

SINAMICS V90PN Position Control with HSP in S7-1500

SINAMICS V90PN / HSP / TIA V16

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1 Introduction

Introduction

In this manual, the basic application of position control with the TIA Portal element V90 “HSP” → Hardware Support Package → of SINAMICS V90 PN will be described in detail.

The described solution in this document contains SINAMICS V90 HSP in combination with the necessary commissioning of a SIMATIC S7-1500 PLC.

NOTE

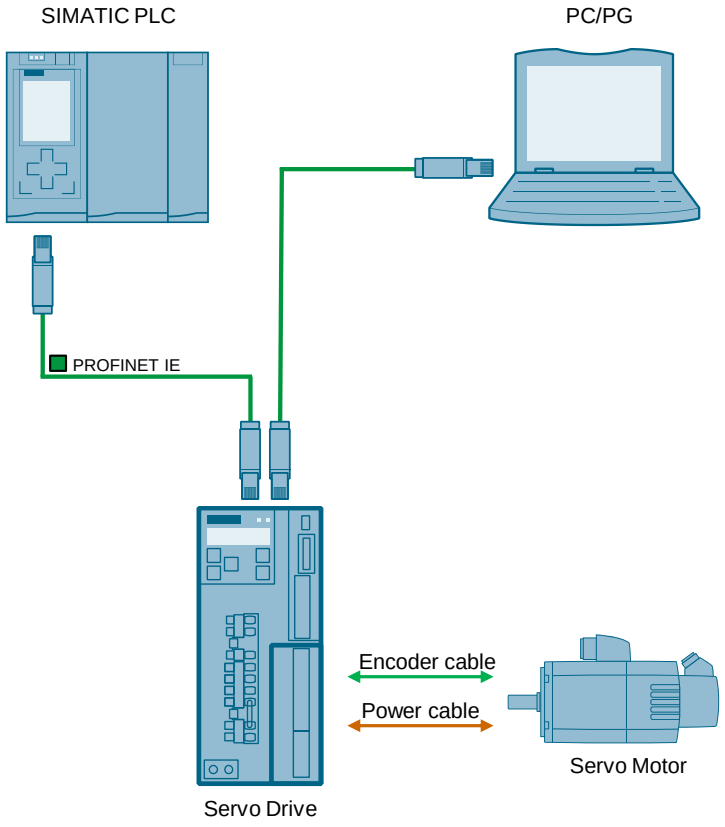
V90PN HSP (Hardware Support Package) can be used only in TIA Portal V14 or further versions.

The V90 HSP can also be connected only to SIMATIC S7-1500 PLCs.

Overview of the automation task

The figure below provides an overview of the automation task.

Figure 1-1



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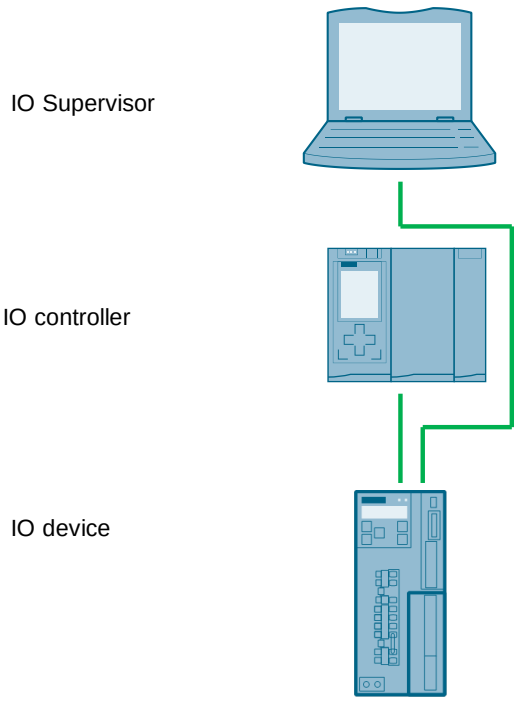
2 Solution

2.1 Solution overview

Schema Display

The following figure displays the most important components of the solution:

Figure 2-1



Delimitation

This application does not include a description of

- PROFINET communication
- SINAMICS V90 PN version
- BOP operation of SINAMICS V90

Basic knowledge of these topics is assumed.

Required knowledge

Basic knowledge on TIA Portal is assumed.

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2.2 Hardware and Software Components

2.2.1 Validity

This application example is valid for

- TIA Portal V16
- S7-1500 CPU with PN interface
- SINAMICS V90PN FW V10400
- HSP_V16_0185_001_SINAMICS_V90_PN_1.4
- SIMOTICS S-1FL6 Li motor

2.2.2 Used Components

The application was generated with the following components:

Hardware components

Table 2-1

Component	No.	Article number	Note
SIMATIC S7-1500 CPU 1511T-1PN	1	6ES7511-1TK01-0AB0	V2.5
SINAMICS V90PN 200V	1	6SL3210-5FB10-1UF0	100W
SIMOTICS S-1FL6 Li motor	1	1FL6024-2AF21-1AA1	100W

Standard software components

Table 2-2

Component	No.	Article number	Note
TIA Portal	1		V16
HSP_V16_0185_001_V90_PN	1		V16
SINAMICS V-ASSISTANT	1		V1.06.02

Sample files and projects

The following list includes all files and projects that are used in this example.

Table 2-3

Component	Note
109780895_SINAMICS_V90PN_position_control_with_S7-1500_and_HSP_CODE.zip	Project file
109780895_SINAMICS_V90PN_position_control_with_S7-1500_and_HSP_DOC_v13_en.pdf	Reference document

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3 Basics

3.1 Basics regarding SINAMICS V90 PN HSP (Hardware Support Package)

The SINAMICS V90 PN supports the following main telegrams:

- Standard telegram 1
- Standard telegram 2
- Standard telegram 3
- Standard telegram 5
- Siemens telegram 102
- Siemens telegram 105

The SINAMICS V90 PN also supports the supplementary telegram 750, but it can only be used together with a main telegram, such as telegram 5 and telegram 105.

If V90 PN HSP is used for applications TO (Technology Object) inside of the SIMATIC S7-1500 must be used.

The V90 PN HSP contains a predefined telegram 105 in its configuration which can be used in different kind of applications (positioning, speed control …).

NOTE The telegram configuration which has been implemented inside of the V90 HSP element cannot be changed by the user.

NOTE Telegram 750 only could be used in V90 PN FW V1.03 or above version.

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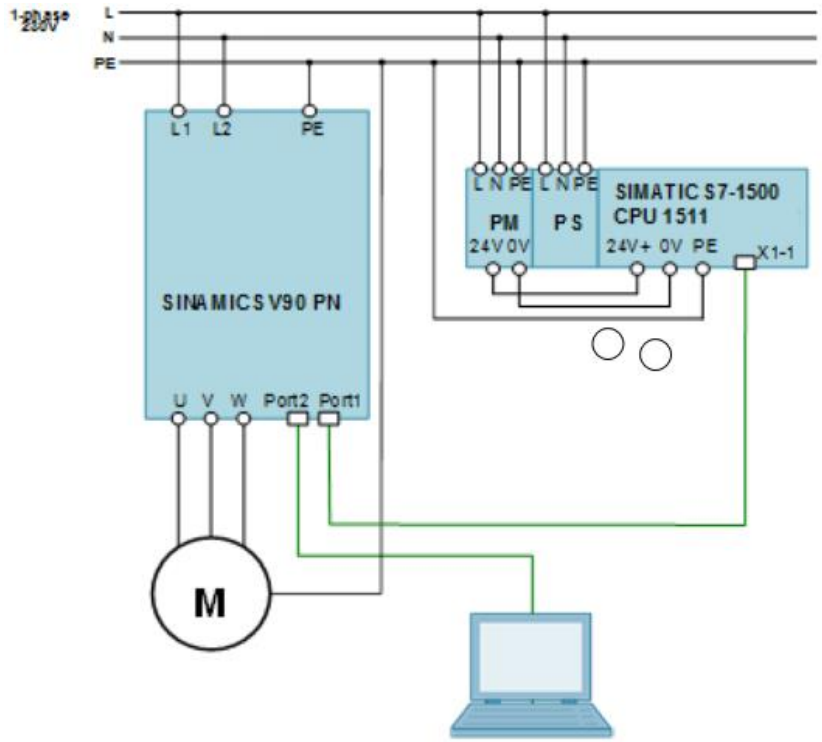
3.2 Installation and startup

3.2.1 Hardware installation

The figure below shows the hardware configuration of the application:

CAUTION	**Wrong wiring can damage the drive!** In this application, the one phase 230V power supply is used. It is a must for you to check the supply voltage; otherwise, the drive can be damaged!

Figure 3-1



3.2.2 Trial-run for V90 PN and 1FL6 motor

Table 3-1 Trial-run

No.	Action	Remarks
1.	Set drive parameter p29108 to be “1”.	JOG function is enabled when p29108 = “1”
2.	Switch to JOG menu with drive BOP operation.	
3.	Press ▲ or ▼ button to run the motor.	Check if the motor can run properly.

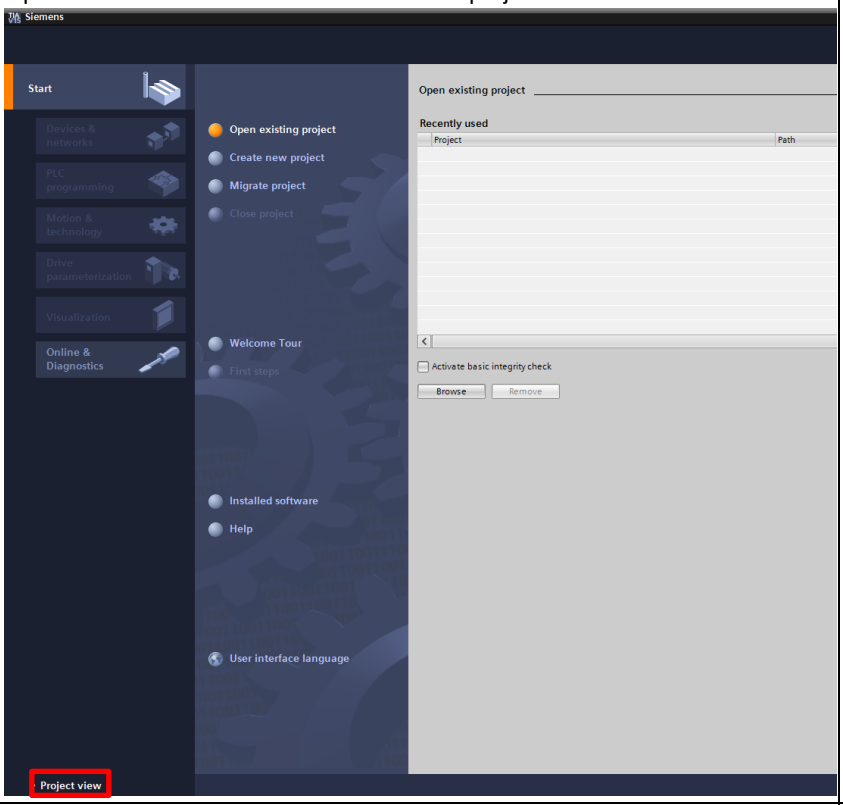
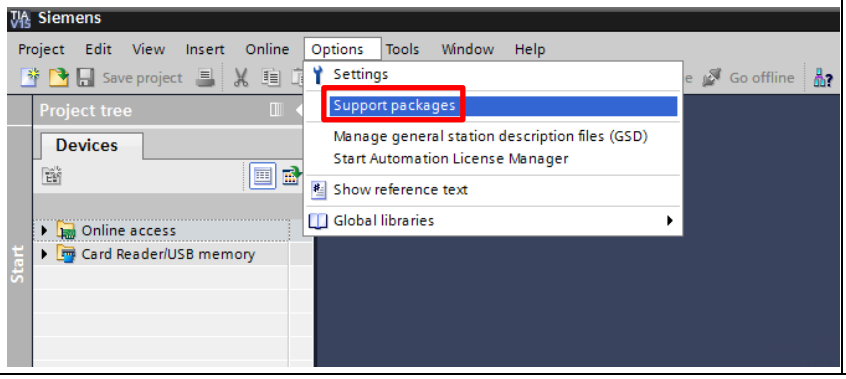
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3.3 Install V90 PN HSP in TIA Portal

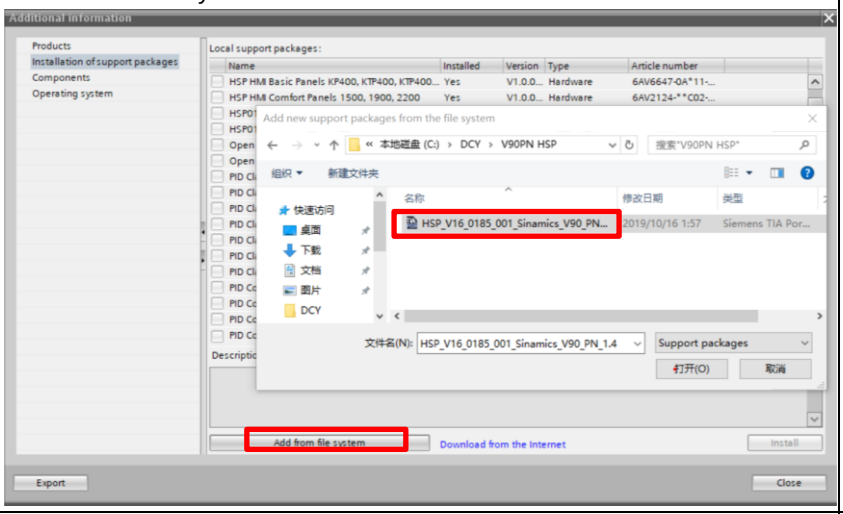
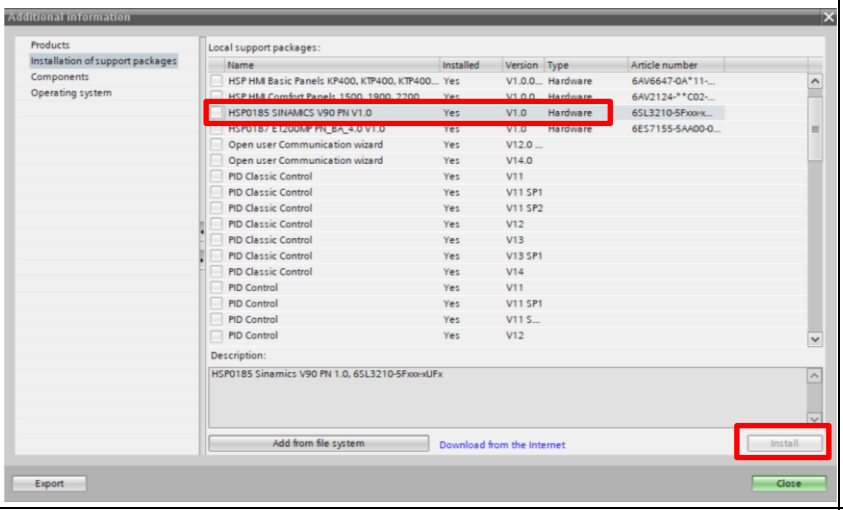
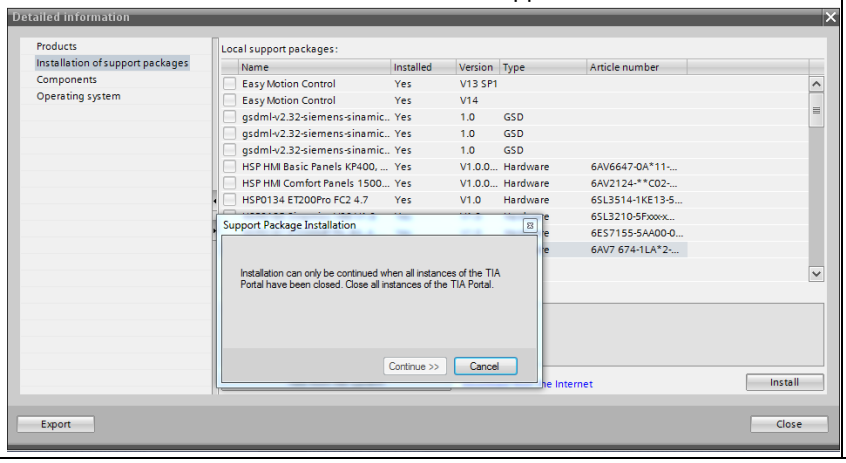
Install V90 PN HSP in TIA Portal as follows:

NOTE The V90 PN HSP file can be downloaded from the following SIOS entry: https://support.industry.siemens.com/cs/ww/en/view/72341852

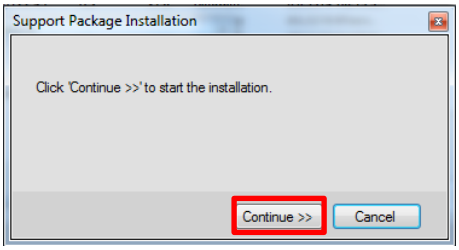
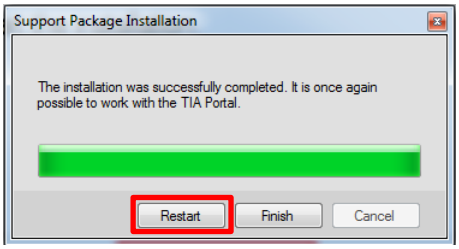
Table 3-1

No.	Action	Remarks
1.	Open the TIA Portal software and click the “project view” 	
2.	Click the “Options” and select the “Support packages” 	

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No.	Action	Remarks
3.	Add the file from system 	
4.	Check the “HSP_V16_0185_001_SINAMICS_V90_PN_1.4”and then click on “Install” 	
5.	Close the TIA Portal software when this notes appears: 	

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No.	Action	Remarks
6.	After closing the TIA Portal software → click “Continue“ 	
7.	Click the “Restart” button and finish the installation of the Hardware Support Package. 	

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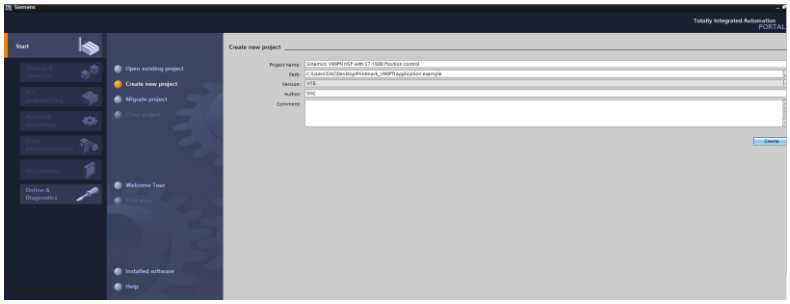
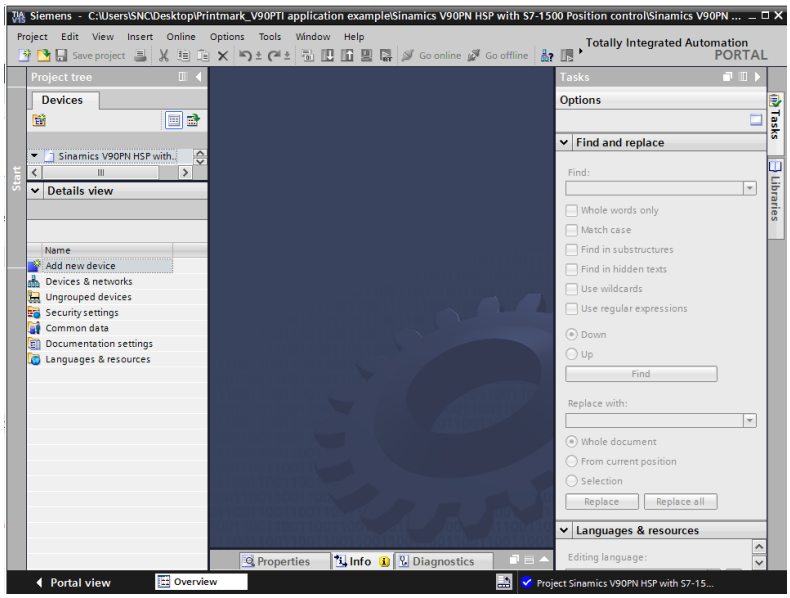
4 Configuration

In this section, the configuration for the example position control with V90 PN HSP will be described in detailed.

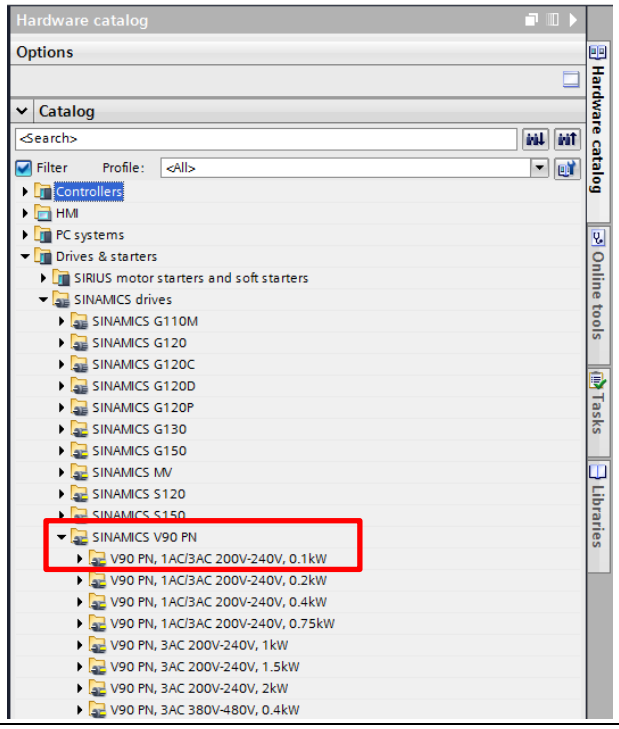
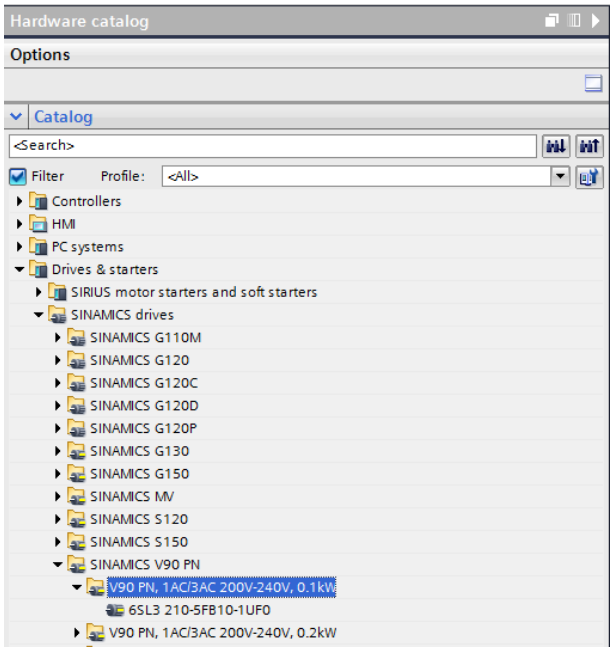
4.1 Introduction of the V90PN HSP in TIA Portal V16

4.1.1 Add the SINAMICS V90 PN via HSP and start with the configuration

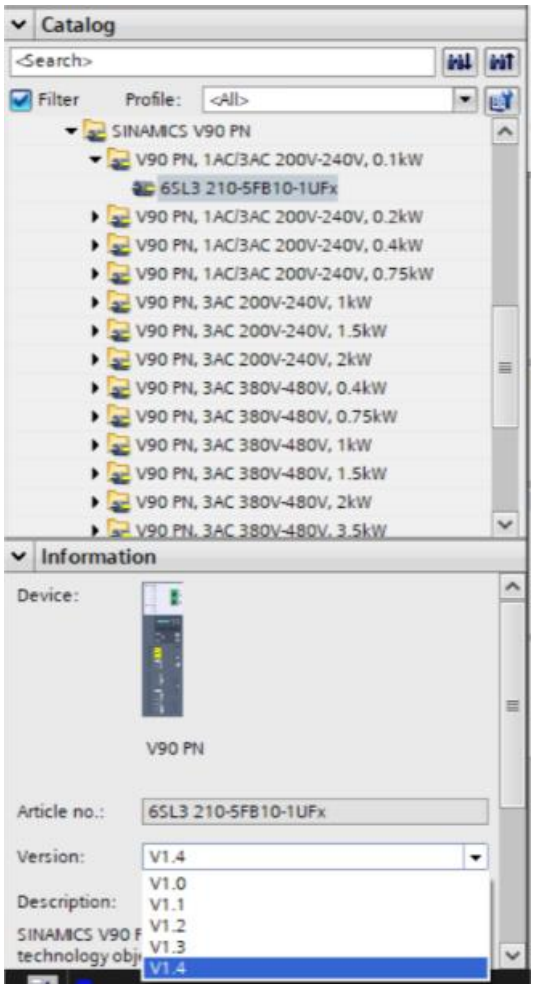
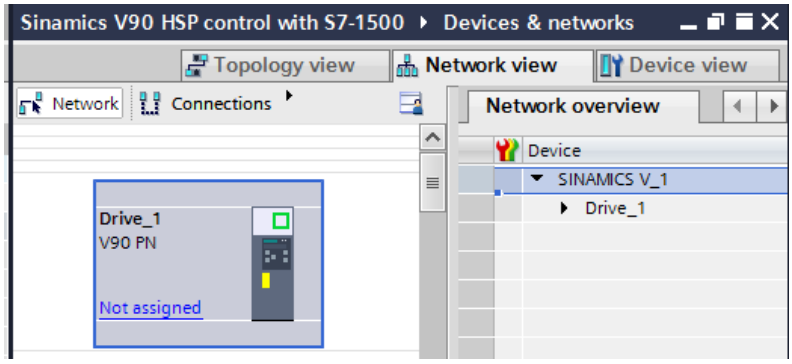
Table 4-1

No.	Action	Remarks
1.	Open the TIA Portal and create a new project: 	
2.	Switch to Project view 	

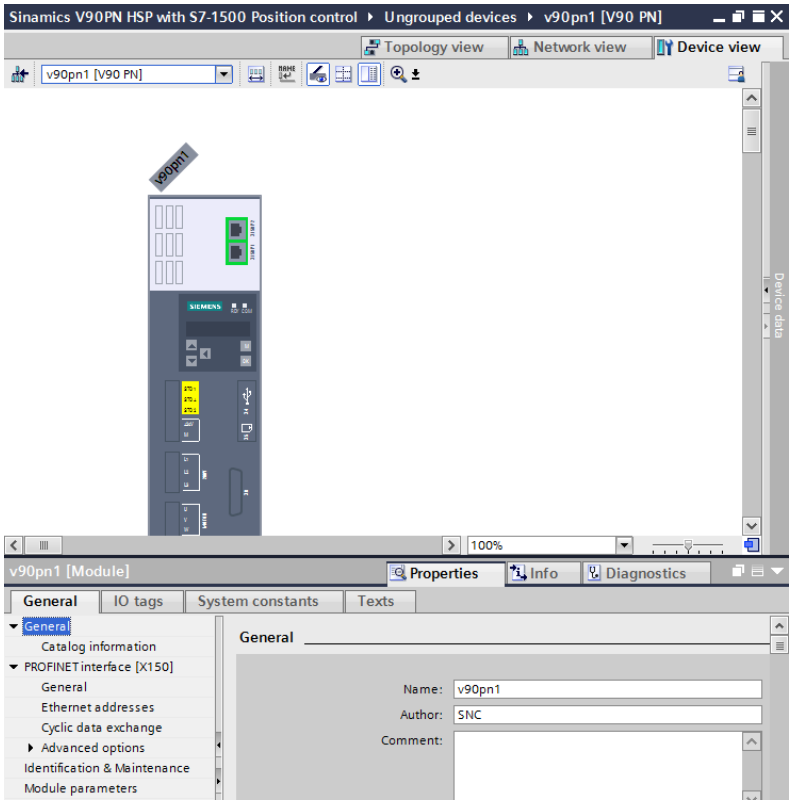
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No.	Action	Remarks
3.	1. Double-click the node “**Devices & networks**” from the project tree 2. Select in the right side panel select the “**Hardware catalog**” tab 3. Click on “Drives & starters”-> “SINAMICS drives”-> “SINAMICS V90 PN” and then select the version of the used SINAMICS V90 PN drive 	
4.	Double click the “**V90PN,1AC/3AC 200V-240V,0.1kW**” 	

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No.	Action	Remarks
5.	Select the corresponding article number and the corresponding V90 PN drive firmware version: 	In this application the drive “6SL3210-5FB10-1UF0” is selected (0.1KW / 200V drive and the V90 PN firmware is V1.4)
6.	Drag the V90PN to the network view: 	

