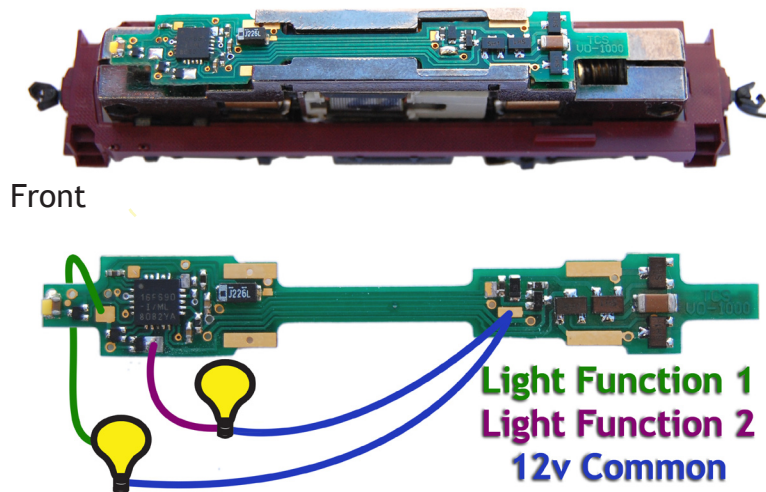


WIRING DIAGRAM



NOTE: Use 680 ohm resistors for 1.5v bulbs

1. Place the engine on its side with the screw heads up. Remove the two screws.
2. Lift off the unattached side. Leave the motor in the other side. Then slip out the light board.
3. Slip the decoder into the slot the light board was removed from. Make sure the motor power pickups on the bottom side of the decoder make contact with the power pickups on the motor
4. Make sure the insulating washers are in place and slip the unattached side into place and secure the two sides with the screws.

PROGRAMMING OTHER FEATURES: Decoder Lock, Variable Momentum, Button Control of the motor, Loadable Speed Tables, Modifiable Momentary Pulse, Mars, Gyra and Rotary Beacon Light and Function Remapping. If you wish to use them, see **Additional Programming Guide** at www.tcsdcc.com or get a copy at your Dealer.

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

1. Register the decoder(s) on our website at www.tcsdcc.com.
2. Print out a copy of the Warranty Registration and include it in the small box with the decoder(s).
3. Return decoder(s) directly to TCS. Train Control Systems

PO Box 341
Blooming Glen, PA 18911

Compatible with NMRA DCC standards.

Made by TCS in the USA.

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Train Control Systems
P.O. Box 341
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Web www.tcsdcc.com

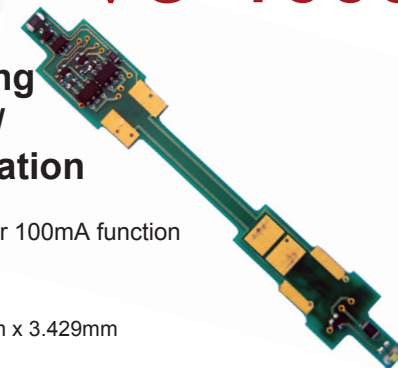
1031

TRAIN CONTROL SYSTEMS

NEW

VO-1000

Now Featuring
**Back EMF /
Load Compensation**



A powerful N Scale drop-in for the VO-1000 with four 100mA function outputs.

Provides 1 amp continuous and 2 amp peak draw.

Dimensions: 3.03"x0.355"x0.135" or 76.962mm x 9.017mm x 3.429mm

- **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**.
- **Dither** is the ultimate in **DCC control** thru the entire speed range.
- **Variable Momentum** lets you make **custom acceleration curves**.
- **Factory Reset** is faster and easier to reset to the default settings.
- **Brake on DC** stops the train with deceleration when in a **DC block**, maintains lighting, then accelerates when DCC returns.
- **Mars, Gyra, Rotary Beacon, Blinking Ditch Lights and Momentary Pulse** are adjustable.
- **Decoder Lock** for programming **same address decoders** independently.
- **Button Control of the Motor Circuit:** for a smoke unit, high speed switching, or a variable brightness light up to 1.2 amps
- **Function Remapping:** 13 buttons for most lights, 7 buttons for operations.
- **OPS Mode Programming** allows on the main track programming.
- **All Program Modes** are supported allowing use with any controller.
- **Basic and Advanced** Consisting for use with any controller.
- **Standard 2 Digit or Extended 4 Digit Addressing.**
- **User Loadable Speed Tables** for custom speed curves.
- **14 or 28 / 128 Speed Step Control** operating at 256 speed steps.
- **Additional lighting features not listed above** include Random Flicker, Single & Double Strobe, and



