Simple Migration of S7-300 - projects to S7-1500 Software Controller

SIMATIC S7-1500 Software Controller , SIMATIC WinCC RT Advanced

https://support.industry.siemens.com/cs/ww/en/view/67121011

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Table of contents

1 Introduction

As of STEP 7 Professional V13 SP1, S7-1500 Software Controller can be configured and programmed in the TIA Portal. With an example application will be shown how to migrate a CPU 315-2 PN/DP and TP1200 Comfort to S7-1500 Software Controller and WinCC Runtime Advanced.

The following application is used as an example for migration:

PC-based Automation: S7-1500 Software Controller in Combination with Drive Control, Safety, Database Connection and Visualization with TIA Portal

https://support.industry.siemens.com/cs/ww/en/view/62521281

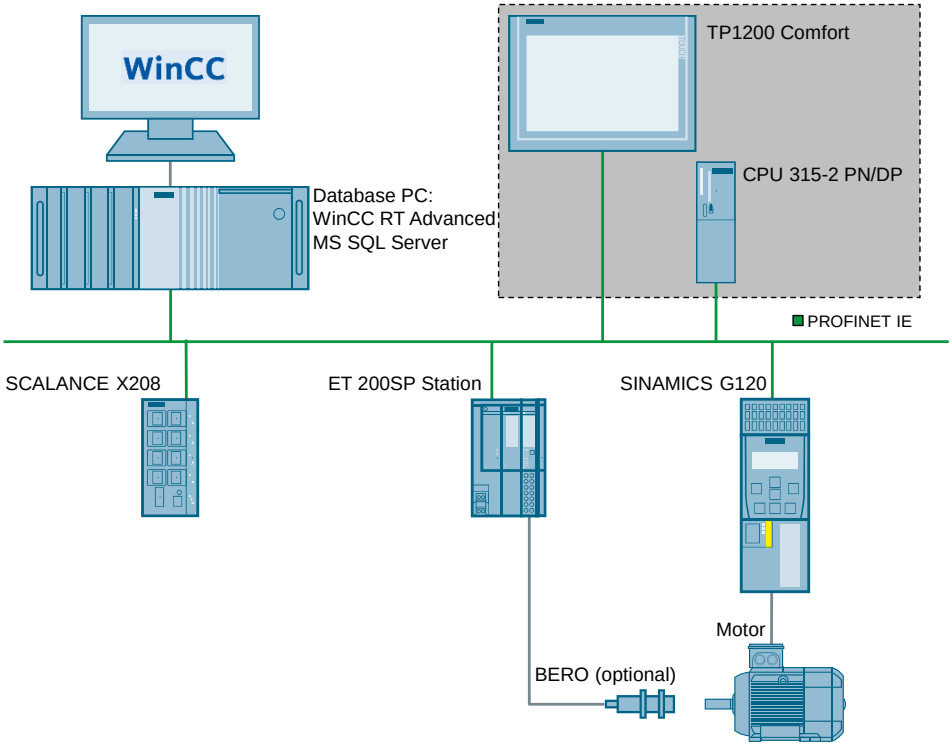
This application example uses a transport solution with rotary table to illustrate various functions and options of S7-1500 Software Controller. You can find a detailed documentation for this application.

NOTE This documentation describes **only how to migrate**.

1.1 Overview

The figure below provides an overview of the automation task and which hardware (gray box) should be migrated. The remaining hardware will be migrated without changes.

Figure 1-1: Original hardware configuration with S7-300 CPU and Comfort Panel



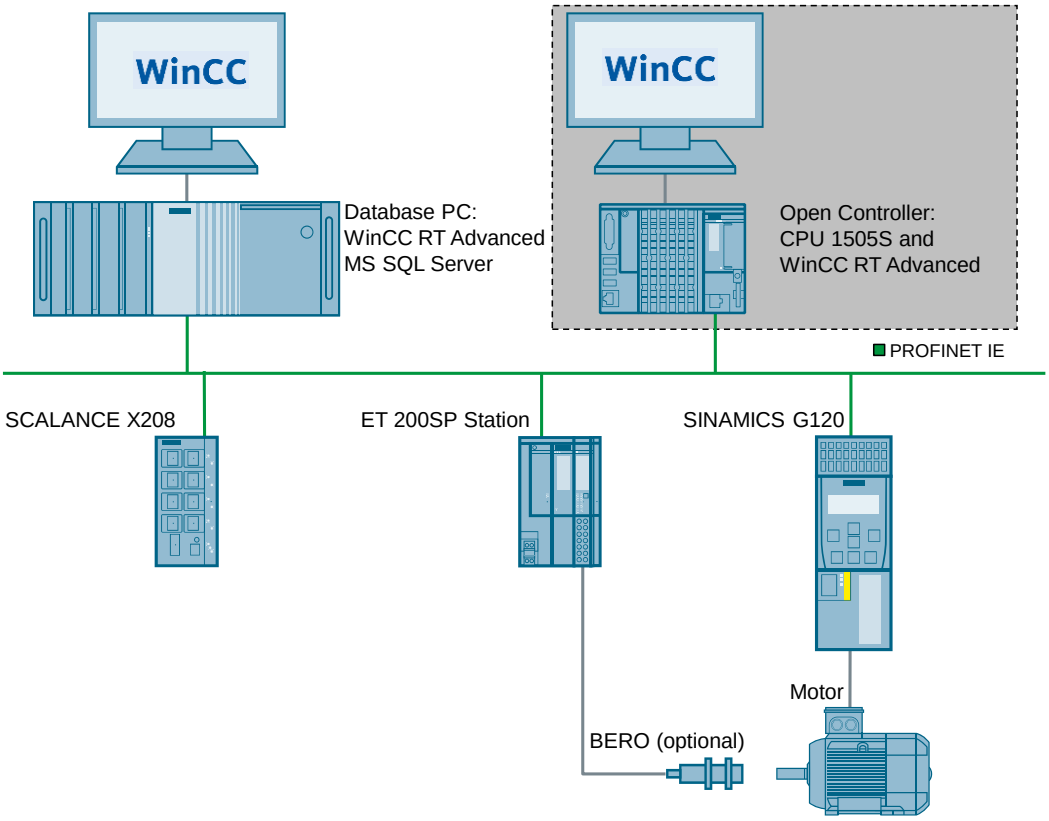
The automation solution was realized with a CPU315-2 PN/DP and a TP1200 Comfort. The task is that these components will be changed alternatively with an Open Controller, software controller S7-1500 Software Controller and visualization software WinCC RT Advanced.

1.2 Mode of operation

Schematic layout

The following figure gives a schematic overview of the most important components of the solution and the components (gray box) after migration:

Figure 1-2: Migrated hardware with Open Controller (S7-1500 Software Controller)



The example shows you how...

- the program will be migrated from CPU 315-2 PN/DP to S7-1500 Software Controller.
- the connections between Database PC, ET 200S station, SCALANCE X208 and SINAMICS G120 will be made to IPC227D.
- the visualization of TP1200 Comfort will be migrated to WinCC RT Advanced.

Topics not covered by this application

This application does not include a detailed description on

- STEP 7 programming
- WinCC configuration
- drive configuration

Assumed knowledge

Basic knowledge on STEP 7 programming, WinCC engineering and the basic application of S7-1500 Software Controller is assumed.