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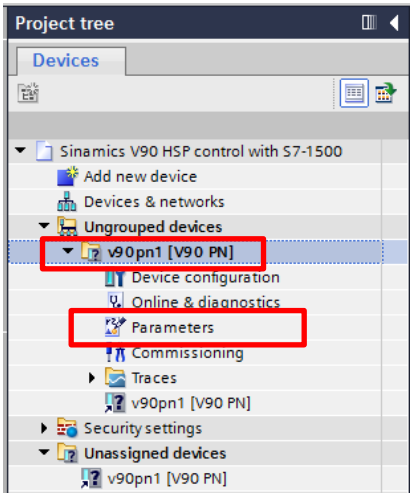
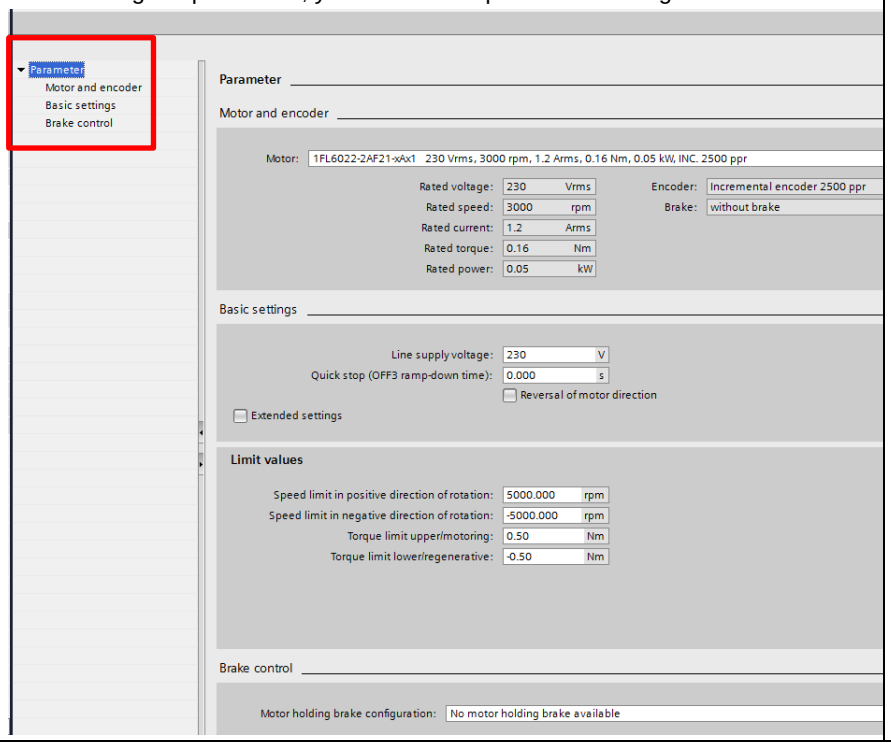
No.	Action	Remarks
7.	Double click the V90PN to enter the properties field: Here, you can configure information about the device name, Ethernet address… 	Example: PROFINET device name: v90pn1 PROFINET Ethernet address:192.168.0.2

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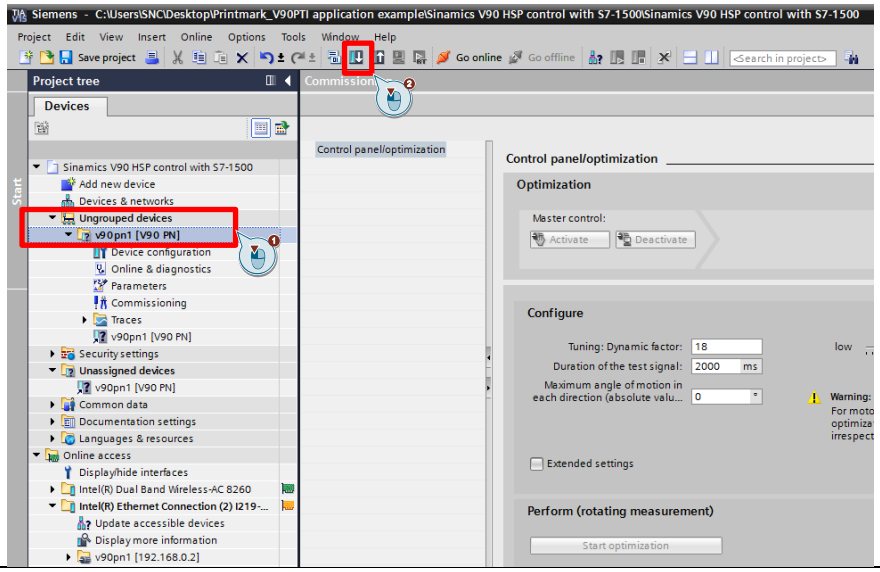
4.1.2 Parameters change and download

You can use V90PN HSP to do the parameters commissioning such as selecting the motor and encoder, setting the line supply voltage, brake control and so on.

Table 4-2

No.	Action	Remarks
1.	Click on the parameters from project tree as below: 	
2.	After clicking the parameter, you will see the parameter setting: 	It is possible to adapt the parameters via the shown options.

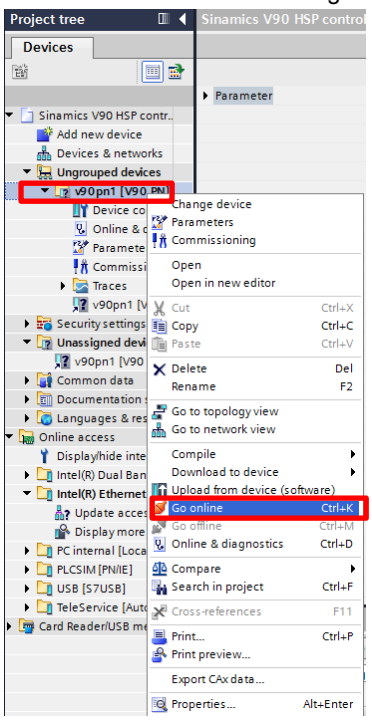
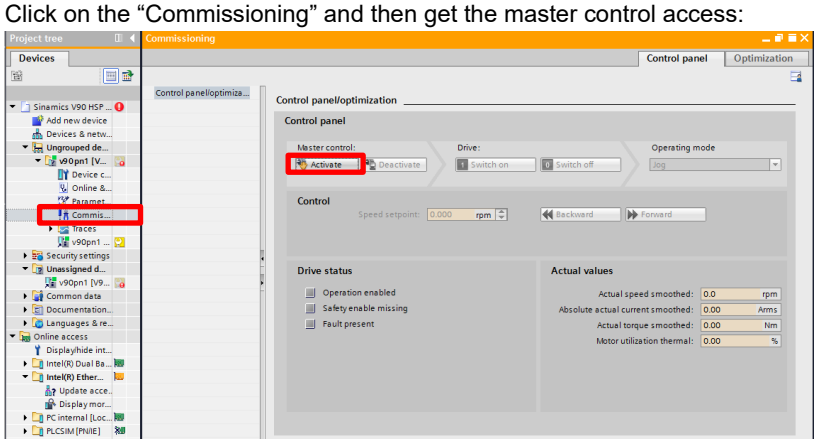
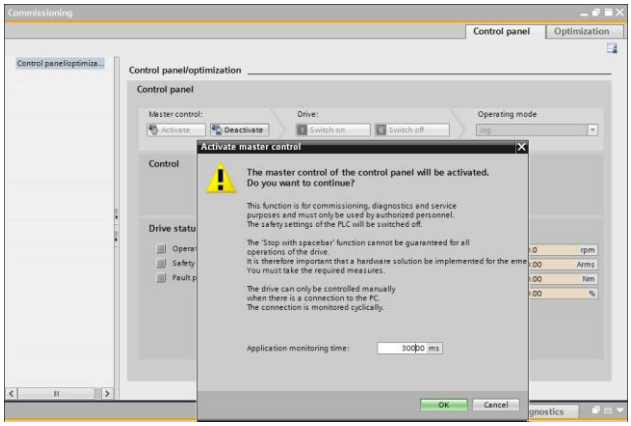
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No.	Action	Remarks
3.	After finishing the parameter setting it is possible to download it via the selection “Ungrouped devices”: 	

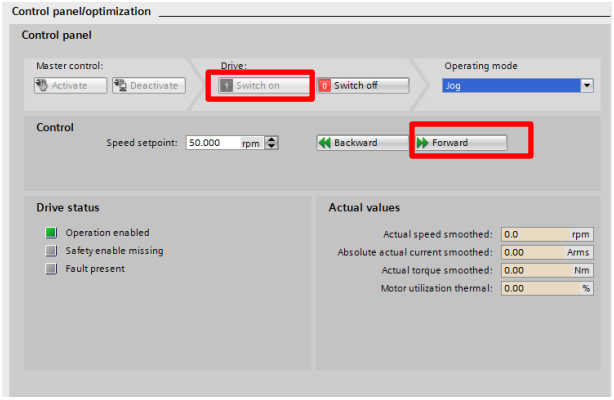
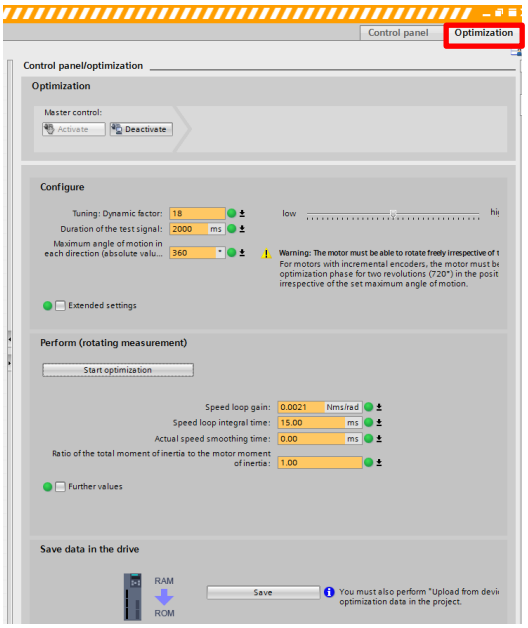
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4.1.3 Online commissioning and optimization

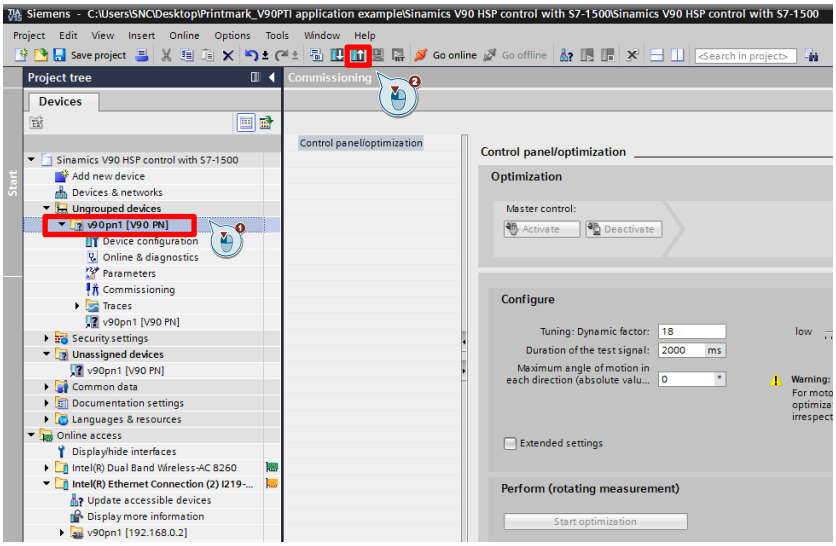
Table4-3

No.	Action	Remarks
1.	Select the V90 PN device → right click and select “Go online”: 	
2.	Click on the “Commissioning” and then get the master control access: 	
3.		If the communication is not stable, it is possible to increase the monitoring time to for example 3000ms.

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No.	Action	Remarks
4.	Click on the Switch on and use the JOG button to test the drive. 	
5.	Change the control panel to the optimization panel as below: 	Note: In this optimization panel it is possible to change the dynamic parameters for the optimization run. If there is a need for a more detailed configuration it is possible to click the extended settings and get more options. (This optimization is similar as one button tuning in V90 V-Assistant)
6.	Click on the “start optimization” and then waiting for the motor optimization run. When it has been finished, the new dynamic values can be saved in the drive. 	

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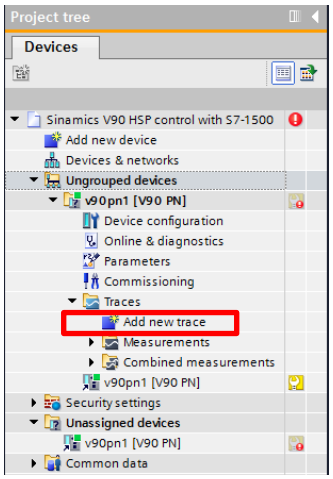
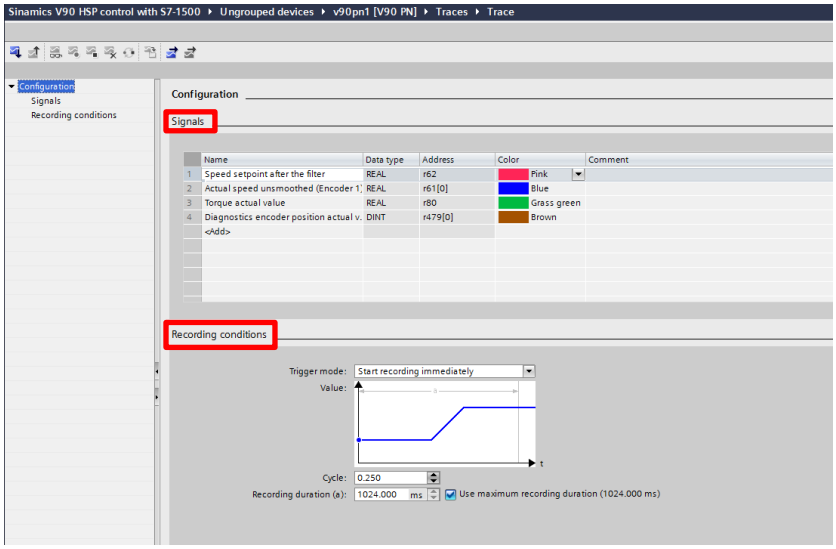
No.	Action	Remarks
7.	After above operations the changes inside of the online drive should be saved in the offline project. Click on the “v90pn1” and then click on “upload from device”: 	If the upload button is not available then disconnect the engineering from the drive (“Go offline”) and upload the drive in the offline project.

