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MOTION TECHNOLOGY

Drive special inputs
Limit switches

Application Note

Easy Motion Studio II

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1. Introduction

This application note describes the default functionality of limit switch inputs and explains how to disable it to use the respective digital inputs as general-purpose inputs. T

The document also details how to restrict load movement using the software limit switches option.

2. Hardware limit switches

Limit switches are control components used to determine the presence, passing, positioning, and end of travel of an object. The simplest version is a push button, but in complex applications, optical, induction, or capacitive sensors are used.

2.1 Limit switches inputs default behavior, configuration and usage

Present on all Technosoft servo drives, the “IN2/LSP” (positive limit switch) and “IN3/LSN” (negative limit switch) digital inputs allow connecting the system limit switch sensors.

When one of the limit switches became active, the drive performs the following default actions:

- stops the motion, using a QUICK STOP profile
- sets the correspondent bit in the MER error register (bit 6 - LSP active / bit 7 - LSN active)
- executes the code inside the correspondent limit switch interrupt routine, if it is enable and set to trigger on the inactive to active limit switch transition
- prevents any motion that moves the load against the active limit switch

The limit switches active level can be set during the drive commissioning through the “Inputs/ outputs” page in the “Setup tree”.

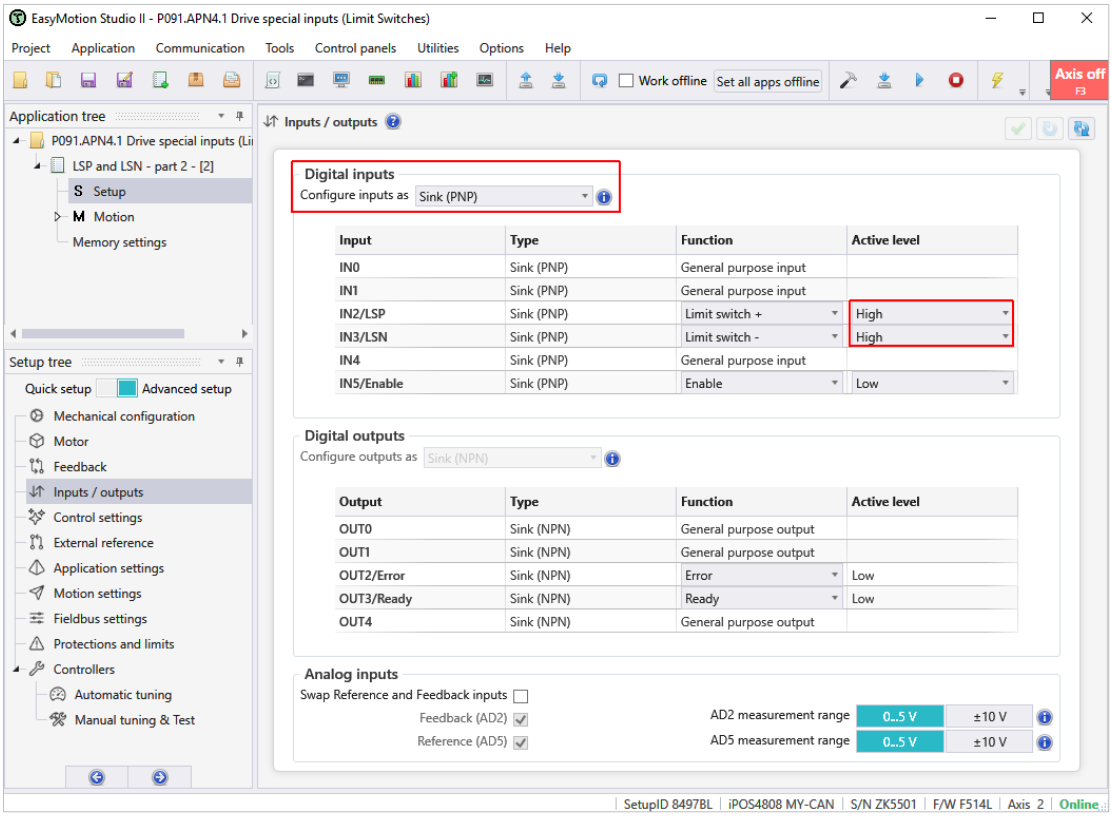


Figure 1 - *Limit switches active level selection*

Remark If the drive hardware design allows configuring the digital inputs type (NPN or PNP), it can also be done through the "Inputs/Outputs" page and applies to the limit switch inputs as well.

The default behavior of the limit switches can be easily observed by plotting the position, speed, and digital inputs status (or only the used limit switch) in Logger or Scope.

For example, the drive was programmed to perform a trapezoidal position profile as in the picture below.

