

Configuration of technology objects with SIMATIC S7-1500 and SINAMICS S210 in the TIA Portal

SINAMICS S210

<https://support.industry.siemens.com/cs/ww/de/view/109749795>

Siemens
Industry
Online
Support



Legal information

Use of application examples

Application examples illustrate the solution of automation tasks through an interaction of several components in the form of text, graphics and/or software modules. The application examples are a free service by Siemens AG and/or a subsidiary of Siemens AG ("Siemens"). They are non-binding and make no claim to completeness or functionality regarding configuration and equipment. The application examples merely offer help with typical tasks; they do not constitute customer-specific solutions. You yourself are responsible for the proper and safe operation of the products in accordance with applicable regulations and must also check the function of the respective application example and customize it for your system.

Siemens grants you the non-exclusive, non-sublicensable and non-transferable right to have the application examples used by technically trained personnel. Any change to the application examples is your responsibility. Sharing the application examples with third parties or copying the application examples or excerpts thereof is permitted only in combination with your own products. The application examples are not required to undergo the customary tests and quality inspections of a chargeable product; they may have functional and performance defects as well as errors. It is your responsibility to use them in such a manner that any malfunctions that may occur do not result in property damage or injury to persons.

Disclaimer of liability

Siemens shall not assume any liability, for any legal reason whatsoever, including, without limitation, liability for the usability, availability, completeness and freedom from defects of the application examples as well as for related information, configuration and performance data and any damage caused thereby. This shall not apply in cases of mandatory liability, for example under the German Product Liability Act, or in cases of intent, gross negligence, or culpable loss of life, bodily injury or damage to health, non-compliance with a guarantee, fraudulent non-disclosure of a defect, or culpable breach of material contractual obligations. Claims for damages arising from a breach of material contractual obligations shall however be limited to the foreseeable damage typical of the type of agreement, unless liability arises from intent or gross negligence or is based on loss of life, bodily injury or damage to health. The foregoing provisions do not imply any change in the burden of proof to your detriment. You shall indemnify Siemens against existing or future claims of third parties in this connection except where Siemens is mandatorily liable.

By using the application examples you acknowledge that Siemens cannot be held liable for any damage beyond the liability provisions described.

Other information

Siemens reserves the right to make changes to the application examples at any time without notice. In case of discrepancies between the suggestions in the application examples and other Siemens publications such as catalogs, the content of the other documentation shall have precedence.

The Siemens terms of use (<https://support.industry.siemens.com>) shall also apply.

Security information

Siemens provides products and solutions with Industrial Security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place. For additional information on industrial security measures that may be implemented, please visit <https://www.siemens.com/industrialsecurity>.

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at: <https://www.siemens.com/industrialsecurity>.

Table of contents

	Legal information	2
1	Task	4
2	Task realization	5
	2.1 Validity	5
	2.2 Hardware and software components used	5
3	Basic information	6
	3.1 Functional principle of the user program	6
	3.2 Installing and commissioning	9
4	Configuration of the application example	10
	4.1 Configuration of the SINAMICS S210 via web server	10
	4.1.1 Setting the administrator password	10
	4.1.2 Configuring Settings via SINAMICS Web Server	11
	4.2 Configurations in the TIA Portal	14
	4.2.1 Creation of new project	14
	4.2.2 Add SIMATIC S7-1500 CPU to project	15
	4.2.3 Configuration of the SINAMICS S210 in Startdrive	18
	4.2.4 Configuration of the SINAMICS S210 using GSDML	19
	4.2.5 Device configuration of the SINAMICS S210 PN	21
	4.2.6 Connection between the SINAMICS S210 PN and the S7-1500 CPU	24
	4.2.7 Configuration of the topology between SINAMICS S210 PN and the S7-1500 CPU	24
5	Programming the application	26
	5.1 Configuration of technological objects	26
	5.1.1 Adding and configuring the positioning axis of the first SINAMICS S210	26
	5.1.2 Adding and configuring the synchronous axis of the second SINAMICS S210	31
	5.2 Creating the S7 program	34
	5.2.1 Programming the positioning axis (master axis)	34
	5.2.2 Programming the synchronous axis (slave axis)	37
	5.2.3 Programming of the cyclic OB	40
	5.2.4 Watch table	41
6	Operating examples	42
	6.1 Scenario: Only positioning the master drive	42
	6.1.1 Relative positioning	42
	6.2 Scenario: Master and slave drive together	43
	6.2.1 Relative positioning	43
	6.2.2 JOG function (jogging)	44
7	Appendix	45
	7.1 Motion Control Instructions	45
	7.2 Loading this application example into the PLC	46
8	Links and Literature	47
9	Version history	47

1 Task

Introduction

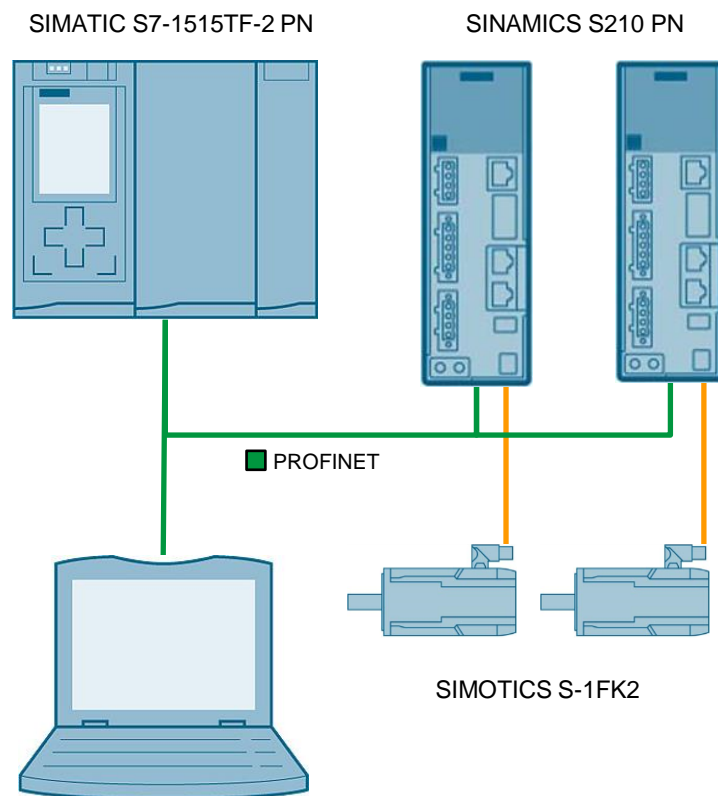
SIMATIC S7-1500 CPUs support the connection of drives as speed axis, positioning axis or synchronous axis via PROFINET, PROFIBUS or an analog drive connection. In TIA Portal, it is possible to control a SINAMICS S210 drive in a TIA Portal program and operate it using motion control instructions.

In this application example two "SINAMICS S210" are used. The first is operated as a position-controlled drive and functions as the master axis for the second drive configured with synchronism.

Overview of the automation task

The following figure shows an overview of the automation task.

Figure 1-1: Automation task



2 Task realization

2.1 Validity

Application example is valid for:

- TIA Portal V14 or higher
- S7-1500 CPU with PROFINET interface
- SINAMICS S210 PN FW V5.1 or higher
- SIMOTICS S-1FK2

Delimitation

PROFINET communication is not described in detail in this application example. Basic knowledge in this area is assumed.

Required knowledge

Basic knowledge of TIA Portal is required.

2.2 Hardware and software components used

The application example was created with the following components:

Hardware components

Table 2-1

Component	Quantity	Article number	Note
SIMATIC S7-1500 CPU 1515TF-2 PN	1	6ES7515-2UM01-0AB0	V2.6
SINAMICS S210 PN	2	6SL3210-5HB10-1UF0	400 W
Motor SIMOTICS S-1FK2	2	1FK2103-5AG00-0SB0-Z	400 W

Note

Alternatively, a SIMATIC S7 CPU 1511T-1 can be used to carry out this application example. (article number: 6ES7511-1TK01-0AB0)

Standard software components

Table 2-2

Component	Quantity	Article number	Note
TIA Portal V15.1	1	6ES7822-1AA05-0YA5	Professional
SINAMICS Startdrive V15.1	1	6SL3072-4FA02-0XA0	Basic

Example files and projects

The following list contains all files and projects used in this example.

Table 2-3

Component	Note
109749795_Conf_PosAxis_SynAxis_S210_S7-1500_PROJ.zip	Project file
109749795_Conf_PosAxis_SynAxis_S210_S7-1500_DOC_en.pdf	Reference document

3 Basic information

3.1 Functional principle of the user program

S7-1500 Motion Control

S7-1500 Motion Control supports controlled positioning and movement of axes and is an integral part of every S7-1500 CPU. The CPU S7-1500T technology offers additional motion control functions.

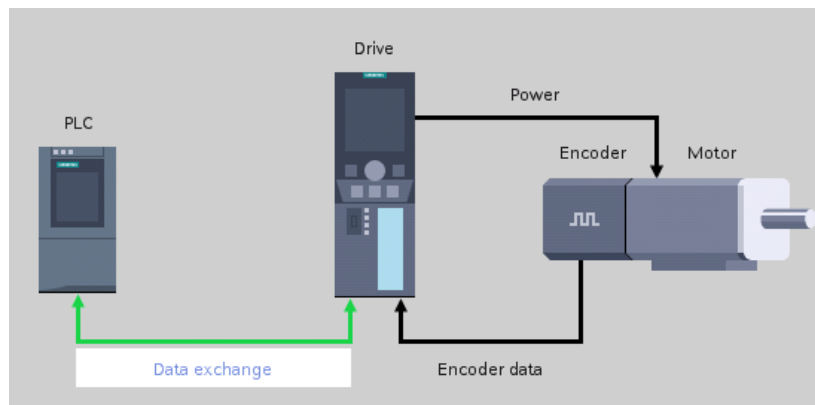
The Motion Control functionality supports the following technology objects:

- Speed axis
- Positioning axis
- Synchronous axis
- External encoder
- Cam and cam track (from version 3.0)
- Cam disk (for S7-1500T from version 3.0)
- Kinematics (for S7-1500T from version 4.0)

The axis control panel and comprehensive online and diagnostic functions support the commissioning and optimization of drives.

Two axes are implemented in this application example: a "positioning axis" serving as master axis and a "synchronous axis" serving as slave axis.

Figure 3-1: Configuration as positioning axis



Note

The configuration of the technology objects "Positioning axis" and "Synchronous axis" is described in section [5.1](#).

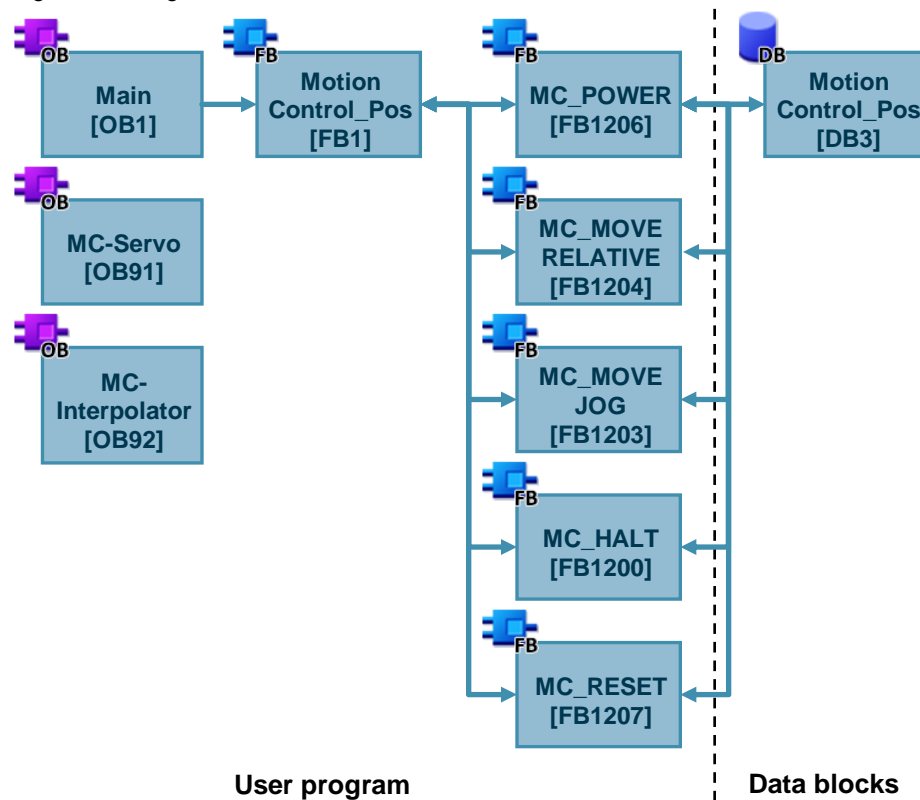
Structure of the user program for the master axis

In this application example, the SINAMICS S210 drive, which serves as the master axis, is configured as the positioning axis. In a user program, this position-controlled drive can be controlled using Motion Control instructions. To enable this control, the following instructions have been added to the program:

- MC_Power (FB 1206)
- MC_MoveRelative (FB1204)
- MC_MoveJog (FB 1203)
- MC_Halt (FB 1200)
- MC_Reset (FB 1207)

The Motion Control instructions for the master axis are called in the function block "MotionControl_Pos" (FB 1).

Figure 3-2 Program structure of the master axis



Structure of the user program for the slave axis

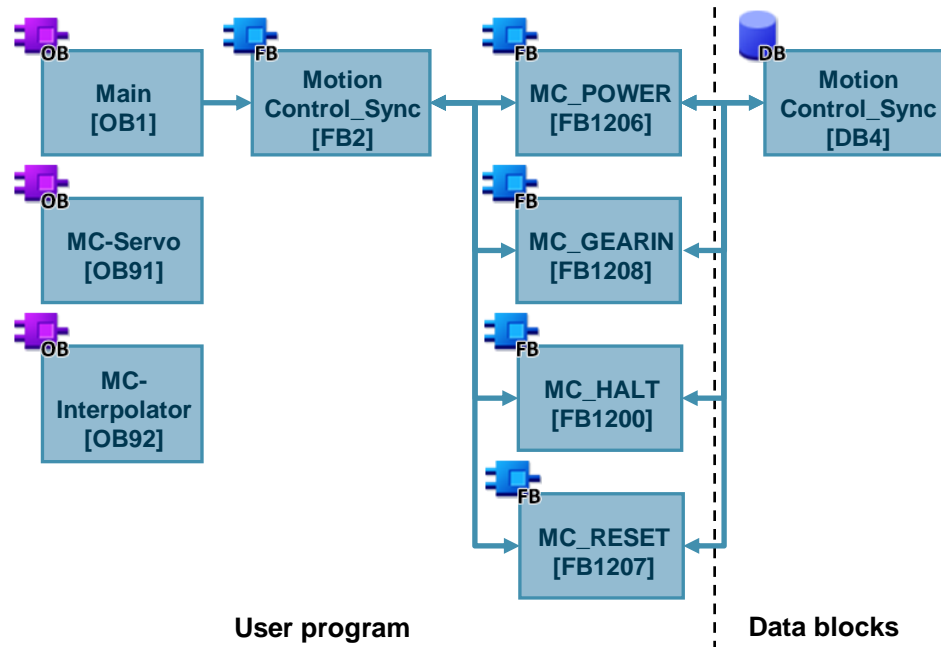
In this application example, the SINAMICS S210 drive, which serves as a slave axis, is configured as a synchronous axis. In the user program, the motion control block "MC_GearIn" can be used to synchronize the slave axis with the master axis configured as the positioning axis.

For this purpose, the following motion control instructions have been added to the program for the slave axis:

- MC_Power (FB 1206)
- MC_GearIn (FB 1208)
- MC_Reset (FB 1207)
- MC_Halt (FB 1200)

The Motion Control instructions for the slave axis are called in the function block "MotionControl_Sync" (FB 2).

Figure 3-3 Program structure of the slave axis

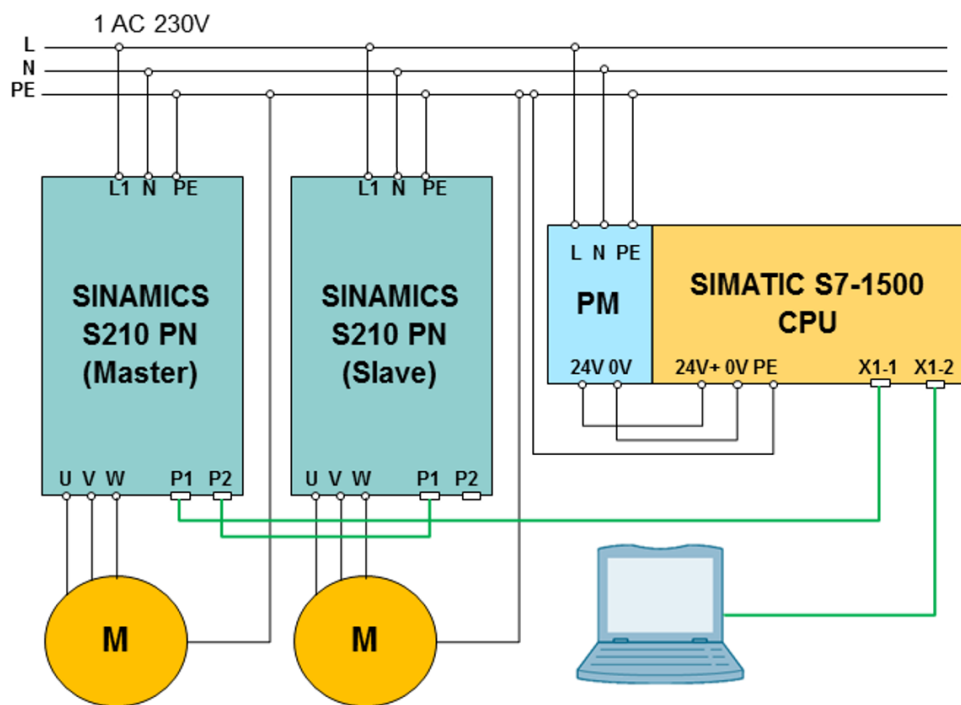


3.2 Installing and commissioning

The following figure shows the hardware structure of the application:

NOTICE	<p>Incorrect wiring can damage the drive!</p> <p>1-phase SINAMICS inverters are used in this application. Make sure that a supply voltage of 230V is applied; otherwise the drives may be damaged!</p>
---------------	--

Figure 3-4 Electrical plan



4 Configuration of the application example

This section describes in detail the project planning for the SINAMICS S210 (including the initial setup via web server) and for the S7-1500 CPU via TIA Portal.

