MRC ⊻

MODEL RECTIFIER CORPORATION

Mini HO Universal Diesel DCC Sound Decoder

Item #00113740 (V.02-8/15)

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

- Six synchronized prime mover sounds
- 1.0 amp capacity
- 22 different types of horns and 8 different types of bells
- Adjustable master & 10 individual sound volumes (16 levels)
- Programmable either 2-digit or 4-digit addresses
- Programmable starting voltage and top-end voltage
- Programmable acceleration and deceleration rates
- Programmable 14, 28, 128 speed steps
- Back EMF load control w/adaptive PID control.
- User controlled service brake and dynamic brake 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, prime strobe...
- 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 is not included
- Dimensions: 29.5mm x 10.0mm x 6.0mm

WARNING

Do not use G scale power packs to operate this decoder. The maximum track voltage cannot exceed 16 Volts.

INSTALLATION

If your loco has a NMRA 8 pin socket, you can simply unplug the original connector and plug in the decoder. If not, you will have to hard wire in the decoder. The decoder will be inserted between the wheel pickups and the motor. After disconnecting the motor terminals from the pickups, connect the right side pickup wires to the red decoder wire, and connect the left side pickup wires to the black wire. Connect the right motor terminal to the orange wire, then connect the left motor terminal to the grey wire. **The motor terminals must be isolated from the wheel pickups.** The white wire is for the front headlight and the yellow wire is for the rear light. The blue wire is the light common. If you use an LED or 1.5V bulb, you have to use a series 750 Ohm resistor to limit the current. Otherwise it will burn your light out. Remember to use good soldering techniques, and shrink wrap to isolate the connections. The decoder cannot touch any metal part or bare wires. The decoder has a two pin 1.5mm pitch speaker connector. You can use 8 to 32 Ohm speaker sizes from 18mm to 28mm. Typically, larger speakers provide better sound quality. MRC speakers comes with the two pin plug which can be directly plug into the decoder.
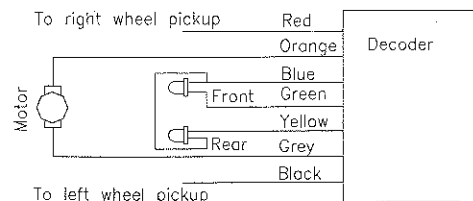
OPERATION

Do not use a G scale power pack to operate the decoder. The maximum track voltage is 16 Volts. The decoder has a default address of #3. Select address #3 on your DCC system. 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 on speed 1 you can add more starting voltage by programming CV2 with a large number. You can program the acceleration momentum with CV3 and deceleration momentum with CV4, to simulate a real train. The decoder has start up and shut down features. If the loco was previously shut down, you must 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. The decoder has six prime movers. You can program CV123 (see the CV123 chart) to match your model. It also has 22 different horns and 8 different bells. You can use (F19) or program CV50 to select horn. Also use (F18) or program CV52 to select bell.

The decoder has an easy function exchange feature (re-mapping), which allows certain pairs of functions to be swapped. For example, program CV37 with a value of 1 will make (F3) and (F4) exchanged. For more information on "function re-mapping" please visit our website **www.modelrectifier.com**

The decoder default is set to automatic notch mode. You can program CV122 to "3" for manual notch mode, allowing more 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 the air compressor's speed synchronized to the prime mover, program CV121 with a value of "1". For a constant speed, program CV121 with a value of "0".

LIGHT EFFECT PROGRAMMING CHART FOR CV#117

The decoder has 17 different lights effects. CV117 controls both front and rear headlight effects. Use (F0) to turn on or off the Headlights. If you use a value inconsistent with actual headlights, (CV117), the headlights will default to normal

on/off. For example trying to use a value of "14" in CV117 for the firebox flicker, the headlights will default to normal on/off.

SERVICE BRAKING

To apply the service brake (requires CV4 set to almost maximum) set the 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 a 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 set at "0". If you don't want to hear the brake sound program CV115 with a value of "2".

DYNAMIC BRAKING

You can use the dynamic brake (F6) in order to reduce the speed of the loco, to half of the throttle speed. When you turn on (F6) the prime mover will notch down to 1. 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 the dynamic brake again you have to cycle (F6) off and on.

BACK EMF LOAD CONTROL (PID CONTROLLER)

This decoder is equipped with an 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 downhill. You can program the back EMF load control intensity with CV124, to a lower value. This lowers the amount of 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 operate smoothly. Program CV125 to "1" will automatically restore the default PID controller settings. If **you cannot get the PID controller to work properly or you do not know how to tune it, you should program CV6 to enable adaptive PID control. This will have the decoder select the best back EMF control for your loco.** You can also turn off the Back EMF load control, by programming CV124 with a value of "0" – if the adaptive control fails.

