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How to realize "travel to fixed stop" application in SINAMICS V90 PN (S mode)

SINAMICS V90

<https://support.industry.siemens.com/cs/ww/en/view/109747886>

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1 Introduction

1.1 Preliminary remark

This frequently asked question (FAQ) shows how to use the function of “travel to fixed stop” when SINAMICS V90 PN is working in the speed control mode (S mode).

1.2 Function description

The function of “Travel to fixed stop” can be used to move a motor to a fixed stop at a specified torque without a fault being signaled. When the stop is reached, the specified torque is built up and remains applied.

The desired torque de-rating is brought about by scaling the upper torque limit and the lower torque limit.

Figure 1-1 Travel to fixed stop

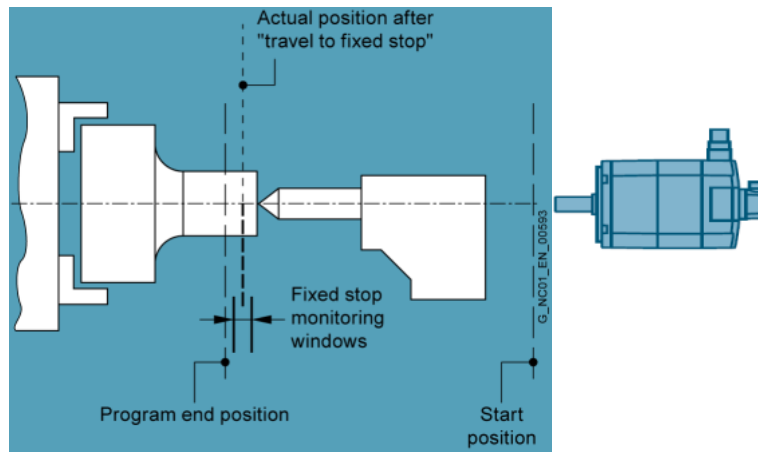
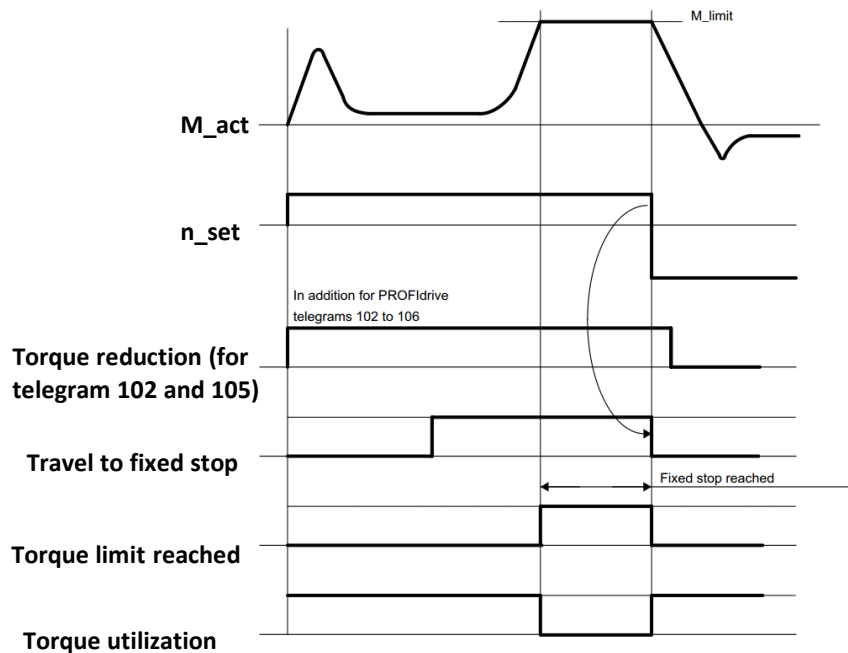


Figure 1-2 Signal chart for “travel to fixed stop”



1.3 Activation of the “travel to fixed stop” function

The activation for the function “Travel to fixed stop” is send to the drive via STW2, Bit 8 (STW2.8). The drive status for the function “Travel to fixed stop” is send to the PLC via ZSW 2.8.

