1. Application note description

This application note describes the limit switches inputs default behavior and how it can be disabled, to use these special inputs as general purpose inputs.

Inside this application note is also shown how the load movement can be restricted using the software limit switches.

2. EasyMotion Studio implementation

2.1 Hardware Limit Switches – Default Behavior

The "LSN" (negative limit switch) and "LSP" (positive limit switch) digital inputs were designed to allow the physical connection of the system limit switches.

By default, when one of the limit switches became active, the drive stops the motor (using a quick stop profile), sets the correspondent bits, in the MER error register, to 1 and executes the code inside the correspondent limit switch interrupt routine (if it is active on the inactive to active limit switch transition).

Remark: The active level for the limit switches inputs can be set through the "Drive Setup" dialog.
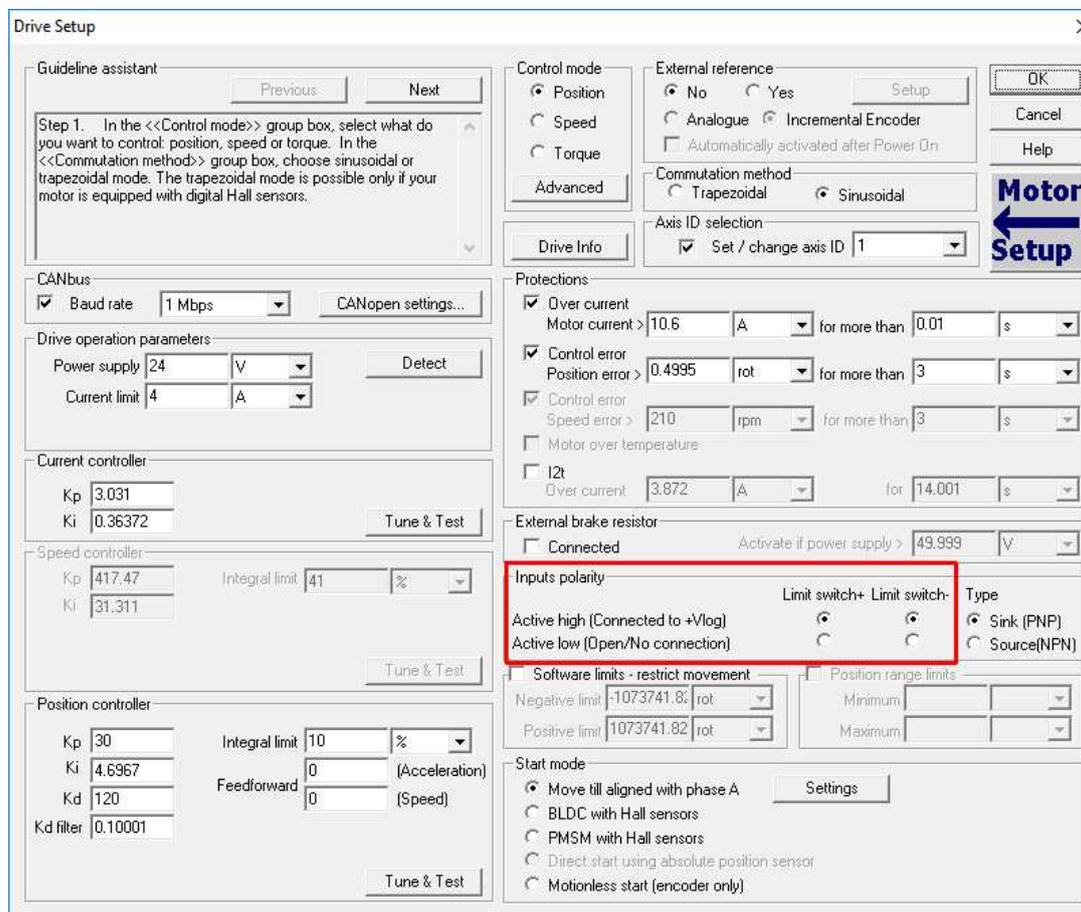

Figure 1. *Limit switches polarity configuration*

The limit switches default behavior can be easily observed when a motion profile is executed and the correspondent limit switch input is changed to the active state.