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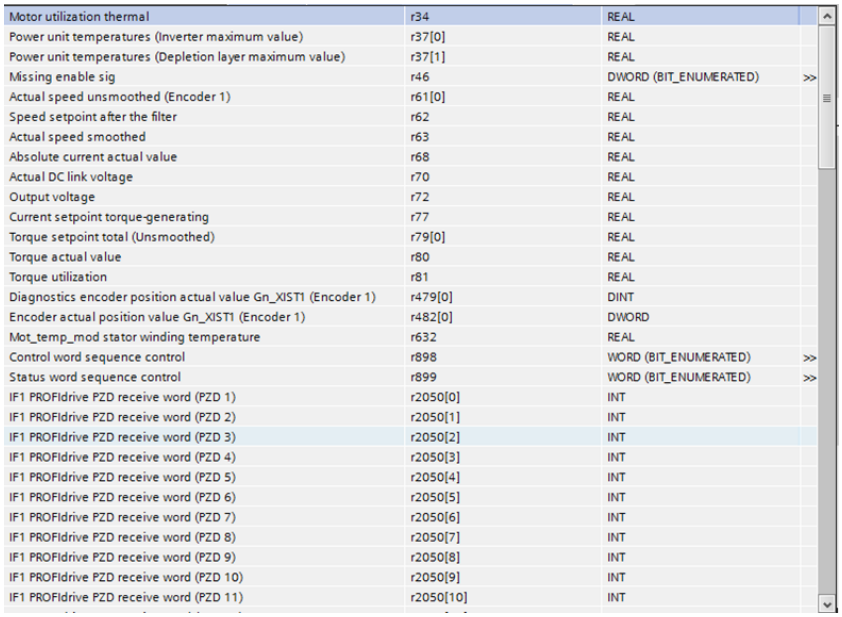
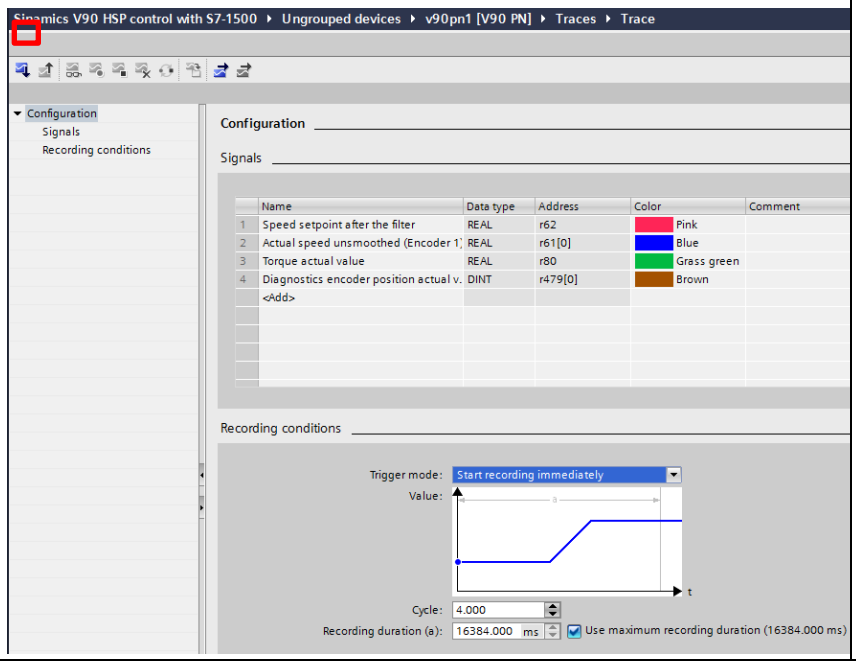
4.1.4 Trace function introduction

If it's necessary to trace the signals of drive or motor during the commissioning, then the trace function of TIA Portal can be used.

Table 4-4

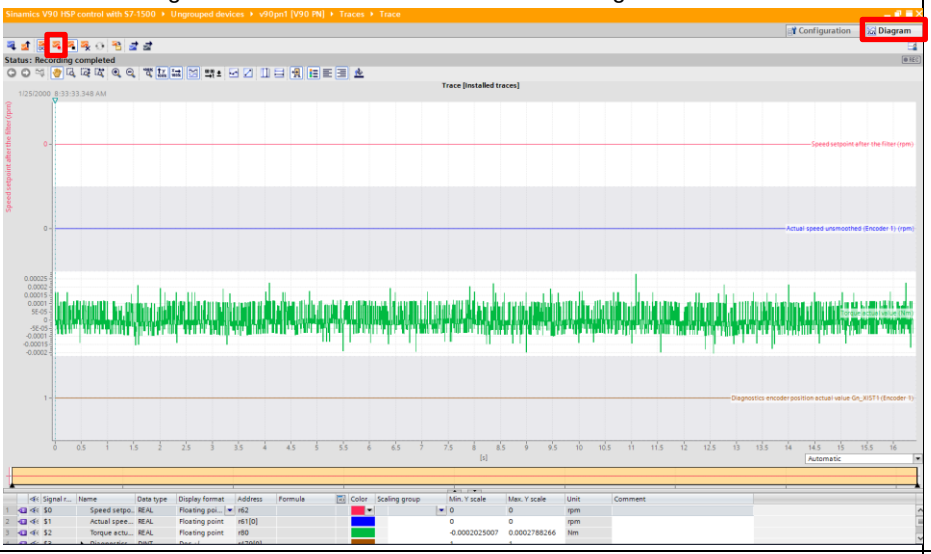
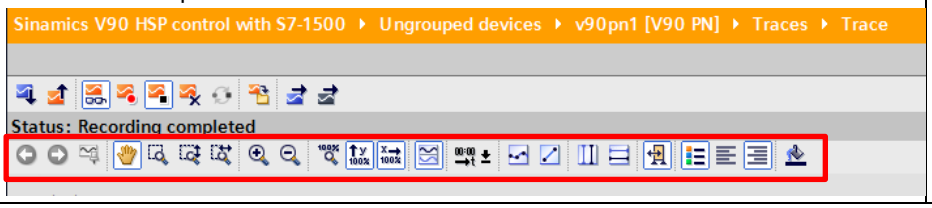
No.	Action	Remarks
1.	Add the trace configuration in project tree: 	
2.	Select the signals which you want to trace and define the recording conditions: 	

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No.	Action	Remarks
3.	There are several signals which can be traced: 	
4.	After finish the configuration, you should download the trace configuration: 	

Motor utilization thermal	r34	REAL
Power unit temperatures (Inverter maximum value)	r37[0]	REAL
Power unit temperatures (Depletion layer maximum value)	r37[1]	REAL
Missing enable sig	r46	DWORD (BIT_ENUMERATED) >>
Actual speed unsmoothed (Encoder 1)	r61[0]	REAL
Speed setpoint after the filter	r62	REAL
Actual speed smoothed	r63	REAL
Absolute current actual value	r68	REAL
Actual DC link voltage	r70	REAL
Output voltage	r72	REAL
Current setpoint torque-generating	r77	REAL
Torque setpoint total (Unsmoothed)	r79[0]	REAL
Torque actual value	r80	REAL
Torque utilization	r81	REAL
Diagnostics encoder position actual value Gn_XIST1 (Encoder 1)	r479[0]	DINT
Encoder actual position value Gn_XIST1 (Encoder 1)	r482[0]	DWORD
Mot_temp_mod stator winding temperature	r632	REAL
Control word sequence control	r898	WORD (BIT_ENUMERATED) >>
Status word sequence control	r899	WORD (BIT_ENUMERATED) >>
IF1 PROFIdrive PZD receive word (PZD 1)	r2050[0]	INT
IF1 PROFIdrive PZD receive word (PZD 2)	r2050[1]	INT
IF1 PROFIdrive PZD receive word (PZD 3)	r2050[2]	INT
IF1 PROFIdrive PZD receive word (PZD 4)	r2050[3]	INT
IF1 PROFIdrive PZD receive word (PZD 5)	r2050[4]	INT
IF1 PROFIdrive PZD receive word (PZD 6)	r2050[5]	INT
IF1 PROFIdrive PZD receive word (PZD 7)	r2050[6]	INT
IF1 PROFIdrive PZD receive word (PZD 8)	r2050[7]	INT
IF1 PROFIdrive PZD receive word (PZD 9)	r2050[8]	INT
IF1 PROFIdrive PZD receive word (PZD 10)	r2050[9]	INT
IF1 PROFIdrive PZD receive word (PZD 11)	r2050[10]	INT

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No.	Action	Remarks
5.	Click on the diagram and then click on the active recording button: 	
6.	After finish the recording, it is possible to use the buttons of the tool to zoom in, zoom out and others operation. 	

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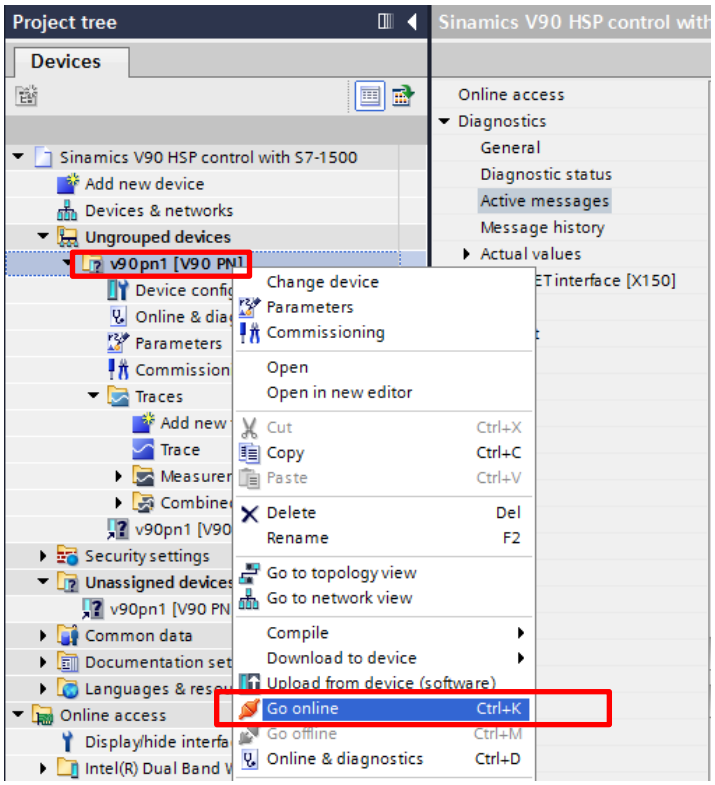
4.1.5 Other related function introduction

NOTE The setup for the PROFINET parameters like device name and IP address can be setup via the V90 PN HSP element in the project tree under “Online and diagnostic” → Functions → Assign …

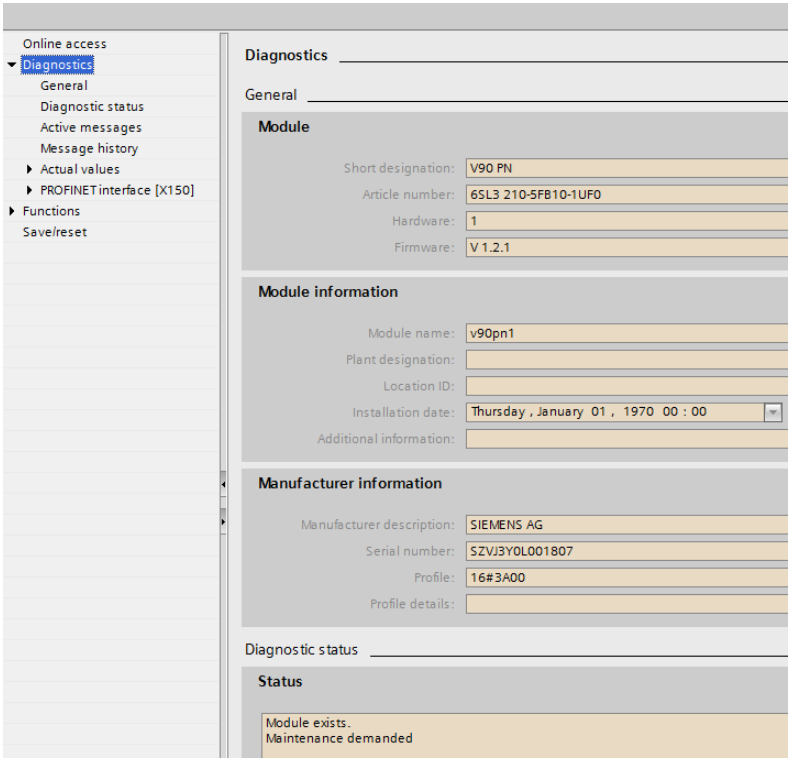
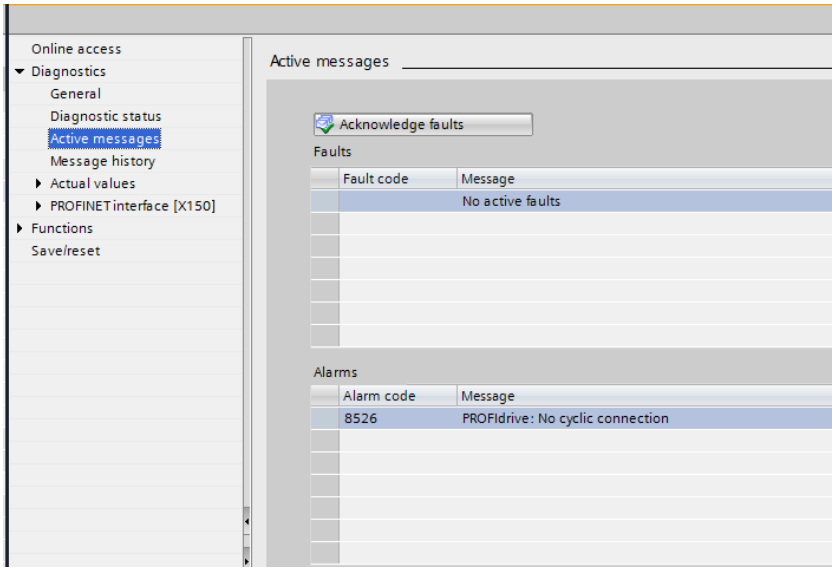
It is also possible to set the PROFINET parameters via the TIA Portal live list (Project tree →Online access → *….LAN adapter → “Online and diagnostic” → Functions → Assign …).

NOTE With the V90 PN HSP element it is possible to check the drive for alarm and fault information, acknowledge faults and save or reset the drive.