Table 1-1 Control word STW2.8

Control Word	Value	Description
STW2.8	0	De-activation of „travel to fixed stop“ function
	1	Activation of „travel to fixed stop“ function

Table 1-2 Status word ZSW2.8

Control Word	Value	Description
ZSW2.8	0	No „travel to fixed stop“ status
	1	Travel to fixed stop reached

NOTE

When SINAMICS V90 PN is working in the speed control mode (S mode), all the telegrams **except for** standard telegram 1 can be used, because the function “travel to fixed stop” function through telegram is part of STW2 and ZSW2 and STW2 and ZSW2 are not included in standard telegram 1

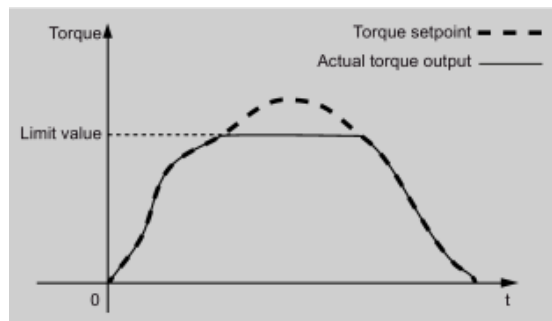
2 Torque limit function in SINAMICS V90 PN

2.1 Internal torque limit

Description

When the torque setpoint reaches the torque limit, then the torque is limited to the value selected by TLIM.

Figure 2-1 Torque limit

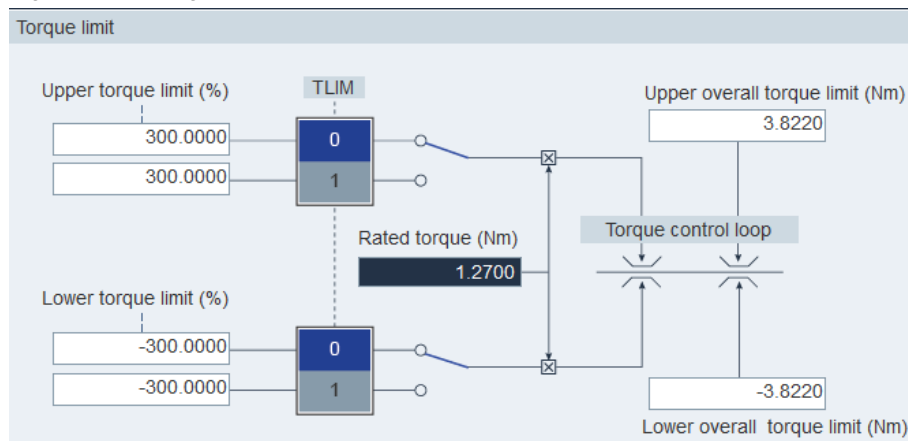


For SINAMICS V90 PN, two sources are available for internal torque limit. You can select one of them via the digital input signal TLIM.

Table 2-1 Digital input signal TLIM

DI Status (TLM)	Description
0	Internal torque limit 1
1	Internal torque limit 2

Figure 2-2 Setting example with SINAMICS V-ASSISTANT



NOTE

At the factory setting state, the status of the digital input signal TLIM is at low level (0), so only the internal torque limit 1 can be used. If you want to use the internal torque limit 2, you need to do wiring with the 20-pin signal cable.

