



TCS BEMF Information Page

Train Control Systems is pleased to announce that BEMF/Load Compensation is now added to the entire line of decoders. This page is here to provide additional information about BEMF and the control thereof.

BEMF Adjustment and Tuning- The BEMF on TCS decoders is self adjusting and automatically corrects itself for different motor characteristics. We are so confident in its ability to correct any hitches that we have done away with the need for adjustment and created a completely autonomous BEMF system. All the normal speed control functions like Vmid, Vmax, User Loadable Speed Tables, 28/128 Speed Steps are all active with BEMF on by default to produce not only smooth, but accurate movement for your locomotive.

BEMF on and off control-

Although BEMF is a valuable feature, there may be situations in which you prefer to turn off BEMF. If you wish to turn BEMF off permanently, you can do that by placing a value of 0 into CV 61. There may be times where you would like BEMF off but only momentarily, or maybe when you reach a certain speed you would rather not have your decoder reacting to changes in the track (i.e. inclines). Some situations where you may want to use momentary stretches of BEMF may include: A switch yard, or sidings in local town. Once you leave the yard or the siding you may want to turn BEMF off for the long stretches without the trouble reprogramming on the fly.

Another reason you may want to turn off the BEMF is when consist. Because BEMF has such precise speed control it may be difficult for some to speed match all of the loco's in a consist. You could end up with one loco slipping or spinning its wheels in an effort to constantly compensate for the other loco. By using button control BEMF can be turned off after the consist is underway, but before any noticeable slips start to occur. By default the function button control is tied to button 6, but by programming CV 136 (based on the upcoming table) you can assign that control to any button between 5-12. When BEMF is disabled Dither will automatically take over and allow the consist to run together smoothly. Dither's speed control is ideally suited for accurate and equal speed control in consist, and will still provide great benefits to users who enjoy the richness and control of Dither.

Fortunately we have added the Button Control of BEMF to simplify your transition between periods where BEMF is necessary, and those regions where you may not want to use it.

There are two methods for conveniently turning off BEMF without the need to program CV's. One method is button control which uses CV 136 to determine which button will be used. The second method is the BEMF cut out which uses CV 10 to determine what speed BEMF will cut out at.

BEMF Function button remapping-

Button-	5	6	7	8	9	10	11	12
Value-	1	2	4	8	16	32	64	128

In order to control which button is used to turn off and on the BEMF select the value in the table above that correlates with the button which you wish to use and put that value into CV 136. If you would like to assign two different buttons to control the BEMF simply add the values correlating to the two buttons together. For example, for buttons 5 and 7 add the two values (4 and 1) and put that value (5) into CV 136. You can combine any number of buttons together by simply adding them. The default value for CV 136 is 2. This puts button 6 in control of turning BEMF on/off.

BEMF Cut Out-

BEMF cut out will automatically turn off BEMF when it reaches the speed step you predetermine. You can select the speed step by programming values into CV 10. The values in CV 10 correlate almost one to one to the speed steps so values between 1-128 would be appropriate.

BEMF Control Table-

13	BEMF disabled = 0		BEMF enabled = 1		BEMF button control = 2		Dims when stopped = 16		
	To turn on BEMF and function button control of it, put 3 into CV 61						Opposite light is dimmed = 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						

Notes on Table 13 BEMF Control (this table is also found in your decoder literature)

Back EMF, Rule 17 Dimming Options and Opposite Dim Control

CV 61 is used to enable or disable BEMF. As noted previously, there is no way to manually adjust BEMF. It can only be turned on or off. BEMF automatically adjusts itself so not there is no need to adjust it. To turn on BEMF CV61 needs to have a value of one. The factory default setting is a value of one in CV61 thereby turning on BEMF. To enable button control of BEMF, CV61 needs a value of three. To enable the other features controlled by CV61 add the values together and place the total value in CV61. For example to enable opposite dim, BEMF, and button control of BEMF, add 32+1+2=35. As another example, to turn on BEMF with Dimmed when stop (but without function button control of BEMF) put a value of 17 (1 for BEMF + 16 for Dims when stopped).

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

NOTE: In order for button control of BEMF to be on BEMF must be enabled, therefore, CV 61 must be equal to at least 3 in order for BEMF button control to be enabled. All other combinations can include the button control along with BEMF simply by adding 3 to their totals.

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	0	Dither Voltage		The lowest voltage = 1.

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

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.