Application Note

FESTO

How to setup „Travel to fixed stop“ with CMMT-AS-PN by using the SINA_POS / telegram 111

This document describes how to set up the CMMT-AS-...-PN in "trav-el to fixed stop" mode by using the SINA_POS function block / telegram 111 in programming environment of TIA Portal

CMMT-AS-...-PN

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1 Components/Software used

Type/Name	Version Software/Firmware	Date of manufacture
Festo Automation Suite	1.1.1.610	--
CMMT-AS-Plug-in	1.1.0.110	--
TIA Portal	V15SP1	--
Drive_Lib_S7_1200_1500	V52	--

Table 1.1: Components/Software used

1.1 Necessary previous knowledge

A previous knowledge of commissioning a CMMT-AS-PN by using Festo Automation Suite and the SINA_POS in TIA Portal // Siemens PLC (S7-1220//1500) is assumed to follow the following description.

2 Application description

This document was created to be able to set-up the CMMT-AS-PN into the “Travel to fixed stop” (application class 3) mode with using the SINA_POS function block and the telegram 111. This instruction shows the needed and useful parameters on the CMMT-AS-PN and on the other hand the must changes on the SINA_POS function block.

In general, the SINA_POS function block does not offer in- or output interfaces for a “Travel to fixed stop”. To setup this mode it needs some changing on the default settings of the control words/ConfigEPos at SINA_POS function block (Siemens) side.

Siemens named the “Torque Mode” as “Travel to fixed stop”. This mode is a positioning task with a defined clamping torque.

2.1 Used parameters and abbreviations/terms

2.1.1 Parameters

Name	Parameter number
Clamping torque [Nm]	526801
Fixed stop detection monitoring window	4694
Fixed stop detection damping time	4693
Fixed stop negative stroke limit	11280409
Fixed stop positive stroke limit	11280408
Lower limit value torque	852
Upper limit value torque	853
Target position	11280604
Profile speed	11280605
Monitoring window target torque	4611
Damping time target reached	468

Table 2.1: Used parameters

There exist some more parameters especially for the monitoring (window, time,..). But these were not changed (used as default values). Details are specified in the documentation of CMMT-AS-PN (at the moment only as on-line help option within the current Plug-in version available).

2.1.2 Abbreviations / Terms

Abbr./Terms	Relevance
STW	Control word
ZSW	Status word
EPos	Basic positioner
ModePos	Operating Mode
PZD	Process data
SLTP/SLTN	Stroke limit Positive/Negative
ConfigEPos	Configuration basic positioner
EPosZSW	Basic positioner status word
FSPR	Fixed stop reached

Table 2.2: Used abbr./terms

2.2 Travel top fixed stop (application class 3)

Travel to fixed stop performs a positioning with reference to a defined max. clamping torque. During travel to fixed stop a fixed stop is approached from the current position before reaching the target position (e.g. at a workpiece). Then a torque is established up to the desired clamping torque. For example, the following parameters can be set:
– Position
– Speed
– Acceleration
– Deceleration
– Clamping torque
– Clamping torque offset
A current positioning task can be switched by "STW2.8 Traverse to fixed endstop". The switching runs a positioning task with clamping torque. The closed-loop limit manager limits the motion to the clamping torque. On completion of the task the original limit is restored.
The following error monitor is not active during the task and the following status bits are set:
– ZSW2.8 Travel to fixed stop active
– POS_ZSW2.14 Move to fixed stop active
The following error monitor of the motion monitor is used during the task to detect the fixed stop.
When the fixed stop is detected, "POS_ZSW2.12 Fixed stop reached" is set and the stroke limit monitor of the motion monitor is activated based on the current position.
With pending clamping torque "POS_ZSW2.13 Fixed stop Clamping torque reached" is set.
The clamping torque remains pending until a new travel command starts.
When the stroke limits for the fixed stop monitor are reached, "POS_ZSW2.12 Fixed stop reached" is reset.