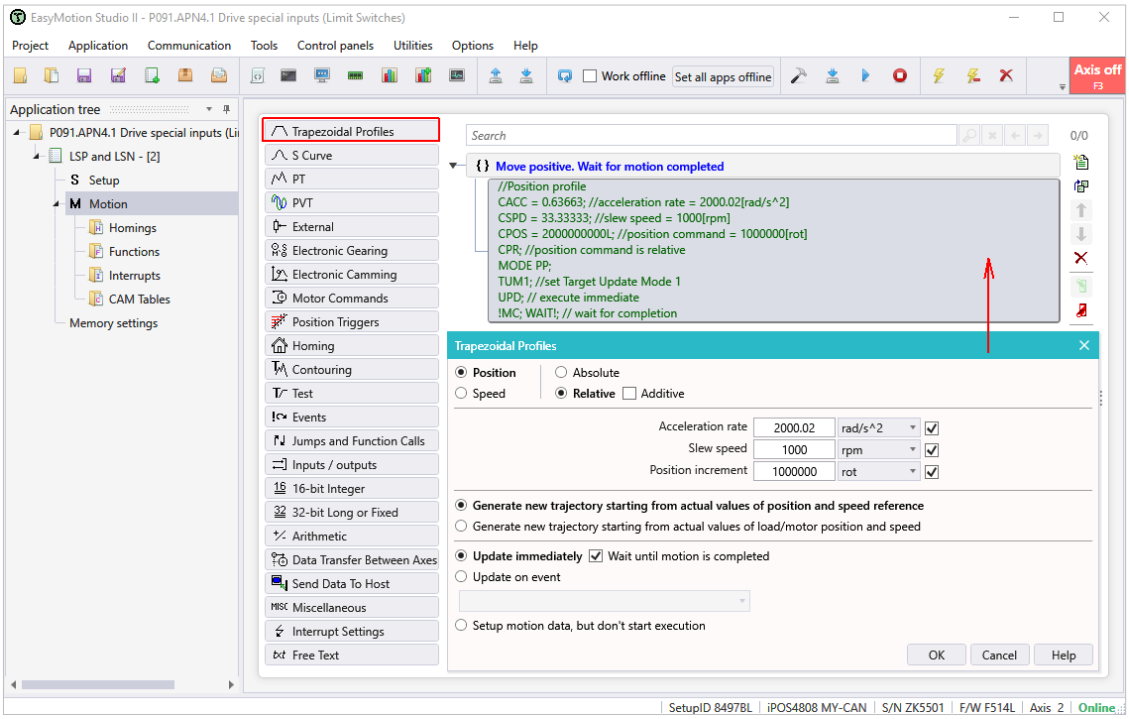


Figure 2 – *Motion profile example*

After running the program, the positive limit switch (IN2/LSP) was manually triggered. As a result, the motion stopped. The position, target speed and digital outputs status was plotted using the Logger tool.

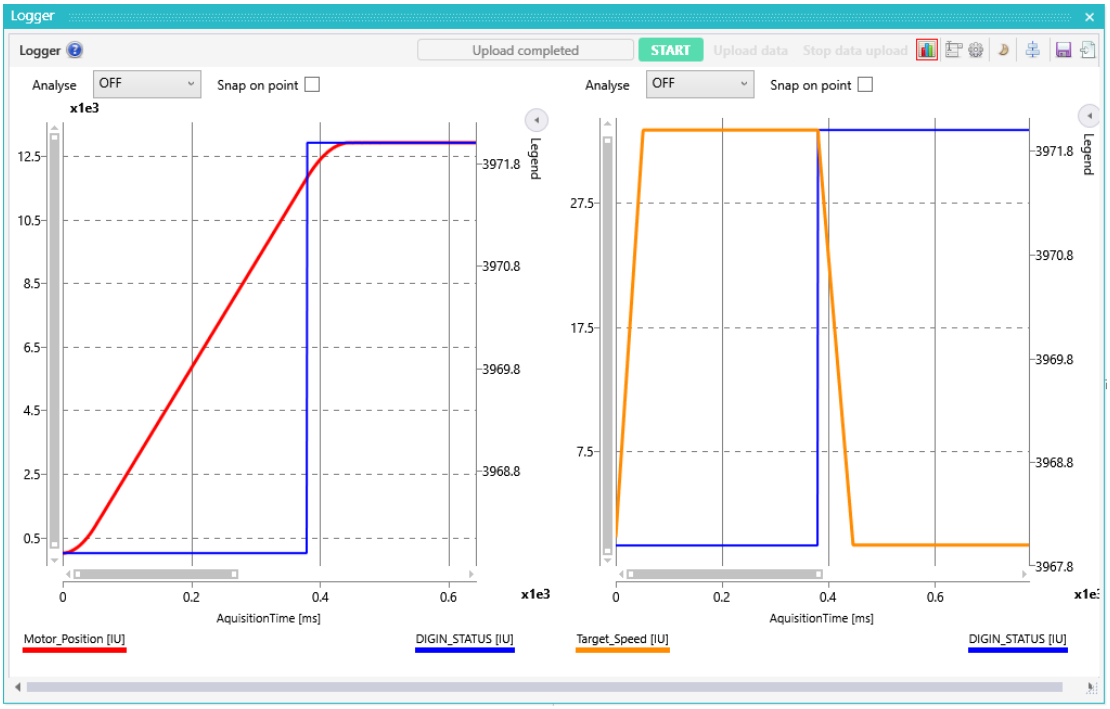


Figure 3 – Positive limit switch default behavior

Remark The Logger setup and usage is detailed in the EasyMotion Studio II help topics. The related topic can be open by pressing the "?" sign in the Logger window (upper left corner).

The first plot shows the motor positon (red line) starting from 0 IU and following the imposed reference. When the positive limit switch (blue line) became active, the drive automatically executed a quick stop profile, stopping the motion.