4.1 Configuration of the SINAMICS S210 via web server

4.1.1 Setting the administrator password

To gain full access to the drive, the user must log on as an administrator. First, however, a password is required to gain administrator access.

To set the password, the drive must be switched on and connected to the PG/PC via the service interface (X127) to the web server within 10 minutes.

When using the **default IP address 169.254.11.22**, the following screen is displayed only if no administrator password has been assigned.

Figure 4-1

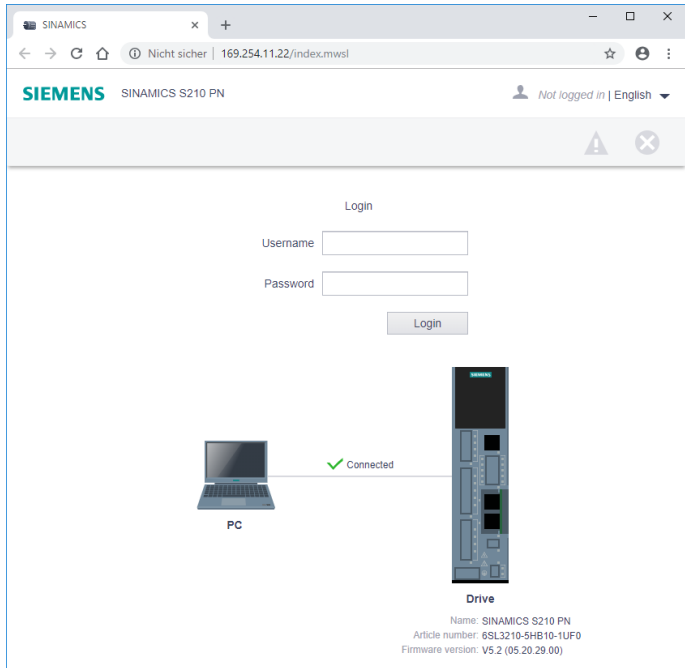
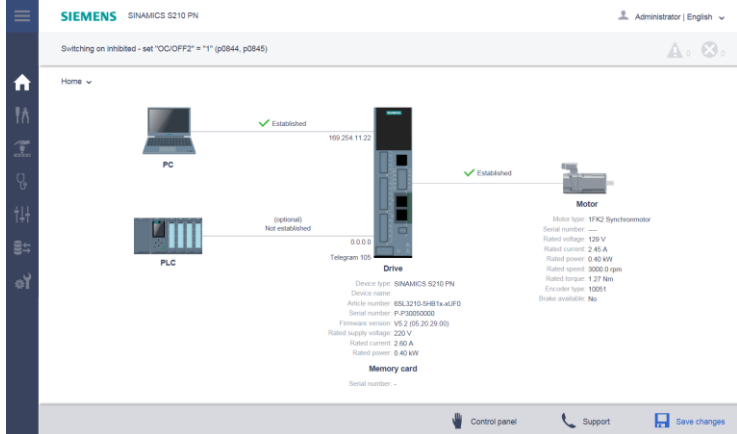
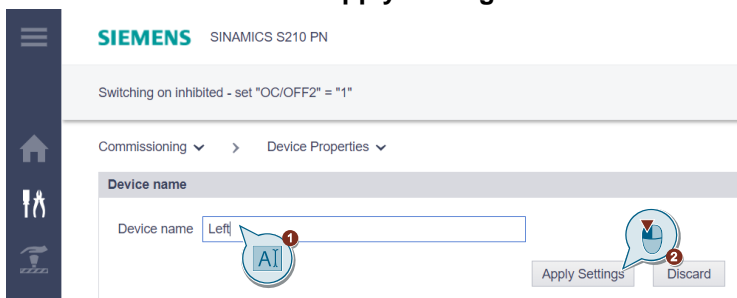
The screenshot shows a web browser window titled "Initial Setup". At the top left is a blue information icon (i). The main text reads: "To get access to the drive you must log in as Administrator within ten minutes. Define a password." Below this text are two input fields: "Password" and "Confirm password". Underneath the input fields is a section titled "Security information" which contains a paragraph of text and a URL: <http://www.siemens.com/industrialsecurity>. At the bottom right of the window is an "OK" button.

Note

- The password is usually set to prevent unauthorized use. To ensure this protection, the password should consist of the following:
 - at least 8 characters
 - Uppercase and lowercase letters:
 - Numbers and special characters (e.g.: !% + ...)The password should not be used elsewhere.
- The display changes to the login screen after 10 minutes, even if no "**administrator password**" has been assigned. When this time has expired, the user can assign the administrator password for the first time by switching the drive off and on again, so that the initial input mask appears again.

4.1.2 Configuring Settings via SINAMICS Web Server

Login and Assign Device Names

No.	Action	Comments
1.	<p>Log in via the web server:</p> 	<p>Note: Use "Administrator" as the user name and the password you created previously.</p>
2.	<p>System overview with menu for easy access:</p> 	
3.	<p>Select "Commissioning" and "Device" in the navigation menu. Select a name and select "Apply Settings":</p> 	<p>Suggestion: Use names to easily distinguish the drives, e.g. according to their position in the control cabinet or rack. Example: "Left" and "Right"</p>

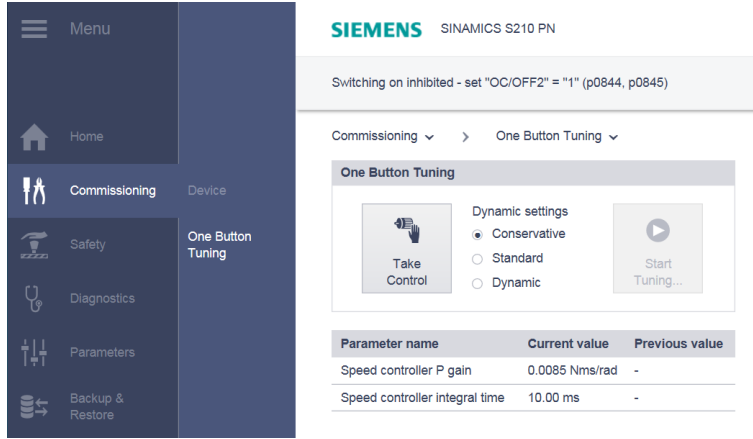
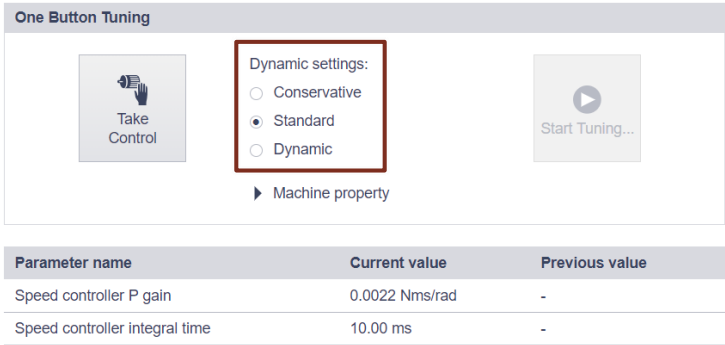
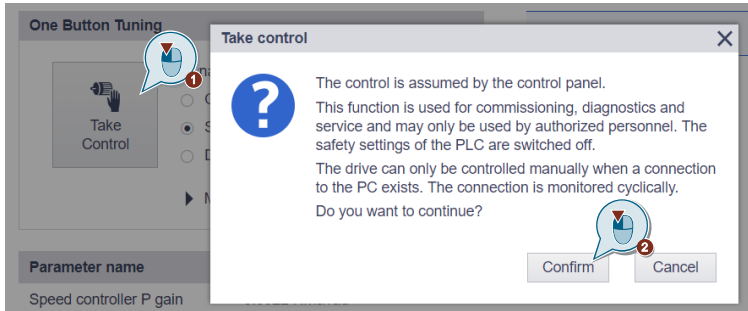
One Button Tuning

The main part of the basic commissioning is controlled by the **"One Button Tuning"**. This means that the optimum adjustment of the drive controller can be carried out very quickly and with few inputs, as shown below.

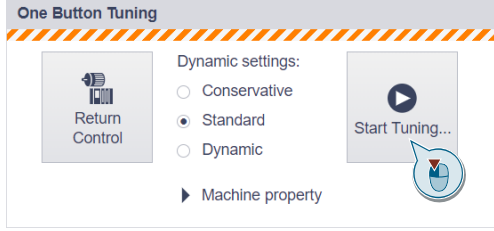
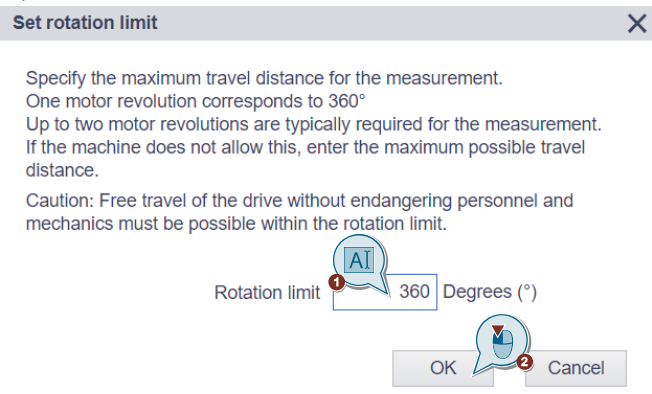
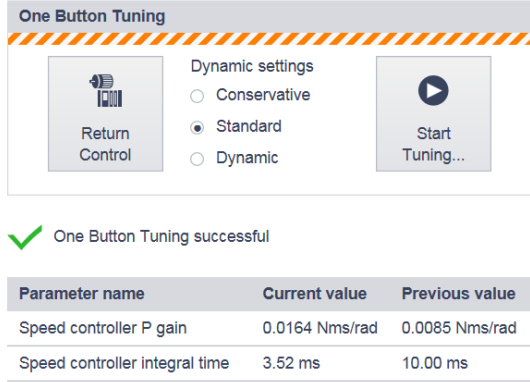
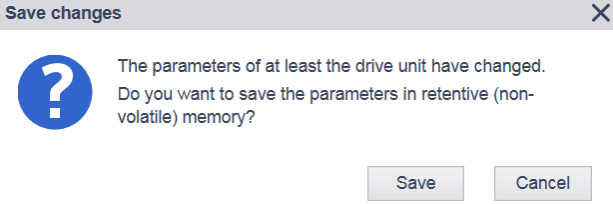
Note

When configuring the SINAMICS S210 PN via Startdrive, the "One Button Tuning" can also be carried out in the TIA Portal.

The "One Button Tuning" can be found in the commissioning mask of the drive.

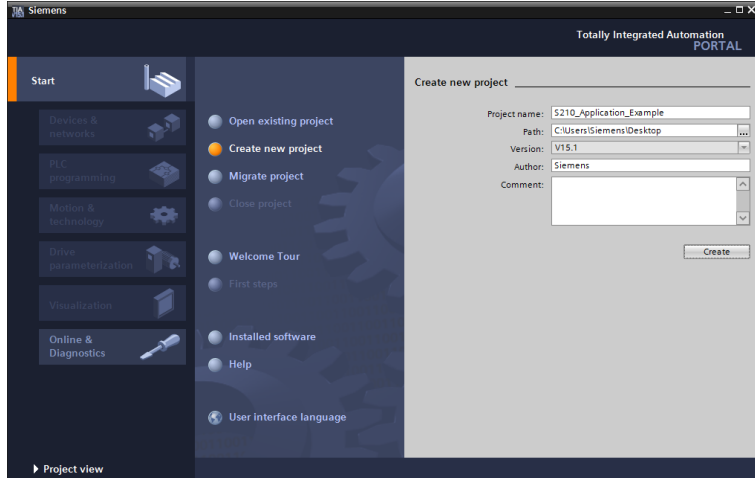
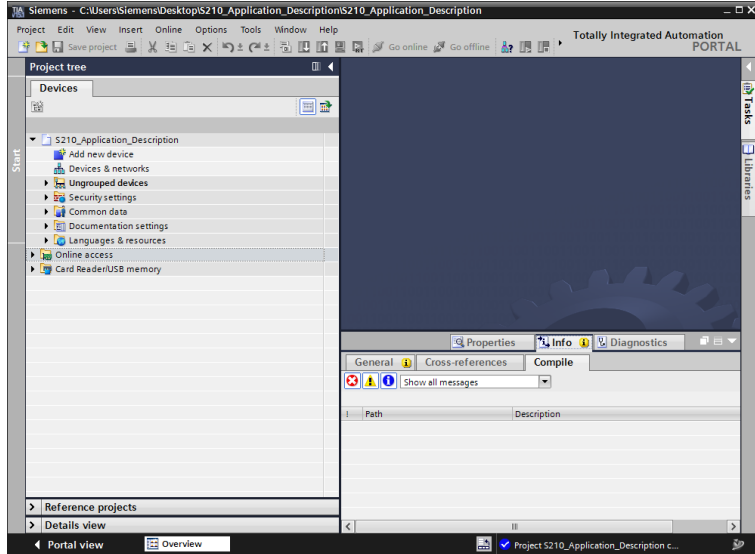
No.	Action	Comments
1.	<p>Select "Commissioning" and "One Button Tuning" in the navigation menu:</p> 	
2.	<p>Select the desired dynamic setting:</p> 	<p>Note: Information on selecting the dynamic settings can be found in the info box or in the manual (see 4).</p>
3.	<p>Click on "Take Control" and answer the security question to activate the master control with "Confirm":</p> 	

4 Configuration of the application example

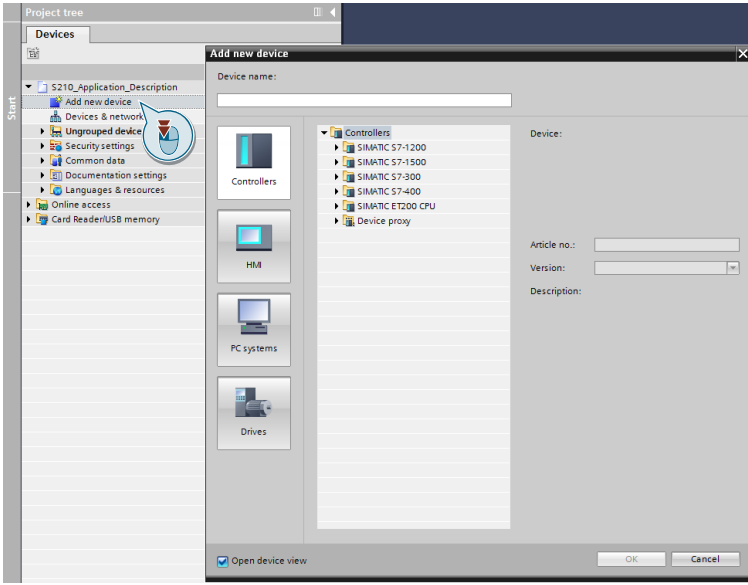
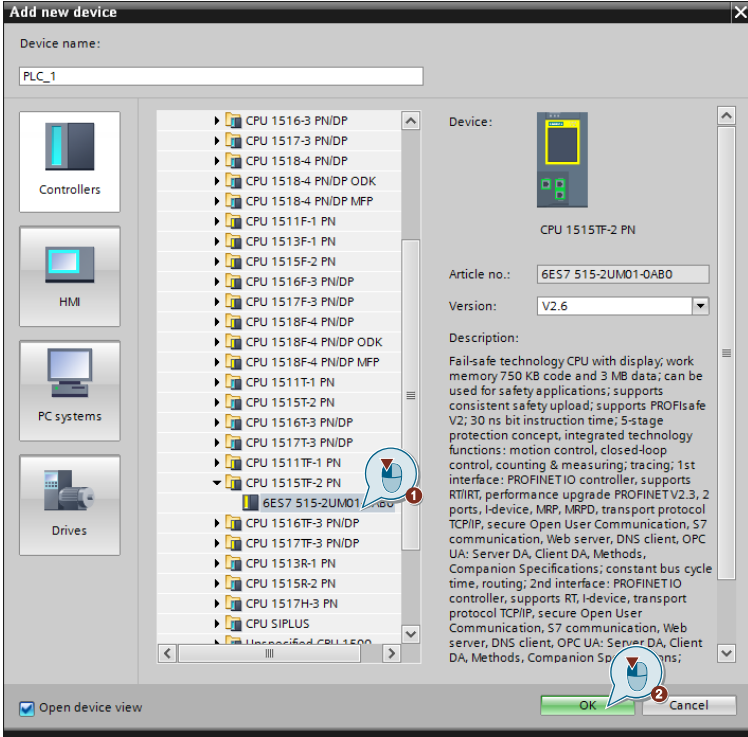
No.	Action	Comments									
4.	<p>Click on "Start Tuning":</p> 	<p>Note: A query for the permissible angle of rotation (travel limitation) of the engine shaft is displayed.</p>									
5.	<p>Enter the maximum tuning travel (e.g. 360° - 1 engine revolution):</p> 	<p>Note: The angle should be at least 60° to determine meaningful controller parameters.</p> <p>In this example, 360° is used as this corresponds to one engine revolution.</p>									
6.	<p>A message will be displayed indicating the "One Button Tuning" status:</p>  <table border="1" data-bbox="448 1447 975 1547"> <thead> <tr> <th>Parameter name</th> <th>Current value</th> <th>Previous value</th> </tr> </thead> <tbody> <tr> <td>Speed controller P gain</td> <td>0.0164 Nms/rad</td> <td>0.0085 Nms/rad</td> </tr> <tr> <td>Speed controller integral time</td> <td>3.52 ms</td> <td>10.00 ms</td> </tr> </tbody> </table>	Parameter name	Current value	Previous value	Speed controller P gain	0.0164 Nms/rad	0.0085 Nms/rad	Speed controller integral time	3.52 ms	10.00 ms	
Parameter name	Current value	Previous value									
Speed controller P gain	0.0164 Nms/rad	0.0085 Nms/rad									
Speed controller integral time	3.52 ms	10.00 ms									
7.	<p>Return master control and click "Save" to save the changes:</p> 										