Timing

Example 1: travel to fixed stop with reaching and stopping at the fixed stop

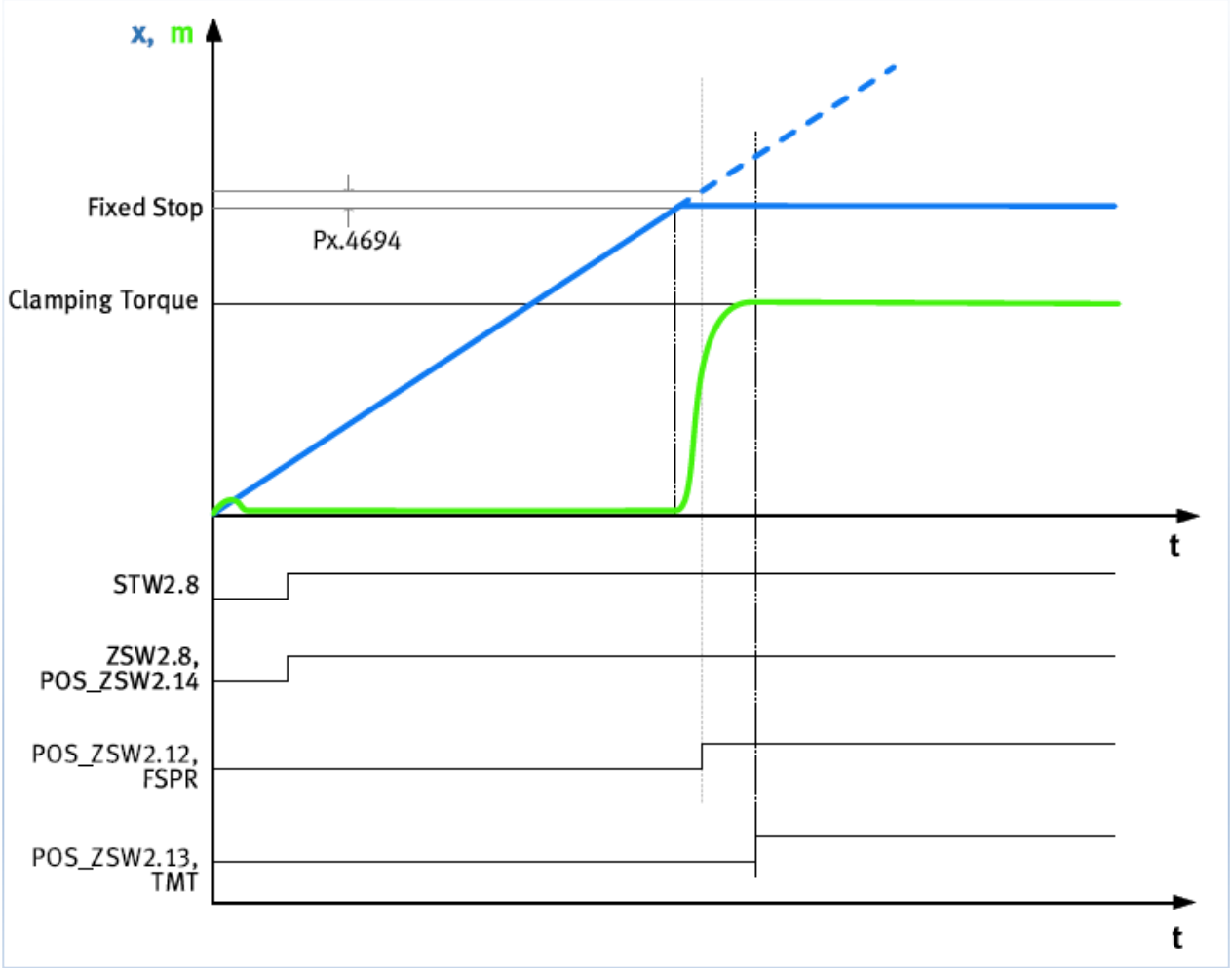


Fig. 1.1 Timing diagram travel to fixed stop

Name	Description	Parameters
Fixed Stop	Fixed Stop	-
Clamping torque	Clamping torque	526801
FSPR	Motion monitoring function "fixed stop reached" (1 = status reached)	Px.460
TMT	Motion monitoring function "target torque range monitor" (1 = status reached)	Px.460