Remark: If the test system does not have a limit switch, the user needs to simulate it by connection the "IN2/LSP" drive terminal to "GND" or to "Vlog" as is described in the drive user manual.

Below is an example where the drive executes a trapezoidal position profile with a position increment of 10000 rot, a speed of 100 rpm and an acceleration of 1500 rad/s^2.
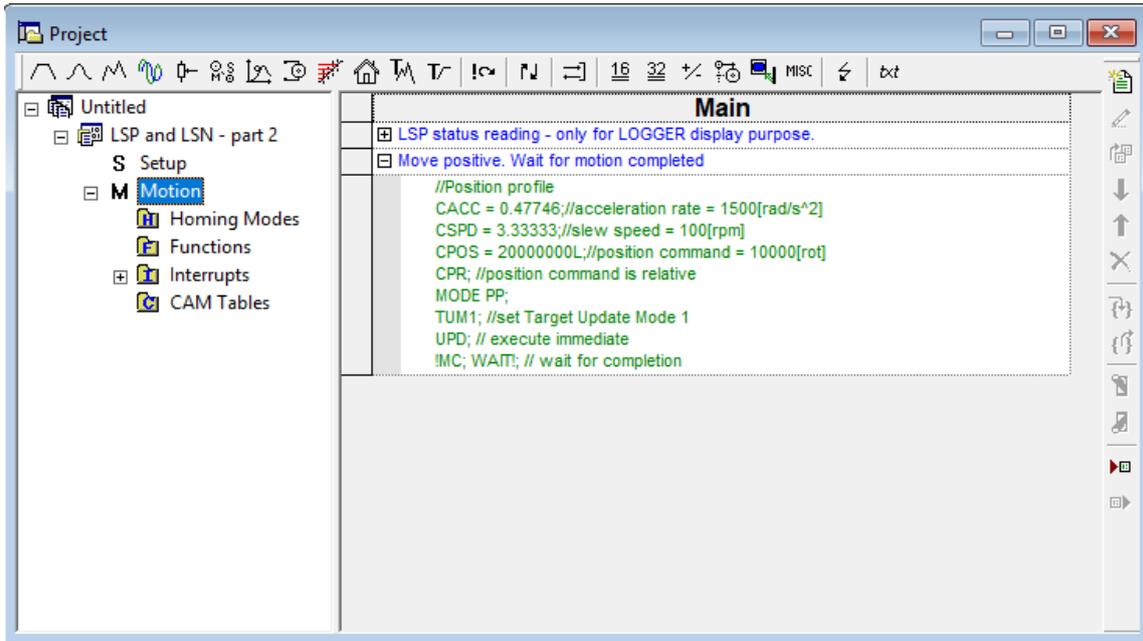