1.3 Components used

This application example has been created with the following hardware and software components:

Table 1-1: Used hardware components

Component	Number	Article number	Note
CPU 315-2 PN/DP	1	6ES7 315-2EH14-0AB0	Optional
Micro Memory Card 512kb	1	6ES7953-8LJ30-0AA0	Optional Other memory cards with different memery size can be used.
TP1200 Comfort	1	6AV2124-0MC01-0AX0	Optional
SIMATIC IPC	1	-	Alternatively, a field PG M5 or a standard PC can be used. For engineering and Database_PC
Open Controller (CPU 1515SP PC)	1	6ES7677-2DBx2-0xB0	There are various bundles for the Open Controller, see: https://support.industry.siemens.com/cs/ww/en/view/104117388 The bundle must contain the following software products: CPU S7-1505S (FW V2.6) WinCC RT Advanced V15.1
ET 200SP IM 155-6 PN ST inkl. Servermodul, inkl. Busadapter 2xRJ45	1	6ES7155-6AU00-0BN0	https://support.industry.siemens.com/cs/ww/en/ps/6ES7155-6AU00-0BN0 https://support.industry.siemens.com/cs/ww/en/view/84133942
BU-Typ A0, 16 Push-In (Digital-/Analog, max.24VDC/10A)	1	6ES7193-6BP00-0DA0	-
DI 8x24VDC ST	1	6ES7131-6BF00-0BA0	-

Component	Number	Article number	Note
SINAMICS CU240E-2 PN F	1	6SL3244-0BB13-1FA0	https://support.industry.siemens.com/cs/ww/en/ps/6SL3244-0BB13-1FA0
SINAMICS PM340 230V	1	6SL3 210-1SB14-0UA0	-
SINAMICS G120 IOP	1	6SL3255-0AA00-4JA0	Optional https://support.industry.siemens.com/cs/ww/en/ps/6SL3255-0AA00-4JA0
Motor	1	1LA7060-4AB10	-
SCALANCE X208	1	6GK5208-0BA10-2AA3	Alternatively other switches can be used with min. 4 ports.
Ind. Ethernet RJ45/RJ45, CAT 6, Leitung 4X2, 2m	6	6XV1840-2AH10	Alternatively other Ethernet cable can be used in different lengths.
Inductive Sensor (BERO)	4	NBN2-8GM40-Z1	Optional http://www.pepperl-fuchs.com
Emergency-stop button	1	-	-
Standard PC monitor	1	-	-
Standard keyboard with USB connection	1	-	-
Standard mouse with USB connection	1	-	-

Tabelle 1-2: Used software components

Component	Qty.	Order number	Note
STEP7 Professional V15.1	1	6ES7822-1..03-..	If you order a Field PG bundle with STEP 7 and WinCC licenses, you don’t have to order this product seperately.
WinCC Advanced V15.1	1	6AV210.-....3-0	If you order a Field PG bundle with STEP 7 and WinCC licenses, you don’t have to order this product seperately.
WinCC Runtime Advanced V15.1	1	6AV2104-....3-0	-
Startdrive V15.1	1	6SL3072-4DA02-0XG0	Free download: https://support.industry.siemens.com/cs/ww/en/view/68034568

This application example consists of the following components:

Table 1-3

Component	File name	Note
TIA Portal project	67121011_S7-1500S_Migration CODE_v40.zip	The zip file contains: • S7-300 project • S7-1500 Software Controller project Database import
This document	67121011_S7-1500S_Migration_DOKU_v40_en.pdf	

2 Engineering

2.1 Migration: S7-300 and Comfort Panel to S7-1500 Software Controller and WinCC RT Adv

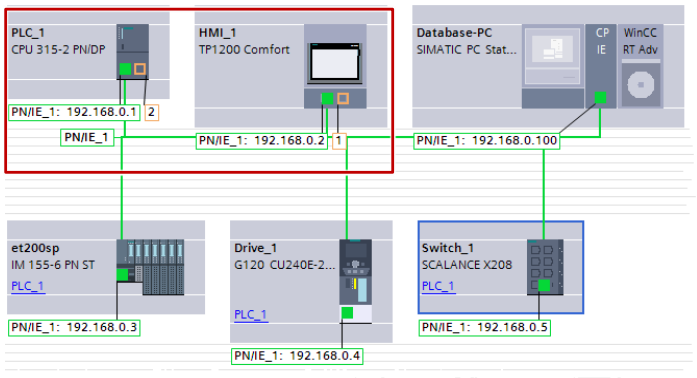
2.1.1 General information

This chapter describes how to reconfigure from S7-300 to S7-1500 Software Controller and from Comfort Panel to WinCC RT Advanced. This migration requires several steps. In the case of this application, the points are divided as follows:

- Integrating Open Controller into the S7-300 project
- Connecting the ET 200SP station with S7-1500 Software Controller
- Connecting SINAMICS G120 drive with S7-1500 Software Controller
- Connecting SCALANCE X208 with S7-1500 Software Controller
- Connecting Database_PC with S7-1500 Software Controller
- Porting the STEP 7 program from S7-300 to S7-1500 Software Controller on Open Controller
- Replacing Comfort Panel with WinCC RT Advanced on Open Controller

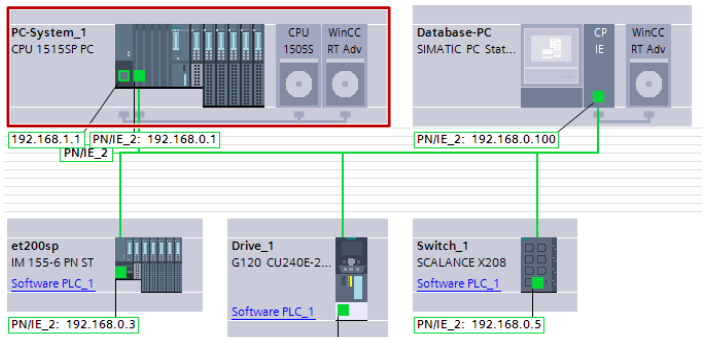
The figure below illustrates the original project with S7-300 and Comfort Panel.

Figure 2-1: S7-300 hardware overview



The figure below illustrates the finished project with Open Controller

Figure 2-2: Open Controller hardware overview



Note

During the entire configuration in the TIA Portal, the **user interface language** should be English.

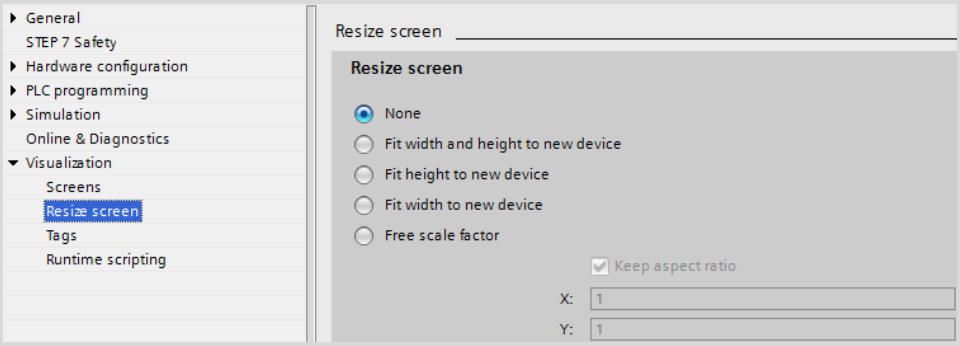
Otherwise, automatically generated names, such as “Watch_table” or “HMI Connection 1”, are created in the respective national language. These names are not changed when switching the user interface language. In this case there may be names deviating from those in this description.

Note

The following documentation describes how a HMI TP1200 is exchanged with WinCC Runtime Advanced. Since TP1200 and WinCC Runtime Advanced do not have the same standard display dimensions, it is possible, that all images are adjusted during porting. This may cause improper representation of the images.

