PROGRAMMING

This decoder supports all program modes and read back features. With MRC Prodigy Advance² DCC you can read its address and CV values.

Please refer your DCC manual to learn how to program CV. See the register/CV chart to custom tailor your **MRC Light Effects**. For a more comprehensive understanding of CVs and registers. visit the National Model Railroad Association website at **www.nmra.org**.

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
CV29	R5	Basic configuration	---	2
CV7	R7	Manufacturer version number	---	32
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, all accessory function will follow its own address. When CV21=1, all functions will follow the consist address	0-1	0
CV65		kick start voltage	0-63	63
CV67-94		28 speed steps table while CV29.4=1	1-255	linear
CV105	---	User identification number	0-255	0
CV106	---	User identification number	0-255	0
CV113		Back EMF Load control proportional gain Kp	0-31	20
CV114		Back EMF Load control integral gain Ki	0-31	10
CV117		0 for directional, 1 for rule 17, 2 for bright and dim	0-2	0
CV118		ACC1 light type control (green wire)	0-5	0
CV119		ACC1 light type control (pink wire)	0-5	0
CV121		Ditch flash (=1) or stay on (=0)	0-1	0
CV124		Back EMF Load control intensity (0=off)	0-255	160
CV125	---	Factory default setting: Program it to 1 will restore all the CV to defult setting	---	0

BACK EMF LOAD CONTROL (PID CONTROLLER)

This decoder is equipped with adjustable back EMF closed loop speed control. Its proportional gain (CV113), integral gain (CV114) and derivative gain (fixed) are pre-tuned for most locomotives. We recommendend that you do not change these settings. Too much gain may cause the motor to oscilate (become unstable). Too little gain may cause slow reponse. Please get some basic knowledge of PID feedback control before trying to adjust CV113/114.

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.

FCC COMPLIANCE

This device complies with the Part 15 of FCC rule. 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 cause undesired operation.

TROUBLE SHOOTING

Whenever you find the decoder doesn't work properly please clean your track and the loco's wheels. And reprogram loco address or program CV125 with a value of 1 to restore factory defualt setting. Your decoder may simply lose its memory. **All you may need to do is to reprogram its address.**

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 contact Model Rectifier Corp. for a price quote to cover the cost of repair or replacement of the decoder, and return shipping and handling. **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**. **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

MRC 1651 4-FUNCTION DECODER with MRC Light Effects
Built-in NMRA DCC & 9-pin plug

Thank you for purchasing our highly advanced DCC locomotive decoder. Combined with any DCC System, our decoder will make your model railroad more realistic and more exciting.

- Adjustable back EMF load control with ultra slow speed control
- Built-in NMRA DCC plug and 9-pin plug
- Maximum current: 1.5 Amp
- Programmable for either 2-digit (1-127) or 4-digit (1-9999) addresses
- Programmable start voltage and top voltage
- Programmable acceleration rate and deceleration rate
- Programmable 14, 28, or 128 speed steps
- Directional lighting at 0.1 amp rate
- Easy setting "Rule 17" lighting, ditch, strobe and Mars lights
- 2 accessory functions (ACC1 & ACC2), at 0.1 amp rate
- Supports advanced consisting, (CV19)
- Supports programming on main
- Supports full read back
- Compatible with NMRA DCC standard
- Complies with the Part 15 of FCC
- 19.30mm long x 17.0mm wide x 5.0mm high

INSTALLATION

If your loco has an NMRA DCC 8 pin socket or 9 pin plug, all you need to do is plug in the decoder. Otherwise you have to cut the 8 pin plug and wire in the decoder. It is quite a challenge to install a decoder into a locomotive without the DCC socket. You should have some basic electrical knowledge and soldering skills. If you do not have the above requirements, please ask the dealer for help in installation.

Figure 1 shows the electrical circuit of most standard locomotives. The terminals of the motor and lights are directly connected to the wheel pick-ups. Each type of loco has its own method of electrical pickup. The connection between wheel and motor/light could be wires, clips, the body or any conductor. Figure out your locomotive's electrical connection and how to disconnect (isolate) the motor and lights. The decoder will be inserted between the wheel pickups and the motor. The 'X' marks in Figure 1 show you where to disconnect.

