How can two limit switches be implemented to shut down equipment when an end stop is reached?

SINAMICS G120/G120D/G120P (from FW V4.5)

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Caution
The functions and solutions described in this article confine themselves to the realization of the automation task predominantly. Please take into account furthermore that corresponding protective measures have to be taken up in the context of Industrial Security when connecting your equipment to other parts of the plant, the enterprise network or the Internet. Further information can be found under the Content-ID 50203404.

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Question

SINAMICS G120/G120D/G120P (CU 2x0x-2): How can two limit switches be implemented to shut down equipment when an end stop is reached?

Answer

The instructions and notes listed in this document provide a detailed answer to this question.

NOTE	This FAQ is only valid for SINAMICS G120/G120D/G120P from FW V4.5

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1   Task

For small, basic applications with a limited number of limit switches, these can be monitored by the inverter. To do this, limit switches are wired to the inverter digital inputs. The monitoring can be realized using free function blocks in the inverter.

Description

If the limit switch is actuated, then the inverter receives the OFF command and decelerates down to standstill along the down ramp. In this case, the limit switch is passed (not actuated) and the drive is started in the direction it was previously traveling with the next ON command. This means that the drive moves against the limit (end stop).

As a consequence, measures must be taken to maintain the limit switch signal active until the drive has passed over the limit switch again in the opposite direction.

Example:

For transport conveyor belts with light barriers as limit switch, the goods transported on the conveyor belts are equipped with corresponding markings, which keep the light barriers "active" until the drive comes to a standstill.

NOTICE	**The limit switch states are not saved in the inverter, therefore appropriate measures must be taken to save the signals**

2 Solution versions to implement two limit switches to shut down equipment when an end stop is reached

2.1 Version 1: Control via terminals

Description of the terminals and signals:

Command in travel direction, right: Terminal 5 (DI0), ON/OFF1 signal (r722.0)

Command in travel direction, left: Terminal 6 (DI1), ON/OFF1 signal + reversing (r722.1)

Signal "limit switch in travel direction right", terminal 7 (DI2), (r722.2)

Signal "limit switch in travel direction left", terminal 8 (DI3), (r722.3)

Function:

In the example, the drive is started in travel direction "right" via digital input 0 (DI0) and via digital input 1 (DI1) in the travel direction "left". The limit switches are wired with digital inputs 2 and 3.

After the limit switch is actuated, the drive is stopped via OFF1 with the down ramp (p1121). From this position the drive can only be started in the opposite direction. The down ramp should be set as short as possible.

Note	The limit switches must remain active until they are "passed in the opposite direction"!

Parameter settings.

Table 2-1

Function	Parameter	Description	Value	Description
Setting the parameter filter to commission a drive	p0010	Drive commissioning parameter filter	1	Quick commissioning
Macro selection	p0015	Macro drive device	18	Macro 18 [1]
Setting the parameter filter to commission a drive	p0010	Drive commissioning parameter filter	0	Ready
Signal source AND 0	p20030.0	AND 0 input 0	r722.0	Terminal 5, DI0, ON/OFF1, right
Signal source AND 0	p20030.1	AND 0 input 1	r722.2	Terminal 7, DI2, limit switch, right
Signal source AND 0	p20030.2	AND 0 input 2	1	Input permanently set
Signal source AND 0	p20030.3	AND 0 input 3	1	Input permanently set

Function	Parameter	Description	Value	Description
Runtime group of AND 0	p20032	AND 0 runtime group	6	Runtime group 6
Signal source AND 1	p20034.0	AND 1 input 0	r722.1	Terminal 6, DI1, ON/OFF1 + reversing (ON/OFF1 left)
Signal source AND 1	p20034.1	AND 1 input 1	r722.3	Terminal 8, DI3, limit switch, left
Signal source AND 1	p20034.2	AND 1 input 2	1	Input permanently set
Signal source AND 1	p20034.3	AND 1 input 3	1	Input permanently set
Runtime group of AND 1	p20036	AND 1 runtime group	6	Runtime group 6
"ON/OFF1" command	p0840.0	ON/OFF1	r3333.0[2]	2-wire control, control word: Bit 00: ON
Negative direction	p1110	Inhibit/enable negative direction	0	Enable negative direction
Sets the signal source to invert the setpoint	p1113	Setpoint inversion	r3333.1[2]	2-wire control, control word: Bit 01: Reversing
2-wire control, command 1	p3330.0	ON command	r20031.0	AND 0 output Q
2-wire control, command 2	p3331.0	ON command + reversing	r20035.0	AND 1 output Q
Ramp-down time	p1121	Ramp-function generator, ramp-down time	x	If possible set the down ramp shorter
Speed setpoint	p1000	Speed setpoint selection	y [3]	If required, adapt
Acknowledge signal	p2103	1. acknowledge faults	z [4]	Must be reparameterized

