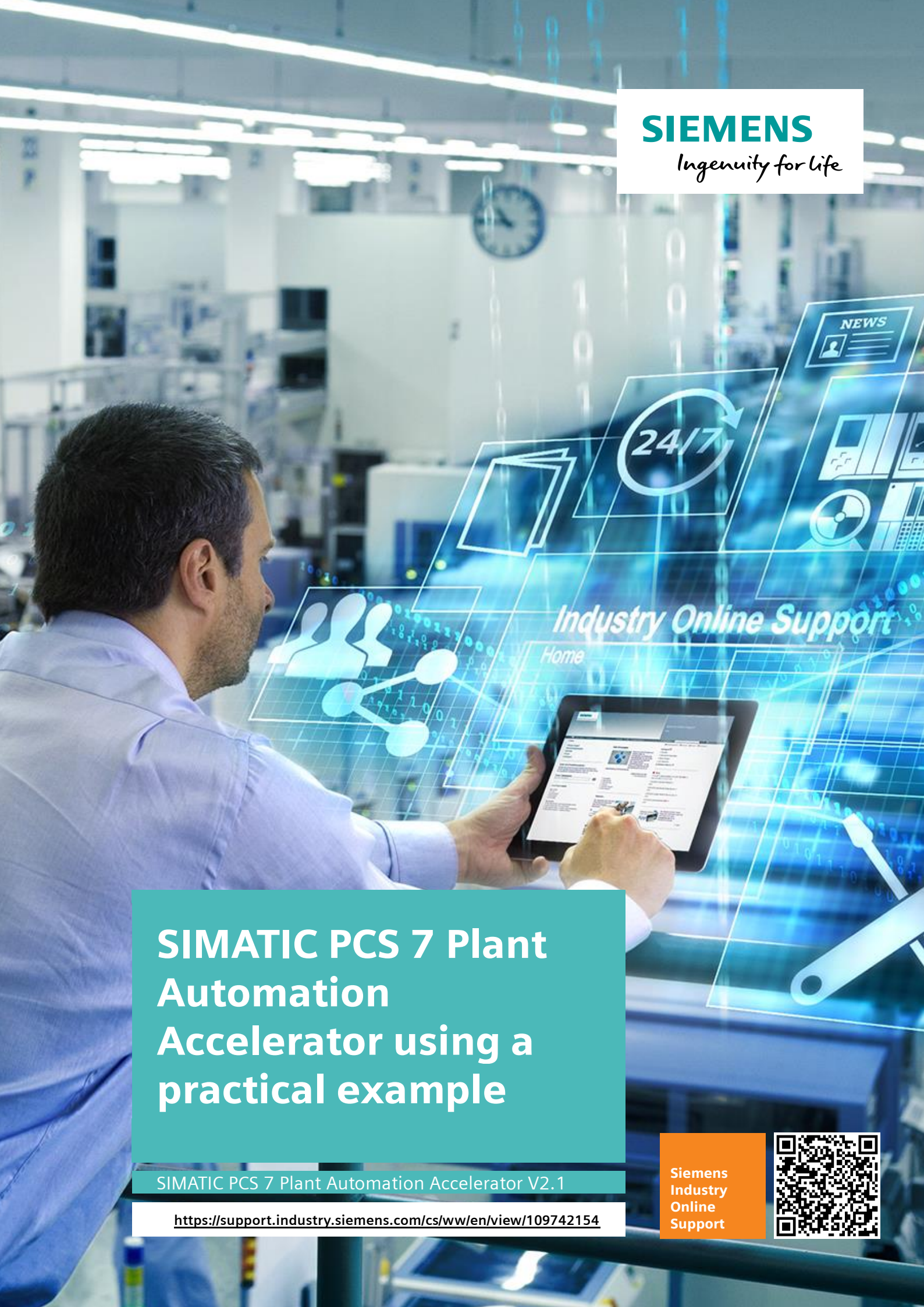

SIMATIC PCS 7 Plant Automation Accelerator using a practical example

SIMATIC PCS 7 Plant Automation Accelerator V2.1

https://support.industry.siemens.com/cs/ww/en/view/109742154

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1 Introduction

1.1 Aim of the Application Example

This application example is a "best practice" example and shows you the basic functions and benefits of the SIMATIC PCS 7 Plant Automation Accelerator (PAA) software solution by means of a sample project.

PAA is used primarily in the detail engineering phase of plant planning. In this planning phase, there is a multitude of requirements to improve the conventional planning process of a plant, save time, reduce costs and conserve resources.

The following challenges and questions result from this:

- Errors and inconsistencies occur because different tools are used and the large number of interfaces increases the error potential.
- Different data bases are used.
- The traceability of changes must be ensured.
- Data should be entered once and must be reusable.
- How can projects be more efficiently planned and documented?
- How can the project quality be improved?
- How can flexibility be increased and project lead times reduced?
- How can costs be reduced?

This application example gives you an initial insight into how you can implement the requirements and questions listed here with the SIMATIC PCS 7 Plant Automation Accelerator software solution.

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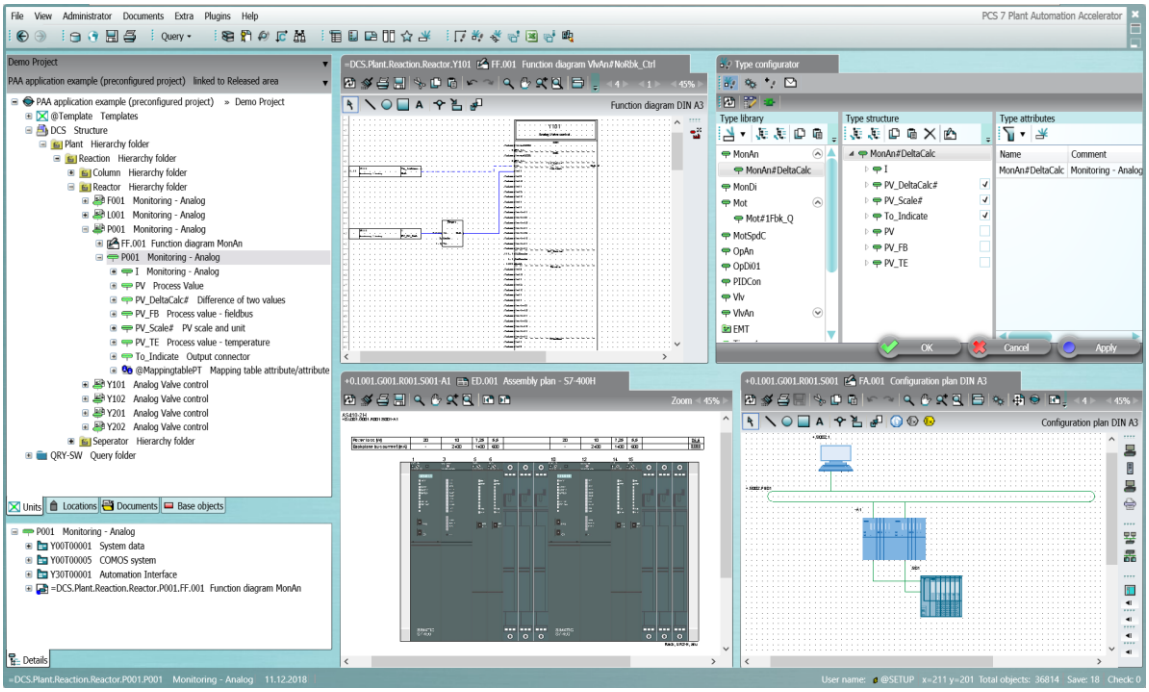
1.2 Modes of operation and the advantages of the PAA

Overview

The SIMATIC PCS 7 Plant Automation Accelerator is the first completely integrated solution for the planning and documentation of plant projects.

In particular, you benefit from consistent engineering without system breaks between automation planning and control system. Thanks to its object-oriented approach, SIMATIC PCS 7 Plant Automation Accelerator enables work on a central data platform and thus guarantees fully integrated planning - from plant engineering to automation - based on an electronic workflow. This workflow includes planning, the preparation of bids including bills of materials and the automatic generation of process data of the SIMATIC PCS 7 process control system from the electrical planning through to controlled bulk data engineering and direct as-is documentation of the plant.



This modular engineering approach raises overall project efficiency and minimizes risks. A high level of standardization and a simple configuration save more engineering time and costs during the implementation phase. Simple synchronization between planning and engineering avoids duplicate input and interface losses and reduces project durations.

SIMATIC PCS 7 Plant Automation Accelerator bridges the digital gap between plant planning and I&C with SIMATIC PCS 7, and thus also extends to the operating phase. It permits totally integrated engineering through all planning phases of an industrial plant with a reduced number of interfaces. The complete plant structure is generated from the engineering data in the control system at the touch of a button. This simplifies automation engineering and enormously reduces the time required. Conversely, changes in the automation during operation or commissioning of the plant can be directly fed back into the planning software for documentation.

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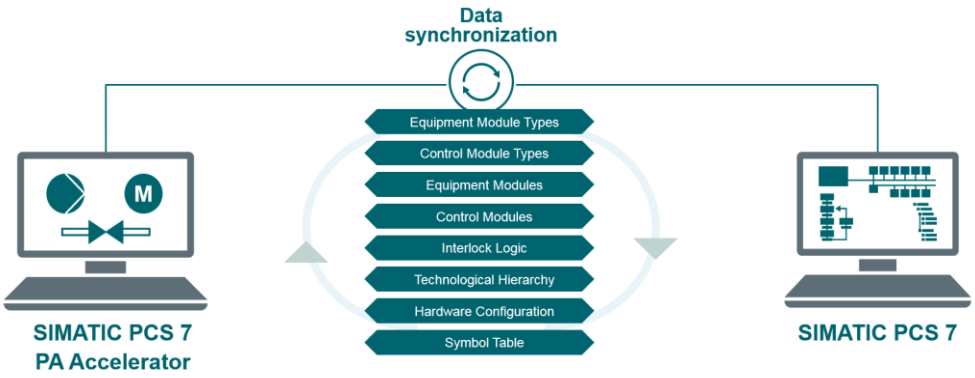

SIMATIC PCS 7 Plant Automation Accelerator thus creates the conditions for more decision-making reliability and more efficient processes throughout the plant and thus contributes to a sustained improvement in competitiveness.

Note

The following options are available for data transfer and matching:

- Direct data exchange:
  When PAA and PCS 7 are installed on the same computer, data is exchanged via an integrated interface in PAA.
- Indirect data exchange:
  When PAA and PCS 7 are installed on different computers, data is exchanged via XML files.

In the application example, the functionality of PAA is shown via the direct data exchange.

The indirect data exchange is not dealt with in greater detail in this application example.
Information on indirect data exchange can be found in the "PCS 7 Plant Automation Accelerator 2.1" manual.

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Advantages

- Shorter project durations thanks to easy and consistent data synchronization between engineering and automation
- Increased plant availability thanks to error-free data transfer and system documentation that is always up-to-date
- Project planning already in the quotation and documentation phase in the engineering phase as well as back-documentation during commissioning and ongoing operation minimize costs and time through standard documents supplied and the elimination of customizing effort.
- Project planning already in the quotation and documentation phase in the engineering phase as well as back-documentation during commissioning and ongoing operation minimize costs and time through standard documents supplied and the elimination of customizing effort.
- Out-of-the box SIMATIC PCS 7 engineering
- Reduced work effort thanks to reusability of hardware configurations
- Easy configuration of the SIMATIC PCS 7 topology
- Consistent as-is-documentation of software and hardware throughout the entire lifecycle
- Reusability of the as-is-documentation for migrations, plant extensions and new-builds

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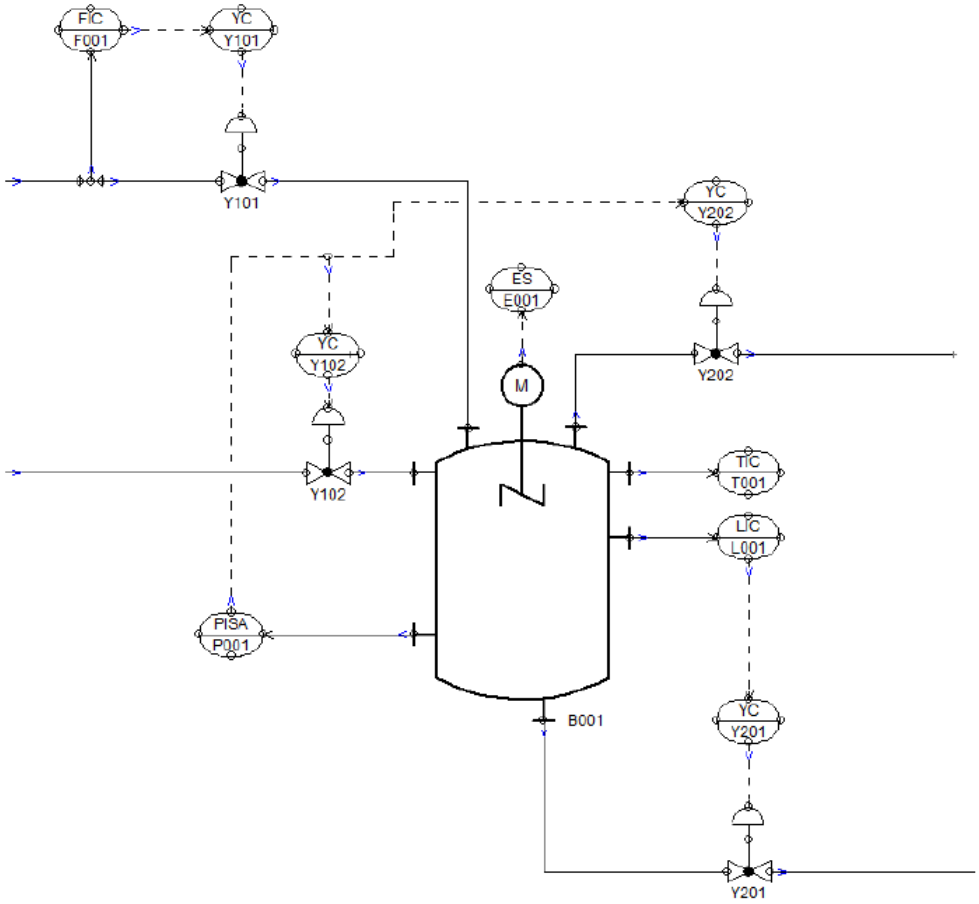
1.3 Example project

The zip file "109742154_files_v2_1.zip" contains a preconfigured PCS 7-project and a preconfigured SIMATIC PCS 7 Plant Automation Accelerator-project:

- BPCM_MP.zip (PCS 7 project)
- Database (PAA database)
- CM_Import.xml

With these preconfigured project data you can use PAA to carry out your automation engineering and learn about the advantages and functions of the system.

The following reactor planning can serve as an example:



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In the first step of the application example, you should use PAA to implement your hardware engineering.

- Creating a redundant SIMATIC station (AS)
- Creating a decentralized periphery (ET 200SP HA)
- Definition of interconnections and addresses
- Working with reports (project documentation)

Then import into PAA the individual control module types (CMTs) already present in SIMATIC PCS 7. The CMTs correspond to the components of the reactor model (valve, motor, measuring transducer, controller, etc.).

Based on these data and the reactor planning, you carry out your automation engineering for the reactor example in PAA. The following points are explained:

- Creating variants of the CMTs
- Create a DCS structure
- Mass data engineering via queries and Excel import
- Creating interconnections
- Logic diagram
- etc.

You will then be shown how to export and automatically generate the data created in the PAA to SIMATIC PCS 7.

Furthermore, you will be shown how to match the data between PAA and SIMIATIC PCS 7 in order to keep the plant documentation and data always up-to-date and synchronous.

You can use this database for COMOS, too. How this works is explained at the end of the application example.

NOTICE	The present application example is for illustrative purposes only and is not a fully worked out solution that can be implemented in your plant.

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1.4 Components used

The following hardware and software components were used to create this application example:

Component	ntity	Article number	Note
PCS 7 V9.0 SP1	1	6ES7658-AX28-0YA5	
PCS 7 Plant Automation Accelerator V2.1	1	Please get in touch for this with your local sales partner. http://w3.siemens.com/aspa_app/	

This application example consists of the following components:

Component	File name	Note
PAA database	109742154_PAA_application_example_project.mdb	This file contains a preconfigured PAA database (incl. project)
PCS 7-project	BPCM_MP.zip	This file contains the first version of a preconfigured PCS 7-project with preconfigured Single Controller Types (CMTs).
CMT data	CMT_Import	CMT Import file
Application example documentation	109742154_PAA_app_docu_v2_1_de.pdf	This document

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2 Preparation of project data

This section describes how to open the supplied SIMATIC PCS 7-project and the supplied PAA database with the preconfigured example project.

It also explains which basic settings are necessary for the correct execution of the application example.

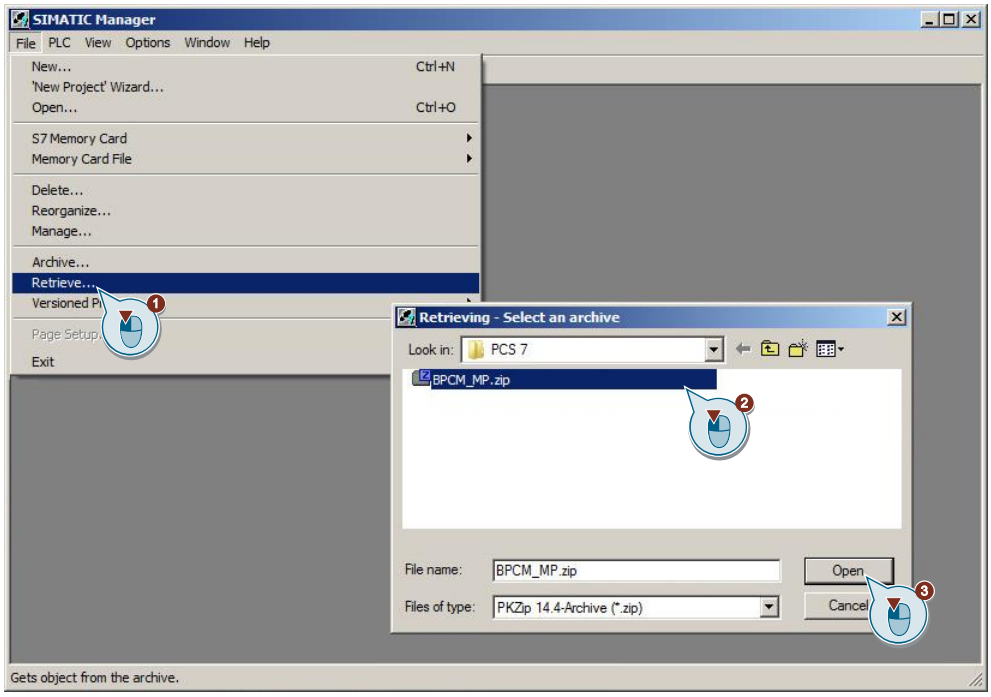
2.1 Opening SIMATIC PCS 7-project

Procedure

1. Open the SIMATIC Manager.

Dearchive the supplied PCS 7 sample project "BPCM_MP.zip".

2. To do this, in the PCS 7 menu bar click on: "File > Retrieve…"
3. In the "Retrieving" window, select the supplied PCS 7-project and then click the "Open" button.



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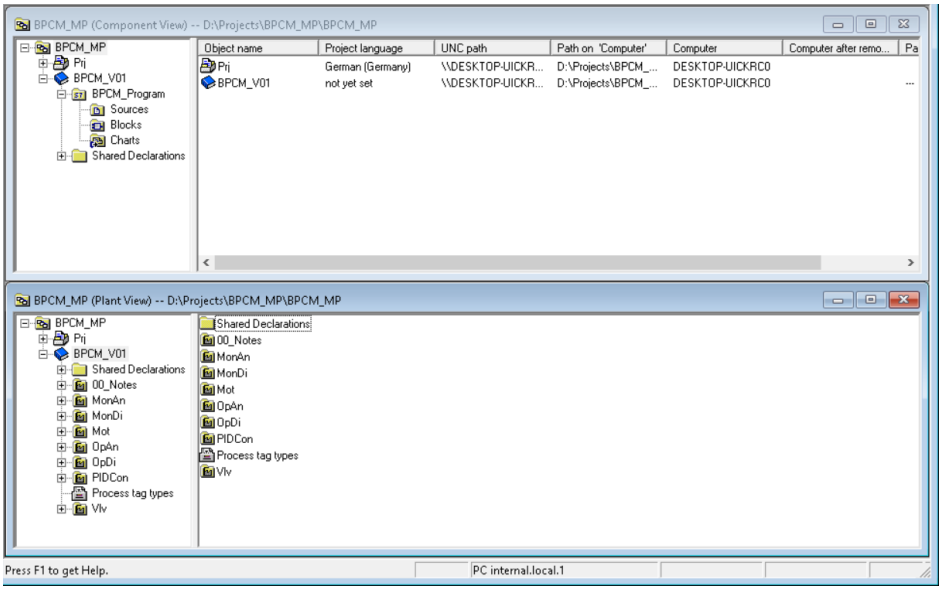
The PCS 7-project opens.



The "Process tag types" folder in the "Plant View" contains preconfigured individual control units (CMTs) and technical equipment (EMTs).

Note

Further information on the new type concept in SIMATIC PCS 7 with individual control unit types and individual control units can be found in the following application examples:

Control Module (CM) Technology - Efficient Engineering in SIMATIC PCS 7

Integrated Engineering with COMOS and SIMATIC PCS 7 on a practical example (section 4.4)

Information about further helpful contributions and links can be found in the section Links and Literature of this document.

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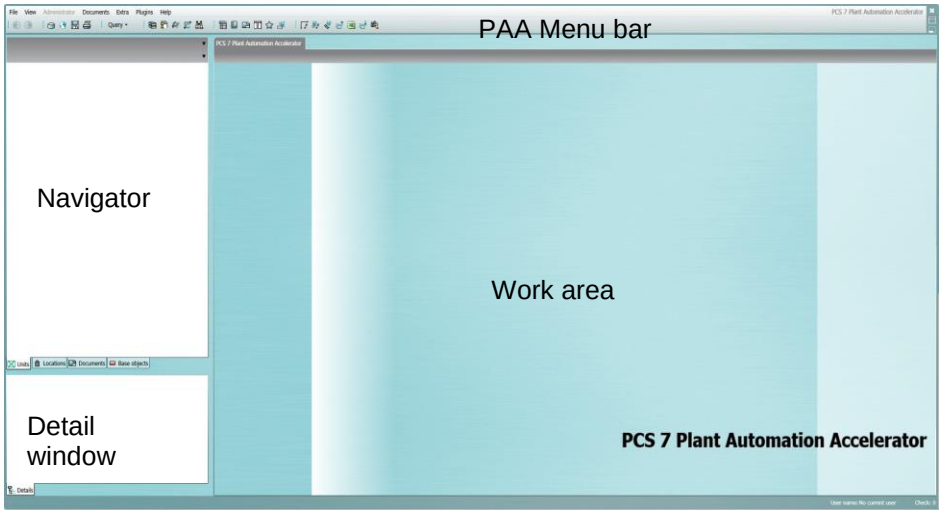
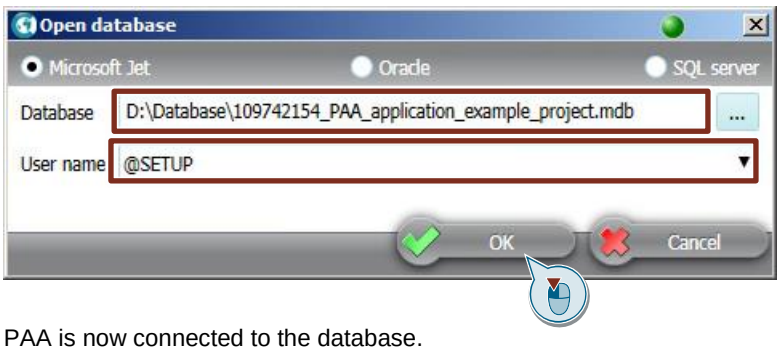
2.2 Opening the PAA database and example project

Procedure

1. Open the PAA.



2. In the PAA menu bar, click on the button "Open database" .
3. Click on the "Browse" button ... .
4. In the selection window, select the supplied database "109742154_PAA_application_example_project.mdb".
5. Open the drop-down list in the "User name" field.
6. Click on the "@Setup" entry.
7. Click on the "OK" button.



PAA is now connected to the database.

Then open the sample project in PAA.

8. To do this, click on the "Open project" button in the PAA menu bar .
9. Open the subordinate working layer "PAA application example (preconfigured project)" with a click on the button of the topmost project node "Demo Project".
10. Double-click the "PAA application example (preconfigured project)" work layer to open the preconfigured PAA sample project.