To prevent this, make the following settings in the TIA Portal:

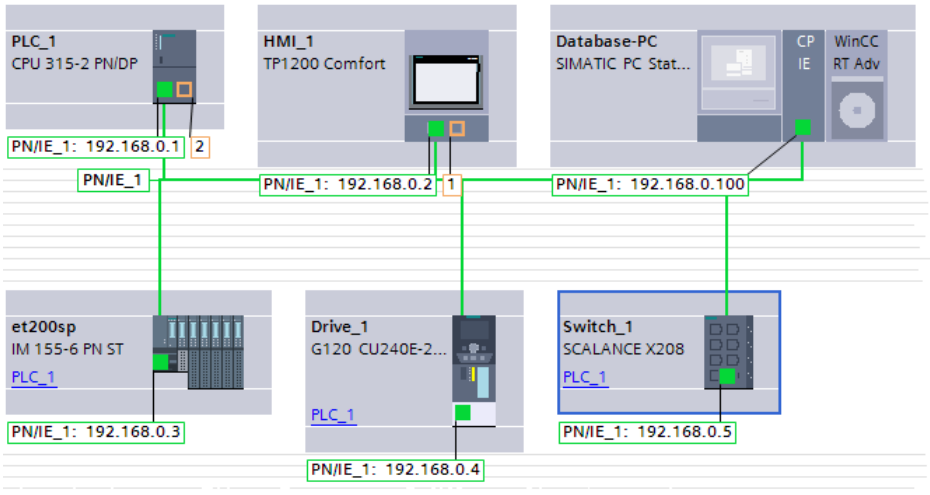
Select “**Options – Settings**” from the menu bar. Navigate to the “**Visualization – Resize screen**” item and select “**None**”



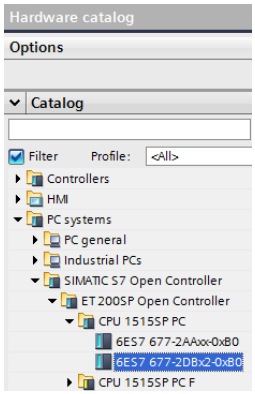
It is recommended after the migration, to adjust the images of the visualization manually to the new screen size.

2.1.2 Integration of Open Controller into the project

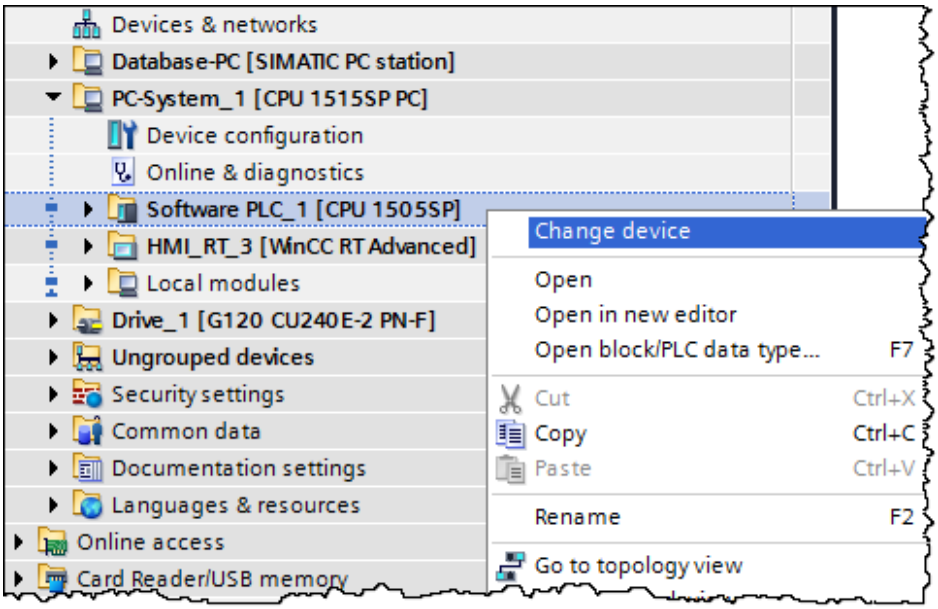
1. Open the “**S7_300_V4**” project with the TIA Portal. In this project, an entire application is realized with S7-300 and a TP1200.
2. Open “**Devices & networks**” and activate the “**Network view**”



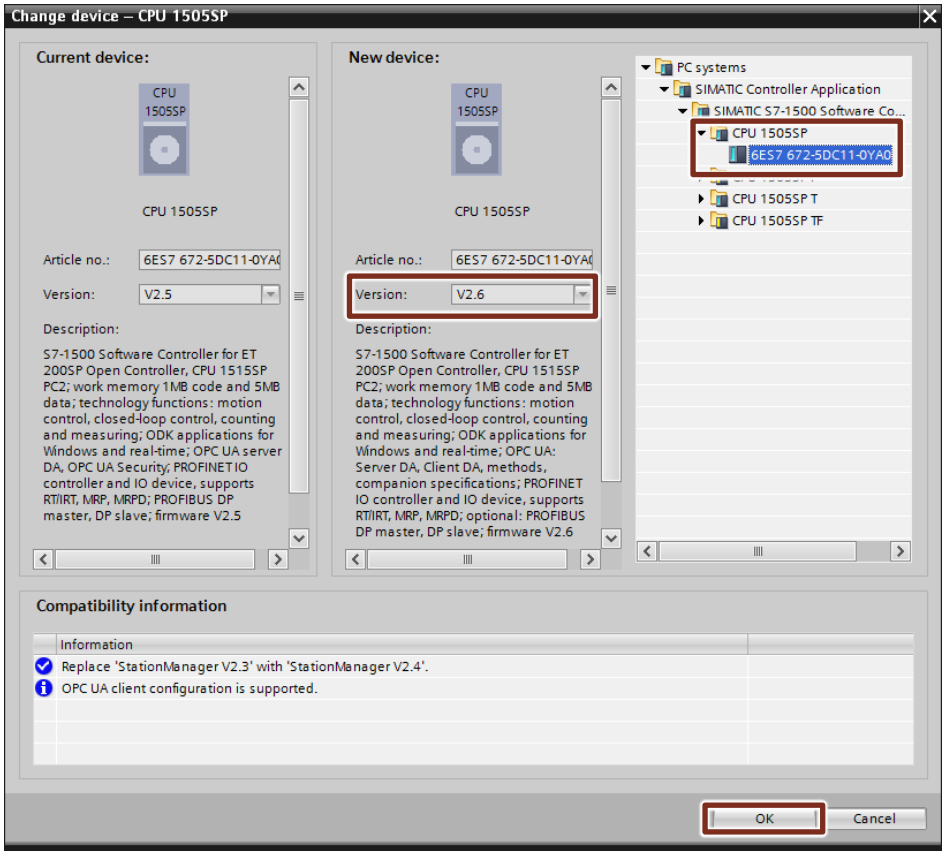
3. In the “**Hardware catalog**”, you navigate to CPU1515SP PC and add the device by double-clicking into the project.