Figure 2. *Main section of the TML program*

When the positive limit switch became active, the quick stop profile is executed and the motion stops. This moment can be also captured using the Logger function in EasyMotion Studio.
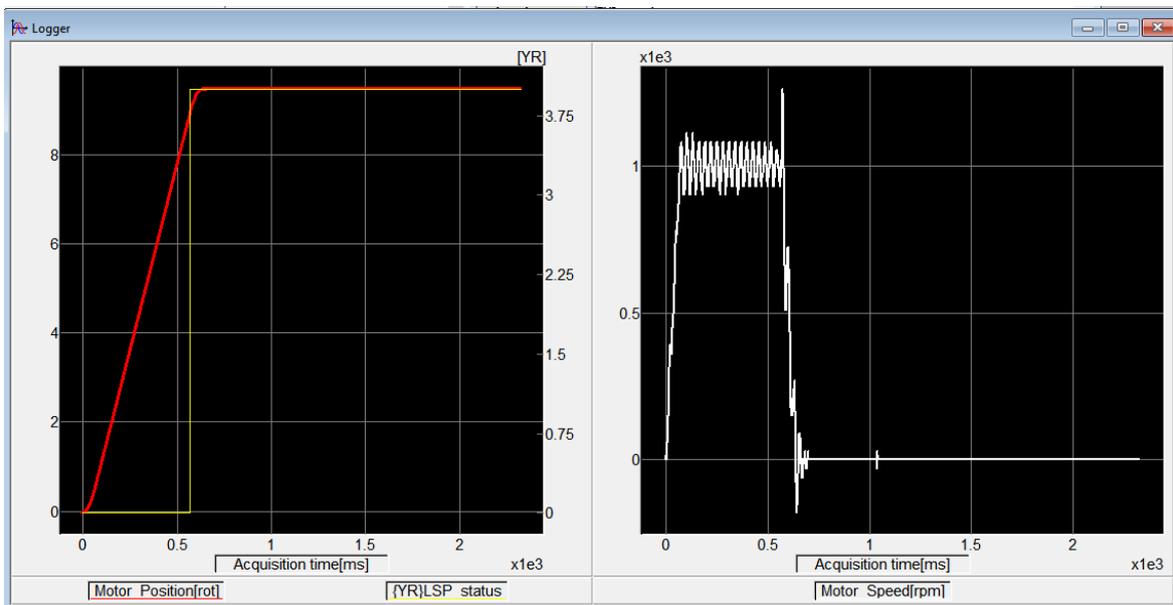

Figure 3. *Quick Stop procedure cached on the Logger*

The load positon (red line) in the above figure, starts from 0 rpm and follows the imposed motion profile. After ~0.6 s, the positive limit switch (the yellow line) became active and the drive enters in the quick stop mode. As can be seen in the second plot, the motor decelerated until the motor speed (white line) became 0 rpm.

While the positive limit switches is active, the bit 6 - "LSP (limit+) active" in the MER error register is also set to 1.
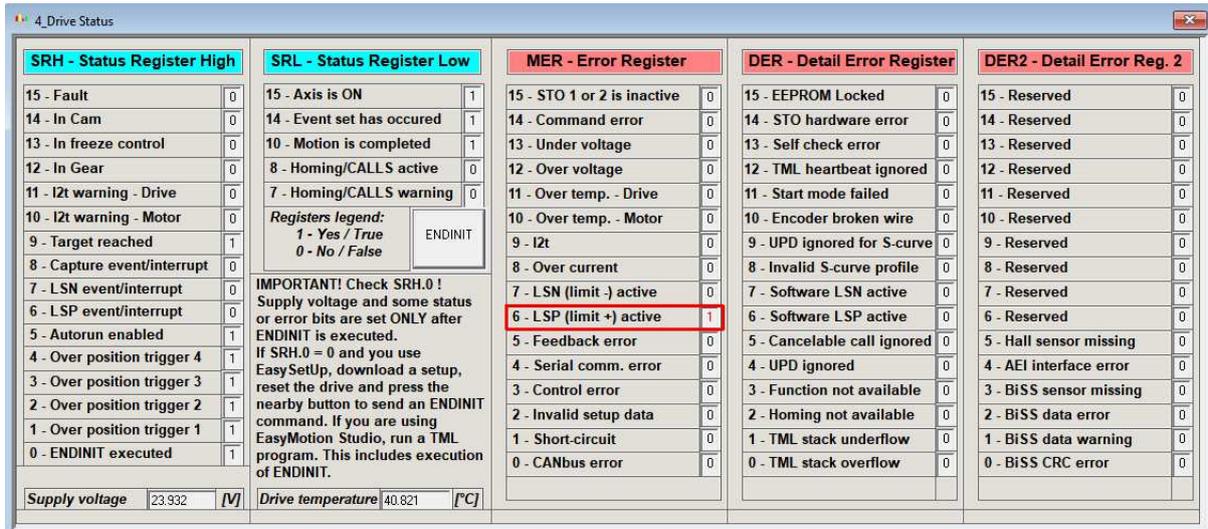

Figure 4. *Drive Status control panel that shows the MER error register*

Remark: While the positive limit switch is active, the drive accepts only negative position commands.

