PROGRAMMING 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. 0=disable, 1=enable	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	Master sound volume, 16=max volume, 0=sound off	0-16	16
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
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 adjudstment	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 soundl type; 2=brake sound off	0-2	0
CV116	Brightness of dim light in Rule 17 or dim-bright-off mode	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	Diesel Primer Mover Select	0-4	0
CV124	Back EMF Load control intensity (0=off)	0-255	0
CV125	Programming to "1" will restore some CV's to factor 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 running without any sound press F12, no chuff sound, press F6. 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. The maximum DCC output should be less than 18 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 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 $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 $55.00 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
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Edison, NJ 08837-3817 U.S.A

Printed in USA

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HO 16 Bit Stereo DCC Drop in Sound Decoder For EMD F & E Units, And ALCO PA's

Item #0001922

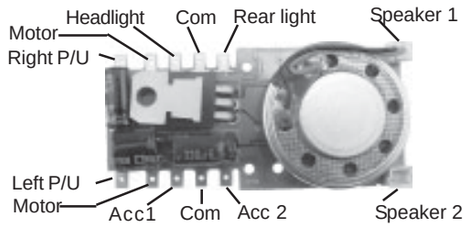
Thank you for purchasing our most advanced triple core stereo sound decoder available. Combined with any DCC System or the MRC Tech 6, our true live capture digital diesel sound decoder will bring your Proto 2000 locos to life.

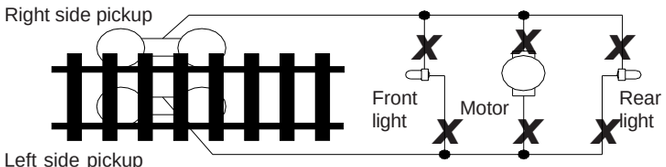
- Adjustable back EMF load control
- 16 bit sound control with 16 levels of sound volume
- Dual out of synch EMD 567B prime movers for realistic E Unit operation
- 1.5 amp capacity
- 2 different prime mover sounds- EMD 567B/Alco 244
- Programmable for either 2-digit (1-127) or 4-digit (1-9999) addresses
- Programmable start voltage and top voltage
- Programmable acceleration and deceleration rates
- Programmable 14, 28/ 128 speed steps
- Programmable user selectable 22 types of horns and 8 types of bells
- 17 light effects: ditch lights, mars light, gyra light...
- 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 regulations
- Programmable individual sound volumes
- True stereo sound comes with two 28mm speakers

INSTALLATION

Remove the screws that hold down the original PCB. Remove the original PCB and note the locomotives wire colors and locations from where they originate inside the chassis. Before removing the wires from the PCB study all wires and identify the four wheel pickup wires (each side has two wires connnected together) and two motor wires. Light wiring may be different depending the on road name. You must disconnect the motor terminals from the pickups, connect the pickup wires to the pickup tabs. Connect the correct motor terminals to the motor tabs.

The decoder is set up to use the LED or 1.5V bulbs. Install the wires to the decoder as noted in the following diagram. The tab marked common on the decoder is set to 5V for low voltage bulbs or LED's. If the light is not bright enough you can use any wheel pickup tab as common tab. You may need a 1k resistor if the light is too bright. Acc1 or Acc2 are used for extra lighting. This stereo decoder comes with two speakers for the E8/9 which has two diesel engines. Speaker # 2 should be placed in the front.





***Standard DC loco wiring diagram**:*

The 'X' marks indicate where to disconnect (isolate).

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 on speed 1 you can add more start voltage by programming CV2 with a larger number. You can program the acceleration momentum CV3 and deceleration momentum CV4 to simulate a 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 22 different horns and 8 bells. You can use F19 or program CV50 to select horn. Also use F18 or program CV52 to select bell.

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).

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 braking, 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 down. 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 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 oscilate (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 program CV6 to enable adaptive PID control to let the decoder to select the best back EMF control for your loco.** You can also turn off the Back EMF load control by program CV124 with a value of 0 if the adaptive control fails.

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

The decoder has 17 different lights effects. CV 117 controls both front and rear headlight effects. Use F0 to turn on or off the Headlights. CV118/CV119 control ACC1/ACC2 light effects. 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. 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 firebox flicker, the headlights will default to normal on/off.

Light effect CV117, CV118, CV119	
Value	Light effect
0	Normal on/off
1	Dynamo 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	Gyralite
8	Mars Light
9	Prime strato light
10	Single strobe light
11	Double strobe light
12	Rotating beacon
13	Fred-flashing rear end device
14	Firebox Flicker A
15	Firebox Flicker B
16	Engine Exhaust Flicker

If you use 1.5V bulbs or LED's, you should connect a 1k ohm resistor in series to one of the leads to reduce the voltage. You may need to adjust CV120 to for LED use.If you use Rule17 or the "dim-bright-off" light effect you may also need to program CV116 to adjust the brightness of the dim light.

Function	Idle/Moving
F1	Bell on/off
F2	Horn
F3	ACC 1 and ACC 2 on/off (CV 118/119)
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 diesel mover type, (CV123, 4 types)
F13	Master volume reduce by 1
F14	Master volume increase by 1
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 diesel rumble volume
F24	Safety valve pop
F25	Air release
F26	Flange noise
F27	Sand drop
F28	Ditch light flash enable/disable with Air release (CV 121)

CV123 value	Diesel type
0	Dual EMD 567B prime mover1
1	Single EMD 567B prime mover1
2	Dual AlCo 244 prime mover2
3	Single AlCo 244 prime mover2
4	All sounds off

MRC will provide custom function re-mapping to meet your special railroading requirements, if needed, for a reasonable fee.