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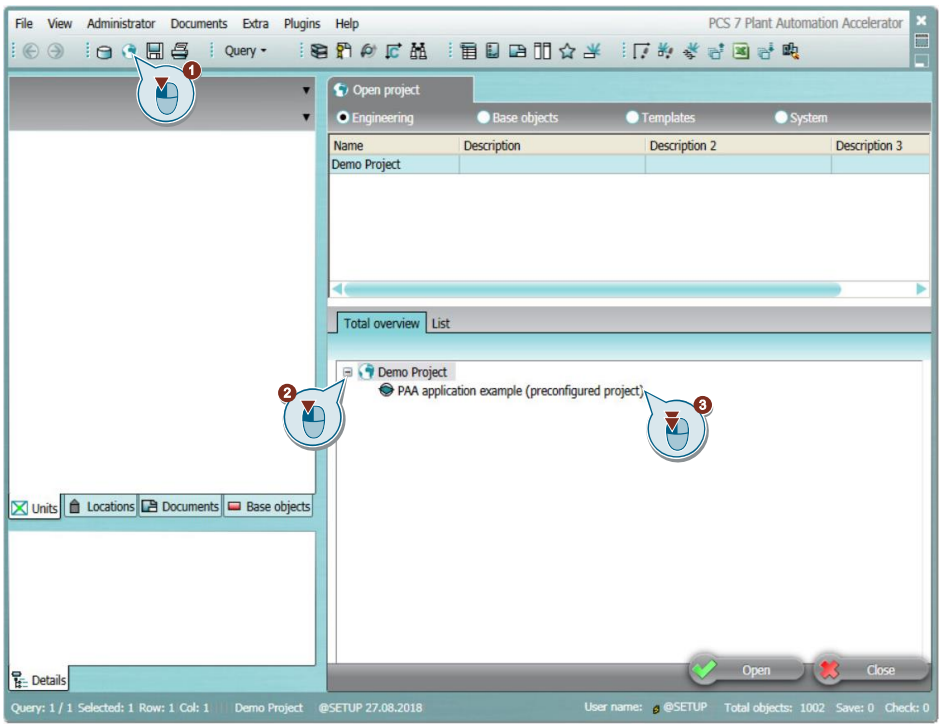

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2.3 Basic PAA-project settings

2.3.1 Basic information regarding language settings

The languages of your operating system, MS Office, SIMATIC PCS 7 and PAA must be identical. Set the languages accordingly.

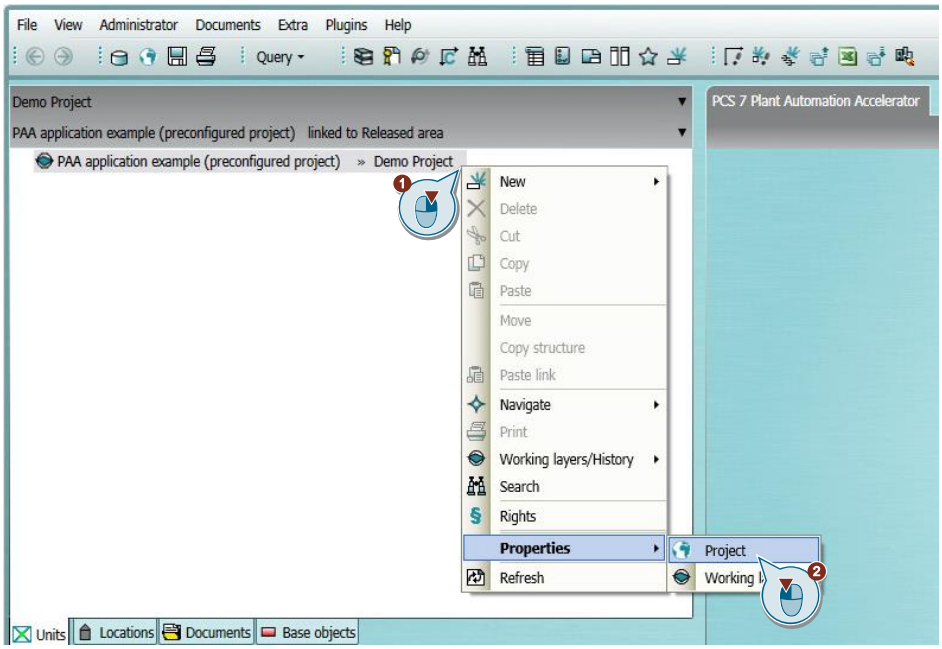
For example, in German the comma is used as a decimal separator and in English as a thousands separator. With different settings, this may cause values to be calculated incorrectly.

2.3.2 Basic PAA-project settings

This section briefly describes the project settings in the PAA sample project.

Open project properties

1. In the PAA-project, open the corresponding context menu by right-clicking on the project node.
2. Click on the entry:
"Properties > Project".



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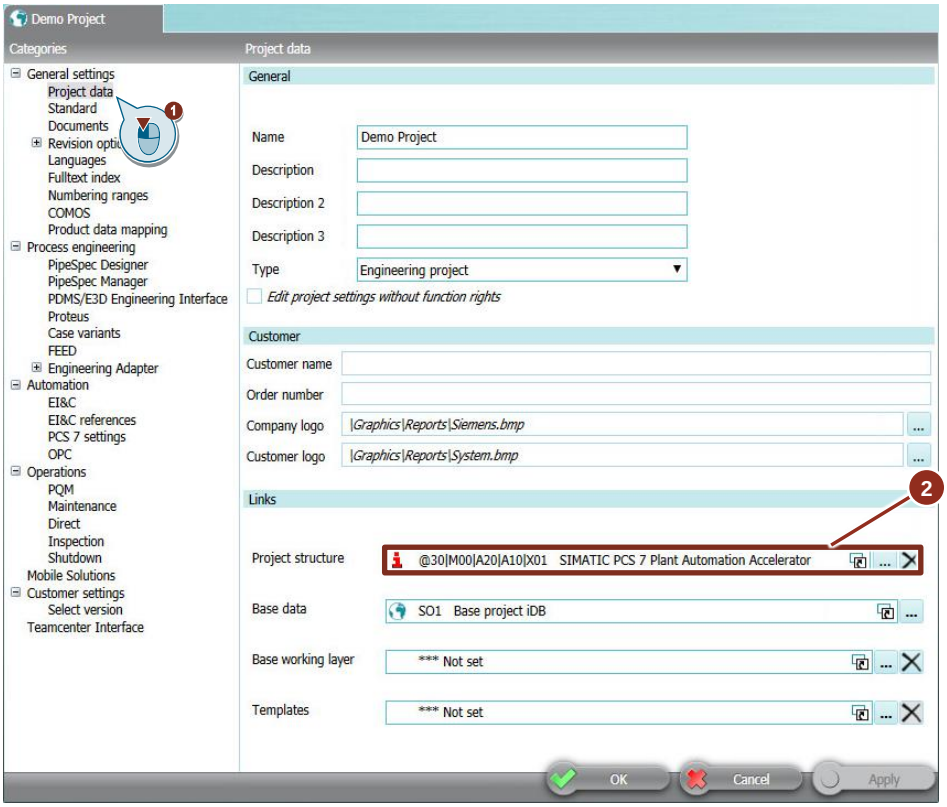
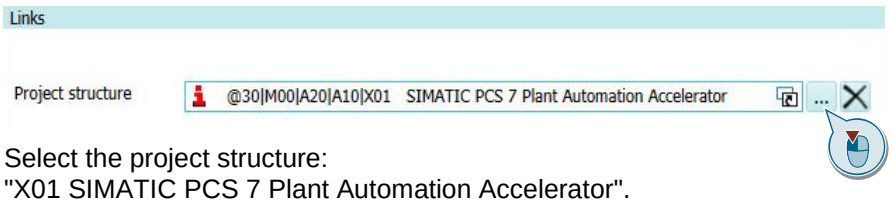
Specify the project structure

1. Select the category "Project data".
2. Check the "Project structure" field in the "Links" directory. In this, "... SIMATIC PCS 7 Plant Automation Accelerator" must be selected.



If "... SIMATIC PCS 7 Plant Automation Accelerator" is not selected, proceed as follows.

a. Click on the "Browse" button.
The "Select project structure…" dialog



b. Select the project structure:
"X01 SIMATIC PCS 7 Plant Automation Accelerator".

c. Then click the "OK" button.

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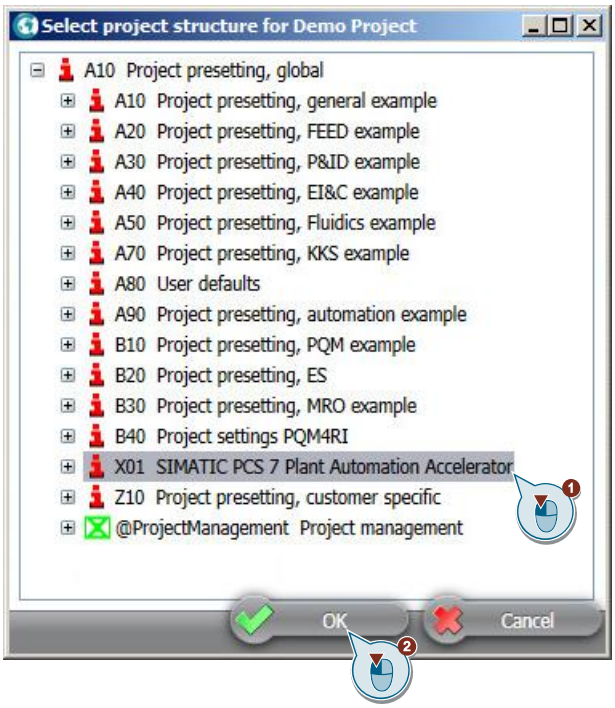
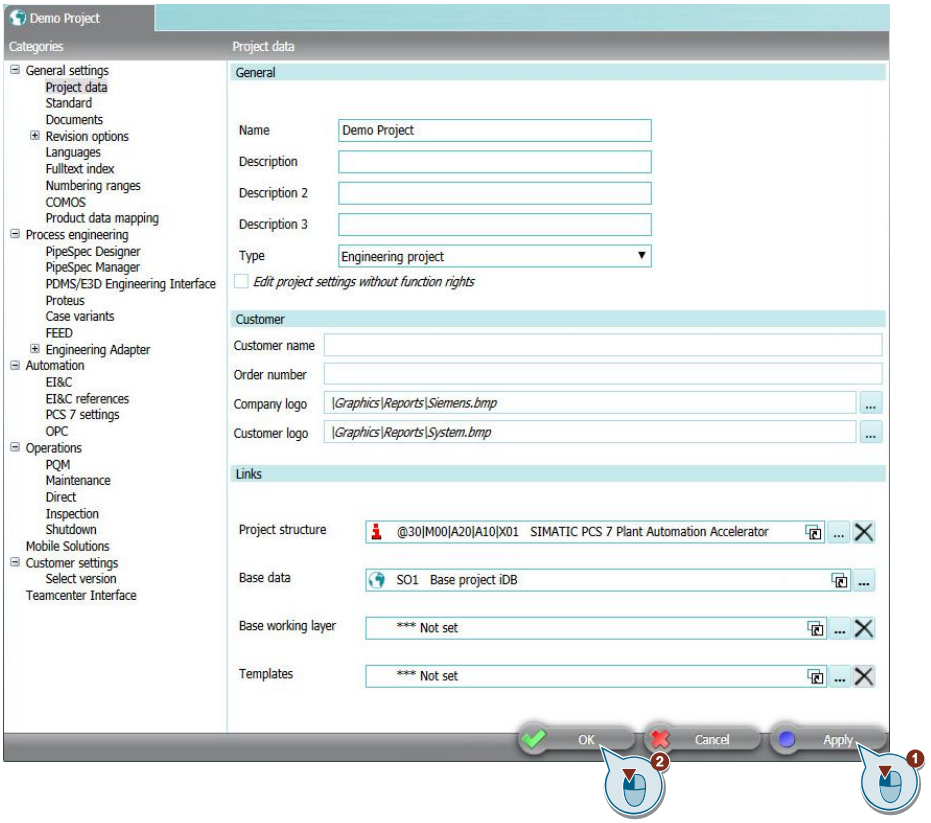


d. Then click on the "Apply" and "OK" buttons to save the changes and to close the project properties.



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Result

The languages of your operating system, MS Office, SIMATIC PCS 7 and PAA are identical.

You have also linked the sample project to the PAA-project structure. This connection determines e.g. which inputs you can select at each object using the right mouse button.

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3 Configuration of the sample project

3.1 Hardware engineering in PAA

This section describes how to quickly and easily create and plan your hardware configuration in PAA.

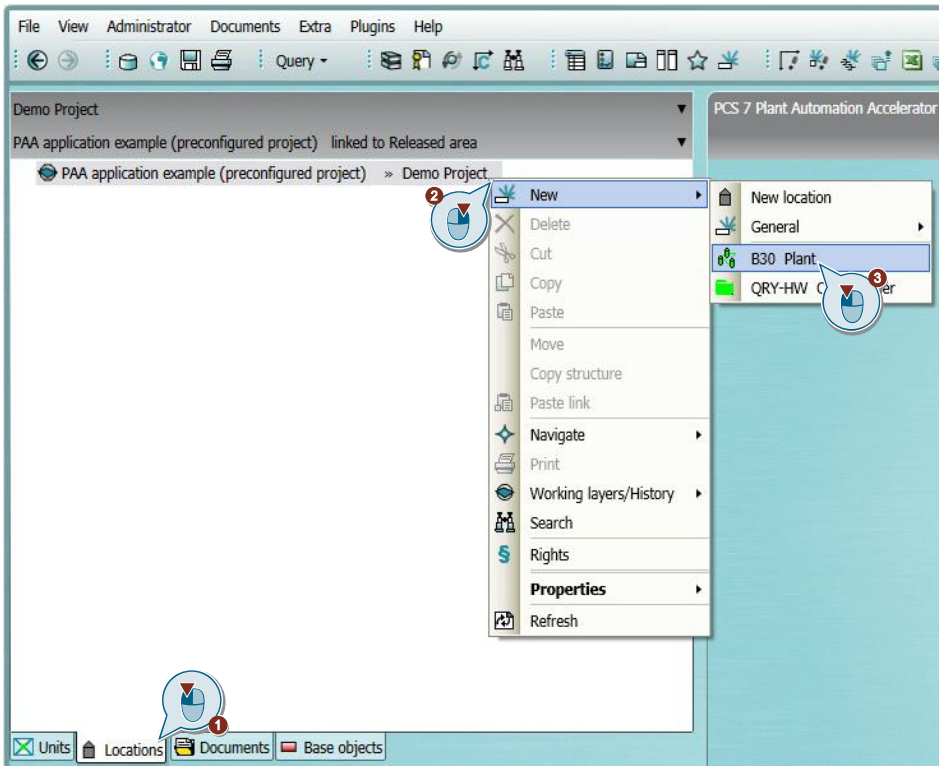
You will also be shown the report functionalities (documentation templates) that give you a quick overview of your hardware configuration.

3.1.1 Creating a redundant SIMATIC station

This section describes how to create a location structure in the PAA sample project.

Create a location structure

1. Open the "Locations" tab in the Navigator.
2. Open the corresponding context menu by right-clicking on the project node. You can create your location structure here.
3. Click on "B30 Plant" to create a new plant.



4. Open the corresponding context menu by right clicking on the object "Plant".
5. Create the object "Building":
   "New > A10 Building"

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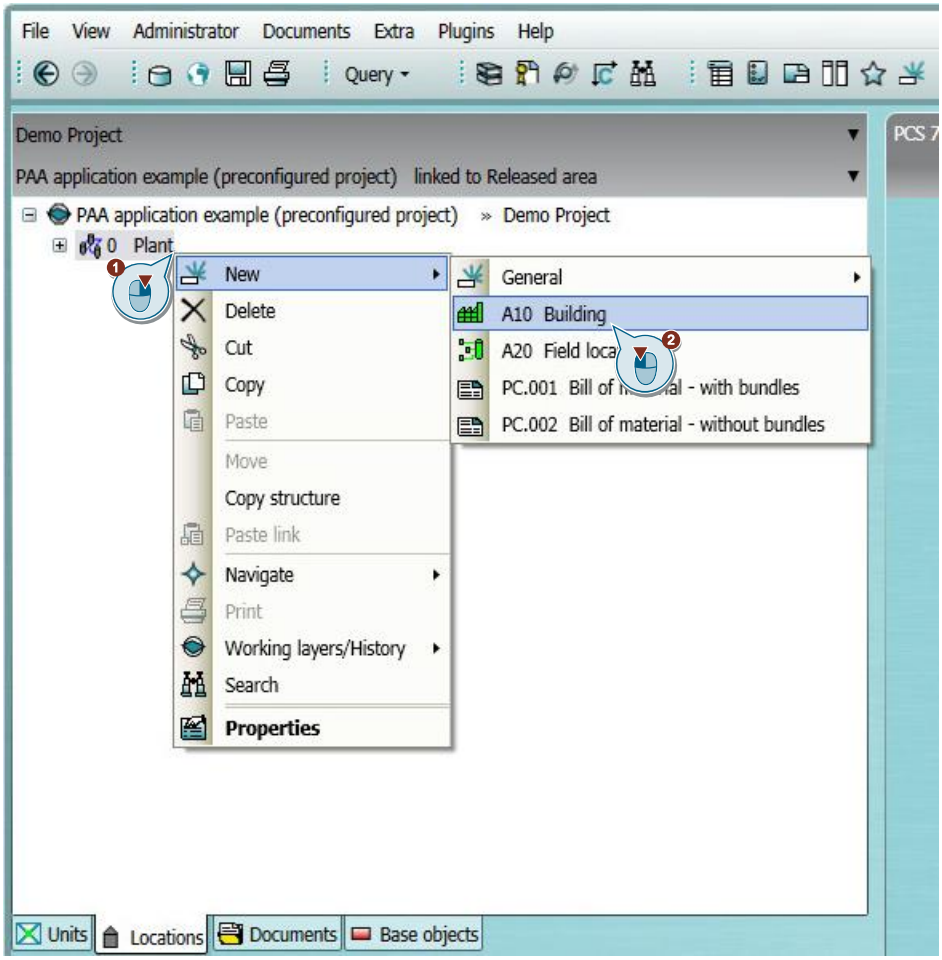
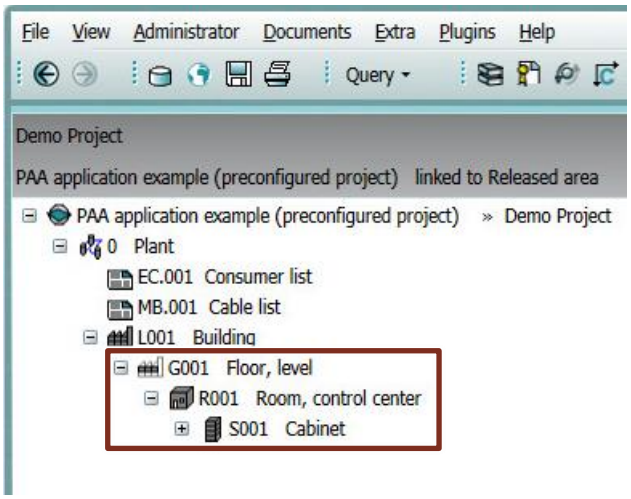


6. Create the structure in the same way as shown in the following figure.



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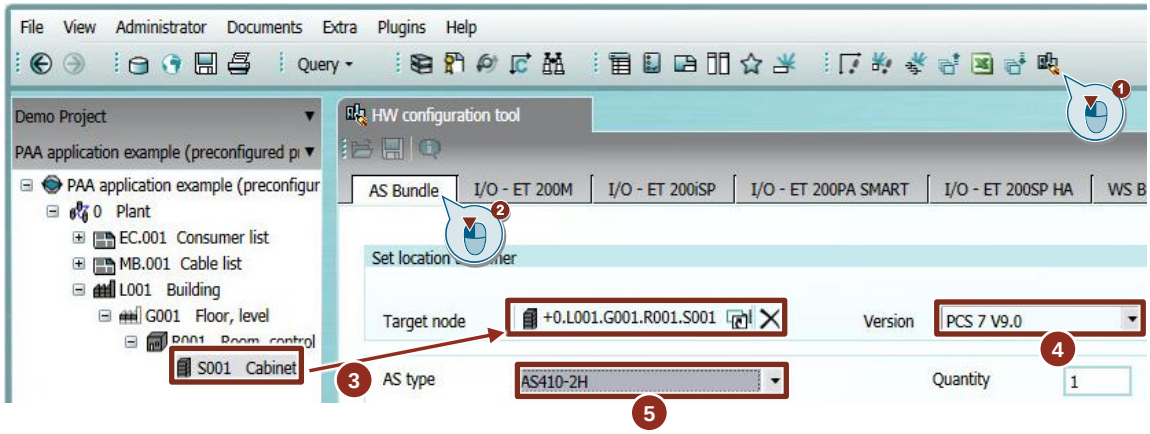
Create hardware with the "Hardware (HW) configurator"

In the "HW configuration tool" you can compile available and released hardware configurations, depending on the PCS 7 version.

This section shows you how to plan and create your hardware quickly and easily with the "HW configuration tool".

1. Open the "HW configuration tool".

   Click on "HW configuration tool" in the menu bar. .
2. Open the "AS bundle" tab.
3. Drag and drop the cabinet object "S001 Cabinet" from the navigator into the field "Target node" of the tab "AS bundle".
4. Select "PCS 7 V9.0" from the drop-down list in the "Version" field.
   This sample project was created on the basis of PCS 7 V9.0.
5. Select "AS 410-2H" from the drop-down list in the "AS type" field.



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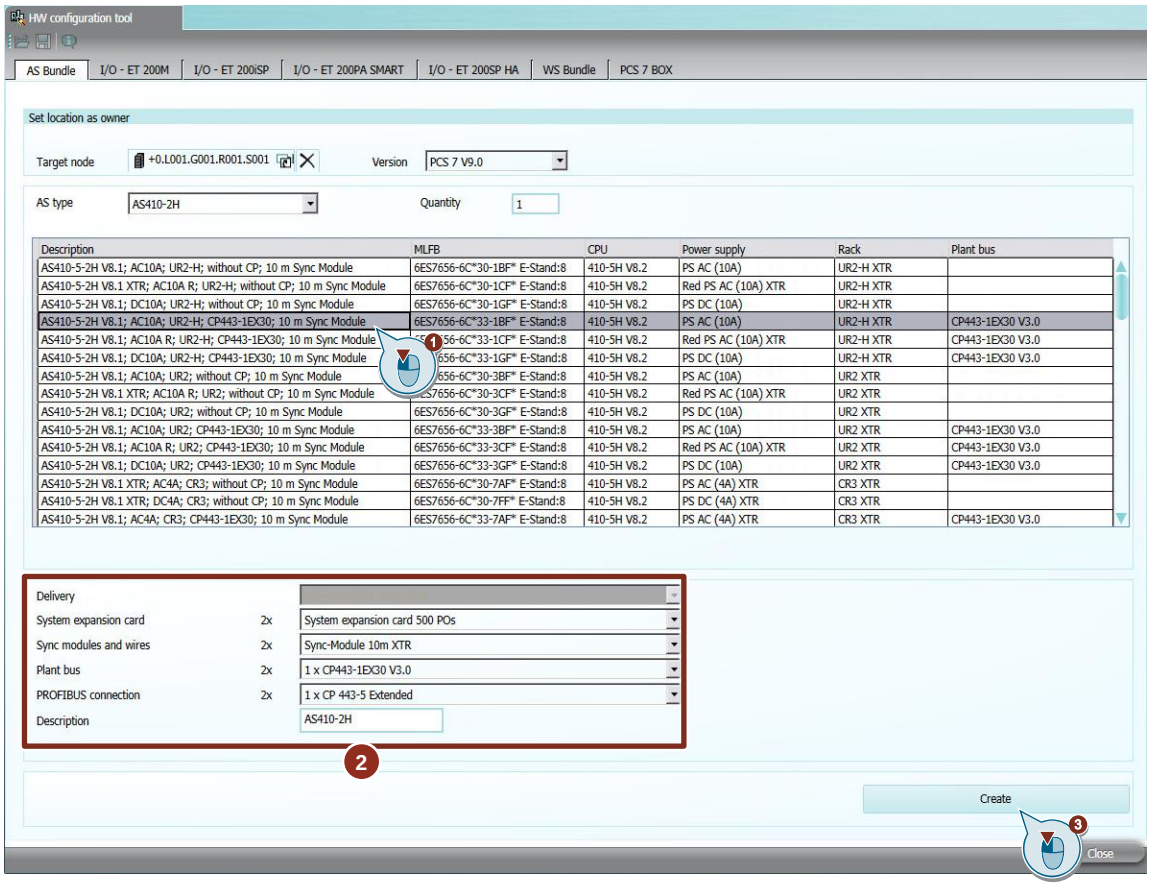
6. Select the "AS bundle" with the "MLFB" "6ES7656-6C*33-1BF* E-Stand:8".
7. Configure the "AS bundle" as follows:
   - "System expansion card": "System expansion card 500 POs"
   - "Sync modules and wires": "Sync-Module 10m XTR"
   - "Plant bus": "1 x CP443 IEX30 V3.0"
   - "PROFIBUS connection": "1 x CP 443-5 Extended"
   - "Description": "AS410-2H"
8. Click on the "Create" button to create the hardware.



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The hardware including the configured components is created under the cabinet object "S001".

