Application Note

FESTO

CMMT-AS-PN controlled by SINAPOS functions block with Siemens S7 1500 controller

This document describes which control figures are implemented in CMMT-AS-PN drives and how to use it in programming environment of Siemens in TIA portal. Specifically focus on how to use SINAPOS functions block(PtP non-interpolated motion) in SINAMICS Lib for point to point linear motion.

100212

Title ..... CMMT-AS-PN controlled by SINAPOS functions block with Siemens S7 1500 controller
Version 1.30
Document no. 100212
Original .....en
Author .....Festo

Last saved 30.08.2022

Copyright Notice

This documentation is the intellectual property of Festo SE & Co. KG, which also has the exclusive copyright. Any modification of the content, duplication or reprinting of this documentation as well as distribution to third parties can only be made with the express consent of Festo SE & Co. KG.

Festo SE & Co KG reserves the right to make modifications to this document in whole or in part. All brand and product names are trademarks or registered trademarks of their respective owners.

Legal Notice

Hardware, software, operating systems and drivers may only be used for the applications described and only in conjunction with components recommended by Festo SE & Co. KG.

Festo SE & Co. KG does not accept any liability for damages arising from the use of any incorrect or incomplete information contained in this documentation or any information missing therefrom.

Defects resulting from the improper handling of devices and modules are excluded from the warranty.

The data and information specified in this document should not be used for the implementation of safety functions relating to the protection of personnel and machinery.

No liability is accepted for claims for damages arising from a failure or functional defect. In other respects, the regulations with regard to liability from the terms and conditions of delivery, payment and use of software of Festo SE & Co. KG, which can be found at www.festo.com and can be supplied on request, shall apply.

All data contained in this document do not represent guaranteed specifications, particularly with regard to functionality, condition or quality, in the legal sense.

The information in this document serves only as basic information for the implementation of a specific, hypothetical application and is in no way intended as a substitute for the operating instructions of the respective manufacturers and the design and testing of the respective application by the user.

The operating instructions for Festo products can be found at www.festo.com.

Users of this document (application note) must verify that all functions described here also work correctly in the application. By reading this document and adhering to the specifications contained therein, users are also solely responsible for their own application.

© (Festo SE & CO. KG, D-73726 Esslingen, 2022)
Internet: http://www.festo.com

Table of contents

1 Components/Software used 5

1.1 Topology of the tested system 5

2 Application Description 6

3 Configuration of parameters in Automation Suite 7

3.1 Automation Suite related parameters 7

4 Setting up TIA Portal 9

4.1 Installing the SINAMICS library to TIA portal 9

4.2 Making the Hardware Configuration in TIA portal 9

4.3 Configuring the SINAMICS function blocks 13

4.4 Compile and Download the program 16

4.5 Use the SINA_POS block with a ‘Watch Table’ 19

5 Using the SINAMICS function blocks 21

5.1 Enabling and stopping the Axis 21

5.2 Activating the Software and Hardware position limits 21

5.3 Monitoring the Actual speed 22

5.4 Modes of Operations 22

5.5 Diagnostic messages 25

1 Components/Software used

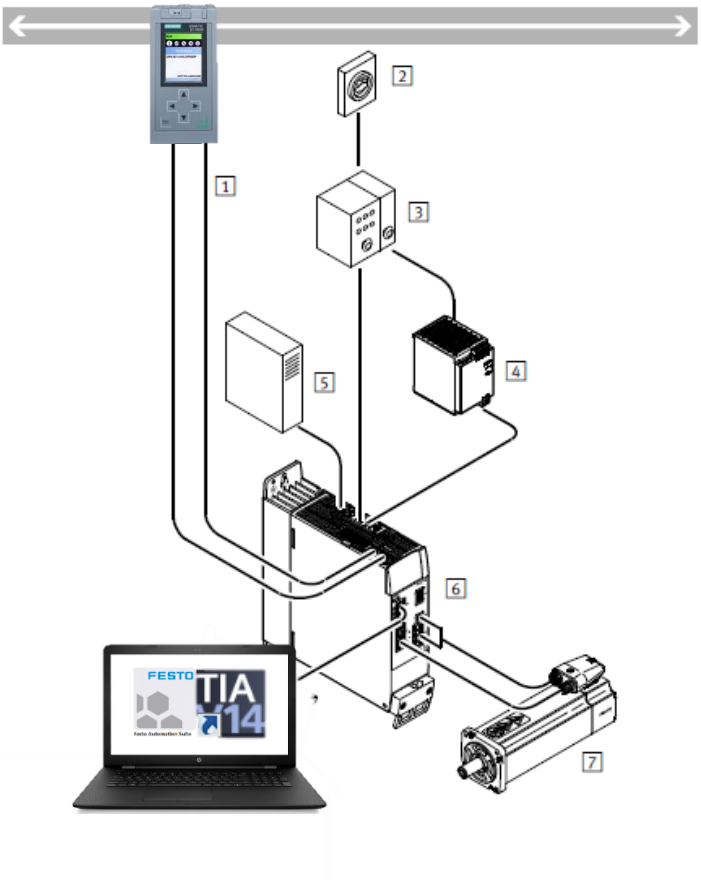
Type/Name	Version Software/Firmware	Date of manufacture
CMMT-AS-C4-3A-PN-S1	V015.0.8.38_release	--
Automation Suite	1.1.1.610	--
CMMT-AS Plug-in	1.1.0.110	--
TIA Portal	V14 SP1	--
SINA_POS	5.4	--
Drive_Lib_S7_1200_1500	V5	--

Table 1.1 : Components/Software used

Information

This AppNote describes the procedure with the CMMT-AS motor controller. The CMMT-AS servo drive controller and CMMT-ST servo drive controller for extra-low voltage are based on the same software platform. Therefore, the described settings can also be used as a reference for its parameterization. It is hereby expressly pointed out, that this has not been explicitly tested and therefore the function cannot be guaranteed!

1.1 Topology of the tested system



1 Bus/network
2 Power switch
3 Circuit breaker/fuses
4 Power supply unit for logic voltage supply 24 VDC (PELV)
5 External braking resistor (optional)
6 Servo drive CMMT-AS
7 Servo motor
8 PC with Ethernet connection for parameterisation

Figure 1.1 : overview of tested system

Please refer to the picture above and make sure all wires are correctly placed and connected

To confiture and run the system for commissioning, it is necessary to install named software in the table 1.1 above on your laptop or other PC system which you will do commissioning with.

2 Application Description

This part of the documentation describes a connectivity and configuration of the motor drive CMMT-AS-..-PN within a Profinet network controlled via Siemens S7-1500 PLC controller. The used bus protocol within this Application Note is an Application Class 3 and Telegram 111 which are specifically defined by Siemens for PtP non-interpolated motion over Profinet. It is targeted at people who are already familiar with this protocol, Festo Automation Suite and Siemens TIA Portal software.

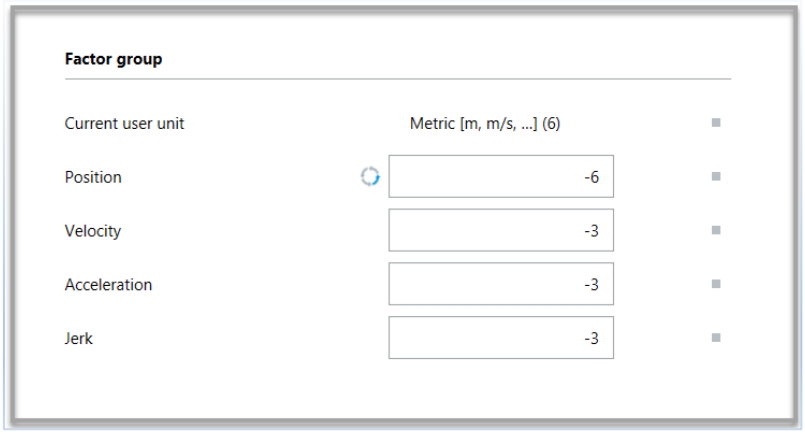
3 Configuration of parameters in Automation Suite

3.1 Automation Suite related parameters

On the Fieldbus tab you can find the parameters that are related to the communication with the host system.

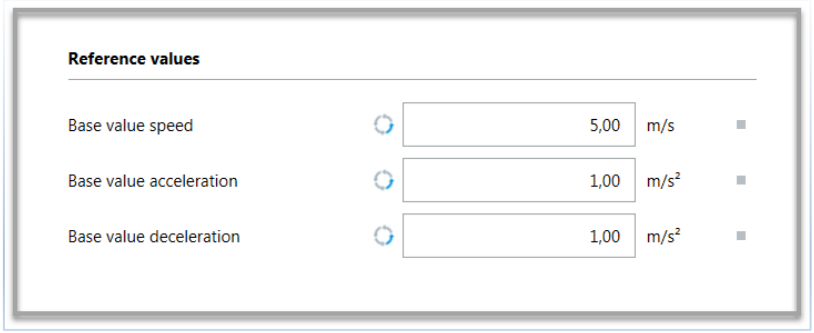
- **Factor Group:**
  These settings allow you to change the resolution of the position, velocity, acceleration and jerk values. They are related to the 'Current user unit', for example Meters or RPM.

  To default settings allow you to control your drive with a resolution of 0,001mm for positioning, while the velocity, acceleration and jerk values are with a resolution of 1mm.



- **Reference Values**
  The 'Base value speed' doesn't influence the speed of the drive, but it does change the way the 'actual speed' is displayed. It is a percentage in the SINA_POS function block, related to this base value.

  For controlling the acceleration and deceleration of the drive these reference values are used, also as a percentage in the SINA_POS block.



- **Dynamic values**
  Using Telegram 111 the 'Jerk' of the movement can be modified under the 'Dynamic values', the acceleration and deceleration values have no function here.

- **Connection Parameters / Connection Properties**
  These parameters are Read Only from the Automation Suite, they have to be set from TIA portal.

