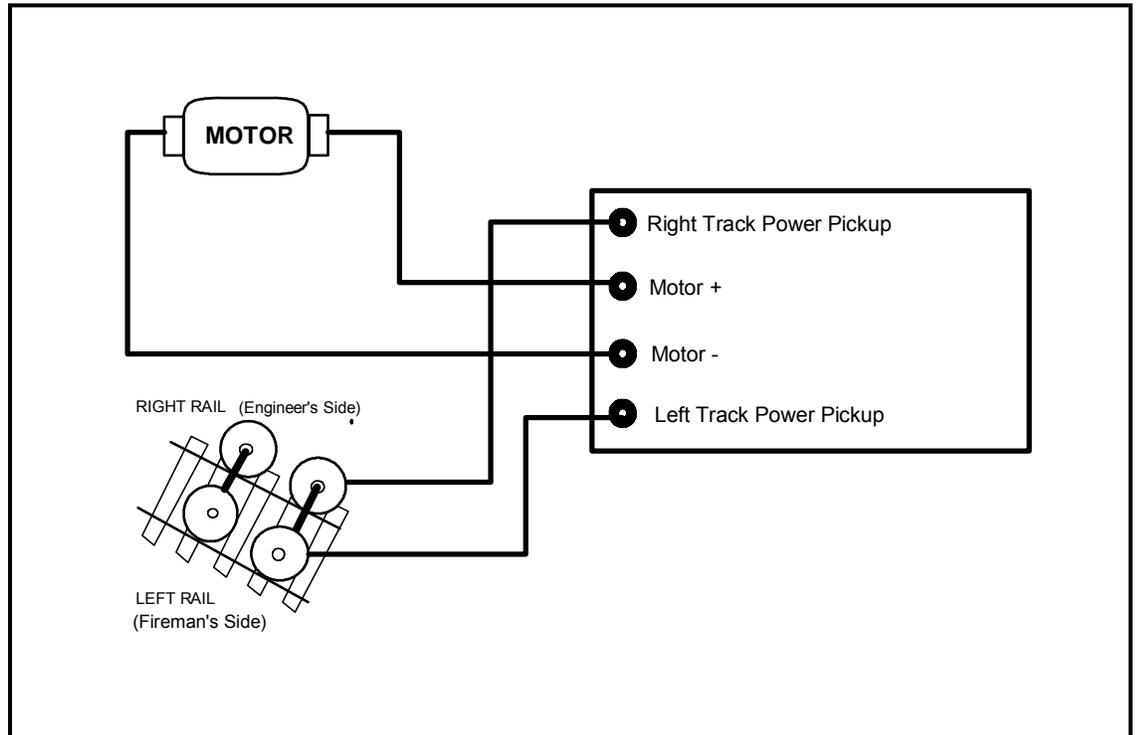


## Decoder Installation:



# Decoder Features

## Decoder version 3.6

Dimensions: 0.650 x 0.340 x .120 inches - 16.5 x 8.6 x 3.6 mm

### **This is an EPF (extended packet format) decoder supporting:**

- ✓ Silent Running™ motor drive
- ✓ Torque Compensation for ultra smooth low speed performance
- ✓ Programmable Start, Mid and Maximum speed works for all speed modes
- ✓ Motor rating 1.3 Amp continuous, 2 Amp peak (stall)
- ✓ All three function outputs have lighting effects generators
- ✓ Select from 15 different lighting effects (Mars, strobes, beacons, flicker, etc)
- ✓ Function outputs can be mapped to different functions
- ✓ Two or Four digit addressing
- ✓ Uploadable speed table interpolated to 128 speed steps
- ✓ 28 and 128 Speed mode operation (always works internally at 256 steps)
- ✓ Support for all forms of DCC programming
- ✓ Decoder programming lock mechanism
- ✓ Brake on DC feature assists automatic train control

Every attempt has been made to ensure this decoder complies with all applicable NMRA Standards and Recommended Practices.

## Fine tuning locomotive operation

The factory settings normally provide good performance for most locomotives. You may want to improve or fine tune performance by adjust the starting characteristics or top speed .

### There are 6 CVs that define:

- ^ The voltage at which the motor starts
- ^ How often and how hard the motor gets kicked a slow speeds to keep it turning smoothly.
- ^ The maximum motor speed
- ^ The mid speed range response characteristics or 'speed curve'.
- ^ Compensation for a motor that runs faster in one direction

**Start Voltage - CV2 (Vstart):** Before programming the start voltage we recommend programming CV65 (Kick Start) to zero. Kick start is used to overcome the 'stiction' of the motor by giving it a voltage 'kick' when starting from a stop. We don't want it getting in the way of setting Vstart. We prefer using Operations Mode Programming (Program on the Main) to set CV2 so the locomotive is **just able** to maintain movement at speed step 1. You can also use the programming track... it just takes a bit longer to find the right setting for CV2.