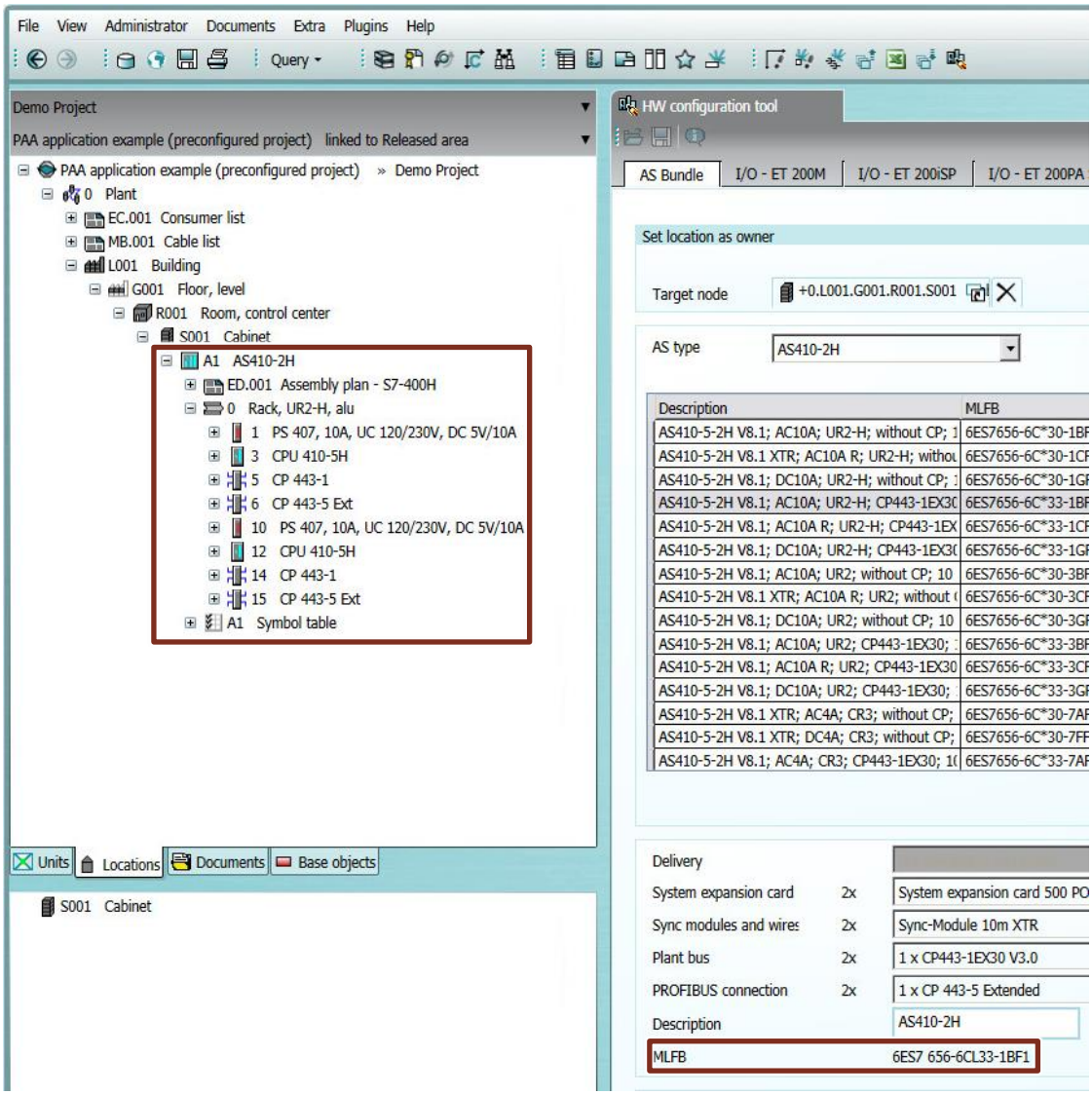
You will also see the corresponding item number for your configuration. This facilitates ordering your hardware configured in PAA via the Siemens Industry Mall.

Note

Special rule for UR2-H racks

With UR2-H racks, all modules of the entire station are physically plugged into one rack. This UR2-H rack is divided into two areas electrically only, the slots themselves provide space for two CPUs.

For this reason, the UR2H racks are not transferred to PAA as two racks with slots 1 to 9, but as one rack with slots 1 to 18. The first half of the slots are intended for the first CPU, and the second half for the second CPU.



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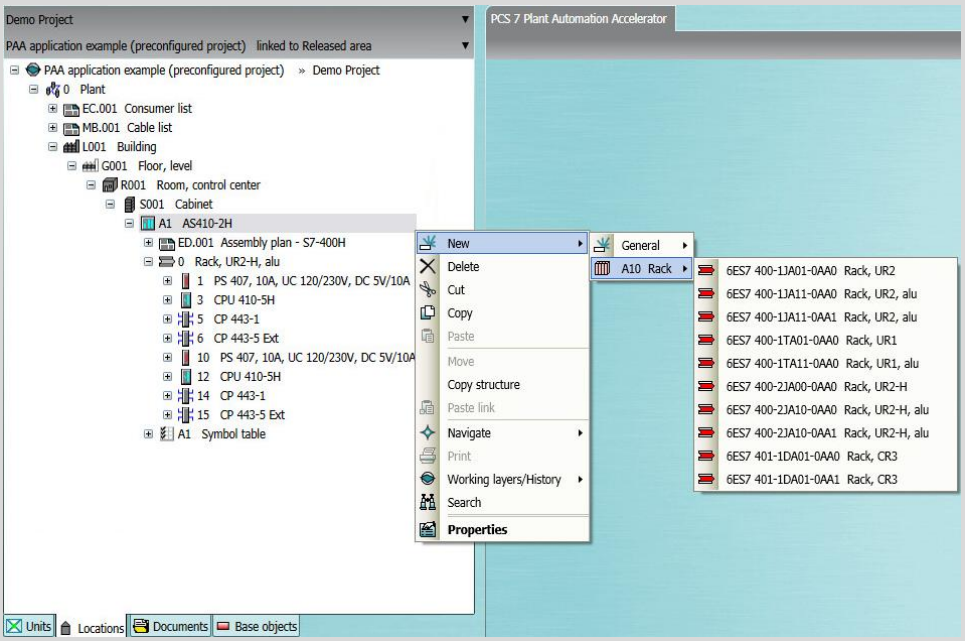
Note

You can also create hardware components manually using the context menu of the respective object.



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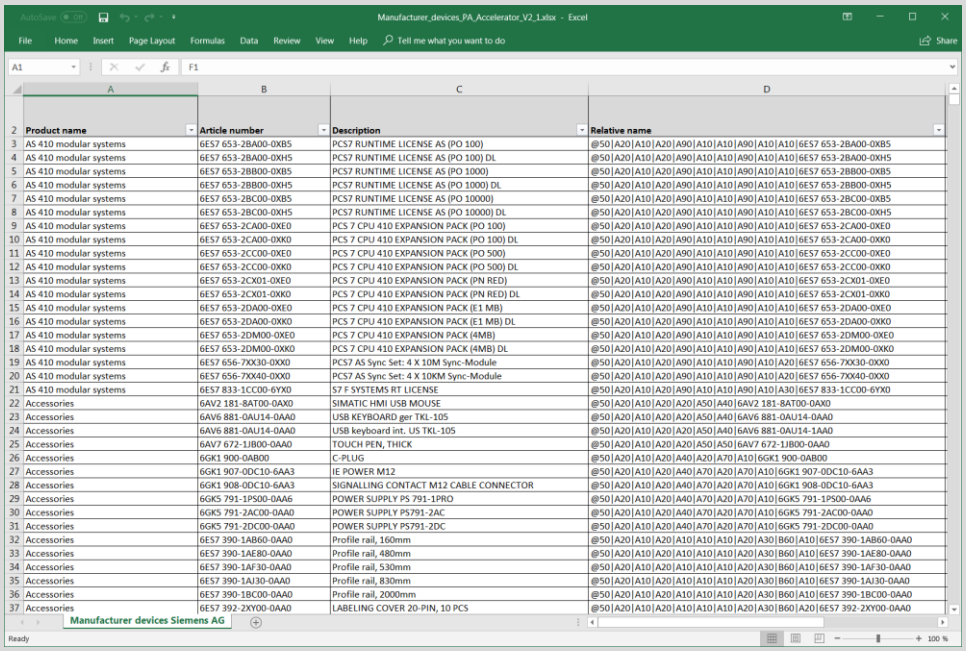
Note

If you want to add a certain hardware component to your project, but it is not displayed in the "HW configuration tool" or in the context menu, this object can still exist in the root objects.

To find an object faster in the root objects, the Excel list "Manufacturer_devices_PA_Accelerator_V2_1.xlsx" is located in the PAA installation folder.

In this list, all master objects of the database are listed and can be filtered. You can use the "Relative name" column to find the location in the root objects and add the object to your project.



Manufacturer_devices_PA_Accelerator_V2_1.xlsx - Excel

	A	B	C	D
2	Product name	Article number	Description	Relative name
3	AS 410 modular systems	6ES7 653-2BA00-0XB5	PCS7 RUNTIME LICENSE AS (PO 100)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2BA00-0XB5
4	AS 410 modular systems	6ES7 653-2BA00-0XH5	PCS7 RUNTIME LICENSE AS (PO 100) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2BA00-0XH5
5	AS 410 modular systems	6ES7 653-2BB00-0XB5	PCS7 RUNTIME LICENSE AS (PO 1000)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2BB00-0XB5
6	AS 410 modular systems	6ES7 653-2BB00-0XH5	PCS7 RUNTIME LICENSE AS (PO 1000) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2BB00-0XH5
7	AS 410 modular systems	6ES7 653-2BC00-0XB5	PCS7 RUNTIME LICENSE AS (PO 10000)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2BC00-0XB5
8	AS 410 modular systems	6ES7 653-2BC00-0XH5	PCS7 RUNTIME LICENSE AS (PO 10000) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2BC00-0XH5
9	AS 410 modular systems	6ES7 653-2CA00-0XE0	PCS 7 CPU 410 EXPANSION PACK (PO 100)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2CA00-0XE0
10	AS 410 modular systems	6ES7 653-2CA00-0XK0	PCS 7 CPU 410 EXPANSION PACK (PO 100) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2CA00-0XK0
11	AS 410 modular systems	6ES7 653-2CC00-0XE0	PCS 7 CPU 410 EXPANSION PACK (PO 500)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2CC00-0XE0
12	AS 410 modular systems	6ES7 653-2CC00-0XK0	PCS 7 CPU 410 EXPANSION PACK (PO 500) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2CC00-0XK0
13	AS 410 modular systems	6ES7 653-2CX01-0XE0	PCS 7 CPU 410 EXPANSION PACK (PN RED)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2CX01-0XE0
14	AS 410 modular systems	6ES7 653-2CX01-0XK0	PCS 7 CPU 410 EXPANSION PACK (PN RED) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2CX01-0XK0
15	AS 410 modular systems	6ES7 653-2DA00-0XE0	PCS 7 CPU 410 EXPANSION PACK (E1 MB)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2DA00-0XE0
16	AS 410 modular systems	6ES7 653-2DA00-0XK0	PCS 7 CPU 410 EXPANSION PACK (E1 MB) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2DA00-0XK0
17	AS 410 modular systems	6ES7 653-2DM00-0XE0	PCS 7 CPU 410 EXPANSION PACK (4MB)	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2DM00-0XE0
18	AS 410 modular systems	6ES7 653-2DM00-0XK0	PCS 7 CPU 410 EXPANSION PACK (4MB) DL	@50|A20|A10|A20|A90|A10|A10|A90|A10|A10|6ES7 653-2DM00-0XK0
19	AS 410 modular systems	6ES7 656-7XX30-0XX0	PCS7 AS Sync Set: 4 X 10M Sync-Module	@50|A20|A10|A20|A90|A10|A10|A90|A10|A20|6ES7 656-7XX30-0XX0
20	AS 410 modular systems	6ES7 656-7XX40-0XX0	PCS7 AS Sync Set: 4 X 10KM Sync-Module	@50|A20|A10|A20|A90|A10|A10|A90|A10|A20|6ES7 656-7XX40-0XX0
21	AS 410 modular systems	6ES7 833-1CC00-6YX0	S7 F SYSTEMS RT LICENSE	@50|A20|A10|A20|A90|A10|A10|A90|A10|A30|6ES7 833-1CC00-6YX0
22	Accessories	6AV2 181-8AT00-0AX0	SIMATIC HMI USB MOUSE	@50|A20|A10|A20|A20|A50|A40|6AV2 181-8AT00-0AX0
23	Accessories	6AV6 881-0AU14-0AA0	USB KEYBOARD ger TKL-105	@50|A20|A10|A20|A20|A50|A40|6AV6 881-0AU14-0AA0
24	Accessories	6AV6 881-0AU14-0AA0	USB keyboard int. US TKL-105	@50|A20|A10|A20|A20|A50|A40|6AV6 881-0AU14-1AA0
25	Accessories	6AV7 672-1JB00-0AA0	TOUCH PEN, THICK	@50|A20|A10|A20|A20|A50|A50|6AV7 672-1JB00-0AA0
26	Accessories	6GK1 900-0AB00	C-PLUG	@50|A20|A10|A20|A40|A20|A70|A10|6GK1 900-0AB00
27	Accessories	6GK1 907-0DC10-6AA3	IE POWER M12	@50|A20|A10|A20|A40|A70|A20|A70|A10|6GK1 907-0DC10-6AA3
28	Accessories	6GK1 908-0DC10-6AA3	SIGNALLING CONTACT M12 CABLE CONNECTOR	@50|A20|A10|A20|A40|A70|A20|A70|A10|6GK1 908-0DC10-6AA3
29	Accessories	6GK5 791-1PS00-0AA6	POWER SUPPLY PS 791-1PRO	@50|A20|A10|A20|A40|A70|A20|A70|A10|6GK5 791-1PS00-0AA6
30	Accessories	6GK5 791-2AC00-0AA0	POWER SUPPLY PS791-2AC	@50|A20|A10|A20|A40|A70|A20|A70|A10|6GK5 791-2AC00-0AA0
31	Accessories	6GK5 791-2DC00-0AA0	POWER SUPPLY PS791-2DC	@50|A20|A10|A20|A40|A70|A20|A70|A10|6GK5 791-2DC00-0AA0
32	Accessories	6ES7 390-1AB60-0AA0	Profile rail, 160mm	@50|A20|A10|A20|A10|A10|A10|A20|A30|B60|A10|6ES7 390-1AB60-0AA0
33	Accessories	6ES7 390-1AE80-0AA0	Profile rail, 480mm	@50|A20|A10|A20|A10|A10|A10|A20|A30|B60|A10|6ES7 390-1AE80-0AA0
34	Accessories	6ES7 390-1AF30-0AA0	Profile rail, 530mm	@50|A20|A10|A20|A10|A10|A10|A20|A30|B60|A10|6ES7 390-1AF30-0AA0
35	Accessories	6ES7 390-1AJ30-0AA0	Profile rail, 830mm	@50|A20|A10|A20|A10|A10|A10|A20|A30|B60|A10|6ES7 390-1AJ30-0AA0
36	Accessories	6ES7 390-1BC00-0AA0	Profile rail, 2000mm	@50|A20|A10|A20|A10|A10|A10|A20|A30|B60|A10|6ES7 390-1BC00-0AA0
37	Accessories	6ES7 392-2XY00-0AA0	LABELING COVER 20-PIN, 10 PCS	@50|A20|A10|A20|A10|A10|A10|A20|A30|B60|A20|6ES7 392-2XY00-0AA0

Manufacturer devices Siemens AG

Ready

100 %

Result

In the example project, you have set up a location structure and created a highly available SIMATIC S7-410 station with the "HW configuration tool".

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3.1.2 Configuration and creation of a distributed periphery

This section describes how to configure and create a decentralized peripheral (ET 200SP HA) with corresponding I/O components using the "HW configuration tool".

Note In the application example, an "R1" redundancy (modular system redundancy) is configured with PROFINET.

The article contains a guide to the most important topics and functions when using PROFINET in process automation: "PROFINET in Process Automation with SIMATIC PCS 7".

Create decentralized periphery with the "HW configuration tool".

1. Open in the menu bar den "HW configuration tool" .
2. Open the "I/O – ET 200SP HA" tab.
3. Drag and drop the cabinet object "S001" from the navigator into the field "Target node".
4. Create a "ET 200SP HA" with the following properties in the "General" directory:
   - "Slave description": "ET 200SP HA"
   - "Rack": "MOUNTING RAIL 1500MM (59")"
   - "Interface modules": "IM155-6-PN"
   - Enable the "Redundant" checkbox
   - "Bus adapter": "ET 200SP HA, BUSADAPTER BA 2XFC"
   - "Spare I/O space [%]": "10"
   - "Sort order for I/Os": "Sort I/Os as selected"
5. In the "I/O configuration" directory, configure as follows:
   - "Base:": "Channels"
   - "Spare I/O channels [%]": "10"
   - "Channels count": "4"
   - "MLFB – Description": "6DL1 135-6TF00-0PH1 – ET 200SP HA, AQ 8XI HART"
6. Click "Create".

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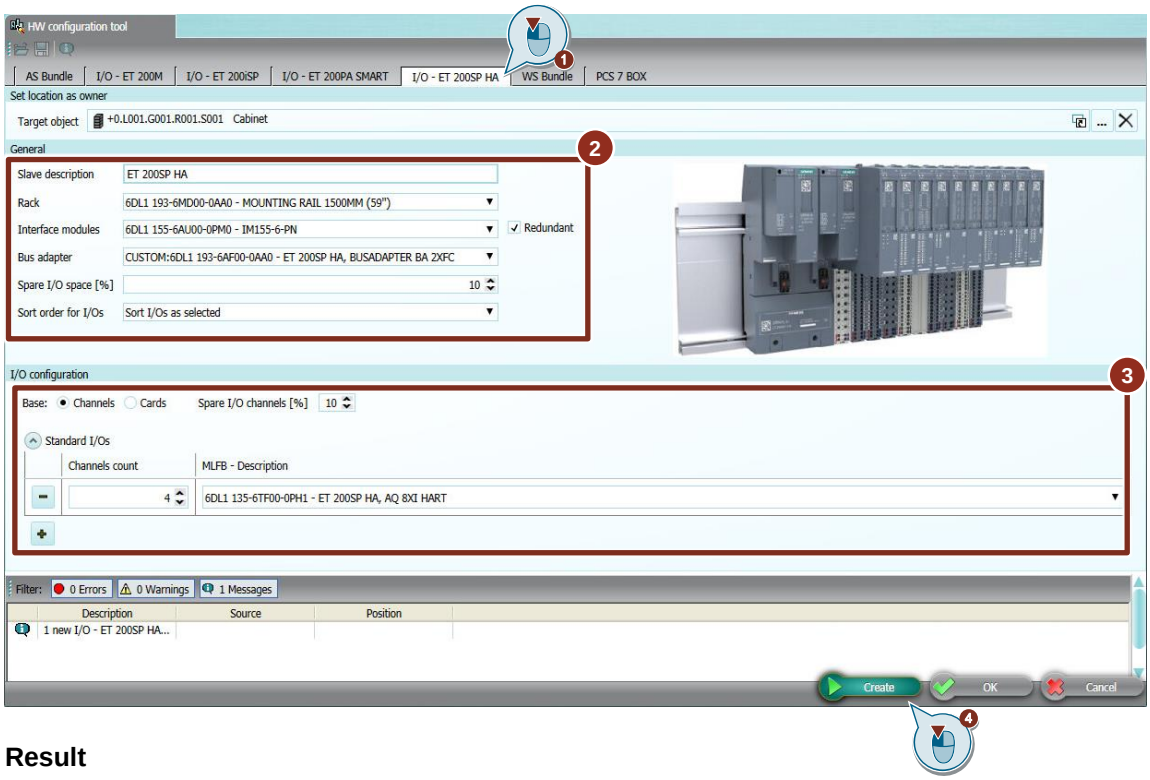

Result

You have configured and created a decentralized periphery with the HW Configurator.

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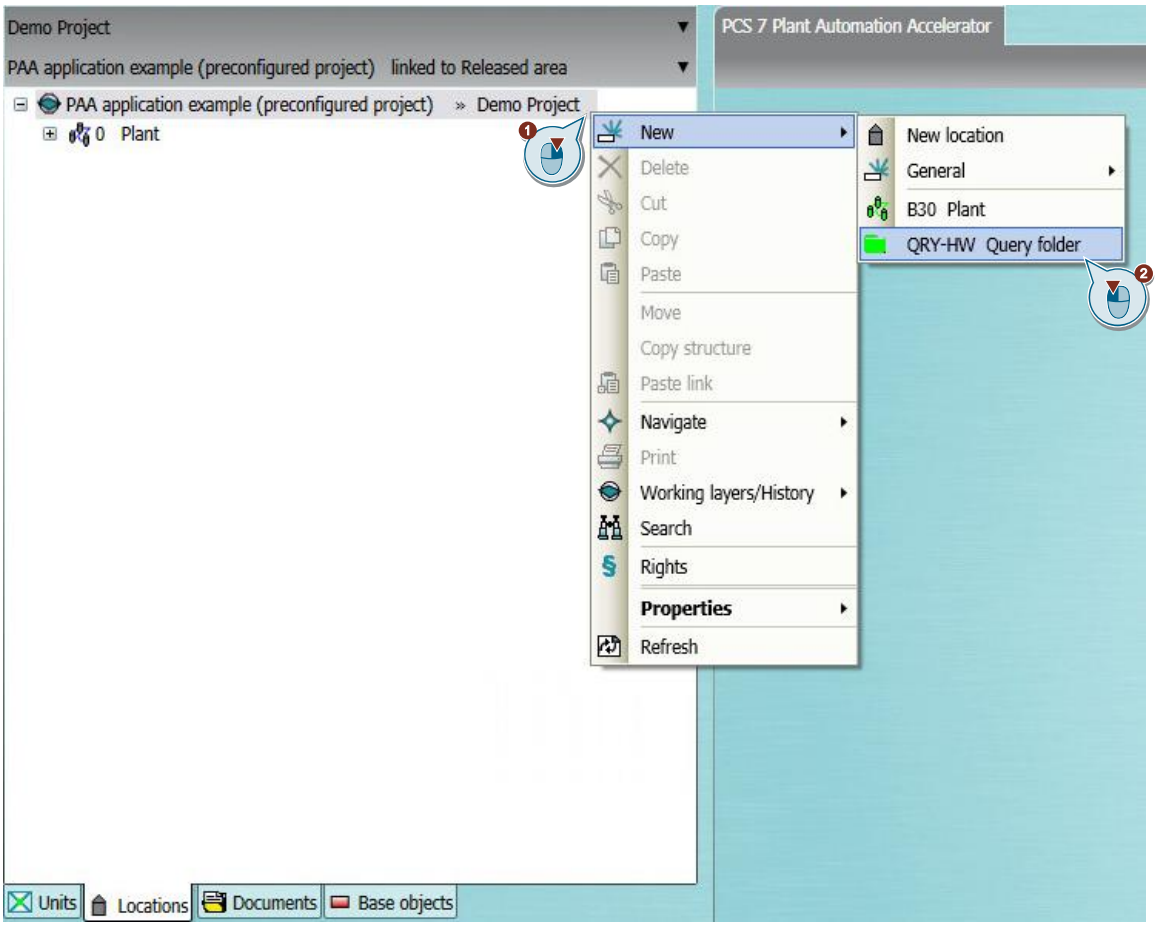
3.1.3 Address and slot configuration of a distributed periphery

This section shows you how to define the slot and the start addresses of the I/O components.

1. In the Navigator, open the "Locations" tab.
2. Open the corresponding context menu by right-clicking on the project node.
3. Create a "QRY-HW Query folder".



4. Open the query "Set addresses for I/O components".
5. Drag and drop the object "S01 ET 200SP HA" from the navigator into the field "Start object(s)".
6. Click on "Search" .

