White Wire = **1**	Yellow Wire = **2**	Record Your Total	
17 Headlight wires you want active when engine is in a Consist		**CV 22**	0

NOTE: You can program a pair of engines so that when in consist, only one light of the front engine lights and only one light of the rear engine lights.

Allows you to reset all of the CVs with a shaded default value. To start the process, enter a value of 2 in either CV 30 or CV 8. When you turn off the power and then restart, the reset will occur.	Record Your Choice	
18 Factory Reset	**CV 30**	0

Identification Numbers		Record Your Choice	
19 TCS Decoder Version Identification	**CV 7**		
TCS Manufacturer Identification Number	**CV 8**	153	
User Identification Provided for User	**CV 105**	0	
User Identification Provided for User	**CV 106**	0	

Blue Wire **Power Supply** for lights
Gray Wire To **Black Motor Lead**
Red Wire To **Right Side Rail** (the Engineer's Side)
Orange Wire To **Red Motor Lead**
Black Wire To **Left Side Rail** (the Fireman's Side)
Yellow Wire (Usually Reverse Headlight)
White Wire (Usually Forward Headlight)

DECODER

Blue
Gray
Red
Orange
Black
Yellow
White

Forward

Before installation, check that each motor lead is isolated from each wheel pickup. To avoid phase reversal, hookup the **red motor to the orange decoder wire** and the **black motor to the gray decoder wire**.

Suggested Resistance needed for Lights, Power Wire and Track Voltage					
Quantity and Type of Light		Power Wire	12 V. Track	14 V. Track	16 V. Track
12 V	(1) 30ma Bulb	Blue	0 to 100	47 to 150	100 to 220
	(2) 30ma Bulbs in Parallel	Blue	0 to 68	33 to 82	56 to 100
	(3) 30ma Bulbs in Parallel	Blue	0 to 68	10 to 68	22 to 68
15 Volt	(1) 30ma Bulb	Blue	270 to 390	330 to 390	470 to 560
	(2) 30ma Bulbs in Series	Blue	220 to 330	270 to 330	470 to 560
	(4) 30ma Bulbs in Series	Blue	180 to 270	270 to 390	330 to 470
	(1) 30ma Bulb	Red or Black	180 to 270	220 to 330	270 to 390
	(2) 30ma Bulbs in Series	Red or Black	100 to 180	150 to 220	220 to 330
	(4) 30ma Bulbs in Series	Red or Black	10 to 100	47 to 150	85 to 180

If using half power AC, turn those wires off for DC use because the voltage will increase and burn out the bulbs. See Table 16.

Contact TCS at
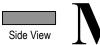P.O. Box 341
845 Blooming Glen Rd.
Blooming Glen, PA 18911

TRAIN CONTROL SYSTEMS ™

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

TCS DCC decoders provide the ultimate in control.

TRAIN CONTROL SYSTEMS ™

Side View **M1** Top View

Two Function Micro Decoder
1.0 amp continuous, 2.0 amp peak motor drive
plus two 250 mA function outputs

This decoder is in # _____
_____

EXCLUSIVE ! **Dither creates the ultimate in slow speed.**

Quiet Drive creates smooth quiet engine performance.

Small enough for N gauge: .350"wide by .565"long by .145"high.
Powerful enough for HO gauge.

Brake on DC feature allows stopping and starting when a DC section is active, all with your programmed acceleration, deceleration and desired lighting.

Reversing Headlights, Rule 17 dimming, **Opposite Dim, Random Flicker, Mars Light, Gyra Light, Rotary Beacon, Single Pulse Strobe, Double Pulse Strobe** and **Flashing** lights

The Only Two Function Decoders with Lighting Effects

Basic and Advanced Consisting flexibility building trains.

Button Remap Control any button can control any light.

User Loadable Speed Tables for custom speed curves.

Three Program Modes allows use with any controller.

OPS Mode Programming program on the main track.

128 Speed Step Control for superfine acceleration.

Extended Addressing for over 10,000 addresses.

Compatible with NMRA DCC standards.   Made by **TCS** in the USA.

EXCLUSIVE ! **Goof Proof warranty no questions asked.**

Factory Reset the fast way back to original settings.

BASIC CONFIGURATION

Make one choice from each row from "A" through "E" and total them on line 1.

					Record
A	Normal Direction in Forward = 0	Reverse Direction in Forward = 1			
B	14 Speed Steps = 0	128 Speed steps = 2			
C	Analog (DC) operation disabled = 0	Analog (DC) operation enabled = 4			
D	Loadable Speed Table Inactive = 0	Loadable Speed Table Active = 16			
E	2 Digit Addressing = 0	4 Digit Addressing = 32			
1	Basic Configuration of the Decoder	total "A" thru "E"	CV 29	6	

ADDRESSING

Primary 2 Digit Address

					Record
2	Primary Loco Address	use when "E" = 0	CV 1	3	

Advanced 4 Digit Address

					Record
3	First two digits of Extended Address	use when "E" = 32	CV 18	0	
	Last two digits of Extended Address	use when "E" = 32	CV 17	0	

Consist Address   If this is greater than 0, you can't alter the regular address.