### Torque compensation kick rate - CV116:

How frequently the motor is 'kicked' at slow speed. Typical adjustment is 2 to 4. The smaller the number the more often the motor gets a brief voltage 'kick'. Factory default is 2. A value of 1 applies kicks continuously. The maximum practical value is about 8.

### Torque compensation kick strength - CV117:

How hard the motor is 'kicked' at slow speed. Typical adjustment is 4 to 25. The larger the number the more voltage is applied in each 'kick'. The strength of these kicks fade out ratiometrically as speed is increased providing a smooth transition to normal motor operation. Factory default is 50 (off), usable range 0-50.

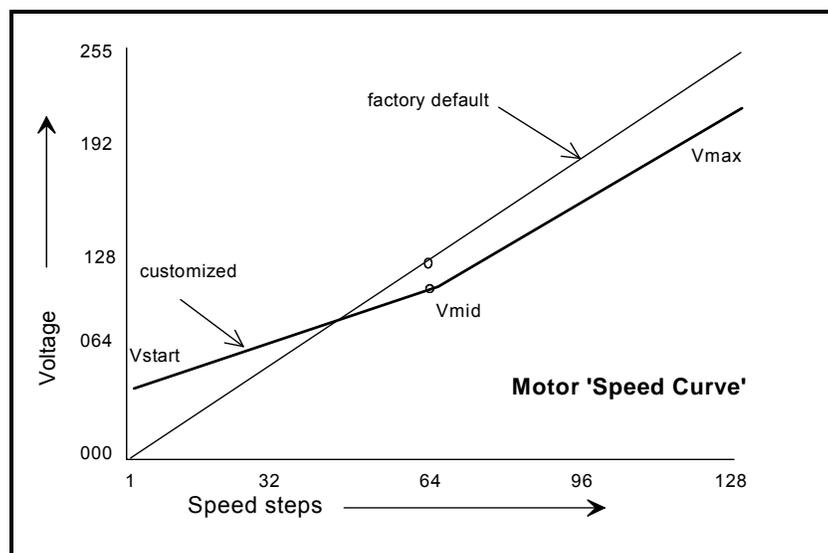
**Vmax - CV5:** If your locomotive runs too fast you can use CV5 to lower its maximum speed. Setting CV5 to 255 uses the maximum possible voltage to run the motor when full speed is requested. Set CV5 to a smaller value to reduce the top speed. A value of 128 will yield approximately 1/2 full voltage to the motor at top speed. 192 will provide about 3/4 full voltage. All speeds from the middle speed step to the maximum will be proportionally reduced (see diagram). If CV5 is set to 0 the decoder will use 255 for maximum speed. Always make sure CV5 is greater than CV6 to avoid erratic operation.

**Vmid - CV6:** CV6 determines how the motor responds through its middle speed ranges to advancement of the throttle. If you set CV6 lower than half the maximum speed you'll have smaller increases in motor speed through the lower speed ranges. Then, as you hit the upper speed ranges there will be larger increases between speed steps. In the diagram below you can see this best illustrated by the factory default line. If you set Vstart larger than 0 you'll most likely want to raise Vmid so a reasonable slope is maintained in the 'speed curve'. If CV6 is set to 0 the decoder will use 127 as the value. If you use high values in CV57 you will want to increase CV6 by a proportional amount to keep a smooth acceleration curve.

### Reverse trim (also forward trim) - CV95:

Values from 1-127 make decoder run **faster in reverse** than forward. 1 is one speed step faster in reverse, 2 is two steps faster, etc.

Values from 129-255 make decoder run **faster in forward** than reverse. 129 is one speed step faster in forward, 130 is 2 speed steps faster, etc. 0 and 128 add nothing to either direction.