4.2 Configurations in the TIA Portal

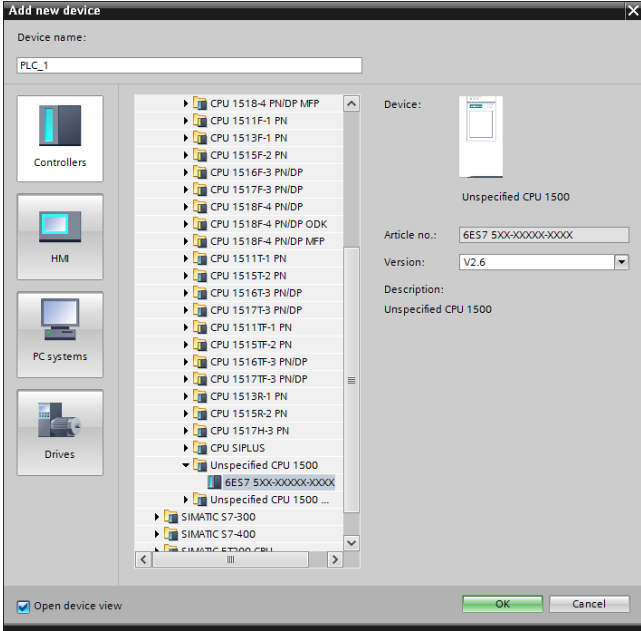
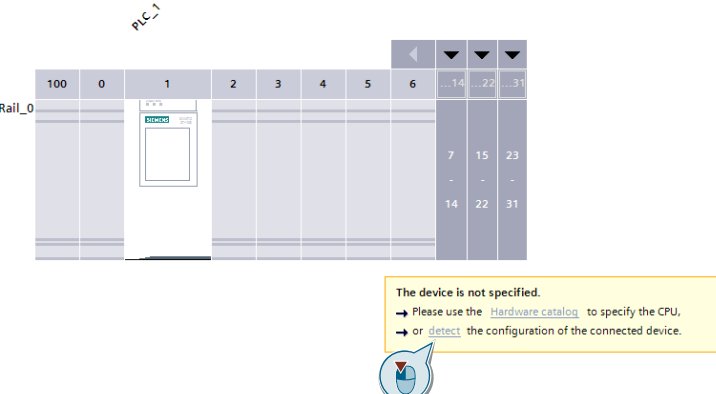
4.2.1 Creation of new project

No.	Action	Comments
1.	<p>Open the TIA Portal and create a new project:</p> 	
2.	<p>Switch to "Project view":</p> 	

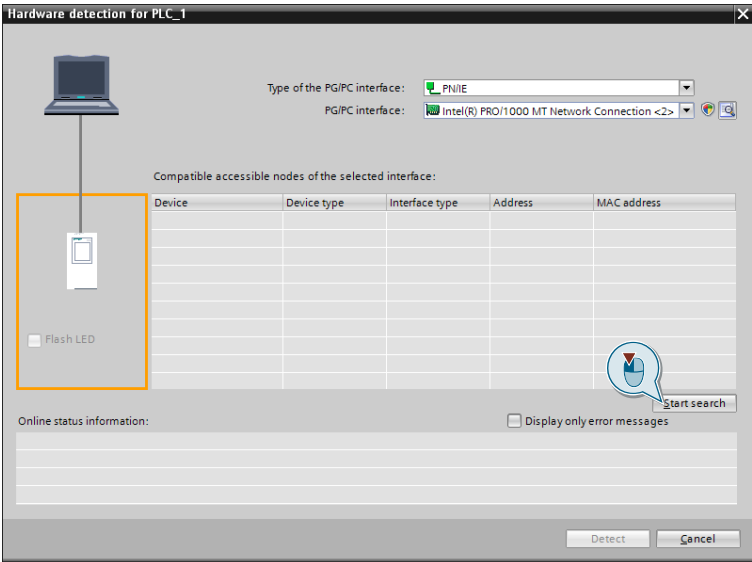
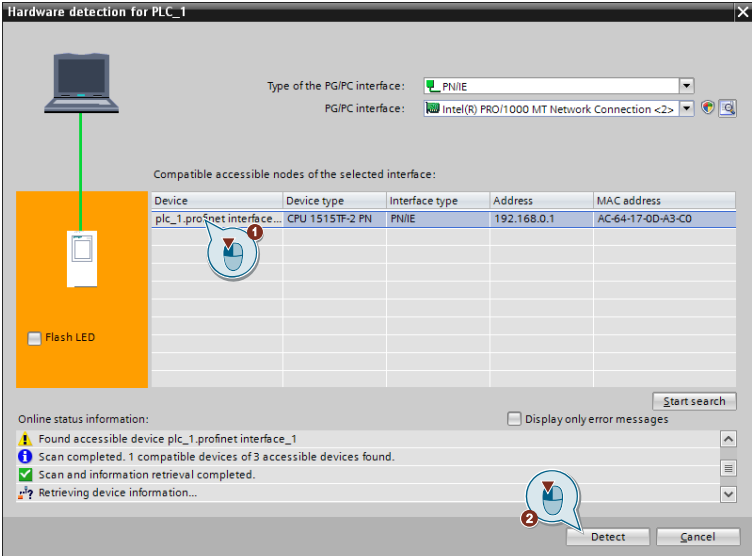
4.2.2 Add SIMATIC S7-1500 CPU to project

No.	Action	Comments
1.	<p>Double-click the "Add new device" node in the device tree:</p> 	
2.	<p>If you know the detailed specifications of the S7-1500 modules, you can search here directly for the type and add it to the project:</p> 	

4 Configuration of the application example

No.	Action	Comments
	<p>Otherwise add an unspecified CPU 1500 to the project:</p> 	
3.	<p>If an unspecified CPU 1500 has been added, you can detect the connected CPU by clicking "Detect" and searching for it online.</p> 	<p>Optional: Only in case of an unspecified CPU 1500</p>

4 Configuration of the application example

No.	Action	Comments
4.	<p>Start the search by clicking on the "Start search" button. The connected S7-1500 CPU is found if the communication via the PROFINET network is working properly:</p> 	<p>Optional: Only in case of an unspecified CPU 1500</p>
5.	<p>Click on the "Detect" button to detect the connected CPU:</p> 	<p>Optional: Only in case of an unspecified CPU 1500</p>

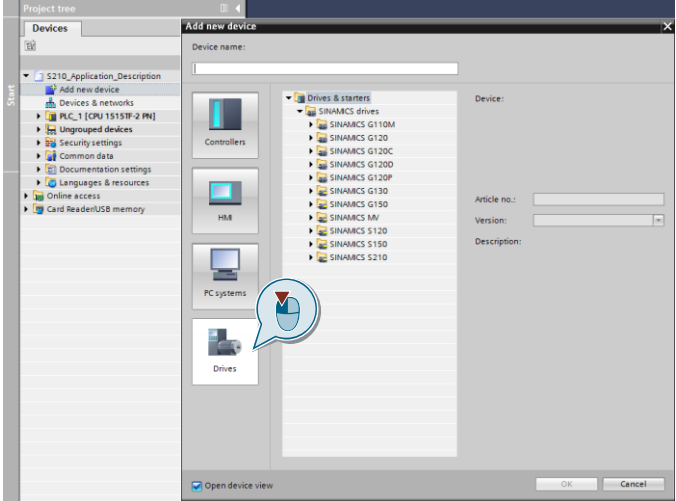
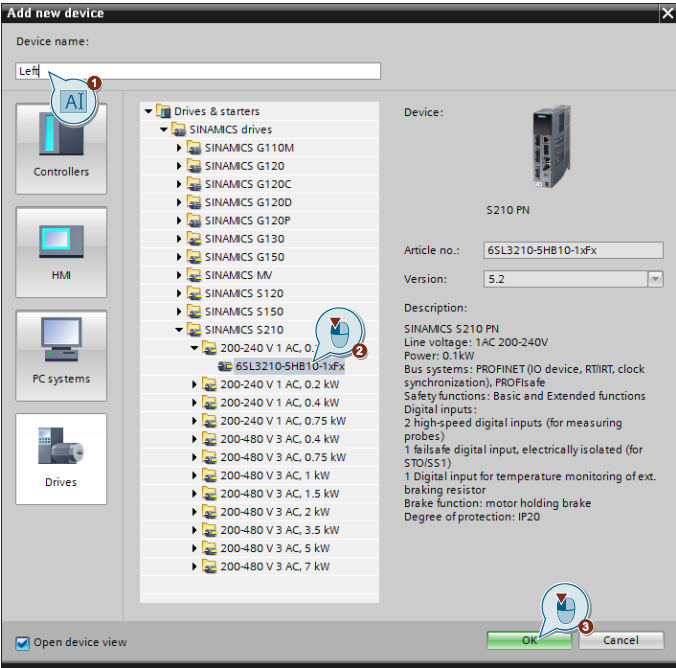
© Siemens AG 2019. All rights reserved.

Note

For this application example, the default settings of the S7-1500 can be used. Further configurations are not necessary.

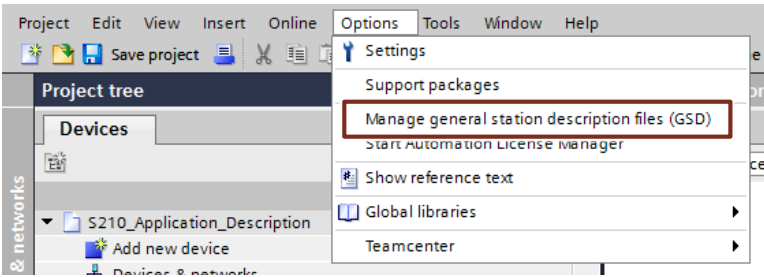
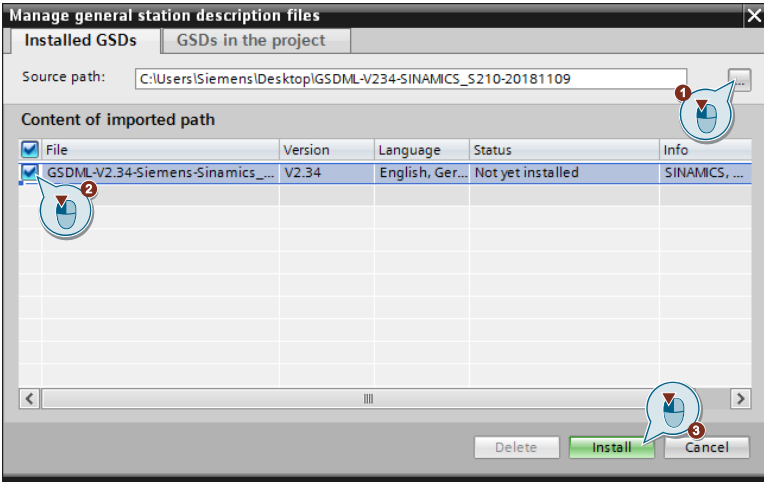
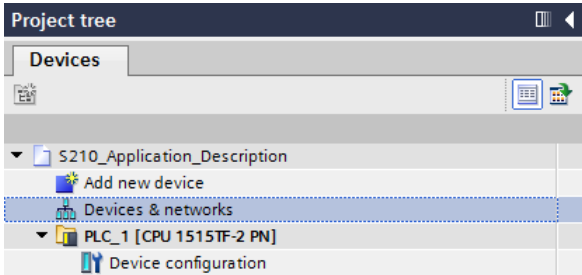
4.2.3 Configuration of the SINAMICS S210 in Startdrive

Note Configuration of the SINAMICS S210 PN V5.2 in the TIA Portal is possible from SINAMICS Startdrive V15.1 onwards. (see [5](#)).

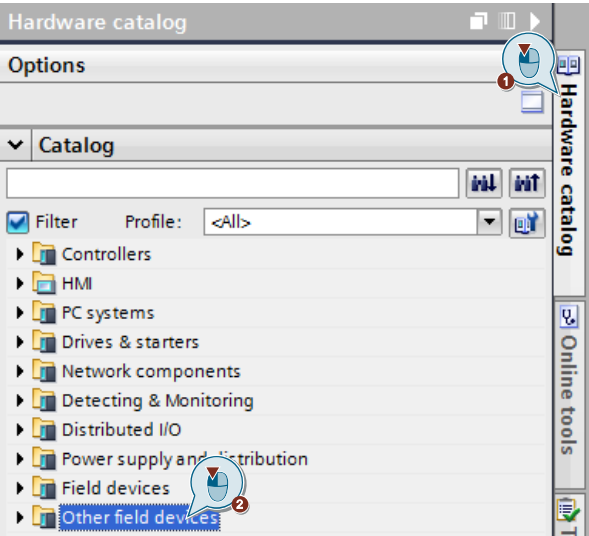
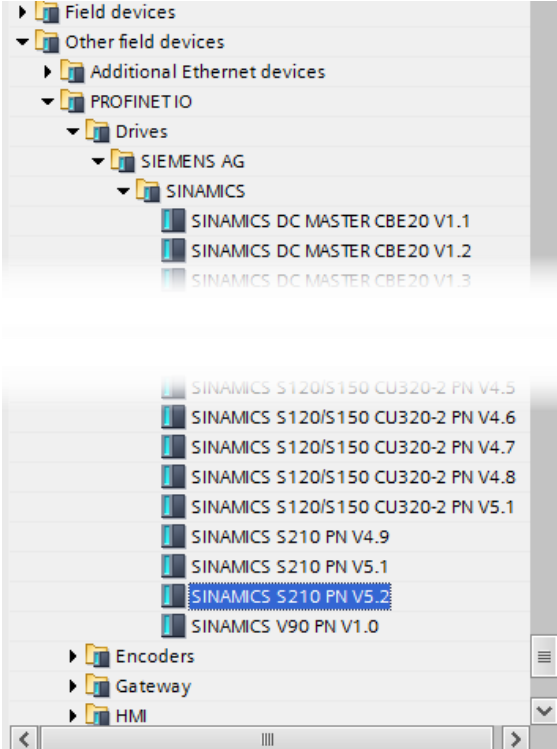
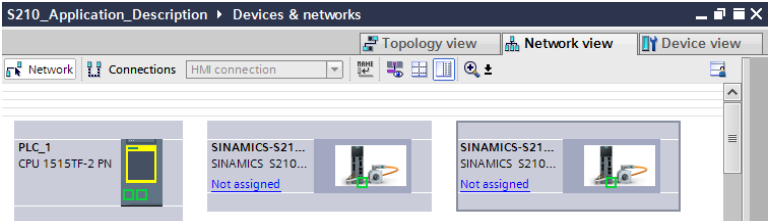
No.	Action	Comments
1.	<p>Double-click the "Add new device" node in the device tree:</p> 	
2.	<p>Select the SINAMICS S210 PN according to the article number:</p> 	<p>The SINAMICS S210 PN is available in SINAMICS Startdrive V15.1 from version 5.2. Earlier versions must either be updated via firmware update (see 6) or configured via GSDML (see 4.2.4).</p>
3.	<p>Add another SINAMICS S210 PN.</p>	

4.2.4 Configuration of the SINAMICS S210 using GSDML

Note The installation of the GSDML file of the SINAMICS S210 PN is required for the TIA Portal versions V14 and V15. You can download the GSDML file from the following website: <https://support.industry.siemens.com/cs/ww/en/view/109752524>

No.	Action	Comments
1.	<p>Open the GSDML file manager to install the GSDML file of the SINAMICS S210:</p> 	
2.	<p>Locate and select the GSDML file. Click the "Install" button to install it:</p> 	
3.	<p>Select "Devices & networks" in the project tree:</p> 	

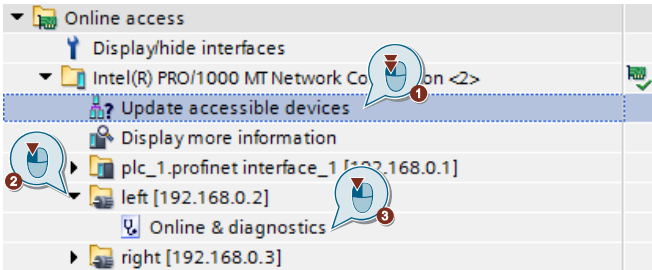

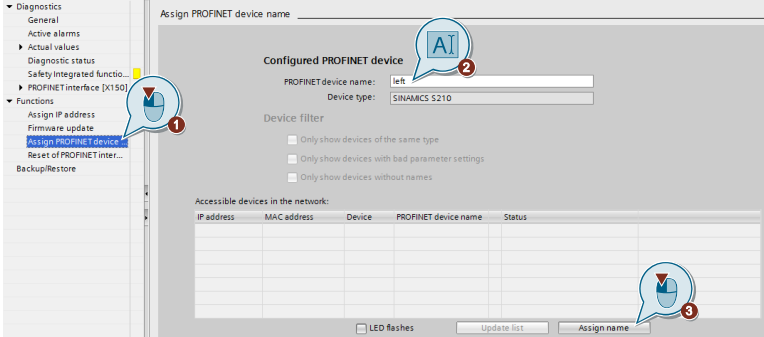
4 Configuration of the application example

