

TCS DCC decoders provide the ultimate in control.



This decoder is in # _____

New User Guide

A decoder works by changing numbers into actions. All you have to do is to put the response you want (in the form of a number) in the proper place.

The decoder will respond to the value that you choose. The decoder will respond to many values. All you have to do to get the decoder to respond to many options is to add up the values for the options you want. The worksheet shows the decoder's response for each available value.

You have to send a value to the decoder at a place where it is expecting instructions. Decoders provide addresses to receive your values. These are called CVs (configuration variables).

Sometimes you are not making choices but setting limits (minimum or maximum) or controlling timing. The usable range is 0 to 255 with any number being a proportion of that range.

The worksheets supplied with our decoders are divided into tables. Each table highlights a feature you may wish to alter. Each table provides you with your available choices and their values plus an address (CV) to put that value. To the right of each CV number is a default value. The default value is a choice of values made by the manufacturer to provide basic operation of the decoder. The default value is permanent unless you change it. Then it will remain at the changed value until it is changed again.

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Make sure that you have both motor terminals isolated from every wheel! Failure to do this can cause the decoder to burn out. Place one probe of an Ohm meter on one of the motor terminals and touch every wheel (both sides) with the other probe. If you get no readings after repeating the process on the other motor terminal, you are isolated. Be careful! A zero (0) or other Ohm reading indicates the motor terminals are not isolated.

There is one line for each CV number that you may alter.

Table Number	Description	Instruction	CV Number	Default Value	Your Choice	Record
	Start Volts	Leave this at 0 and use Dither for slow speed control.				
5	Start Volts	1 volt = roughly 18	use if "D" = 0	CV 2	0	0
NOTE: Start Volts are added to each speed step.						
Special Information			Information			

If the preprogrammed value (Default Value) equals your choice, there is no need to program it.

All numbers shown are for decimal systems and totals must be converted to hex if required.

This is a Multiple Decision Table

This CV sets 5 ways your decoder uses other choices you make.

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

NOTE: For example, if you wish to use 4 digit addressing, change "E" from 0 to 32 and change CV 29 from a total of 6 to a total of 38.

To use this table:

1. Make a choice from line A. Circle that choice and put the value for that choice in the box to the right.
2. Repeat that procedure for lines B through E.
3. Total the numbers you put in the right hand column. If your choice is the same as the default value, you do not need to do any more with this CV.
4. You may program as you go or make all your decisions and then program those which differ from the default value.

A note about Addressing

Consist addressing should be programmed as your system requires. If your system doesn't automatically set a consist address, a place to record your choice is provided on the worksheet.

A note about Slow Speed Control

Tables 5 and 9 are ways to overcome mechanical resistance to motion. Table 5 is used in basic decoders. Table 5 and Table 9 are offered in advanced decoders including TCS. Both ways basically boost the starting voltage to overcome the friction. Either can be used with TCS decoders however Dither, a TCS Exclusive, is the state of the art solution. Dither (Table 10) provides pulses of power to overcome resistance but not enough power to maintain the speed that the voltage would cause if applied continuously.

A note about Dither

DITHER creates operating speeds that are a fraction of what are otherwise possible. Because the control is so precise, it must be matched to the friction, weight and motor torque of each engine. *DITHER must be programmed to be effective because all engines are different.*

Dither provides the ultimate in slow speed control. Engines will run slower than one half MPH.
NOTE: Both CV 56 & CV 57 Must be greater than 0.

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

NOTE: If the flywheel isn't moving with the throttle at 1% or 2%, set CV 56 a value of 6, then increase CV 57 by 5 until you have some very slow movement of the flywheel (barely detectable). If you want to change the motor speed once you have movement, increase CV 56 by 1 until it is running as slow as you desire or decrease CV 56 by 1 to increase speed.

A note about Lighting Effects

Use the information in the two "choices" tables to find the values for the CVs in table 11.