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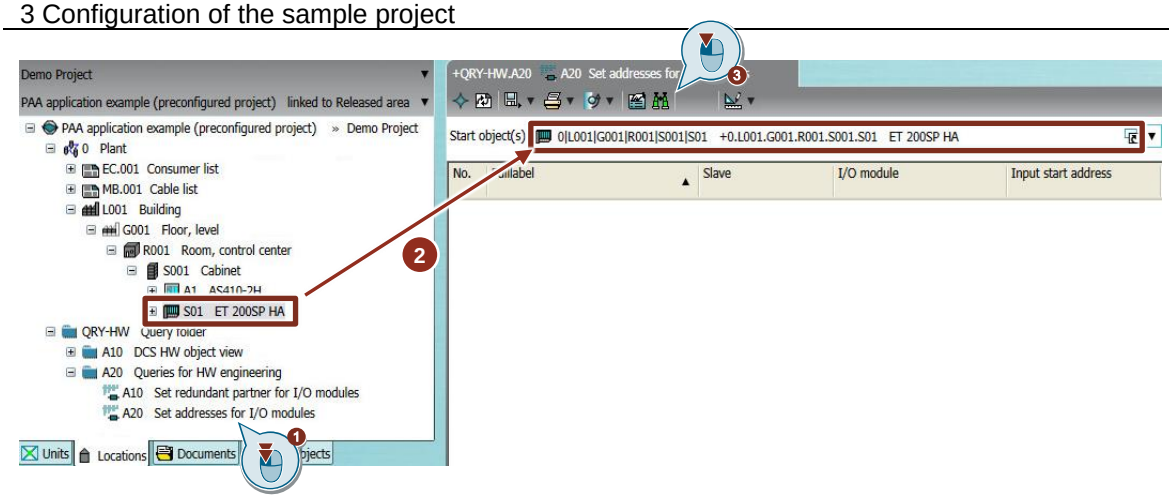
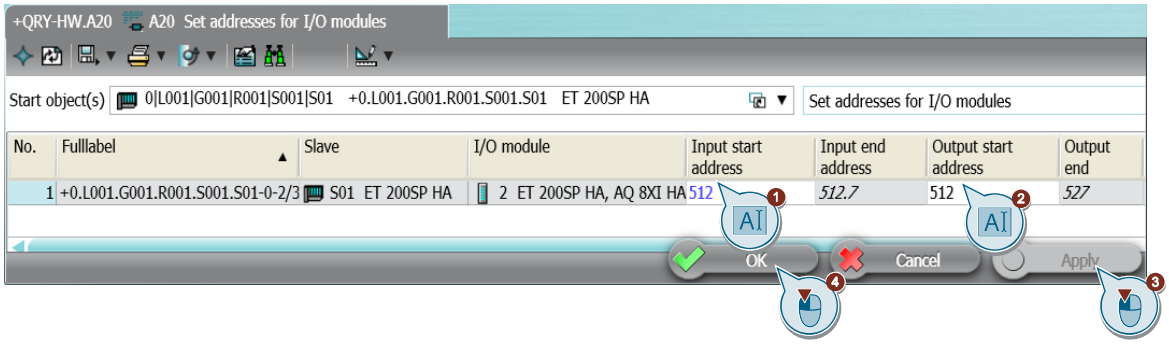


7. Change the "Input start address" to "512" and the "Output start address" to "512".
8. Click on "Apply" and "OK".



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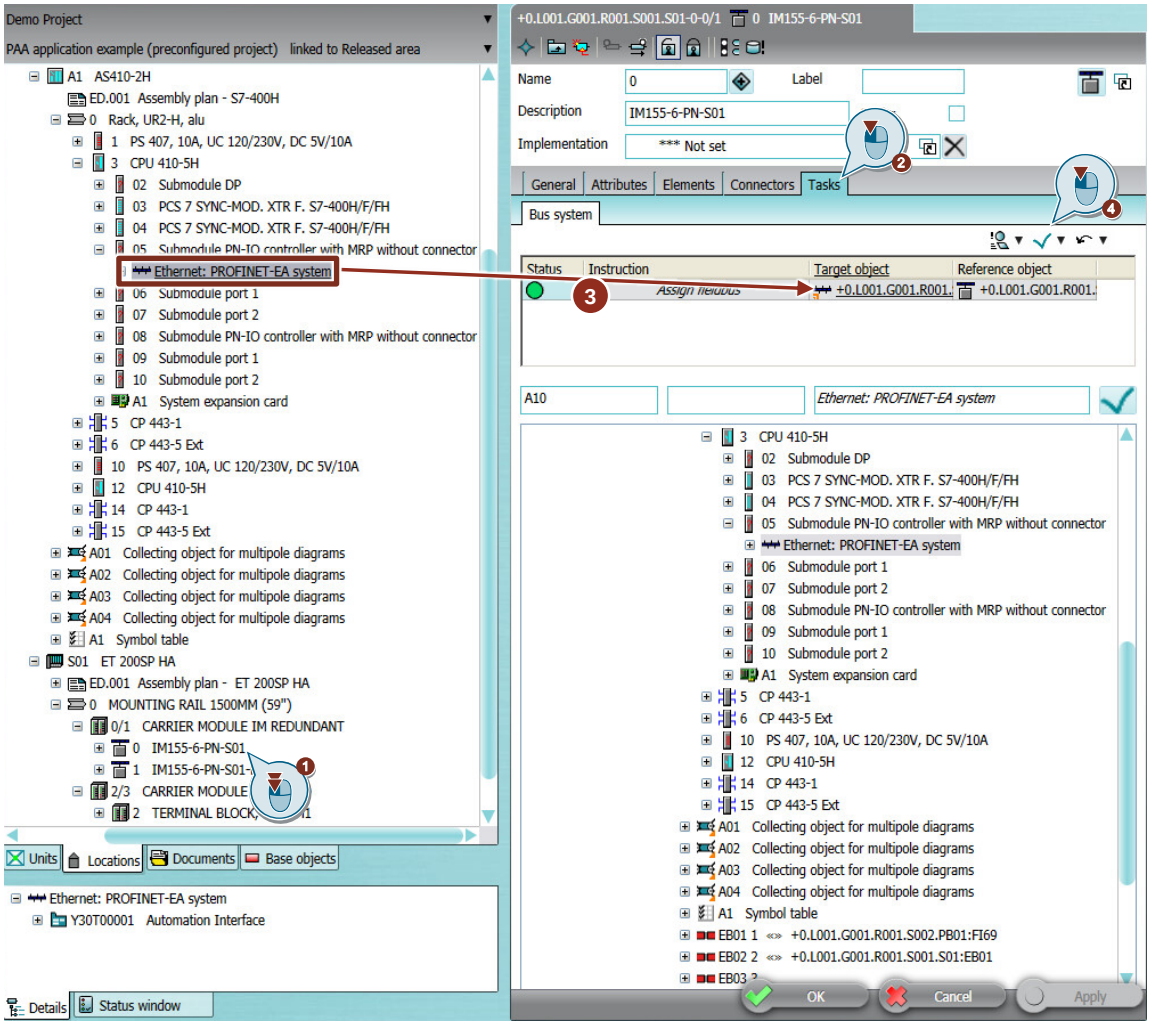
3.1.4 Redundant terminal bus interconnection

This section shows you how to interconnect the created SIMATIC station to the distributed I/O (redundant PROFIBUS configuration) in the sample project.

1. Open the corresponding properties with a double click on the interface module "0" of the "ET 200SP HA".
2. Open the tab "Tasks > Bus system"
3. Drag the PROFINET object "3 CPU 410-5h > 05 Submodules PN-IO controller with MRP without connector > Ethernet: PROFINET-EA system" by Drag & Drop into the field "Target object" of the task "Assign fieldbus".
4. Click on ✓ "Execute (selected)".

The assignments are implemented and their status checked.
If the execution is error-free, the status color changes to green.



5. Open the corresponding context menu with a right click in the free area of the "Bus system" tab and click on "New > Assign redundant field bus".
6. Drag the PROFINET object "12 CPU 410-5h > 05 Submodules PN-IO controller with MRP without connector > Ethernet: PROFINET-EA system" by Drag & Drop into the field "Target object" of the task "Assign fieldbus".

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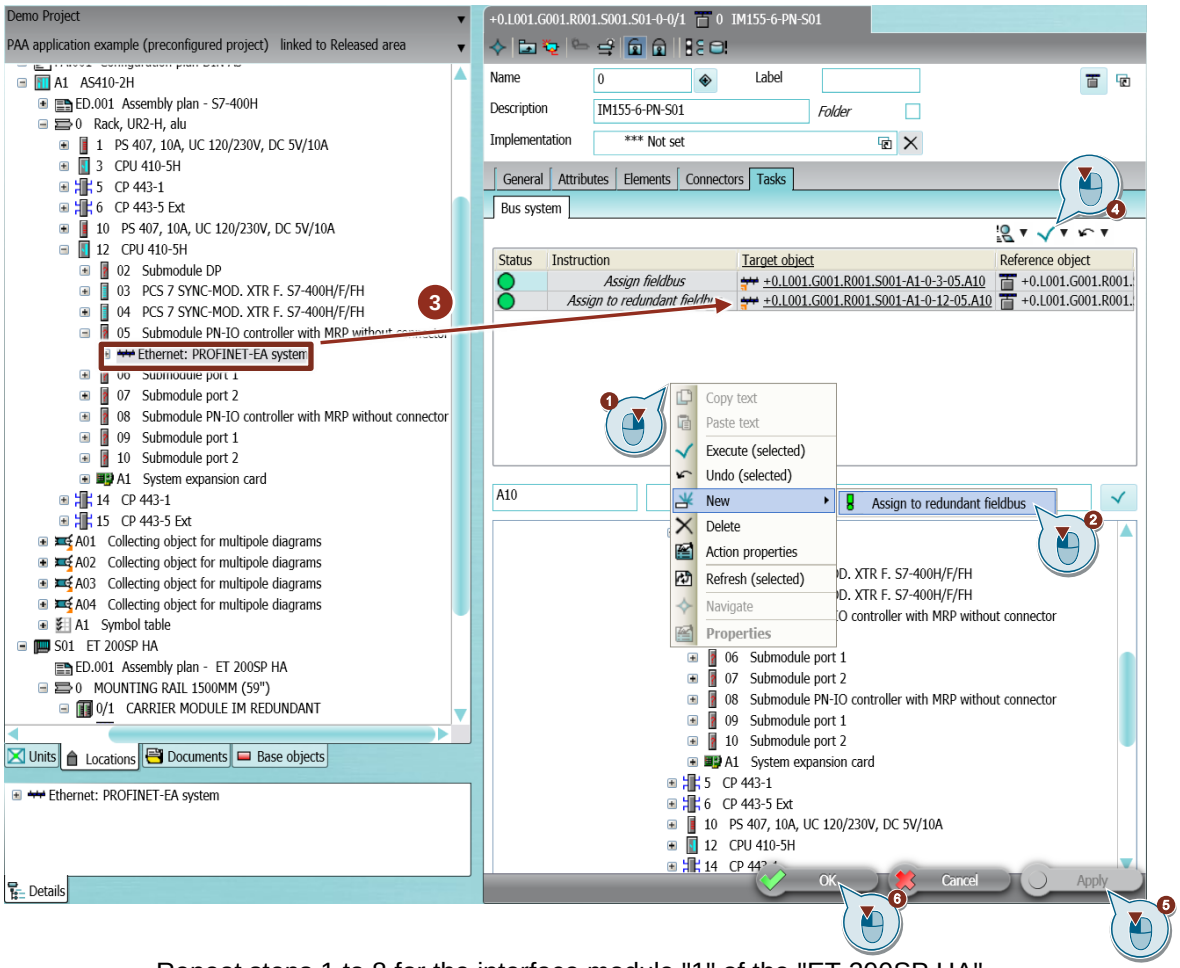
7. Click on ✓ "Execute (selected)".
8. Click "Accept" and "OK" to accept the changes.



Repeat steps 1 to 8 for the interface module "1" of the "ET 200SP HA".

Note

"Known issue":

Only with redundant ET 200SP HA are all four fieldbuses assigned in PAA 2.1.

How to assign the fieldbuses to other decentralized peripherals can be found in the application example "SIMATIC PCS 7 Plant Automation Accelerator (PAA) on a practical example" V1.0.

As of PAA 3.0, with redundant ET 200SP HA only the first engineering task "Assign fieldbus" per interface module is executed.

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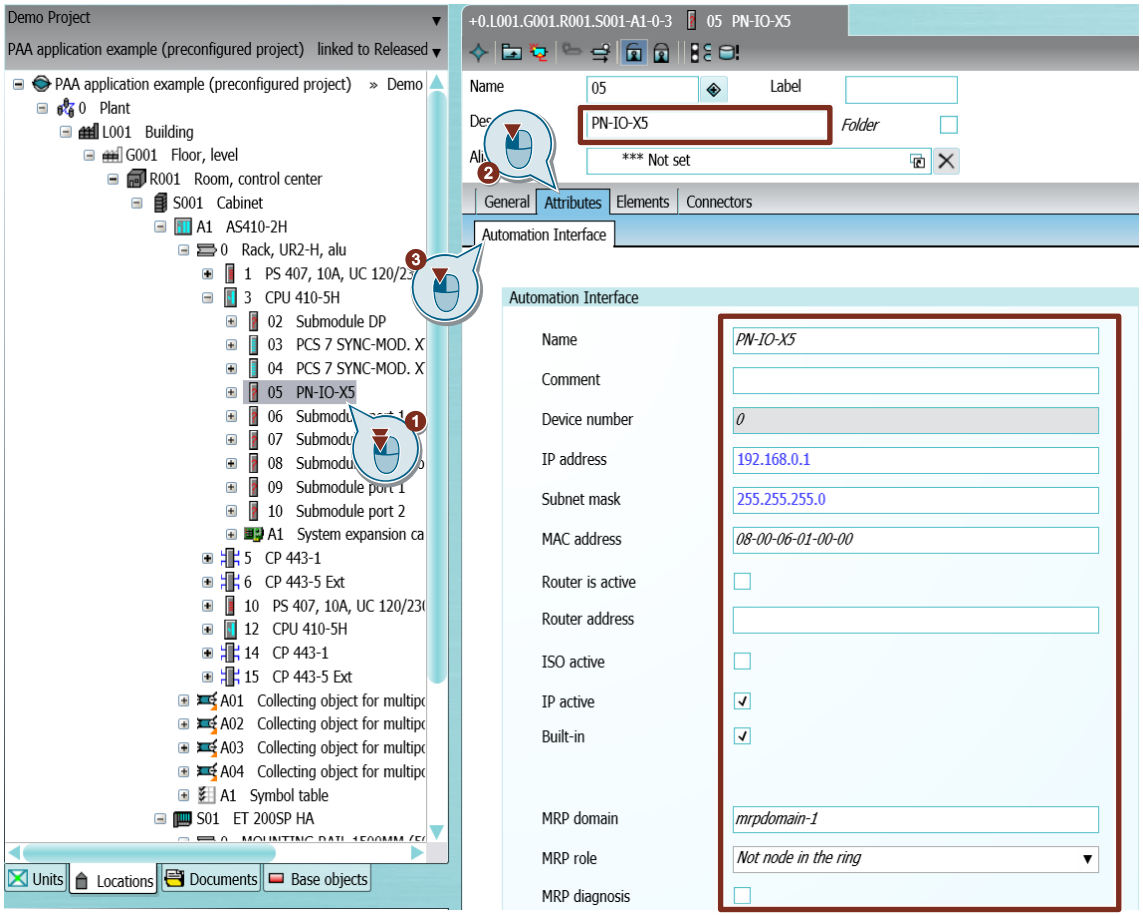
9. Navigate to the "PN-IO controller" at slot 5 of the CPU at slot 3. Double-click to open the associated properties.
10. Open the "Attributes > Automation interface" tab.
11. Change the settings as follows:
    - "Description": "PN-IO-X5"
    - "Name": "PN-IO-X5"
    - "IP address": "192.168.0.1"
    - "Subnet mask": "255.255.255.0"
    - "MAC address": "08-00-06-01-00-00"
    - "MRP domain": "mrpdomain-1"
    - "MRP role": "Not node in the ring"



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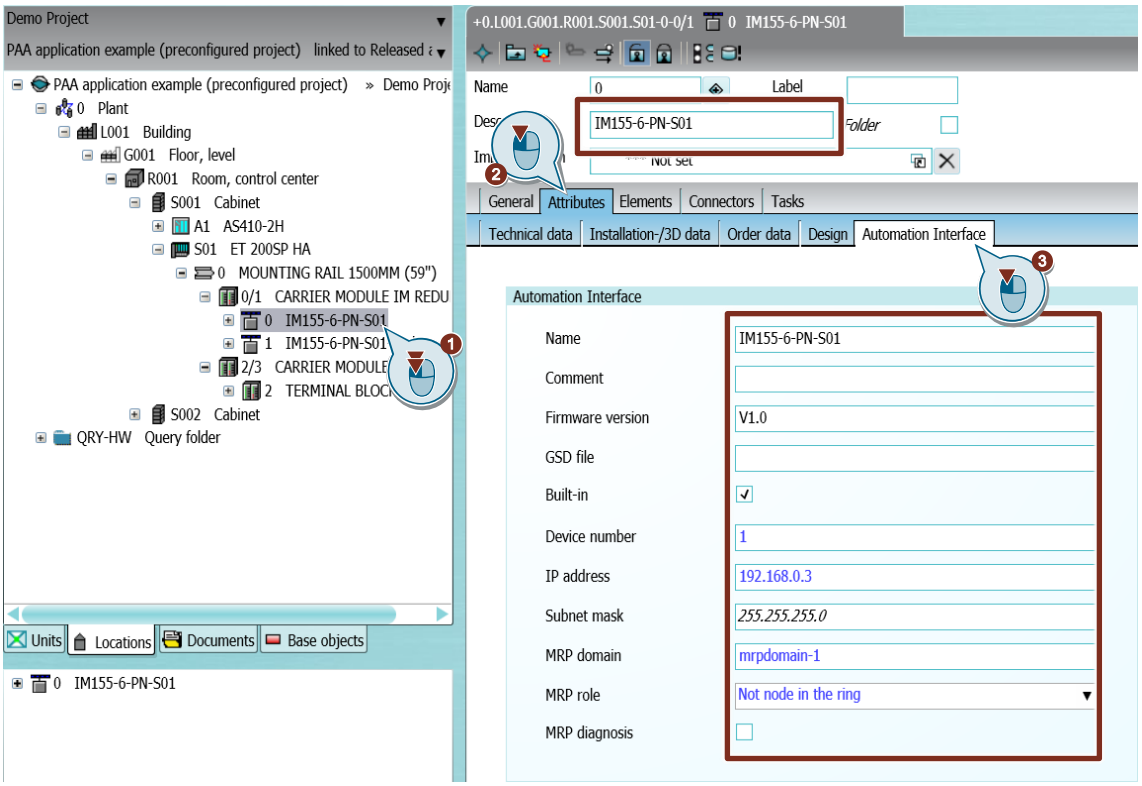
12. Navigate to the "Interface Module" at slot 0 of the ET 200SP HA. Double-click to open the associated properties.
13. Open the "Attributes > Automation interface" tab.
14. Change the settings as follows:
    - "Description": "IM155-6-PN-S01"
    - "Name": " IM155-6-PN-S01"
    - "IP address": "192.168.0.3"
    - "Subnet mask": "255.255.255.0"
    - "MRP domain": "mrpdomain-1"
    - "MRP role": "Not node in the ring"



15. Repeat steps 9-14 for the redundant CPU and the redundant "Interface Module".
16. Change the settings of the "PN-IO controller" at slot 5 of the CPU at slot 12 as follows:
    - "Description": "PN-IO-X5-1"
    - "Name": "PN-IO-X5-1"
    - "IP address": "192.168.0.2"
    - "Subnet mask": "255.255.255.0"
    - "MAC address": "08-00-06-01-00-00"
    - "MRP domain": "mrpdomain-1"
    - "MRP role": "Not node in the ring"

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17. Change the settings of the redundant "Interface Module" of the ET 200SP HA as follows:
    - "Description": "IM155-6-PN-S01-Red"
    - "Name": " IM155-6-PN-S01-Red"
    - "IP address": "192.168.0.4"
    - "Subnet mask": "255.255.255.0"
    - "MRP domain": "mrpdomain-1"
    - "MRP role": "Not node in the ring"

Result

You have configured a redundant PROFINET configuration of the "ET 200SP HA" in the example project.

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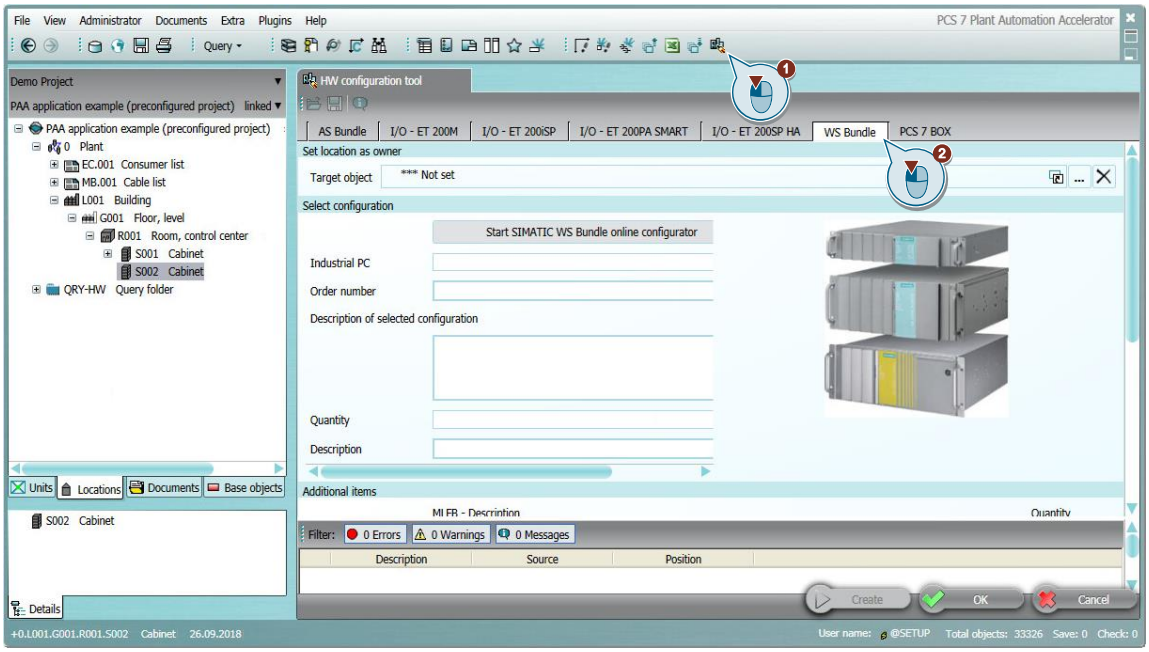
3.1.5 Creating hardware components with the "HW Configurator"

This section describes how to use the "HW configuration tool" to create additional hardware components such as an Engineering Station (ES) with corresponding licenses.

Create the hardware and license components in the sample project in a separate cabinet ("S002").

1. To do this, create a new cabinet object ("S002") in the location structure as described in Section 3.1.1.
2. Open the "HW Configuration tool" with a double click.
3. Open the "WS bundle" tab.



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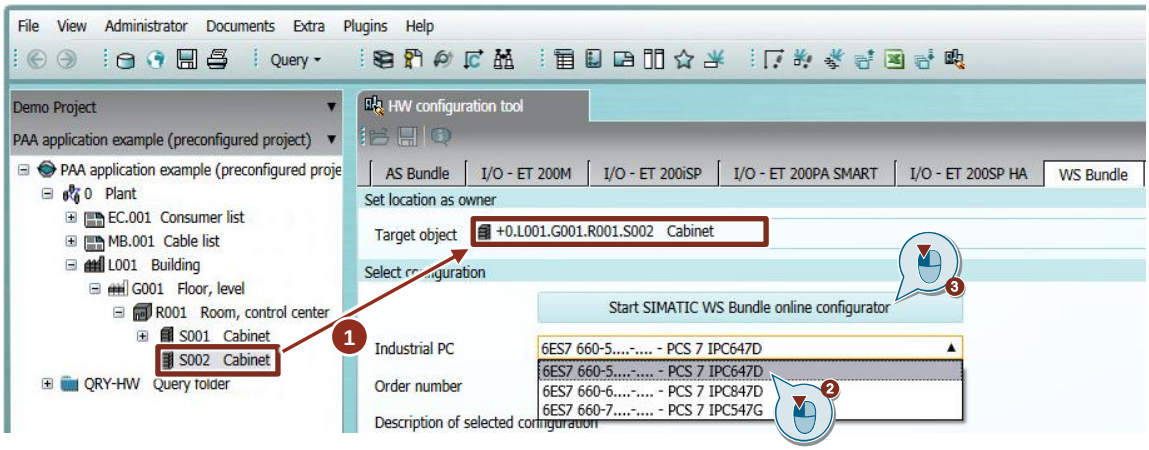
4. Create an engineering station (ES) here.
   Place the hardware components of the ES in the "ES" cabinet.

   To do this, drag & drop the "S002" cabinet object from the navigator to the "Target node" field of the "WS bundle" tab.
5. Select the following PC for "Industrial PC": "6ES7 660-5….-….-
   PCS 7 IPC647D".
6. Click on the "Start SIMATIC WS Bundle online configurator"

Note To create a "SIMATIC WS Bundle", as described in the example project, an Internet connection is required.