**Our Famous GOOF PROOF NO
Questions Asked Warranty**

WORKSHEET INSTRUCTIONS

- A blank outlined box is provided by each CV number. This is so you can preplan your decoder and have a record of your choices.
- In many cases you are recording a single value such as an address, a rate, or a limit.
- In some cases you are choosing more than one value such as actions, functions, or buttons. Each of these will have a value. Add the values of those you want active and enter that sum in the blank box.
- The other box by the CV number is the factory set value. If it is shaded, it can be reset with **Factory Reset**.

BASIC CONFIGURATION

Circle the values by all of the changes you want to make.

1	A	0	1	Reverse the direction the engine runs.
	B	2	-2	Use 14 Speed Steps instead of 28/128.
	C	4	-4	Disable 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			Adjust the Default Value by the values you have circled.

ADDRESSING

2 Digit Address

Use if the address is 127 or less.

2	CV 1	3		Record your choice here.
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4 Digit Address

Make sure Table 1 "E" = 32.

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

For more information about CV 17 and 18 visit our web entry on this topic at:
http://www.tcsdcc.com/faq/four_digit_addressing.htm

Consist Address

If this is greater than 0, the regular address is unalterable.

4				Add 128 to reverse the loco when in consist. Some systems only!
CV 19	0			Use a 2 digit address when in a consist (Multiple units).

Decoder Lock

Same address decoders need a different sub address in CV 16.

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

MOTOR CONTROL

Speed Graph

1 volt = 18

0 produces straight line acceleration.

6	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

The effect of engines starting and stopping heavy loads.

7	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

Dither If BEMF is turned off dither can provide an alternate form of speed control.

10	CV 56	3	Dither Frequency	The highest frequency = 1.
	CV 57	10	Dither Voltage	The lowest voltage = 1.

NOTE: Both CV 56 and CV 57 must be greater than 0 for Dither to be active.

Back EMF, Rule 17 Dimming Options and Opposite Dim Control

If BEMF is enabled Dither is disabled. If BEMF is disabled Dither is automatically enabled based on the values of CV56 and CV57. To adjust dither set CV57 to a recommended value of 15, if there isn't movement at 2% throttle setting, increase CV57 by 5 until you have movement of the flywheel. To fine tune the speed, change CV 56 by 1 until it is running as desired.

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

13	BEMF disabled = 0		BEMF enabled = 1		BEMF button control = 3		Dims when stopped = 16	
	To turn on BEMF and function button control of it, put 3 into CV 61							
	CV 61	1	BEMF and Dimming Control			Opposite light is dimmed = 32		
	CV 136	2	Function button control of BEMF			BEMF+Stopped + Opposite dim = 49		
	CV 64	15	Dimmed Brightness			(2 – 6 for LEDs, 12 – 18 for Bulbs)		
CV 10	0	BEMF Cut Out			For more information go to www.tcsdcc.com/BEMF.pdf			

LIGHTING CONTROL

11	Light Function Wires			Light Effect			fwd	rev	both
	CV 49	0	White Wire	Constant Bright Light	0	16	32		
	CV 50	16	Yellow Wire	Random Flicker (fire box)	1	17	33		
	CV 51	32	Green Wire	Mars Light	2	18	34		
	CV 52	32	Purple Wire	Flashing Light	3	19	35		

Place the value attained from the table by the function wire that will control it.

* Auto-Mars: Automatically turns Mars light on when decelerating below 36% speed. This setting also turns the Mars light on steady above 36% speed.

Rule 17 must be enabled in table 11 to enable dimming options in table 13.

	Single Pulse Strobe	4	20	36
	Double Pulse Strobe	5	21	37
	Rotary Beacon	6	22	38
	Gyra Light	7	23	39
	Rule 17 (dimnable light)	8	24	40
	Ditch Light (Left or Right)	10	26	42
	Ditch Light (Other side)	11	27	43
	Constant Dim light (50%)	12	28	44
	*Auto-Mars	13	29	45

Analog (DC) Power Control Turn off Black or Red wire powered functions.

17	CV 13	255	Activate power to light functions on DC
	Brake on DC		Activate by subtracting 4 from CV 29 in table 1.

Consist Lighting Control

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

Factory Reset

Sets all CVs with a shaded value back to that value.

20	CV 8	153	Enter 2 to perform a Factory Reset.
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