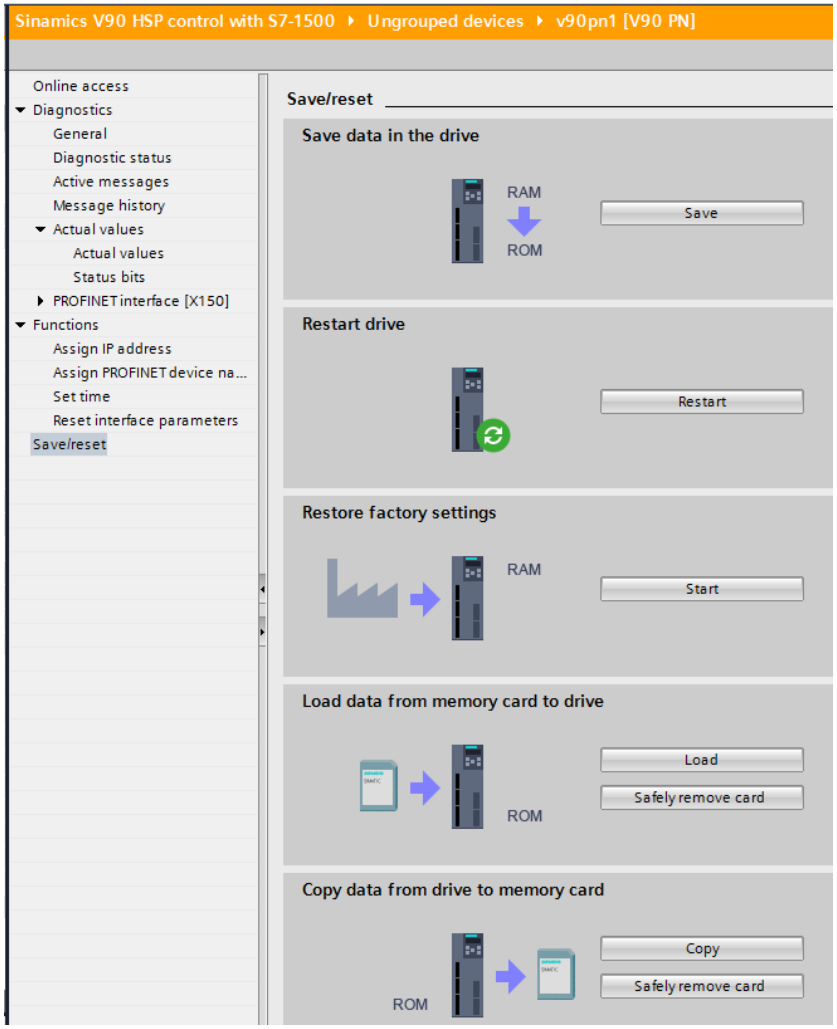
Table 4-5

No.	Action	Remarks
1.	Click on the V90pn1 and change it to online mode: 	

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No.	Action	Remarks
2.	Click on the diagnostics → it is possible to see the information of the drive: 	
3.	Click on the Active messages → it is possible to acknowledge faults: 	

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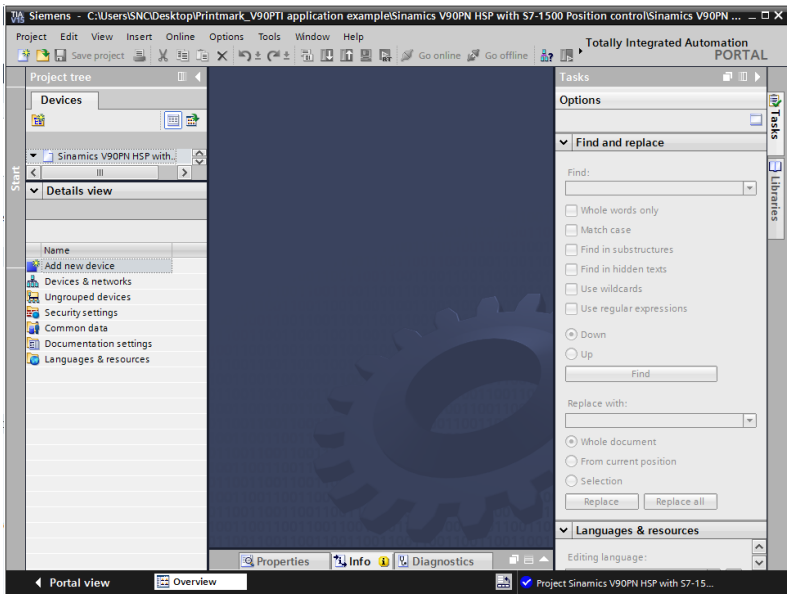
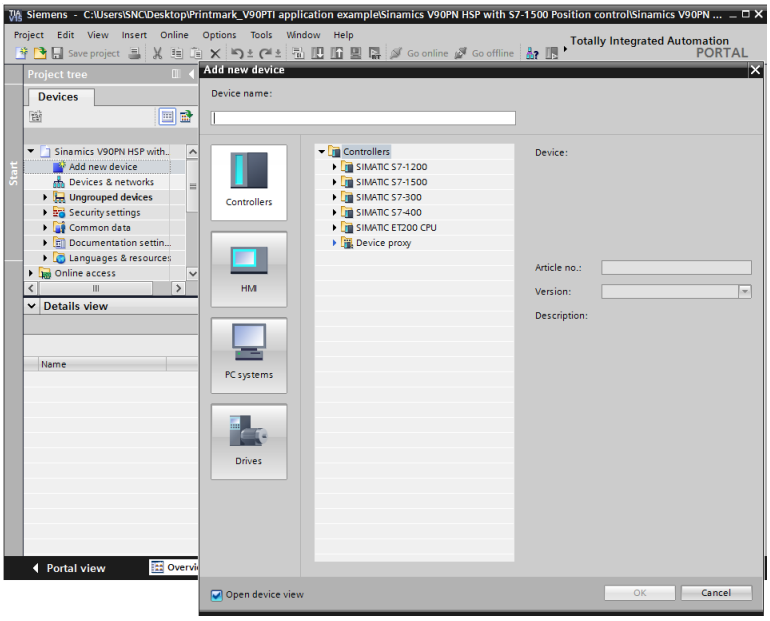
No.	Action	Remarks
4.	Click on “Save/reset” → it is possible to select the save/restart function: 	
5.	Setup the PROFINET device name / IP address: 	

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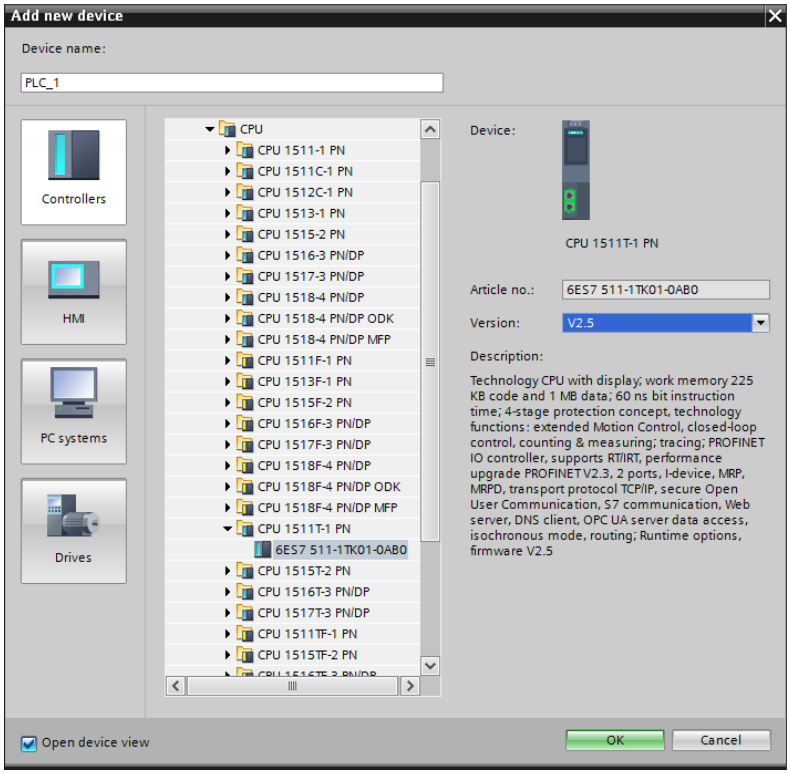
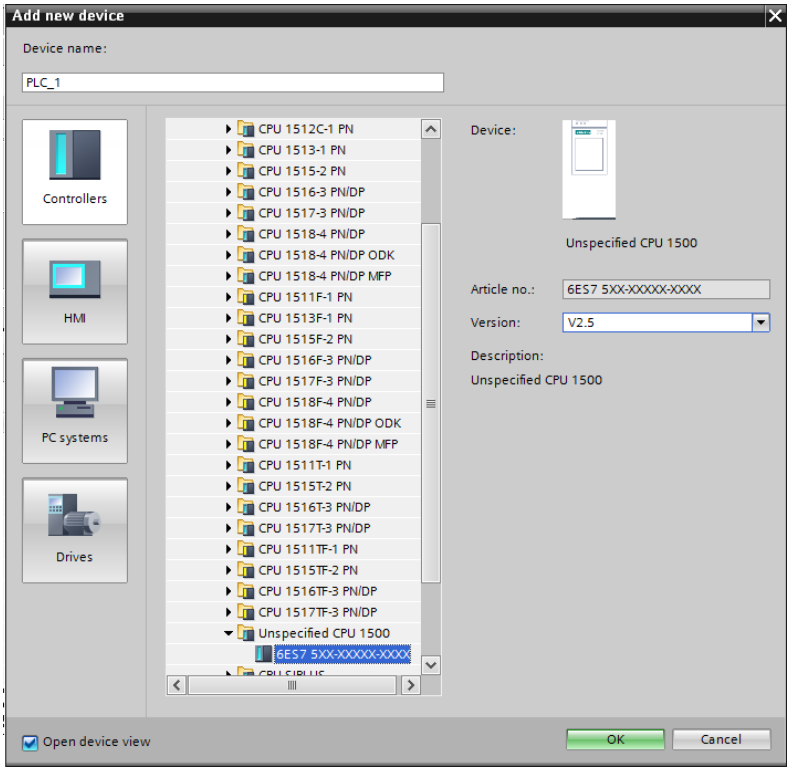
4.2 Configure PROFINET settings via the TIA Portal

4.2.1 Add S7-1500 into the project

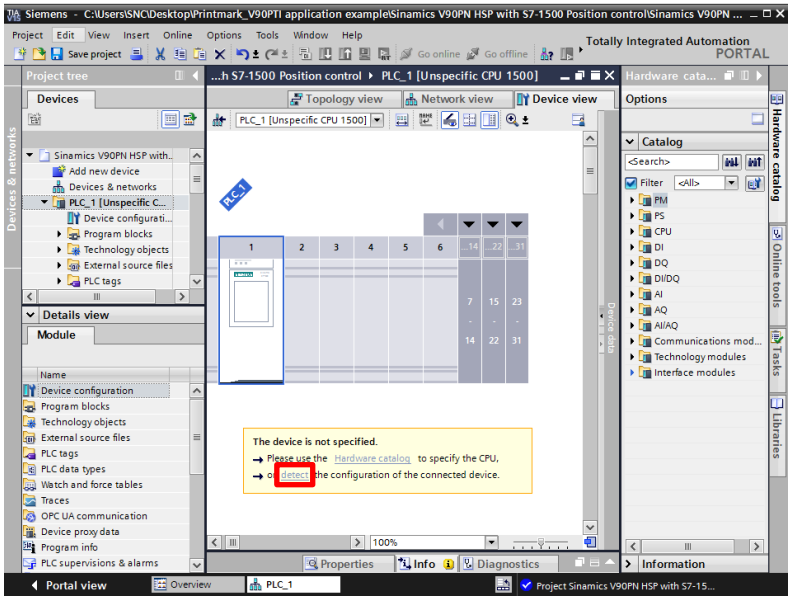
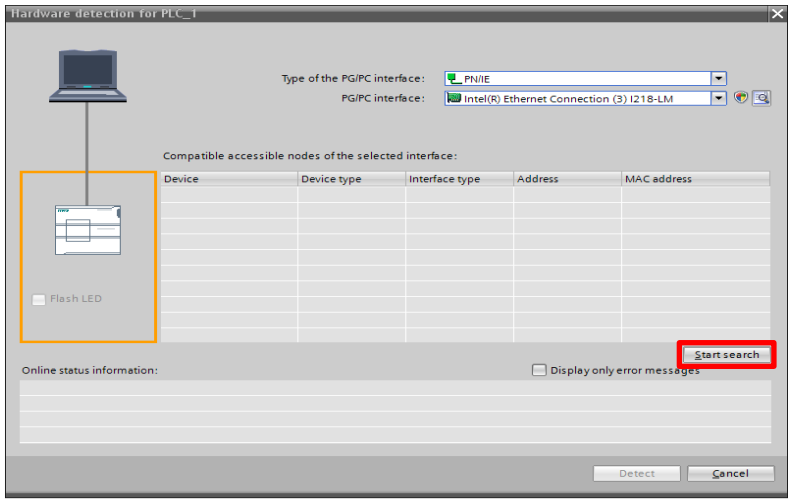
Table 4-6

No	Action	Remarks
1.	Switch to Project view 	
2.	Double-click the node “**Add new device**” from the Device tree: 	

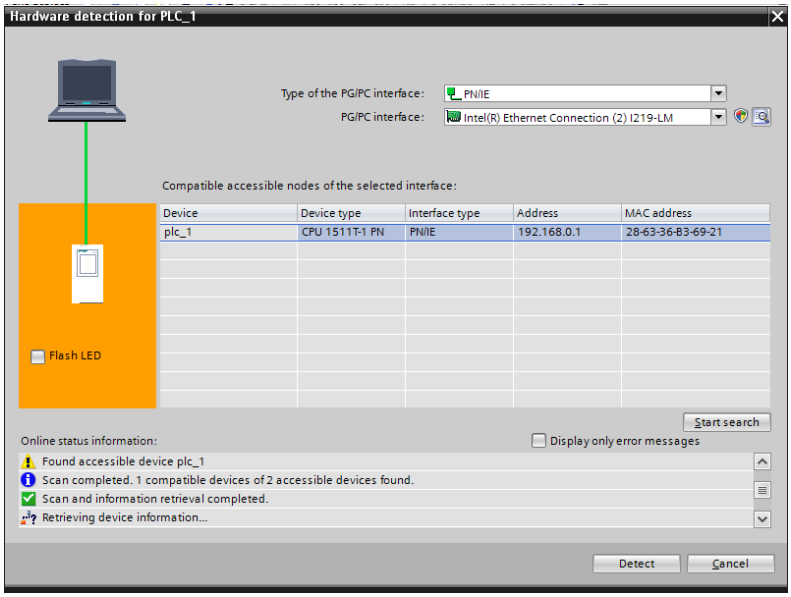
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No	Action	Remarks
3.	In here, if you know the detailed information about the S7-1500 modules, you can directly find the type and add it into the project: 	
4.	Otherwise, you can add an unspecified CPU1500 into the project: 	

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No	Action	Remarks
5.	If an unspecified 1500 CPU has been added, you can detect the connected CPU by clicking the “Detect” and search it with online access 	Optional: only in case of unspecified CPU 1500
6.	Start the search by clicking the “Start search” button, and the connected S7-1500 CPU will be found if the PROFINET network communication works properly: 	