Tab. 2.3: Legend for timing diagram travel to fixed stop

Example 2: travel to fixed stop without reaching the fixed stop

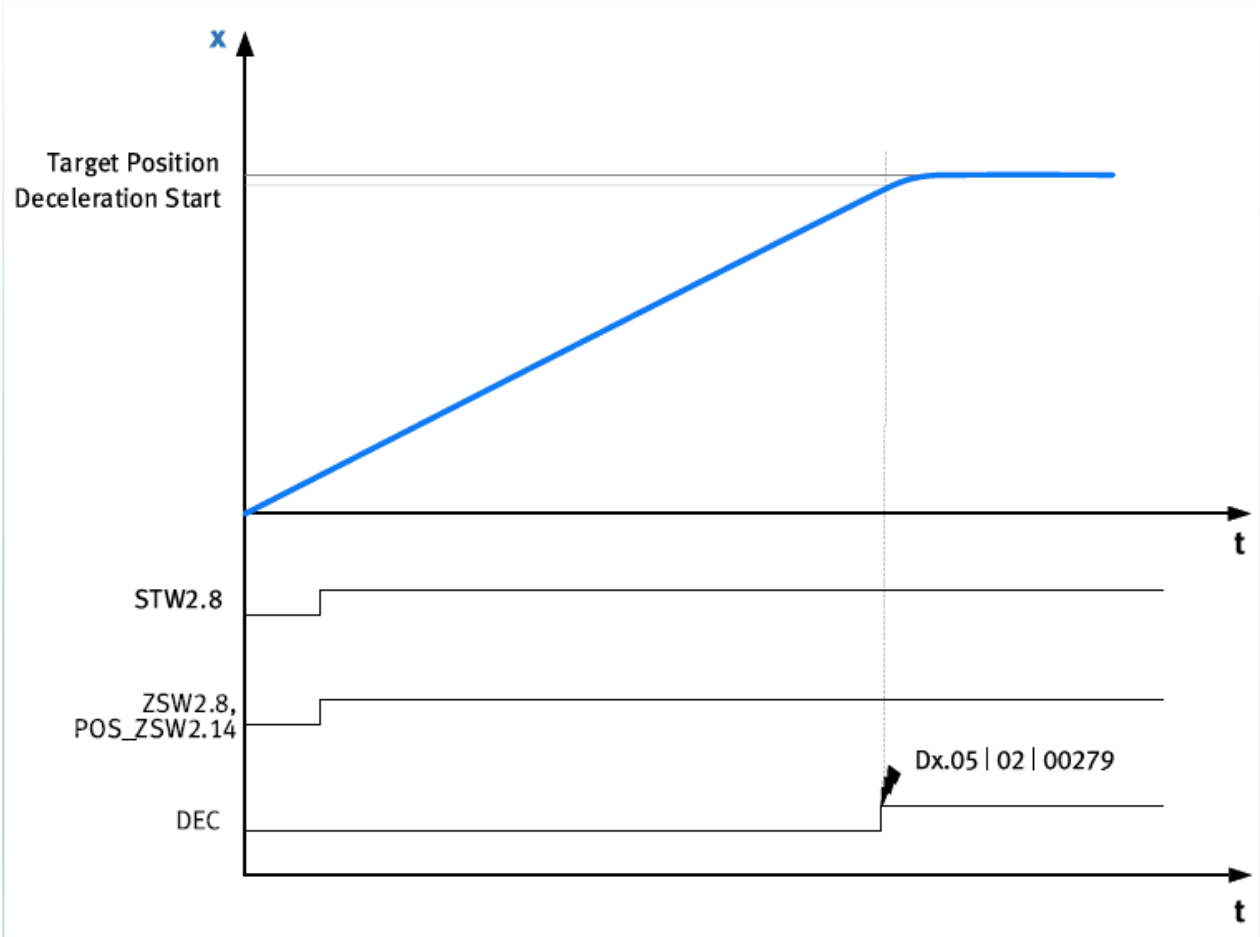


Fig. 1.2 Timing diagram fixed stop not reached

Name	Description	Parameters
Target position	Target position	-
Deceleration start	Start of deceleration	-
DEC	Motion monitoring function "drive decelerated" (1 = status reached)	Px.460
Dx.05|02| 000279	Diagnostic message Fixed stop not detected	-