The second plot shows the target speed (orange line) that goes to 0 IU, when the limit switch (blue line) triggers, with the set quick stop deceleration.

Remark If needed, the quick stop deceleration value can be set / changed through the “Motor Commands” wizard dialogue.

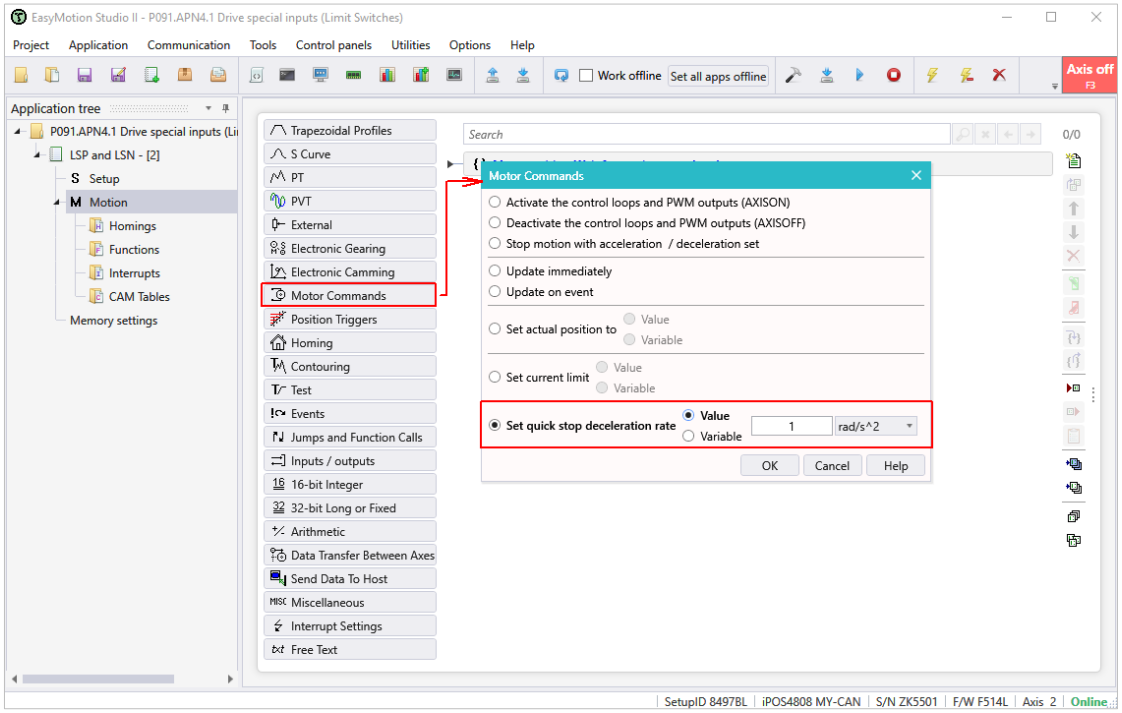


Figure 4 – Quick stop deceleration rate adjustment

The status of the limit switches is included in the MER error register and can be visualized through the "Drive Status" control panel. The screenshot below was taken while performing the above example.

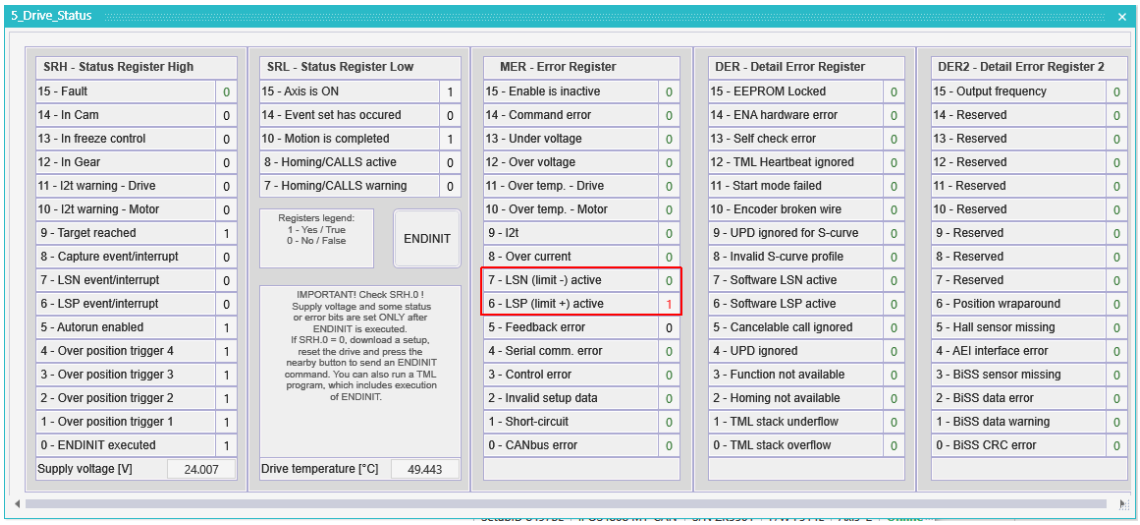


Figure 5 - *Drive Status control panel that shows the MER error register*

Remark As a default drive behavior, while the positive limit switch is active, the drive accepts only negative position or speed commands.