No.	Action	Comments
4.	<p>In the right window, select the "Hardware catalog" tab and click on "Other field devices":</p> 	
5.	<p>Select the S210 PN under "Other field devices":</p> 	
6.	<p>Double-click the S210 PN or drag it twice to the network view:</p> 	

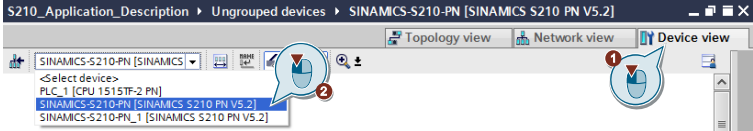
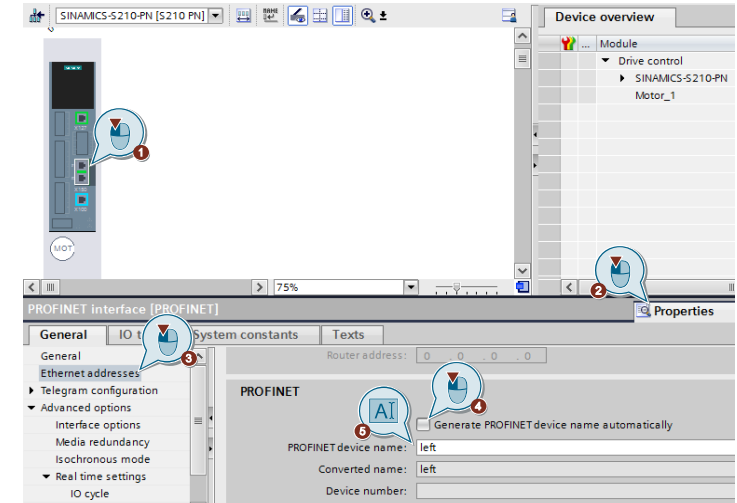
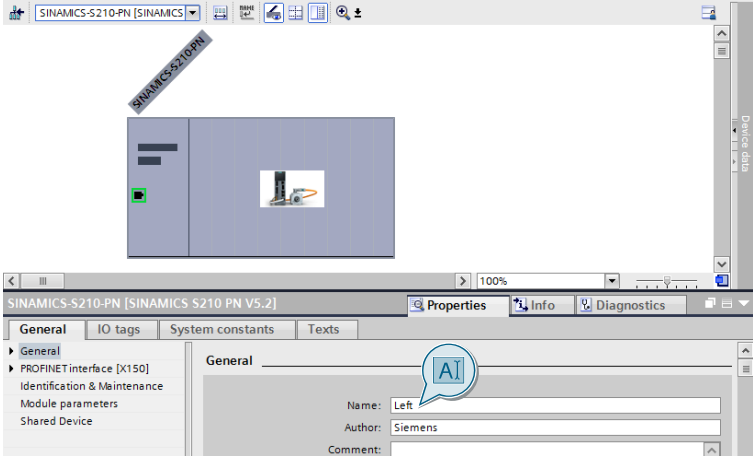
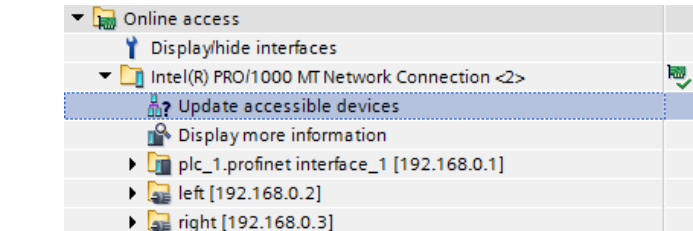
4.2.5 Device configuration of the SINAMICS S210 PN

The following procedure must be performed for both S210 drives.

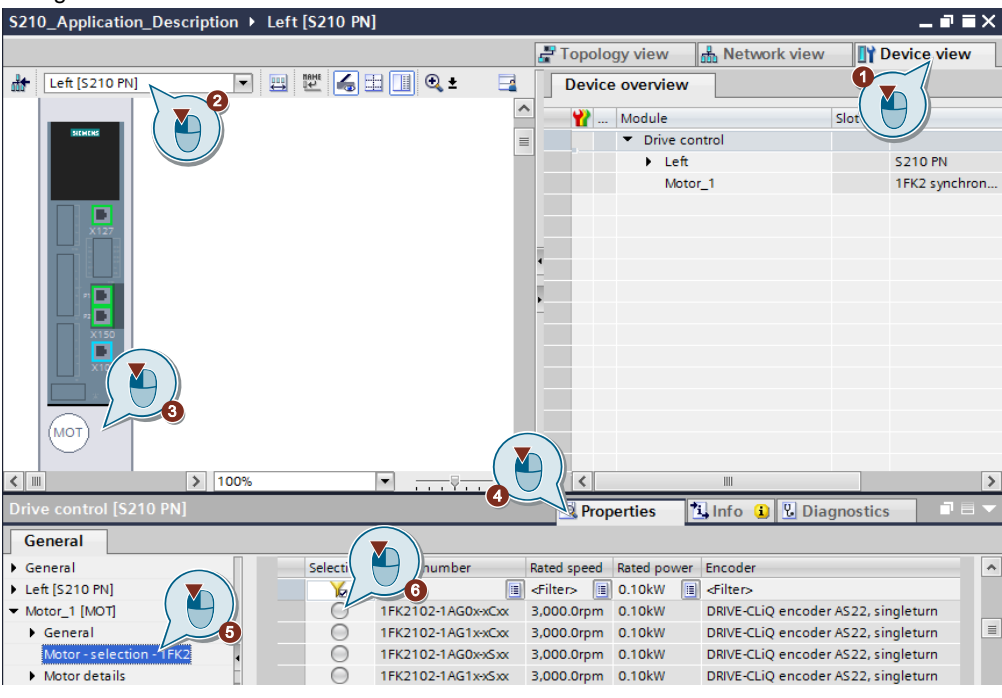
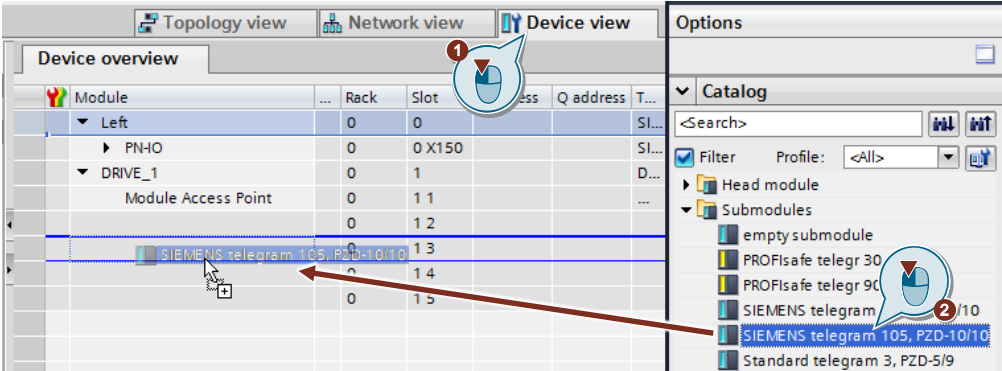
Set the device name and the Ethernet address in TIA Portal via "Accessible devices"

No.	Action	Comments
1.	<p>Click "Online access" to search for available devices, and then click "Online & diagnostics" under each device:</p> 	<p>Note: You may notice that no IP address has been assigned because MAC addresses are displayed for both devices instead.</p>
2.	<p>In this new window, select the "Functions" option and change the values for "IP Address" and "Subnet mask". Then click on "Assign IP address":</p> 	<p>Note: The following IP addresses and subnet masks are used in this project:</p> <p>Drive "Left": 192.168.0.2 255.255.255.0</p> <p>Drive "Right": 192.168.0.3 255.255.255.0</p>
3.	<p>Click on "Assign PROFINET device name", write the name in the field and click on "Assign name".</p> 	

Device configuration for the project

No.	Action	Comments
1.	<p>Select the SINAMICS S210 PN in the device view:</p> 	
2.a	<p>For configuration via Startdrive Select the PROFINET interface (X150).</p> 	<p>Here you can configure information such as the device name, the Ethernet address, etc.</p> <p>Important! In this step change the device names of the S210 drives to "Left" and "Right" so that they match the device names and IP addresses assigned via Accessible devices!"</p>
2.b	<p>For configuration via GSDML Double-click on the S210 PN to open the property field:</p> 	<p>Important! The PROFINET device name is requirement for a valid communication. Check this information in the SINAMICS S210 PN configuration.</p>
3.	<p>Click "Online access" to search for available devices and ensure that the information is consistent:</p> 	<p>Important! The PROFINET device name is requirement for a valid communication. Check this information in the SINAMICS S210 PN configuration.</p>

4 Configuration of the application example

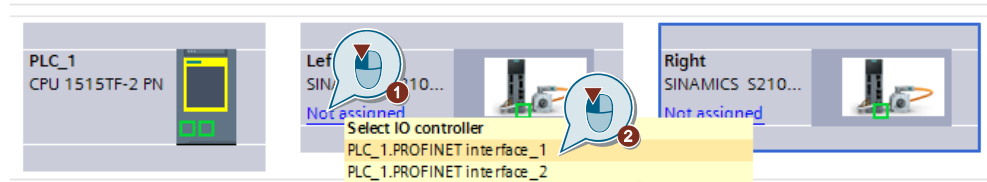
No.	Action	Comments
4.a	<p>For configuration via Startdrive</p> <p>Select the motor used in the "Device view" of both SINAMICS S210 PNs. After selection, the motor and encoder data are automatically transferred and Siemens telegram 105 is configured.</p>  <p>The correct article number can be found on the rating plate of the motor.</p>	
4.b	<p>For configuration via GSDML</p> <p>In the "Device view" of both SINAMICS S210 PNs, select "SIEMENS telegram 105" from the submodules:</p> 	

4.2.6 Connection between the SINAMICS S210 PN and the S7-1500 CPU

After the configuration of both SINAMICS S210 PN and the S7-1500 CPU a PROFINET connection must be assigned:

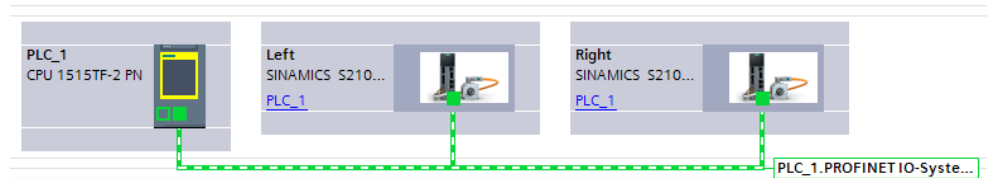
Click **"Not assigned"** in the network view and select **"PLC_1.PROFINET Interface_1"**:

Figure 4-2



Perform the same procedure for the second drive:

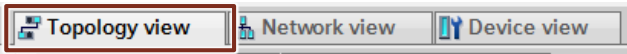
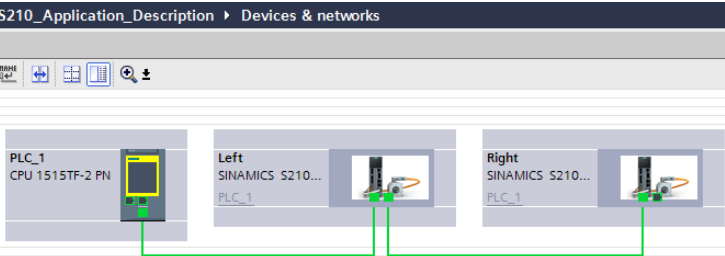
Figure 4-3:



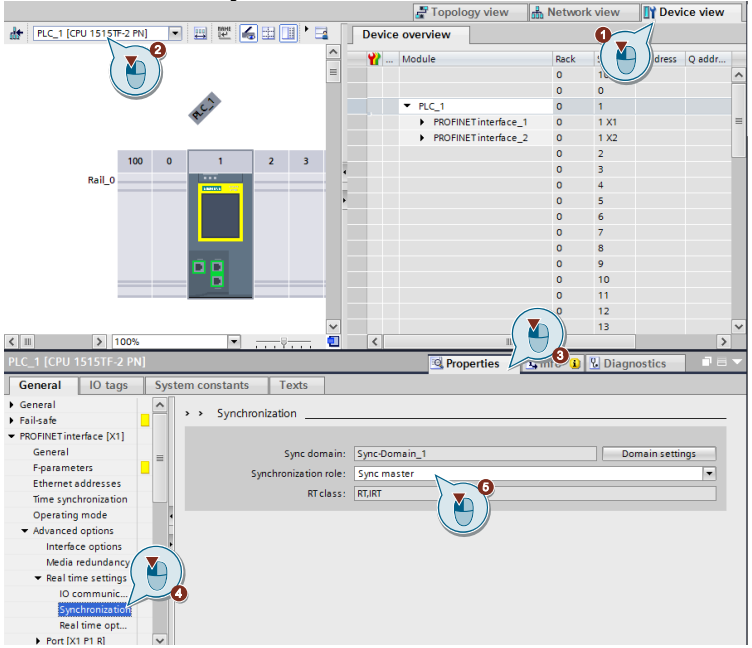
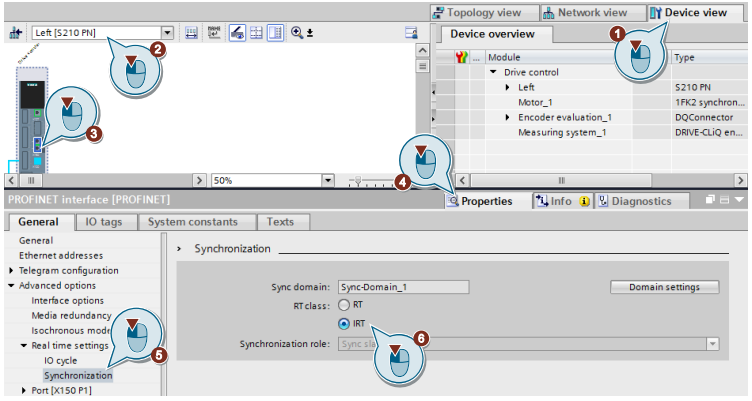
4.2.7 Configuration of the topology between SINAMICS S210 PN and the S7-1500 CPU

Note For isochronous mode the topology must correspond to the actual wiring between the SINAMICS drives and the CPU!

After the network connection of both SINAMICS S210 PN and the S7-1500 CPU, configure the topology as follows:

No.	Action	Comments
1.	Switch to the "Topology view" tab: 	
2.	Configure the topology according to the real connection of the hardware structure by drag-and-drop: 	Note: Check that the PROFINET wiring present corresponds to the structure of this wiring. If the PROFINET wiring deviates from this, this must also be considered in the topology view.

4 Configuration of the application example

No.	Action	Comments
3.	<p>Select the S7-1500 CPU in the "Device view". In the properties tab select "PROFINET Interface [X1]" and go to "Advanced options" → "Real time settings" → "Synchronization". Set the synchronization role of the CPU to "Sync master".</p> 	
4.	<p>In the "Device view" for both SINAMICS S210 PN drives go to the settings tab and select "PROFINET Interface". Go to "Advanced options" → "Real time settings" → "Synchronization" and set the RT class to "IRT".</p> 	

5 Programming the application

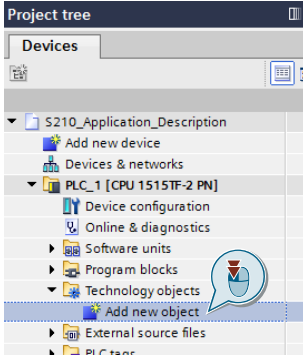
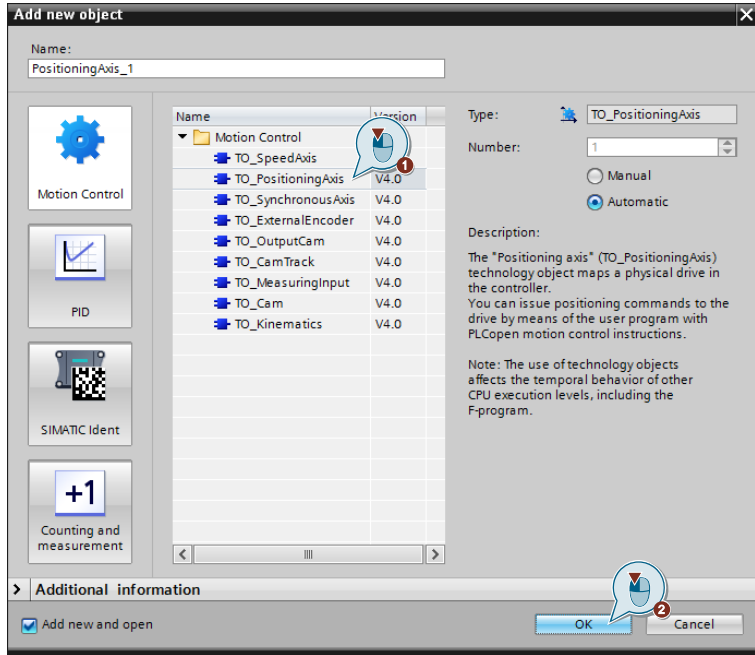
In the following section we use technology objects (TO) for programming and drive operation.