For more details about the digital input/output signals as well as their wirings, please refer to *SINAMICS V90 PN Operating Instructions*:

<https://support.industry.siemens.com/cs/ww/en/view/109742518>

Parameterization

Table 2-1 Parameterization

Parameter	Value range	Default	Unit	Description	TLIM
p29050[0]	-150~300	300	%	Internal torque limit 1 (positive)	0
p29050[1]	-150~300	300	%	Internal torque limit 2 (positive)	1
p29051[0]	-300~150	-300	%	Internal torque limit 1 (negative)	0
p29051[1]	-300~150	-300	%	Internal torque limit 2 (negative)	1
p1520	-1000000.0 to 2000000.0	0	Nm	Overall torque limit (positive)	-
p1521	2000000.0 to 1000000.0	0	Nm	Overall torque limit (negative)	-

Torque limit reached signal (TLR)

When the torque reach the value of the positive torque limit or negative torque limit, the signal TLR (torque limit reach) is output.

2.2 Torque reduction (MOMRED)

Description

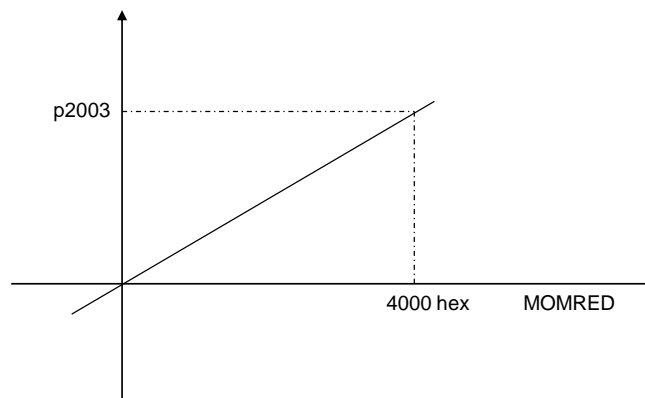
Note For SINAMICS V90 PN, the torque reduction function can be used only when the Siemens telegram 102 or 105 has been selected.

MOMRED (torque reduction) control word can be used to reduce the torque limit currently active on the drive. It specifies the percentage of the reference torque (p2003). You can access this control word by directly writing into the address in PLC.

Table 2-2 Structures of Siemens telegrams 102 and 105

Telegram	102		105	
	Receive	Send	Receive	Send
PZD1	STW1	ZSW1	STW1	ZSW1
PZD2	NSOLL_B	NIST_B	NSOLL_B	NIST_B
PZD3				
PZD4	STW2	ZSW2	STW2	ZSW2
PZD5	MOMRED	MELDW	MOMRED	MELDW
PZD6	G1_STW	G1_ZSW	G1_STW	G1_ZSW
PZD7		G1_XIST1	XERR	G1_XIST1
PZD8				
PZD9		G1_XIST2	KPC	G1_XIST2
PZD10				

Figure 2-3 Scaling of MOMRED



Calculation of actual torque limit value

When the torque reduction function is used, the calculation of actual torque limit value is shown as follows:

$$\text{Actual torque limit value} = \text{Torque limit} * (1 - \text{percentage of reference torque})$$

Example

Prerequisites:

- A 0.4 kW low inertia motor is used (rated torque=1.27Nm)
- Keep the torque limit of factory setting (torque limit=300%*rated torque)
- MOMRED=3600hex (13824)

The calculation of actual torque limit value after torque reduction is as follows:

$$\text{Actual torque limit value} = 300\% * 1.27\text{Nm} * (1 - 13824/16384) = 0.5953\text{Nm}$$

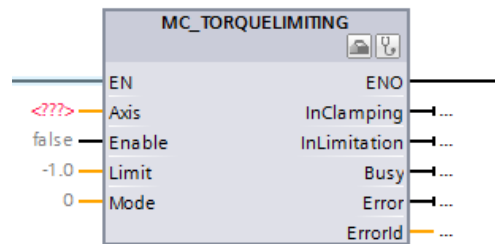
3 Fixed Stop in TIA Portal V14

3.1 Function Block “MC_TorqueLimiting”

General Description

In TIA Portal V14, the new function block “**MC_TorqueLimiting**” is available for activating and assigning parameters of force/torque limiting or fixed stop detection while technology objects are being used.

