Main Features of this Decoder

- **Red Marker Lights** automatically operate when in the reverse direction.
- **Back EMF Load Compensation** for superior slow speed control even with heavy loads.
- **Quiet Drive** creates **SUPER QUIET** engine performance.
- **Autodetect** for realistic throttle response when using **DC power**.
- **Dimmed Brightness** of bulbs or LEDs is **adjustable**.
- **Variable Momentum** lets you make **custom** acceleration **curves**.
- **Ditch Lights:** control alternating ditch lights with realistic pulsing.
- **Mars, Gyra, and Rotary Beacon** are adjustable.
- **Decoder Lock** for programming **same address decoders** independently.
- **Function Remapping:** 13 buttons for most lights, 7 buttons for operations.

Other Features of This Decoder: This decoder has too many features that could be listed on this page. For the complete list of available features, print out the "Additional Programing Guide" that can be found in the literature section of our website (www.tcsdcc.com). Some of the features include: Function Remapping, 3 Point Acceleration/Deceleration Curves, Button Control of the Motor, Loadable Speed Tables, Various lighting effects, decoder lock and many more.

WARRANTY PROCEDURE: All decoders are covered by a one year goof proof, no questions asked warranty. **Please return in a small box.**

1. You MUST register the failed decoder on our website at www.tcsdcc.com. If you do not have access to a computer you MUST call to register your warranty at: **(267) 733-3408**
2. Print out a copy of the Warranty Registration and include it in the box with the decoder(s).
3. Return decoder(s) directly to us using the address below.

Compatible with NMRA DCC standards.

Made by TCS in the USA.

Train Control Systems
P.O. Box 341
845 Blooming Glen Rd.
Blooming Glen, PA 18911

Phone **215-453-9145**
Fax **215-257-0735**
Email **tcs@tcsdcc.com**
Web **www.tcsdcc.com**

Our Famous GOOF PROOF NO Questions Asked Warranty

1489 K5D7

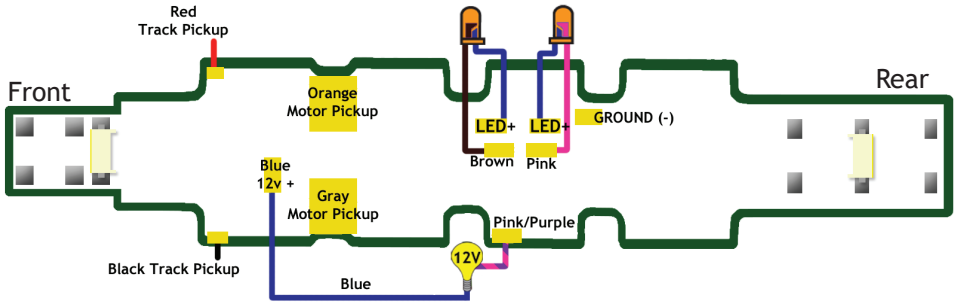
Scale	Functions	Function Rating	Continuous/Peak
N	7	80 mA	1.0 /2.0 Amp

Dimensions: 2.71"x0.545"x0.072" or 68.8mm x 13.83mm x 1.81mm

Red Marker Lights operate automatically in the reverse direction.

This full featured BEMF decoder is designed to fit the Kato N-Scale F40PH Locomotive. This decoder includes onboard LED's for the forward, reverse, and red marker board lights. Included is our auto-adjusting BEMF for outstanding slow speed performance and hassle free set up. Also includes Quiet Drive for super quiet engine performance.

WIRING DIAGRAM



INSTALLATION

For detailed installation pictures visit our website where we maintain a constantly growing database of a wide range of locomotives and decoders.

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1489 K5D7

BASIC CONFIGURATION

CV 29 Configuration

A	0	1	Reverse the direction the engine runs.
B	2	2	Use 28/128 speed step mode.
C	4	4	Enable analog (DC) operation.
D	0	16	Make the Loadable Speed Tables active.
E	0	32	Make the decoder address 128 or higher.
CV 29	6		← **Program the sum of the values you choose into CV 29**

2 Digit Address

Use if the address is 127 or less.

CV 1	3		← Record your choice here.

4 Digit Address

Make sure 4-digit Addressing is enabled in CV29

CV 17	0		← Record your four digit address here
CV 18	0		Your command station will assign the values of CV 17 and CV18

Consist Address

Add 128 to reverse the loco when in consist.