2.2 Limit switches related interrupts

The TML interrupts are special routines that the drive can execute automatically when the triggering condition (continuously monitored by the drive) occurs. A detailed description of the TML interrupts can be found in the related EasyMotion Studio II help topic or in the "TML interrupts usage" application note.

The available interrupts are displayed when selecting the "Interrupts" subtree item. The "Interrupts" page also allows setting one or more interrupts as "user-defined" or reloading the default code.

For limit switch inputs, the associated interrupts are: "***int6 – LSP programmed transition detected***" and "***int7 – LSN programmed transition detected***".

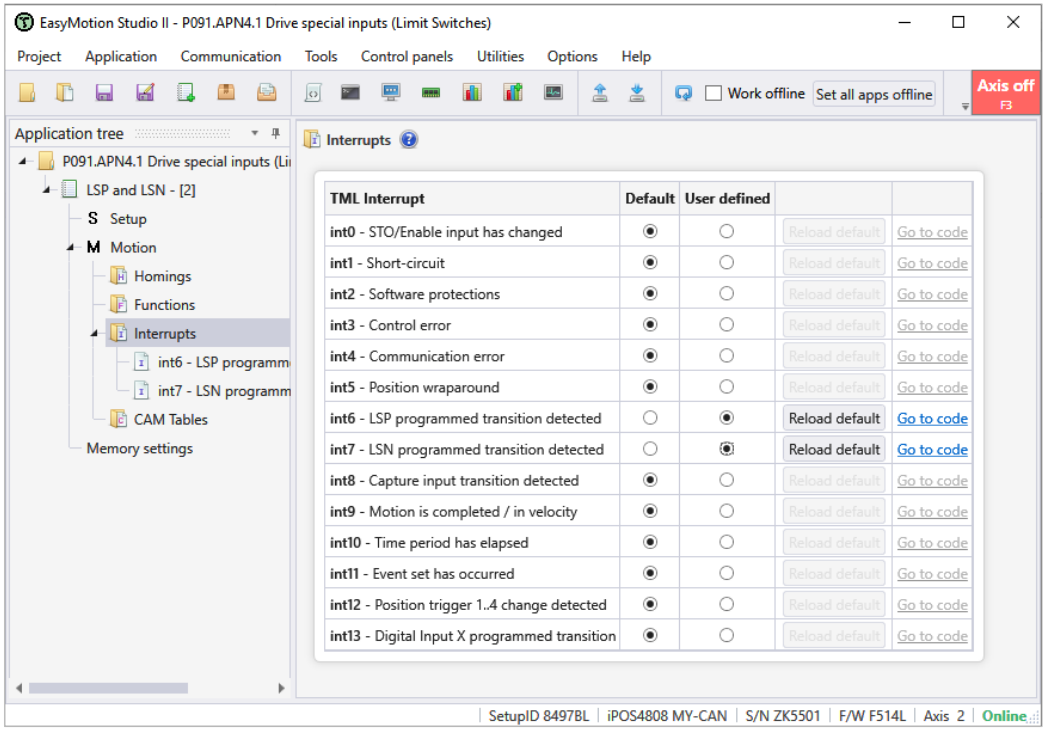


Figure 6 – *Limit switches related interrupt routines*

When selecting an interrupts from the list, the related code page will open, allowing to modify the existent code (if any) or to implement the needed custom functionality.

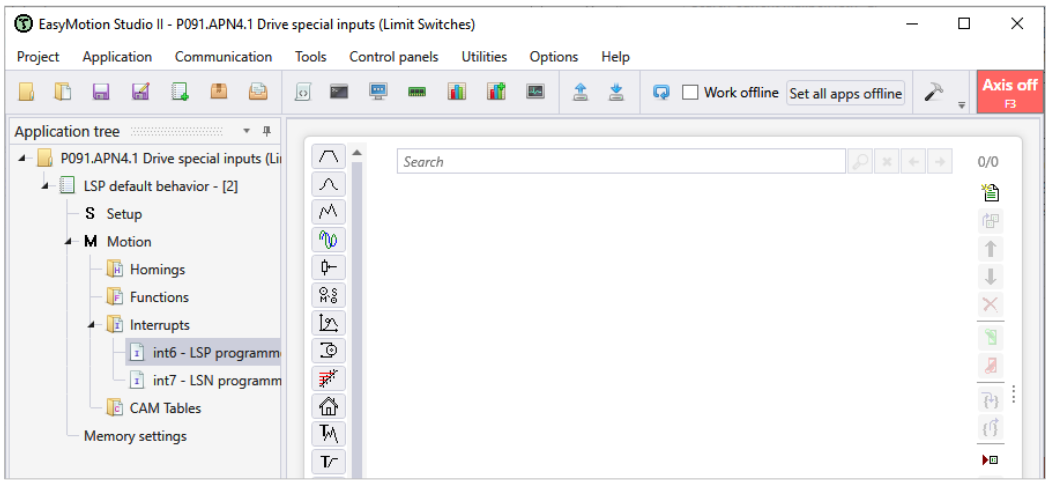


Figure 7 – LSP l*imit switches interrupt routine body*

For limit switch interrupts, there is no code inside the interrupt body, as the related functionality is implemented at the firmware level.