Figure 3-1 Function block “MC_TorqueLimiting”



Two function modes are available for you to choose:

- **Mode=0**: this function block is used for force/torque limiting
- **Mode=1**: this function block is used for fixed stop detection.

Together with a position-controlled motion job,.

NOTE

To use this new function block, the drive and the PROFIdrive telegram must support torque reduction, which means only the telegrams 102 and 105 can be used for SINAMICS V90 PN.

For more details about this function block, please refer to online help in TIA Portal V14.

Force/torque limiting (mode=0)

Force/torque limiting (mode=0) is the default setting of this function block. It applies to:

- Speed axis
- Positioning axis
- Synchronous axis

With this function mode, adjustable force/torque limiting is available for above mentioned technology objects.

Fixed stop detection (mode=1)

With this function mode, a "Travel to fixed stop" can be realized with the fixed stop detection together with a position-controlled motion job. This function mode applies to:

- Positioning axis
- Synchronous axis

3.2 Configurations in Technology Object (TO)

General Description

When the telegram 102 or 105 is used, you can configure force/torque limiting for the technology object (speed axis, positioning axis or synchronous axis) and fixed stop detection for the technology object (positioning axis or synchronous axis).

NOTE For detailed information about TO configurations of torque limit and fixed stop detection, please refer to relevant online helps in TIA Portal V14.

Force/torque limiting

Figure 3-2 TO Configuration of "Torque limit"

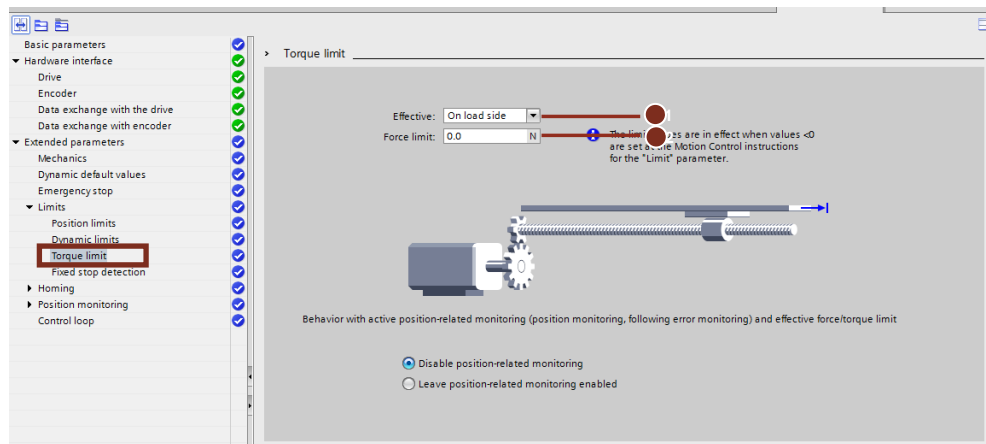


Table 3-1 Description

Mark number	Description
1	You can select to do configuration <ul style="list-style-type: none"> On load side On motor side
2	Configure <ul style="list-style-type: none"> Force limit on load side (unit: N) Torque limit on motor side (unit: Nm)

Fixed Stop Detection

Figure 3-3 TO Configuration of "Fixed stop detection"