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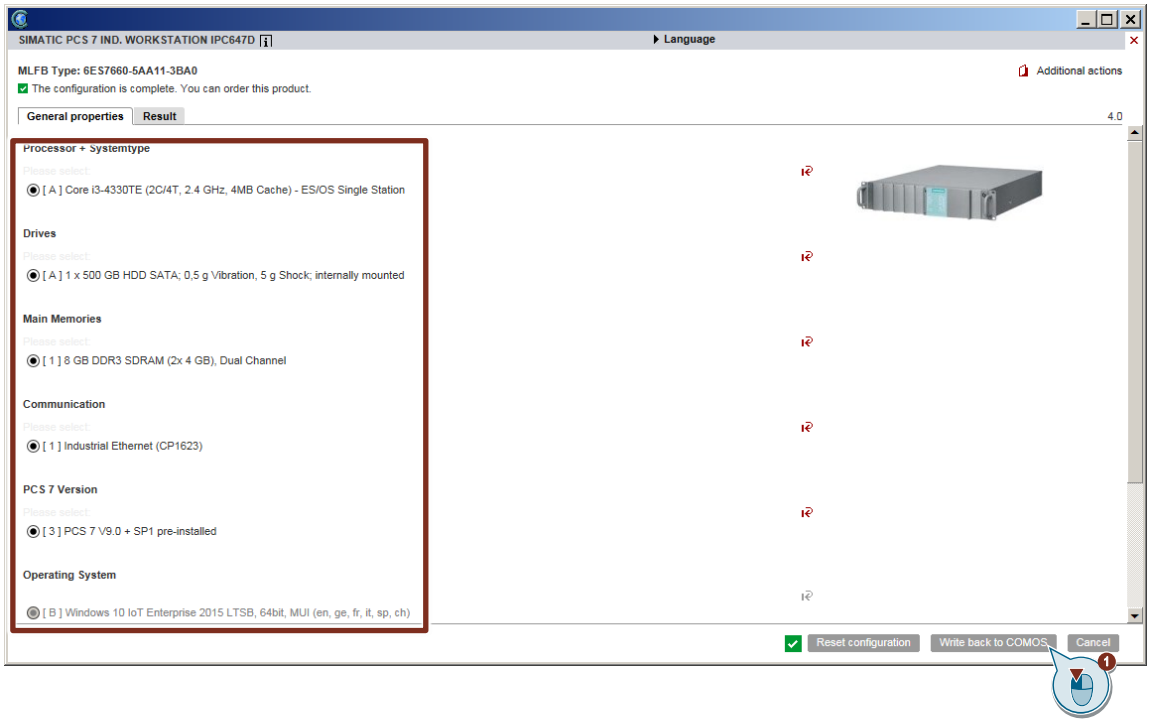
7. Configure your ES as follows:
   - "Processor + System type": "[A] Core i3-4330TE (2C/4T, 2.4 GHz, 4MB Cache) – ES/OS Single Station".
   - "Drives": "[A] 1 x 500 GB HDD SATA; 0.5 g Vibration, 5 g Shock; internally mounted".
   - "Main Memories": "[1] 8 GB DDR3 SDRAM (2x 4 GB), Dual Channel".
   - "PCS 7 Version": "[3] PCS 7 V9.0 + SP1 pre-installed".
   - "Operating System": "[B] Windows 10 IoT Enterprise 2015 LTSB, 64bit, MUI (en, ge, fr, sp, ch)".
8. Click the "Write back to COMOS" button.



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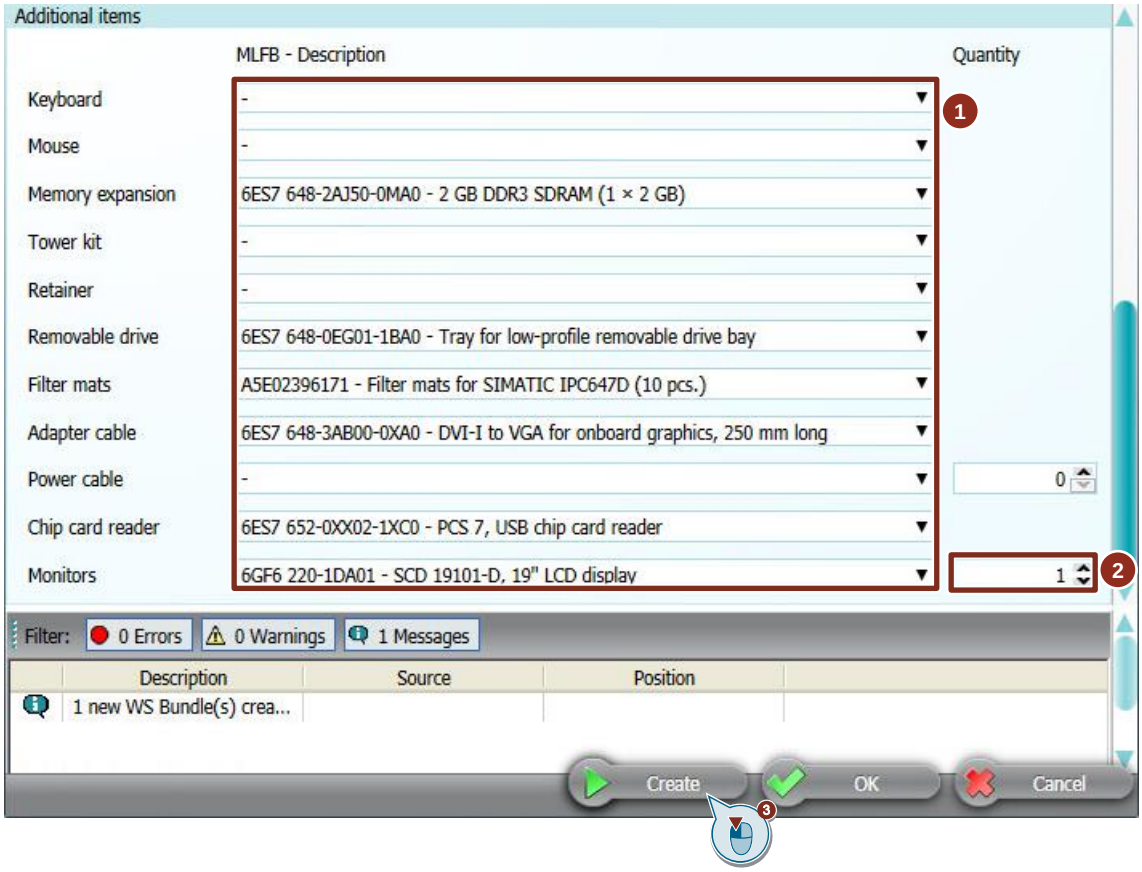
9. Configure your ES in the "Additional items" directory as follows:
   - "Memory expansion": "6ES7 648-2AJ50-0MA0 – 2 GB DDR3 SDRAM (1 x 2GB)"
   - "Removable drive": "6ES7 648-0EG01-1BA0 – Tray for low-profile removable drive bay"
   - "Filter mats": "A5E02396171 – Filter mats for SIMATIC IPC647D (10 pcs.)"
   - "Adapter cable": "6ES7 648-3AB00-0XA0 – DVI-I to VGA for onboard graphics, 250 mm long"
   - "Chip card reader": "6ES7 652-0XX02-1XC0 – PCS 7, USB chip card reader"
   - "Monitors": "6GF6 220-1DA01 – SCD 19101-D, 19" LCD display"
10. Increase the "Quantity" of the monitors to "1".
11. Click "Create".



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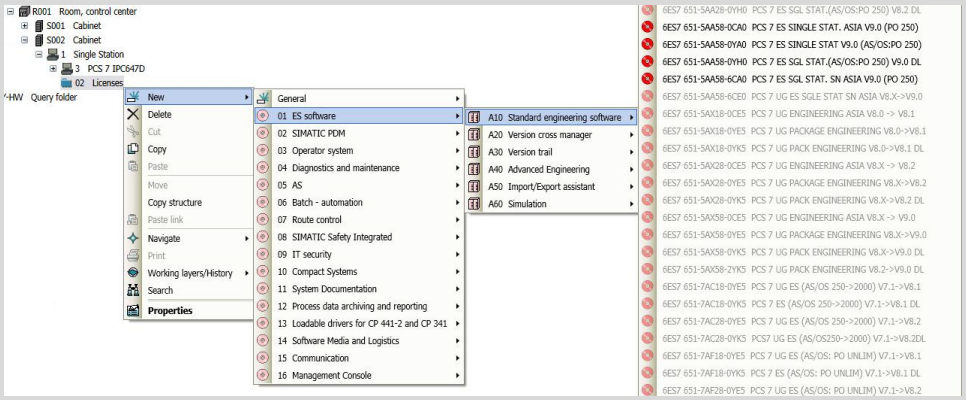
Note

You can select your licenses in the subfolder "Licenses" with a right click and add them to the PAA-project.



Result

You have configured an ES with the "Hardware configuration tool" and created it in the PAA-project.

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3.1.6 Creating a system architecture with "Configuration plan"

This section shows you how you can use the "Configuration Plan" to graphically display your system architecture.

Note The functionality of the configuration plan has been enhanced for PAA V3.0. The following description only applies up to PAA V2.1

With the "Configuration Plan" you can display the rough structure of your automation hardware, including all hardware components and all line and ring buses.

The following objects are displayed:

- S7 400 stations
- ET 200 stations
- Workstations
- Plant Bus
- Terminal bus

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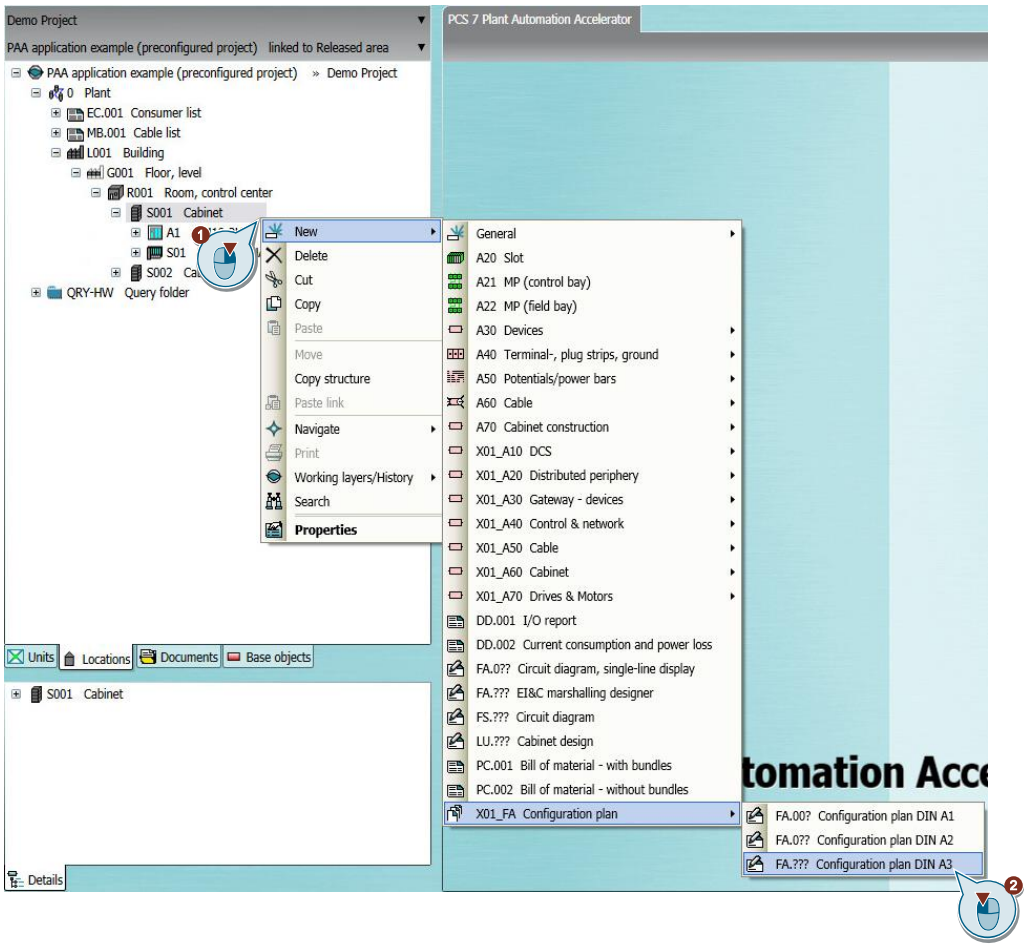
Create a "Configuration Plan" in A3 format and create a structure for the "automation hardware" in the example project.

1. To do this, open the "Locations" view.
2. Open the corresponding context menu by right-clicking on the "S001" cabinet.
3. Click on the entry:
   "New > Configuration plan > DIN A3"



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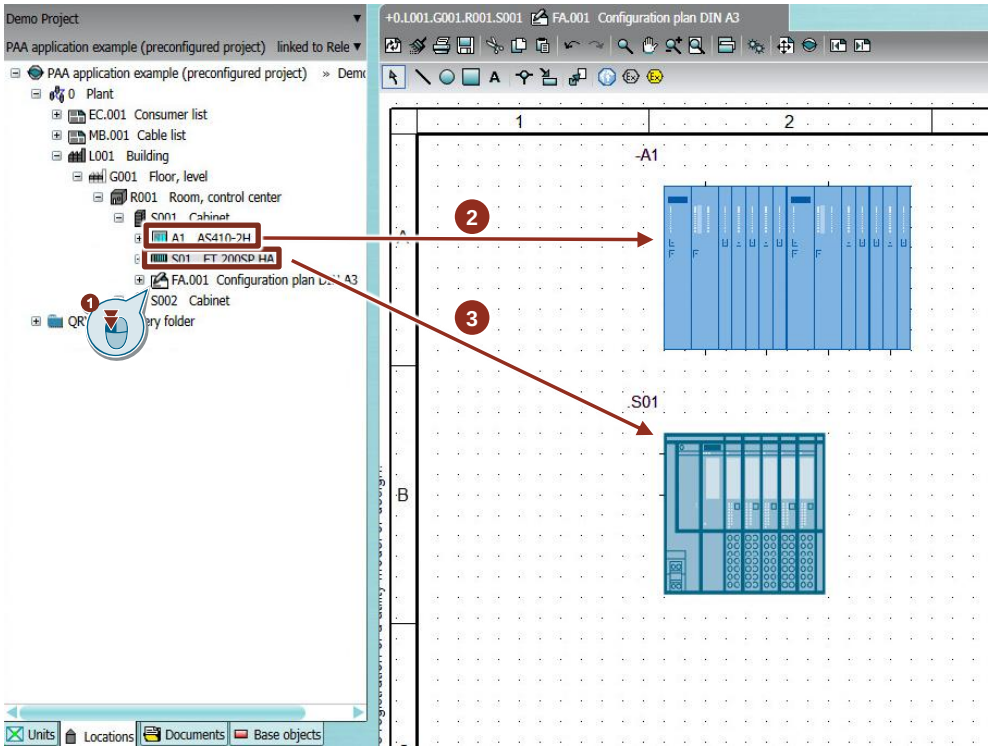
4. Open the "Configuration plan" with a double click.
5. Drag & drop the SIMATIC station "A1" to the chart.
6. Drag & drop "ET 200SP HA" to the chart.



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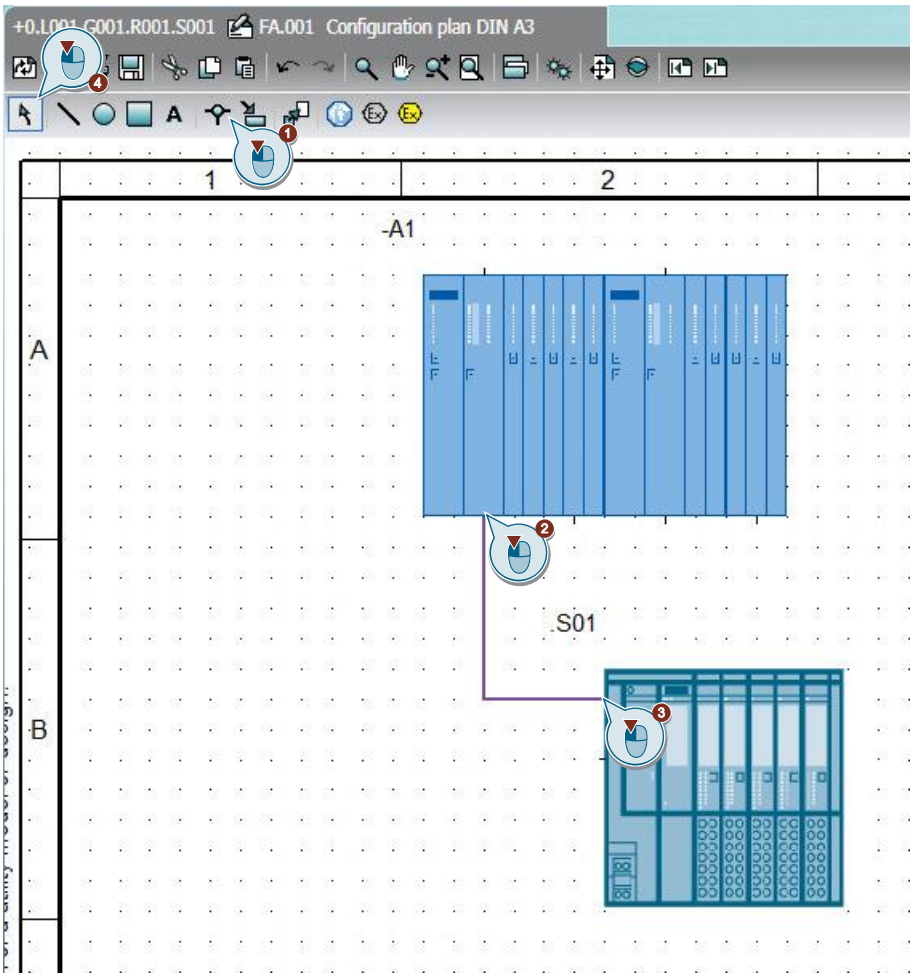
7. Click in the menu bar of the "Configuration Plan" on the button "Connection" and connect the SIMATIC station with the "ET 200SP HA".

   To do this, click on a connection point at the station and then on "ET 200SP HA".

   Then click on the "Identify" button to end the connection mode.



The link line has been created. The line has the color purple for "PROFIBUS DP" instead of green for "PROFINET".

To change the color of the line, you must change the settings of the connection of the AS.

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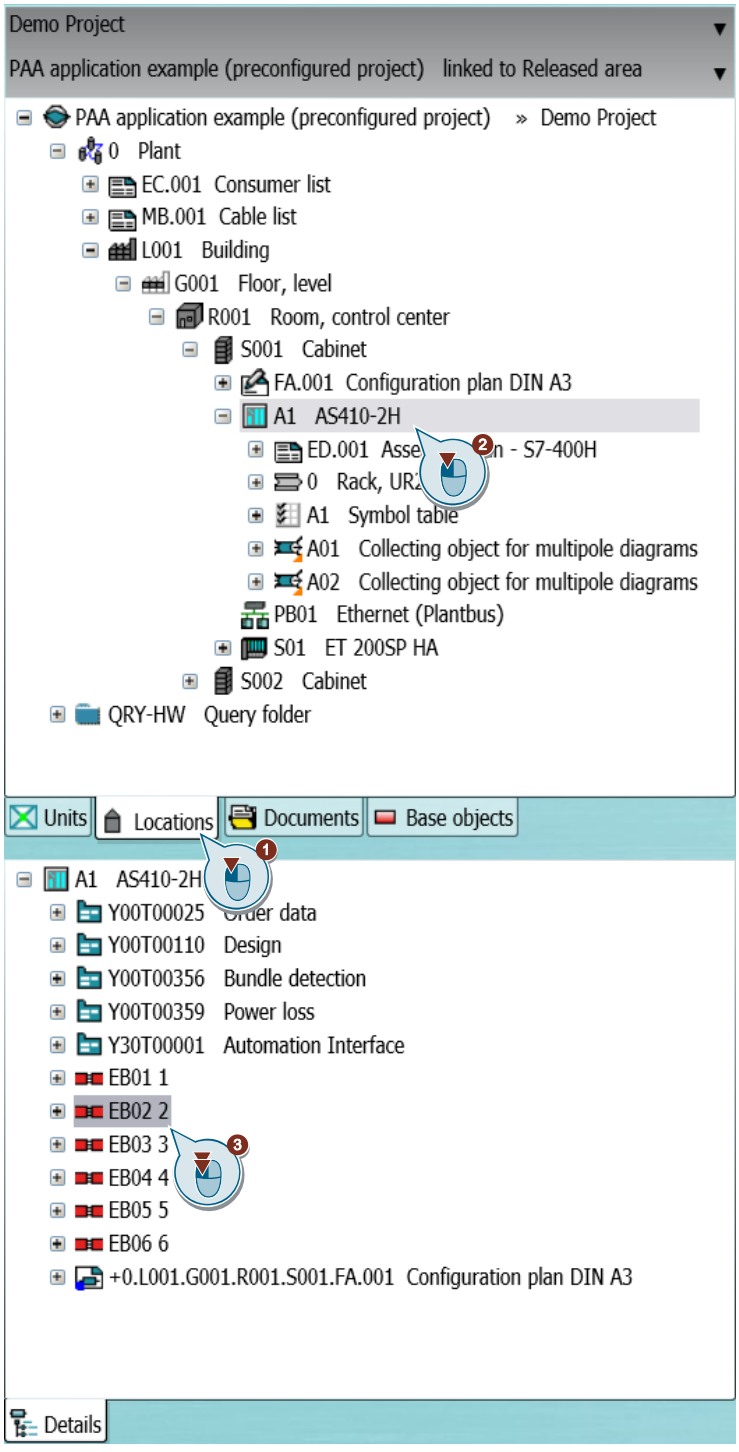
8. To do this, open the "Locations" view.
9. Select the AS "A1 AS410-2H".
10. In the "Details" window, open the settings for port "EB02 2" with a double-click.



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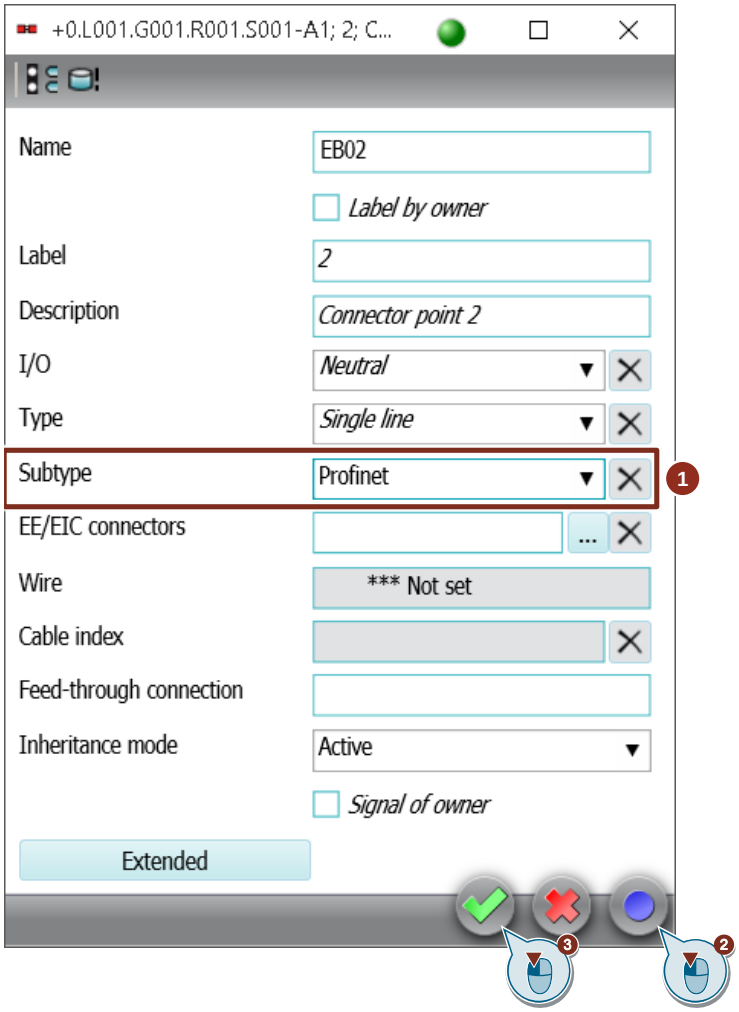
11. Change the settings "Subtype" from "Profibus DP" to "Profinet".
12. Click "Apply" and "OK" to apply the changes and close the window.



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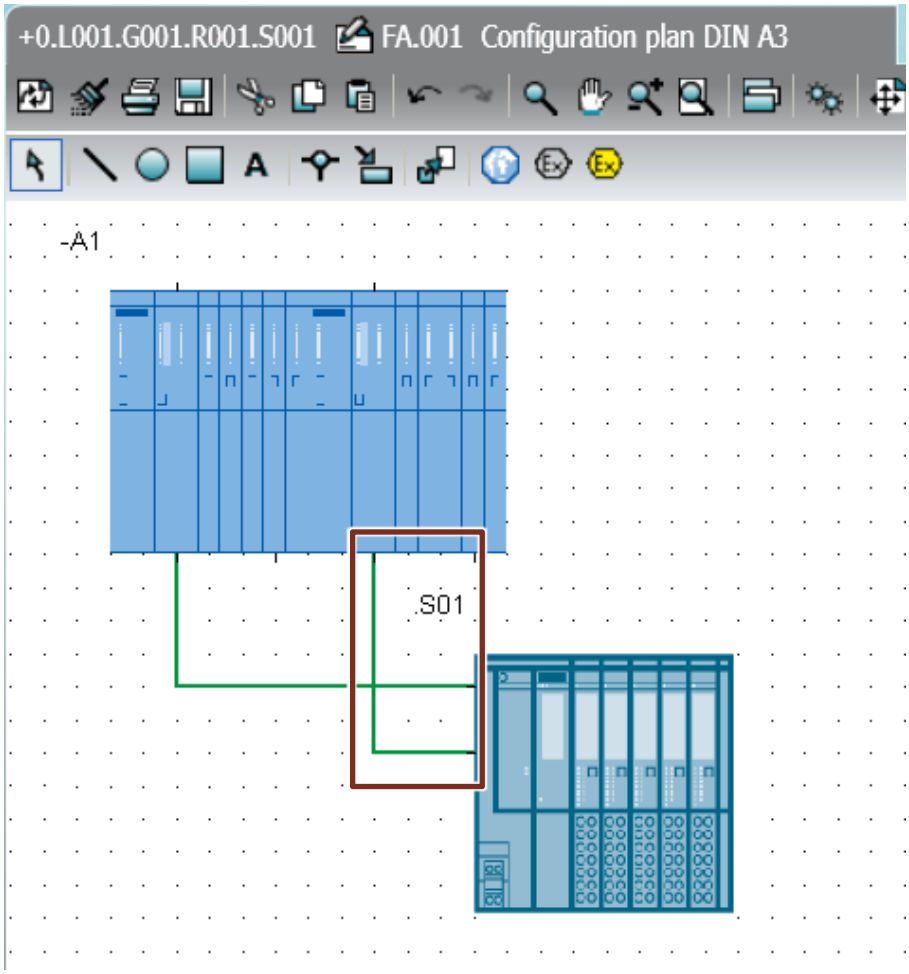
13. Repeat this procedure for the connection "EB05 5" of the AS and create the second PROFINET line.