	Lighting	CV	Value	Timing	+	Effect	=	Total
11	White Wire	CV 49	0	0	+	8	=	8
	Yellow Wire	CV 50	16	16	+	8	=	24
	Green Wire	CV 51	32	32	+	0	=	32
	Purple Wire	CV 52	32	0	+	10	=	10
	Brown Wire	CV 53	32	0	+	11	=	11

Choice of lighting effects.
Constant Bright Light = 0
Random Flicker (fire box) = 1
Mars Light = 2
Flashing Light = 3
Single Pulse Strobe = 4
Double Pulse Strobe = 5
Rotary Beacon = 6
Gyra Light = 7
Rule 17 (dimmable light) = 8
Ditch Light phase A = 10
Ditch Light phase B = 11
Constant Dim light (50% power) = 12

Choose when light is On (timing).
Light is On when running Forward only = 0
Light is On when running in Reverse only = 16
Light is On when running in Both directions = 32

NOTE: Add the value you choose for the light timing to the value you choose for the lighting effect to get the value you need for the CV you are programming.

Some CVs allow you to choose none, some or all features.

In table 12, 0 yields no features, 16 yields dim on stop, 32 yields opposite headlight dimmed, and 48 (16 + 32) yields both features. If the choices are shaded, the default value includes them as active.

	CHOICES:			Record Your Total
12	Dims when loco is stopped = 16 Opposite headlight is on dimmed = 32	CV 61	0	16

NOTE: This can be used with a "0" or "8" in the effect column of table 11.

	CHOICES:			Record Your Total
16	White and Yellow Wire = 1 Green Wire = 2 Purple Wire = 4 Brown Wire = 8	CV 13	255	13

NOTE: If you are powering one or more of these wires with the red or black wires (AC), **deactivate that wire with DC power** because you will burn out the bulb. This example shows the green wire AC powered or is simply a feature you don't wish active on DC.

A note about Button Control (Function Remapping).

In most cases, you can control almost any wire (function) with almost any button on your controller.

Button Control Circle the value under the button number you want to control each wire. One button can control multiple wires. One wire can be operated by multiple buttons.

Button Number	8	7	6	5	4	3	2	1	R-0-F	Total for each Row			
15	White Wire		128	64	32	16	8	4	2	1	CV 33	1	129
	Yellow Wire		128	64	32	16	8	4	2	1	CV 34	2	2
	Green Wire		128	64	32	16	8	4	2	1	CV 35	4	4
		8	4								CV 37	0	
	Purple Wire		128	64	32	16	8	4	2	1	CV 36	8	16
		8	4								CV 38	0	
Brown Wire						16	The Brown Wire cannot be changed						
Ditch Lights Flash on button 2 or 5				5				2	Choose a single (on/off) button for both ditch light wires.				
Rule 17 dims when button 4 is pressed					4								

NOTE: If you are using Ditch Lights, do not use buttons 2 or 5 for any wires because these buttons control the ditch light flash. If you are using Rule 17 light dimming, do not use button 4 for any wire because it controls light dimming. You may use buttons 2, 4 & 5 as you wish if you are not using ditch lights or headlight dimming.

The example above shows the following:

The Front Headlight (White Wire) is controlled by button 0 or 6. The Rear Headlight (Yellow Wire) is controlled by button 0 only. Pushing button 0 turns on both the White and Yellow Wires. Pushing button 6 turns on the White wire only. If you decided to use Rule 17 dimming in Table 11, the lights will dim when you press button 4.

The Purple Wire and Brown Wire are set up for Ditch Lights, which require a single button to turn them on. Button 3 was chosen because the Brown wire cannot be changed. If you decided to use the Green Wire and the Purple Wire for Ditch Lights, you could use button 1, 6, 7, 8 or (4 if you are not using Rule 17 dimming). The ditch lights will alternately flash if you press button 2 or 5.

A note about Consist Lighting

You can program your lights so the lights are active differently when an engine is part of a consist (Multiple Unit) than when it is operating independently.