4 Setting up TIA Portal

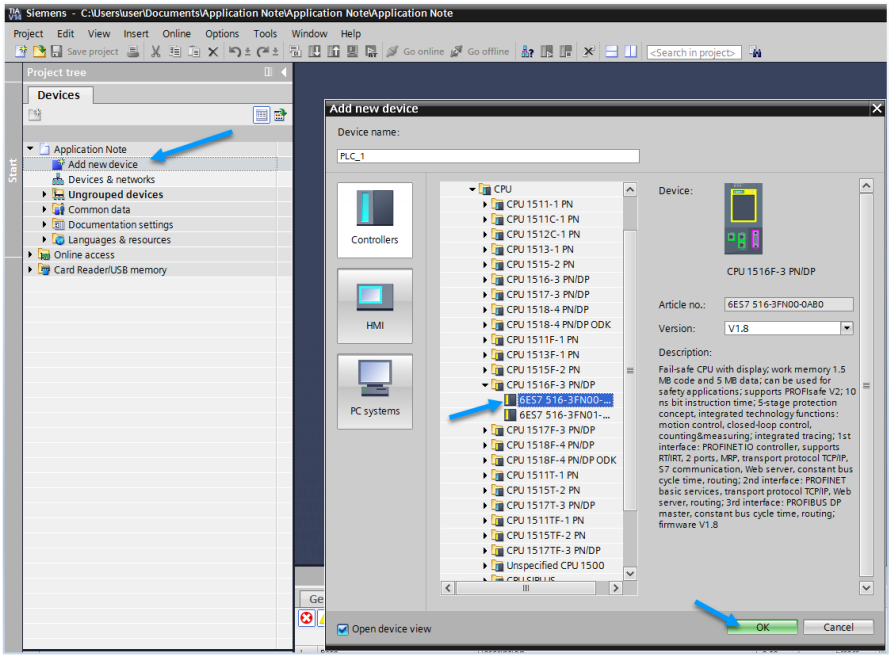
4.1 Installing the SINAMICS library to TIA portal

Download the latest version of the SINAMICS Drivelib from the Siemens website here:
Link to SINAMICS Drivelib
SINAMICS Blocks DriveLib for the control in the TIA Portal

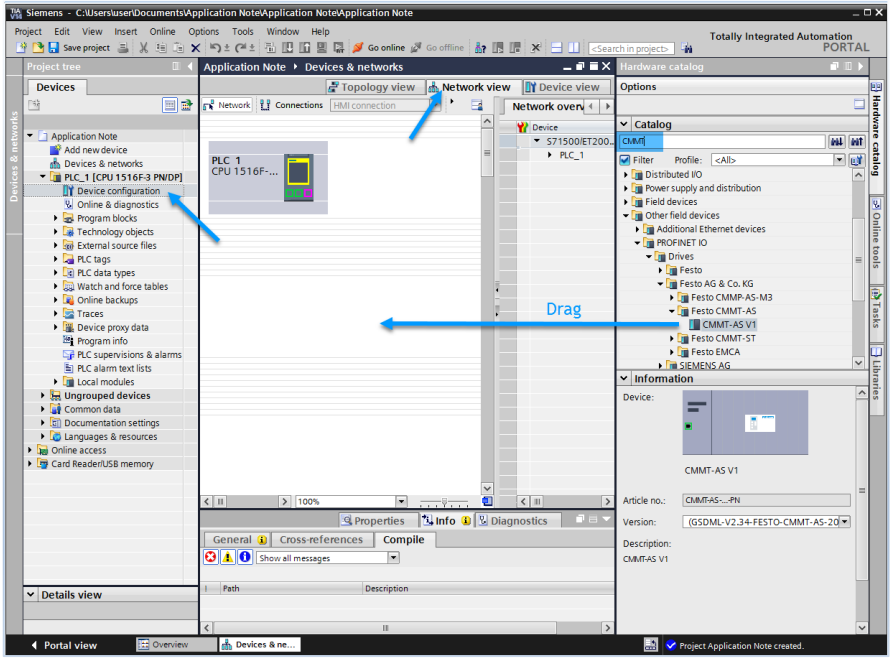
Make sure TIA portal is closed and execute the downloaded *.MSI*.

4.2 Making the Hardware Configuration in TIA portal

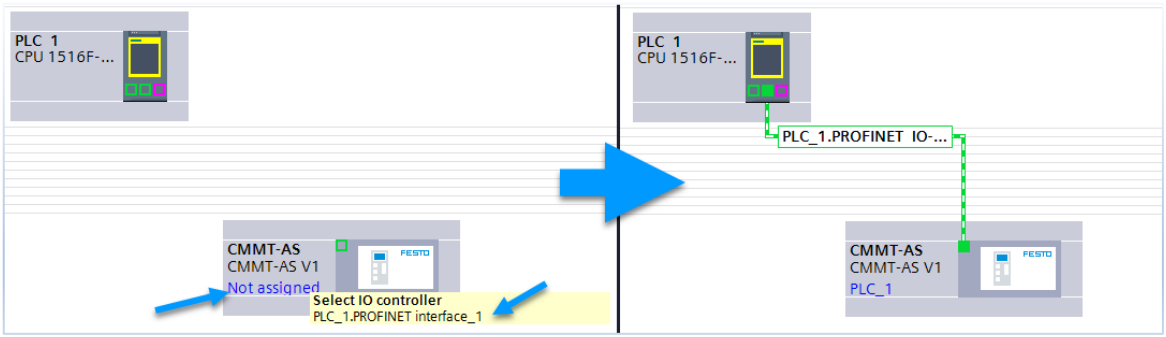
1. Create a new project and add your PLC:



2. Go the the 'Device Configuration' tab, select 'Network View' and search for the CMMT in the Hardware Catalog. Drag and drop this to the middle screen:

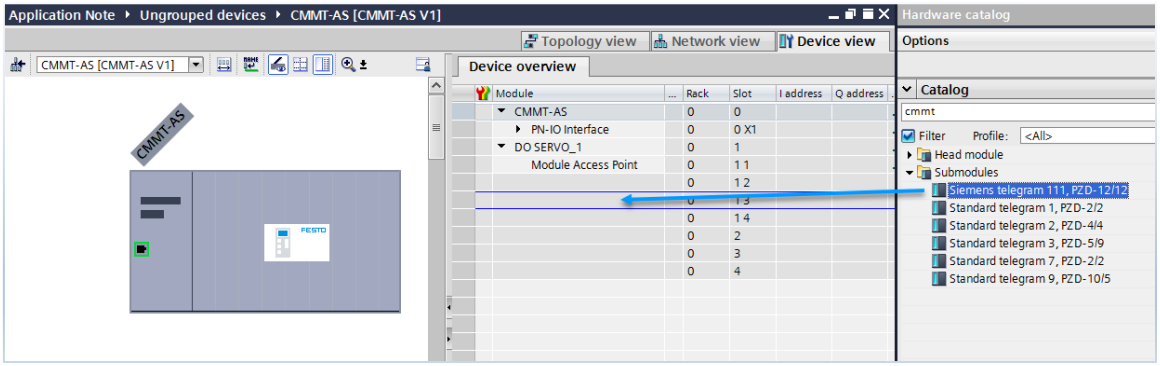


3. To connect the CMMT with the PLC, click on ‘Not Assigned’ and select the Profinet interface. After this, a green line will show the connection between the PLC and CMMT:



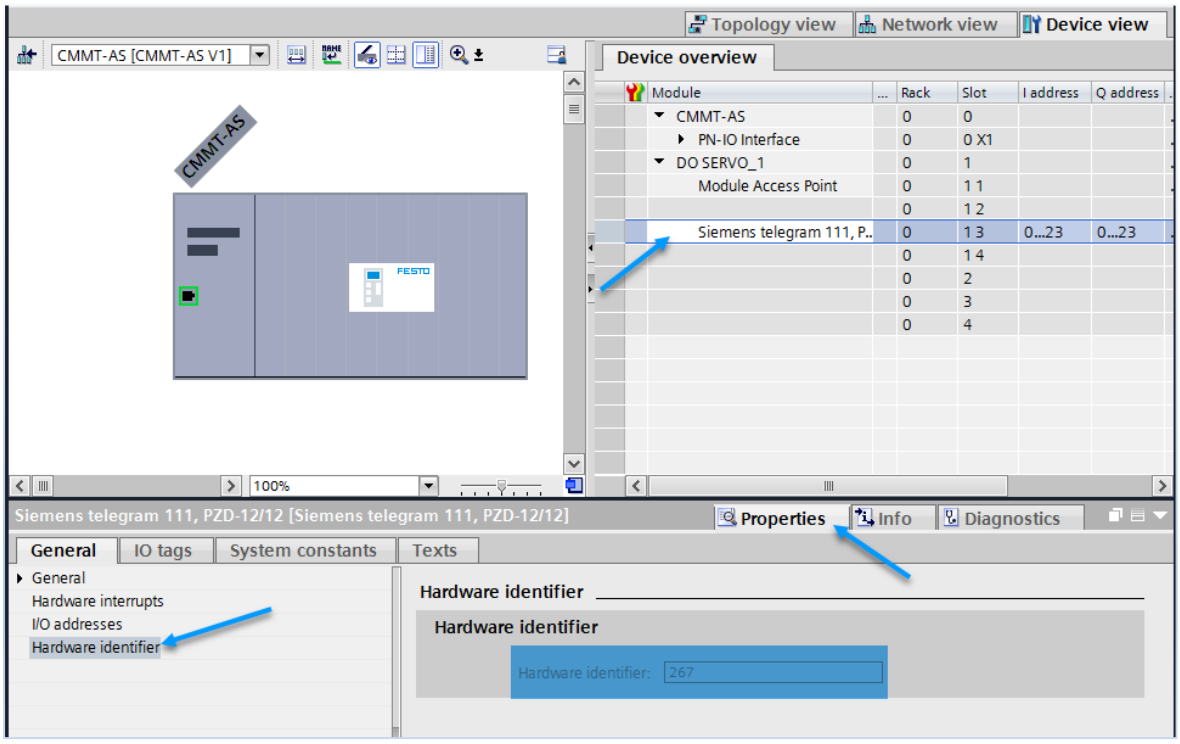
4. Double click on the CMMT to get into the ‘Device View’ tab. Here we can select the different Telegrams. To use the CMMT in Point-to-Point mode with the SINAMICS Drivelib we need to select:

Siemens telegram 111, PZD-12/12 (Drag and drop to the second empty slot)