4. Right-click on "**Software PLC_1**" and click on "Change Device" to adjust the firmware.

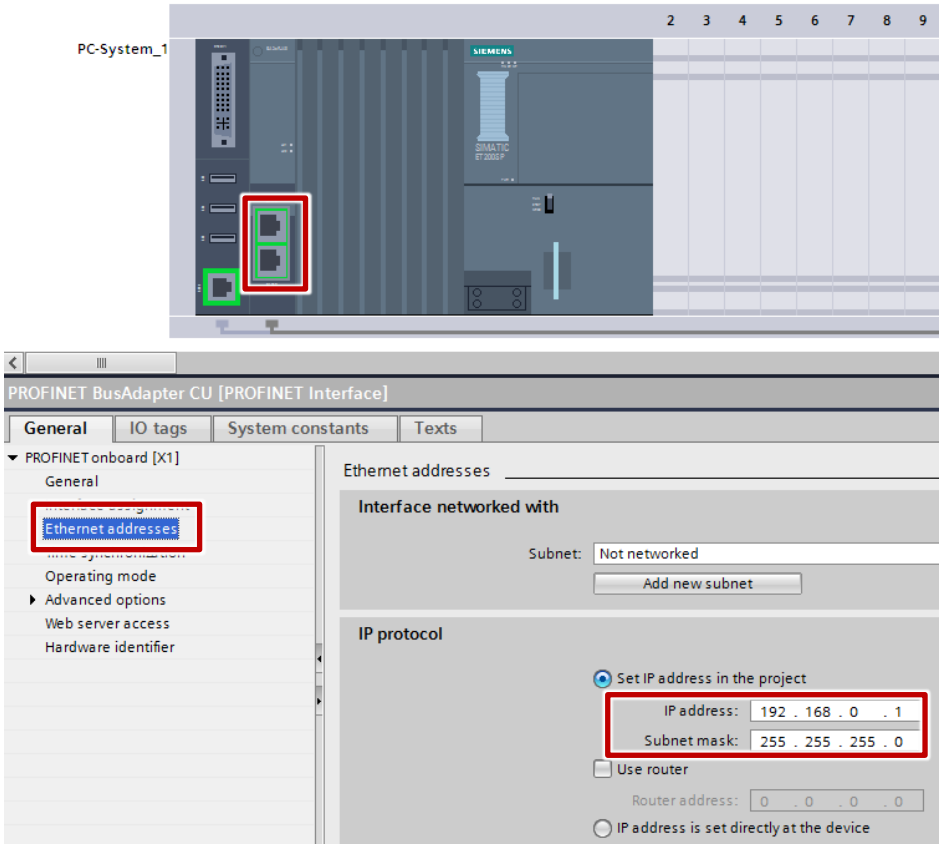


5. Open the dropdown of "CPU 1505SP" on the right side and click on the device (6ES7 672-5DC11-0YA0). Choose firmware version V2.6. Confirm with "OK".



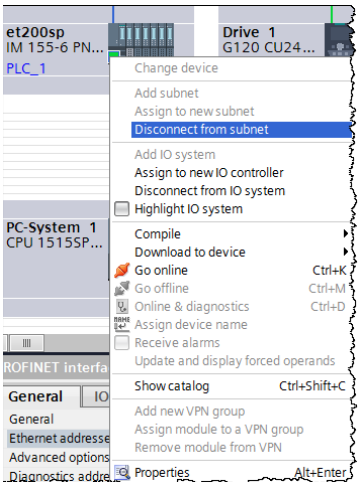
6. Navigate to the “**Device view**” and select PC-System_1 or CPU1515SP PC.
7. Set **Ethernet-Adresse 192.168.0.1** for PROFINET BusAdapter CU:

Note:
This is the same S7-300 Ethernet address to be replaced.

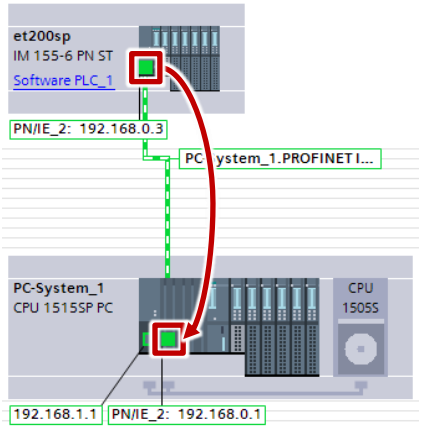


2.1.3 Connecting the ET 200SP station with S7-1500 Software Controller

1. Open “**Devices & Networks**” and activate the “**Network view**”.
2. Delete the PROFINET connection between CPU 315 and ET 200SP station.

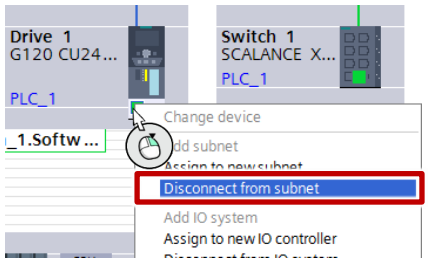


3. Configure a PROFINET connection between “**CPU1515SP PC > PROFINET onboard_1**” and the “**ET 200SP**” via drag&drop.

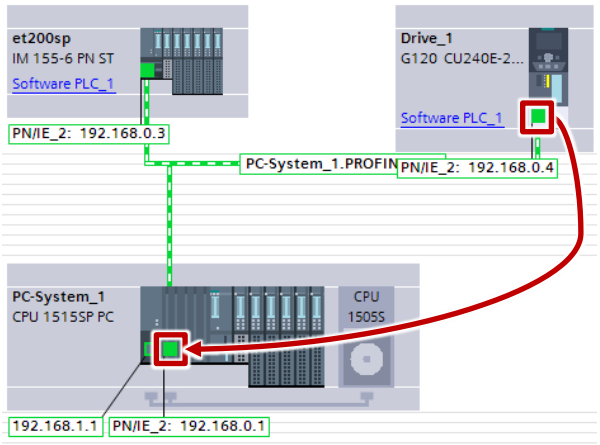


2.1.4 Connecting SINAMICS G120 drive with S7-1500 Software Controller

1. Open “**Devices & Networks**” and activate the “**Network view**”.
2. Delete the PROFINET connection between CPU 315 and Drive_1.

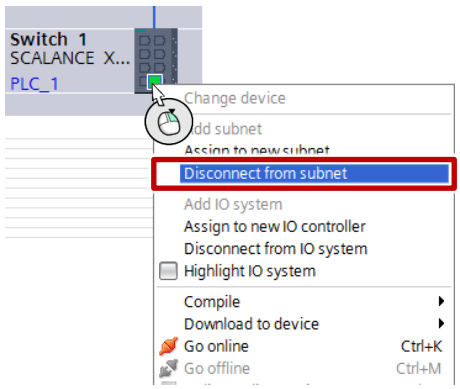


3. Configure a PROFINET connection between “**CPU1515SP PC > PROFINET onboard_1**” and “**Drive_1**” via drag&drop.

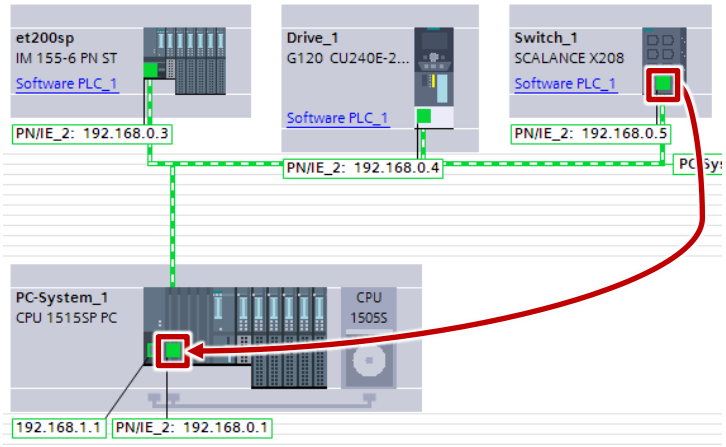


2.1.5 Connecting SCALANCE X208 with S7-1500 Software Controller

1. Open “**Devices & Networks**” and activate the “**Network view**”.
2. Delete the PROFINET connection between CPU 315 and Switch_1.