CHOICES:	Green Wire = 1	Purple Wire = 2	Brown Wire = 4	Record Your Total	
17	Wires you want active when engine is part of a Consist			CV 21	0
CHOICES:	White Wire = 1	Yellow Wire = 2		Record Your Total	
17	Headlight wires you want active when engine is in a Consist			CV 22	0

If you have a couple of geeps that you sometimes consist, you can program them so that only the Forward Headlight and other running lights of the lead engine operate and only the Reverse Headlight of the following engine operate when you put them in consist. Just decide which engine you want to use as lead engine and which will be the follower and program the Consist Lighting accordingly.

A note about Autodetect.

TCS decoders recognize whether they have DCC or DC (analog) power input. Many people feel that TCS decoders operate transparently on DC power. (Just as if the decoder was not there.) There is no danger of overheating the motor or decoder while using a TCS decoder with DC power.

TCS DCC decoders provide the ultimate in control.

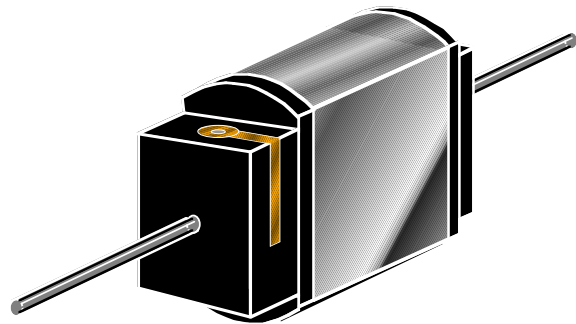
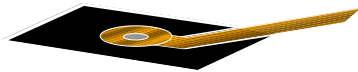


Wiring Motors For Decoders

If your motor has one or two strip contacts to conduct current to the motor terminals, follow the steps shown with this illustration.

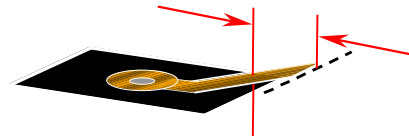
STEP 1

Carefully straighten and bend up the strap.



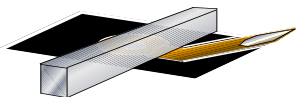
STEP 2

Cut the strap leaving about an eighth of an inch overhanging the side.



STEP 3

Clean the top end of the strap. Clamp a piece of aluminum on top of the strap as a heat sink and tin the top end of the strap. Then cut a piece of shrinkable tubing big enough in diameter to fit over the strap and long enough to cover the strap **plus one half an inch**.



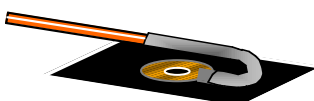
STEP 4

Place the tubing over the proper wire (orange or gray) and solder the wire to the end of the strap. Remove the heat sink and push the tubing over the strap and shrink it.



STEP 5

Fold the strap upon itself covering the terminal.



When wiring motors with red and black wires attached to the motor terminals, leave an inch or two of the original wires to avoid the chance of unsoldering the wires from the terminals. Use shrinkable tubing to cover every wire splice to avoid any chance of a short.

Make sure that you have both motor terminals isolated from every wheel! Failure to do this can cause the decoder to burn out. Place one probe of an Ohm meter on one of the motor terminals and touch both sides of every wheel with the other probe. If you get no readings after repeating the process on both motor terminals, you are isolated. **Be careful! A zero (0) or other Ohm reading indicates the motor terminals are not isolated. A reading which is the same as the reading you get when the probes aren't touching anything indicates the terminals are isolated.**

To avoid phase reversal, hookup the **red motor lead to the orange decoder wire and black motor lead to the gray decoder wire.**

If you end up with the engine running in the direction opposite the direction you want, **do not rewire the motor. Look at the value you have for "A" in table 1 (CV 29). If you have a 0 for "A", add 1 to the total you have for CV 29. If you have a 1 for "A", subtract 1 from the total you have for CV 29. This will reverse the phase as it was wired.**

When wiring lighting wires (functions), the Power to supply the White, Yellow, Green, Purple and Brown wires is available from three wires. The Blue wire provides Full Power DC. If you use the Black or the Red wire to power a feature, you have Half Power DC which will be about half the power of the Blue wire. When you use Red to Black you have Full Power AC (track voltage).

Compatible with NMRA DCC standards.

Made by TCS in the USA.

Contact TCS at
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