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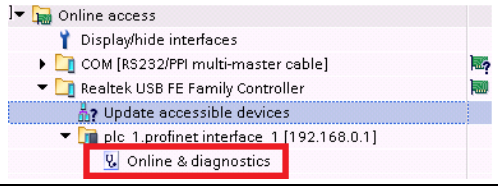
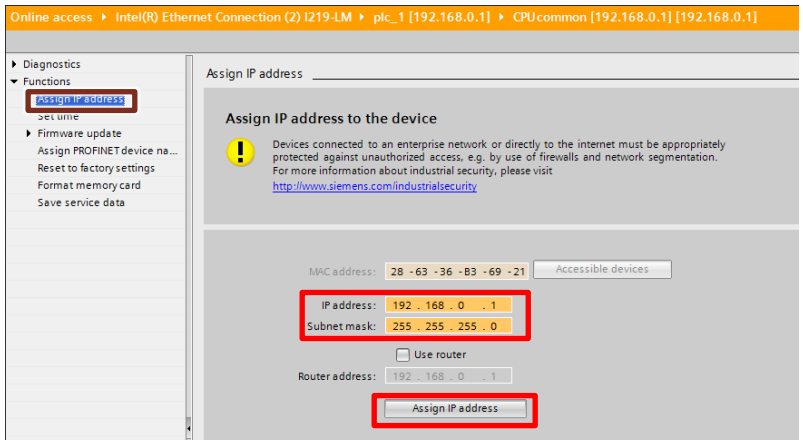
No	Action	Remarks
7.	Press “Detect” button to detect the connected CPU: 	

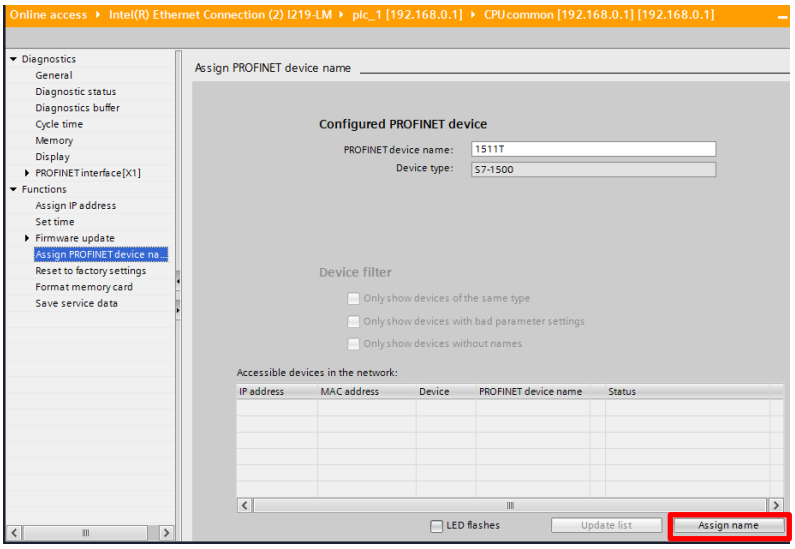
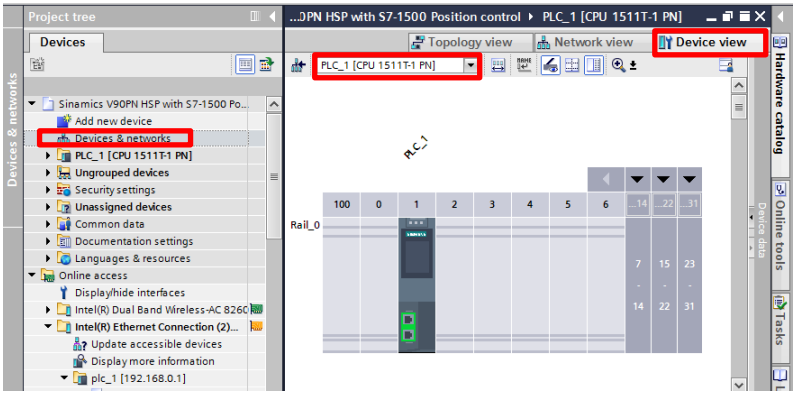
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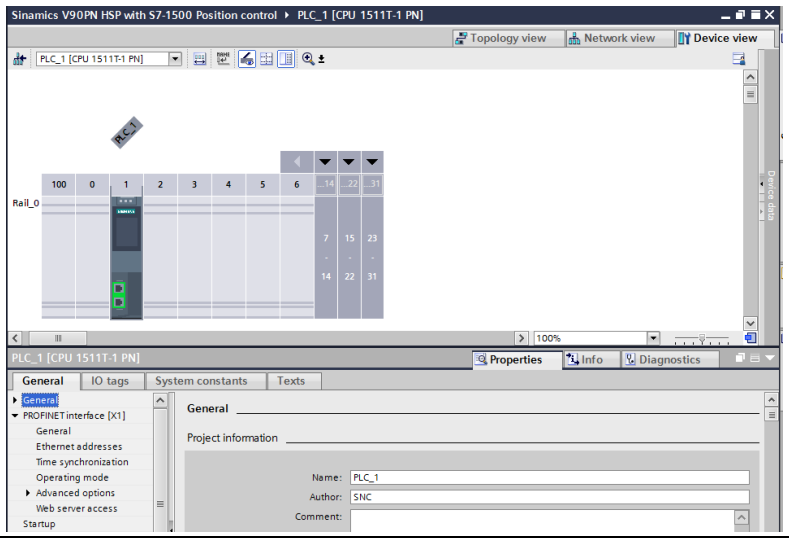
4.2.2 Device configuration of the S7-1500 CPU

Device name and Ethernet address configuration via TIA Portal

Table 4-7

No.	Action	Remarks
1.	Click on “**Online access**” to find the accessible devices, and under the PLC device click on “**Online&diagnostics**”: 	
2.	In this new window select “**Functions**” and change “**IP Address**” and “**Subnet mask**” and then click on “**Assign IP address**”: 	**Note:** in this project the IP address: 192.168.0.1 and Subnet mask: 255.255.255.0 will be used

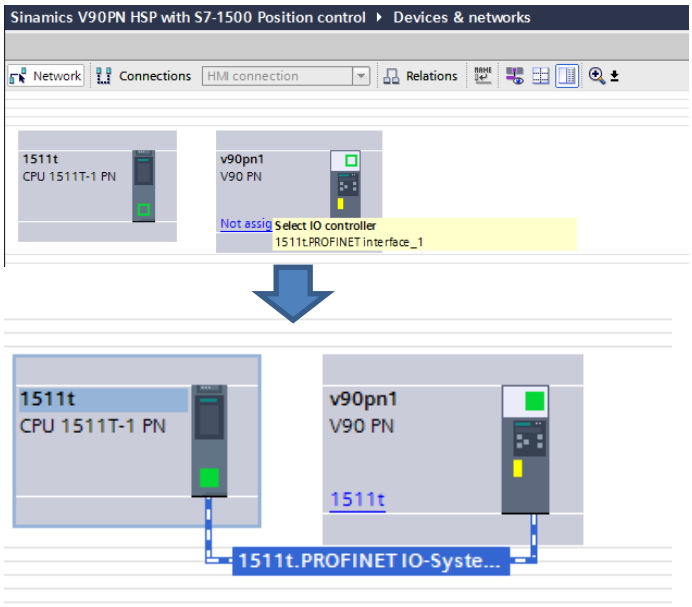
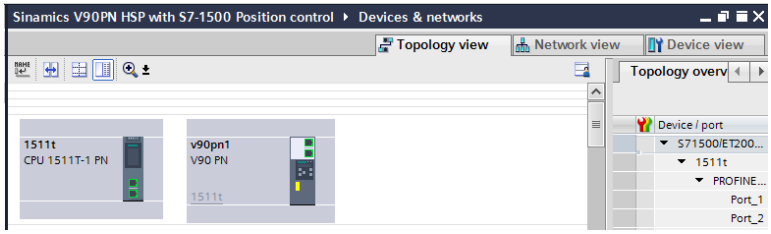
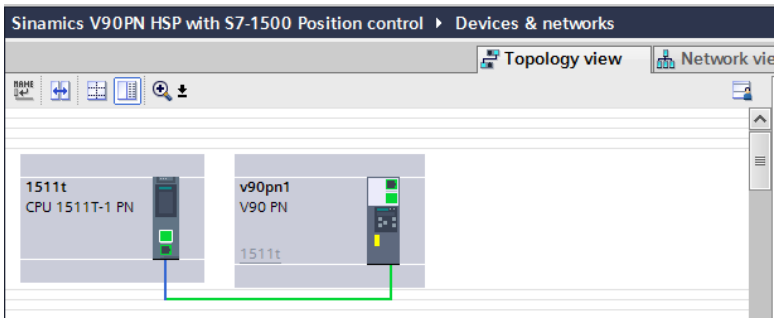
No.	Action	Remarks
3.	Click on “**Assign PROFINET device name**”, write the name on the field and click on “**Assign name**” 	
4.	Double click the “Devices&networks”-> “Device view” and select 1511T CPU 	
5.	Double click the 1511T CPU to enter the properties field: Here, you can configure information about the device name, Ethernet address…	Device name: 1511T, Ethernet address: 192.168.0.1



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4.2.3 Connect V90 PN with S7-1500

Table4-8

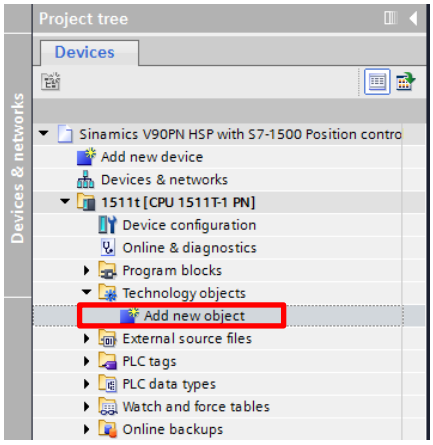
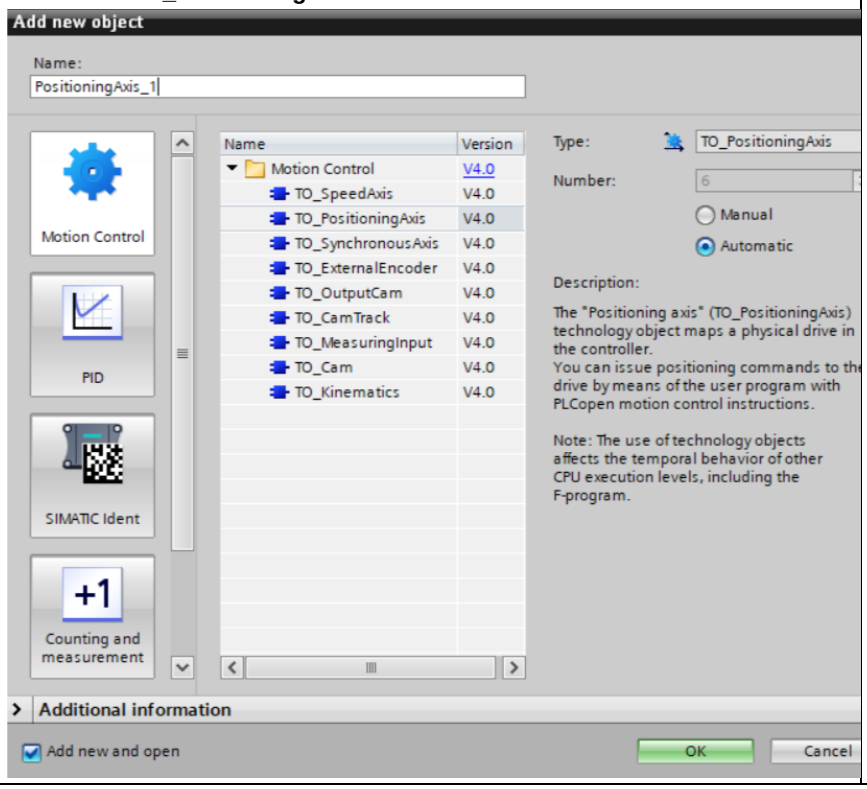
No.	Action	Remarks
1.	In the network view, click the "**Not assign**" and select "**1511t.PROFINET Interface_1**": 	
2.	Configure the topology between V90PN and 1511T, switch to the topology view: 	If IRT communication is selected, topology is necessary.
3.	Configure the topology according to the actual wiring connection and dragging and dropping: 	In this example, the X1 Port 1 of the S7-1500 CPU is connected to the port 1 at the drive side.

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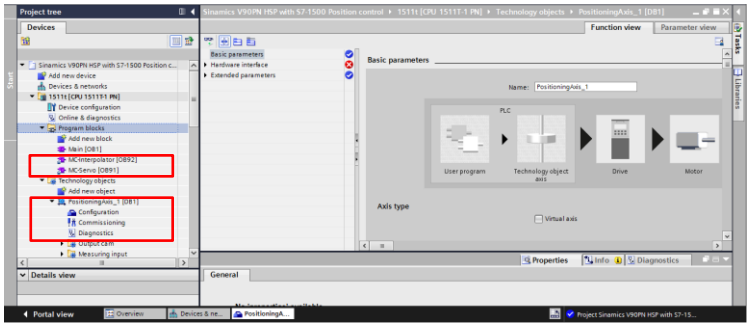
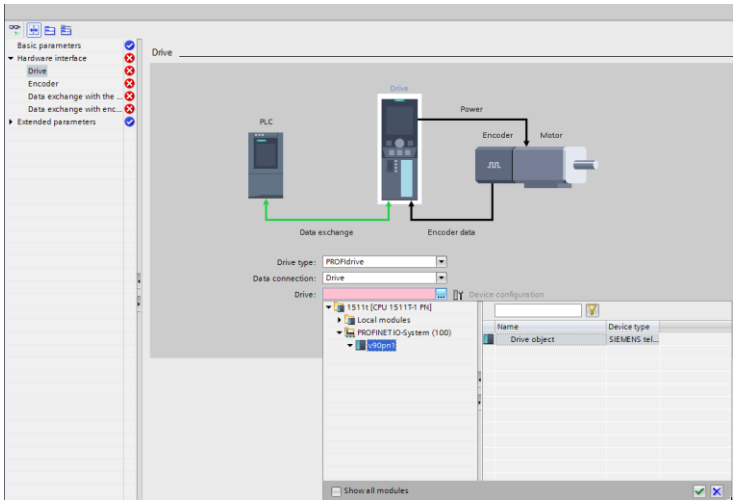
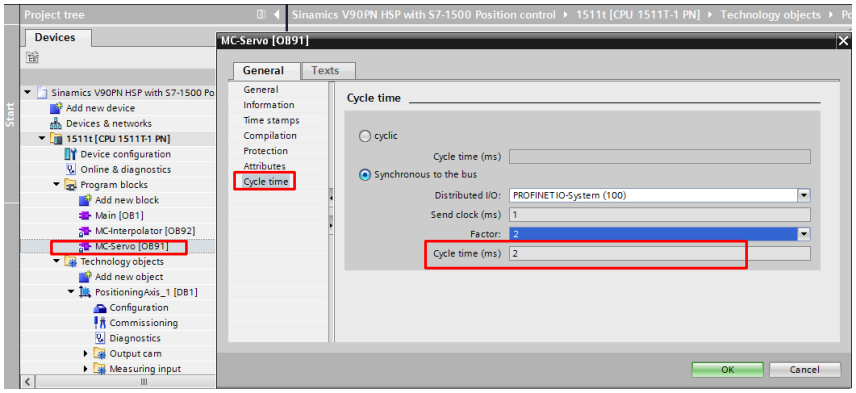
5 Operation of the application

In the following paragraph, we will use TO (Technology Object) of positioning axis for commissioning.