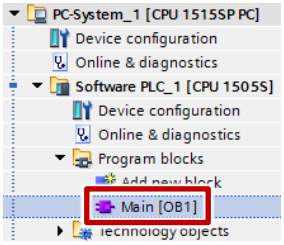


3. Configure a PROFINET connection between “**CPU1515SP PC > PROFINET onboard_1**” and “**Switch_1**” via drag&drop.



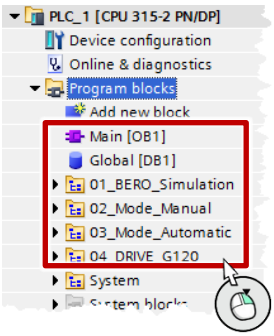
2.1.6 Porting the STEP 7 program from S7-300 to S7-1500 Software Controller

1. In the Project tree, you navigate to "**PC-System_1 > Software PLC_1 > Program blocks**".
   Here you delete the block generated by the TIA Portal:
   - Main [OB1]

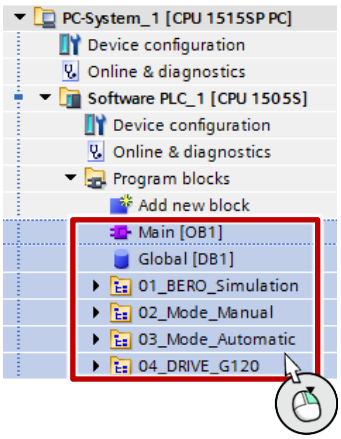


2. In the project tree, you navigate to "**PLC_1 > Program blocks**". Select the following blocks and groups:
   - Main [OB1]
   - Global [DB1]
   - 01_BERO_Simulation
   - 02_Mode_Manual
   - 03_Mode_Automatic
   - 04_DRIVE_G120

   "Right-click – Copy"



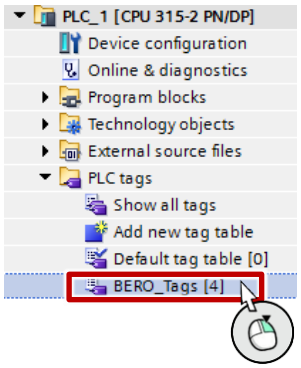
3. In the Project tree, you navigate to “**PC-System_1 > Software PLC_1 > Program blocks**”. Insert the blocks with “Right-click – Paste”.



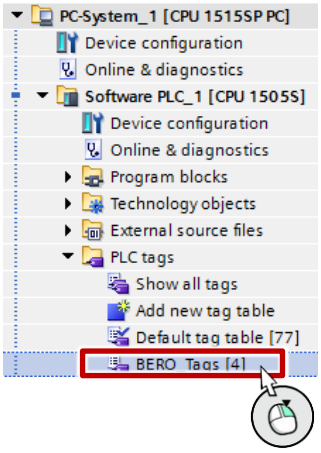
4. In the project tree, you navigate to “**PLC_1 > PLC tags**”. Select the following tag table:

   - BERO_Tags

   “Right-click – Copy”

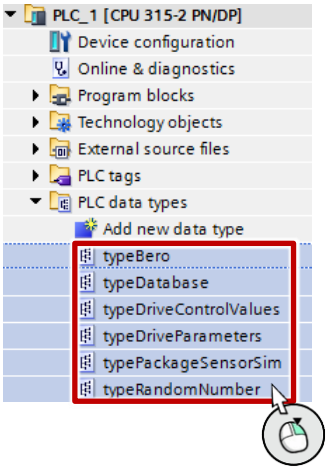


5. In the Project tree, you navigate to “**PC-System_1 > Software PLC_1 > PLC tags**”.
   Insert the blocks with “Right-click – Paste”.



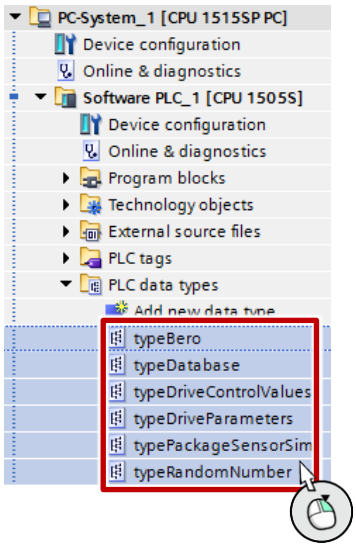
6. In the Project tree, you navigate to “**PLC_1 > PLC data types**“. Select the following types:
   - typeBero
   - typeDatabase
   - typeDriveControlValues
   - typeDriveParameters
   - typePackageSensorSim
   - typeRandomNumber

   “Right-click – Copy”



7. In the Project tree, you navigate to “**PC-System_1 > Software PLC_1 > PLC data types**“. Insert the types with “Right-click – Paste”.

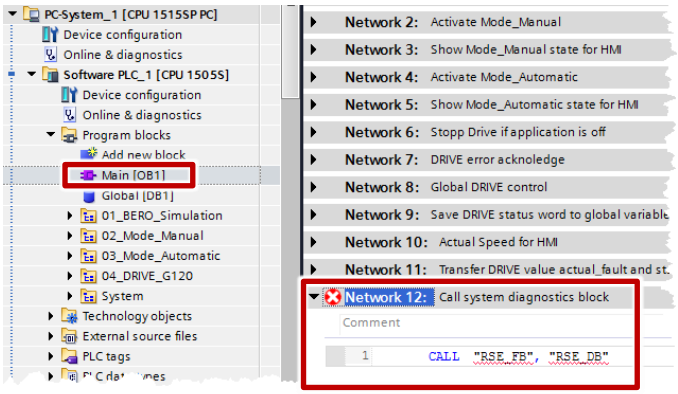
   Note:
   In case you wish to use watch tables from S7-300, you can also copy them to S7-1500 Software Controller.



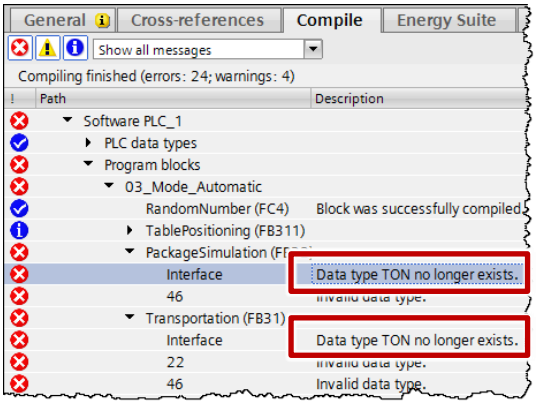
8. If you use any additional hardware functions (e.g. clock memory, interrupts, webserver etc.) you have to parameterize manually.

9. In the Project tree, you navigate to “**PC-System_1 > Software PLC_1 > Program blocks**“. Open „**Main** [OB1]“ and delete network 12.