The interrupts can be enabled and configured through the “Interrupts Settings” wizard.

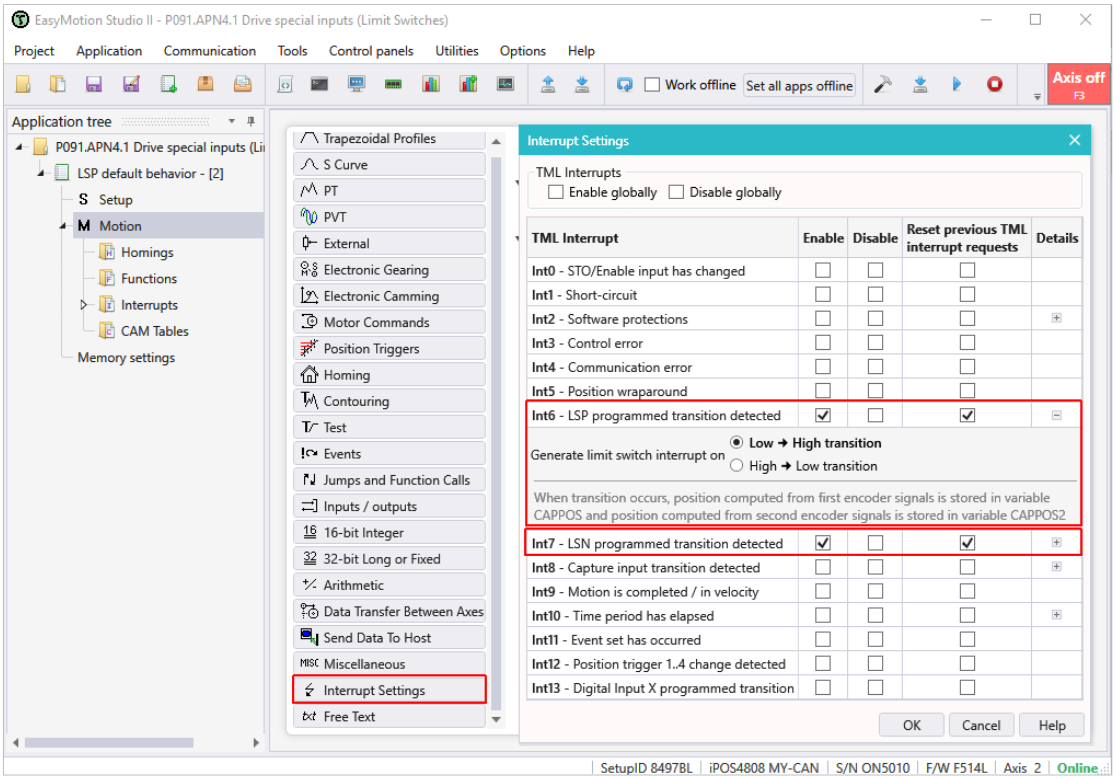


Figure 8 – *Interrupts settings wizard dialogue*

For limit switch interrupts, the wizard also allows setting the input transition that will generate the related interrupt.

2.3 Limit switches inputs usage as general-purpose inputs

The functionality of the limit switch inputs ("IN2/LSP" and "IN3/LSN") can be set during drive commissioning through the "Inputs/Outputs" page in the "Setup” tree.

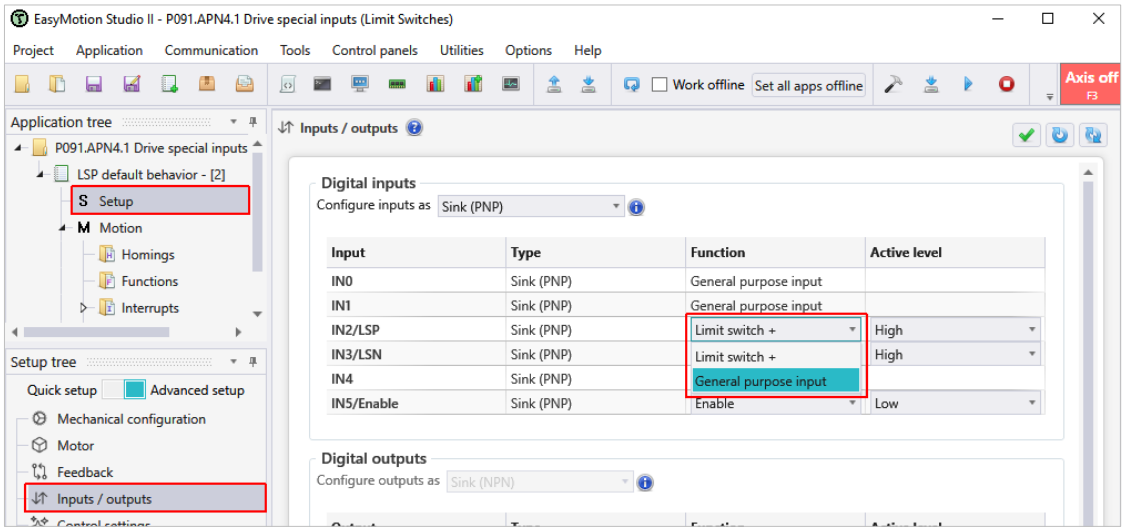


Figure 9 – *Limit switches functionality selection*

Remark When set as “general purpose inputs”, the limit switches default behavior is disabled but the related interrupt routines are still available. They can be enabled and used as when the limit switches are used with their default function.