Tab. 2.4: Legend for timing diagram fixed stop not reached

Example 3: travel to fixed stop with reaching and feedback at the fixed stop

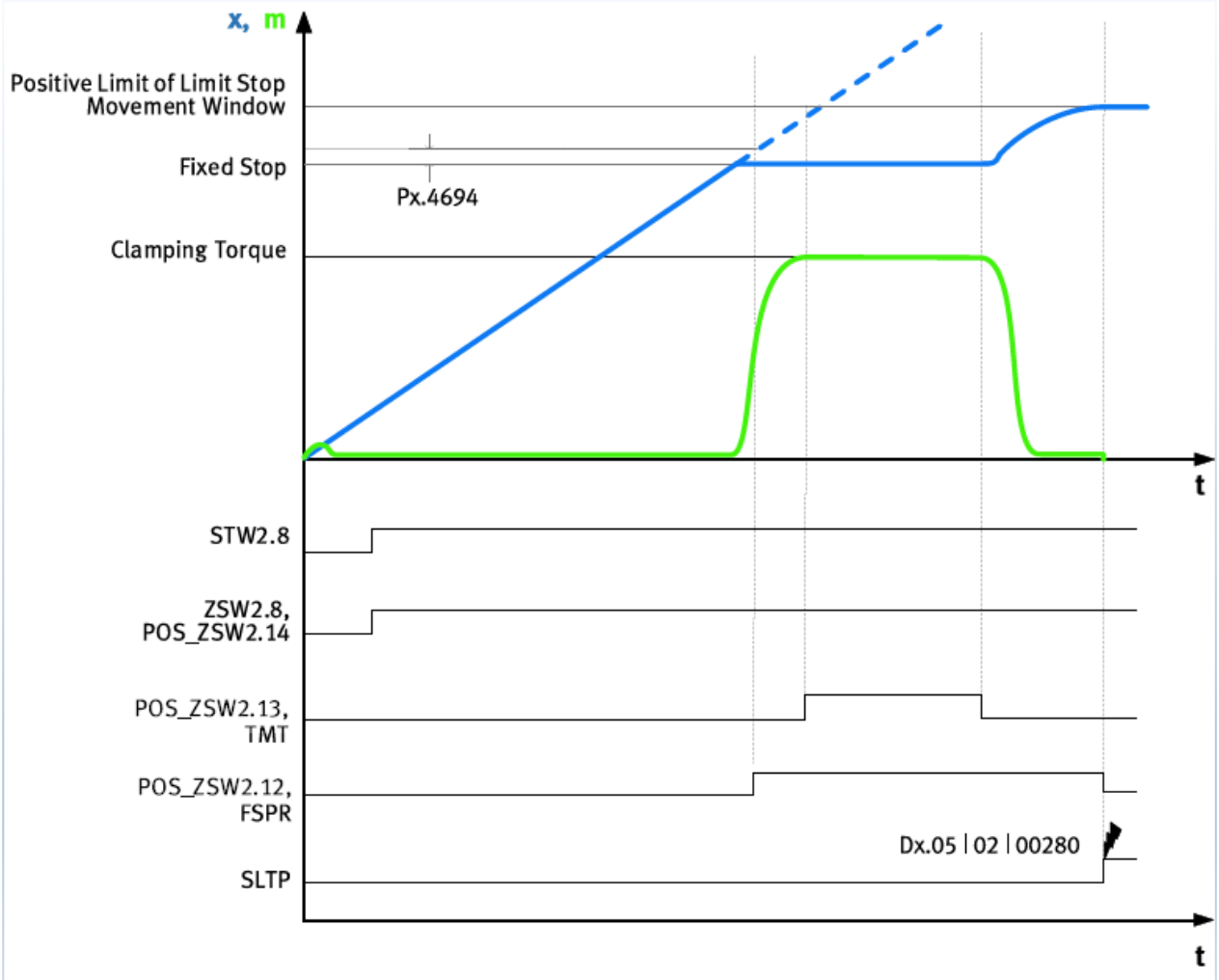


Fig. 1.3 Timing diagram fixed stop feeds back

Name	Description	Parameters
Positive Limit of Limit Stop Movement Window	Positive stroke limit of fixed stop monitor	11280408 11280409
Clamping torque	Clamping torque	526801
Fixed Stop	Fixed Stop	-
TMT	Motion monitoring function "target torque range monitor" (1 = status reached)	Px.460
FSPR	Motion monitoring function "fixed stop reached" (1 = status reached)	Px.460
STLP	Motion monitoring function "stroke limit reached" (1 = status reached)	Px.460
Dx.05|02|280	Diagnostic message Monitoring window of fixed stop left	-

Tab. 2.5 Legend for timing diagram fixed stop feeds back

2.3 General parameters for “Travel to fixed stop”

Used parameters are described in the software documentation of the CMMT-AS in detail.
Below were the parameter numbers and the related chapters which are specified in the official documentation of CMMT-AS-PN.

Details of the motion monitoring functions -› 5.1 Motion monitoring functions.
The fixed stop detection acts like the following error monitor for position with critical limit and timing -› 5.3 Following error. The following error of the position and a damping time are used (Px.4694, Px.4693).

