

Theory of operation.

As soon as the ABC stop/condition is activated, a locomotive (train) practically slows down until its speed reaches 0. Like in real life, a locomotive (train) cannot stop at any small distance. Depending on its mass and inertia, it needs a certain distance to be able to brake completely (this makes the stop of the model realistic).

Therefore, the set Vmax (CV5 value) is considered for stopping, because we calculate that in the worst case, the locomotive should be able to stop at the same distance even at this Vmax value.

Regardless of the speed at which the locomotive is traveling when ABC is activated, whether at low speed or at maximum speed, it should stop at approximately the same distance. Therefore, it is very important what Vmax values are set.

The Vmax should be set in CV5 in such a way, that when the throttle is at its maximal position (maximum speed step >> speed step >> 126 for example with the so-called 128 speed step setting), the locomotive should travel at a realistic maximum speed on the track. The factory default CV5 value (200) could be too high for realistic operation of the model locomotive on the track (Note: the maximum value for CV5 is 255).

Recommendation to set up the ABC operation.

1. Set the realistic Vmax as described above. We recommend setting of Vmid (CV6) to the middle of Vmin and Vmax (at least at the beginning), so the speed characteristic will be linear between Vmin and Vmax. This can of course be changed later
2. Set CV27 = 3. This will enable the ABC detection on both polarities. Later this can be changed to values 1 or 2 (only one of the polarities will be used for detection), but at the beginning we recommend enabling both polarities, while we validate the ABC detection. It might happen, that the ABC module is installed in a wrong way, and if we enable both polarities, the ABC sector will be detected. If only one polarity is enabled, and we installed the ABC module inversed, we will not detect the ABC sector
3. Set CV146 = 0. This will disable the CBD (Constant Braking Distance, by default it has the value 1). This will result in a non-precisely controlled stopping/braking distance. But we must validate, that the ABC will be triggered, and the locomotive will slow down and stop with the braking rate set in CV4. The stopping distance will depend on the actual speed of the locomotive with this setting, but we must validate that the ABC sensitivity is set correctly. So, after the ABC is triggered, we must see a continuously slowing down movement, till stop. If some fluctuations are visible, the ABC sensitivity must be adjusted in CV141.
4. ABC sensitivity: practical values for the sensitivity are in the range of 6 to 14 (default value is 10, valid for the Lokommander II series decoders !!). If the set value is too low, we can notice false ABC triggering, the locomotive will start to break even if it is not on the ABC segment. In this case even the switching noise on the tracks can trigger a false ABC detection. So, the lower threshold must be verified, while the locomotive is not running on an ABC segment. If the value of the ABC sensitivity is too high, the locomotive will not detect the ABC triggering even when it is in the ABC sector. So, the high-end value must be verified when the

locomotive is inside an ABC sector. It must always detect the ABC triggering as it enters to the ABC sector. As a conclusion, the sensitivity value is the most important parameter to set up the correct ABC operation. Changes to the default values are recommended only if we notice uncertain ABC detection.

5. The ABC settings has two more important parameters (CV values): CV193 and CV194.

a. ABC switch-on delay CV193 (default value: 25 units, one unit is 4 milliseconds, default value = 200 milliseconds = 0.2 seconds): if the voltage difference between the two rails is greater than the switch-on threshold set in CV141 for at least the time set in CV193, then the ABC condition is set (switched ON). If configured, a permanent braking process is started. This plays an important role in the activation of the ABC detection. If the ABC condition is detected, then the CV194 setting below will play a role in the switch-off (of course, the switch-on threshold set in CV141 is a necessary condition for switch-on)

b. ABC switch-off delay CV194 (default value: 25 units, one unit is 4 milliseconds, default value = 200 milliseconds = 0.2 seconds): if the voltage difference between the two rails is less than the switch-off threshold set in CV192 for at least the time set in CV194, then the ABC condition is cleared (will be switched OFF). If a permanent braking process was configured and started earlier, it is interrupted (since the ABC condition has been eliminated). Therefore, if we want to exclude possible contact errors, then this value must be increased so that the ABC does not accidentally switch off (and restart) the stop. It may happen that 200 milliseconds is too short, this can be increased (for example, doubled, quadrupled, etc.). This way, in the event of a short contact error, the ABC stop will be definitely not invalidated. The switch-off threshold set in CV192 must be met for at least the time set in CV194, for the ABC stop to be switched off.