CV 19	0		Use a 2 digit address when in a consist (Multiple units).

Decoder Lock

CV 15	0		All unlocked = **0**	Decoder to unlock = **1 - 6**			All locked = **7**	
CV 16	1		Mobile = 1	Sound = 2	Light Only = 3	4	5	6

To unlock a decoder, make CV 15 = 0 or CV 15 = CV 16. To lock a decoder, make CV 15 not equal to CV 16. To lock all same address decoders, make CV 15 = 7.

Factory Reset

CV 8	153	Enter 2 to perform a Factory Reset.

Back EMF and Rule 17 Dimming Options

Even number OR 0= BEMF OFF Odd number = BEMF ON

BEMF disabled =0	BEMF enabled = 1	BEMF button control= 3		Dims when stopped = 16
Turn on BEMF and button control of it make CV 61 = 3				Opposite light dim = 32
CV 61	1		BEMF and Dimming Control	BEMF+Stopped + Opposite dim = 49
CV 136	2		Function button control of BEMF	Bits 0-7 designates buttons 5-12
CV 64	15		Dimmed Brightness	(2 - 6 for LEDs, 12 - 18 for Bulbs)
CV 10	0		BEMF Cut Out	

RailCom®

CV 178	0	CV address pointer
CV 180	0	RailCom® Transmit Options
CV 181	0	RailCom® Transmit Options
CV 28	0	Broadcast enable

® Registered trademark of Lenz Elektronik Gmbh

For more information on decoder features or programming visit:
www.tcsdcc.com and check out the **Complete Programming Guide**.

MOTOR CONTROL

Speed Graph

CV 2	0		**Start Volts** -- Set the voltage when the throttle is first applied.
CV 6	0		**Mid Volts** -- Set the voltage when the throttle is at midpoint.
CV 5	0		**Top Volts** -- Set the voltage when the throttle is at full speed.

Momentum

CV 3	1		**Acceleration --** Larger values add time to each speed step.
CV 4	1		**Deceleration --** Larger values add time to each speed step.
CV 23	0		***Acceleration Adjustment when in Consist**
CV 24	0		***Deceleration Adjustment when in Consist**

*Values above 128 increase the adjustment * Values below 128 decrease the adjustment

Motor Trim

CV 66	0		Forward Trim	Values above 128 increase speed,
CV 95	0		Reverse Trim	values below 128 decrease speed.

LIGHTING CONTROL

Lighting Features

Light Function Wires

CV 49	0	White Wire	F0F
CV 50	16	Yellow Wire	F0R
CV 51	16	Green Wire	F1
CV 52	32	Violet Wire	F2
CV 53	32	Brown Wire	F3
CV 54	32	Pink Wire	F4
CV 55	32	Pink/Purple	F5

UNIQUE BUTTON MAPPING NOTE:

Button 0 - turns on Forward Headlight when travelling in the forward direction and the Marker Lights when travelling in the reverse direction.

Button 1 - turns on the Reverse Headlight when travelling in the reverse direction only.

Light Effect	fwd	rev	both
Constant Bright Light	0	16	32
Random Flicker (fire box) 1	1	17	33
Mars Light	2	18	34
Flashing Light	3	19	35
Single Pulse Strobe 1	4	20	36
Double Pulse Strobe 1	5	21	37
Rotary Beacon	6	22	38
Gyra Light	7	23	39
Rule 17 (dimmable light)	8	24	40
Ditch Light (Left or Right)	10	26	42
Ditch Light (Other side)	11	27	43
Constant Dim 1	12	28	44
*Auto-Mars	13	29	45
Brake Light(s)	14	30	46
Single Pulse Strobe 2	15	31	47
Double Pulse Strobe 2	64	80	96
Random Flicker 2	65	81	97
Constant Dim 2	66	82	98
Constant Dim 3	67	83	99
Constant Dim 4	68	84	100

Consist Lighting Control

CV 21	0		Extra Functions	Green and Purple wire = 3
CV 22	0		Headlight Functions	White and Yellow Wire = 3

Lighting Quick Presets

CV 8	11	Program a value of 11 for default trolley settings.
	12	Program a value of 12 for standard trolley settings and tail lights.

Note: For more information on Quick Presets visit the Comprehensive Programming Guide at www.tcsdcc.com