The detection of the pending clamping torque acts like the target range monitor for torque with critical limit and timing -› 5.5 Target area monitoring.

The monitoring of the stroke limits after detected fixed stop acts like the stroke limit reached motion monitor -› 5.10 Stroke limit reached.

The window limits can be set in the positive and negative directions (Px.11280408, Px.11280409 -› Tab. 266 Parameters).

If the motion leaves the monitoring window in the positive and negative direction it is detected and triggers the following diagnostic message:
– Monitoring window of fixed stop left: Dx.05 | 02 | 00280

The following parameter determines the braking behaviour on exit of the monitoring window:
– Activation of automatic stop ramp stroke limit: Px.4675

The clamping torque depends on the direction of motion. The set clamping torque is added with the offset. This means that the resulting clamping torque depends on the sign of the offset.
An asymmetrical clamping torque can be set with the offset for suspended axes (parameter Clamping torque offset, Px.11280407).

3 Procedure to get the CMMT-AS-PN in “Travel to fixed Stop” mode with the Siemens SINA_POS function block

- Using a positioning mode absolute or relative (ModePos = 1 or 2 (positioning absolute/relative))
- Find out the right bit within the control word / ConfigEPos

3.1 Assignment of STW2

Due to the supported Profidrive specification in our CMMT-AS-PN we can follow the library documentation from Siemens DriveLib. Below table shows the assignment of STW2 for a Siemens drive.

Assignment of STW2

Bit	Abbr.	Designation	Drive parameter	Function diagram
0	DDSBit0	Drive data set, bit 0	p820.0	8565
1	DDSBit1	Drive data set, bit 1	p821.0	8565
2	DDSBit2	Drive data set, bit 2	p822.0	8565
3	DDSBit3	Drive data set, bit 3	p823.0	8565
4	DDSBit4	Drive data set, bit 4	p824.0	8565
5	GlbStart	Global start	<not used>	
6	ResiComp	Reset I-component of speed controller	<not used>	
7	ActPrkAxis	Activate parking axis	p897	
8	TrvFixedStp	Travel to fixed stop	<not used> (p1545.0)	<not used> (8012)
9	GlbTrgCom	Global trigger command	<not used>	
10	Bit10	Reserved		
11	MotSwOver	Motor switchover completed (0->1)	p828.0	8575
12	MsZykBit0	Master sign-of-life, bit 0	<not used>	
13	MsZykBit1	Master sign-of-life, bit 1	<not used>	
14	MsZykBit2	Master sign-of-life, bit 2	<not used>	
15	MsZykBit3	Master sign-of-life, bit 3	<not used>	

DriveLib - documentation

The “Travel to fixed stop” is assigned to Bit8 of STW2. That means the Bit8 has to be set to 1.

3.2 EPos telegram 111

In EPos telegram 111 which is a must to select in TIA Portal HW configuration for the SINA_POS function block one can see that the control word 2 (STW2) was assigned to PZD4.

PZD	Assignment of the process data
PZD1	Control word 1
PZD2	EPosSTW 1
PZD3	EPosSTW 2
PZD4	Control word 2
PZD5	Velocity override for all operating modes (4000HEX = 100%)
PZD6	Position setpoint in [LU] for direct setpoint specification / MDI mode
PZD7	
PZD8	Velocity setpoint in the MDI mode
PZD9	
PZD10	Acceleration override for direct setpoint input / MDI mode
PZD11	Deceleration override for direct setpoint input / MDI mode
PZD12	Reserved

DriveLib – documentation

3.3 Description of the configuration input of “ConfigEPos”

The SINA_POS function block offers the ConfigEPos as an input interface. There is no input/output interface for the control or status words available. The ConfigEPos is a word of 32Bit and looks like below:

ConfigEPos	Meaning	PZD	Interconnection in the drive (telegram 111)	Default
Bit0	OFF2 (1 = no pulse inhibit)	1	r2090.1 = p 844[0]	1
Bit1	OFF3 (1 = no pulse inhibit)	1	r2090.2 = p 848[0]	1
Bit2	Software limit switch (active = 1)	3	r2092.14 = p2582	0
Bit3	Stop output cam (active = 1)	3	r2092.15 = p2568	0
Bit4	Probe edge evaluation	3	r2092.11 = p2511[0]	0
Bit5	Select probe	3	r2092.10 = p2510[0]	0
Bit6	External block change (via BUS)	1	r2090.13 = p2633	0
Bit7	Signal source reference mark	3	r2092.2 = p2612	0
Bit8	Continuous setpoint transfer MDI (active = 1)	2	r2091.12 = p2649	0
Bit9	DDS BIT0	4	r2093.0 = 820[0]	0
Bit10	DDS BIT1	4	r2093.1 = 821[0]	0
Bit11	DDS BIT2	4	r2093.2 = 822[0]	0
Bit12	DDS BIT3	4	r2093.3 = 823[0]	0
Bit13	DDS BIT4	4	r2093.4 = 824[0]	0
Bit14	Parking axis selection	4	r2093.7 = p897	0
Bit15				
Bit16	Reserve – can be used as required below	1	r2090.14	0
Bit17	Reserve – can be used as required below	1	r2090.15	0
Bit18	Reserve – can be used as required below	2	r2091.6	0
Bit19	Reserve – can be used as required below	2	r2091.7	0
Bit20	Reserve – can be used as required below	2	r2091.11	0
Bit21	Reserve – can be used as required below	2	r2091.13	0
Bit22	Reserve – can be used as required below	3	r2092.3	0
Bit23	Reserve – can be used as required below	3	r2092.4	0
Bit24	Reserve – can be used as required below	3	r2092.6	0
Bit25	Reserve – can be used as required below	3	r2092.7	0
Bit26	Reserve – can be used as required below	3	r2092.12	0
Bit27	Reserve – can be used as required below	3	r2092.13	0
Bit28	Reserve – can be used as required below	4	r2093.5	0
Bit29	Reserve – can be used as required below	4	r2093.6	0
Bit30	Reserve – can be used as required below	4	r2093.8	0
Bit31	Reserve – can be used as required below	4	r2093.9	0

DriveLib - documentation

Like shown above the Bit30 was assigned to PZD4 and to Bit8 with a default value of 0. This must be used to activate the “Travel to fixed stop”.

3.4 Online look into the SINA_POS

At the SINA_POS the ConfigEPos interface was set to 16#0000_0003hex. It means the Bit0 and Bit1 were set as default. These two bits were OFF1 and OFF2 to get the drive into xxx state within the statemachine.

To set the Bit30 the value 16#4000_0003hex has to be assigned on the CofigEPos:

TIA15_CMMT ▸ PLC_1 [CPU 1516F-3 PN/DP] ▸ Beobachtungs- und Forcetabellen ▸ SINA_POS

	Name	Adresse	Anzeigeformat	Beobachtungswert	Steuerwert
1	"SINA_POS_DB".ModePos		DEZ+/-	0	2
2	"SINA_POS_DB".EnableAxis		BOOL	FALSE	TRUE
3	"SINA_POS_DB".CancelTraversing		BOOL	TRUE	TRUE
4	"SINA_POS_DB".IntermediateStop		BOOL	TRUE	TRUE
5	"SINA_POS_DB".Positive		BOOL	FALSE	
6	"SINA_POS_DB".Negative		BOOL	FALSE	
7	"SINA_POS_DB".Jog1		BOOL	FALSE	FALSE
8	"SINA_POS_DB".Jog2		BOOL	FALSE	FALSE
9	"SINA_POS_DB".FlyRef		BOOL	FALSE	FALSE
10	"SINA_POS_DB".AckError		BOOL	FALSE	FALSE
11	"SINA_POS_DB".ExecuteMode		BOOL	FALSE	TRUE
12	"SINA_POS_DB".Position		DEZ+/-	0	
13	"SINA_POS_DB".Velocity		DEZ+/-	0	10
14	"SINA_POS_DB".OverV		DEZ+/-	100	
15	"SINA_POS_DB".OverAcc		DEZ+/-	100	
16	"SINA_POS_DB".OverDec		DEZ+/-	100	
17	"SINA_POS_DB".ConfigEPos		Hex	16#0000_0003	16#4000_0003
18	"SINA_POS_DB".HWIDSTW		DEZ	267	
19	"SINA_POS_DB".HWIDZSW		DEZ	267	
20	"SINA_POS_DB".AxisEnabled		BOOL	FALSE	
21	"SINA_POS_DB".AxisPosOk		BOOL	FALSE	
22	"SINA_POS_DB".AxisSpFixed		BOOL	FALSE	
23	"SINA_POS_DB".AxisRef		BOOL	TRUE	TRUE
24	"SINA_POS_DB".AxisWarn		BOOL	FALSE	
25	"SINA_POS_DB".AxisError		BOOL	FALSE	
26	"SINA_POS_DB".Lockout		BOOL	FALSE	FALSE
27	"SINA_POS_DB".ActVelocity		DEZ+/-	0	
28	"SINA_POS_DB".ActPosition		DEZ+/-	54	10
29	"SINA_POS_DB".ActMode		DEZ+/-	0	
30	"SINA_POS_DB".EPosZSW1		Bin	2#0000_0000_0000_0000	
31	"SINA_POS_DB".EPosZSW2		Bin	2#0000_0000_0000_0001	
32	"SINA_POS_DB".ActWarn		Hex	16#0000	
33	"SINA_POS_DB".ActFault		Hex	16#0000	
34	"SINA_POS_DB".Error		BOOL	TRUE	
35	"SINA_POS_DB".Status		Hex	16#8202	
36					
37	"SINA_POS_DB".ActVelocity		DEZ+/-	0	
38					
39					
40					
41					