Figure 1. Connection of a standard loco *Note: The 'X' signs indicate where to disconnect (isolate)*
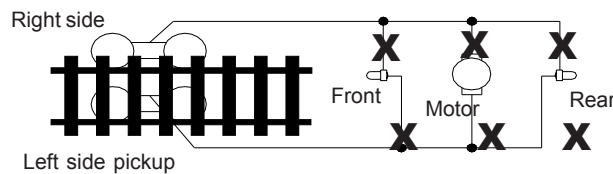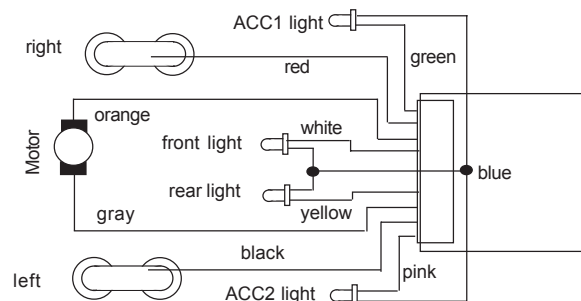
Right side

Front   Motor   Rear

Left side pickup

Figure 2 shows you how to wire the decoder. After disconnecting the motor terminals from pickups, connect the red wire to the right side pickup and the black wire to the left side pick up. Connect the orange wire to the motor terminal that originally connect to the right pickup. Connect the gray wire to the motor's other terminal. Connect the front light to the blue wire and the white wire. Connect the rear light to the blue wire and the yellow wire.

The blue wire is the common terminal for headlights (white for front and yellow for rear) and accessory functions (green for ACC1 and pink for ACC2). You may use the black wire or the red wire to replace the blue wire. This is very useful when you find that it is hard to isolate one of the light terminals from the pickup. Wiring the bulb this way will also make the light dimmer. If your loco has only a front light, you should connect the white and the yellow wires together.

Figure 2. Decoder wiring diagram

ACC1 light
right   green
red
orange
Motor   front light   white
rear light   blue
gray   yellow
black
left   pink
ACC2 light

MAKE A TEST TRACK

Before you start with your decoder installation, we strongly recommend building a test track which uses a 20 ohm resistor to limit current. **Only test your installed decoder on the test track.** The test track will prevent any damage due to an incorrectly wired decoder.

DCC base unit
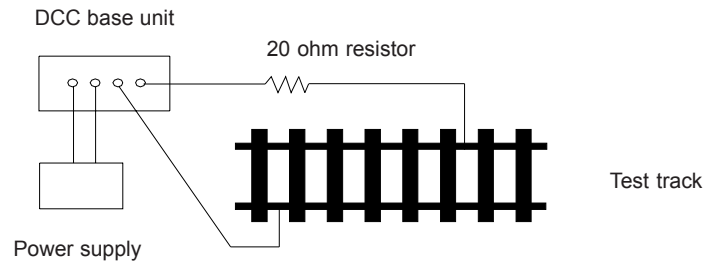
20 ohm resistor

Test track

Power supply

Figure 3. Diagram of test track

TEST

All MRC decoders have been factory programmed with address #3, 28/128 speed steps and maximum top voltage. After you have finished your decoder installation, you are ready to test it. **Never run the installed decoder on your layout without first passing the test.** You may damage the decoder if it is not wired correctly or if you have not properly isolated the motor and the lights.

Put the loco on the test track. Select the Run Mode of your DCC system and select or acquire address #3. Move up throttle and the loco should move forward. Push the light button and the front light of your loco should turn on. Push the reverse direction button. The loco should move backward and the rear light should turn on. The loco cannot get to normal speed because there is a 20 ohm protection resistor in the test track. If you are able to turn on/off the front and rear lights and you are able to move the loco in forward and reverse, you did a great job. Congratulations! **Do not test the loco on the test track for an extended period of time. To do so will cause the protection resistor to overheat.**

green wire

pink wire

NMRA DCC plug   9-pin plug
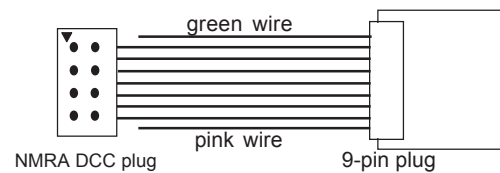
If your installed decoder does not pass the test, find the problem, correct it and test it again. As long as you test the decoder on the test track there is little chance of damaging your decoder. This is why making a test track is so important.

OPERATION

Headlight

There are three ways to operate headlight (depends on CV117):
1. Normal directional lighting (CV117=0)
2. Rule17 lighting (CV117=2). One light is bright to indicate direction of travel, the other is dim.
3. Dim, bright, off cycle (CV117=1). Use F4 toggle between bright and dim.

Note: If you loco's headlight has dim function, you should program CV117 to 1. And use F0 to turn on or turn off the headlight and use F4 to control it dim or bright.

ACC1 & ACC2 LIGHT EFFECTS

There are two function output wires (green and pink) on the decoder. Their functions are controlled by CV118 (green) and CV119 (pink). See the CV118&CV119 chart. To turn on/off ACC1&ACC2 use F3.

Light Type	Green wire CV112	Pink wire CV113
Ditch	0	0
Gyra	1	1
Mars	2	2
Prime Strato	3	3
Single Strobe	4	4
Double Strobe	5	5
On/off	6	6

Note: **Ditch lights** will use two lights. Both CV118 and CV119 must be programmed to 0. Ditch lights flash when F2 is on. When F3 is on and CV121=0 ditch light stead on. When F3 is on and CV121=1 ditch light flash.

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.