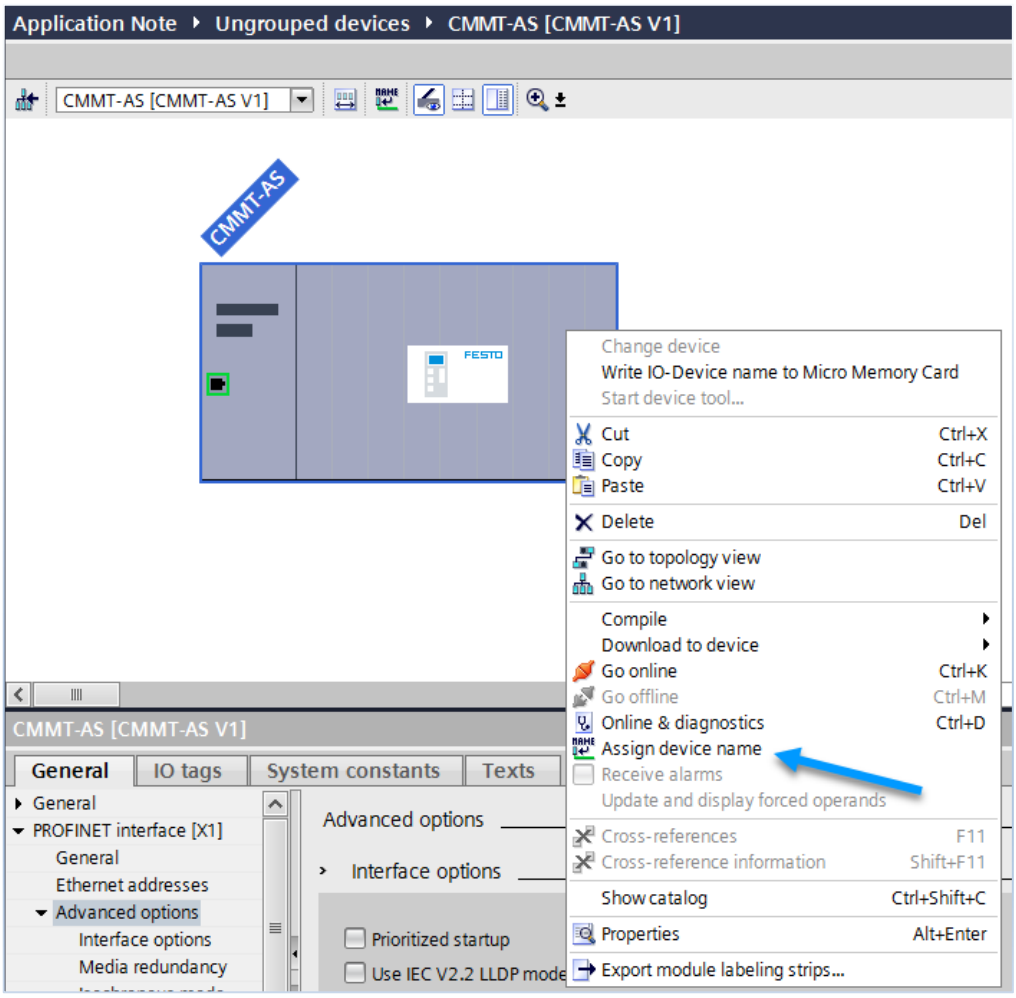


5. Select the telegram you just dropped in and go to ‘Properties’ on the bottom of that screen. Make note of the ‘Hardware identifier’ value that has been given to this Telegram, as we will need it later.

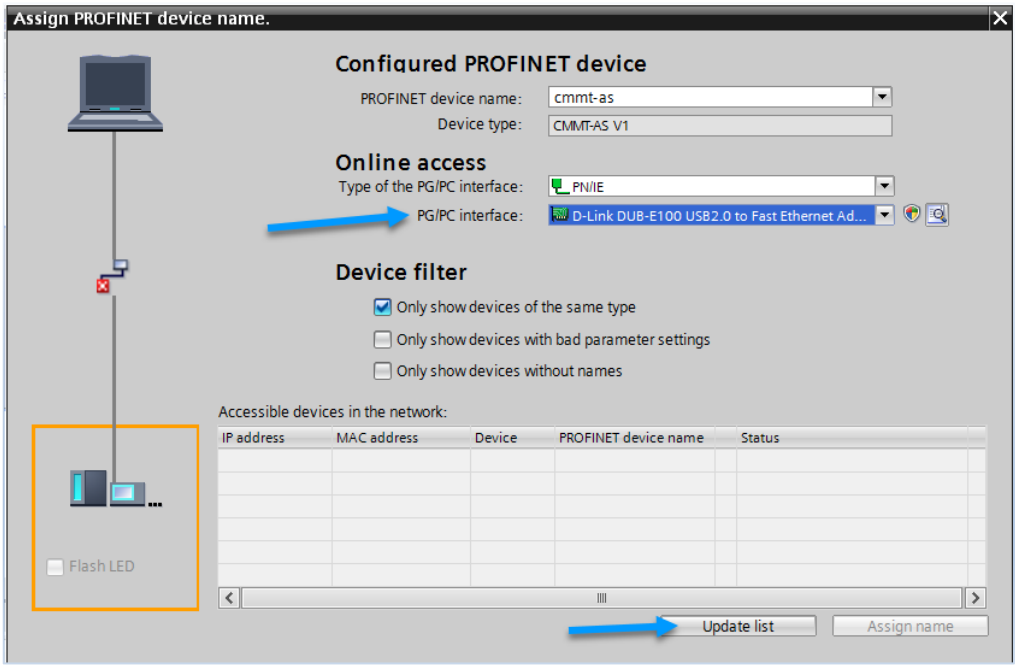
Hardware identifier: 267 (e.g.) (make sure you select the Telegram first!)



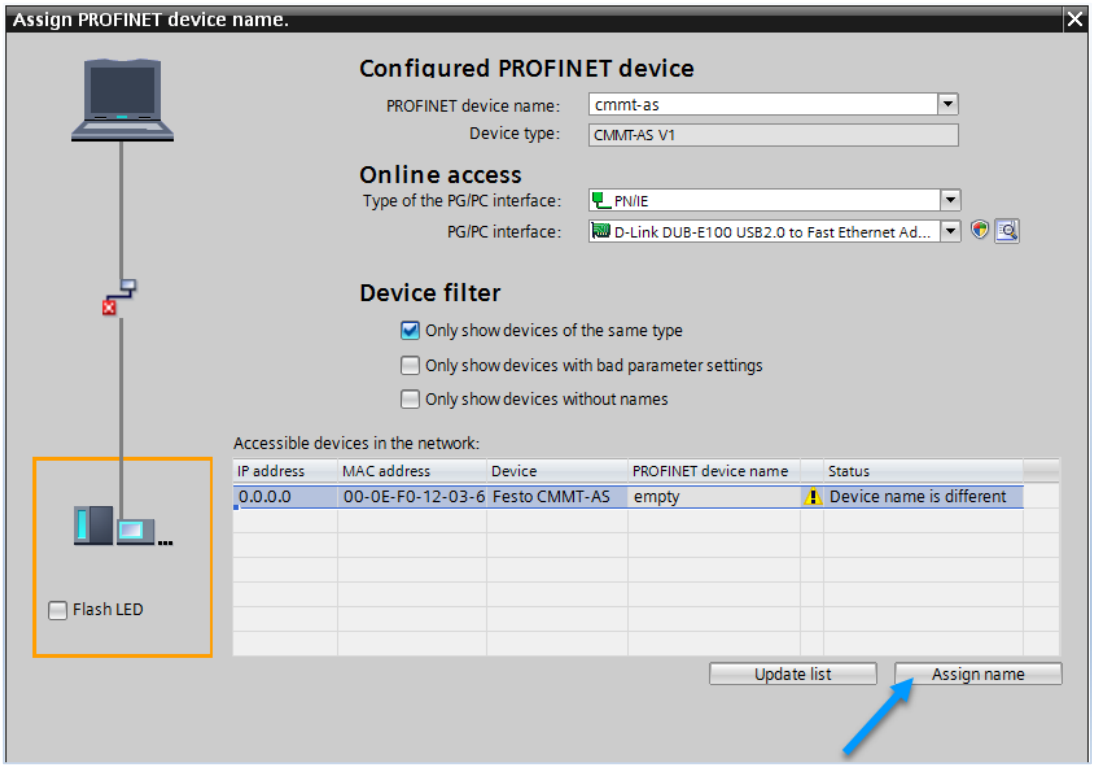
6. Right click on the CMMT and select ‘Assign Device Name’. For this you need to have access to either the whole Profinet network or the X19 port on the CMMT.



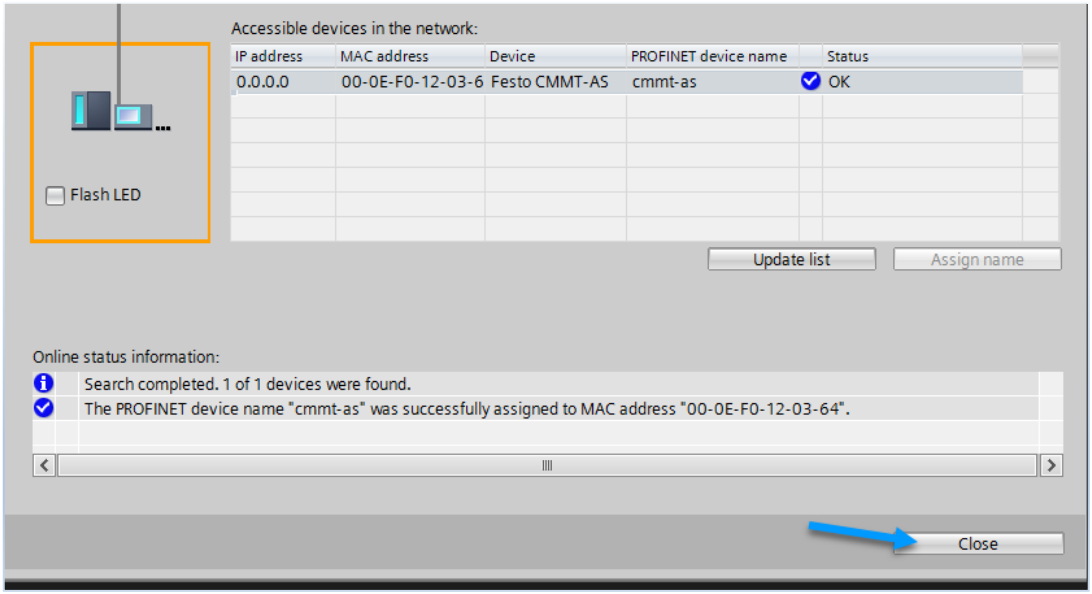
7. Select the correct interface and click on ‘Update List’:



8. The CMMT should appear with the status ‘Device name is different’. Select the CMMT and click on ‘Assign name’



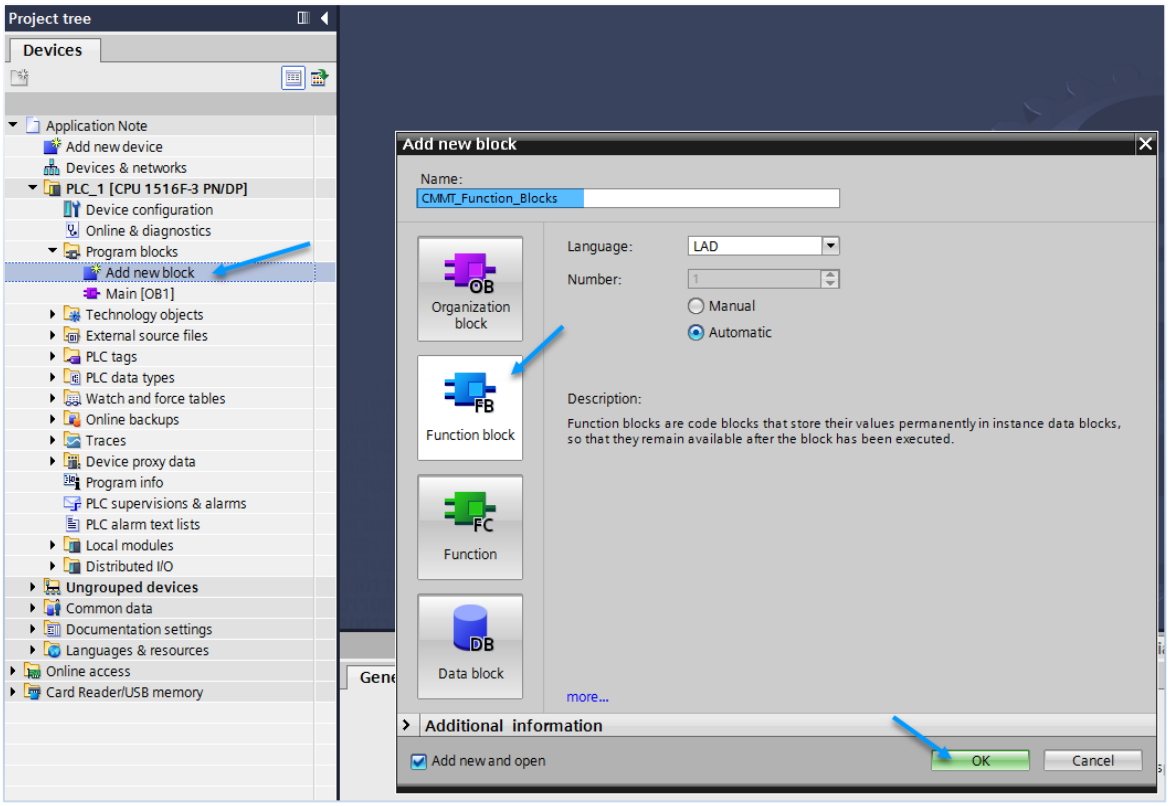
9. After the status switched to ‘OK’, close the dialog:



4.3 Configuring the SINAMICS function blocks

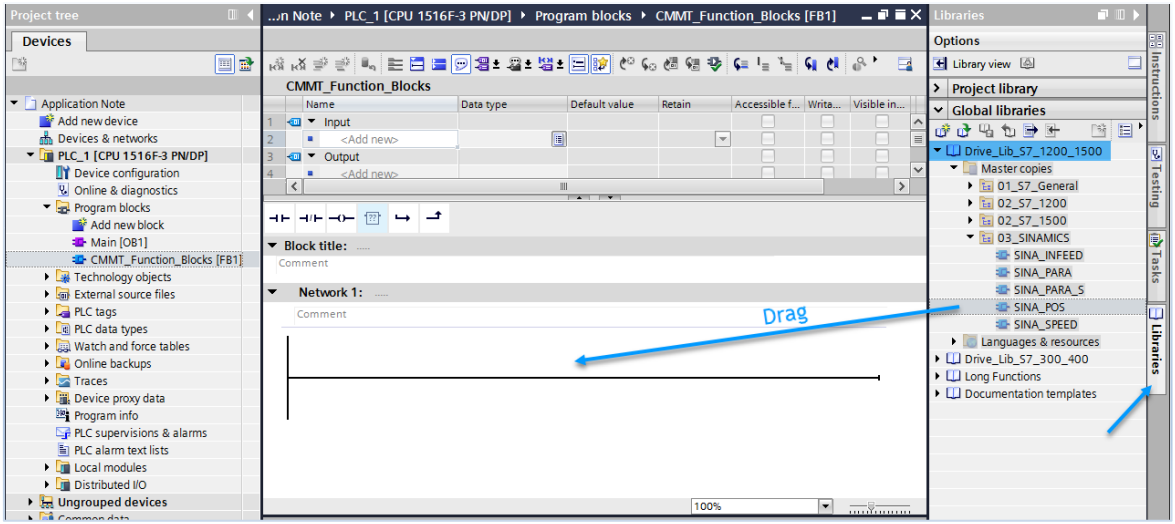
Make sure you first installed the SINAMICS DriveLib to your TIA portal, explained in part 4.1 of this document.

- From the Project Tree select ‘Add new block’ and create a Function Block. Fill in the name (e.g. CMMT_Function_Blocks), select ‘Function block’ and click ‘OK’.

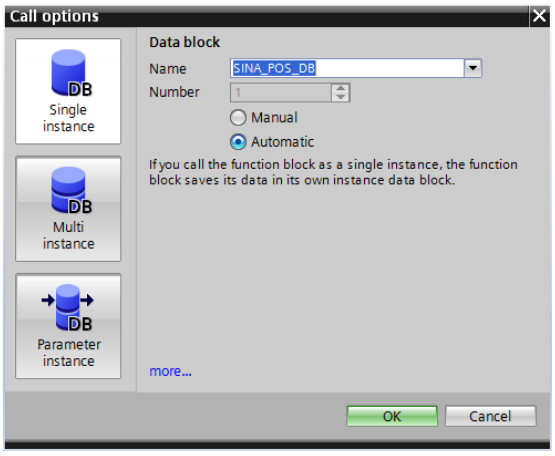


- After creating the function block it jumps straight into it. We now want to open the ‘Libraries’ tab (on the right), open the ‘Drive_Lib_S7_1200_1500’ and open the sub-folder ‘03_SINAMICS’.

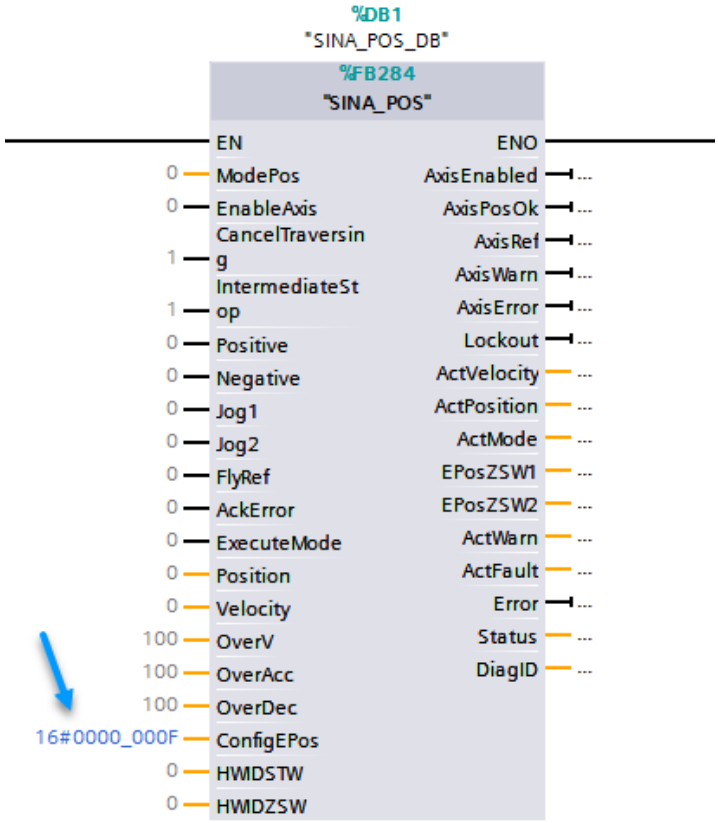
  Drag and drop the **‘SINA_POS’** function block to a network.



- To automatically create the required data blocks, click ‘OK’:

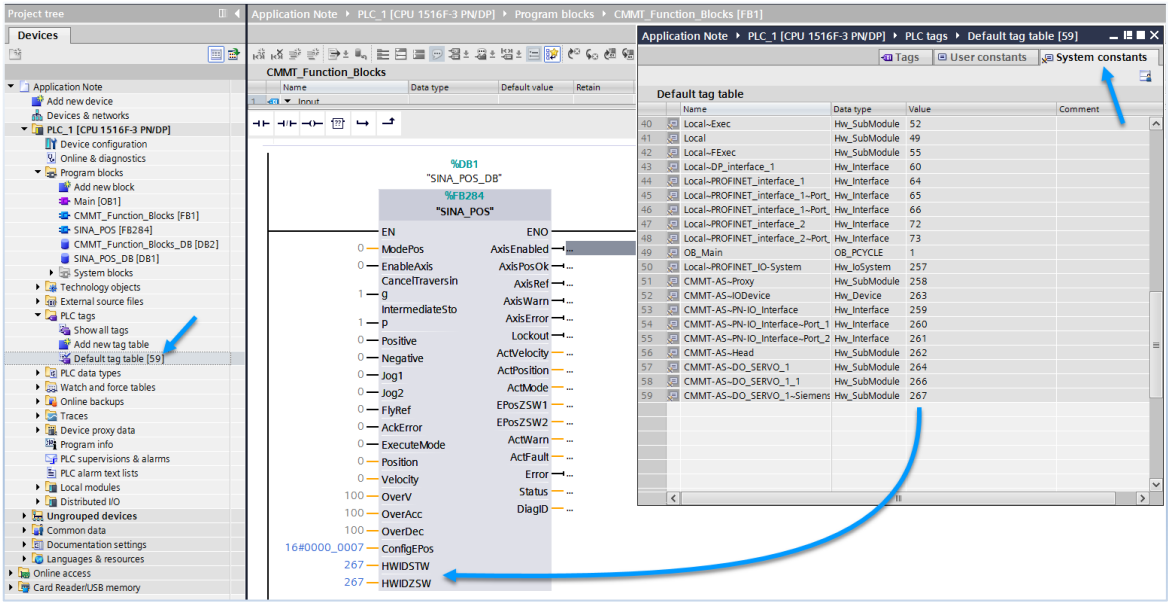


- Festo strongly advises to enable the Software Limit monitoring by the CMMT. To do this, change the default ‘ConfigEPos’ value from ‘16#0000_0003’ to ‘16#0000_000F’ (activating bit 2 and bit 3). More information on this can be found in part 5.2 of this document.