6. The setting of the CBD (Constant Braking Distance) must be made at the end, after we set up the ABC triggering. This will determine the exact distance after which the locomotive will stop within an ABC sector. In the user manual there is a detailed description. Here is an overview:

a. there are two different braking modes. The first one is a two-tier constant braking rate mode. For using this, the braking rate must be set in CV146

b. the second mode has a variable braking rate in which we set directly the distance. This is set in CV150.

c. the CVs 146-151 have doubled pairs for forward and reverse operations. This means, that you can set up differently the behavior of the braking in the two travelling directions. The variable braking rate mode has priority (over the constant braking rate) if set in CV150.

Overview of the CVs which must be used

CV141	ABC turn on Sensitivity	
CV142	ABC Wait Time	
CV143	ABC Slow Speed forward	
CV144	ABC Slow Speed revers	
(CV145	ABC Measurement Count)	>> irrelevant in the current firmware!)
CV146	CBD brake deceleration forward	
CV147	CBD brake deceleration Reverse	
CV148	CBD Brake Delay forward	
CV149	CBD Brake Delay Reverse	
CV150	CBD Brake distance forward	
CV151	CBD brake distance reverse	
CV192	ABC turn of Sensitivity	>> this CV is applicable/usable from version 5.xx.xx up
CV193	ABC on delay time (default 200ms)	>> this CV is applicable/usable from version 5.xx.xx up
CV194	ABC off delay time (default 200ms)	>> this CV is applicable/usable from version 5.xx.xx up

Troubleshooting

In case of too long stopping distance, or inconsistent ABC detections please check and adjust accordingly:

- Set a realistic Vmax in CV5
- The ABC sensitivity must be set correctly. If the ABC condition is detected, then lost, then detected again, etc. it will start calculating the braking distance again every time. This can lead to a much longer braking distance. To overcome this, the value of CV141 can be reduced. For example, set it to 8 (Note: the value of CV192 must be lower than the value of CV141!!).
- Set the switch-on and switch-off delay correctly. To overcome losing the ABC condition because of an improper rail contact, the values of CV193 and CV193 must be set according to recommendation 5.
- The Constant Braking Distance (CBD) must be set after the ABC detection is correctly set up and is working properly.

NOTE:

The exact firmware version of the Lokommander II decoders can be read from CVs 253,254,255,256 as follows (detailed also in the Lokommander II manual, chapter 22, Firmware update, page 46 of the English version, page 58 of the German version):

Major version: CV253 (for example 3) (this is the same as the value of CV7 !!!!)

Minor version: CV254 (for example 7)

Subversion/Build Number: $(CV255 * 256) + CV256$ (for example if CV255 = 0 and CV256 = 236 this means build number is 236)

So, in the above example, the firmware version is 3.7.236.

Compared to the old manual (available on the website, document version 0.1.22), the following CVs have been changed, and have direct impact over the ABC braking:

old CV64 >> moved to CV146 (Forward Direction).

old CV150 >> moved to CV147 (Reverse Direction). You can set the two parameters independently/separately for both directions. If CV147 remains 0 (zero), then for the Reverse Direction the same value will be used as is set for Forward Direction (CV146)

old CV65 >> moved to CV148 (Forward Direction)

old CV151 >> moved to CV149 (Reverse Direction). In the same way, you can set the two parameters independently/separately for both directions. If CV149 remains 0 (zero), then for the Reverse Direction the same value will be used as is set for Forward Direction (CV148)

old CV153 >> moved to CV150 (Forward Direction)

old CV161 >> moved to CV151 (Reverse Direction)