use 8 Ohm speakers.

If you use 1.5V bulbs or LED's, you should connect a 1k ohm resistor in series to one of the leads to limit current. Use CV120 to adjust the brightness.

## OPERATION

The decoder has a default address #3. Select address #3 on your DCC. Release service brake (F5) and dynamic brake (F6). You will hear the brake release sound when you turn off F5. Move up the throttle and the loco should start to move. If the loco does not move a speed 1 you can add more start voltage by programming CV2 with a large number. You can program the acceleration momentum CV3 and deceleration momentum CV4 to simulate the real train. The decoder has start up and shut down features. If the loco was previously shut down you have to start up the engine first. Press any function key to start up the engine. To shut down the engine you must bring the loco to idle and then press F8 three times.

This decoder has 4 different horns and bells. You can use F19 or program CV50 to select horn. And use F18 or program CV52 to select bell.

This decoder has an easy function exchange feature (re-mapping) that allows certain pairs of functions to be swapped. For example, program CV37 with a value of 1 will make F3 and F4 exchanged.

The decoder default is set to automatic notch mode. You can program CV122 to 3 for manual notch mode for realistic operation. In the manual notch mode the notch level is not controlled by loco speed. It is controlled by F9 ( notch up) and F8 ( notch down).

To make traction air compressor's speed synchronize to the prime mover, program CV121 with a value of 1. For a constant speed program CV121 with a value of 0.

## SERVICE BRAKING

To apply service brake set throttle to zero and press F5. The loco will slow down fast and you will hear the brake squeal. You can pump the brake by turning F5 on and off to stop the loco at desired location. The brake rate is proportional to deceleration rate that you program in CV4. If you forget to turn off F5 and move

the throttle up. The loco will move. However, when you release the throttle the service brake will apply again. The service brake can only operate when throttle is at 0. If you don't hear the brake sound program CV115 with a value of 2.

## DYNAMIC BRAKING

You can use dynamic brake F6 to reduce the speed. When you turn on F6 the prime mover will notch down to 1 and you will hear the dynamic brake sound and the loco will reduce its speed. When you release F6 the loco will speed up to the original speed. If you forget to turn off F6 and move throttle up it will automatically disable the dynamic brake and loco will start to move. To apply dynamic brake again you have to cycle F6 off and on.

## BACK EMF LOAD CONTROL (PID CONTROLLER)

This decoder is equipped with adjustable back EMF load control feature. It is a closed loop speed control. With back EMF load control the locomotive will maintain its speed regardless of pulling up hill or driving down hill. You may program the back EMF load control intensity, CV124, to a lower value to get less back EMF load control. This will enable the locomotive to slow down during uphill travel like a real locomotive.

The PID controller contains three components: proportional gain (CV113); the integral gain (CV114); and derivative gain (fixed). Designing (tuning) a PID controller is a kind of "rocket science". So we optimized these gains at the factory but still give the customer final adjustments. We recommend that you do not change these settings. Too much gain may cause the motor to oscillate (become unstable). Too little gain may cause a slow response. Additional knowledge of PID feedback control is required before attempting to adjust CV113 and CV114. If CV113 and CV114 are programmed incorrectly, the locomotive will not run smoothly. Program CV125 to "1" will automatically restore the default PID controller settings. If you can not get the PID controller work properly or you don't know to tune it you should turn off the Back EMF load control by program CV124 with a value of 0.

## LIGHT EFFECT PROGRAMMING CHART FOR CV#117/118/119

The decoder has 17 different lights effects. CV 117 controls both front and rear headlight effect. Use F0 to turn on or off the Headlights. CV118/CV119 control ACC1/ACC2 light effect. Use F3 to turn on or off ACC1 and ACC2. For ditch light operation you must program CV118 and CV119 to the same ditch light type. In type A the ditch lights will flash when F2 (horn) or F3 is on. In type B the ditch lights will flash when F2 is on and stay on when F3 is on.

CV117/118/119	Light effect
0	Normal on/off
1	Dyno effect (fading)
2	Dim, bright, off cycle
3	Rule 17
4	Both headlights on
5	Ditch Light type A
6	Ditch Light type B
7	Gyalite
8	Mars Light
9	Prime strato light
10	Single strobe light
11	Double strobe light
12	Rotating beacon
13	Fred Rear End Flashing
14	Firebox Flicker A
15	Firebox Flicker B
16	Engine Exhaust Flicker

Function	Idle/Moving
F0	Headlight on/off
F1	Bell on/off
F2	Horn
F3	Accessory light on/off
F4	Coupling 1
F5	Brake handle: brake when moving, brake release when idle
F6	Dynamic brake on/off: turn on will reduce speed
F7	Air hose firing/uncoupling lever
F8	3 times will shut down when in idle / Manual notch down
F9	Engine cooling fan / Manual notch up
F10	Rail wheel clack (only moving)
F11	Traction air compressor
F12	prime mover on/off
F13	Short air release
F14	Coupler crash
F15	Air compressor
F16	Flange squeal
F17	Air release
F18	Change bell type (use F1 to turn off bell after adjustment)
F19	Horn type select
F20	Associated loco sound
F21	Change bell volume (use F1 to turn off bell after adjustment)
F22	Change horn volume
F23	Change prime mover volume
F24	Safety valve pop
F25	Air release
F26	Flange noise
F27	Sand drop
F28	Air compressor speed mode change (CV 121) / with Air release

Decoder	Prime mover	Suitable for the locomotive
0001619	EMD645E	SD39, SD40, SD40A, SD40-2, SD40T-2, SD45, SDP45, SD45X, SD45-2, SD45T-2, F45, FF45, DDA40X, GP15T, GP39, GP39-2, GP40, GP40-2
0001620	EMD645	SW1000, SW1001, SW1500, SW1504, MP15DC, MP15AC, MP15T, GP38, GP38-2, SD38, SD38-2, GP15AC, GP15-1
0001621	EMD710	SD70AC, SD70M-2
0001622	ALCO 244	RS-3, PA1, PB1
0001623	ALCO 539T	S-2, S-4, RS-1, RSC-1, RSD-1, DL-105, DL107, DL-108, DL-109, DL-110
0001624	EMD567	F2A/B, F3A/B, F7A/B, F9A/B, BL1, BL2, FP7, FL9, FT, GP7, GP9, GP18, GP28, E6, E7, E8, E9, NW2, NW3, NW4, SW1, SW7, SW8, SW9, SW600, SW900, SW1200