If the application requires temporarily disabling the limit switch functionality (e.g. during the homing procedure), the “LSACTIVE = 1;” TML instruction can be used. This instruction disables the default functionality of the limit switches and can be inserted using the "Inputs/Outputs" or "16-bit Integer" wizard dialogues.

This instruction can also be sent via the communication line or write as a free text.

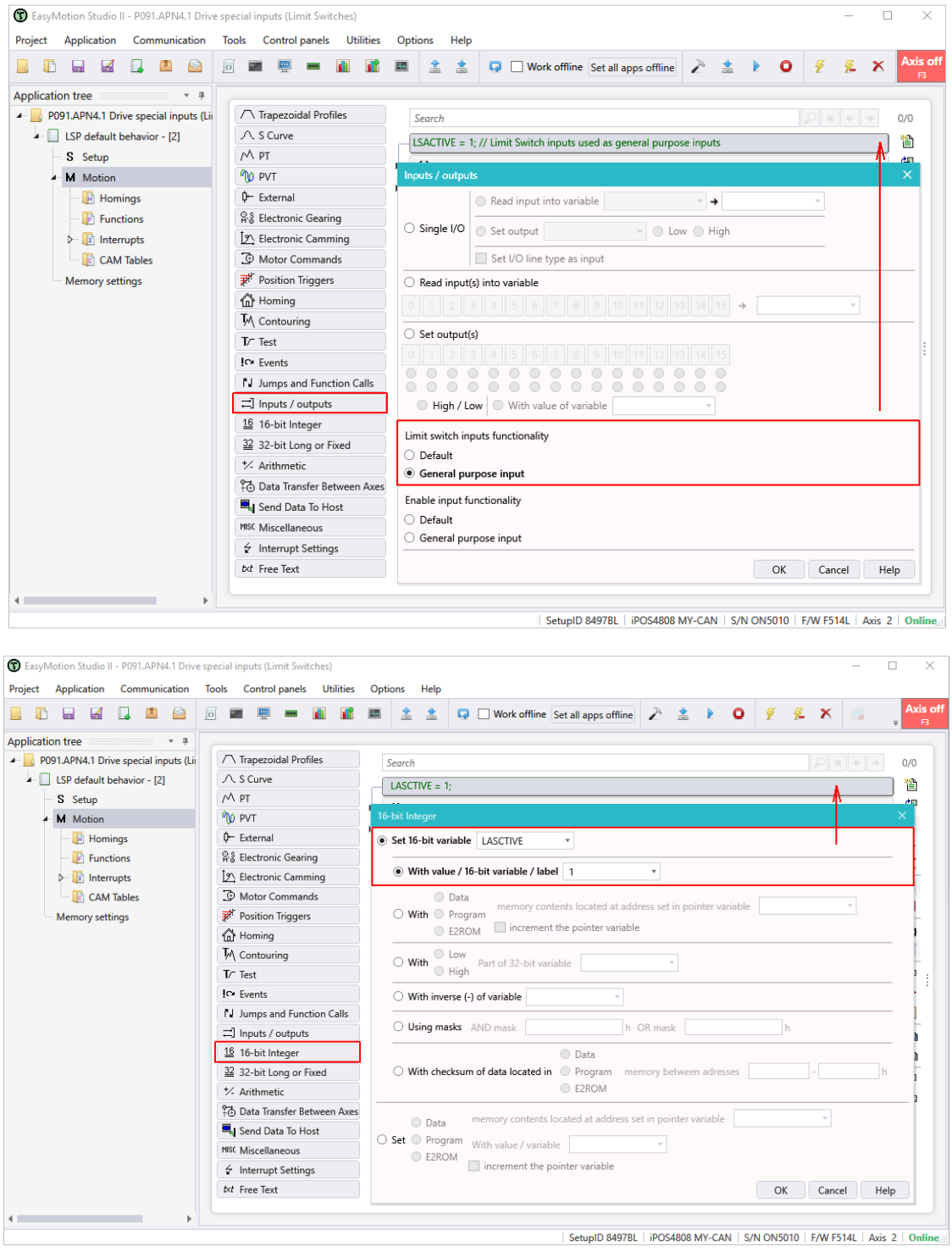


Figure 10 – *Limit switches default functionality disabling*

The limit switches default functionality can be restored using the “LSACTIVE = 0;” TML instruction, which can be generated using “Inputs / outputs” or “16-bit Integer” wizard dialogues.

If need, it can also be sent via the communication line or write in the TML application as fee text.

3. Software limits configuring and usage

Software limits function similarly to hardware limit switches, restricting movement within set boundaries. This option can be enabled and configured through the "Protections and Limits" subtree item.