Cut-out from TIA Portal “Watch-Forcetable”

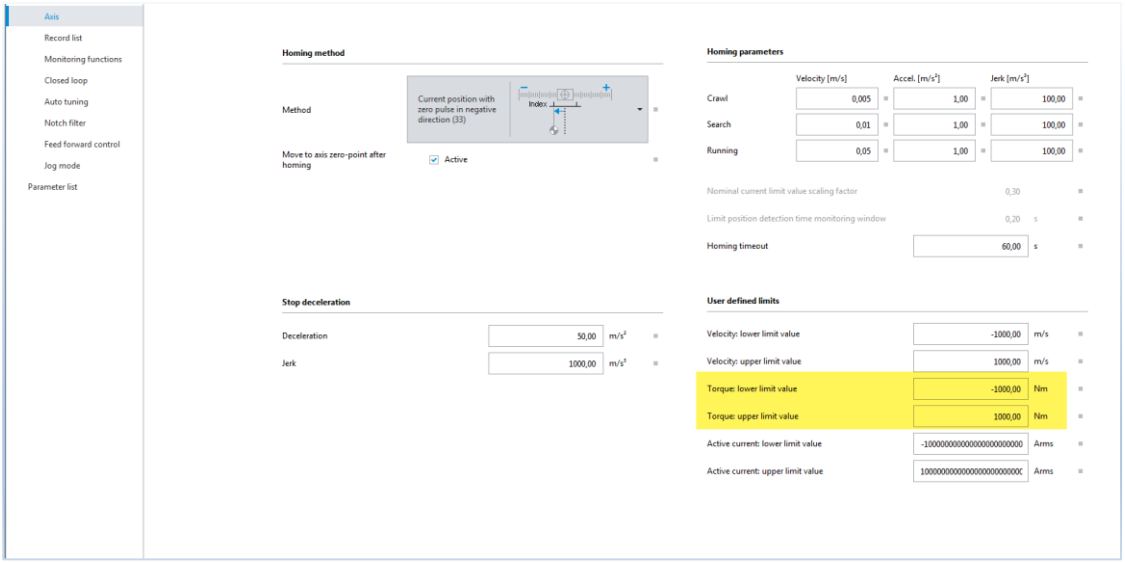
Hint: when activating the “Travel to fixed stop” mode than the following error will be disabled automatically.

The feedback can be read out on EPosZSW2 Bit14 or in ZSW2 Bit8. The SINAPOS has the output interface EPosZSW1 and EPosZSW2. That means the feedback can be read-out easily at Bit14 on EPosZSW2.

Like on the picture above to see the SINAPOS does not offer an input for a torque setpoint. The torque setpoint is called Clamping Torque [Nm] and can be found at P1.526801.0.0 in Festo Automation Suite.

Cut-out from FestoAutomationSuite

The max. allowed clamping torque is related to the “User defined limits” P1.852.0.0 for Torque: lower limit value and P1.853.0.0 for Torque: upper limit value in tab Axis, see below:



Cut-out from FestoAutomationSuite

To be able to change the clamping torque the SINA_PARA_S function block could be used to change the value acyclically.

Hint: Within the next firmware version an additional telegram length of 32Byte will be possible for read/write. Like the FHPP+ channel in the past. That means this will be an additional option to be able to change the clamping torque setpoint cyclically.