## Configuration of CV29 settings:

**Table of commonly used values for CV29**

Value for CV29		Long/Short Address	Uploadable/Factory Speed table	Analog Conversion	14 or 28 Speed mode
decimal	hex				
2	2	Short	Factory	no	28
6	6	Short	Factory	yes	28
18	12	Short	Uploadable	no	28
22	16	Short	Uploadable	yes	28
34	22	Long	Factory	no	28
36	24	Long	Factory	yes	14
38	26	Long	Factory	yes	28
48	30	Long	Uploadable	no	14
50	32	Long	Uploadable	no	28
52	32	Long	Uploadable	yes	14
54	36	Long	Uploadable	yes	28

Note: If you want the locomotive to operate in the opposite direction increase the indicated value for CV29 by one. (Hex numbers are provided for Digitrax users)

## Factory default values for decoder Configuration Variables (CVs)

CV	Default value	Description	CV	Default value	Description
1	3	short address	73	0	Alt spd table step 7
2	0	start voltage	74	0	Alt spd table step 8
3	0	acceleration	75	0	Alt spd table step 9
4	0	deceleration	76	0	Alt spd table step 10
5	0	maximum speed	77	0	Alt spd table step 11
6	80	mid speed	78	0	Alt spd table step 12
7	36	decoder version	79	0	Alt spd table step 13
11	0	Packet timeout value	80	0	Alt spd table step 14
15	0	Programming "key"	81	0	Alt spd table step 15
16	0	Programming "lock"	82	0	Alt spd table step 16
17	192	long address high byte	83	0	Alt spd table step 17
18	0	long address low byte	84	0	Alt spd table step 18
19	0	consist address	85	0	alt spd table step 19
21	255	consist functions F1-F8	86	0	alt spd table step 20
22	63	consist function FLF,FLR	87	0	alt spd table step 21
23	0	acceleration adjust	88	0	alt spd table step 22
24	0	deceleration adjust	89	0	alt spd table step 23
29	2	decoder configuration	90	0	alt spd table step 24
30	0	error/reset register	91	0	alt spd table step 25
67	0	alt spd table step 1	92	0	alt spd table step 26
68	0	alt spd table step 2	93	0	alt spd table step 27
69	0	alt spd table step 3	94	0	alt spd table step 28
70	0	alt spd table step 4	95	0	reverse trim
71	0	alt spd table step 5	116	2	torque kick rate
72	0	alt spd table step 6	117	50	torque kick strength

## Configuration Variables used by V3.6 Decoders

- CV1** Short decoder address; 1-127 valid
- CV2** Start Voltage (useful range 0-100)
- CV3** Acceleration rate (each unit = 7mS between speed steps) 255 max.
- CV4** Deceleration rate (each unit = 7mS between speed steps) 255 max.
- CV5** Vmax, speed at highest speed step. 0=use factory default of 255
- CV6** Vmid, speed (on a scale of 1-255) at speed step 7,14,or 63. 0=use default of 127
- CV7** Decoder version number. This decoder is 35 which means version 3.5
- CV8** Manufacturer ID. = 11
- CV11** Packet timeout value (in ½ second increments) Time the decoder will wait before braking to a stop after running into a section of track with DC power. 0=Don't brake
- CV15** Decoder programming lock "KEY". This CV is always programmable even when "locked"
- CV16** Decoder programming lock ID. When CV15=CV16, programming is unlocked and the decoder will respond to programming commands. If CV15 is not equal to CV16 then decoder programming is locked and it will not program (except CV15) or read.
- CV17** High byte of long (4 digit) address  
- bit 6,7 always= 1  
- bits 0-5 are upper 6 bits of address
- CV18** Low byte of long (4 digit) address
- CV19** Consist address. (0 or 128 = no consist active)  
- bits 0-6 short consist address (1-127 valid)  
- bit 7 0= direction is normal, 1= direction is reversed
- CV21** Functions active in consist mode. Bit 0 controls F1,bit 1=F2, bit 2=F3, etc.  
- bit 0 - 1=function can be controlled at consist address, 0 = no consist control
- CV22** Functions active in consist mode. Bits 0,1 control FLF and FLR respectively  
each bit 1=function can be controlled at consist address, 0 = no consist control
- CV29**  
- bit 0 1= direction of operation is reversed, 0= direction is normal  
- bit 1 1=28 speed mode (always enabled)  
- bit 2 1= analog operation mode enabled, 0 = disabled  
- bit 4 1= alternate speed table active, 0= use table defined by CV2,5,6  
- bit 5 1= use long address in CV17/18, 0= use short address CV1  
- bits 3,6,7 are ignored by the decoder
- CV30** Set this CV to 2 **on the programming track** and the decoder will reset to factory settings.
- CV67-CV94** Uploadable speed table steps 1-28 (128 speed mode calculates intermediate steps)
- CV95** Reverse trim, values 1-127 add to reverse speed, values 129-255 add to forward speed
- CV116** Torque kick rate - number of 16ms periods in a row that motor is 'kicked' with voltage pulse
- CV117** Torque kick strength - how much voltage is used to kick the motor at slow speeds. Reduces to 0 as speed is increased.

**CV NOTES:** All CV numbers not listed above are ignored. This decoder supports all DCC programming methods.