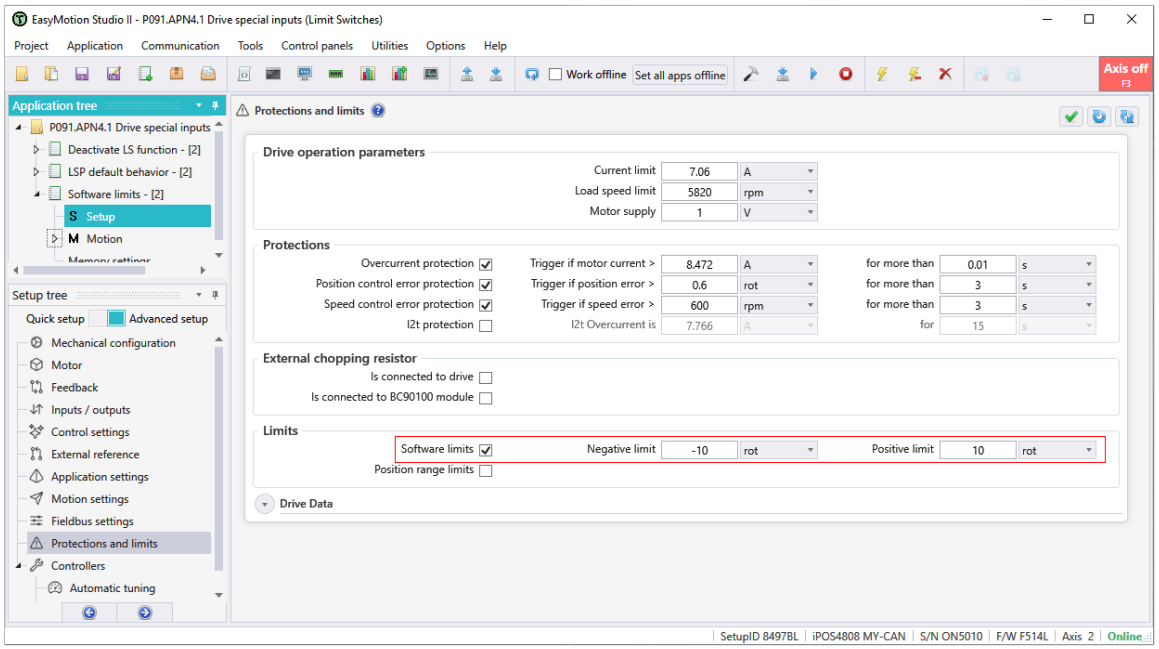


Figure 8 - *Software limit switches configuration*

When a software limit is reached, the drive stops the motion, using a quick stop profile, and sets the correspondent bit in the DER register.

For example purpose, the drive was set to perform 20 rot (using a relative trapezoidal positon profile) while the software limits were set to -10 rot. …. +10 rot.

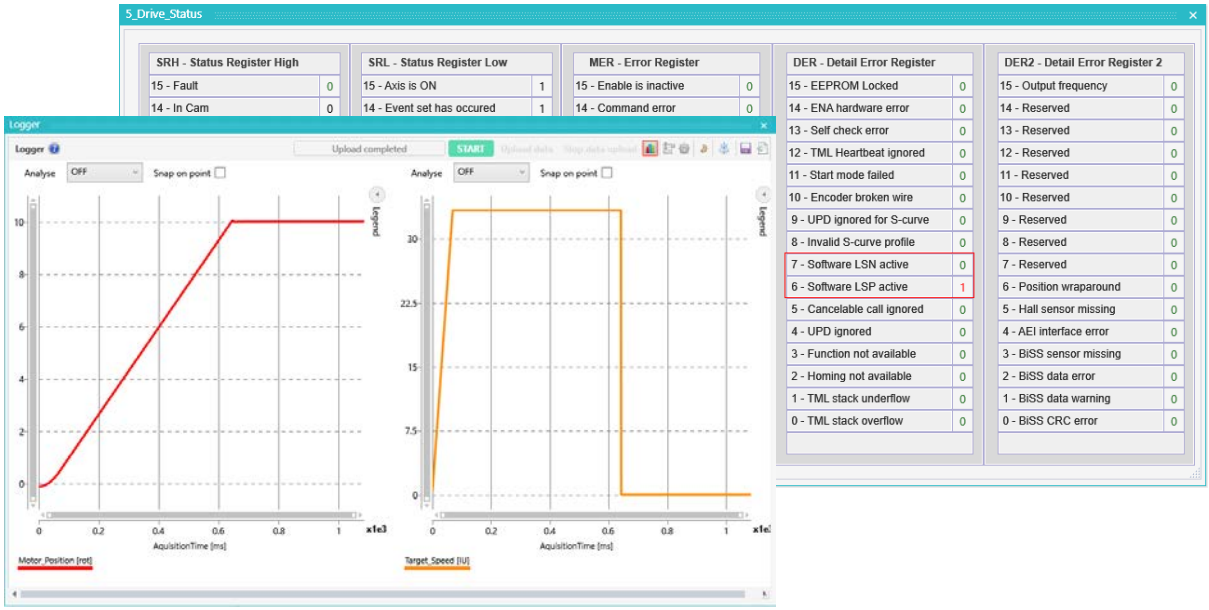


Figure 9 - *Software limits default behavior*

The above picture shows the motor position (red curve) that starts form 0 rot and increase according to the set profile. When reaching 10 rot, the motion is stopped as a result of reaching the positive software limit, and bit 6 in the DER register is set. The quick stop can also be observed in the second plot where the speed (orange line) drops to 0 IU, with the set quick stop deceleration value.