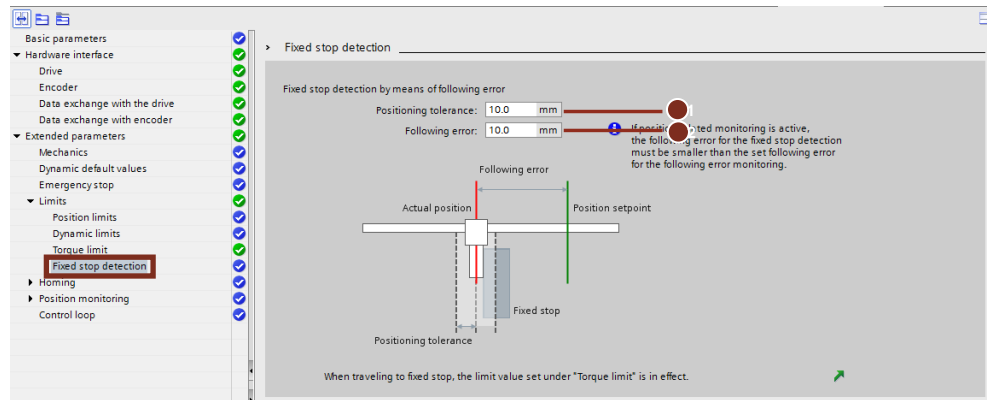


Table 3-2 Description

Mark Number	Description
1	Configure the positioning tolerance that is regarded as a breaking away or turning back of the fixed stop when exceeded. The configured position tolerance must be less than the configured following error.
2	Configure the following error that serves as a criterion for fixed stop detection.

4 Function Test

Prerequisite

Hardware:

- SIMATIC S7-1500 CPU 1511F-1PN: 6ES7 511-1FK01-0AB0
- 0.4kW SINAMICS V90 PN: 6SL3210-5FB10-4UF1
- 0.4kW Low inertia motor

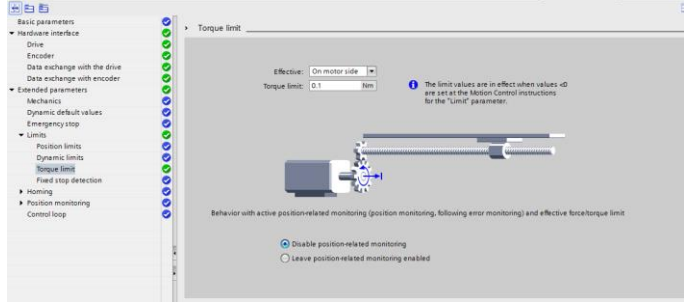
Software:

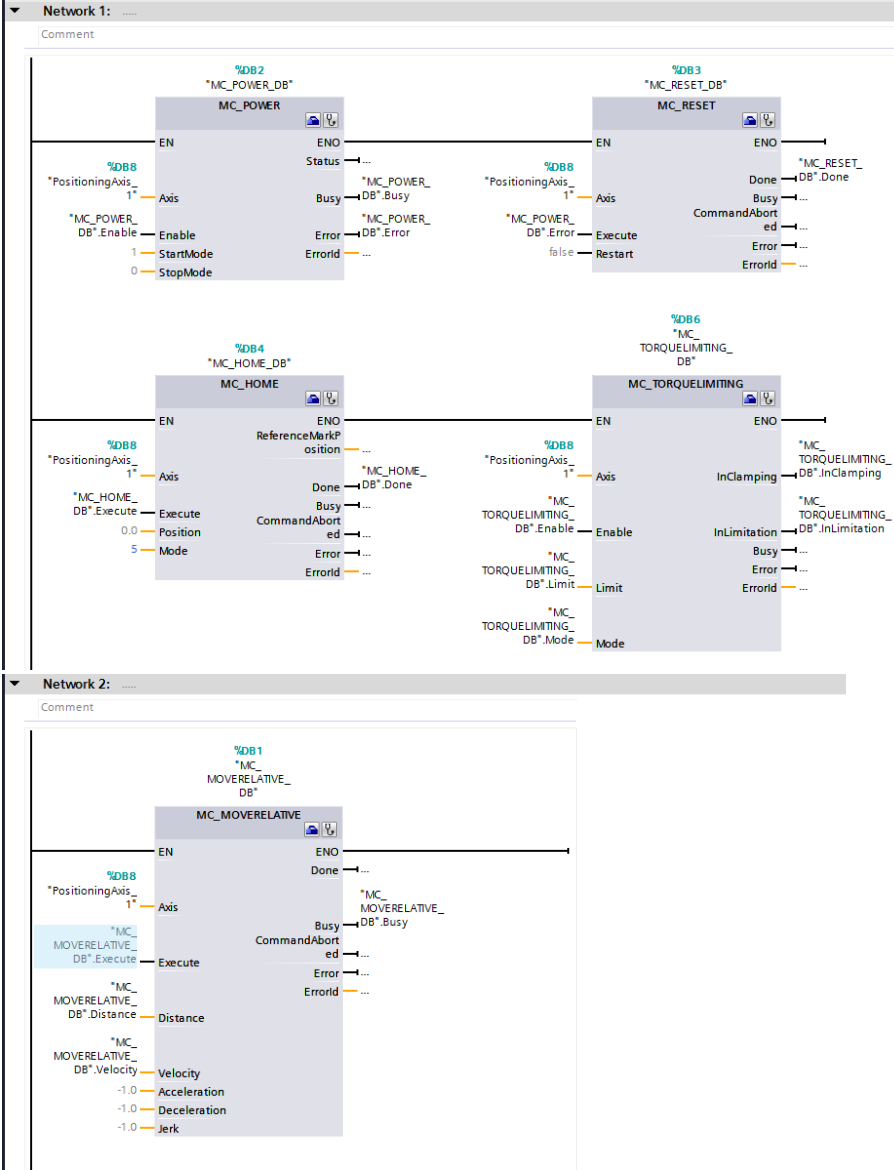
Table 4-1

Item	Description
109747886_V90_TravelToFixedStop_S-mode_PROJ_TIAP14.zip	Project file for function test

Operating sequence

Table 3-1 Operating sequence

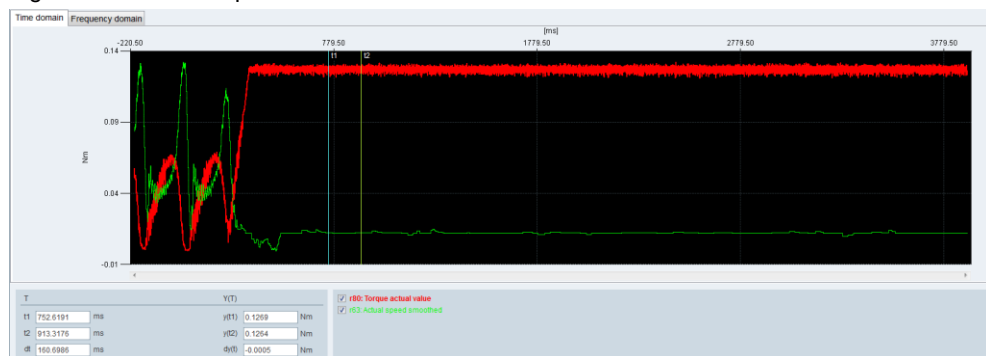
Nr	Action
1.	Configure SINAMICS V90 PN drive: <ul style="list-style-type: none"> • Control mode: S mode • Telegram: 102
2.	Create a new project in TIA Portal V14 and make configuration for PLC and SINAMICS V90 PN.
3.	Insert a technology object (positioning axis) into this project and make basic configurations like drive and encoder.
4.	Configure torque limit for TO as follows: 
5.	Keep the configurations of fixed stop detection as default.