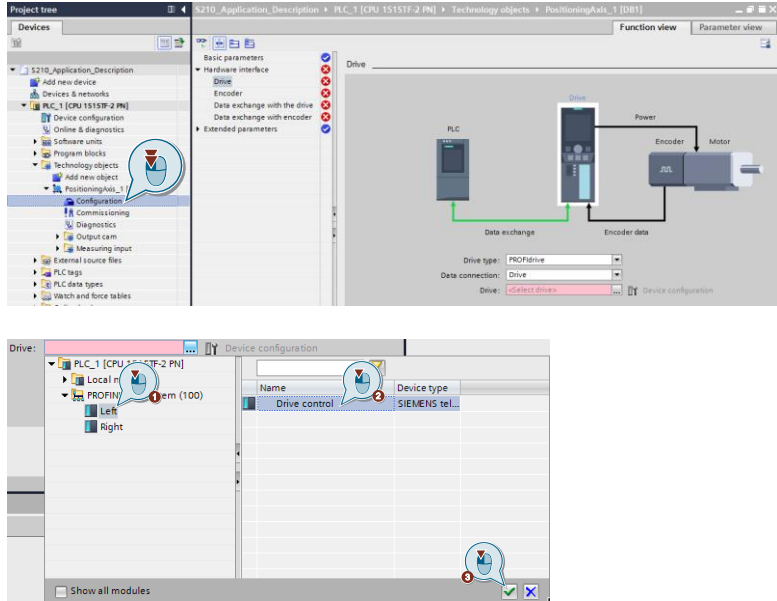
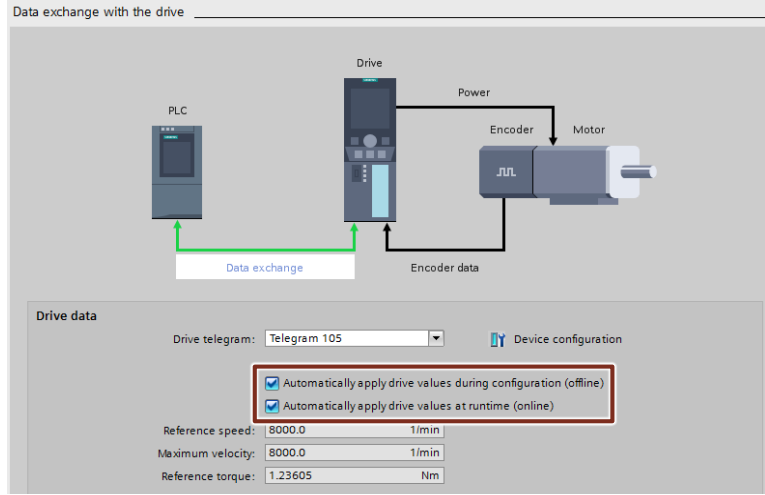
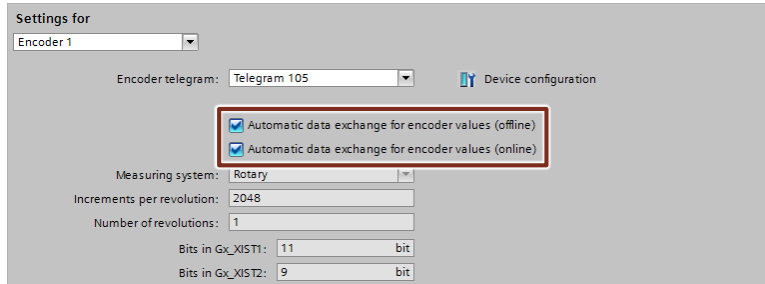
5.1 Configuration of technological objects

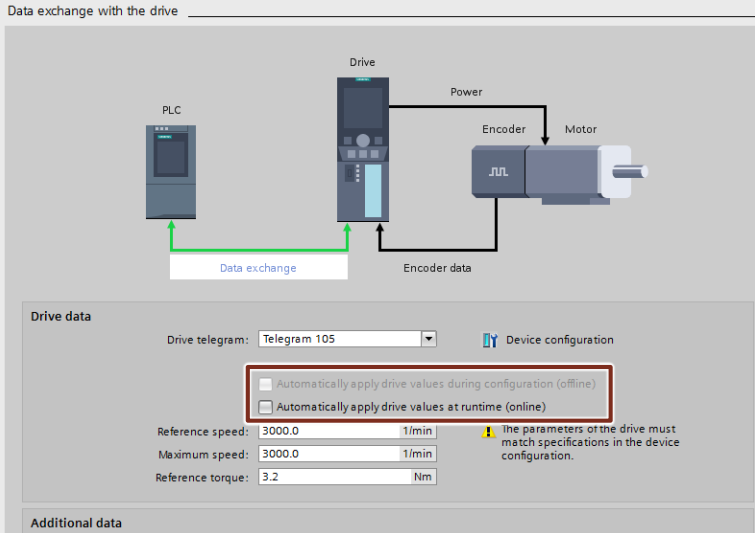
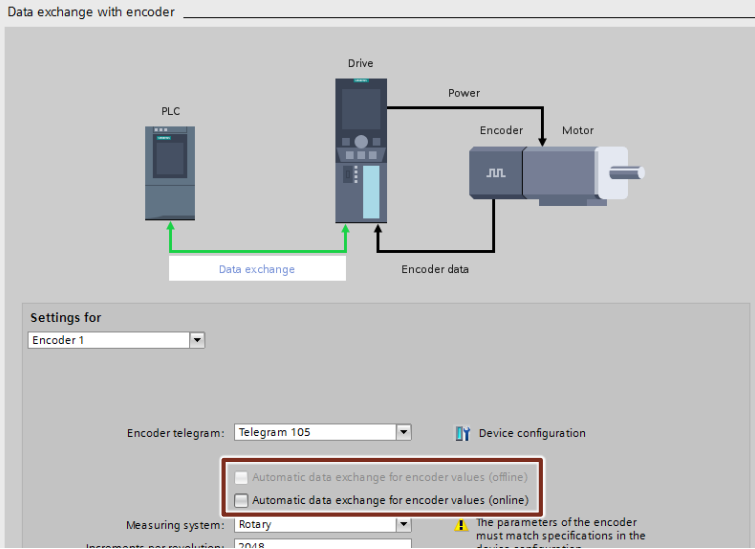
Two technology objects are projected for this application example:

1. A **"Positioning Axis"** that is operated as a master axis.
2. A **"Synchronous Axis"** which is operated as a slave axis.

5.1.1 Adding and configuring the positioning axis of the first SINAMICS S210

No.	Action	Comments
1.	<p>Add a new object by clicking "Add new object" in the project tree:</p> 	
2.	<p>Select the entry "TO_PositioningAxis" in the "Motion Control" list:</p> 	

No.	Action	Comments
3.	<p>Under "Hardware interface" for the axis, enter "PROFIdrive" as "Drive type". Select the desired SINAMICS S210 drive as "Drive", in this example the drive is "Left":</p> 	<p>Note: When a new object is successfully added, the object node is added to the device tree and the configuration for this newly added axis is opened.</p>
4.a	<p>Configuration via Startdrive</p> <p>The drive and encoder data are automatically transferred to the technology object after connecting with the drive.</p> <p>S210 drive:</p>  <p>Encoder:</p> 	

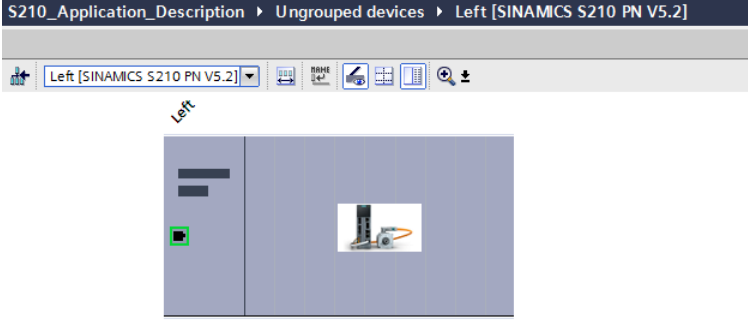
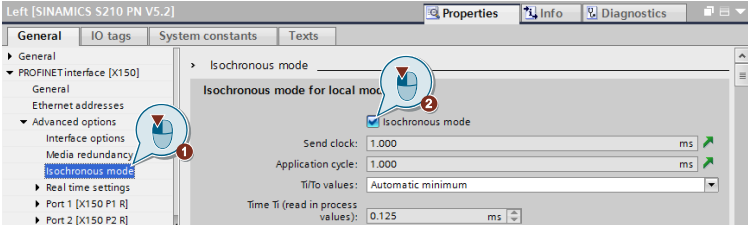
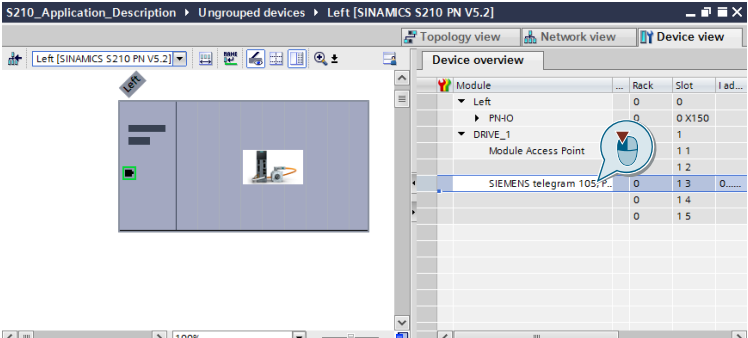
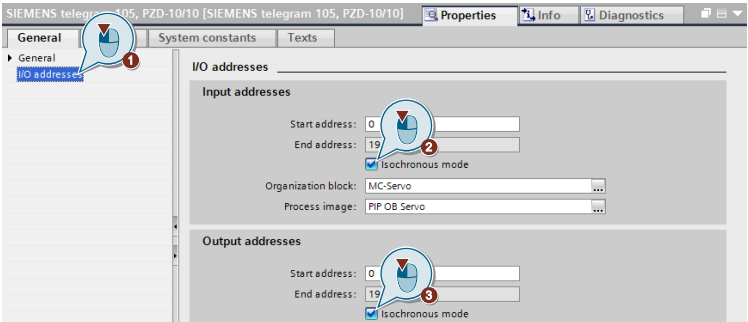
No.	Action	Comments
4.b	<p>Configuration via GSDML</p> <p>When configuring via GSDML, check the data under "Data exchange with the drive" and "Data exchange with the encoder" to make sure they are correct:</p> <p>S210 drive:</p>  <p>Encoder:</p> 	<div style="border: 2px solid brown; padding: 5px; width: fit-content;"> <p>The automatic transfer of the drive parameters for the SINAMICS S210 to the TO is supported from TIA Portal V15.</p> </div>

© Siemens AG 2019. All rights reserved.

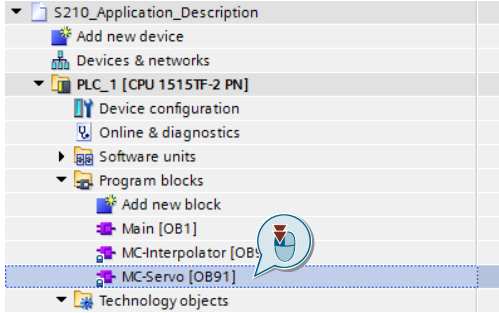
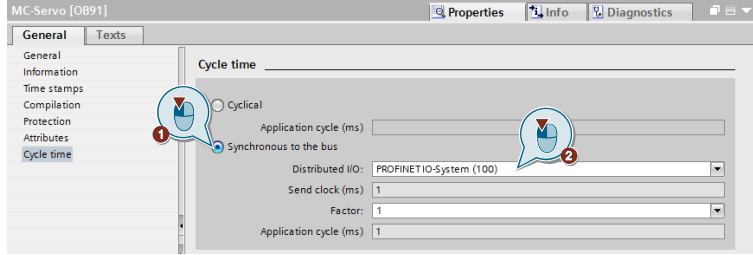
Note When configuring the SINAMICS S210 PN via Startdrive, the isochronous mode is already preset. Continue with [step 9](#).

If the drive was configured via GSDML, the isochronous mode must now be set.

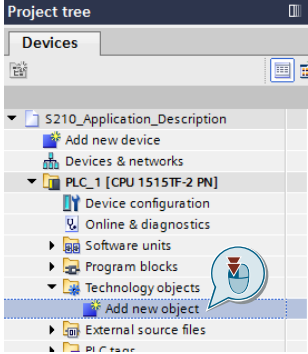
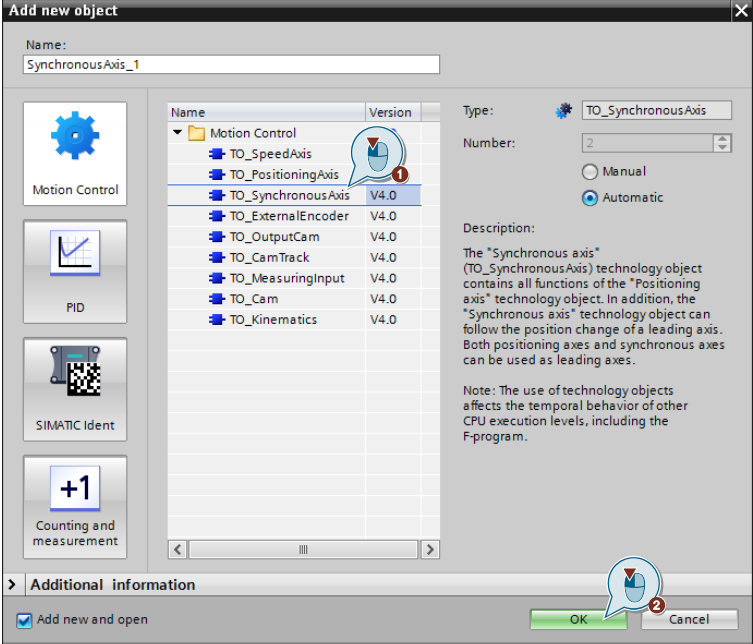
5 Programming the application

No.	Action	Comments
5.	<p>Then switch to the device view of the SINAMICS S210-PN "Left" drive:</p> 	
6.	<p>Open the device properties by double-clicking on the picture of the S210 PN.</p> <p>Select the "Isochronous mode" checkbox under the "Isochronous mode" option to activate the IRT mode:</p> 	
7.	<p>Open the properties of the configured telegram in the device overview:</p> 	
8.	<p>Select the "Isochronous mode" checkbox in the I/O addresses:</p> 	<p>Note: A correct organizational block must be selected.</p> <p>In this example, MC_Servo is used because it is automatically created with technology objects.</p>

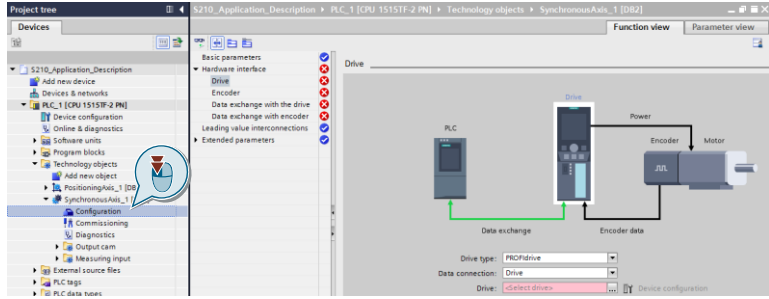
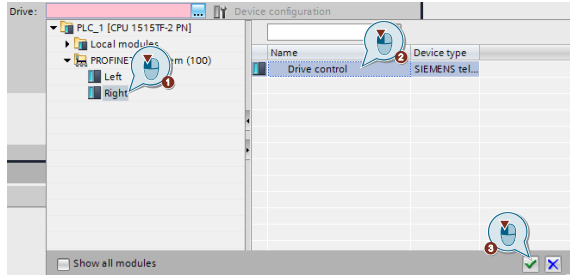
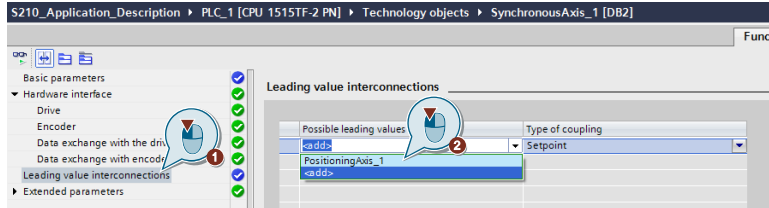
5 Programming the application

No.	Action	Comments
9.	<p>Double-click "MC-Servo [OB91]" in the program block tree to open the properties of the program block OB91:</p> 	
10.	<p>Select the option "Synchronous to the bus" and then "PROFINET IO System (100)" for the distributed I/O:</p> 	<p>Depending on the SIMATIC controller used, it may be necessary to enter a higher factor for the cycle time in order to avoid exceeding the cycle time.</p>
11.	<p>Save the project.</p>	

5.1.2 Adding and configuring the synchronous axis of the second SINAMICS S210

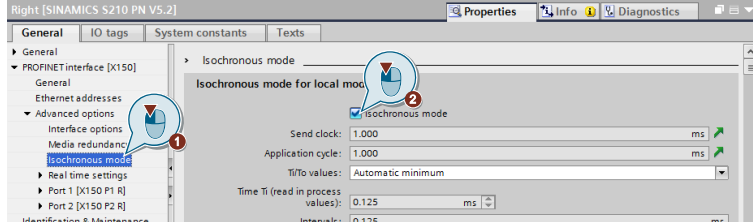
No.	Action	Comments
1.	<p>Add a new object by clicking "Add new object" in the project tree:</p> 	
2.	<p>Select the entry "TO_SynchronousAxis" in the "Motion Control" list:</p> 	

5 Programming the application

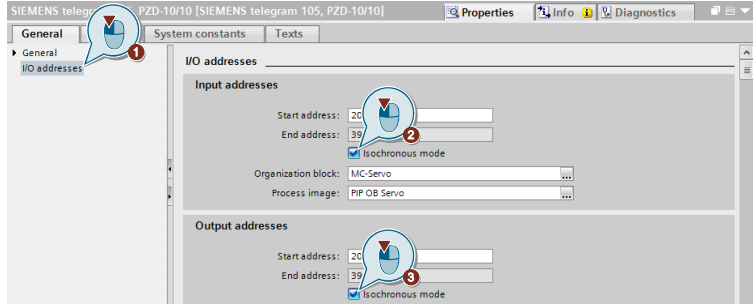
No.	Action	Comments
3.	<p>Under "Hardware interface" for the axis, enter "PROFdrive" as "Drive type". Select the desired SINAMICS S210 drive as "Drive", in this example the drive is "Right":</p>  	<p>Note: When a new object is successfully added, the object node is added to the device tree and the configuration for this newly added axis is opened.</p>
4.	<p>Under "Leading value interconnections", add the positioning axis that is to serve as the leading value:</p> 	

Note When configuring the SINAMICS S210 PN via Startdrive, the isochronous mode is already preset. Continue with [step 7](#).