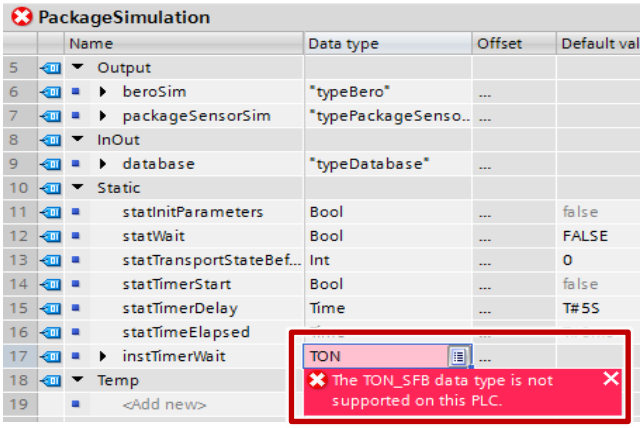
   Note:
   System diagnostics are activated automatically in S7-1500 Software Controller. An S7 program is not needed.



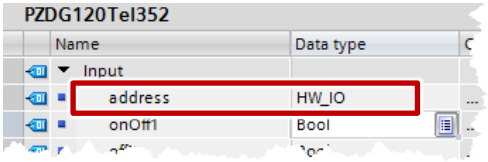
10. Compile „**PC-System_1**“. Some errors occur that can be solved easily. Navigate by double click to the error destination.



11. Replace „**TON**“ with „**TON_TIME**“.



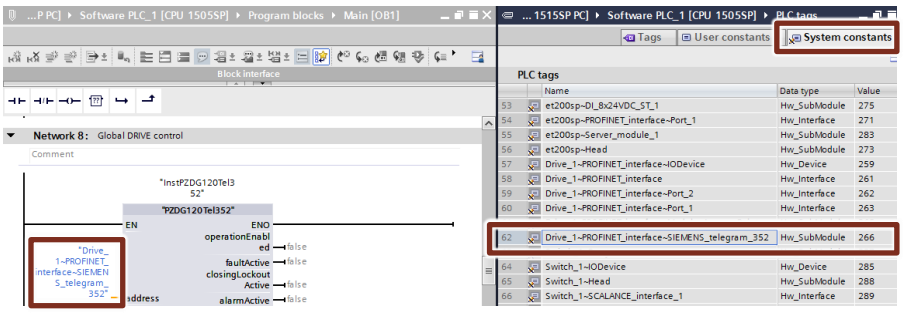
12. Repeat the step until all errors are solved.
13. Open block „**PZDG120Tel352**“ in folder „**04_DRIVE_G120**“.
14. Change data type of input „**address**“ to „**HW_IO**“.



15. Change row 7 and 96 (see screenshot).

```
7   #statReturnValueRD := DPRD_DAT(LADDR := #address, RECORD => #tempInData);
.
.
94  //SEND DATA
95  //Copy all 6 words (Siemens telegram 352) from buffer (with SFC15 DPWR_DAT)
96  #statReturnValueWR := DPWR_DAT(LADDR := #address, RECORD := #tempOutData);
```

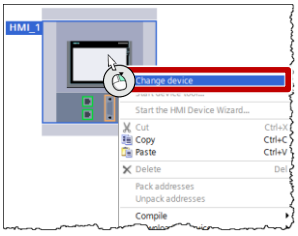
16. Change to „**Main[OB1]**“, network 8 and right-click on block „**Update block call**“. Confirm with „**OK**“.
17. Open “**System constants**“ under „**PLC tags – Show all tags**“ and connect „ **Drive_1~PROFINET_interface~SIEMENS_telegram_352** “ with input „**address**“ of block „**PZDG120Tel352**“.



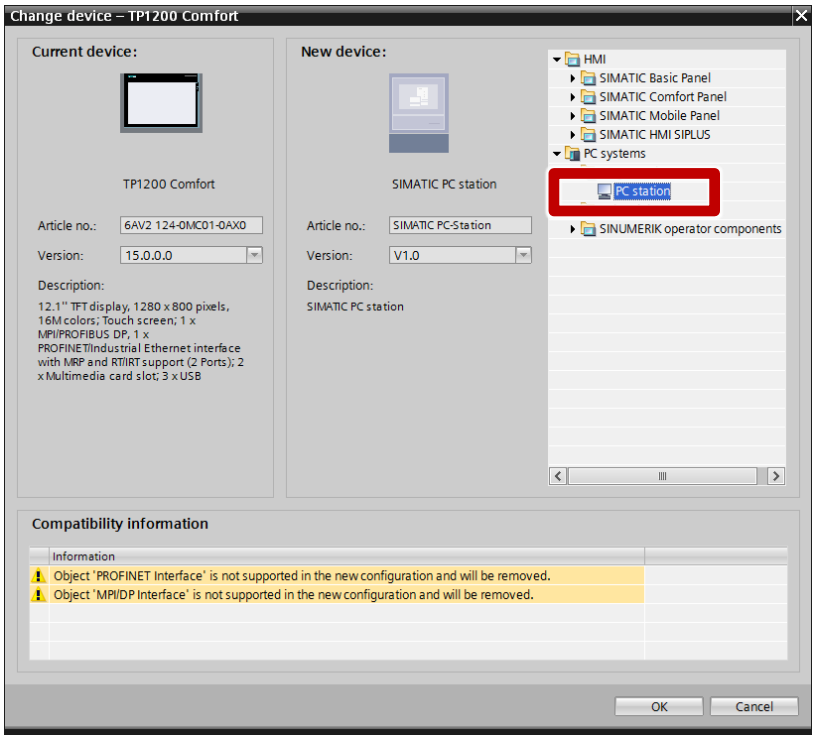
18. Compile „**PC-System_1**“.

2.1.7 Replacing TP1200 with WinCC RT Advanced on Open Controller

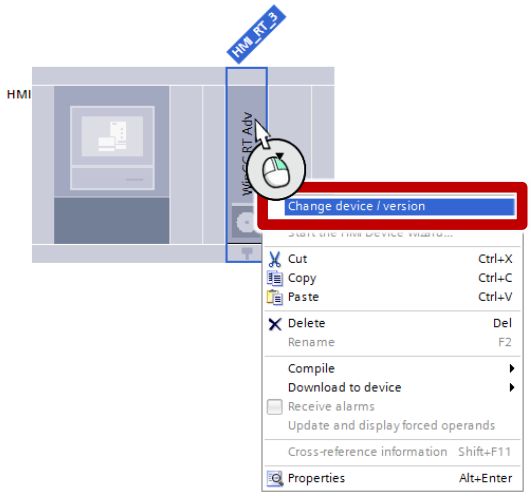
1. Open “**Devices & Networks**”, activate the “**Device view**” and select the “**HMI**” device. Right-click on the panel and select “**Change Device**”.



2. In the Product tree, you navigate “**PC systems - PC general – PC station**“. Click on the “**OK**” button.



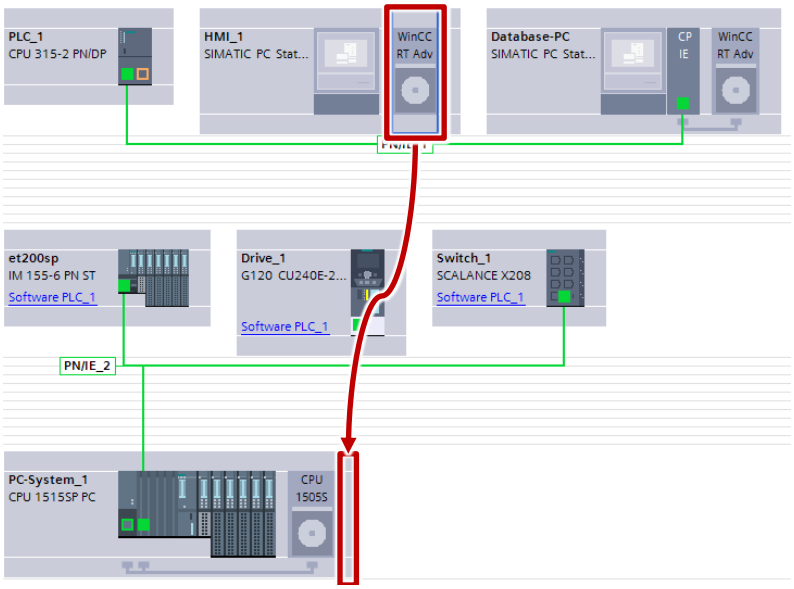
3. Click right on “**WinCC RT Adv**“ and select “**Change device / version**“.