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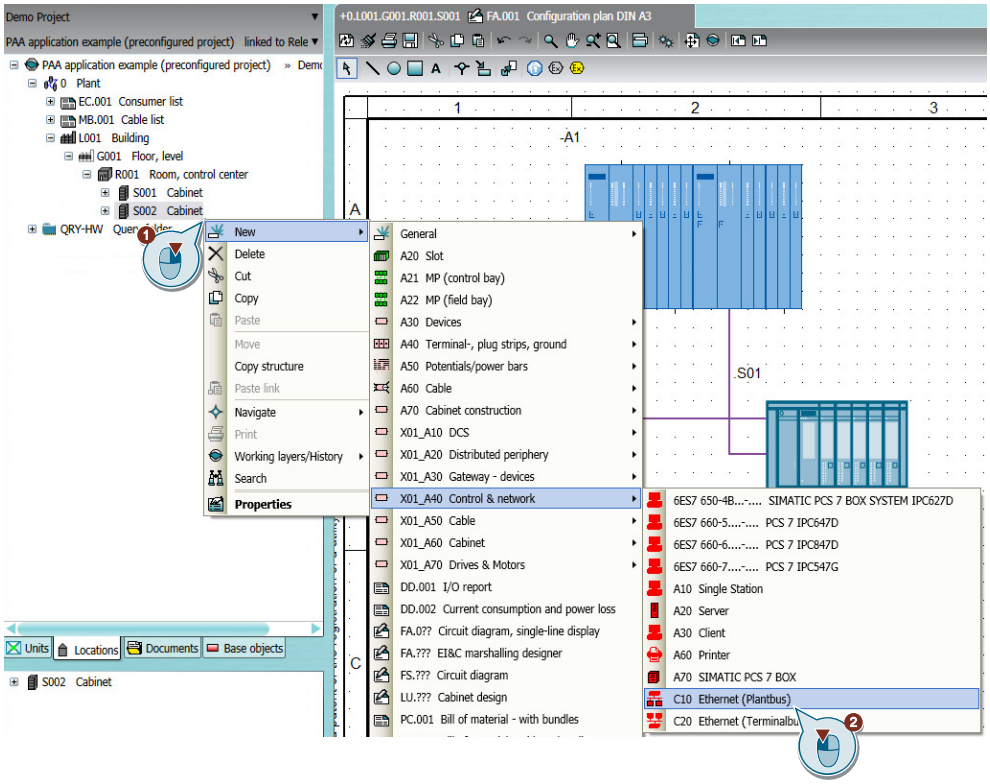
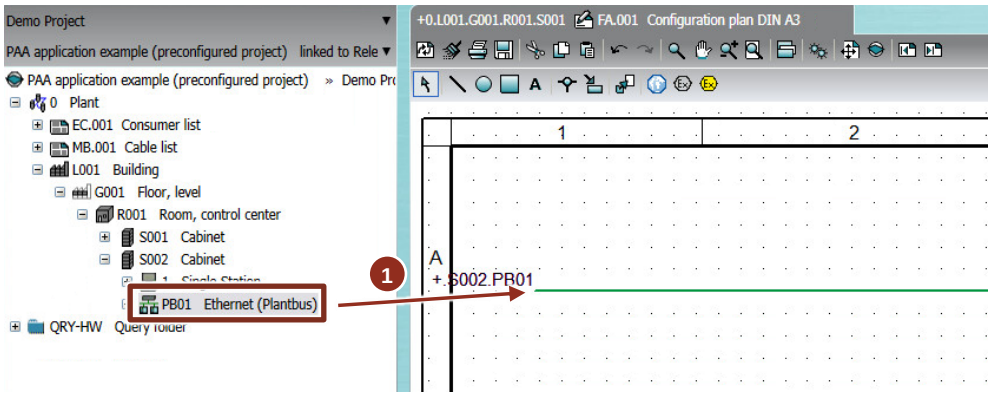
Create a system bus.

14. To do this, right-click on the oven "S002" to open the corresponding context menu and click on the entry:
    "New > Controllers & Network > Ethernet (System bus)"
    "New > Control & network > Ethernet (Plant bus)"



The object is created under the "S002" cabinet.

15. Drag & drop the object created into the "Configuration Plan".



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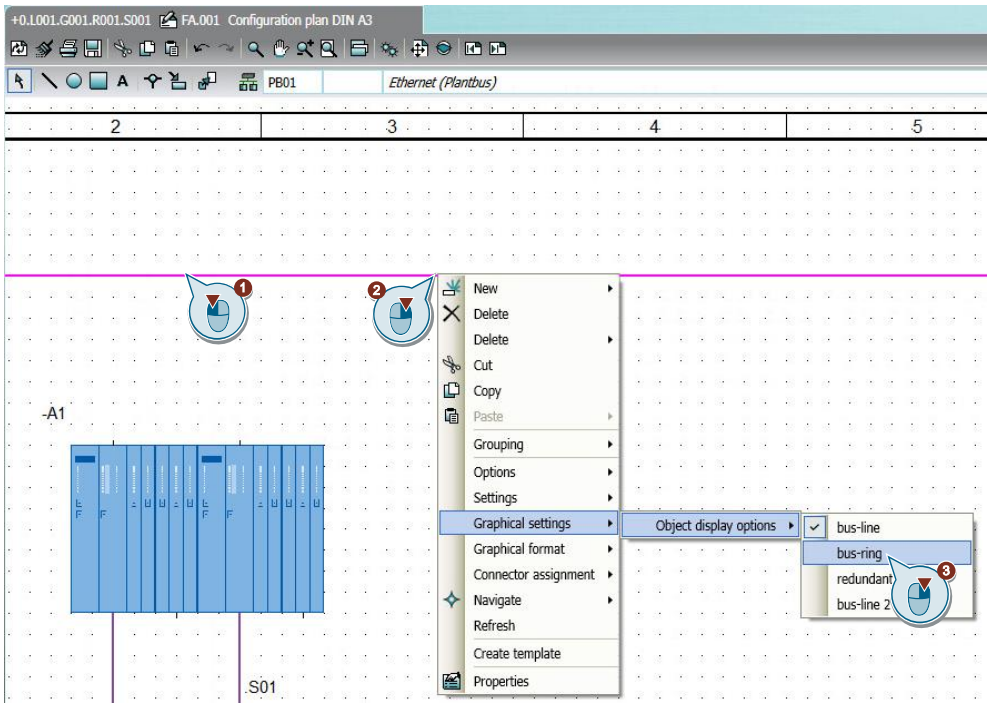
16. Configure the bus as a ring.
    To do this, select the plant bus on the "Configuration Plan" and right-click on the bus to open the corresponding context menu.
17. In order to configure the bus as a ring, click on the entry:
    "Graphical Settings > Object Display Options > Bus Ring"
    "Graphical settings > Object display options > bus-ring".



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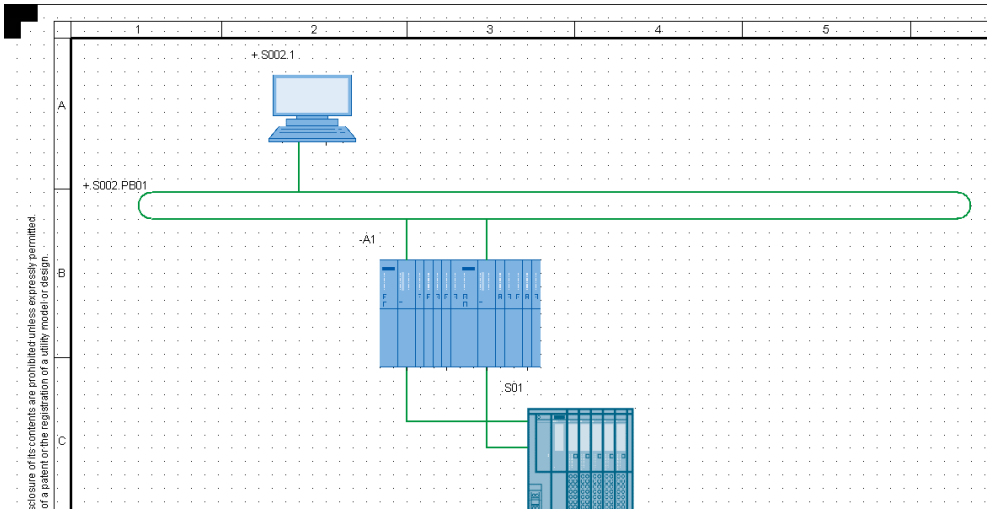
18. Drag and drop the ES onto the "Configuration Plan" and connect the SIMATIC Station "A1" redundantly and the ES simply with the "Plant Bus".



Result

You have represented your system structure with the previously created hardware components in a clear and structured way.

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3.1.7 Working with reports

In PAA you can use different types of reports (documents).
With their help, you can easily create order lists or get a better overview of the hardware and software used in the project.

In this section, various reports are presented that will help you improve your project handling.

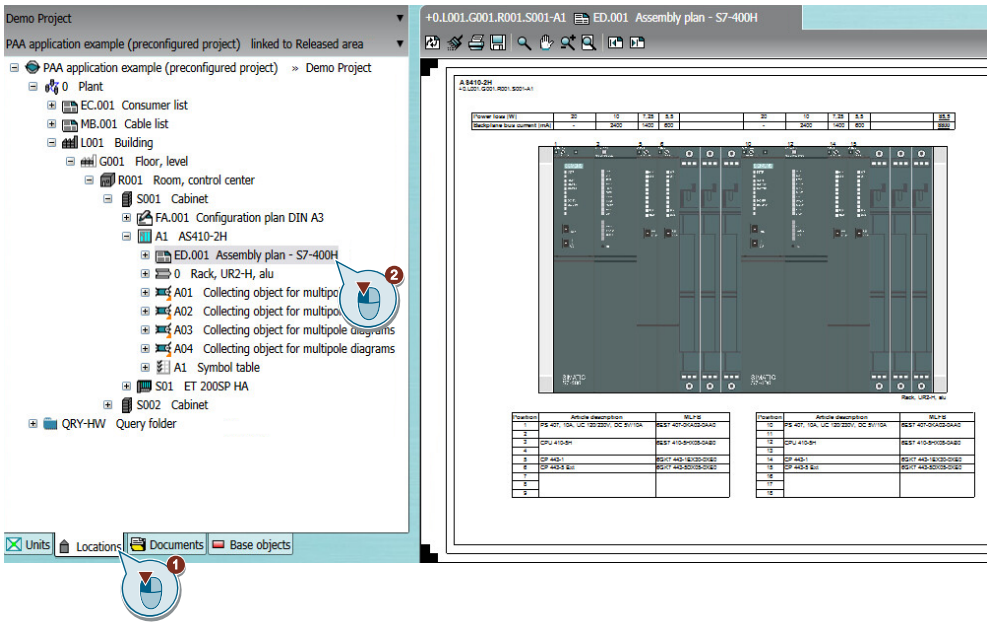
Assembly plan

The assembly plan shows you the profile rail with the individual components and evaluates additional information, e.g. the power loss.

The "Assembly Plan" was created automatically together with the SIMATIC Station and the ET 200SP HA were created with the "HW configuration tool".

1. In the "Locations" view, navigate to the SIMATIC Station and open the subordinate objects.
2. Open the "Assembly Plan" with a double click.

   The current configuration of the SIMATIC Station is displayed.



Note

To hide the power loss calculation table and the details table on the assembly plan, proceeds as follows.

Open the corresponding context menu by right-clicking the Assembly plan.
By doing so you open the properties of the Assembly plan.
In the "Attributes", open the tab:
"Attributes > Design".
In the tab, you can disable the display of the power loss or of the details.

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Parts list

The parts lists give you an overview of all order-relevant objects in your PAA hardware configuration.

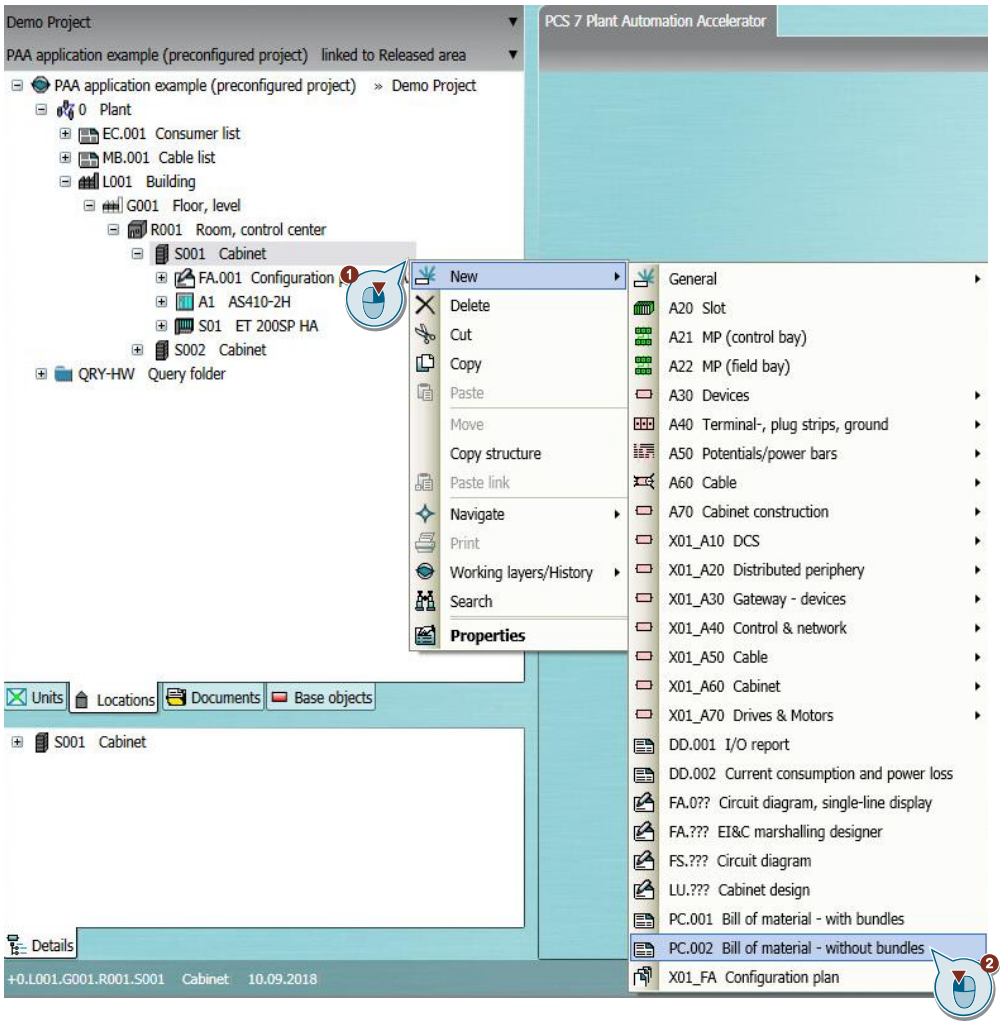
There are two types of BOMs in PAA:

- **Bill of material – with bundles**
  The bill of materials contains bundle item numbers, each of which contains a collection of objects.
- **Bill of material – without bundles**
  This bill of materials does not contain bundle item numbers. All objects are listed separately.

You can create item lists under cabinet objects in the "Locations" view.

In the sample project, create a Bill of materials without bundles in the "S001" cabinet.

1. Open the corresponding context menu by right-clicking on the "S001" cabinet.
2. To create a bill of materials without bundles, click the entry:
   "New > Bill of material – without bundles".



3. Open the bill of materials with a double click.
   All the hardware components of the "S001" cabinet are listed separately with the corresponding item number.

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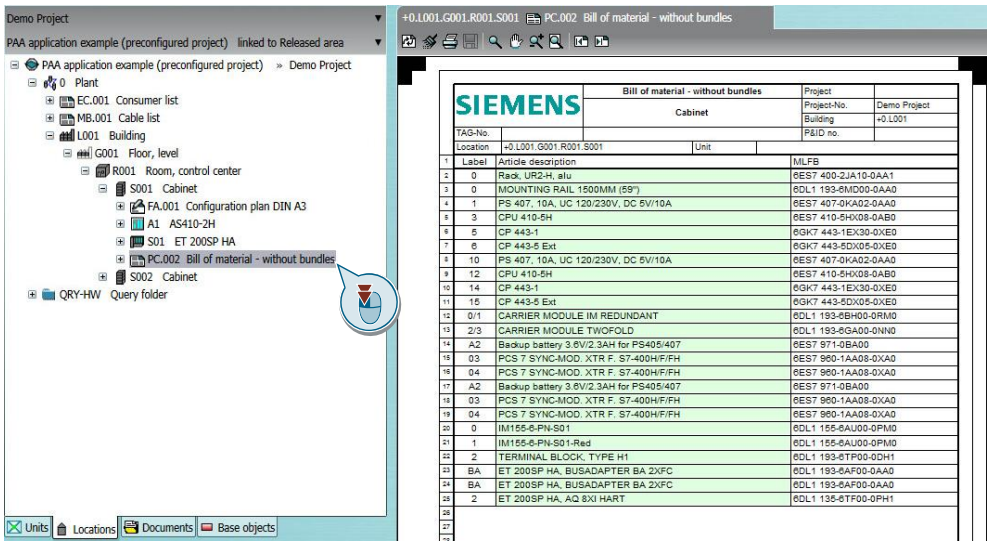

Note

To define how the objects are displayed on the report, proceed as follows:

1. Open the on the bill of materials by right clicking on the corresponding context menu.
2. Open the properties of the bill of materials.
3. In the "Attributes", open the tab:
   "Attributes > Design".
4. Here you have the possibility to activate the options "Grouped" and "Detailed". You can combine the options with each other or not to select any option.
   - **"Grouped"**
     If this option is activated, the objects are displayed sorted by item number. You get an overview of the number of identical objects.
   - **"Detailed"**
     If this option is activated, the objects are displayed sorted according to owner.

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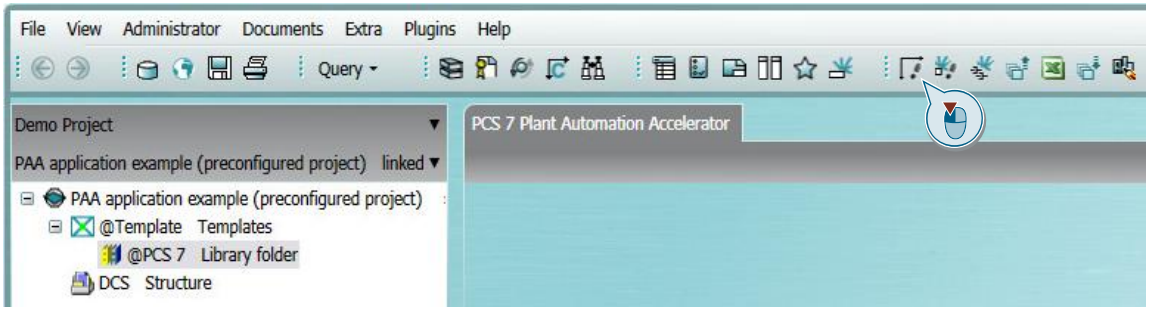
3.2 Importing from PCS 7 to PAA

This section describes how to import types from a PCS 7 master data library to PAA.

Procedure

1. In the PAA menu bar, click on the button "Import / Export PCS 7" .



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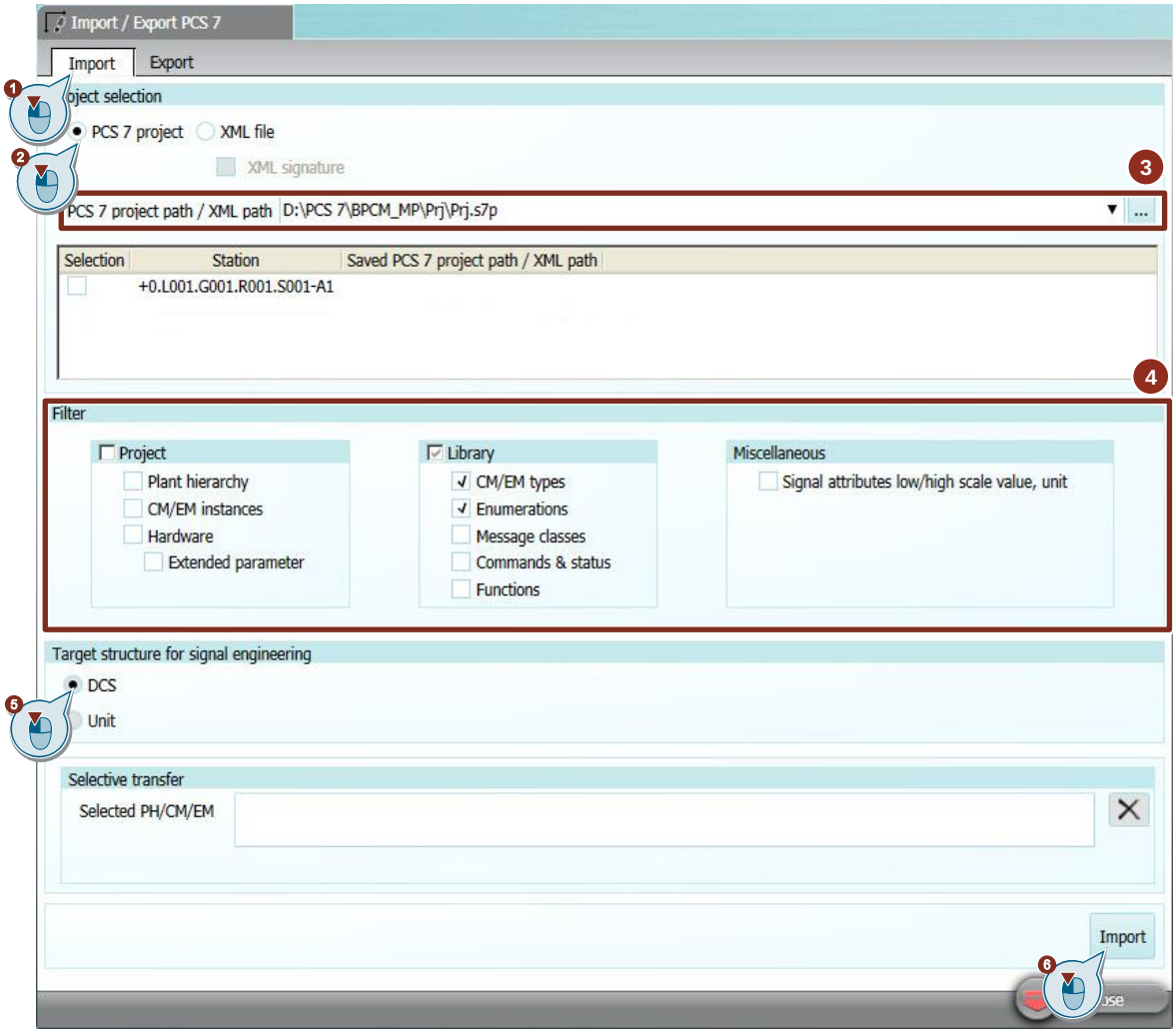
2. Open the "Import" tab in the "Import / Export PCS 7" dialog.
3. Select the "PCS 7-project" option
4. Select the PCS 7 sample project.
5. In the "Filter" directory, select the "CM types" and "Enumerations" option boxes and deselect the remaining option fields.
6. Select option "DCS".
7. Click the button "Import".



PAA then automatically checks for differences between the PCS 7-project and the PAA-project.

The dialog "Data transfer - Generate/import" opens.

The result of the comparison is displayed in this window.

All objects in the overview window are highlighted in green.
This means that this data is only available in the PCS 7-project.