2.2 How to use the limit switches digital inputs as general-purpose inputs

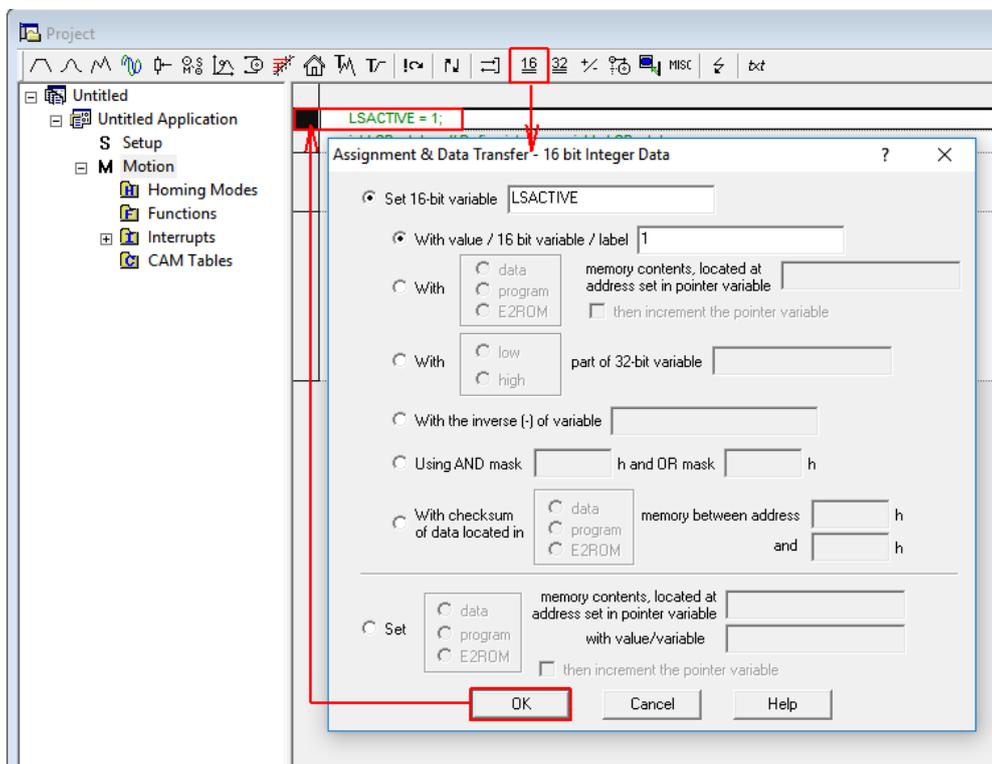The limit switches default behavior can be disabled by setting the "LSACTIVE" parameter to 1.

Figure 5. *Generate the "LSACIVE = 1;" instruction*

To reactivate the limit switches default behavior is enough to set the "LSACTIVE" parameter back to 0.