Nr	Action																																																																																											
6.	<p>Create a simple program as follows:</p>  <p>Network 1: ...</p> <p>Network 2: ...</p>																																																																																											
7.	<p>Add a watch table and put necessary signals into it:</p> <table border="1" data-bbox="448 1563 1345 1854"> <thead> <tr> <th></th> <th>Name</th> <th>Address</th> <th>Display format</th> <th>Monitor value</th> <th>Modify value</th> <th></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>"MC_MOVERELATIVE_DB".Distance</td> <td></td> <td>Floating-point number</td> <td>0.0</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>2</td> <td>"MC_MOVERELATIVE_DB".Velocity</td> <td></td> <td>Floating-point number</td> <td>0.0</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>3</td> <td>"MC_HOME_DB".Execute</td> <td></td> <td>Bool</td> <td>TRUE</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>4</td> <td>"MC_MOVERELATIVE_DB".Execute</td> <td></td> <td>Bool</td> <td>FALSE</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>5</td> <td>"MC_POWER_DB".Enable</td> <td></td> <td>Bool</td> <td>FALSE</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>6</td> <td>"MC_RESET_DB".Execute</td> <td></td> <td>Bool</td> <td>FALSE</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>7</td> <td>"MC_TORQUELIMITING_DB".Enable</td> <td></td> <td>Bool</td> <td>FALSE</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>8</td> <td>"MC_TORQUELIMITING_DB".Limit</td> <td></td> <td>Floating-point number</td> <td>0.0</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>9</td> <td>"MC_TORQUELIMITING_DB".Mode</td> <td></td> <td>DEC+/-</td> <td>0</td> <td></td> <td><input checked="" type="checkbox"/> <input checked="" type="checkbox"/></td> </tr> <tr> <td>10</td> <td>"MC_TORQUELIMITING_DB".InClamping</td> <td></td> <td>Bool</td> <td></td> <td></td> <td><input type="checkbox"/> <input type="checkbox"/></td> </tr> <tr> <td>11</td> <td>"MC_TORQUELIMITING_DB".InLimitation</td> <td></td> <td>Bool</td> <td></td> <td></td> <td><input type="checkbox"/> <input type="checkbox"/></td> </tr> <tr> <td>12</td> <td colspan="6" style="text-align: right;"><input type="button" value="Add new"/></td> </tr> </tbody> </table>		Name	Address	Display format	Monitor value	Modify value		1	"MC_MOVERELATIVE_DB".Distance		Floating-point number	0.0		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	2	"MC_MOVERELATIVE_DB".Velocity		Floating-point number	0.0		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	3	"MC_HOME_DB".Execute		Bool	TRUE		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	4	"MC_MOVERELATIVE_DB".Execute		Bool	FALSE		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	5	"MC_POWER_DB".Enable		Bool	FALSE		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	6	"MC_RESET_DB".Execute		Bool	FALSE		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	7	"MC_TORQUELIMITING_DB".Enable		Bool	FALSE		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	8	"MC_TORQUELIMITING_DB".Limit		Floating-point number	0.0		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	9	"MC_TORQUELIMITING_DB".Mode		DEC+/-	0		<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	10	"MC_TORQUELIMITING_DB".InClamping		Bool			<input type="checkbox"/> <input type="checkbox"/>	11	"MC_TORQUELIMITING_DB".InLimitation		Bool			<input type="checkbox"/> <input type="checkbox"/>	12	<input type="button" value="Add new"/>					
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8.	Download the project into PLC.																																																																																											
9.	Download configured SINAMICS V90 PN into SINAMICS V90 PN device.																																																																																											
10.	Set the V-ASSISTANT tool to trace the actual torque (r68) and actual speed (r63).																																																																																											