If the drive was configured via GSDML, the isochronous mode must now be set.

No.	Action	Comments
5.	<p>Make sure that "Isochronous mode" is selected by double-clicking on the picture of the S210 PN:</p> 	

5 Programming the application

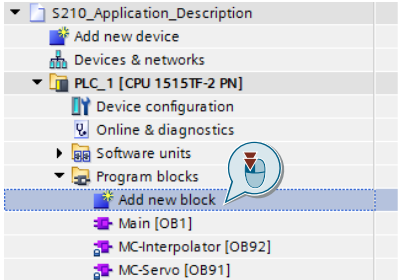
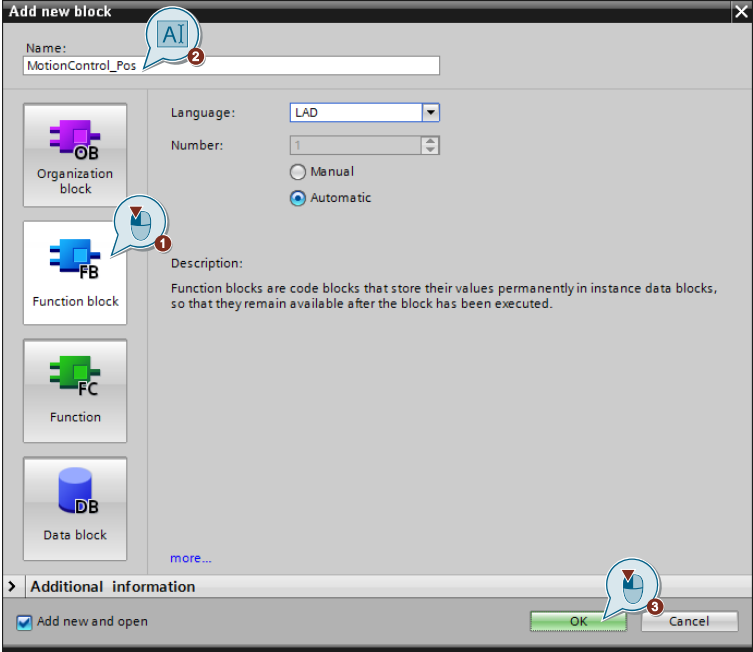
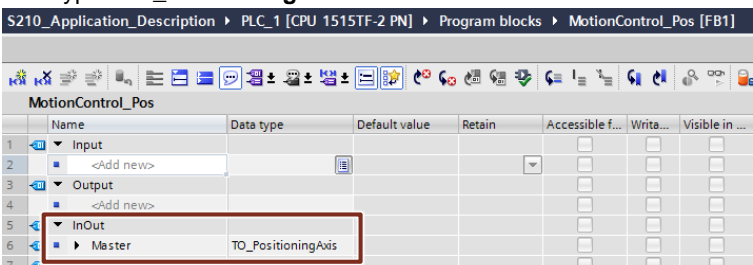
No.	Action	Comments
6.	<p>Open and check the properties of the configured telegram in the device overview:</p> 	
7.	Save the project.	

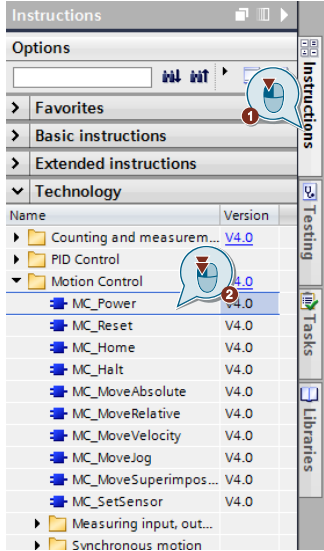
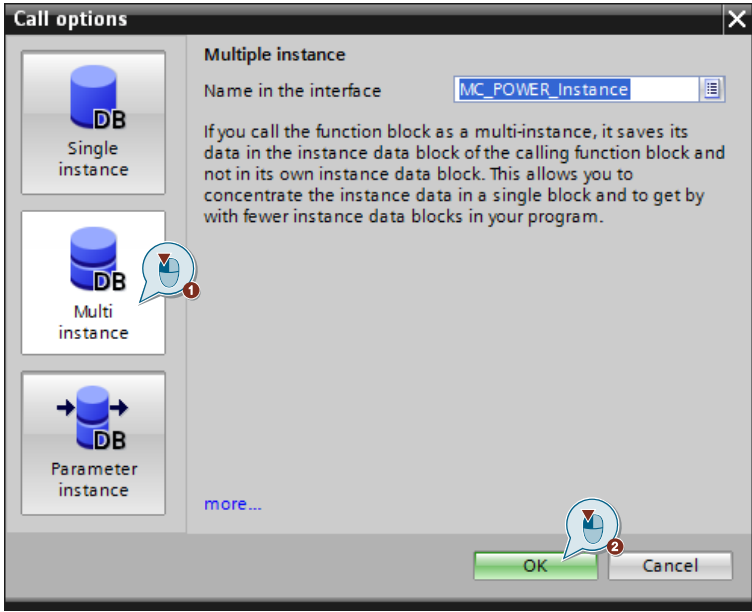
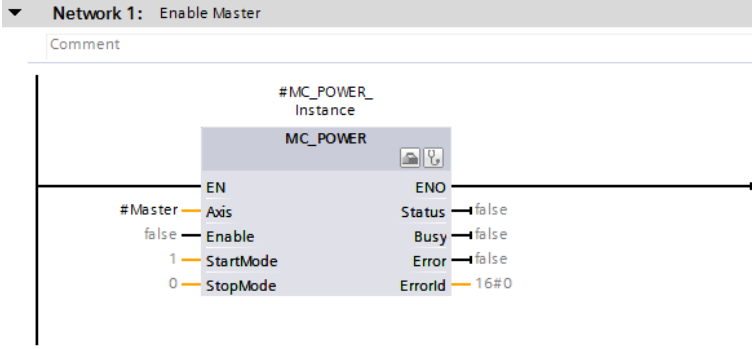
5.2 Creating the S7 program

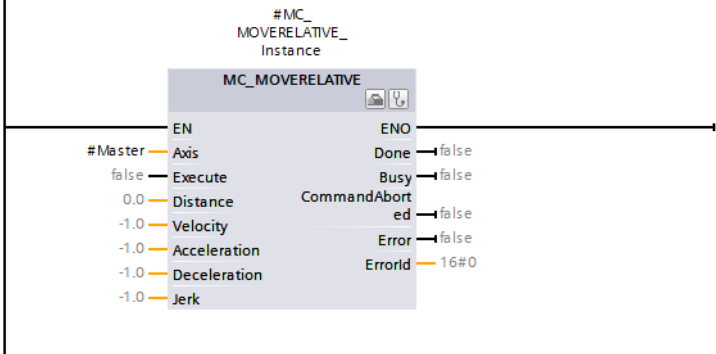
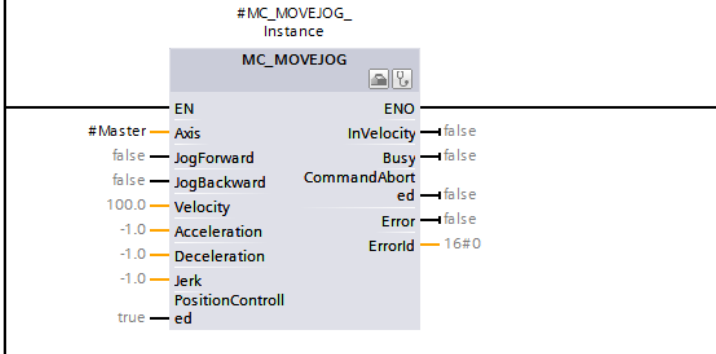
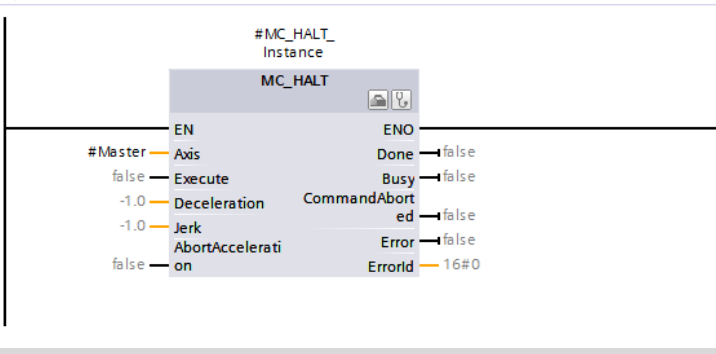
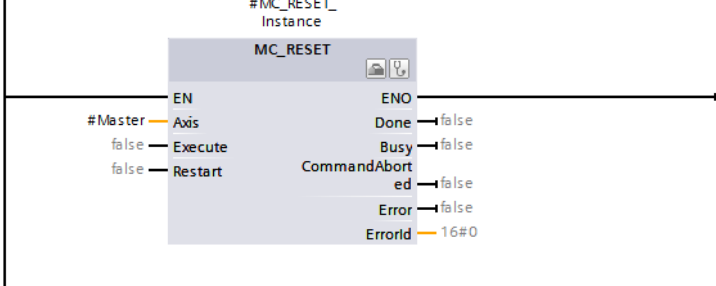
The structure of the S7 program and the motion control instructions are used as shown in the section 3.1. Follow the steps in the table below for each drive.

5.2.1 Programming the positioning axis (master axis)

Table 5-1

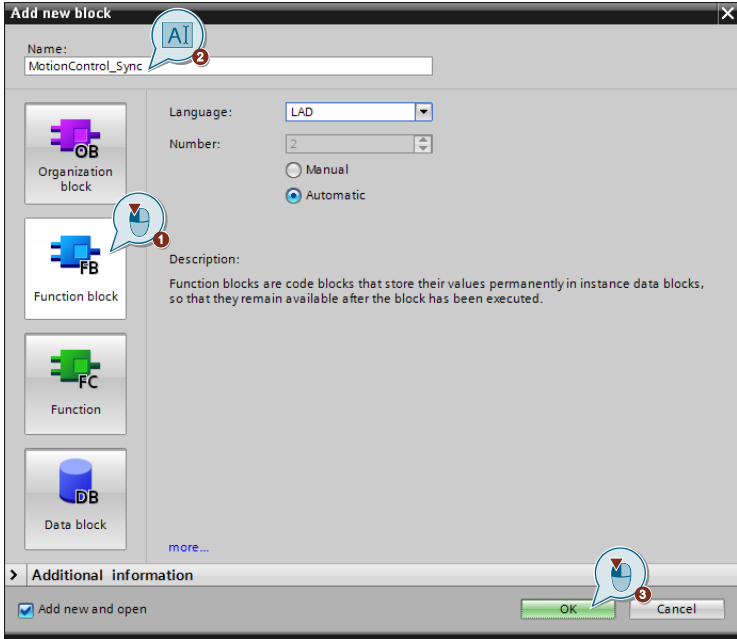
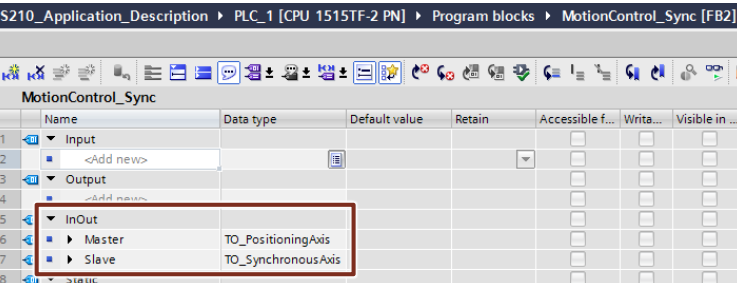
No.	Action	Comments
1.	<p>Add a function block to the program, name it "MotionControl_Pos" and confirm with "OK":</p>  	
2.	<p>In the InOut area of the block interface add a variable "Master" of data type "TO_PositioningAxis":</p> 	

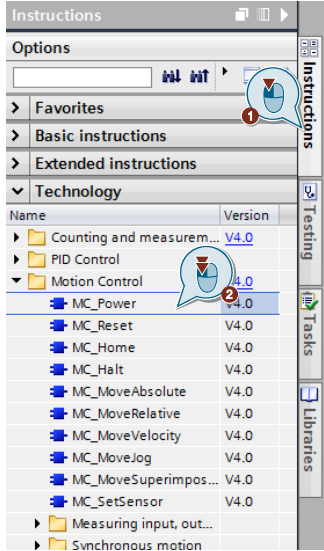
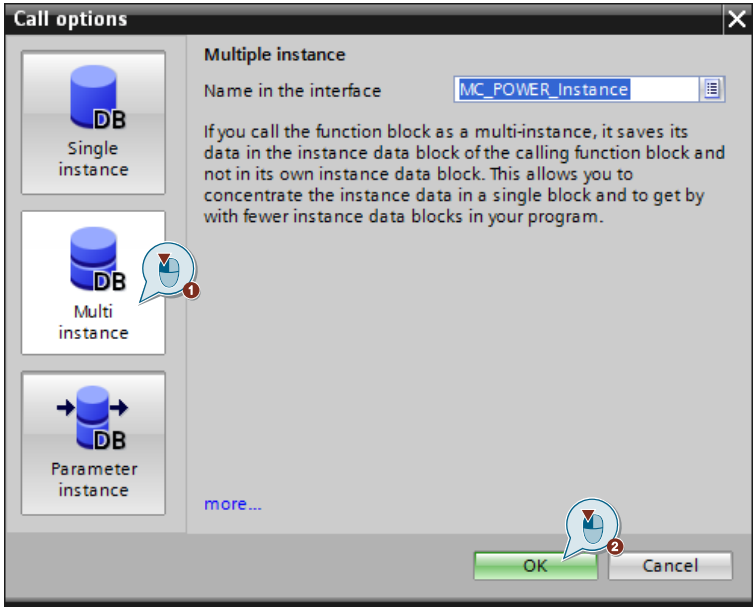
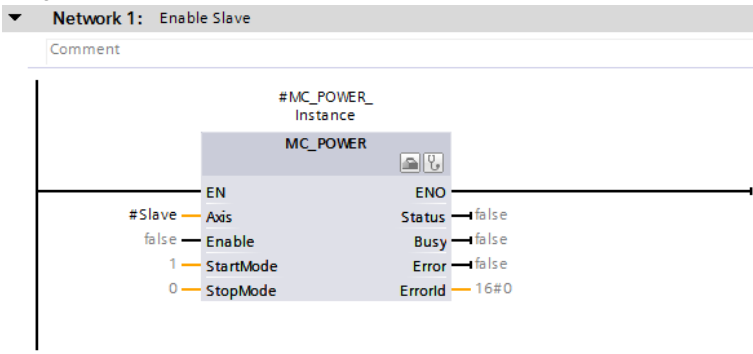
No.	Action	Comments
3.	<p>Go to the "Technology" palette in the "Instructions" task card and open the "Motion Control" folder:</p> 	
4.	<p>Use multi-instances to add the required instructions to the function block:</p> 	<p>Note: In this example, the following instructions are used:</p> <ul style="list-style-type: none"> • MC_Power • MC_MoveRelative • MC_MoveJog • MC_Halt • MC_Reset
5.	<p>Program all blocks as follows:</p> 	

No.	Action	Comments
	<p>Network 2: Relative Positioning</p> <p>Comment</p>  <p>Network 3: Jog axis</p> <p>Comment</p>  <p>Network 4: Stop axis</p> <p>Comment</p>  <p>Network 5: Acknowledge alarms</p> <p>Comment</p> 	

