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	Register	Description	Range	Default
CV1	R1	Short address	1-127	3
CV2	R2	Start voltage	0-32	0
CV3	R3	Acceleration	0-32	0
CV4	R4	Deceleration	0-32	0
CV5	---	Top voltage	0-32	32
CV6		Speed curve select (0=linear, 1=slow increase, 2=fast increase at slow speed	0-2	0
---	R6	Page number	---	---
CV29	R5	Basic configuration	---	2
CV7	R7	Manufacturer version number	---	2
CV8	R8	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 on/off	0-1	1
CV50	---	Horn type	0-22	13
CV51	---	Horn volume	0-15	12
CV52	---	Bell type	0-6	3
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	7
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
CV63	---	Auto ditch lights flash with horn enable	0-1	1(enable)
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
CV113	---	Back EMF Load control proportional gain Kp	0-31	20
CV114	---	Back EMF Load control integral gain Ki	0-31	10
CV115	---	Auto brake squeal enable/disable	0-1	1(enable)
CV118-119		Accessory light mode	0-6	0
CV118		ACC1 light mode	0-6	0
CV119		ACC2 light mode	0-6	0
CV121	---	Mars lights flashing on/off (F28)	0-1	0
CV122	---	Diesel Notch mode, 0=auto, 3=manual	0-3	0
CV123	---	Prime mover type	0-3	0
CV124		Back EMF Load control intensity (0=off)	0-255	160
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 select 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 then 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 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

Loco runing without sound click F12 turn on prime mover sound. Whenever the decoder doesn't work please <u>use the program track to program CV# 125 with value 1 to restore the decoder to factory settings. This should bring the decoder to life with address #3.</u> 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 to 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**.

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 $9.00 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
Send the decoder to:

Model Rectifier Corporation
Attn: Parts & Service
80 Newfield Avenue
Edison, NJ 08837-3817 U.S.A   Printed in USA

HO Gauge DC/DCC Diesel Sound Decoder

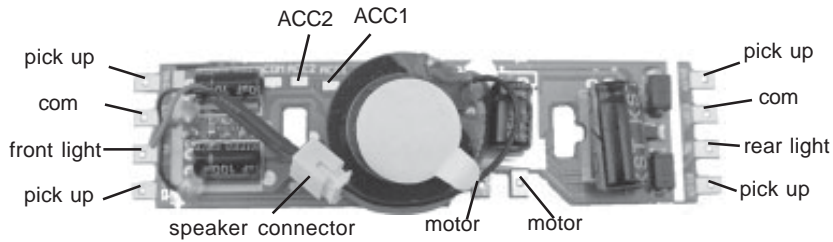### Fits Many Atlas/Kato/Athearn/Intermountain Locomotives

Item #0001905

Thank you for purchasing our most advanced 16 bit DC/ 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.

- Three types of synchronized prime mover sounds: Alco 539T /SD70/Electric Loco
- 1.5 amp capacity
- 22 different types of horns and 8 types of bells
- Adjustable individual sound volumes (16 levels)
- Programmable either 2-digit or 4-digit addresses
- Programmable start voltage and top voltage
- Programmable acceleration and decelaration rates
- Programmable 14, 28, 128 speed steps
- Back EMF load control
- Supports read back address and CV value
- Selectable factory default speed curve
- Advanced speed table control CV67-CV94
- Kick start voltage control CV65
- Easy function mapping
- 7 accessory 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
- 18 mm speaker included
- Dimensions: 73.0mm x 17.8mm x 7.7mm

INSTALLATION

For newer locomotives with 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.

For older model locomotives such as Atlas/Kato RS-1, RS-3 and RSD-4, follow the installation tips.

There are no bulbs furnished with this decoder, as modification to the internal light bars and internal weights may be needed to complete installation. New lenses and bulb retainers are to be fabricated by the decoder installer. Use of DCC rated bulbs is reccomended. The speaker is attached to the decoder with a plug. If you have enough room inside the locomotive, a larger speaker from MRC can be used in place of the 18mm round one included.