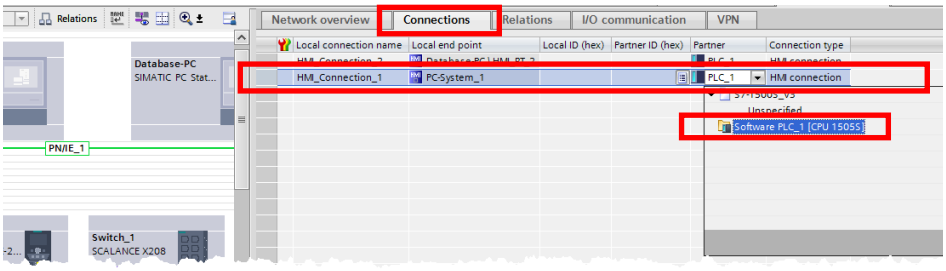
4. In the Project tree, you navigate to “**WinCC RT Advanced**“ and select “**Version 15.1.0.0**“.

   Click „**OK**“.

5. Go to “**Network view**”. Move “**WinCC RT Advanced**” from the “**HMI_1**” into the “**PC-System_1**” via drag&drop.



6. In “**Connections**”, the HMI connection between “**PC-System_1 \ HMI_RT_3**” must be generated. Click on the Combo box in the Partner column and select “**CPU 1505S**”.

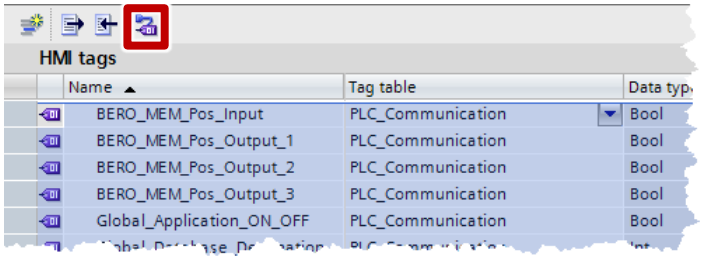


7. Reconnect PLC tag:

   In the Project tree, you navigate to **“PC-System_1 \ HMI_RT_3 > HMI tags”** and open the **“Show all tags”** table.

8. Mark all tags with Ctrl+A.

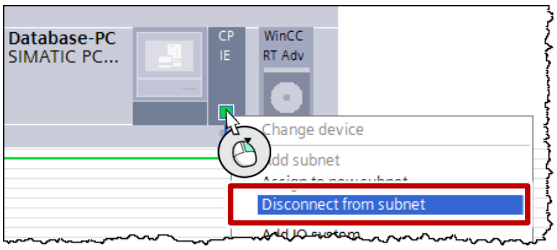
   Click on the button “**Synchronize with the plc tag**“.



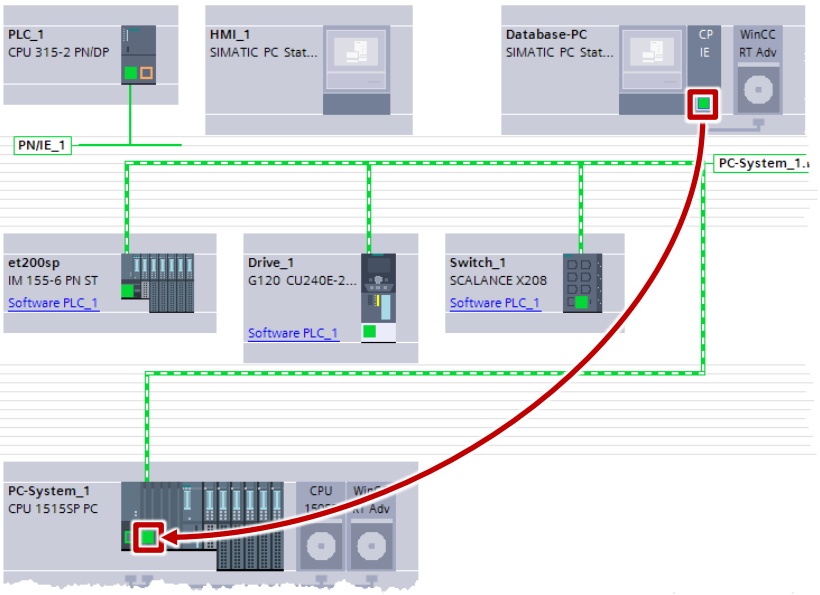
9. Deactivate “**Replace WinCC tag name with PLC tag name**“ and set “**Paths of the PLC tags match**“.
   Click on “**Synchronize**” and confirm next dialog.

2.1.8 Connecting Database_PC (WinCC RT Adv) with S7-1500 Software Controller

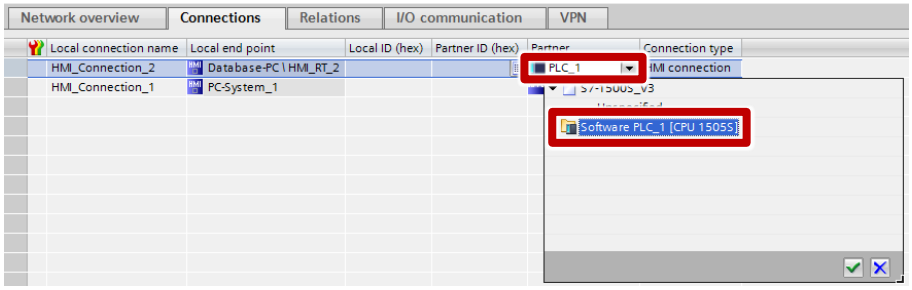
1. Open “**Devices & Networks**” and activate the “**Network view**”.
2. Delete the PROFINET connection between CPU315 and Database_PC.



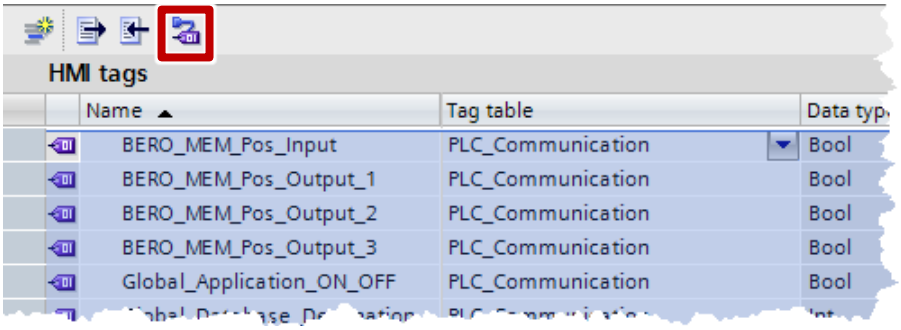
3. Configure a PROFINET connection between “**CPU1515SP PC > PROFINET onboard_1**” and “**Database_PC > CP IE**” via drag&drop.