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 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

When you hear "off" it indicates overload or over voltage. Correct problem it will operate normally. *Whenever the decoder doesn't work, please 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.* This decoder should perform well with all DCC systems. 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 it's top speed is too slow, program top voltage CV5 to 63. 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 <u>does not</u> 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.* 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 contact Model Rectifier Corp. for a price quote to cover the cost of repair or replacement of the decoder, and return shipping and handling. <u>*Customers outside the continental United States, including; Hawaii, Alaska, Canada and Mexico, have to contact MRC for exact return shipping rates for both warranty and non-warranty repairs. Contact rrtech@modelrectifier.com.*</u> 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

LIGHT EFFECT CHART

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

FUNCTION CHART

Function	Idle/Moving
F0	Headlight on/off
F1	Bell on/off
F2	Horn
F3	Acc1 light on/off / Air release (Air release disable when CV63=0)
F4	Coupling
F5	Brake handle: brake when moving, brake release when idle
F6	Dynamic brake on/off. The loco will slow down when F6 is on
F7	Acc2 light on/off, Air hose firing/uncoupling lever
F8	3 times will shut down when in idle / Notch down when in manual notch
F9	Engine cooling fan / Notch up when in manual notch
F10	Rail wheel clack (only moving)
F11	Traction air compressor
F12	Toggle between max master volume and sound off (CV49)
F13	Reduce master volume by 1 / air release when reach minimum
F14	Increase master volume by 1 / air release when reach maximum
F15	Air compressor on/off
F16	Flange squeal
F17	Air release
F18	Change bell type CV52 (use F1 to turn off bell after adjustment)
F19	Change horn type CV50
F20	Associated loco sound
F21	Increase bell volume CV53 by 1. It will roll back to 0 when reach 15
F22	Increase horn volume CV51 by 1. It will roll back to 0 when reach 15
F23	Increase diesel volume CV55 by 1. It will roll back to 0 when reach 15
F24	Safety valve pop
F25	Air release
F26	Flange noise
F27	Sand drop
F28	Air compressor speed mode change (CV 121) / with Air release

CV123 PRIME MOVER CHART

CV123	Prime mover	Suitable for the locomotive
0	EMD645E	SD39, SD40, SD40A, SD40-2, SD40T-2, SD45. SDP45, SD45X, SD45-2, SD45T-2, F45, FP45, DDA40X, GP15T, GP39, GP39-2, GP40, GP40-2
1	EMD645	SW1000, SW1001, SW1500, SW1504, MP15DC, MP15AC, MP15T, GP38, GP38-2, SD38, SD38-2, GP15AC, GP15-1
2	EMD710	SD60 Series, SD70 Series, SD75 Series, GP59, GP60 Series, SD80, SD90
3	ALCO 244	RS-2, RS-3, RS10, RSD4, RDS5, PA1, PB1, PA2, PB2, FA1, FA2, FB1, FB2
4	ALCO 539T	S-2, S-4, RS-1, RSC-1, RSD-1, DL-105, DL107, DL-108, DL-109, DL-110
5	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

For More Information about DCC, DCC Systems, and Decoders visit us at www.modelrectifier.com

CV CHART

CV	Description	Range	Default
CV1	Short address	1-127	3
CV2	Start voltage	0-63	10
CV3	Acceleration, 1=1 sec, max is 63 sec to reach top speed	0-63	0
CV4	Deceleration, 1=1 sec, max is 63 sec to stop at top speed	0-63	0
CV5	Top voltage, 63=full speed, 0=half of the top speed	0-63	63
CV6	Adaptive back EMF control enable, 1=enable, 0=disable	0-1	1
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	Master sound volume,16=max volume, 0=sound off	0-16	16
CV50	Horn type	0-22	0
CV51	Horn volume	0-15	12
CV52	Bell type	0-8	0
CV53	Bell volume	0-15	12
CV54	Bell ring rate	0-50	3
V55	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
CV63	F3 control air release enable	0-1	1
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
CV116	Brightness of dim light	0-255	120
CV117	Headlight light effect	0-15	0
CV118-119	Accessory light mode	0-15	0
CV120	Light brightness	0-255	255
CV121	Air compressor mode (1=change with engine rpm)	0-1	0
CV122	Diesel Notch mode, 0=auto, 3=manual	0-3	0
CV123	Prime mover sound select	0-5	0
CV124	Back EMF Load control intensity (0=off)	0-255	160
CV125	Programming to "1" will restore some CV's to factor settings	---	0