Remove the body shell of the locomotive by following the directions that came with it. There is a centrally mounted board mounted on the chassis with one light bulb mounted to it. Disconnect the four black pick up wires that are attached to the corners of the board and label them right side and left side. Gently slide the motor brush pick up tabs from under the brass pick up strips running lengthwise across the circuit board. Pop the board off the retention clips and discard. Cut the motor brush pick up tabs slightly short, leaving enough room to solder a short piece of wire to each tab. These two wires then get soldered to the decoder's motor terminals, [see diagram]. Solder the four pick up wires from the trucks to the four corner terminals of the decoder, keeping left side pick up wires to one side of the board and right side pick up wires to the other side of the board, [see diagram]. Before attaching the decoder to the retention clips on top of the motor, place a piece of insulating tape on top of the motor to isolate the bottom of the decoder to the top of the motor, motor brush tabs and wires. Decoder orientation does not matter as some locos ran long hood forward and some ran short hood forward. If the locos direction does not match your particular road name, you can reverse the decoder orientation, or reverse the two wires on the motor brush terminals, or program CV # 29 to reverse direction.
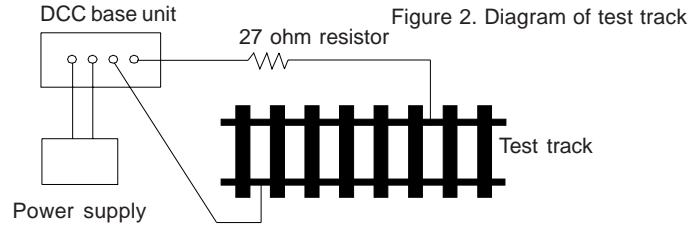
There are two light bars running lengthwise inside the body shell. These must be shortened or removed to accomodate the decoder. Choice of headlight/number board lighting is left up to the decoder installer. The speaker can be mounted on the decoder in the space provided if there is enough internal body shell clearance. If not it can be mounted to the underside of one of the hoods. Some of these locos have weights that sit over the gear towers, these must be trimmed down to gain clearance when mounting the speaker to the undersides of the hoods. Remove the paper backing from the face of the speaker to expose the glue ring and press speaker into the desired location.

If your loco has more space for a large speaker we recommend to order 20mm or even 28mm speaker for a better sound quality.

If you use 1.5V bulbs or LED's, you should connect a 2k ohm resistor in series to one of the leads to limit current.

MAKING A TEST TRACK

We strongly recommend building a test track with a 27 ohm resistor to limit current. Only test your installed decoder on the test track. The test track will reduce the chance of damaging your decoder due to an incorrectly installed decoder.

Figure 2. Diagram of test track

TESTING

The decoder has been programmed to address #3, 28/128 speed steps. To test, place the loco on the test track. Select address #3 and 28 speed step. Move up the throttle and the loco should move. Push the light button [F0] and headlight should come on. Change the direction of the loco and the loco should change direction. The loco cannot reach full speed, due to the resistor. If all the above occurs, you passed the test. Congratulations! Do not run the loco for an extended period of time on the test track or the resistor will overheat. If your installed decoder does not pass the test, find the problem, correct it and test it again. As long as you test the decoder on the test track there is little chance of damaging the decoder. This is why the test track is so important.

OPERATION

The decoder has start up and shut down features. If the loco was previously shut down you have to start up the engine. Press any function key to start up the engine before operating the loco. To shut down the engine you must bring the loco to idle and then press F8 three times.

The decoder has three types of prime mover sound effects. You can use F12 or CV 123 to select the desired prime mover sound or turn them off. Set CV123 to 0 for Alco, to 1 for SD70 or SD60, to 2 for electric loco, and to 3 for prime mover sound off. You can use F19 to select 22 different horn sounds and use F18 to select 8 different bell sounds. With MRC Prodigy Advance[2] DCC which has 28 functions, you can easily setup and access all the decoder's functions. If not, you may not be able to access all the features of the decoder. And you have to use the CV program to setup the decoder.

This decoder allows certain functions to be re-mapped easily, (CV numbers- 37, 39 and 42). If the values of these CV's are set to "0" (default), normal DCC keypad/functions are applicable. Inseting the values shown in the CV chart allows certain function swapping for example: F3 becomes F4 and vice versa.

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 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 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 oscilate (become unstable). Too little gain may cause 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 smothly. Program CV125 to "1" will automatically restore the default PID controller settings.

Function	Idle/Moving
F0	Lights on/off
F1	Bell on/off
F2	Horn
F3	Mars light on/off with air release
F4	Coupling 1
F5	Brake release (idle) / brake squeal (moving)
F6	Dynamic brake on/off
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	Change prime mover type, (3 types and 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 (total 22 different horns)
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	Mars light flash enable/disable with Air release (CV 121)

The decoder default is set to automatic notch. You can program CV122 to 3 for manual notch for realistic operation. And then use F9 to notch up and use F8 to notch down.

LIGHT EFFECT PROGRAMMING CHART FOR CV#118/119

Both ACC1 and ACC2 has 7 different accessory lights effects. Program CV #118/119 to choose the desired light effect. CV118 for ACC1 and CV119 for ACC2. For ditch light both CV118 and CV119 must be 0. In ditch light mode, use F3 to turn on/off and use F28 to enable/disable flash. When you blow the horn the ditch lights will flash. The ditch lights will remain flashing for several seconds after horn is off.

CV118/119 value	ACC#1/ACC#2 Light effect
0	Ditch light
1	Gyra light
2	Marslight
3	Prime strato light
4	Single strobe light
5	Double strobe light
6	on/off