4. In “**Connections**”, the HMI connection between **“Database_PC \ WinCCRT Advanced”** and **“CPU 1505S”** must be generated. Click on the Combo box in the Partner column and select **“CPU 1505S”**



5. Reconnect PLC tag:
   In the Project tree, you navigate to **“Database_PC > WinCC RT Advanced > HMI tags”** and open the **“Show all tags”** table.
6. Mark all tags with Ctrl+A. Click on the button “**Synchronize with the plc tag**“.



7. Deactivate “**Replace WinCC tag name with PLC tag name**“ and set “**Paths of the PLC tags match**“.

   Click on “**Synchronize**” and confirm next dialog.

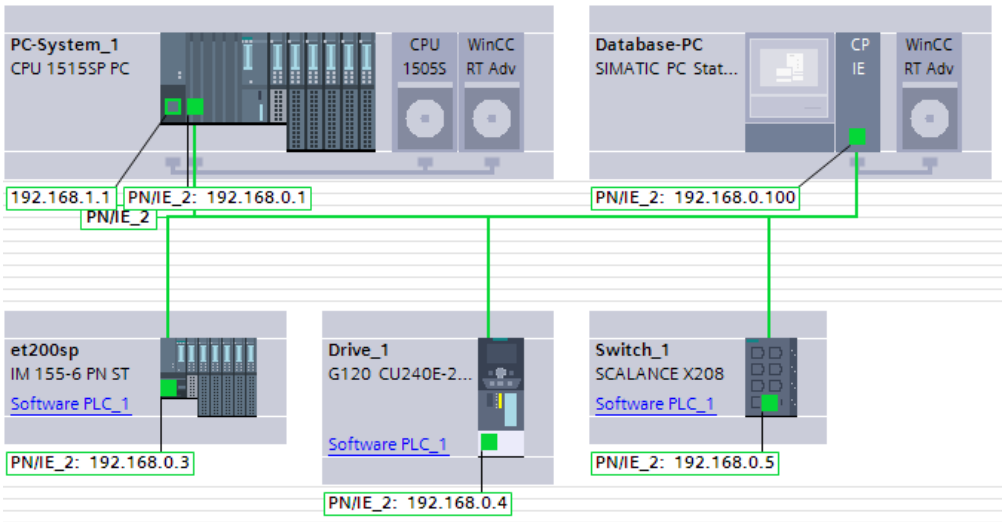
2.1.9 Completion

Finally, devices no longer needed in the project can be deleted:

- PLC_1 (CPU 315-2 PN/DP)
- HMI_1 (SIMATIC PC station)
- PN/IE_1 (PROFINET_1)

The setup then looks as follows:

Figure 2-3: Open Controller Hardware overview



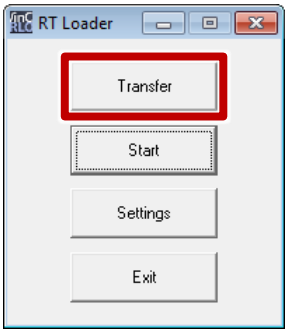
2.2 Preparation for project download

2.2.1 First download to Open Controller

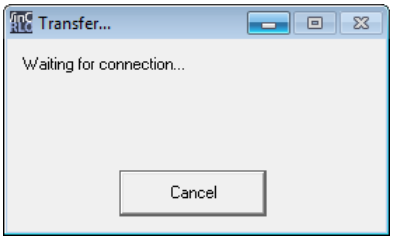
Note If the project is loaded the first time on Open Controller you have to download via Ethernet interface X2P1. The IP address of the Open Controller (Windows) must be the same like the parameterized address in the TIA Portal project.

After the download the Open Controller will be restarted.

1. Open the "**WinCC Runtime Loader**" and start the "**Transfer**"



2. Now you can load the WinCC Runtime.



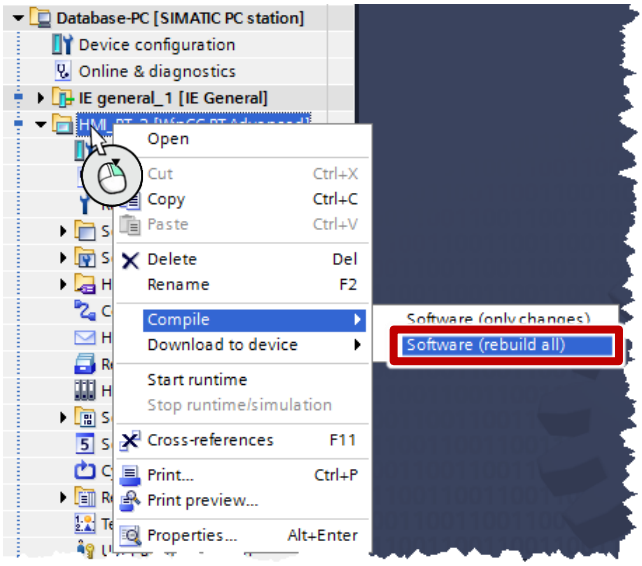
Note Detailed information about using the application is the following documentation:

http://support.automation.siemens.com/WW/view/en/62521281

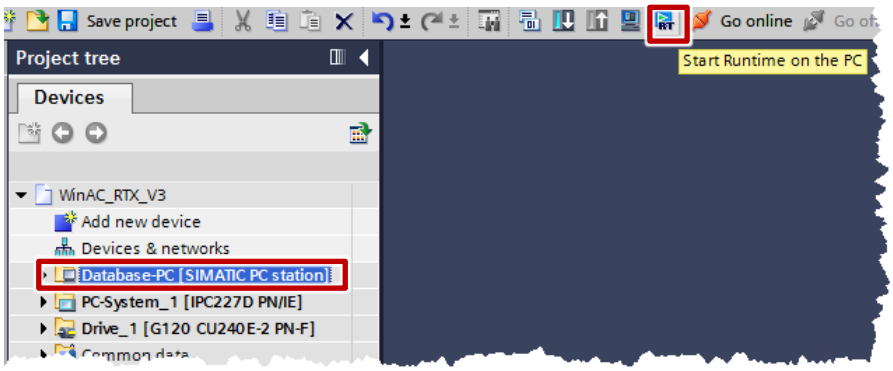
2.2.2 Addition to Database_PC

Before the runtime of the Database_PC can be started, the entire project must be compiled.

1. Go to **„Database_PC -> WinCC RT Advanced -> Compile -> Software (rebuild all)"** in the project tree.



2. Start the runtime of the **„Database_PC"**



3 Appendix

3.1 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 – Training for Industry

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 Apple iOS, Android and Windows Phone:
support.industry.siemens.com/cs/ww/en/sc/2067

3.2 Links and literature

Table 3-1

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/67121011
\3\	PC-based Automation: S7-1500 Software Controller in Combination with Drive Control, Safety, Database Connection and Visualization with TIA Portal https://support.industry.siemens.com/cs/ww/en/view/62521281

3.3 Change documentation

Table 3-2

Version	Date	Modifications
V1.0	02/2013	First version
V2.0	06/2014	Update: - New Hardware SIMATIC IPC227D, SINAMICS G120 (PROFINET), SCALANCE X208 - Engineering with TIA Portal V13
V3.0	09/2015	Update: New hardware SIMATIC Open Controller (CPU 1515SP PC) - Engineering with TIA Portal V13 SP1 Update 4
V4.0	01/2019	Update: New hardware SIMATIC Open Controller 2 (CPU 1515SP PC) Engineering with TIA Portal V15.1