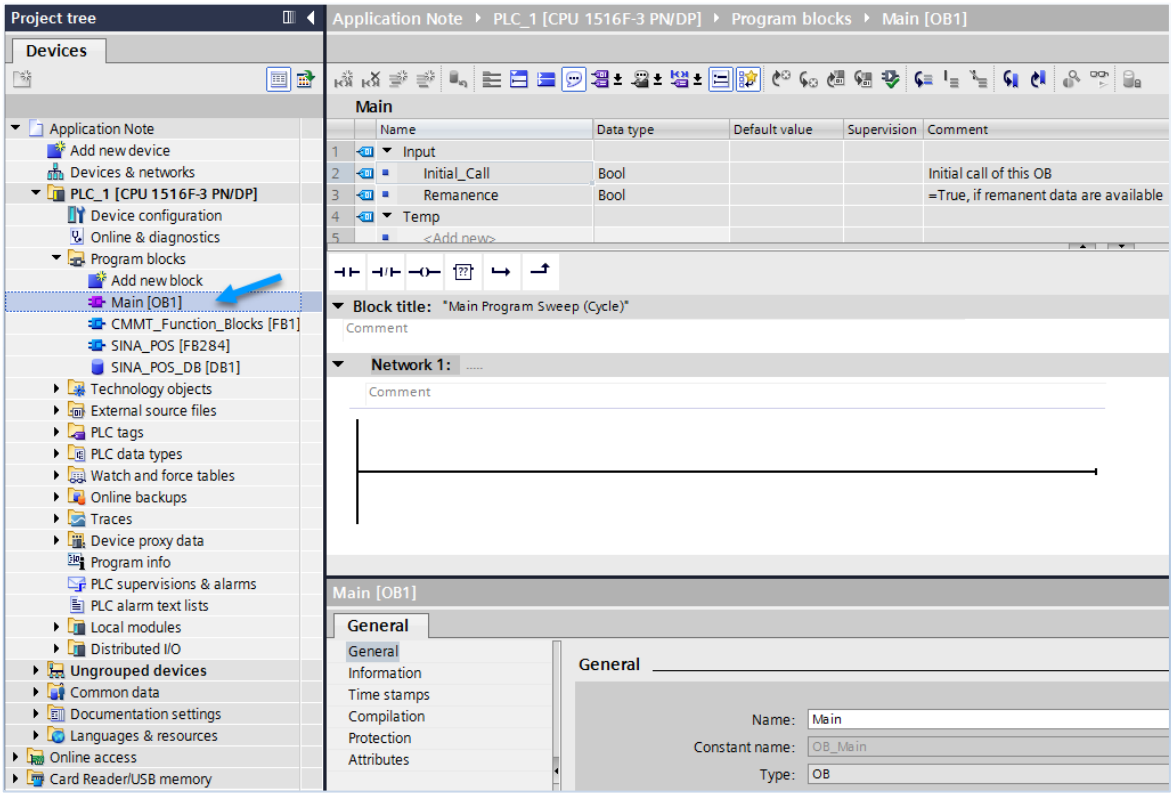


- The function block requires the ‘Hardware identifier’ we made note of in part 4.2.4. You can also find the value in the ‘Default tag table’ --› ‘System constants’.

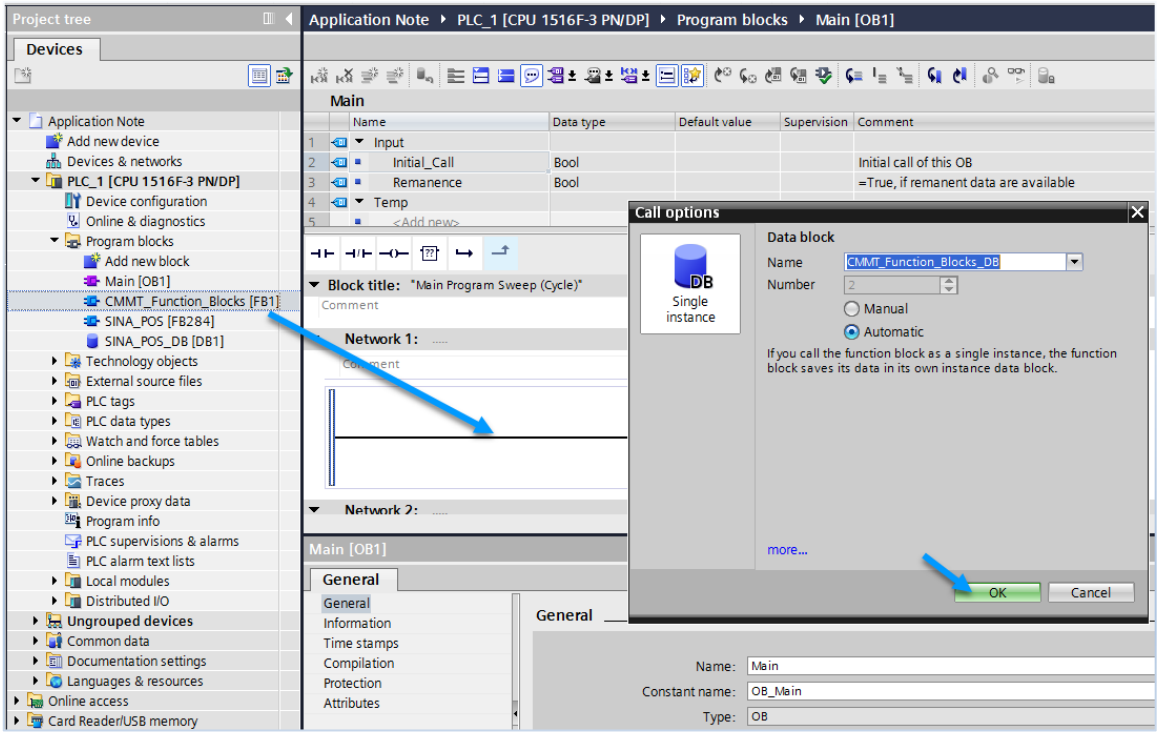
- Set the value to both ‘HWIDSTW’ and ‘HWIDZSW’ on the SINA_POS block



- To make sure the function blocks will be executed we need to call it in the main task. Double click on the ‘Main [OB1]’:

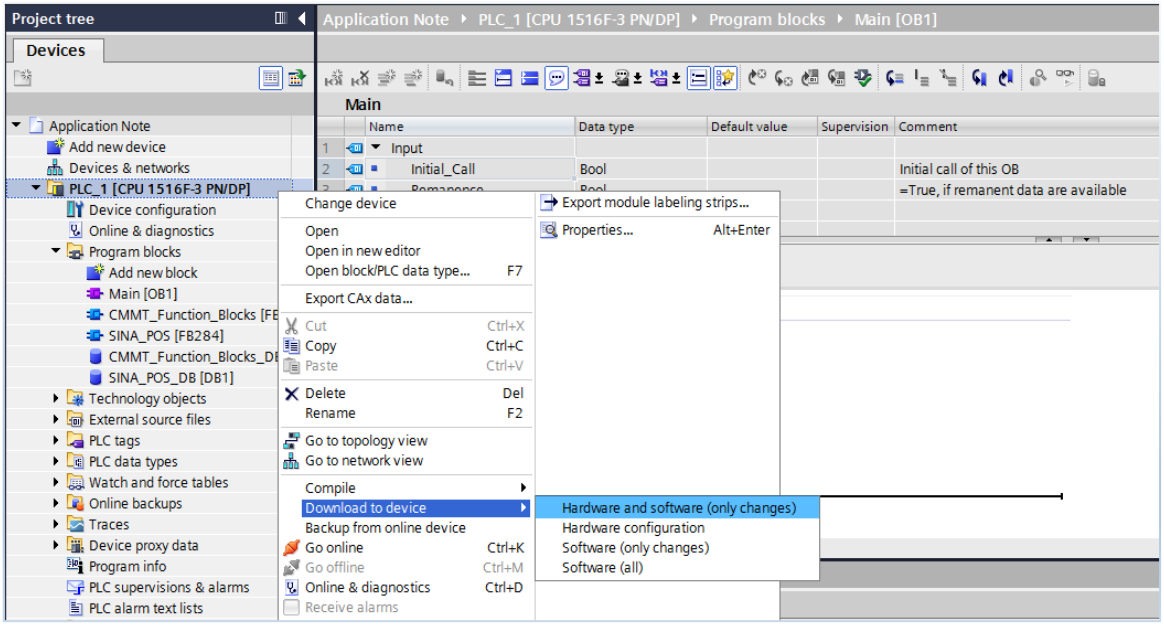


- Now drag and drop the ‘CMMT_Function_Blocks [FB1]’ to Network 1, upon asked to create the Data Block click ‘OK’:

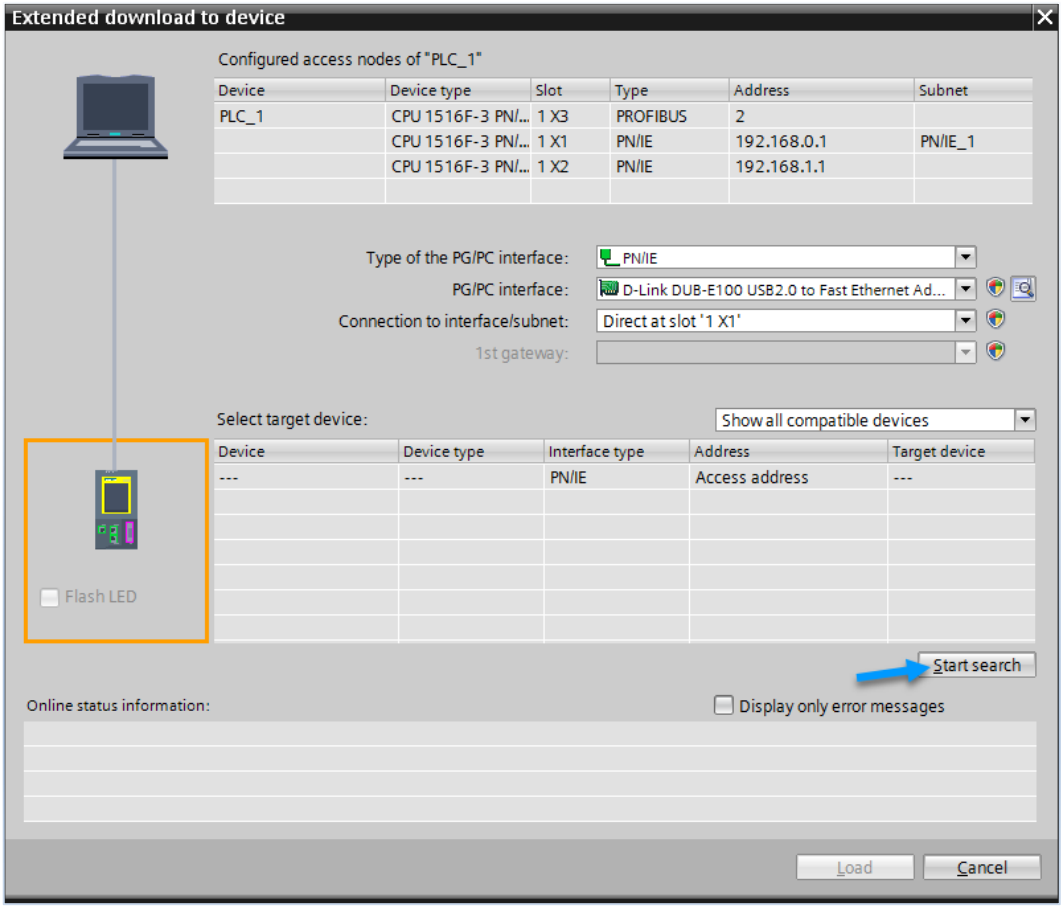


4.4 Compile and Download the program

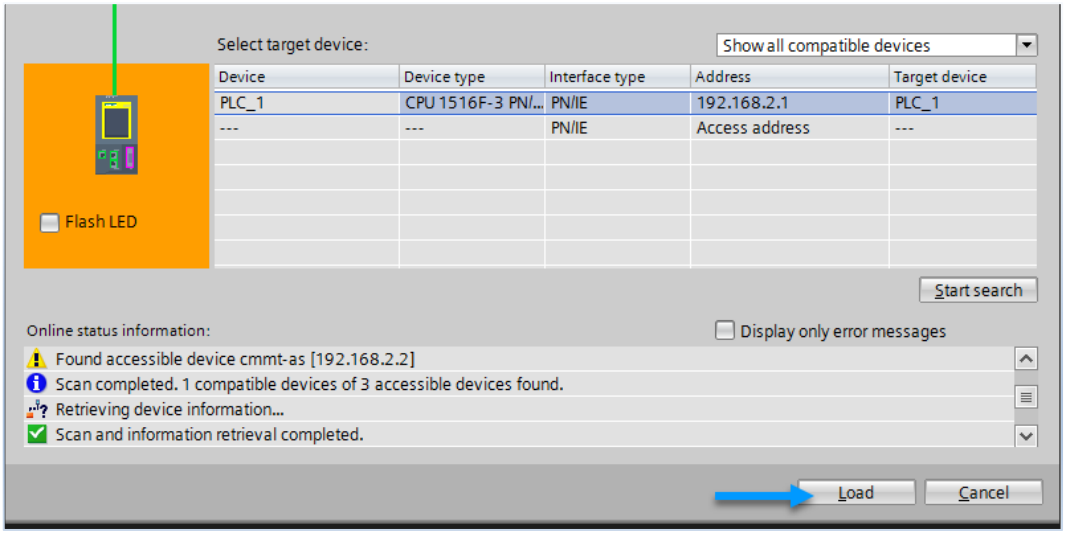
- Right click on the PLC_1 and select ‘Download’ --› ‘Hardware and software (only changes)’:



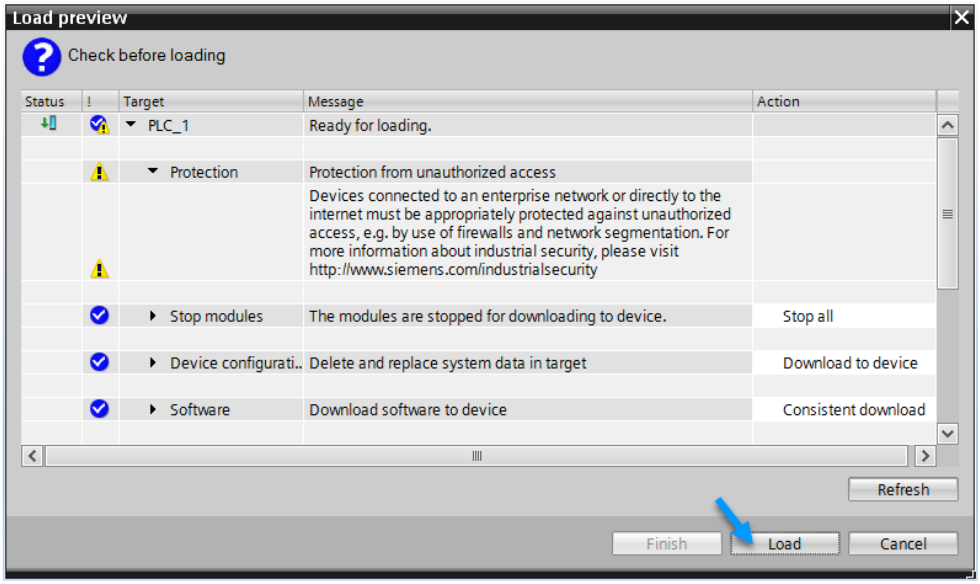
- Start searching for the PLC:



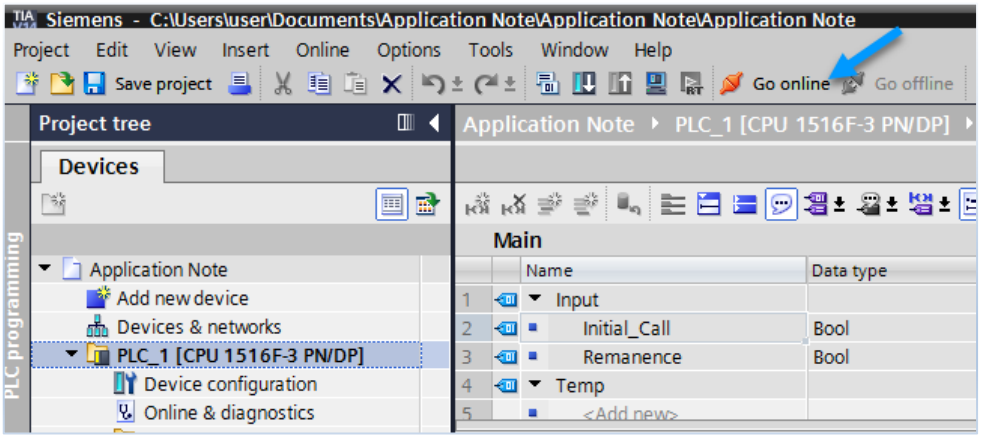
- Select the PLC and load the project:



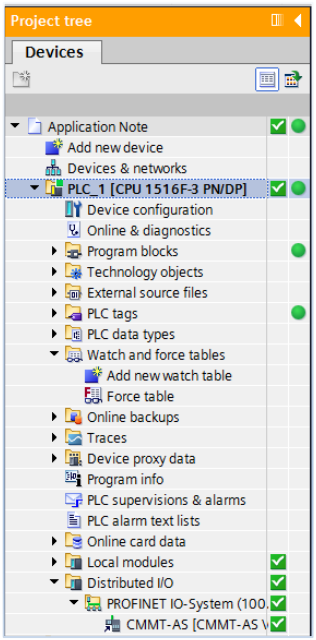
- Select ‘Load’ on the Load preview and ‘Finish’ on the dialog that comes after.



- While still selecting PLC_1 in the Project tree, go online:

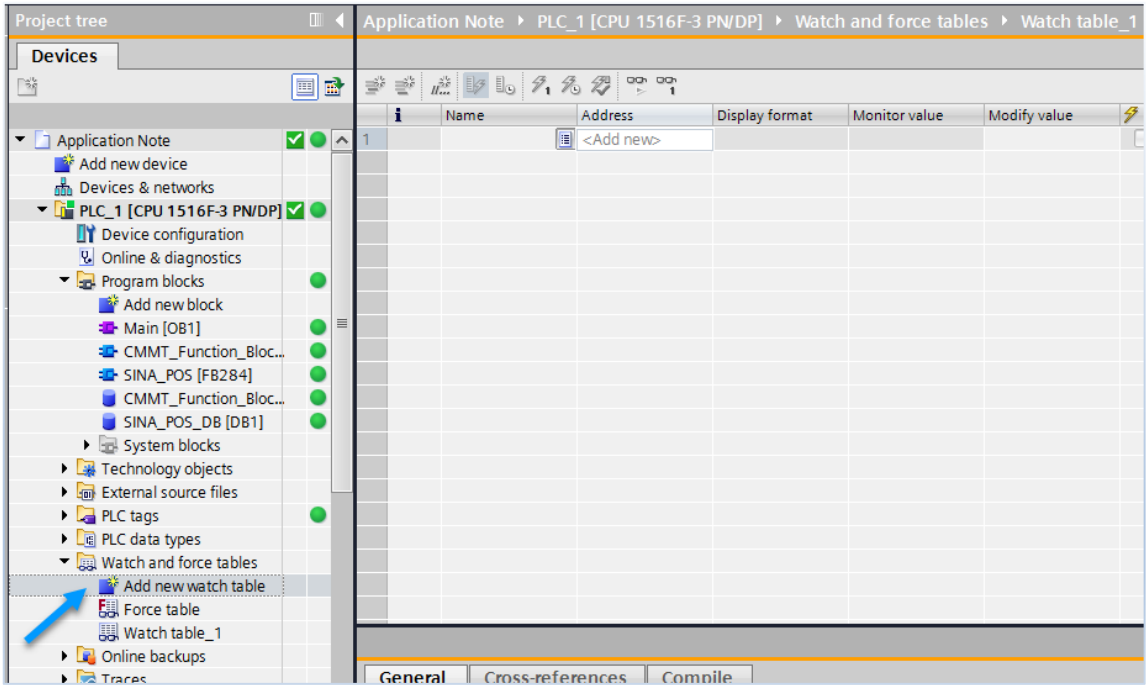


- Make sure the Profinet Network is up and running by checking if all is green and with checkmarks:

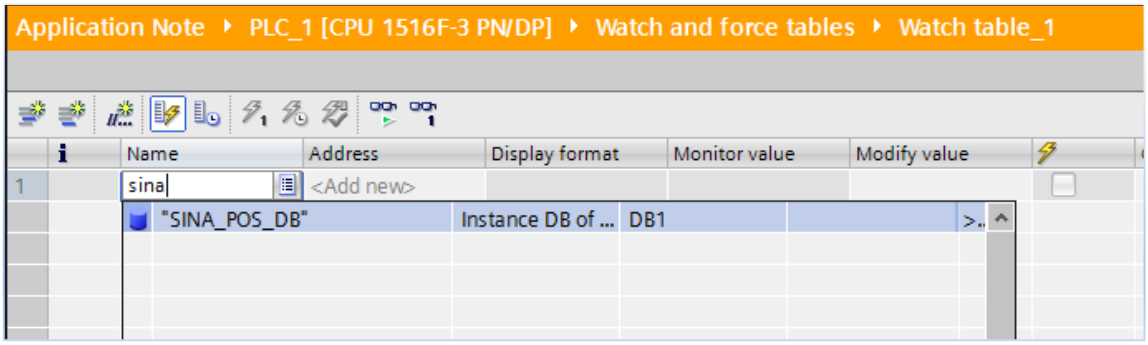


4.5 Use the SINA_POS block with a ‘Watch Table’

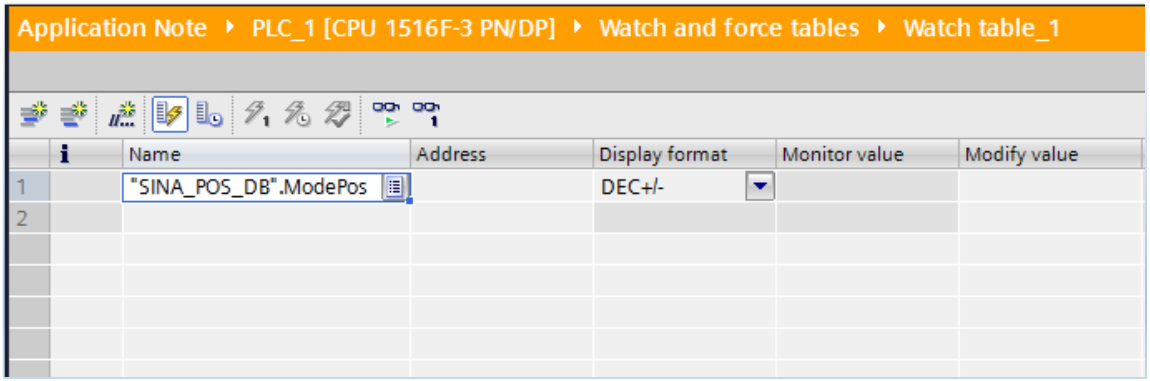
- Double click on ‘Add new watch table’:



- Start typing the name ‘SINA_POS_DB’ and select it by pressing the ‘Tab’-key:

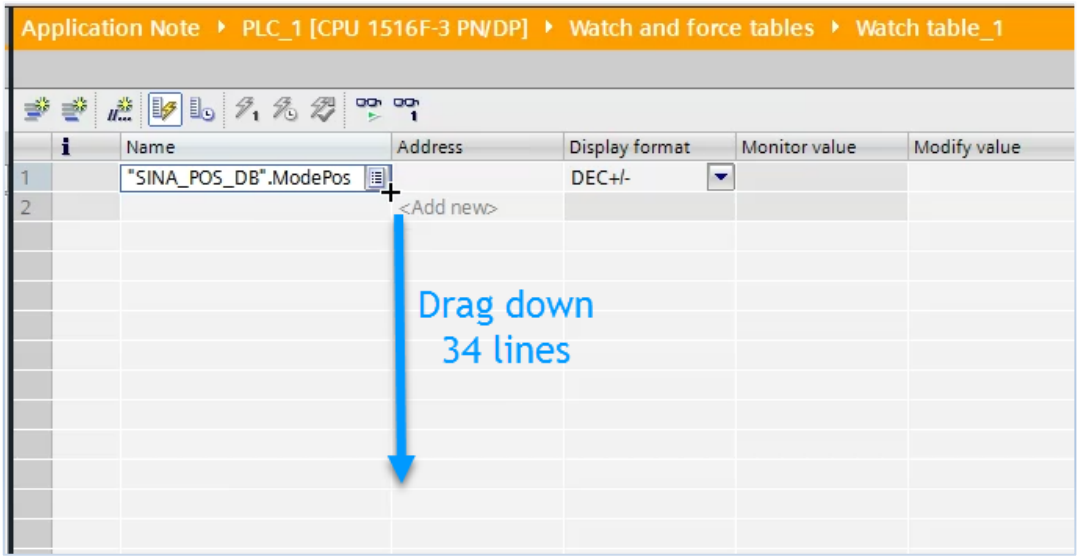


- Type ‘ModePos’ and press the ‘Enter’-key:

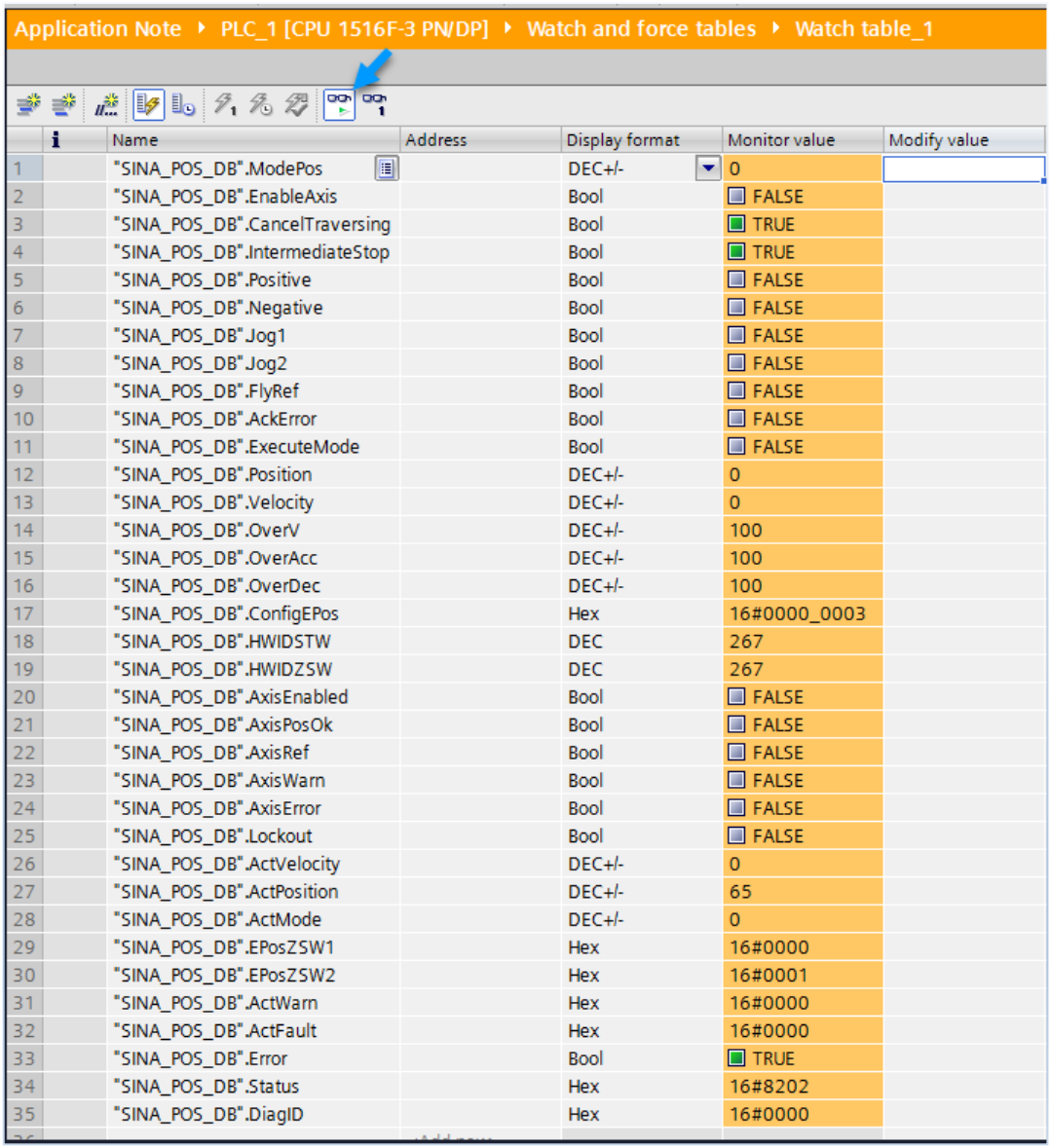


- Drag down from the little square in the bottom right, it should show a + before dragging:

  Drag down 34 lines to add all used variable



- Click on the 'Monitor all' button to watch the variables online:



	Name	Address	Display format	Monitor value	Modify value
1	"SINA_POS_DB".ModePos		DEC+/-	0	
2	"SINA_POS_DB".EnableAxis		Bool	FALSE	
3	"SINA_POS_DB".CancelTraversing		Bool	TRUE	
4	"SINA_POS_DB".IntermediateStop		Bool	TRUE	
5	"SINA_POS_DB".Positive		Bool	FALSE	
6	"SINA_POS_DB".Negative		Bool	FALSE	
7	"SINA_POS_DB".Jog1		Bool	FALSE	
8	"SINA_POS_DB".Jog2		Bool	FALSE	
9	"SINA_POS_DB".FlyRef		Bool	FALSE	
10	"SINA_POS_DB".AckError		Bool	FALSE	
11	"SINA_POS_DB".ExecuteMode		Bool	FALSE	
12	"SINA_POS_DB".Position		DEC+/-	0	
13	"SINA_POS_DB".Velocity		DEC+/-	0	
14	"SINA_POS_DB".OverV		DEC+/-	100	
15	"SINA_POS_DB".OverAcc		DEC+/-	100	
16	"SINA_POS_DB".OverDec		DEC+/-	100	
17	"SINA_POS_DB".ConfigEPos		Hex	16#0000_0003	
18	"SINA_POS_DB".HWIDSTW		DEC	267	
19	"SINA_POS_DB".HWIDZSW		DEC	267	
20	"SINA_POS_DB".AxisEnabled		Bool	FALSE	
21	"SINA_POS_DB".AxisPosOk		Bool	FALSE	
22	"SINA_POS_DB".AxisRef		Bool	FALSE	
23	"SINA_POS_DB".AxisWarn		Bool	FALSE	
24	"SINA_POS_DB".AxisError		Bool	FALSE	
25	"SINA_POS_DB".Lockout		Bool	FALSE	
26	"SINA_POS_DB".ActVelocity		DEC+/-	0	
27	"SINA_POS_DB".ActPosition		DEC+/-	65	
28	"SINA_POS_DB".ActMode		DEC+/-	0	
29	"SINA_POS_DB".EPosZSW1		Hex	16#0000	
30	"SINA_POS_DB".EPosZSW2		Hex	16#0001	
31	"SINA_POS_DB".ActWarn		Hex	16#0000	
32	"SINA_POS_DB".ActFault		Hex	16#0000	
33	"SINA_POS_DB".Error		Bool	TRUE	
34	"SINA_POS_DB".Status		Hex	16#8202	
35	"SINA_POS_DB".DiagID		Hex	16#0000	

5 Using the SINAMICS function blocks

5.1 Enabling and stopping the Axis

The axis is switched on using input bit "**EnableAxis**" **= 1**. OFF2 and OFF3 are preassigned 1 using input "**ConfigEPos**" – and do not have to be written to for operation.

The axis is ready to start when there is no error – "**AxisError**"= "**0**" – and no switching on inhibited – "**Lockout**" = "**0**". Feedback signal "**AxisIEnabled**" goes to "**1**" after switching "**EnableAxis**".

The "**ModePos**" input is decisive for the mode selection. The required operating mode is selected via this input. A simultaneous, multiple mode selection is therefore not possible. However, it is possible to switch between various subordinate modes within the operating mode.

The input signals "**CancelTraversing**" (reject traversing task) and "**IntermediateStop**" (intermediate stop) are relevant for all modes except for jog and must be set to "**1**" when using EPos.

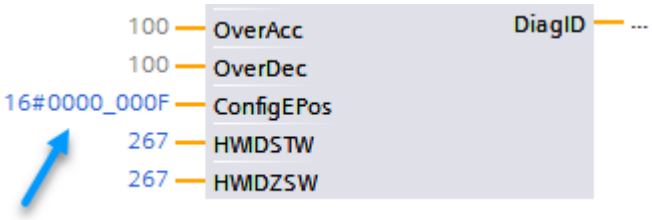
1. If the "**CancelTraversing**" bit is set to "**0**" this results in a ramp stop with 100% of the set deceleration. The task data is rejected and the axis can be assigned a new task from standstill. A mode change is possible in this state.
2. If the "**IntermediateStop**" bit is set to "**0**" this results in a ramp stop of the axis with the currently valid acceleration values. The task data is NOT rejected so that the axis continues with the motion when the bit is set to "**1**". A mode change is possible at standstill.