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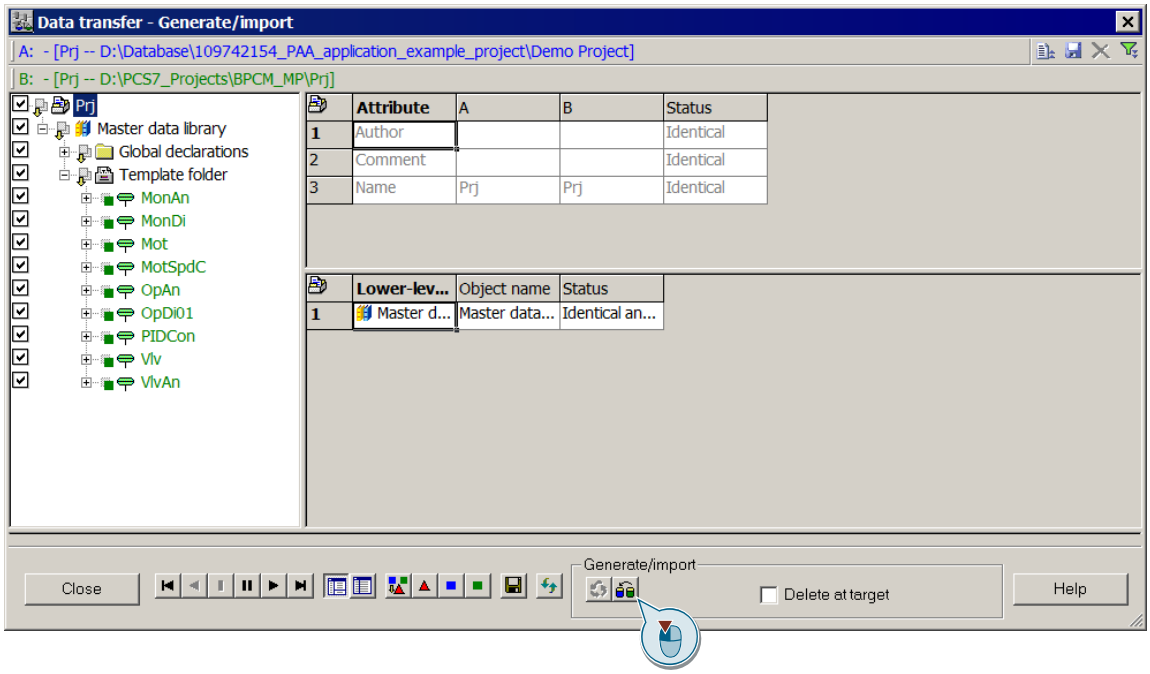
8. Click on the button to start the import from PCS 7 to PAA.



Note

The button is only enabled if differences are found between the PAA and the PCS 7-projects.

Note

Activate the "Delete in target" function if you want to delete the data in the PAA-project that are no longer current.

Example:

You have already imported individual control unit types and a hardware configuration in the PAA-project. Subsequently, delete an individual control unit type in the master data library and change the name of the PROFINET master system in the HW configuration.

- With the function "Delete in destination", the new name of the PROFINET master system is adopted during import and the old single control unit type is removed from the PAA-project.
- Without the function "Delete in destination" an additional PROFINET master system is created and the data of the already existing PROFIBUS master system is retained in PAA.

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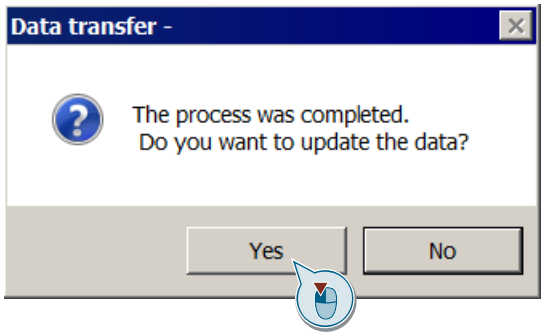
The "Data transfer" dialog opens.
The data have been transferred to PAA.

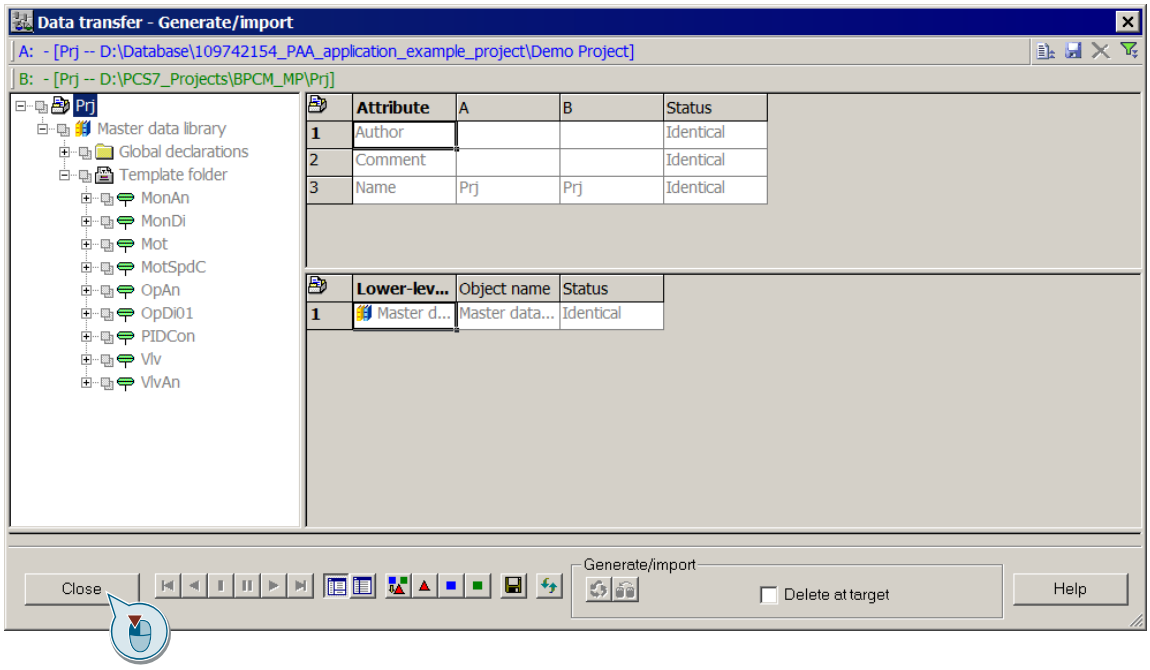
9. Click on the "Yes" button in the window to repeat the comparison between the PAA-project and the PCS 7-project.



The projects are compared with each other again.

In the overview field, the objects are no longer displayed in green, but in gray. This means that the current data of the PCS 7-project is identical to that of the PAA-project.

10. Click on the "Close" button to close the import dialog.



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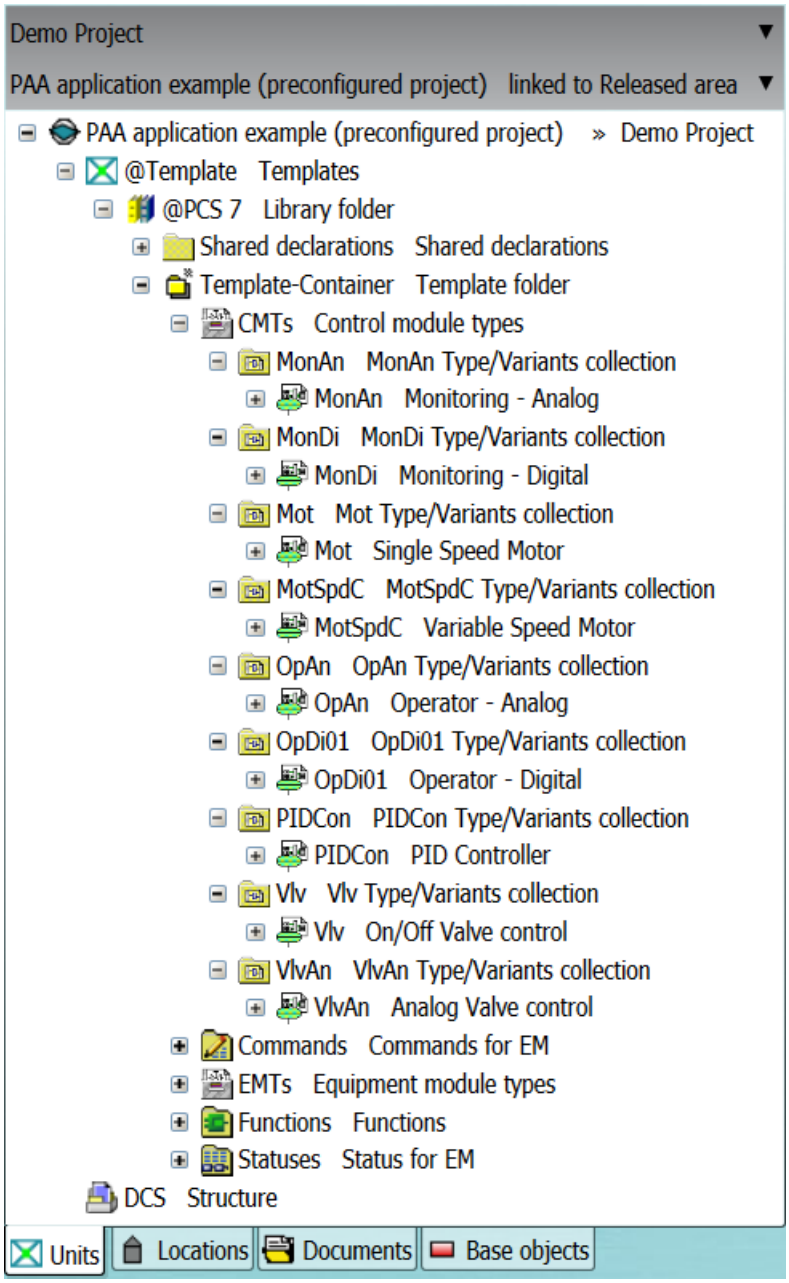
The imported CMTs were stored in the PAA-project in the "Units" view under the "@Templates > @PCS 7 > Template Container > CMTs" node.



11. Click on the "Save" button in the PAA menu bar to save the changes.

Result

You have imported the CMTs and the enumerations from the PCS 7-project into the PAA-project and can now use the data in PAA.

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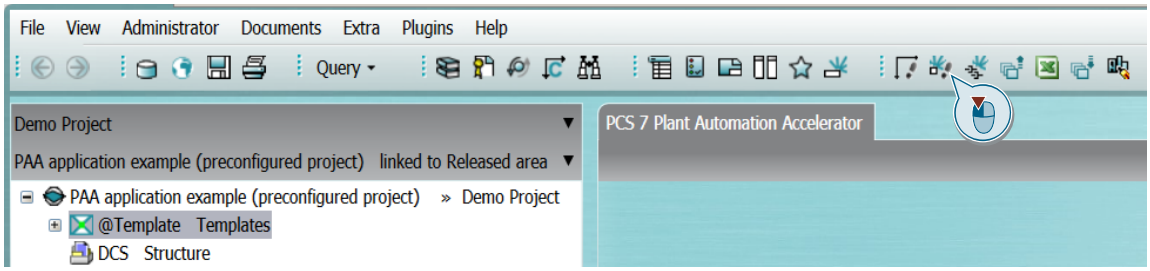
3.3 Creating variants

This section describes how to create variants of individual control unit types (CMTs) in PAA with the "Type configurator".

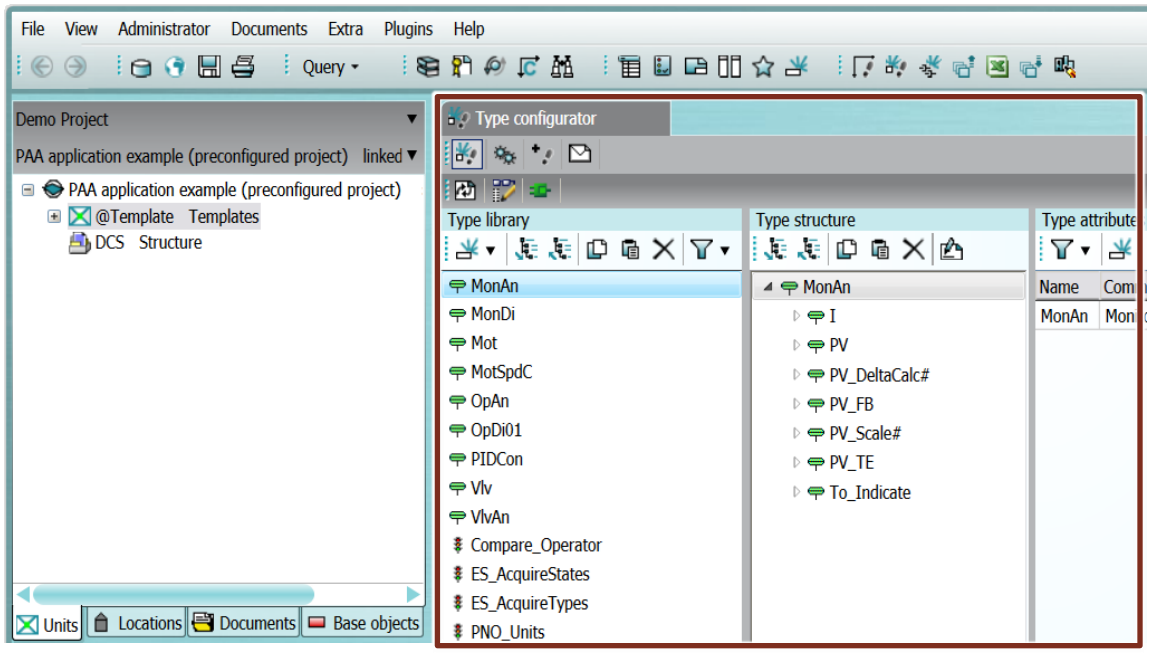
Use the "Type Configurator" to create a variant of each of the CMTs:

- "MonAn"
- "Mot"
- "VlvAn"

To do this use the PAA Menu bar to open the "Type configurator"
Click the button: "Type configurator" .



The "Type configurator" opens in the PAA work area.



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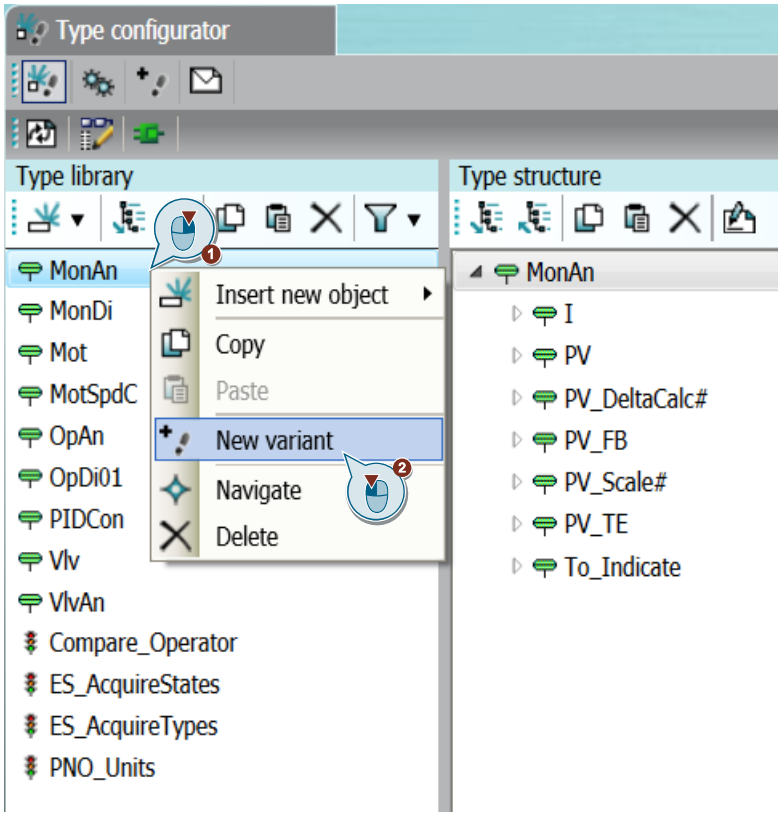
"MonAn"

Create the variant "MonAn#DeltaCalc" from the CMT "MonAn".

1. Open the corresponding context menu with a right click on the CMT "MonAn".
2. Click on the entry "New Variant" to create a new variant of the type.



3. The new variant "MonAnVar1" is created in the column "Type library".
4. Select the variant "MonAnVar1".

Note

The type and variant are marked with an "x" symbol.

The "x" symbol means that the type and its variant do not yet have any differences. Only if you deactivate individual elements in the "Type structure" column will the symbol no longer be displayed.

In the "Type structure" column, all the elements of the type are displayed.

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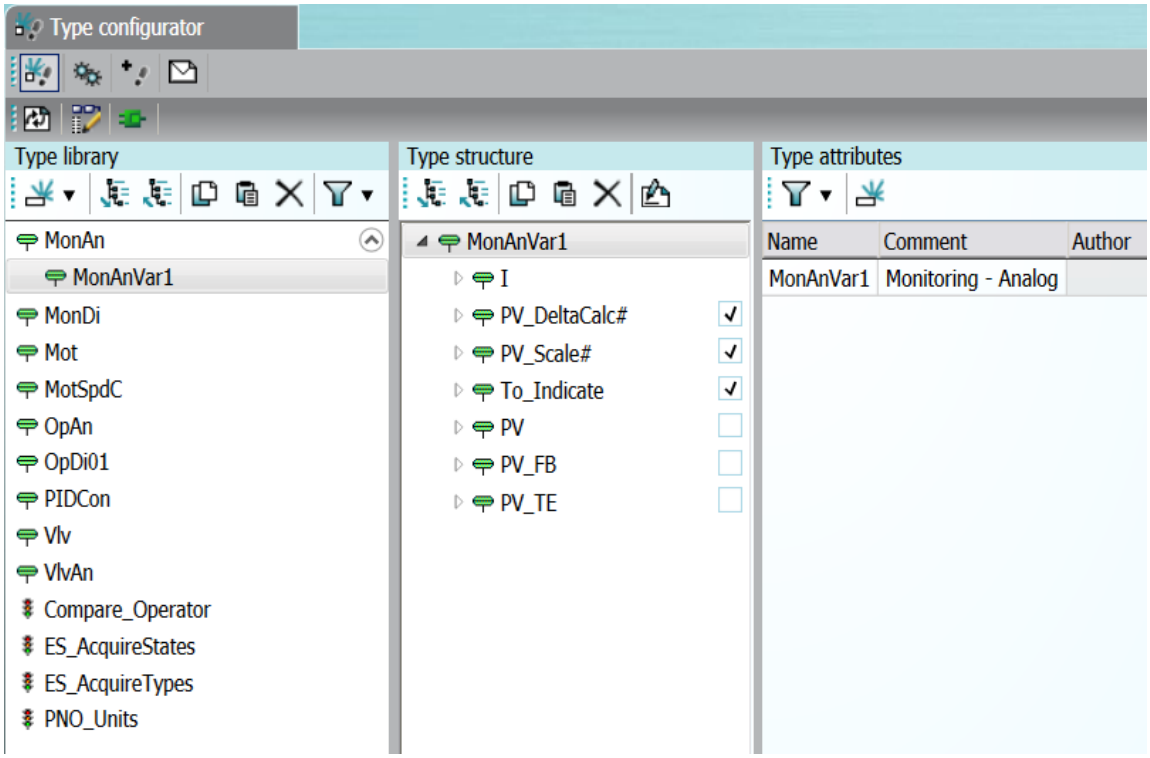
The variant of the type "MonAn" should only contain the blocks "PV_DeltaCalc#", "PV_Scale#" and "To_Indicate".

5. Deactivate the remaining modules via the corresponding option fields
   The deactivated modules are then displayed last in the column. Furthermore, the "x" symbol is no longer displayed because there are now differences between the type and the corresponding variant.



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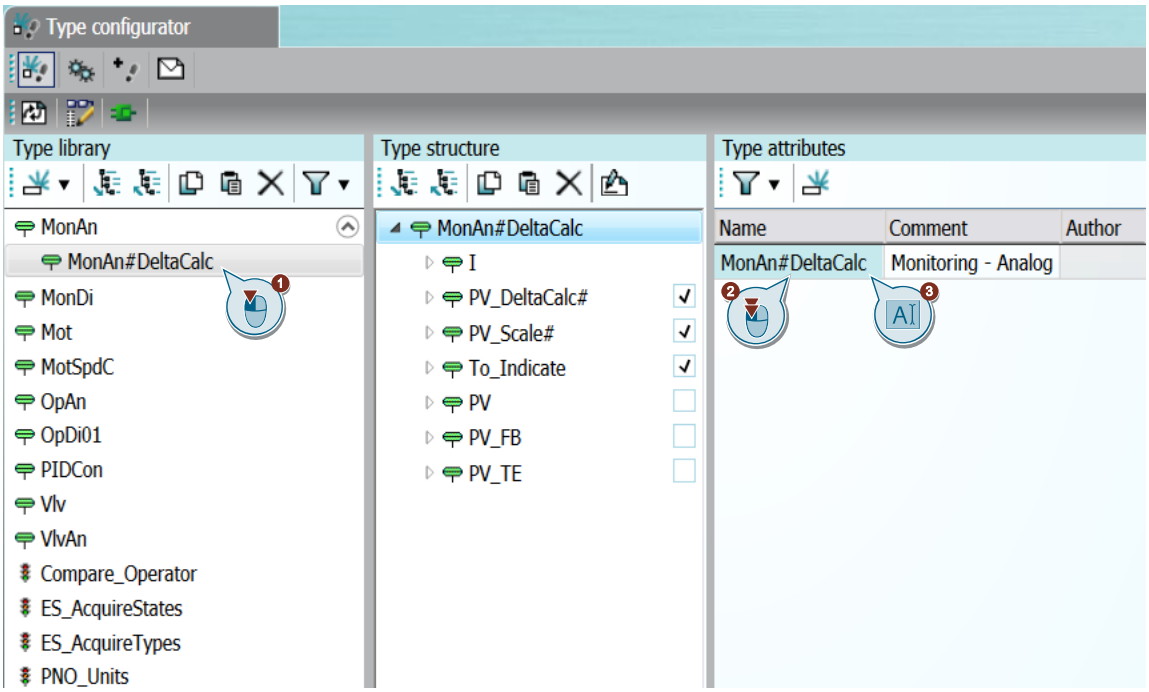
Change the name of the variant to "MonAn#DeltaCalc".

Note The name of the type and the variant must not be identical. In the best case, assign the name so that there is a reference to the functionality.

6. Select the variant "MonAnVar1" in the column "Type library"
   In the "Type attributes" column the associated attributes of the variant are displayed now.
7. Double-click the name of the variant in the "Name" column and change it to "MonAn_DeltaCalc#".



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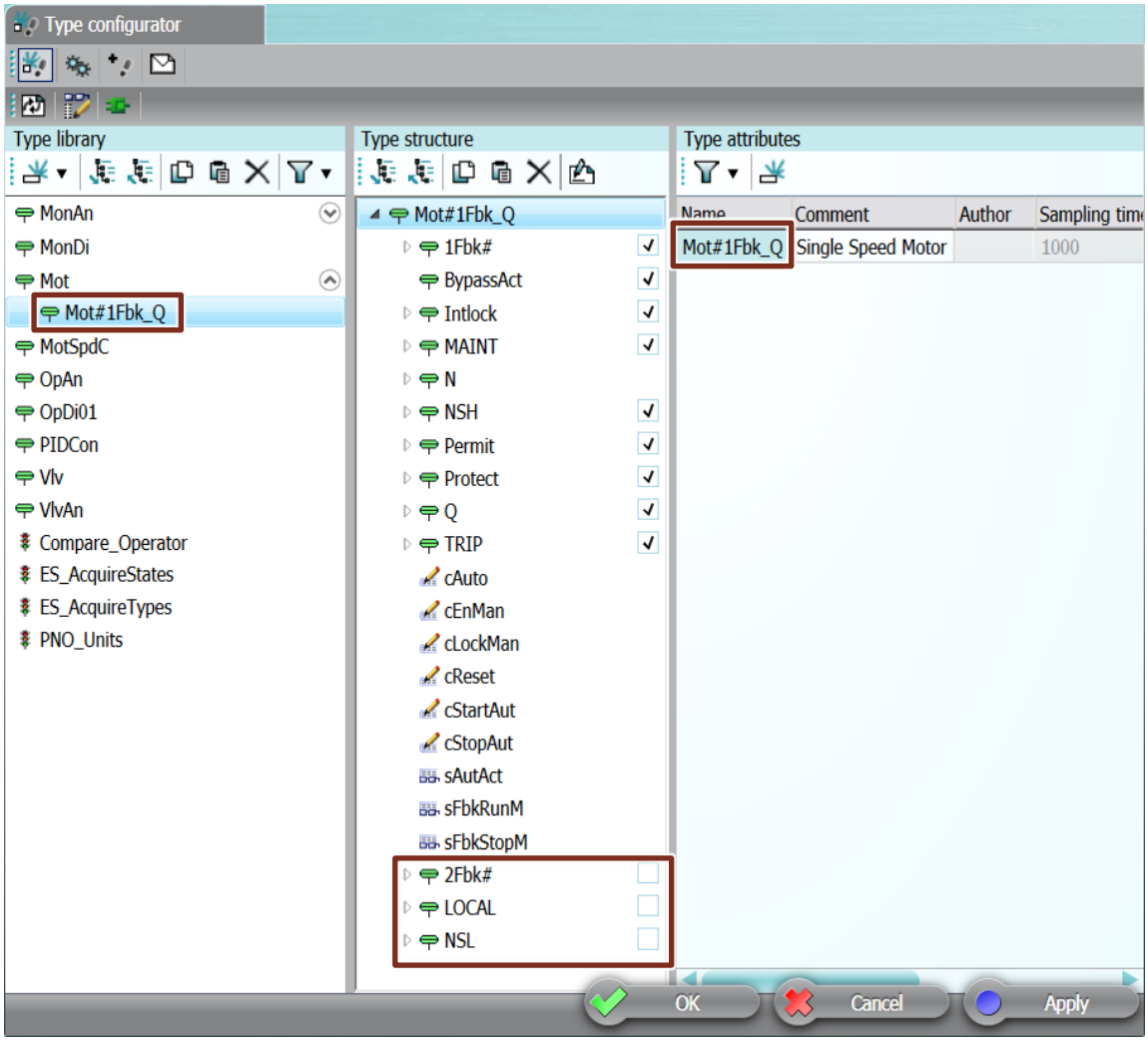
"Mot"

Create the variant "Mot#1Fbk_Q" of the CMT "Mot".