The application example in the previous point was modified to include the "LASCTIVE = 1" instruction.
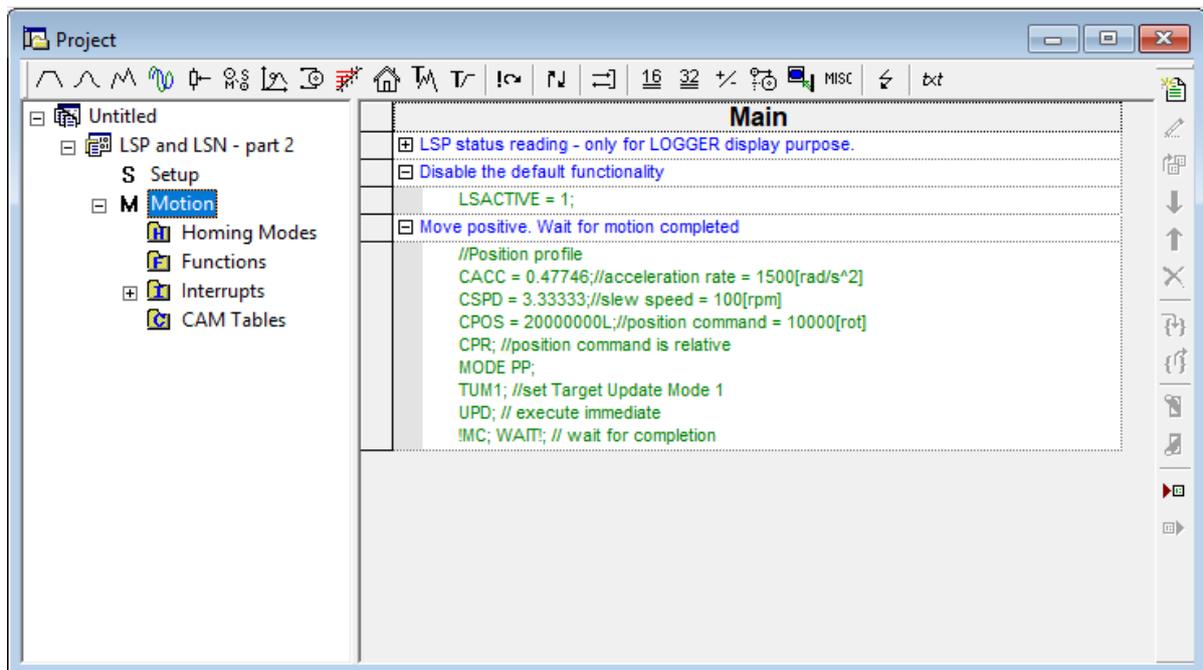
Figure 6. *Main section for TML program*

In this case, the trapezoidal position profile will not be stopped any more when the positive limit switch became active. It will simply continue until the motion will be completed (if no event or protection will be triggered).
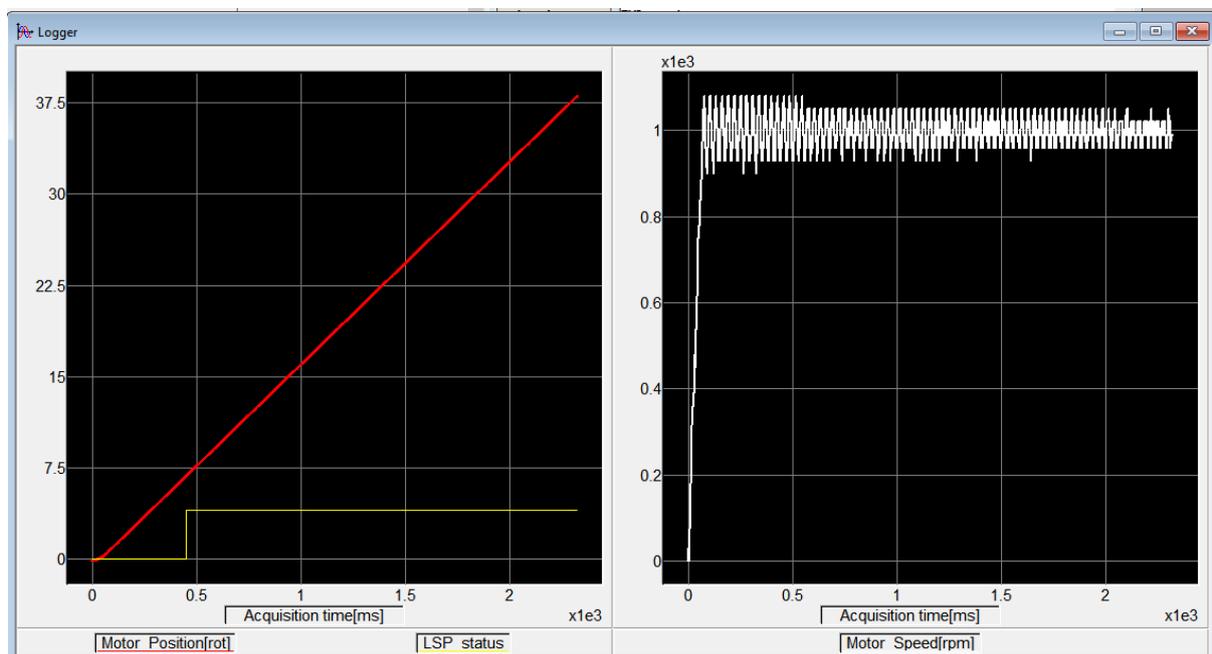