2.2 Version 2: Control via PROFIBUS / PROFINET

Description of the terminals and signals

Command in travel direction, right: "ON/OFF1" signal (r2090.0)

Command in travel direction, left: "ON/OFF1+reversing" signal (r2090.0 + r2090.11)

Input via PROFIBUS / PROFINET

Signal "limit switch in travel direction right", terminal 7 (DI2), (r722.2)

Signal "limit switch in travel direction left", terminal 8 (DI3), (r722.3)

Function:

In the example, the drive is started in the travel direction "right" and "left" via PROFIBUS / PROFINET. The limit switches are wired to digital inputs 2 and 3 (the option of entering the signals through I/O modules is not considered here).

After the limit switch is actuated, the drive is stopped via OFF1 with the down ramp (p1121). From this position the drive can only be started in the opposite direction. The down ramp should be set as short as possible.

Note	The limit switches must remain active until they are "passed in the opposite direction"!

Parameter settings.

Table 2-2

Function	Parameter	Description	Value	Description
Setting the parameter filter to commission a drive	p0010	Drive commissioning parameter filter	1	Quick commissioning
Macro selection	p0015	Macro drive device	18	Macro 18 [1]
Setting the parameter filter to commission a drive	p0010	Drive commissioning parameter filter	0	Ready
Sets the send and receive telegram	p0922	PROFIdrive telegram selection	1	Standard telegram 1, PZD-2/2
Sets the send and receive telegram	p0922	PROFIdrive telegram selection	999	Free telegram configuration with BICO
Signal source AND 0	p20030.0	AND 0 input 0	r722.2	Terminal 7, DI2, limit switch, right
Signal source AND 0	p20030.1	AND 0 input 1	r2090.0	ON/OFF1 signal from the bus
Signal source AND 0	p20030.2	AND 0 input 2	r20079.0	NOT 0 inverted output
Signal source AND 0	p20030.3	AND 0 input 3	1	Input permanently set
Runtime group of AND 0	p20032	AND 0 runtime group	6	Runtime group 6
Signal source AND 1	p20034.0	AND 1 input 0	r722.3	Terminal 8, DI3, limit switch, left
Signal source AND 1	p20034.1	AND 1 input 1	r2090.0	ON/OFF1 signal from the bus
Signal source AND 1	p20034.2	AND 1 input 2	r2090.11	Reversing signal from the bus
Signal source AND 1	p20034.3	AND 1 input 3	1	Input permanently set
Runtime group of AND 1	p20036	AND 1 runtime group	6	Runtime group 6
Signal source NOT 0	p20078.0	NOT 0 input I	r2090.11	Reversing signal from the bus
Runtime group of NOT 0	p20080	NOT 0 runtime	6	Runtime group 6

Function	Parameter	Description	Value	Description
		group		
"ON/OFF1" command	p0840.0	ON/OFF1	r3333.0	2-wire control, control word: Bit 00: ON
Negative direction	p1110	Inhibit/enable negative direction	0	Enable negative direction
Sets the signal source to invert the setpoint	p1113	Setpoint inversion	r3333.1	2-wire control, control word: Bit 01: Reversing
2-wire control, command 1	p3330.0	ON command	r20031.0	AND 0 output Q
2-wire control, command 2	p3331.0	ON command + reversing	r20035.0	AND 1 output Q
Ramp-down time	p1121	Ramp-function generator, ramp-down time	x	If possible set the down ramp shorter

Footnotes for the previous tables

Table 2-3

| No.	Text
1)	The detailed description of macro 18 is provided in the operating instructions "SINAMICS G120 inverters with Control Units CU240B-2 and CU240E-2" FW4.5 article ID: 61618946 in sections: 3.4.6.2 Pre-assignment and wiring of the inverter with CU240E-2 Control Unit 8.2.5 Two-wire control, method 3
2)	Factory setting in macro 18
3)	In macro 18, the analog setpoint from analog input AI0 is used as setpoint. If another setpoint is required, parameter p1000 – and possibly other parameters – must be adapted for the setpoint input.
4)	In macro 18, digital input DI2 is used as signal for the fault acknowledgment. This is used as "limit switch right" (r722.2) in this example; this means that another source must be set for the fault acknowledgment in parameter p2103.

3 Running scripts in STARTER 4.x

You can use the attached script files to quickly change parameters.

Note	Before you use a script, reset your inverter to the factory settings by pressing the button **"Restore factory settings"** ⋈ .

3.1 Procedure

1. Select and save the appropriate script file in a folder on your computer's hard disk.
2. Create a script folder for the drive in your STARTER project by clicking on the drive (Control Unit) with the right-hand mouse key, and then on **"Expert"** (left-hand mouse key) and then on **"Insert script folder**.