5.2 Activating the Software and Hardware position limits

By default the SINA_POS library deactivates the function of the CMMT to monitor the Software and Hardware position limits of the axis. Without this function it's possible to instruct the drive to move to a position which is beyond its reachable limit.

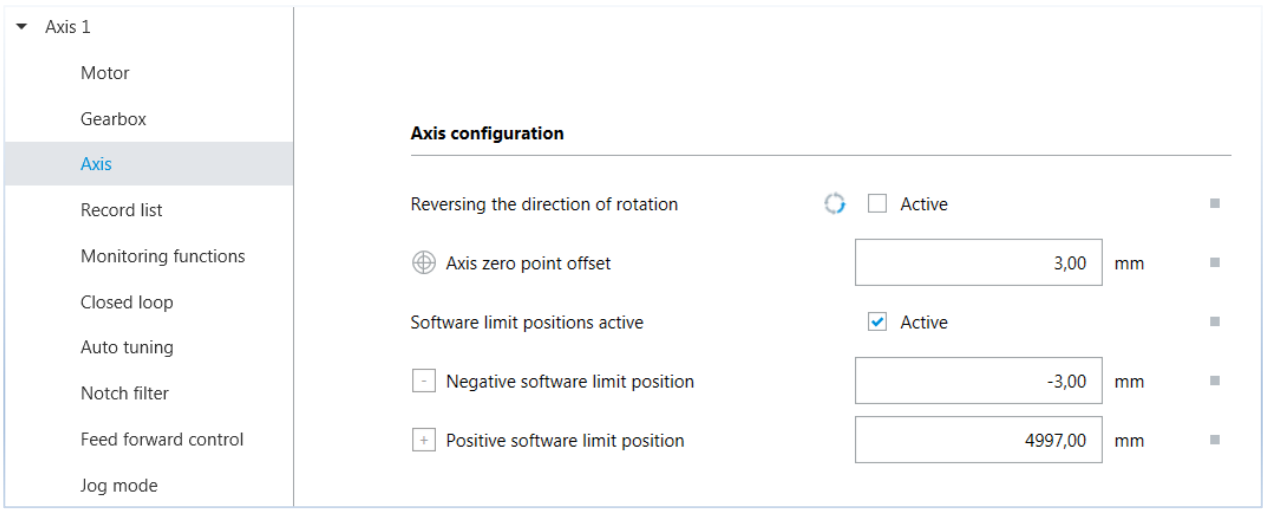
To ensure a safe operation with Software limit monitoring, it is required to enable bit 2 on the "**ConfigEPos**" variable.

For activating the Hardware Limit Switches, enable bit 3.



Since bit 0 and bit 1 are already set, input variable "**ConfigEPos**" must be set to **16#0000_000F**.

Please pay attention that the required parameters in the Festo Automation Suite are also correct. These can be found in the 'Axis' tab:



5.3 Monitoring the Actual speed

Where the setpoint velocity is directly set as user units, the actual drive speed is displayed different in the SINA_POS function block. The variable "**ActVelocity**" is used, where the value is scaled from 0 to 100% with 40000000hex = 100%. The base value can be modified in the Festo Automation Suite, as described in part 3.2.1 of this document. It can also be changed using PNU 60000 (which refers to this exact same parameter).

5.4 Modes of Operations

The CMMT-PN with the SINA_POS function block supports the following modes of operation:

ModePos 1: Relative Positioning
ModePos 2: Absolute Positioning task
ModePos 3: *Not Supported*
ModePos 4: Referencing – Reference point approach
ModePos 5: Referencing - Set reference point
ModePos 6: Traversing blocks (record mode)
ModePos 7: Jog
ModePos 8: *Not Supported*

- **Relative Positioning [ModePos 1]**
  1. Requirements:
     - The mode is selected with "**ModePos**"=1.
     - The device is switched on via "**EnableAxis**"
     - The axis must be referenced
     - The axis is at standstill if selected by an operating mode greater than 3. A change within the operating modes (1,2) is possible at any time.

  2. Sequence:
     The traversing path and dynamic responses are specified via the inputs "**Position**", "**Velocity**", "**OverAcc**" (acceleration override) and "**OverDec**" (deceleration override).
     The operating conditions "**CancelTraversing**" and "**IntermediateStop**" must be set to "**1**". "**Jog1**" and "**Jog2**" have no effect and should be set to "**0**" (false).
     The direction of travel in relative positioning always results from the sign of the traversing path.
     Traversing motion is started with a positive edge at "**ExecuteMode**".
     The block acknowledges when the end of the traversing path is reached successfully with "**AxisPosOk**". If an error occurs during the traversing motion, the output signal "**Error**" is issued.

Note
The current command can be replaced on-the-fly by a new command via "**ExecuteMode**". This is only possible for the "**ModePos**" 1 and 2.

- **Absolute Positioning [ModePos 2]**

  1. Requirements:
     - The mode is selected with "**ModePos**"=2
     - The device is switched on via "**EnableAxis**"
     - The axis must be referenced
     - The axis is at standstill if selected by an operating mode greater than 3. A change within the operating modes (1,2) is possible at any time.

  2. Sequence:

     The traversing path and dynamic responses are specified via the inputs "**Position**", "**Velocity**", "**OverAcc**" (acceleration override) and "**OverDec**" (deceleration override).

     The operating conditions "**CancelTraversing**" and "**IntermediateStop**" must be set to "**1**". "**Jog1**" and "**Jog2**" have no effect and must be set to "**0**".

     Traversing motion is started with a positive edge at "**ExecuteMode**".

     The block acknowledges when the end of the traversing path is reached successfully with "**AxisPosOk**". If an error occurs during the traversing motion, the output signal "**Error**" is issued.

➔ **Note**

The current command can be replaced on-the-fly by a new command via "**ExecuteMode**". This is only possible for the "**ModePos**" 1 and 2

- **Referencing - Reference point approach [ModePos 4]**

  The **Referencing – reference point approach** mode enables the reference point approach of the axis, selected in the Automation Suite.

  1. Requirements:
     - The mode is selected with "**ModePos**"=4
     - The device is switched on using "**EnableAxis**".
     - The axis is at standstill

  2. Sequence:

  All required parameters for homing (homing mode, velocity, etc) are set in the Automation Suite.

  The reference point approach is started with a positive edge at "**ExecuteMode**".

  Output signal "**AxisRef**" is set if the reference point is appropriately found and evaluated. If an error occurs during traversing motion, the output signal "**Error**" is issued.

- **Referencing – Set reference point [ModePos 5]**

  The **Referencing – set reference point** mode enables the referencing of the axis at the current position.

  1. Requirements:
     - The mode is selected with "**ModePos**"=5
     - The axis can be in closed-loop control, but must be at a standstill.

  2. Sequence:

  The axis is at standstill and the reference point is set with a positive edge at "**ExecuteMode**".

  If an error occurs while setting the reference point, the output signal "**Error**" is issued.

- **Traversing blocks (record mode) [ModePos 6]**

  The **Traversing blocks** mode is implemented via the "**Traversing blocks**" drive function. It enables the creation of automatic programs, velocity mode, force mode, travel to fixed stop and outputs to be set and reset. It uses the records that are created in the 'Record list' tab in the Automation Suite.

  1. Requirements:
     - The mode is selected with "**ModePos**"=6
     - The device is switched on using "**EnableAxis**"
     - The axis is at standstill
     - The axis must be referenced

  2. Sequence:

  The selection of the traversing task to be started is set via the "**Position**" input. The value refers to the record list and can be between 0 and 127.

  The operating conditions "**CancelTraversing**" and "**IntermediateStop**" must be set to "**1**". "**Jog1**" and "**Jog2**" have no effect and should be set to "**0**".

  Traversing motion is started with a positive edge at "**ExecuteMode**".

  The block displays the current command processing with "**AxisEnabled**" and acknowledges when the target position is reached successfully or the last task step completed with "**AxisPosOk**". If an error occurs during the traversing motion, the output signal "**Error**" is issued.

- **Jog [ModePos 7]**

  1. Requirements:
     - The mode is selected with "**ModePos**" = 7.
     - The device is switched on using "**EnableAxis**"
     - The axis is at standstill

  2. Sequence:

  "**Jog1**" and "**Jog2**" are the signal sources for the jog mode in EPos. The "**ExecuteMode**" signal is not required in this mode.

  "**Jog1**" = Positive
  "**Jog2**" = Negative

  The dynamic values for jogging are set in the Automation Suite on the 'Jog mode' tab. The corresponding parameters are:

  - Velocity (slow)
  - Acceleration (slow)
  - Jerk (slow)

5.5 Diagnostic messages

The function block can give multiple types of diagnostic messages. The following chapter will explain how to handle or solve them.

- **Drive Error**

  When the drive is in error, the output "**ActFault**" of the function block SINA_POS will provide a message number. This message number relates to the same number which is shown in the Festo Automation Suite.

  After elimination of the fault, the error must be acknowledged using the bit "**AckError**" before enabling the axis again.

- **Drive Warning**

  When the drive has a warning message, the output "**ActWarning**" will provide a message number.

  After elimination of the warning the message number will disappear.

- **Function block faults**

  When an error on the function block has been detected, the "**Error**" group error and the "**ErrorId**" are set. The following errors are monitored:

Error number Status	Cause	Remedy
16#7002	No error	--
16#8600	Interruption of the communication to the SINAMICS drive: Error DPRD_DAT	Check the communication connections / settings (see DiagId)
16#8601	Interruption of the communication to the SINAMICS drive: Error DPWR_DAT	Check the communication connections / settings (see DiagId)
16#8202	Incorrect operating mode selected	Set "ModePos" from 1 to 8
16#8203	Incorrect parameterization of the override inputs	Check the settings of the override inputs
16#8204	Invalid traversing block number	Enter a traversing block number from 0 to 127
16#8401	Alarm message(s) in the SINAMICS drive	Evaluation of the error code at the "ActFault" output
16#8402	Switching on inhibited of the SINAMICS drive active	Check whether axis/encoder is parked, safety functions active, Parameter p10 ≠ 0
16#8403	Flying referencing could not be started	Check for pending alarms/faults in the drive,

The following settings will help for text-transfer:

Options	**Settings**
Pasting within the same document	Keep Source Formatting
Pasting between documents	Use Destination Styles
Pasting between documents when style definitions conflict	Use Destination Styles
Pasting from other programs	Use Destination Styles

Table 5.1: Word Options