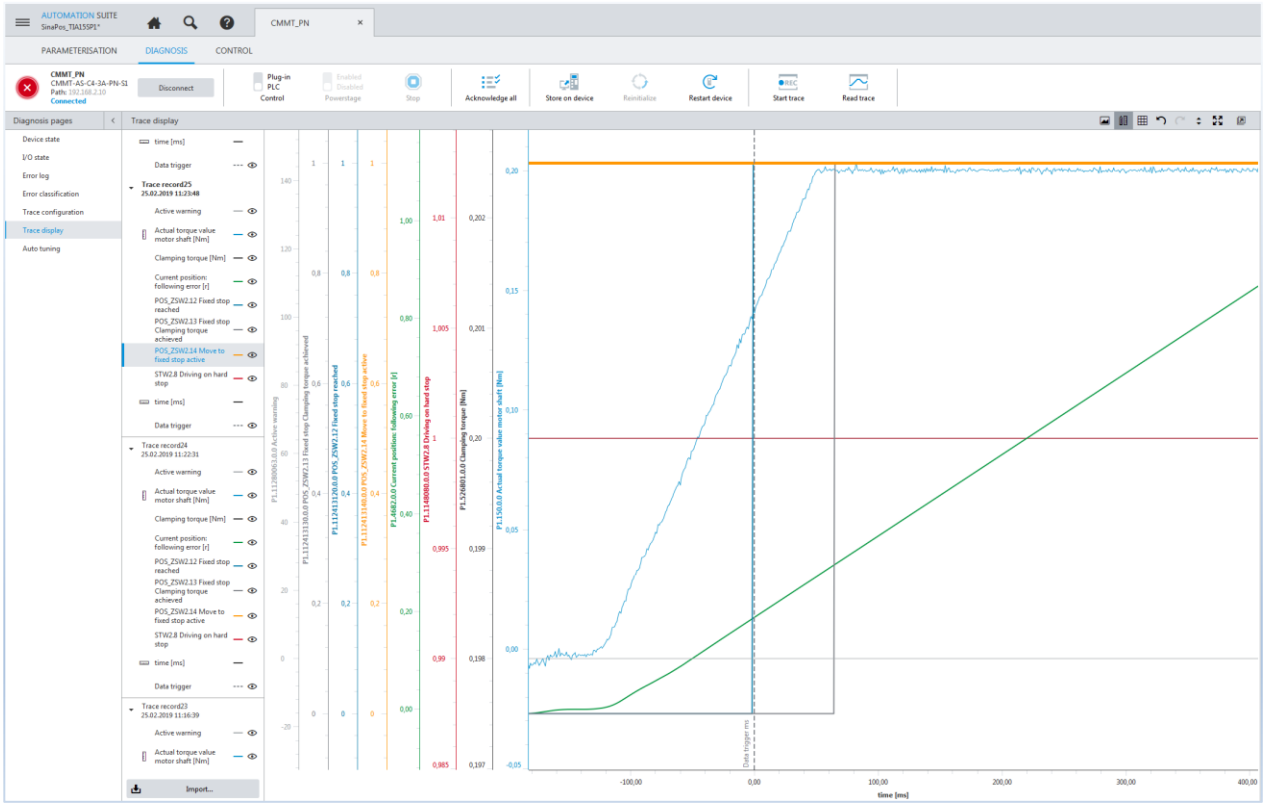
4 Traces from a “Travel to fixed stop” mode

4.1 Trace display: starting and reaching the clamping torque for “travel to fixed stop”

Procedure and parameter settings related to the trace below:

Clamping torque 0,2Nm -› setpoint
Actual torque value motor shaft light blue -› rises up to 0,2Nm
Fixed stop detection monitoring window 0,1rev.
Fixed stop detection damping time 50ms

POS_ZSW2.14 Move to fixed stop was activated before activating the mode •
POS_ZSW2.12 Fixed stop reached was 1 when the current position following error was ›= 0,1rev. and 50ms time delayed •
POS_ZSW2.13 Fixed stop clamping torque achieve was set by reaching the torque 0,2Nm on the motor shaft •



4.2 Trace display: yielding of the fixed stop and reaching the stroke limit “SLTP/SLTN”

Procedure and parameter settings related to the trace below:

Clamping torque 0,2Nm -› setpoint
Actual torque value motor shaft light blue -› rises up to 0,2Nm

As soon as the POS_ZSW2.13 reached state 1 the stroke limit fixed stop will be activated and thus when the clamping torque (actual torque on motor shaft decreases while yielding of the hard stop the POS_ZSW2.13 will be reset
Time delayed the POS-ZSW2.12 & POS_ZSW2.14 will be reset & warning/error (depends on the error management) will appear as a result.