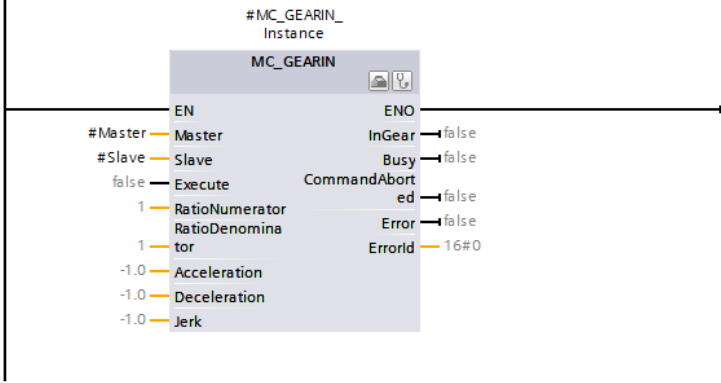
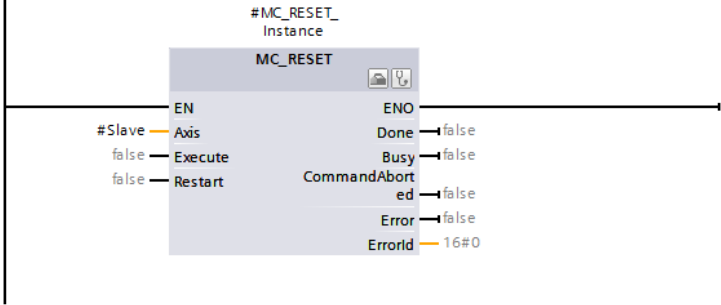
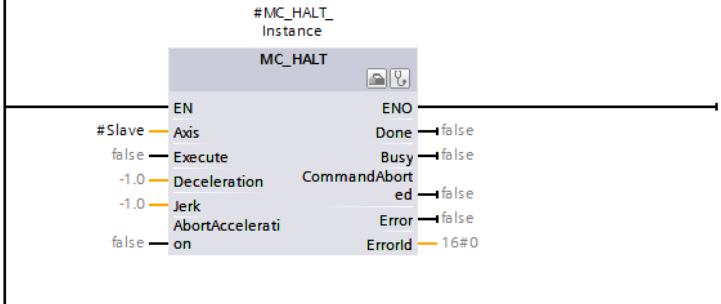
5.2.2 Programming the synchronous axis (slave axis)

Table 5-2

No.	Action	Comments
1.	<p>Add a function block to the program, name it "MotionControl_Sync" and confirm with "OK":</p> 	
2.	<p>In the InOut area of the block interface add the following variables</p> <ul style="list-style-type: none"> • "Master" of data type "TO_PositioningAxis" • "Slave" of data type "TO_SynchronousAxis": 	

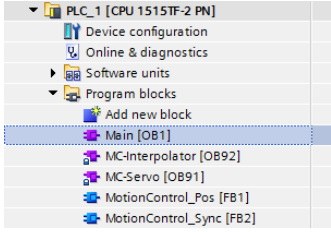
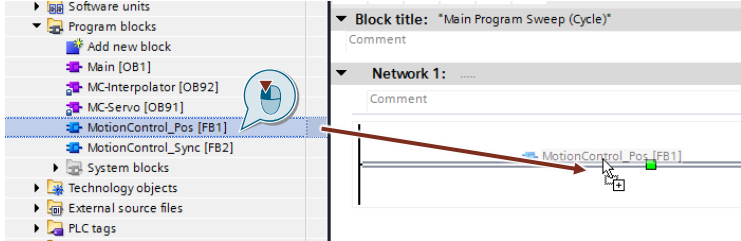
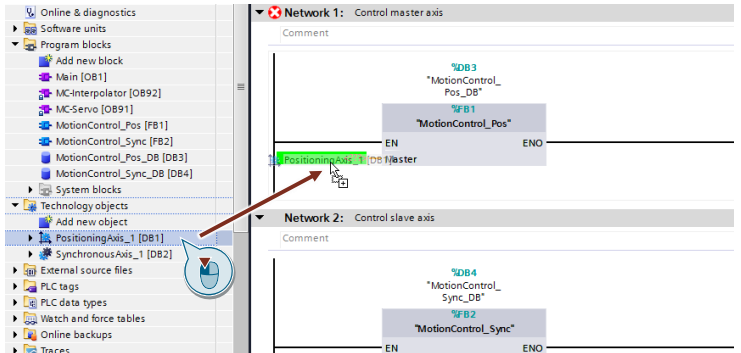
No.	Action	Comments																																
3.	<p>Go to the "Technology" palette in the "Instructions" task card and open the "Motion Control" folder:</p>  <p>The screenshot shows the 'Instructions' task card with the 'Technology' palette expanded. The 'Motion Control' folder is selected, and its contents are listed in a table below:</p> <table border="1" data-bbox="560 517 874 875"> <thead> <tr> <th>Name</th> <th>Version</th> </tr> </thead> <tbody> <tr> <td>Counting and measurem...</td> <td>V4.0</td> </tr> <tr> <td>PID Control</td> <td></td> </tr> <tr> <td>Motion Control</td> <td>V4.0</td> </tr> <tr> <td>MC_Power</td> <td>V4.0</td> </tr> <tr> <td>MC_Reset</td> <td>V4.0</td> </tr> <tr> <td>MC_Home</td> <td>V4.0</td> </tr> <tr> <td>MC_Halt</td> <td>V4.0</td> </tr> <tr> <td>MC_MoveAbsolute</td> <td>V4.0</td> </tr> <tr> <td>MC_MoveRelative</td> <td>V4.0</td> </tr> <tr> <td>MC_MoveVelocity</td> <td>V4.0</td> </tr> <tr> <td>MC_MoveJog</td> <td>V4.0</td> </tr> <tr> <td>MC_MoveSuperimpos...</td> <td>V4.0</td> </tr> <tr> <td>MC_SetSensor</td> <td>V4.0</td> </tr> <tr> <td>Measuring input, out...</td> <td></td> </tr> <tr> <td>Synchronous motion</td> <td></td> </tr> </tbody> </table>	Name	Version	Counting and measurem...	V4.0	PID Control		Motion Control	V4.0	MC_Power	V4.0	MC_Reset	V4.0	MC_Home	V4.0	MC_Halt	V4.0	MC_MoveAbsolute	V4.0	MC_MoveRelative	V4.0	MC_MoveVelocity	V4.0	MC_MoveJog	V4.0	MC_MoveSuperimpos...	V4.0	MC_SetSensor	V4.0	Measuring input, out...		Synchronous motion		
Name	Version																																	
Counting and measurem...	V4.0																																	
PID Control																																		
Motion Control	V4.0																																	
MC_Power	V4.0																																	
MC_Reset	V4.0																																	
MC_Home	V4.0																																	
MC_Halt	V4.0																																	
MC_MoveAbsolute	V4.0																																	
MC_MoveRelative	V4.0																																	
MC_MoveVelocity	V4.0																																	
MC_MoveJog	V4.0																																	
MC_MoveSuperimpos...	V4.0																																	
MC_SetSensor	V4.0																																	
Measuring input, out...																																		
Synchronous motion																																		
4.	<p>Add instructions to the function block using multi-instances of MC_Power, MC_GearIn, MC_Reset, and MC_Halt:</p>  <p>The screenshot shows the 'Call options' dialog box with the 'Multiple instance' option selected. The 'Name in the interface' field is set to 'MC_POWER_Instance'. The dialog explains that using a multi-instance saves data in the instance data block of the calling function block.</p>																																	
5.	<p>Program all blocks as follows:</p>  <p>The screenshot shows a ladder logic network for 'Network 1: Enable Slave'. It features an MC_POWER function block with the following connections:</p> <ul style="list-style-type: none"> EN: Connected to #Slave (Axis) Enable: Connected to false StartMode: Connected to 1 StopMode: Connected to 0 ENO: Connected to ENO Status: Connected to false Busy: Connected to false Error: Connected to false ErrorId: Connected to 16#0 																																	

5 Programming the application

No.	Action	Comments
	<p>Network 2: Gear in</p> <p>Comment</p>  <p>Network 3: Acknowledge alarms</p> <p>Comment</p>  <p>Network 4: Stop axis</p> <p>Comment</p> 	

5.2.3 Programming of the cyclic OB

Tabelle 5-3

Nr.		
6.	<p>Open the cyclic OB "Main [OB1]":</p> 	
7.	<p>Add the blocks "MotionControl_Pos" and "MotionControl_Sync" via drag & drop into the cyclic OB:</p> 	
8.	<p>Connect the technology objects to the input parameters of the blocks:</p> 	
9.	<p>Save the project and download it into the S7-1500 CPU.</p>	

5.2.4 Watch table

In this example, the following watch table is used to monitor and operate the drives.

Watch table of the left drive (master axis)

Figure 5-1

S210_Application_Description > PLC_1 [CPU 1515TF-2 PN] > Watch and force tables > S210_Operation						
	Name	Address	Display format	Monitor value	Modify value	
1	// MC_POWER (MASTER)					
2	*MotionControl_Pos_DB*.MC_POWER_Instance.Enable		Bool			<input type="checkbox"/>
3	*MotionControl_Pos_DB*.MC_POWER_Instance.Status		Bool			<input type="checkbox"/>
4	*MotionControl_Pos_DB*.MC_POWER_Instance.Busy		Bool			<input type="checkbox"/>
5	*MotionControl_Pos_DB*.MC_POWER_Instance.Error		Bool			<input type="checkbox"/>
6						<input type="checkbox"/>
7	// MC_MOVE_RELATIVE (MASTER)					
8	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Execute		Bool			<input type="checkbox"/>
9	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Distance		Floating-poi...	1000.0		<input checked="" type="checkbox"/>
10	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Velocity		Floating-poi...	50.0		<input checked="" type="checkbox"/>
11	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Done		Bool			<input type="checkbox"/>
12	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Busy		Bool			<input type="checkbox"/>
13	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.CommandAborted		Bool			<input type="checkbox"/>
14	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Error		Bool			<input type="checkbox"/>
15						<input type="checkbox"/>
16	// MC_MOVE_JOG (MASTER)					
17	*MotionControl_Pos_DB*.MC_MOVE_JOG_Instance.JogForward		Bool			<input type="checkbox"/>
18	*MotionControl_Pos_DB*.MC_MOVE_JOG_Instance.JogBackward		Bool			<input type="checkbox"/>
19	*MotionControl_Pos_DB*.MC_MOVE_JOG_Instance.Velocity		Floating-poi...	50.0		<input type="checkbox"/>
20						<input type="checkbox"/>
21	// MC_HALT (MASTER)					
22	*MotionControl_Pos_DB*.MC_HALT_Instance.Execute		Bool			<input type="checkbox"/>
23	*MotionControl_Pos_DB*.MC_HALT_Instance.Done		Bool			<input type="checkbox"/>
24						<input type="checkbox"/>
25	// MC_RESET (MASTER)					
26	*MotionControl_Pos_DB*.MC_RESET_Instance.Execute		Bool			<input type="checkbox"/>
27	*MotionControl_Pos_DB*.MC_RESET_Instance.Restart		Bool			<input type="checkbox"/>
28	*MotionControl_Pos_DB*.MC_RESET_Instance.Done		Bool			<input type="checkbox"/>
29	*MotionControl_Pos_DB*.MC_RESET_Instance.Busy		Bool			<input type="checkbox"/>
30	*MotionControl_Pos_DB*.MC_RESET_Instance.CommandAborted		Bool			<input type="checkbox"/>
31	*MotionControl_Pos_DB*.MC_RESET_Instance.Error		Bool			<input type="checkbox"/>
32						<input type="checkbox"/>

Watch table of the right drive (slave axis)

Figure 5-2

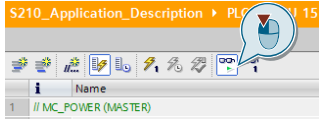
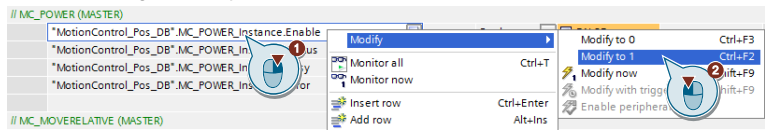
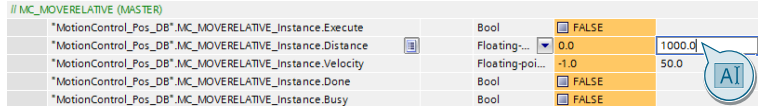
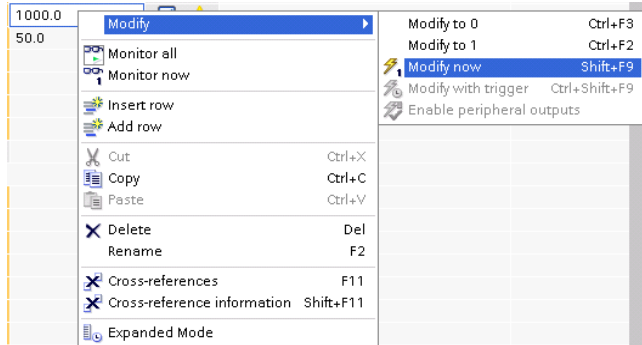

S210_Application_Description > PLC_1 [CPU 1515TF-2 PN] > Watch and force tables > S210_Operation						
	Name	Address	Display format	Monitor value	Modify value	
35	// MC_POWER (SLAVE)					
36	*MotionControl_Sync_DB*.MC_POWER_Instance.Enable		Bool			<input type="checkbox"/>
37	*MotionControl_Sync_DB*.MC_POWER_Instance.Status		Bool			<input type="checkbox"/>
38	*MotionControl_Sync_DB*.MC_POWER_Instance.Busy		Bool			<input type="checkbox"/>
39	*MotionControl_Sync_DB*.MC_POWER_Instance.Error		Bool			<input type="checkbox"/>
40						<input type="checkbox"/>
41	// MC_GEARIN (SLAVE)					
42	*MotionControl_Sync_DB*.MC_GEARIN_Instance.Execute		Bool	FALSE		<input type="checkbox"/>
43	*MotionControl_Sync_DB*.MC_GEARIN_Instance.RatioNumerator		DEC+/-	1		<input type="checkbox"/>
44	*MotionControl_Sync_DB*.MC_GEARIN_Instance.RatioDenominator		DEC+/-	1		<input type="checkbox"/>
45	*MotionControl_Sync_DB*.MC_GEARIN_Instance.InGear		Bool	FALSE		<input type="checkbox"/>
46	*MotionControl_Sync_DB*.MC_GEARIN_Instance.Busy		Bool	FALSE		<input type="checkbox"/>
47	*MotionControl_Sync_DB*.MC_GEARIN_Instance.Error		Bool	FALSE		<input type="checkbox"/>
48						<input type="checkbox"/>
49	// MC_RESET (SLAVE)					
50	*MotionControl_Sync_DB*.MC_RESET_Instance.Execute		Bool	FALSE		<input type="checkbox"/>
51	*MotionControl_Sync_DB*.MC_RESET_Instance.Restart		Bool	FALSE		<input type="checkbox"/>
52	*MotionControl_Sync_DB*.MC_RESET_Instance.Done		Bool	FALSE		<input type="checkbox"/>
53	*MotionControl_Sync_DB*.MC_RESET_Instance.Busy		Bool	FALSE		<input type="checkbox"/>
54	*MotionControl_Sync_DB*.MC_RESET_Instance.CommandAborted		Bool	FALSE		<input type="checkbox"/>
55	*MotionControl_Sync_DB*.MC_RESET_Instance.Error		Bool	FALSE		<input type="checkbox"/>
56						<input type="checkbox"/>
57	// MC_HALT (SLAVE)					
58	*MotionControl_Sync_DB*.MC_HALT_Instance.Execute		Bool	FALSE		<input type="checkbox"/>
59	*MotionControl_Sync_DB*.MC_HALT_Instance.Done		Bool	FALSE		<input type="checkbox"/>

6 Operating examples

6.1 Scenario: Only positioning the master drive

6.1.1 Relative positioning

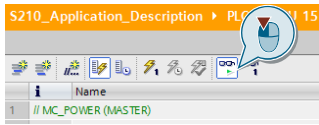
Table 6-1

No.	Action	Comments
1.	<p>Go online and select in the monitoring table "Monitor all":</p> 	<p>Note: After you select this option, the color of the "Monitor value" column changes to orange.</p>
2.	<p>Activate the drive "Left" with MC_Power by right-clicking on the value and selecting "Modify to 1".</p>  <p>Key combinations can be used to speed up the process.</p> <p>Ctrl+F3: Modify to 0 Ctrl+F2: Modify to 1 Shift+F9: Modify now</p>	
3.	<p>Write the desired value in the field "Modify value" for "Distance" [mm] and "Velocity" [mm/s]:</p> 	
4.	<p>Right-click the value and select "Modify now":</p> 	
5.	<p>Perform the operation with the command "Modify to 1":</p> 	
6.	<p>After the task is complete, set the command back to "FALSE".</p>	