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12.	<p>Set the target position of 1000 mm with running speed of 5 mm/min:</p> <table border="1"> <tbody> <tr> <td>*MC_MOVERELATIVE_DB".Distance</td> <td>Floating-point number</td> <td>1000.0</td> <td>1000.0</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> <tr> <td>*MC_MOVERELATIVE_DB".Velocity</td> <td>Floating-point number</td> <td>5.0</td> <td>5.0</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_MOVERELATIVE_DB".Distance	Floating-point number	1000.0	1000.0	<input checked="" type="checkbox"/>		*MC_MOVERELATIVE_DB".Velocity	Floating-point number	5.0	5.0	<input checked="" type="checkbox"/>																																																																																													
*MC_MOVERELATIVE_DB".Distance	Floating-point number	1000.0	1000.0	<input checked="" type="checkbox"/>																																																																																																					
*MC_MOVERELATIVE_DB".Velocity	Floating-point number	5.0	5.0	<input checked="" type="checkbox"/>																																																																																																					
13.	<p>Select function mode 1 (fixed stop detection):</p> <table border="1"> <tbody> <tr> <td>*MC_TORQUELIMITING_DB".Mode</td> <td>DEC+/-</td> <td>1</td> <td>1</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_TORQUELIMITING_DB".Mode	DEC+/-	1	1	<input checked="" type="checkbox"/>																																																																																																			
*MC_TORQUELIMITING_DB".Mode	DEC+/-	1	1	<input checked="" type="checkbox"/>																																																																																																					
14.	<p>Enable SINAMICS V90 PN:</p> <table border="1"> <tbody> <tr> <td>*MC_POWER_DB".Enable</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_POWER_DB".Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																			
*MC_POWER_DB".Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																					
15.	<p>Perform homing for the positioning axis:</p> <table border="1"> <tbody> <tr> <td>*MC_HOME_DB".Execute</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_HOME_DB".Execute	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																			
*MC_HOME_DB".Execute	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																					
16.	<p>Enable torque limiting:</p> <table border="1"> <tbody> <tr> <td>*MC_TORQUELIMITING_DB".Enable</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_TORQUELIMITING_DB".Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																			
*MC_TORQUELIMITING_DB".Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																					
17.	<p>Write "-1" into the variant "MC_TORQUELIMITING_DB".Limit", which means that the torque limit value configured in TO is used:</p> <table border="1"> <tbody> <tr> <td>*MC_TORQUELIMITING_DB".Limit</td> <td>Floating-point number</td> <td>-1.0</td> <td>-1.0</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_TORQUELIMITING_DB".Limit	Floating-point number	-1.0	-1.0	<input checked="" type="checkbox"/>																																																																																																			
*MC_TORQUELIMITING_DB".Limit	Floating-point number	-1.0	-1.0	<input checked="" type="checkbox"/>																																																																																																					
18.	<p>Start running:</p> <table border="1"> <tbody> <tr> <td>*MC_MOVERELATIVE_DB".Execute</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_MOVERELATIVE_DB".Execute	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																			
*MC_MOVERELATIVE_DB".Execute	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	<input checked="" type="checkbox"/>																																																																																																					
19.	<p>Brake the motor with an external brake.</p>																																																																																																								
20.	<p>When the fixed stop has been detected, the signals "InClamping" and "InLimitation" are output, and no fault occurs:</p> <table border="1"> <tbody> <tr> <td>*MC_TORQUELIMITING_DB".InClamping</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> <td><input type="checkbox"/></td> <td></td> </tr> <tr> <td>*MC_TORQUELIMITING_DB".InLimitation</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> <td><input type="checkbox"/></td> <td></td> </tr> </tbody> </table>	*MC_TORQUELIMITING_DB".InClamping	Bool	<input checked="" type="checkbox"/> TRUE		<input type="checkbox"/>		*MC_TORQUELIMITING_DB".InLimitation	Bool	<input checked="" type="checkbox"/> TRUE		<input type="checkbox"/>																																																																																													
*MC_TORQUELIMITING_DB".InClamping	Bool	<input checked="" type="checkbox"/> TRUE		<input type="checkbox"/>																																																																																																					
*MC_TORQUELIMITING_DB".InLimitation	Bool	<input checked="" type="checkbox"/> TRUE		<input type="checkbox"/>																																																																																																					
21.	<p>Trace the torque output and actual speed.</p>																																																																																																								

The figure 3-1 shows the record of the actual torque output after a fixed stop, which is 0.1Nm (r68):

Figure 4-1 Actual torque limit value



5 Contact

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