Figure 7 *The effect of the "LSACTIVE = 1;" instruction*

On the Logger above can be easily seen how the motor position (red line) starts from 0 rot and increases, according to the profile reference, even the positive limit switch (yellow line) has become active. The speed is also increasing until it achieves the imposed value (100 rpm) and then remains constant.

3. Software Limit Switches

When the system is not equipped with hardware limit switches but the application requires to limit the load movement, the software limit switches can be used.

The software limit switches can be activated and configured from the "Drive Setup" dialog.
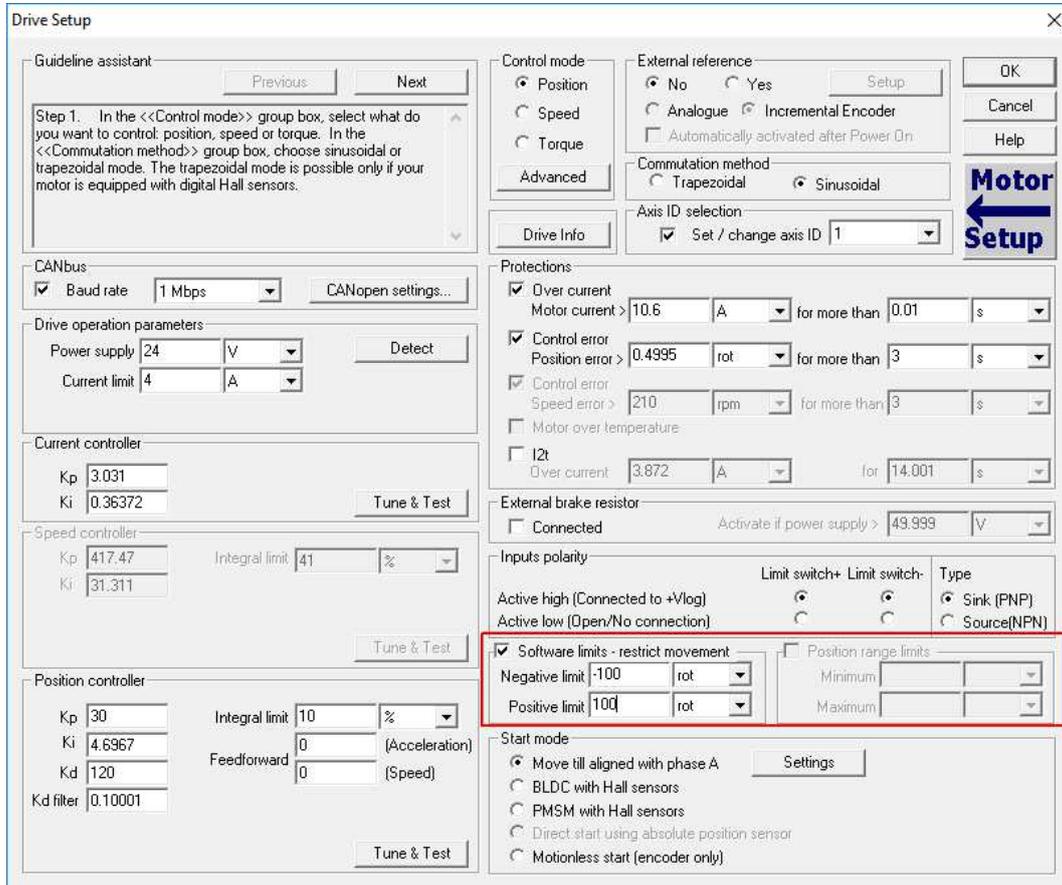
Figure 8 *Software limit switches configuration*