6.2 Scenario: Master and slave drive together

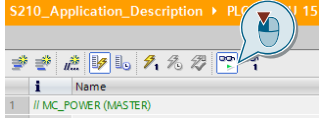
6.2.1 Relative positioning

Table 6-2

No.	Action	Comments																																								
1.	Go online and select in the monitoring table "Monitor all" : 																																									
2.	Activate the master and slave drives with MC_Power by right-clicking on the value and selecting "Modify to 1" . <table border="1" data-bbox="331 667 1091 853"> <thead> <tr> <th colspan="4">// MC_POWER (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB*.MC_POWER_Instance.Enable</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_POWER_Instance.Status</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_POWER_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_POWER_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <th colspan="4">// MC_POWER (SLAVE)</th> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_POWER_Instance.Enable</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_POWER_Instance.Status</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_POWER_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_POWER_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> </tbody> </table>	// MC_POWER (MASTER)				*MotionControl_Pos_DB*.MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Pos_DB*.MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Pos_DB*.MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Pos_DB*.MC_POWER_Instance.Error	Bool	<input type="checkbox"/>	FALSE	// MC_POWER (SLAVE)				*MotionControl_Sync_DB*.MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Sync_DB*.MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Sync_DB*.MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Sync_DB*.MC_POWER_Instance.Error	Bool	<input type="checkbox"/>	FALSE	
// MC_POWER (MASTER)																																										
MotionControl_Pos_DB.MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Pos_DB.MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Pos_DB.MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Pos_DB.MC_POWER_Instance.Error	Bool	<input type="checkbox"/>	FALSE																																							
// MC_POWER (SLAVE)																																										
MotionControl_Sync_DB.MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Sync_DB.MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Sync_DB.MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Sync_DB.MC_POWER_Instance.Error	Bool	<input type="checkbox"/>	FALSE																																							
3.	Activate the synchronization task by setting the command to "TRUE" : <table border="1" data-bbox="331 891 1091 1021"> <thead> <tr> <th colspan="4">// MC_GEARIN (SLAVE)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Sync_DB*.MC_GEARIN_Instance.Execute</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_GEARIN_Instance.RatioNumerator</td> <td>DEC+/-</td> <td><input type="text" value="1"/></td> <td>1</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_GEARIN_Instance.RatioDenominator</td> <td>DEC+/-</td> <td><input type="text" value="1"/></td> <td>1</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_GEARIN_Instance.InGear</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_GEARIN_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB*.MC_GEARIN_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> </tbody> </table>	// MC_GEARIN (SLAVE)				*MotionControl_Sync_DB*.MC_GEARIN_Instance.Execute	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Sync_DB*.MC_GEARIN_Instance.RatioNumerator	DEC+/-	<input type="text" value="1"/>	1	*MotionControl_Sync_DB*.MC_GEARIN_Instance.RatioDenominator	DEC+/-	<input type="text" value="1"/>	1	*MotionControl_Sync_DB*.MC_GEARIN_Instance.InGear	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Sync_DB*.MC_GEARIN_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Sync_DB*.MC_GEARIN_Instance.Error	Bool	<input type="checkbox"/>	FALSE													
// MC_GEARIN (SLAVE)																																										
MotionControl_Sync_DB.MC_GEARIN_Instance.Execute	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Sync_DB.MC_GEARIN_Instance.RatioNumerator	DEC+/-	<input type="text" value="1"/>	1																																							
MotionControl_Sync_DB.MC_GEARIN_Instance.RatioDenominator	DEC+/-	<input type="text" value="1"/>	1																																							
MotionControl_Sync_DB.MC_GEARIN_Instance.InGear	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Sync_DB.MC_GEARIN_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Sync_DB.MC_GEARIN_Instance.Error	Bool	<input type="checkbox"/>	FALSE																																							
4.	Enter the desired value in the "Distance" [mm] and "Velocity" [mm/s] fields, then select "Modify now" : <table border="1" data-bbox="331 1088 1091 1234"> <thead> <tr> <th colspan="4">// MC_MOVE_RELATIVE (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Execute</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Distance</td> <td>Floating-poi...</td> <td><input type="text" value="1000.0"/></td> <td>1000.0</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Velocity</td> <td>Floating-poi...</td> <td><input type="text" value="50.0"/></td> <td>50.0</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Done</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Busy</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.CommandAborted</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> </tbody> </table>	// MC_MOVE_RELATIVE (MASTER)				*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Execute	Bool	<input type="checkbox"/>	FALSE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Distance	Floating-poi...	<input type="text" value="1000.0"/>	1000.0	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Velocity	Floating-poi...	<input type="text" value="50.0"/>	50.0	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Done	Bool	<input type="checkbox"/>	FALSE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Busy	Bool	<input type="checkbox"/>	FALSE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.CommandAborted	Bool	<input type="checkbox"/>	FALSE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Error	Bool	<input type="checkbox"/>	FALSE									
// MC_MOVE_RELATIVE (MASTER)																																										
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Execute	Bool	<input type="checkbox"/>	FALSE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Distance	Floating-poi...	<input type="text" value="1000.0"/>	1000.0																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Velocity	Floating-poi...	<input type="text" value="50.0"/>	50.0																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Done	Bool	<input type="checkbox"/>	FALSE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Busy	Bool	<input type="checkbox"/>	FALSE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.CommandAborted	Bool	<input type="checkbox"/>	FALSE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Error	Bool	<input type="checkbox"/>	FALSE																																							
5.	Execute the MC_MoveRelative command by setting the command to "TRUE" : <table border="1" data-bbox="331 1301 1091 1447"> <thead> <tr> <th colspan="4">// MC_MOVE_RELATIVE (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Execute</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Distance</td> <td>Floating-poi...</td> <td><input type="text" value="1000.0"/></td> <td>1000.0</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Velocity</td> <td>Floating-poi...</td> <td><input type="text" value="50.0"/></td> <td>50.0</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Done</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/></td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.CommandAborted</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/></td> <td>FALSE</td> </tr> </tbody> </table>	// MC_MOVE_RELATIVE (MASTER)				*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Execute	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Distance	Floating-poi...	<input type="text" value="1000.0"/>	1000.0	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Velocity	Floating-poi...	<input type="text" value="50.0"/>	50.0	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Done	Bool	<input type="checkbox"/>	FALSE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.CommandAborted	Bool	<input type="checkbox"/>	FALSE	*MotionControl_Pos_DB*.MC_MOVE_RELATIVE_Instance.Error	Bool	<input type="checkbox"/>	FALSE									
// MC_MOVE_RELATIVE (MASTER)																																										
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Execute	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Distance	Floating-poi...	<input type="text" value="1000.0"/>	1000.0																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Velocity	Floating-poi...	<input type="text" value="50.0"/>	50.0																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Done	Bool	<input type="checkbox"/>	FALSE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Busy	Bool	<input checked="" type="checkbox"/>	TRUE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.CommandAborted	Bool	<input type="checkbox"/>	FALSE																																							
MotionControl_Pos_DB.MC_MOVE_RELATIVE_Instance.Error	Bool	<input type="checkbox"/>	FALSE																																							
6.	After the task is complete, set the command back to "FALSE" .																																									

6.2.2 JOG function (jogging)

Table 6-3

No.	Action	Comments																																								
1.	Go online and select in the monitoring table "Monitor all" : 																																									
2.	Activate the master and slave drives with MC_Power by right-clicking on the value and selecting "Modify to 1" . <table border="1" data-bbox="331 622 1091 806"> <thead> <tr> <th colspan="4">// MC_POWER (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB".MC_POWER_Instance.Enable</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_POWER_Instance.Status</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_POWER_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_POWER_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> <tr> <th colspan="4">// MC_POWER (SLAVE)</th> </tr> <tr> <td>*MotionControl_Sync_DB".MC_POWER_Instance.Enable</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_POWER_Instance.Status</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_POWER_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_POWER_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> </tbody> </table>	// MC_POWER (MASTER)				*MotionControl_Pos_DB".MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	*MotionControl_Pos_DB".MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/> TRUE		*MotionControl_Pos_DB".MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/> TRUE		*MotionControl_Pos_DB".MC_POWER_Instance.Error	Bool	<input type="checkbox"/> FALSE		// MC_POWER (SLAVE)				*MotionControl_Sync_DB".MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	*MotionControl_Sync_DB".MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/> TRUE		*MotionControl_Sync_DB".MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/> TRUE		*MotionControl_Sync_DB".MC_POWER_Instance.Error	Bool	<input type="checkbox"/> FALSE		
// MC_POWER (MASTER)																																										
*MotionControl_Pos_DB".MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE																																							
*MotionControl_Pos_DB".MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/> TRUE																																								
*MotionControl_Pos_DB".MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/> TRUE																																								
*MotionControl_Pos_DB".MC_POWER_Instance.Error	Bool	<input type="checkbox"/> FALSE																																								
// MC_POWER (SLAVE)																																										
*MotionControl_Sync_DB".MC_POWER_Instance.Enable	Bool	<input checked="" type="checkbox"/> TRUE	TRUE																																							
*MotionControl_Sync_DB".MC_POWER_Instance.Status	Bool	<input checked="" type="checkbox"/> TRUE																																								
*MotionControl_Sync_DB".MC_POWER_Instance.Busy	Bool	<input checked="" type="checkbox"/> TRUE																																								
*MotionControl_Sync_DB".MC_POWER_Instance.Error	Bool	<input type="checkbox"/> FALSE																																								
3.	Activate the synchronization task by setting the command to "TRUE" : <table border="1" data-bbox="331 887 1091 1008"> <thead> <tr> <th colspan="4">// MC_GEARIN (SLAVE)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Sync_DB".MC_GEARIN_Instance.Execute</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_GEARIN_Instance.RatioNumerator</td> <td>DEC+/-</td> <td>1</td> <td></td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_GEARIN_Instance.RatioDenominator</td> <td>DEC+/-</td> <td>1</td> <td></td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_GEARIN_Instance.InGear</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_GEARIN_Instance.Busy</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td></td> </tr> <tr> <td>*MotionControl_Sync_DB".MC_GEARIN_Instance.Error</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> </tbody> </table>	// MC_GEARIN (SLAVE)				*MotionControl_Sync_DB".MC_GEARIN_Instance.Execute	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	*MotionControl_Sync_DB".MC_GEARIN_Instance.RatioNumerator	DEC+/-	1		*MotionControl_Sync_DB".MC_GEARIN_Instance.RatioDenominator	DEC+/-	1		*MotionControl_Sync_DB".MC_GEARIN_Instance.InGear	Bool	<input checked="" type="checkbox"/> TRUE		*MotionControl_Sync_DB".MC_GEARIN_Instance.Busy	Bool	<input checked="" type="checkbox"/> TRUE		*MotionControl_Sync_DB".MC_GEARIN_Instance.Error	Bool	<input type="checkbox"/> FALSE														
// MC_GEARIN (SLAVE)																																										
*MotionControl_Sync_DB".MC_GEARIN_Instance.Execute	Bool	<input checked="" type="checkbox"/> TRUE	TRUE																																							
*MotionControl_Sync_DB".MC_GEARIN_Instance.RatioNumerator	DEC+/-	1																																								
*MotionControl_Sync_DB".MC_GEARIN_Instance.RatioDenominator	DEC+/-	1																																								
*MotionControl_Sync_DB".MC_GEARIN_Instance.InGear	Bool	<input checked="" type="checkbox"/> TRUE																																								
*MotionControl_Sync_DB".MC_GEARIN_Instance.Busy	Bool	<input checked="" type="checkbox"/> TRUE																																								
*MotionControl_Sync_DB".MC_GEARIN_Instance.Error	Bool	<input type="checkbox"/> FALSE																																								
4.	Write the desired speed value in the velocity field [mm/s], then select "Modify now" : <table border="1" data-bbox="331 1084 1091 1160"> <thead> <tr> <th colspan="4">// MC_MOVEJOG (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity</td> <td>Floating-poi...</td> <td>100.0</td> <td>50.0</td> </tr> </tbody> </table>	// MC_MOVEJOG (MASTER)				*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward	Bool	<input type="checkbox"/> FALSE		*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward	Bool	<input type="checkbox"/> FALSE		*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity	Floating-poi...	100.0	50.0																									
// MC_MOVEJOG (MASTER)																																										
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward	Bool	<input type="checkbox"/> FALSE																																								
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward	Bool	<input type="checkbox"/> FALSE																																								
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity	Floating-poi...	100.0	50.0																																							
5.	To start the JOG task with "JogForward" or "JogBackward", set one of the commands to "TRUE" : <table border="1" data-bbox="331 1236 1091 1312"> <thead> <tr> <th colspan="4">// MC_MOVEJOG (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward</td> <td>Bool</td> <td><input checked="" type="checkbox"/> TRUE</td> <td>TRUE</td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity</td> <td>Floating-poi...</td> <td>50.0</td> <td>50.0</td> </tr> </tbody> </table>	// MC_MOVEJOG (MASTER)				*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward	Bool	<input checked="" type="checkbox"/> TRUE	TRUE	*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward	Bool	<input type="checkbox"/> FALSE		*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity	Floating-poi...	50.0	50.0	Note: The JOG mode (jog) can only be activated in forward or reverse direction.																								
// MC_MOVEJOG (MASTER)																																										
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward	Bool	<input checked="" type="checkbox"/> TRUE	TRUE																																							
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward	Bool	<input type="checkbox"/> FALSE																																								
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity	Floating-poi...	50.0	50.0																																							
6.	To stop both drives, set the command to "FALSE" : <table border="1" data-bbox="331 1357 1091 1433"> <thead> <tr> <th colspan="4">// MC_MOVEJOG (MASTER)</th> </tr> </thead> <tbody> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td>FALSE</td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward</td> <td>Bool</td> <td><input type="checkbox"/> FALSE</td> <td></td> </tr> <tr> <td>*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity</td> <td>Floating-poi...</td> <td>50.0</td> <td>50.0</td> </tr> </tbody> </table>	// MC_MOVEJOG (MASTER)				*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward	Bool	<input type="checkbox"/> FALSE	FALSE	*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward	Bool	<input type="checkbox"/> FALSE		*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity	Floating-poi...	50.0	50.0																									
// MC_MOVEJOG (MASTER)																																										
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogForward	Bool	<input type="checkbox"/> FALSE	FALSE																																							
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.JogBackward	Bool	<input type="checkbox"/> FALSE																																								
*MotionControl_Pos_DB".MC_MOVEJOG_Instance.Velocity	Floating-poi...	50.0	50.0																																							

7 Appendix

7.1 Motion Control Instructions

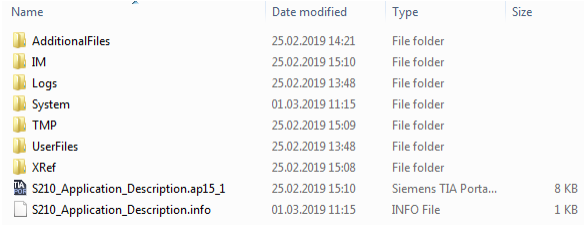
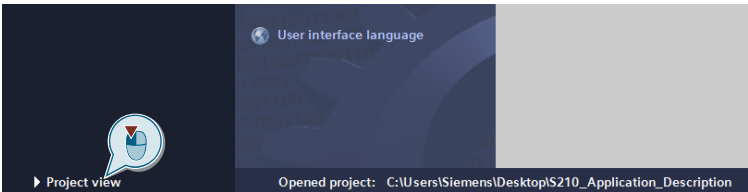
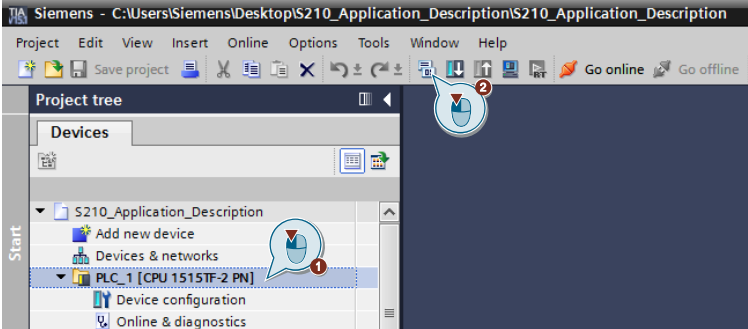
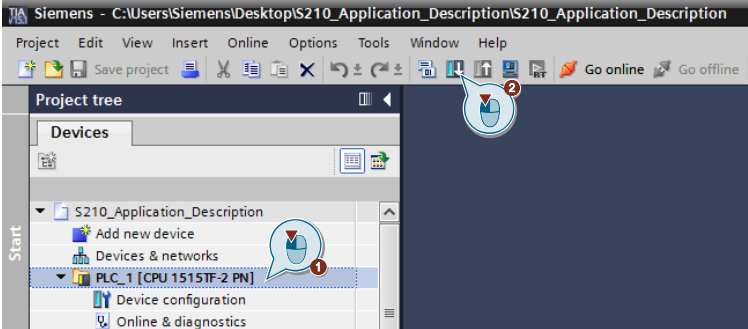
The following table shows the motion control instructions and their functionalities supported by technology objects.

Table 7-1

MC Instruction / FB	Function	Technology objects		
		Speed axis (TO_SpeedAxis)	Positioning axis (TO_PositioningAxis)	Synchronous axis (TO_SynchronousAxis)
MC_Power	Activate / deactivate technology objects	X	X	X
MC_Home	Reference technology objects, set reference point	-	X	X
MC_MoveJog	Moving the axis in jog mode	X	X	X
MC_MoveVelocity	Move axis with predefined speed	X	X	X
MC_MoveRelative	Relative positioning of the axis	-	X	X
MC_MoveAbsolute	Absolute positioning of the axis	-	X	X
MC_MoveSuperimposed	Position axis overlapping	-	X	X
MC_GearIn	Start synchronization	-	-	X
MC_Halt	Stop axis	X	X	X
MC_TorqueLimiting	Limiting torque with torque reduction	X	X	X
MC_Reset	Acknowledge warnings, restart technology objects	X	X	X

7.2 Loading this application example into the PLC

Table 7-2

No.	Action	Comments
1.	Get the project "109749795_Conf_PosAxis_SynAxis_S210_S7-1500_PROJ.zip" available as a ZIP file and save it in a local directory.	
2.	Double-click the .ap15_1 file in the project folder you just retrieved to open the project in TIA Portal: 	
3.	When TIA Portal is opened in the Portal view , go down left to switch to the Project view : 	
4.	Compile the project: 	1) Select the S7 controller in the project tree. 2) Load the project into the controller.
5.	Load the device into the SIMATIC controller: 	1) Select the S7 controller in the project tree. 2) Load the project into the controller.
6.	The application is now ready for operation, as described in section 6.	

8 Links and Literature

Table 8-1

	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Article download page https://support.industry.siemens.com/cs/ww/de/view/109749795
\3\	Function manual SIMATIC S7-1500 S7-1500 Motion Control V4.0 in TIA PORTAL V15 https://support.industry.siemens.com/cs/ww/en/view/109749262
\4\	Commissioning manual for SINAMICS S210 https://support.industry.siemens.com/cs/ww/en/view/109744577
\5\	Download page SINAMICS Startdrive 15.1 https://support.industry.siemens.com/cs/ww/en/view/109760845
\6\	Download SINAMICS S210 Firmware https://support.industry.siemens.com/cs/ww/en/view/109744577

9 Version history

Table 9-1

Version	Date	Changes
V1.0.0	08/2017	Initial version
V1.1.0	04/2018	Figure 1-1 and text passages updated
V1.2.0	03/2019	Configuring S210PN with Startdrive