A new folder **"SCRIPTS"** appears at the lower end of the tree.

Diagram 3-1   Inserting a script folder

3. Import your script file from your folder into STARTER as shown in the following:
   – Right click on the **"Scripts"** tab;
   – Click on **"ASCII Import..."** and open the required script file;
   – Allocate a name to the opened file, and confirm with **"OK"**.

Diagram 3-2   ASCII import
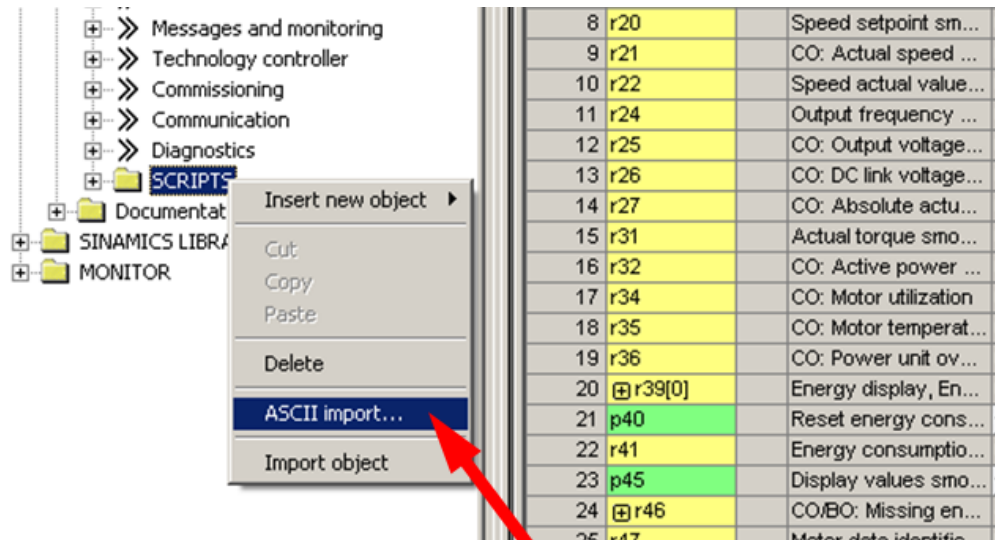
4. Go online with the inverter, by pressing on the button **"Connect with selected target devices"** .
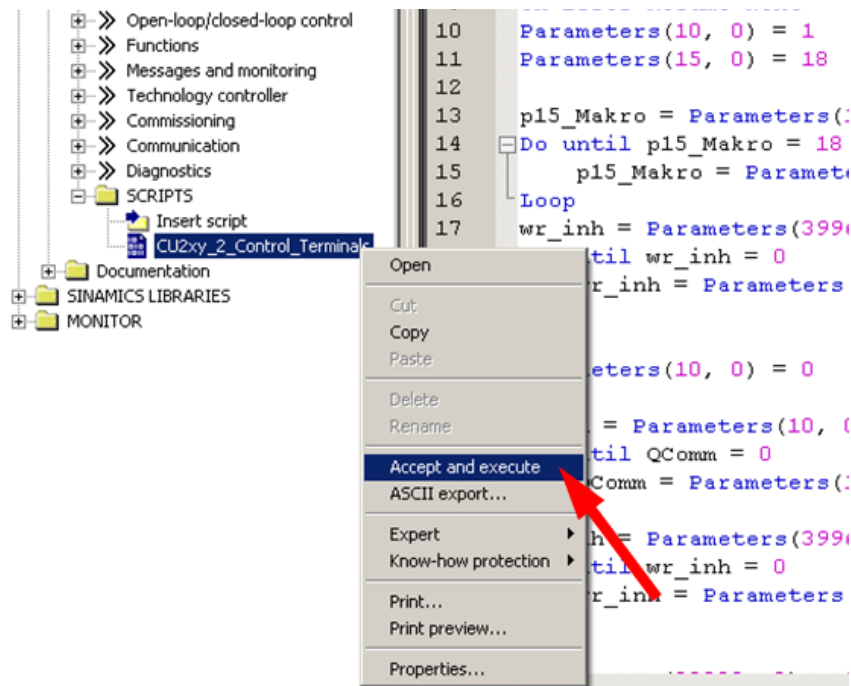
5. Run the script by right clicking on the script in the project tree and selecting **"Accept and execute"**; or open the script with a double-click and press on

    "Accept and execute" .

Diagram 3-3   Accepting and executing the script

6. Set other parameters when required. Then save the settings in the EEPROM of the inverter by pressing the button **"Copy RAM to ROM"** .

Additional information on the topic

FAQ: "MICROMASTER 4 (MM4): How can I transfer projects from DriveMonitor to STARTER?" Article ID: 32582476.