As functionality, the software limits switches act like the hardware limit switches: when a limit is reached, the drive executes the quick stop routine and set the correspondent bits in the DER register.

Figure 9 *Software limit switches bits in the DER register*

Using the same portion profile as in the previous examples, the following Logger results were obtained, if the positive software limit switch is set to 10 rot.
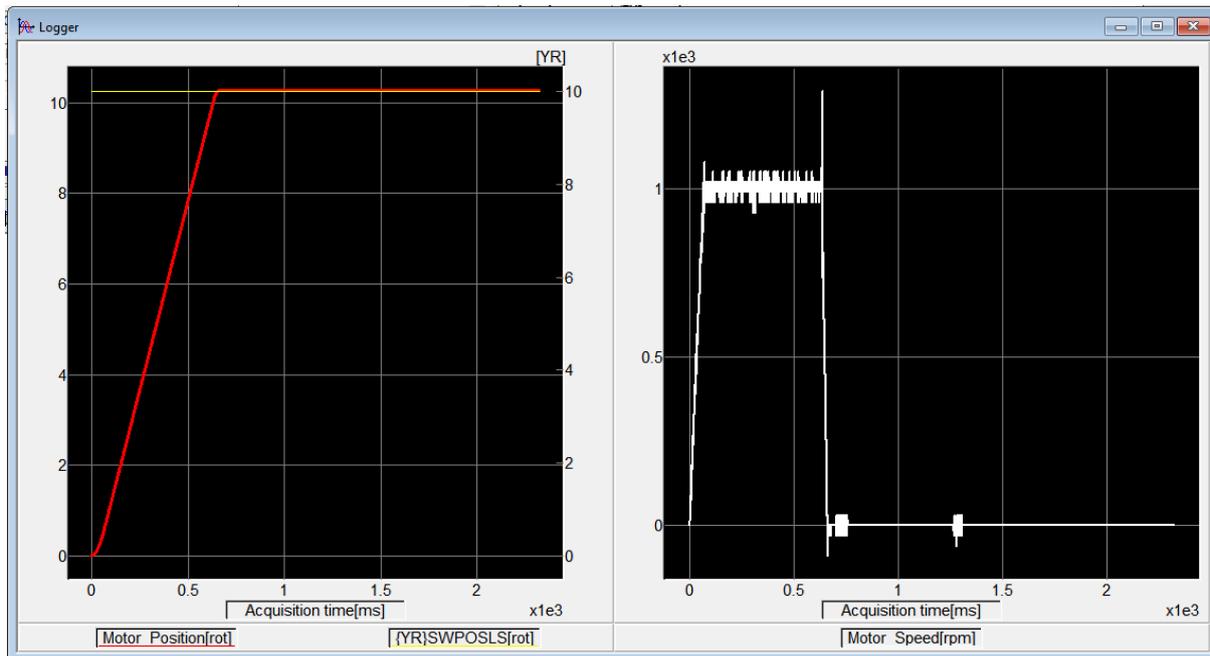

Figure 10. Software limit switches behavior

The motor position (red line) increases, according to the imposed motion profile. When it reaches 10 rot (software limit - yellow line), the motion is stopped. This can also be seen in the second plot, where the motor speed (white line) is plot.