If the application requires enabling or disabling the software limits on the fly, it can be done through bit 12 in the ASR register:

- if **ASR.12 = 1**, the software limits are enabled
- if **ASR.12 = 0**, the software limits are disabled

The ASR register value can be changed through the “16-bit Integer” wizard, using the mask option.

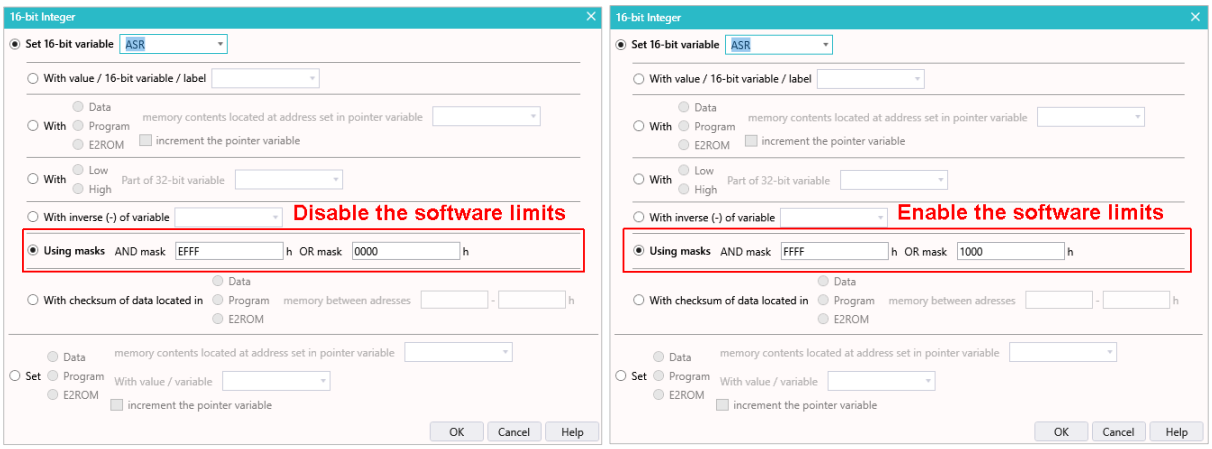


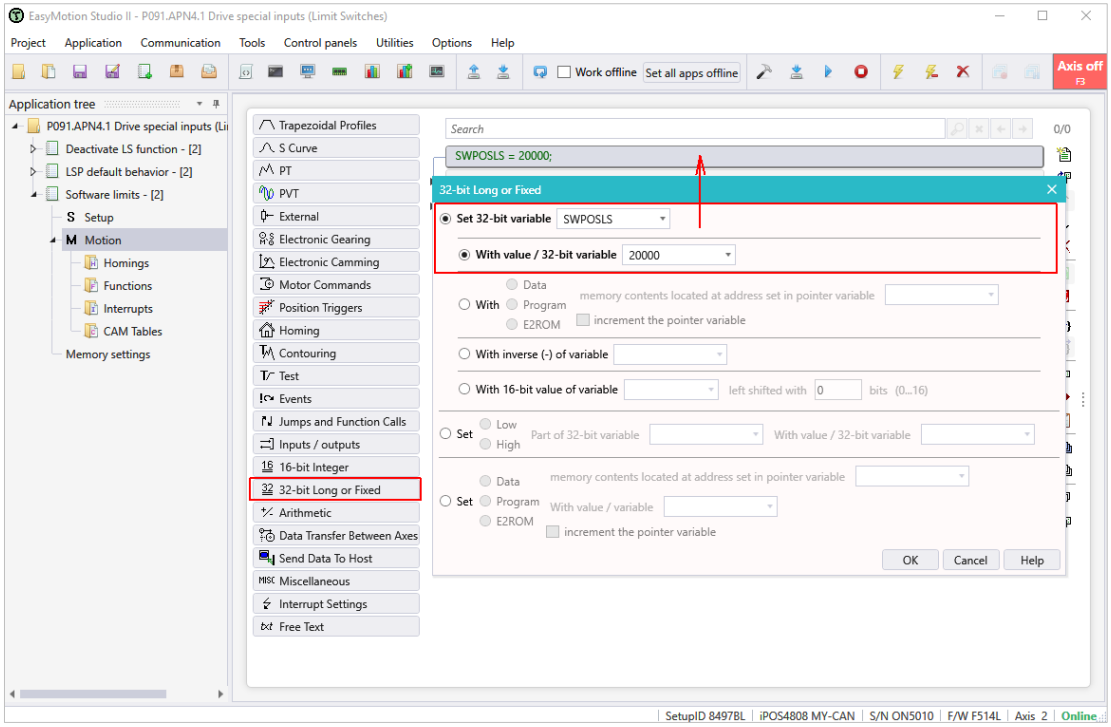
Figure 10 – *On the fly software limits disabling/enabling*

Remark The ASR register bits description is present in the EasyMotion Studio II Help topics.

If the software limits values should also be set on the fly, this can be done through the following TML parameters:

- **SWNEGLS** - the negative position limit value, in internal units
- **SWPOSLS** - the positive position limit value, in internal units

The software limits related parameter values can be set through the "32-bit Long or Fixed" wizard dialogue or via the communication line.



Remark The position internal units are described in the “Internal units and Scaling factors” help topic.