				Record
4	2 Digit Address when added to a consist (Multiple units).	CV 19	0	

NOTE: If you want to maintain some or all engine lighting when in consist, see table 17.

MOTOR CONTROL

Start Volts   For most conditions, leave this "0" and **use Dither.**

					Record
5	Start Volts	1 volt = roughly 18	use if "D" = 0	CV 2	0	

Speed Graph   Using "0" (the default value) produces straight line acceleration.

					Record
6	Top Volts	1 volt = roughly 18	use if "D" = 0	CV 5	0	
	Mid Volts	1 volt = roughly 18	use if "D" = 0	CV 6	0	

NOTE: Adjust these to make engines run alike. This is useful in multiple unit operation.

Momentum creates the effect of engines pulling and stopping heavy loads.

				Record
7	Acceleration	Adds time to each speed step. Practical range is 0-25	CV 3	0	
	Deceleration	Adds time to each speed step. Practical range is 0-25	CV 4	0	

8	Loadable Speed Tables		Use if **"D" = 16**					
CV 67	2	CV 74	30	CV 81	72	CV 88	135	
CV 68	5	CV 75	35	CV 82	79	CV 89	147	
CV 69	7	CV 76	40	CV 83	84	CV 90	161	
CV 70	12	CV 77	47	CV 84	93	CV 91	177	
CV 71	16	CV 78	51	CV 85	100	CV 92	196	
CV 72	21	CV 79	58	CV 86	112	CV 93	219	
CV 73	26	CV 80	65	CV 87	121	CV 94	255	

Shaded CVs are the ones used for 14 speed steps **(when "B" = 0).**

Kick Start   A value of "0" in CV 65 nullifies Kick Start. It is superceded by **Dither.**

					Record
9	Burst Duration	Higher values increase duration. 60 = 1 sec.	CV 58	50	
	Burst Voltage	Higher values increase voltage. 18 = roughly 1 volt	CV 65	0	

Dither, an exclusive of TCS, provides the ultimate in slow speed control. Engines will run as slow or slower than one half MPH. Dither works when the engine is in the lower fifth of the speed range. To start, try CV 56 = 6 and CV 57 = 15.

					Record
10	Dither Frequency	The frequency range is 1 (high) to 10 (low)	CV 56	6	
	Dither Voltage	The practical range is 5 (low) to 50 (high)	CV 57	15	

NOTE: To refine Dither, remove the shell so that you can see the flywheel or some other rotating part. If the flywheel isn't moving with the speed control at minimum speed, make sure CV 56 is greater than 0 then increase CV 57 by 5 until you have some very slow movement of the flywheel. If you want to slow the motor, increase CV 56 by 1 until it is running as desired.

LIGHTING CONTROL

Lighting			Effect + Timing = Total		Choose **when the light is on**.	
11	White Wire	CV 49	0	+ =	0	Light is On going Forward only
	Yellow Wire	CV 50	16	+ =	16	Light is On going in Reverse only
					32	Light is On going in Both directions

Put the number in the **Timing** column for each

Choose **lighting effects**.   Put the number in the **Effect** column for each wire.

0	Bright Constant Light	4	Single Pulse Strobe	8	Rule 17 (dimmable light)
1	Random Flicker (fire box)	5	Double Pulse Strobe	12	Dim light (50% power)
2	Mars Light	6	Rotary Beacon		for future use
3	Flashing Light	7	Gyra Light		for future use

	Dims when loco is stopped = **16** Opposite headlight is on dimmed = **32**		Record Your Total
12	Headlight Dimming Parameters	CV 61	0

NOTE: This is not used unless you have an 8 in the effect column of table 11.

Gyra or Mars Light Modification. You can use only the Gyra light or Mars light at a particular time. You can't use both at the same time. CV 59 controls total cycle time. Lower values equal a shorter cycle. CV 60 controls time at low power. Lower values equal less time at low power. The default values are for a Gyra light. Set up for a Mars light by trying CV 59 = 46 & CV 60 = 12.

				Grya Light	Mars Light
				Record	Record
14	Oscillating Light Modulation	CV 59	46		
	Oscillating Light Latency	CV 60	54		

NOTE: This is not used unless you have a 2 or 7 in the effect column of table 11.

Button Control   Circle the value under the button numbers you want to control each wire.

15	Button Number	6	5	4	3	2	1	Rr	0	Ft	Total for the Row	
	White Wire	128	64	32	16	8	4	2		1	CV 33	1
	Yellow Wire	128	64	32	16	8	4	2		1	CV 34	2
	Rule 17 dims when button 4 is pressed			4								

NOTE: No changes are required here to operate button control of the motor circuit.

	White Wire **= 1** Yellow Wire **= 2**		Record Your Total
16	Wires you want to use with Analog (DC) Power	CV 13	255

NOTE: If you are powering one or more of these wires with the red or black wires (AC), do not have that wire active with DC power because the voltage will be higher.