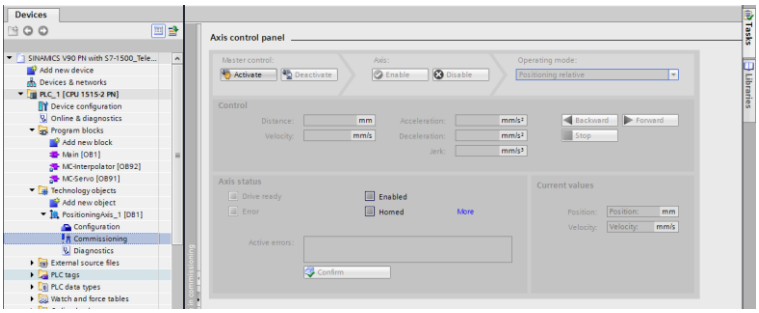
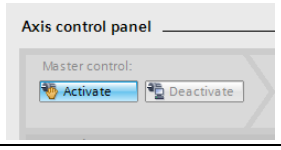
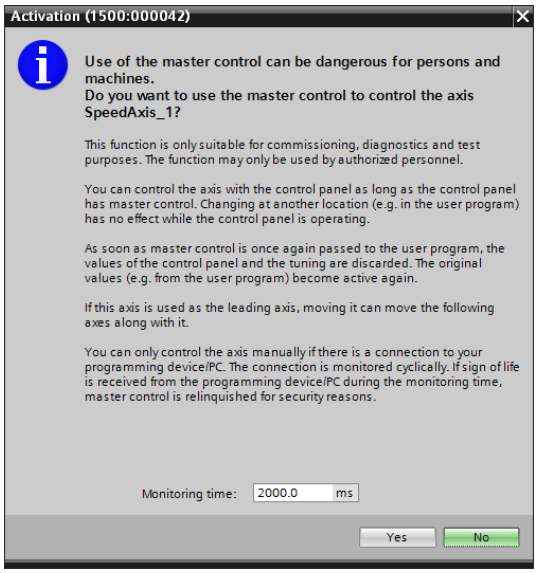
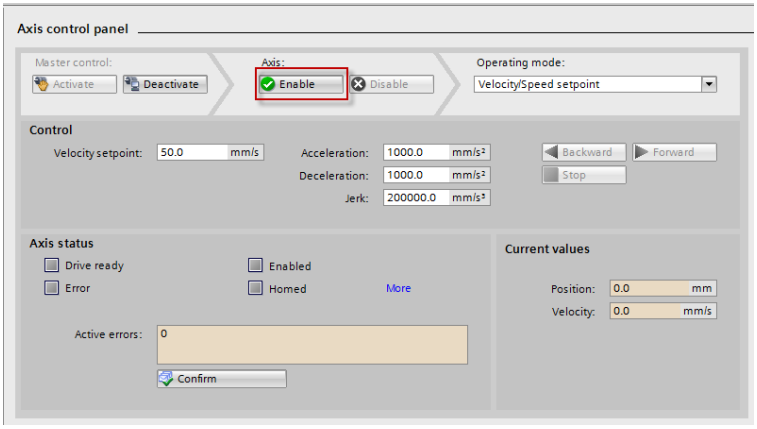
Table 5-1

No.	Action	Remarks
1.	Add a new object by double-click “**Add new object**” from the project tree: 	
2.	Select the “**TO_Positioning**” from the “**Motion Control**” list: 	

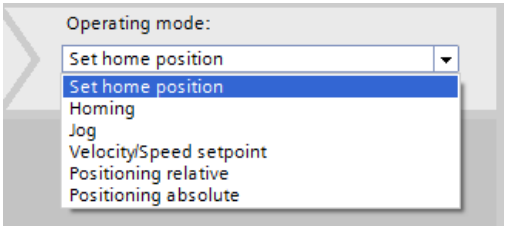
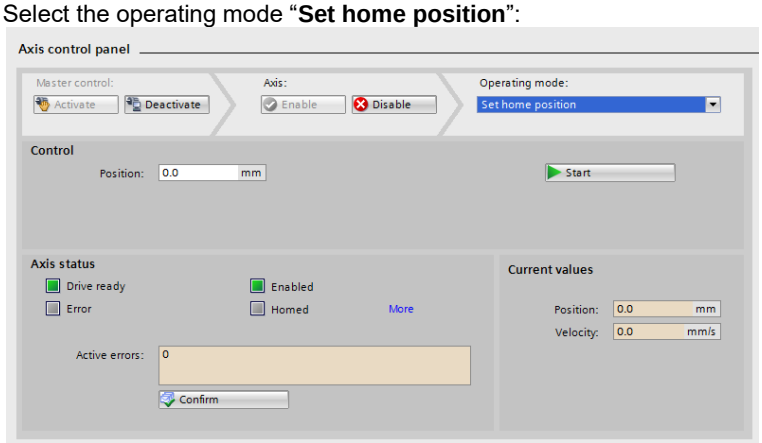
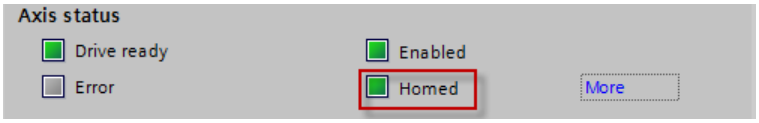
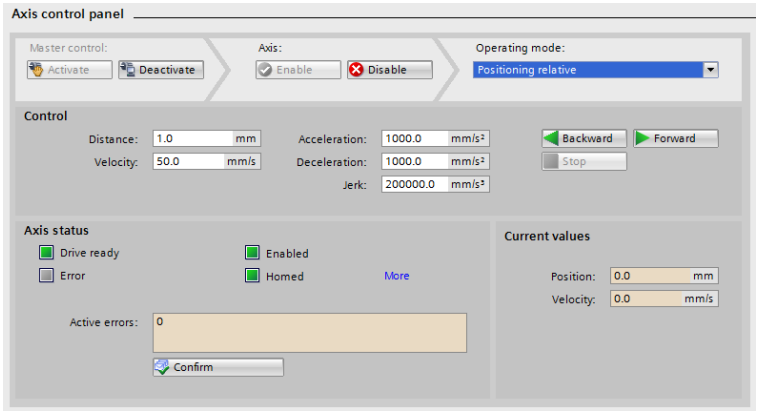
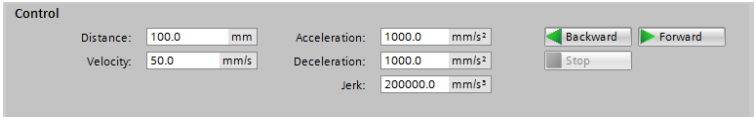
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No.	Action	Remarks
3.	When a new object has been added successfully, the object node is added into the device tree and the configuration panel for this newly added axis is opened: 	
4.	Make configurations step by step. In this example, we firstly need to configure the drive under the hardware interface: 	
5.	Right-click the OB91 and select the properties and change the cycle time to 2ms 	V90 PN IRT communication time is 2ms.
6.	Compile the project and then download it into device.	

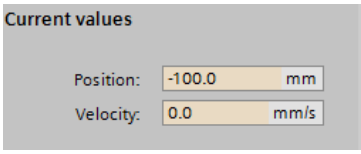
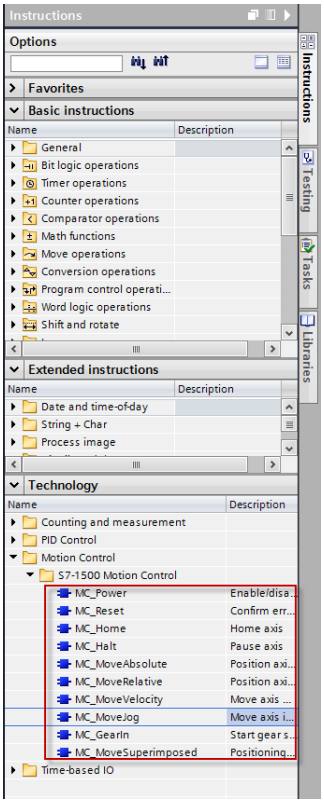
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No.	Action	Remarks
7.	Switch to the commissioning panel by double-clicking the “**Commissioning**” under the technology object tree: 	
8.	Click the “**Activate**” button: 	
9.	Set the monitoring time for the master control. In this example, we use the default 2000ms. Click “**Yes**” button to proceed: 	
10.	Click the “**Enable**” button to make servo drive at SON state: 	

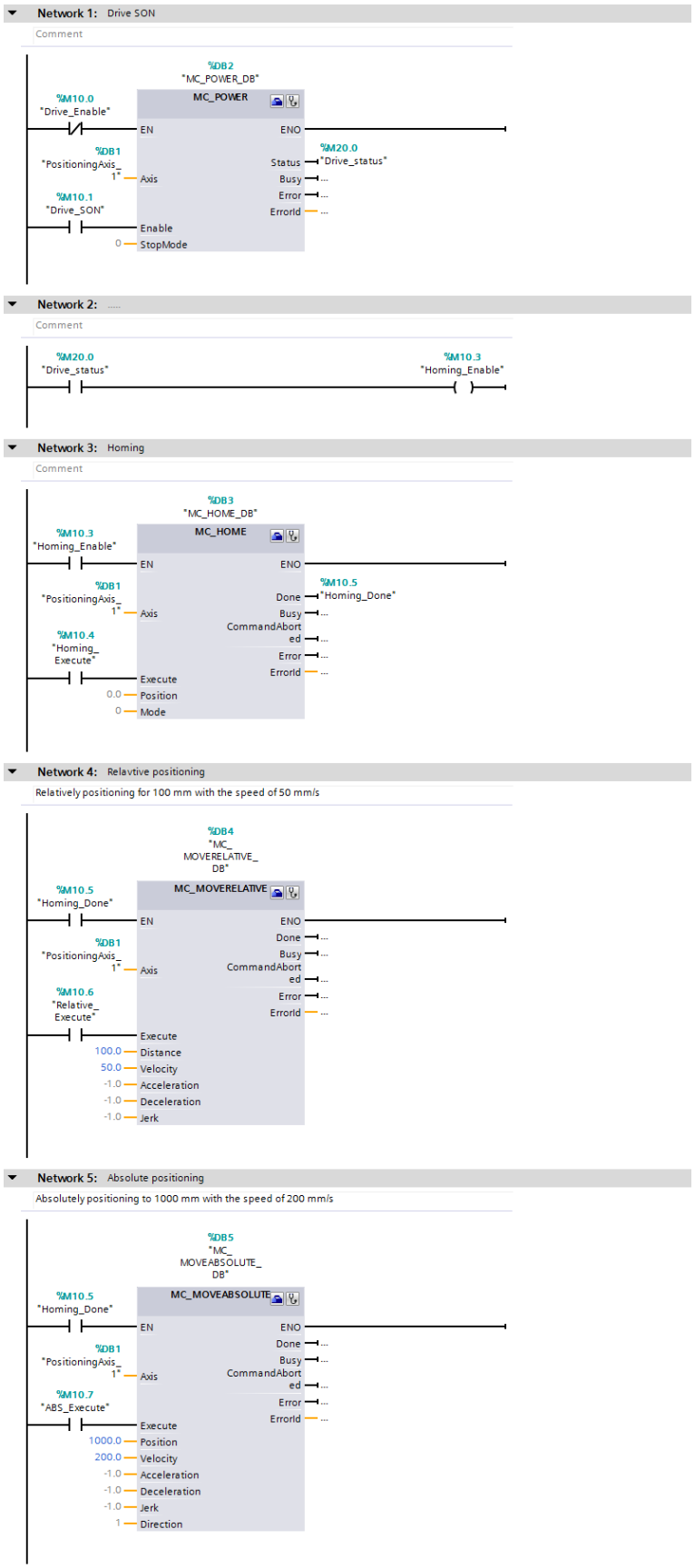
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No.	Action	Remarks
11.	Here you can select an operating mode from the drop list: 	
12.	Select the operating mode “**Set home position**”: 	
13.	Press the “Start” button and then current position is set as the home position. After that, the axis status indicates that the homing operation has been finished: 	
14.	Select the operating mode “**Positioning relative**”: 	
15.	Input “100” into the distance field: 	

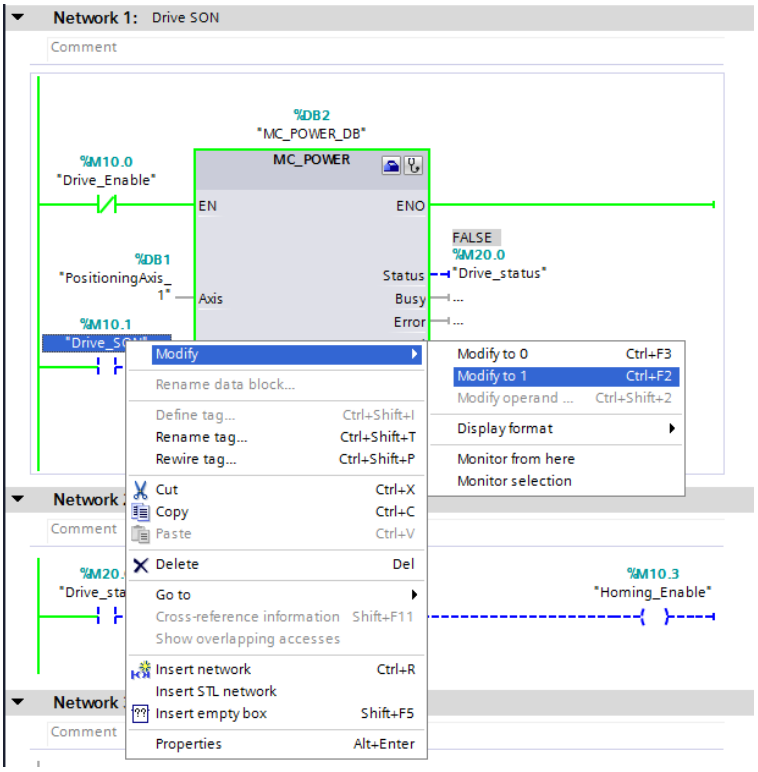
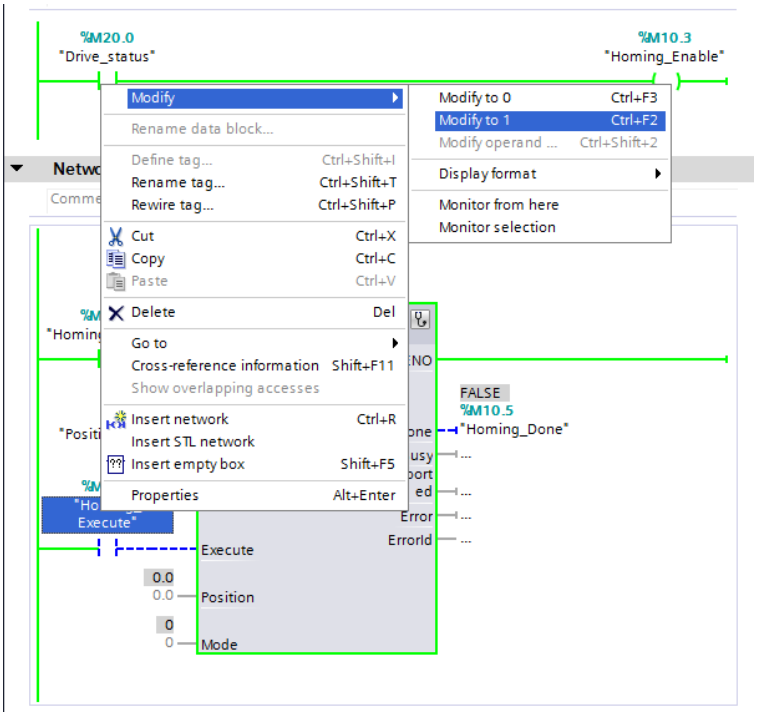
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No.	Action	Remarks
16.	Press “**Backward**” or “**Forward**” button, and then the motor starts running to the relative position of 100 mm. The current position and speed values are indicated in the “**Current values**” field: 	
17.	Switch to offline mode and open the main program block OB1.	
18.	Program with the technology instructions at the right side: 	

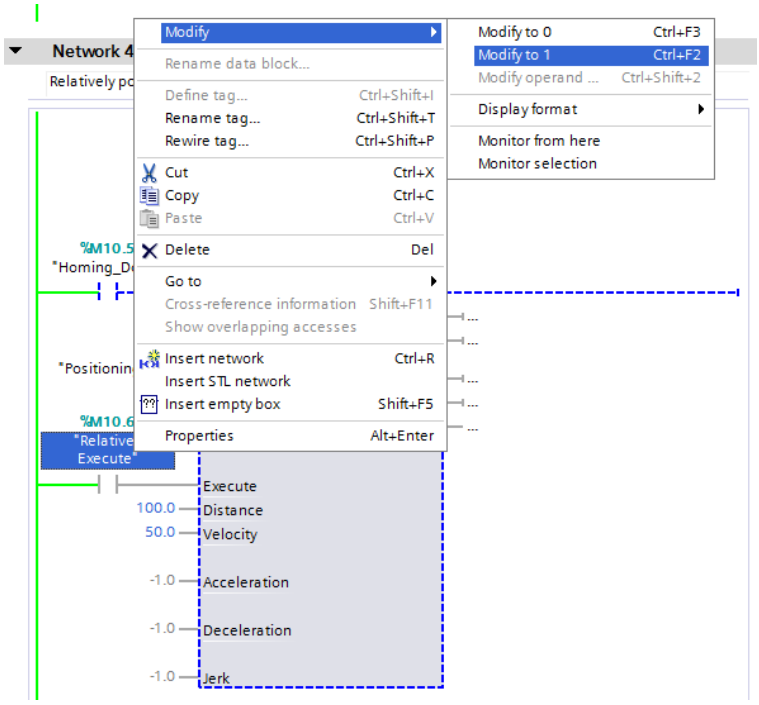
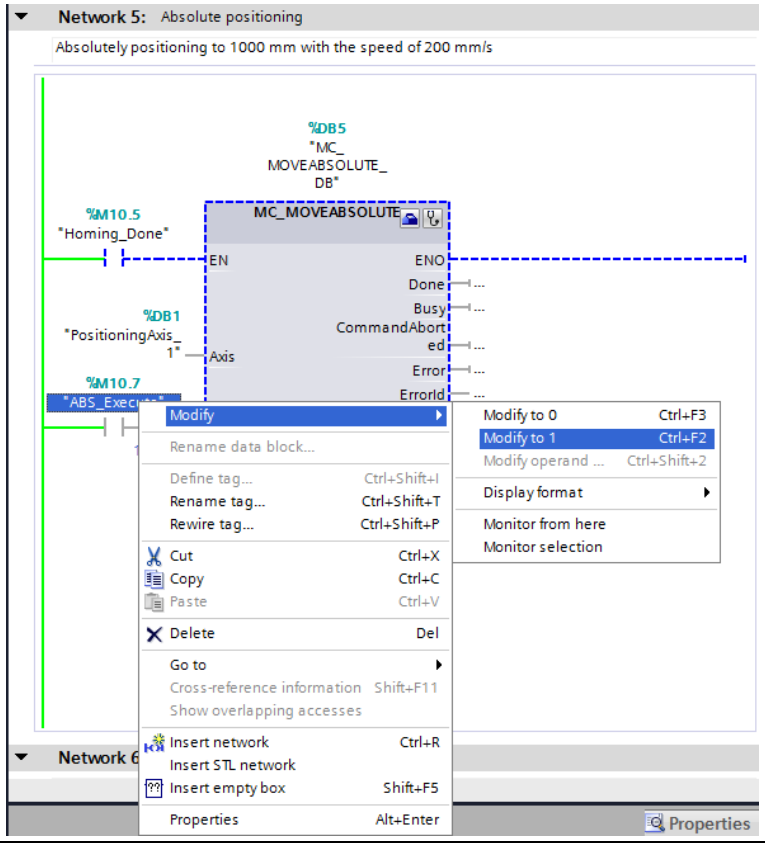
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No.	Action	Remarks
19.	Program as follows: 	

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No.	Action	Remarks
20.	Compile and load the project into devices.	
21.	Switch to online mode and activate the monitoring function.	
22.	Modify M10.1 to 1 to make drive SON: 	
23.	Modify M10.4 to 1 to perform homing: 	

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No.	Action	Remarks
24.	Modify M10.6 to 1 to perform relative positioning for 100 mm with the speed of 50 mm/s: 	
25.	Modify M10.7 to 1 to move to absolute position of 1000 mm with the speed of 200 mm/s: 	

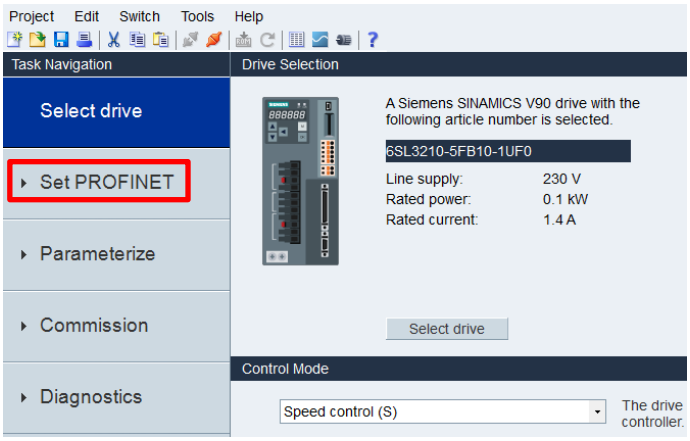
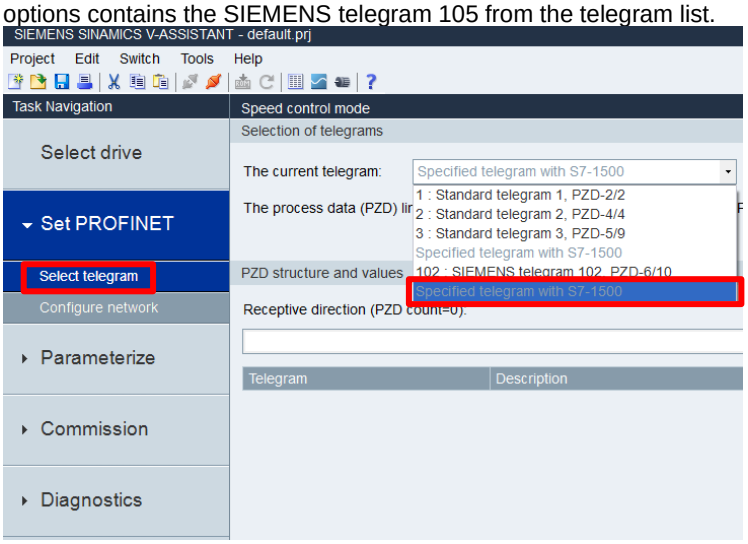
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6 Optional - Basic parameter configuration regarding SINAMICS V90 with V-Assistant

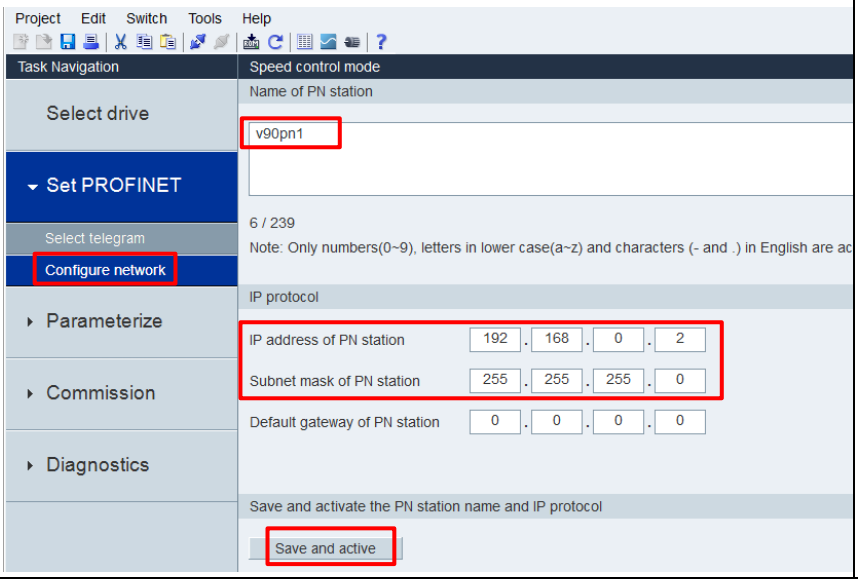
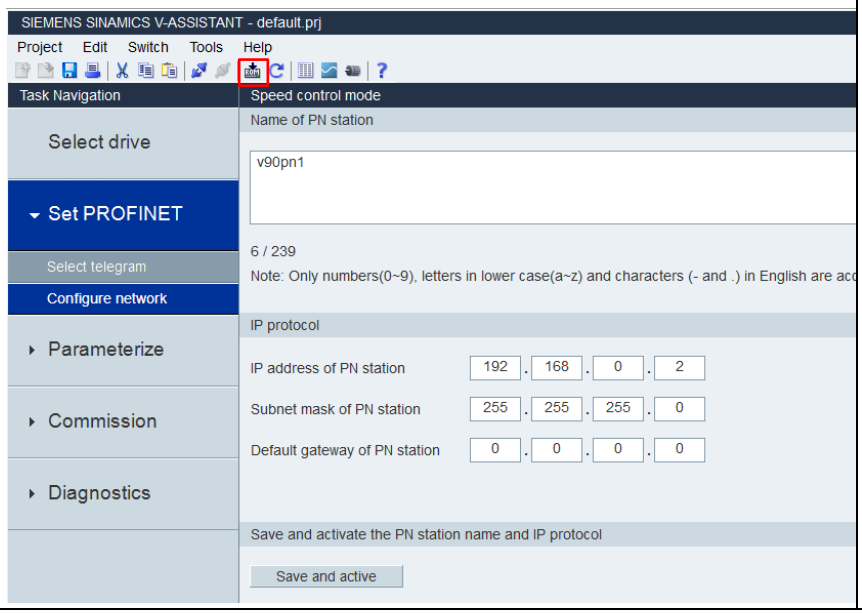
NOTE The usage of the V-Assistant is normally not necessary by working with the Hardware Support Package of the V90 PN because every necessary part of the drive commissioning can be made via TIA Portal and the Hardware Support Package.

Configure PROFINET settings via SIANMICS V-ASSISTANT

Table 6-1

No.	Action	Remarks
1.	Click “Set PROFNET”. 	Open V-Assistant and open connect for example directly to the drive via USB.
2.	Click “Select telegram”，Select the “Specified telegram with S7-1500” – this options contains the SIEMENS telegram 105 from the telegram list. 	The default telegram setting in the drive is SIEMENS telegram 105. This will be also the default option after making a factory reset.

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No.	Action	Remarks
3.	Click “Configure network” and set the PROFINET Name of Station – in this example it is “V90pn1” as the device name. Setup the application defined IP – address – in this example it is “192.168.0.2” as the IP address. And then click “Save and active” 	
4.	Click on the RAM to ROM button and then restart the drive 	

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7 Appendix

7.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:
support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:
www.siemens.com/industry/supportrequest

SITRAIN – Digital Industry Academy

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:
www.siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:
support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:
support.industry.siemens.com/cs/ww/en/sc/2067

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7.2 Industry Mall



The Siemens Industry Mall is the platform on which the entire siemens Industry product portfolio is accessible. From the selection of products to the order and the delivery tracking, the Industry Mall enables the complete purchasing processing – directly and independently of time and location:
mall.industry.siemens.com

7.3 Application support

Siemens Ltd., China
DF M3-BF GMC

No. 18 Siemens Road
Jiangning Development Zone
Nanjing, 211100
China

mailto: mc_gmc_mp_asia.cn@siemens.com

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7.4 Links and literature

Table 7-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109780895
\3\	

7.5 Change documentation

Table 7-2

Version	Date	Modifications
V1.3	02/2020	First version, splitt from Application example 109739053