To do this, proceed as follows:

1. Create a new variant for the CMT "Mot".
2. Deactivate the blocks in the variant:
   - "2Fbk#"
   - "LOCAL"
   - "NSL"
3. Change the name of the variant to "Mot#Fbk_Q".



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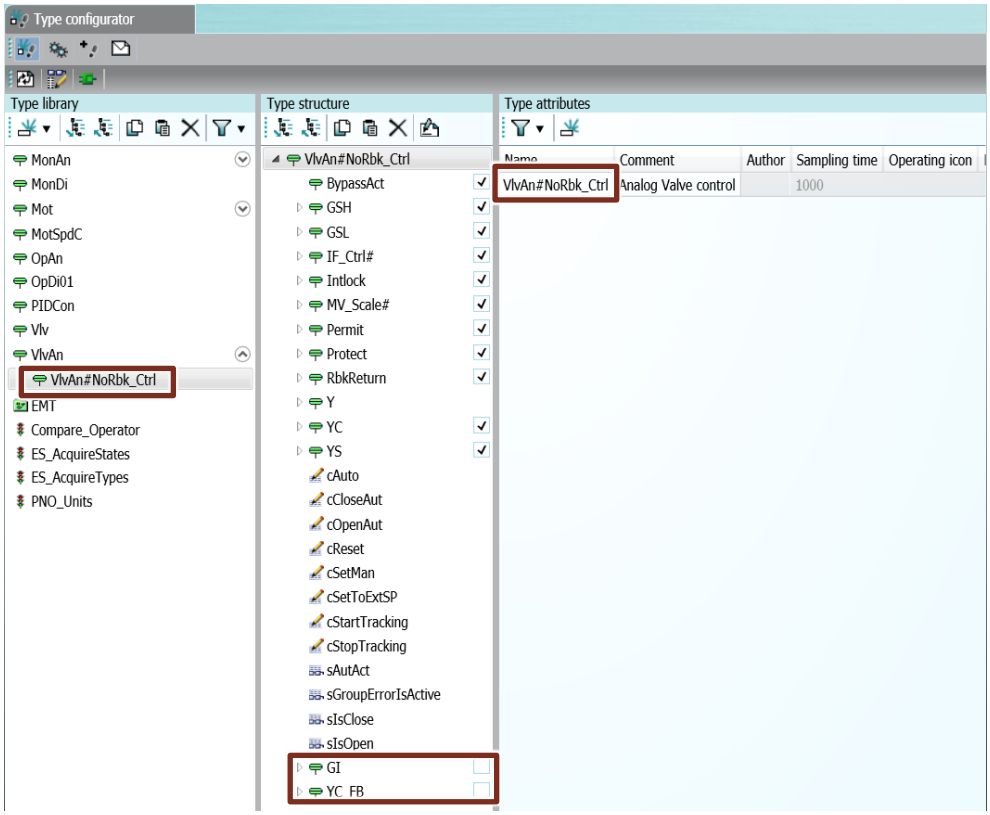
"VlvAn"

Create the variant "VlvAn#NoRbk_Ctrl" from the CMT "VlvAn".

To do this, proceed as follows:

4. Create a new variant for the CMT "VlvAn".
5. Deactivate the blocks in the variant:
   - "GI"
   - "YC_FB"
6. Change the name of the variant to "VlvAn#NoRbk_Ctrl".



7. Then, click on the "Apply" and "OK" buttons to apply your changes and close the dialog.

   The variants of the three types were created in the "@Template > @PCS 7 > Template Container > CMTs" node like the previously imported CMTs in the "Unit" view.

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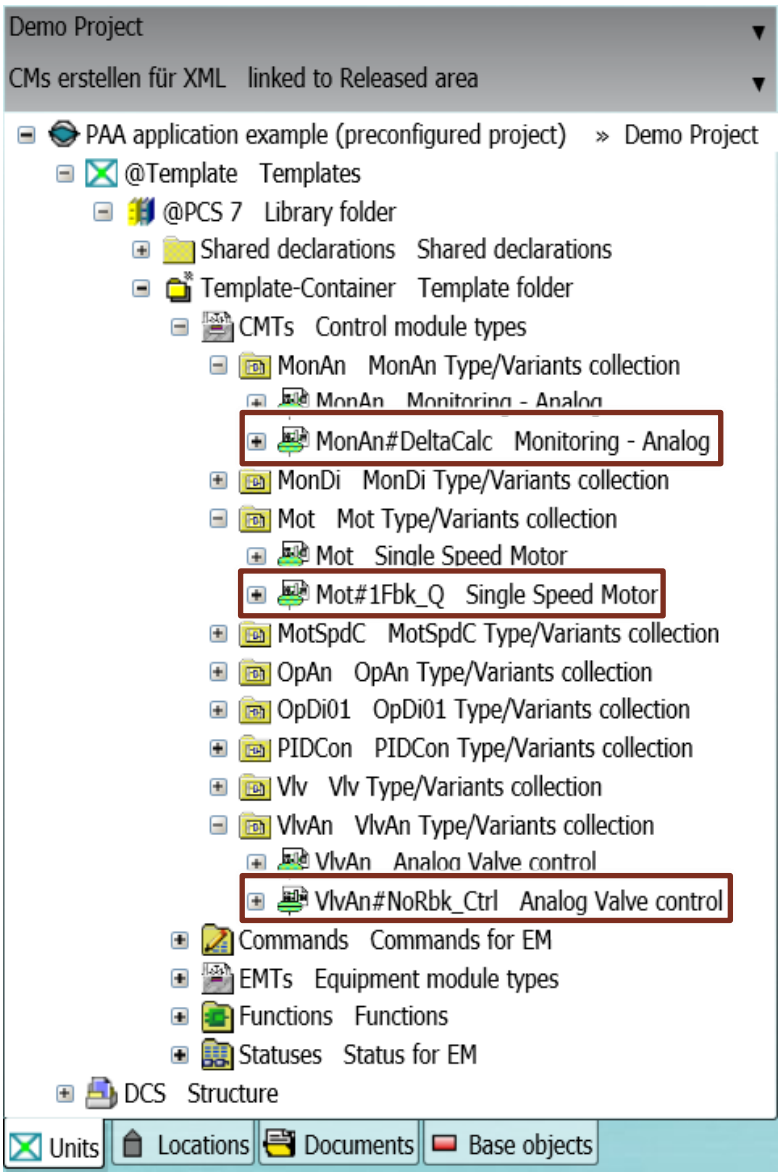

Result

You have created a variant of the previously imported CMTs "MonAn", "Mot" and "VlvAn" with the "Type configurator".

You have deactivated individual modules that you do not need for the variant.

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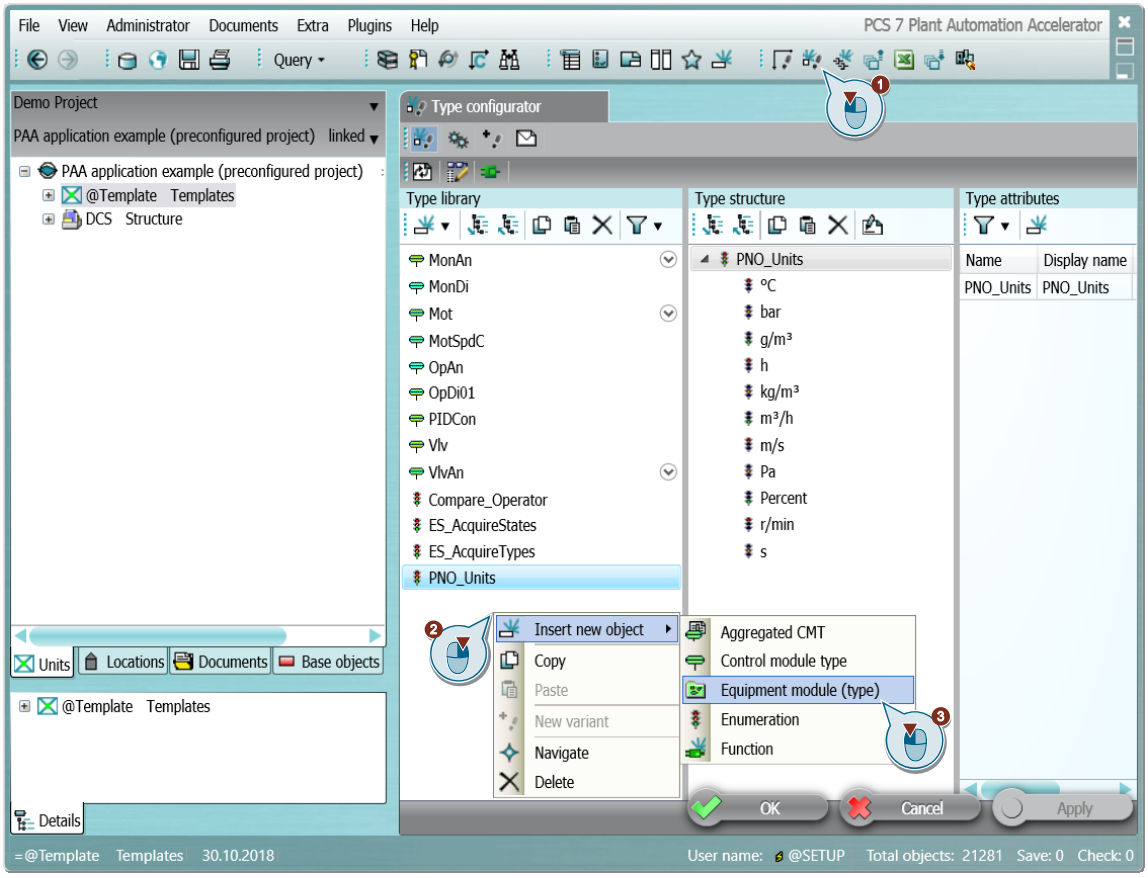
3.4 Creating an equipment module type

This section describes how to create a technical institution type "EMT", individual control unit assignment ("Inlet_Valve" and "Outlet_Valve") and characteristics (operation mode "Charge", process value "PV_Level" and setpoint "SP_Amount") in PAA.

Procedure

1. Click on the "Type configurator" button in the PAA navigation bar .
2. Right-click in the "Type Library" column and select "Insert new object > Equipment module (type)" from the context menu.



3. Select the EMT in the column "Type structure" and rename it in the column "Type attributes" from "EMT_1" to "EMT".
4. Enter "Raw material tank" in the comment field and select "100" as "Sampling time".

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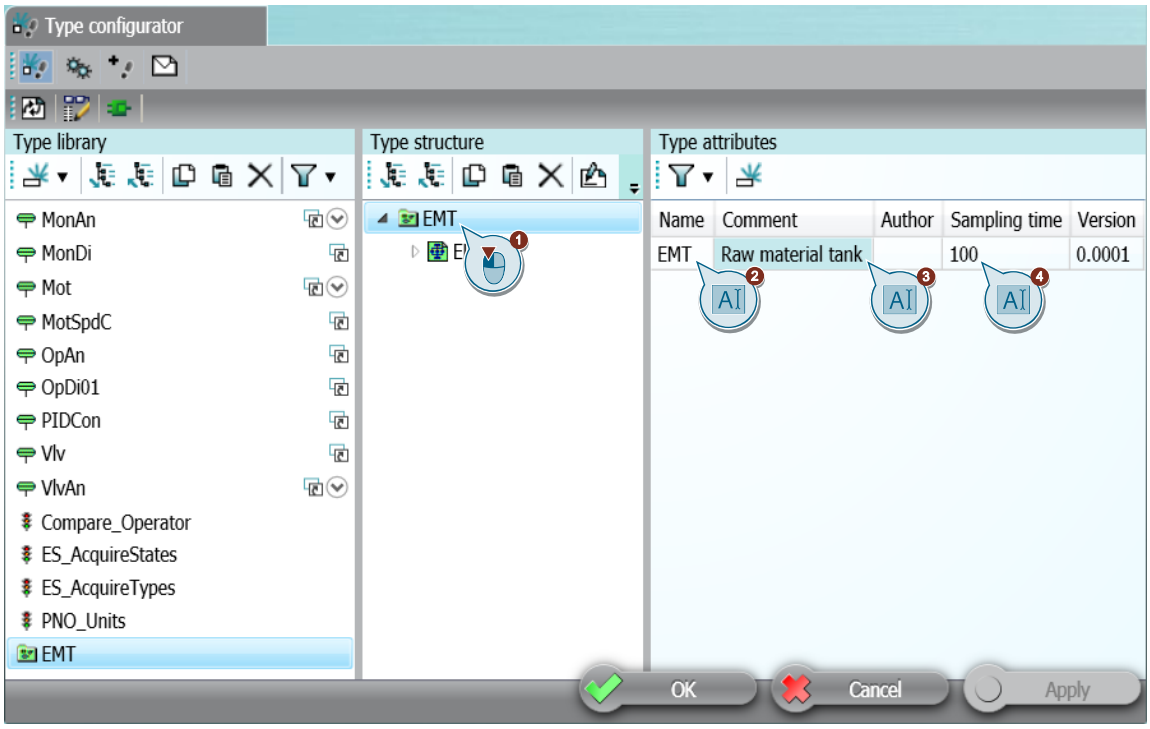
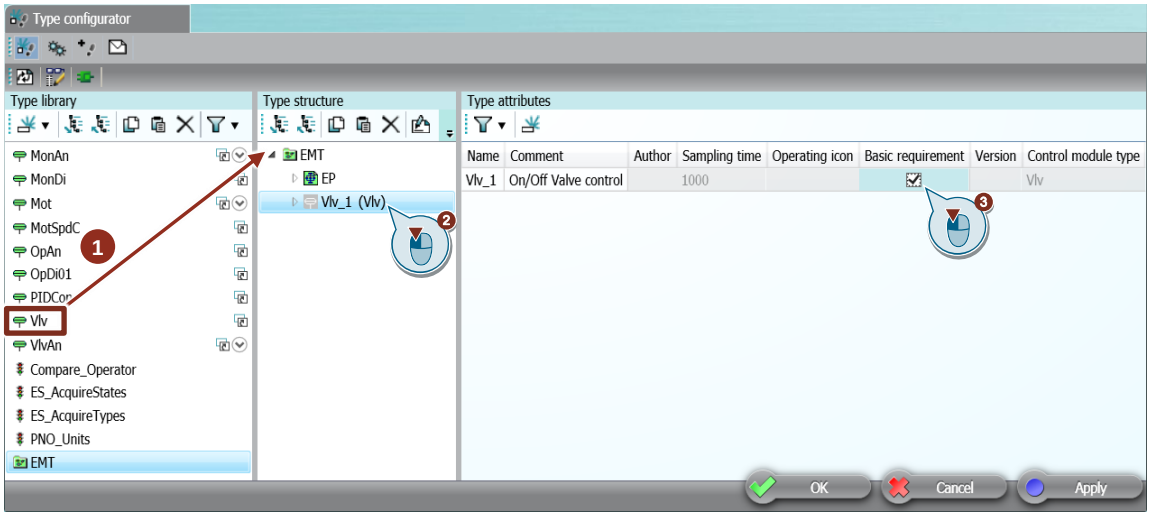


The next step describes how to define two single-controller associations, Inlet_Valve and Outlet_Valve.

5. Drag and drop the CMT "Vlv" onto the technical device "EMT" in the column "Type structure".
   The individual control unit "Vlv_1" is created in the column "Type structure".
6. Select the single control unit "Vlv_1" and activate the option box "Basic requirement" in the column "Type attributes".



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Note

The "Basic requirement" option is used to describe the minimum requirements for the individual control unit to be assigned in abstract terms, e.g: the required commands or status feedback.

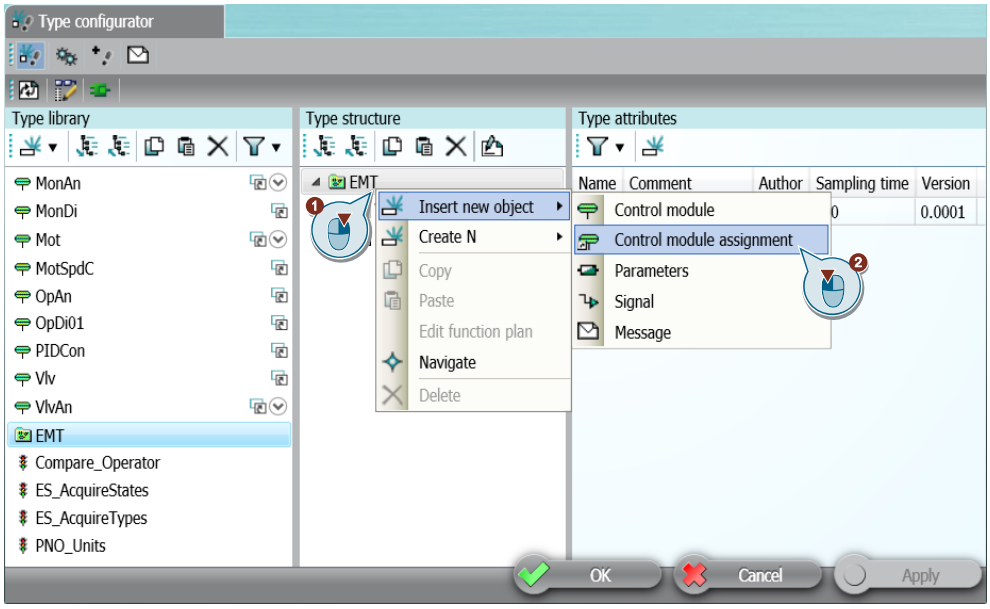
An individual control unit assigned to a technical institution is flagged as a basic requirement if it only describes the requirement for an individual control unit and should not be implicitly included in the copy quantity during instantiation.

Note

Basic requirements do not apply to the EMT instance.

Control modules in an EMT defined as the basic requirement do not apply to instancing. In this case, you assign concrete individual control units to ensure that the corresponding mode of operation is still permitted and functional at the points of use.

7. Right-click the EMT in the Type Structure column.
8. Select the command "Insert new object > Control module assignment" from the context menu.



Note

You can also use this context menu to create parameters and signals that are routed to the outside as connections on the block (in the PCS 7-project).

You can also use this to create notifications and individual control units in the technical institution type.

9. Select the created individual control unit assignment.
10. Assign the role "Inlet_Valve" to the created individual tax unit assignment "Assignment_1".

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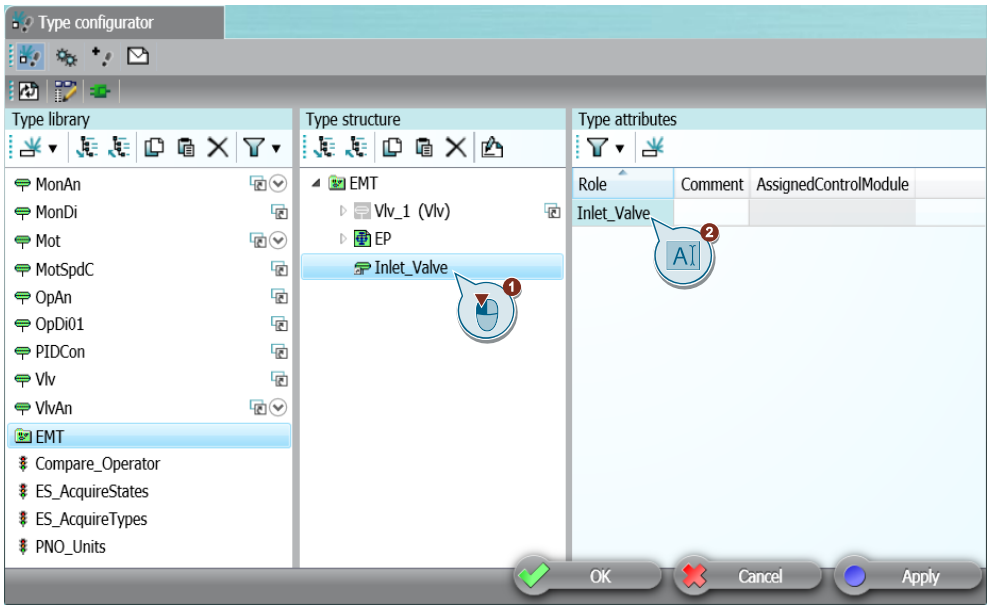
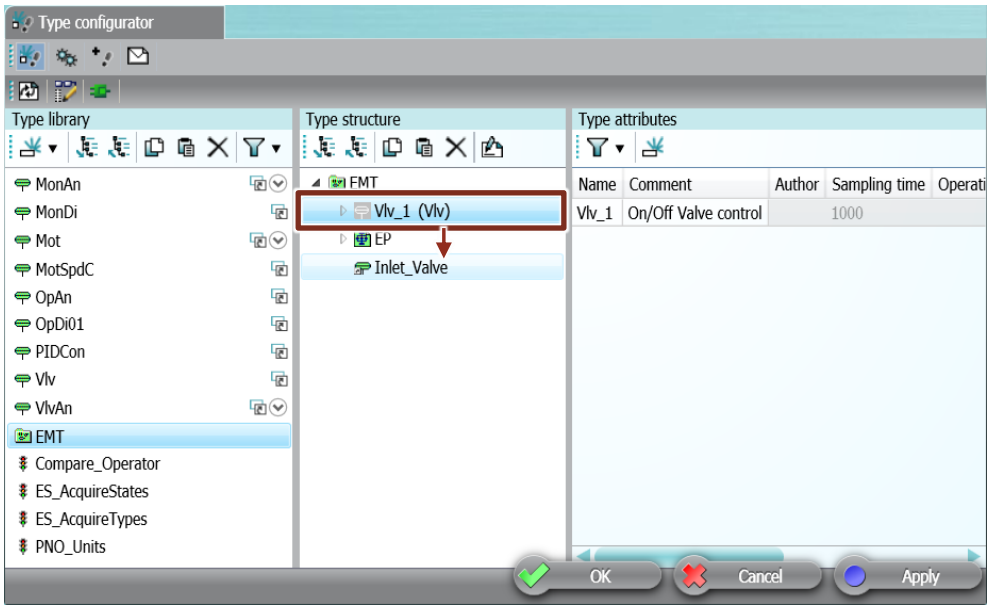


11. Select the basic requirement "Vvl_1" and drag and drop it onto the individual control unit assignment "Inlet_Valve".



12. Repeat the process and define another individual tax unit assignment called Outlet_Valve.

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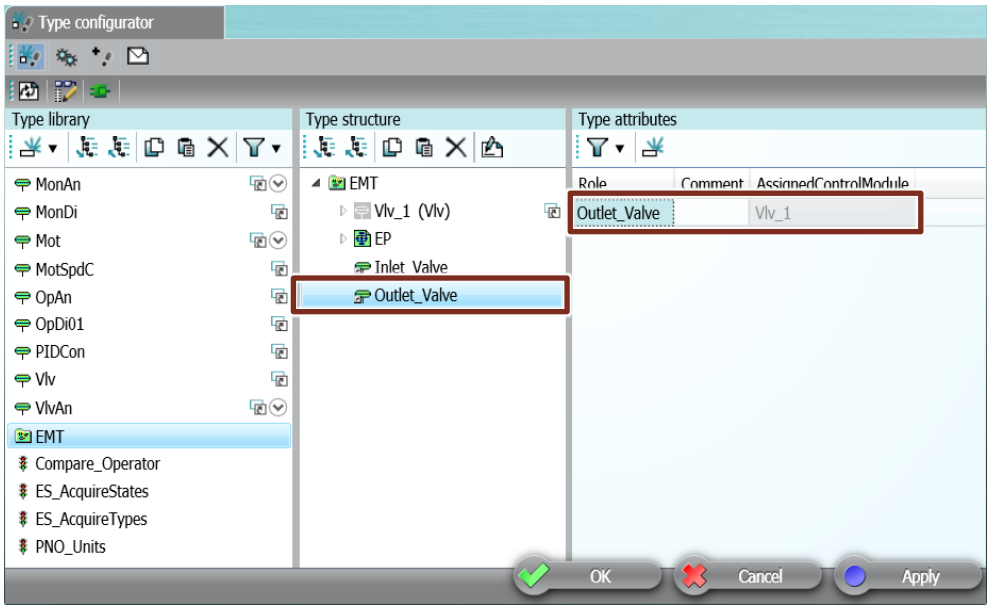

You have defined a base requirement in EMT and assigned it to the individual control unit assignments "Inlet_Valve" and "Outlet_Valve".

This ensures that the requirements of the CMT "Vlv" (e.g: commands and statuses) to the individual control unit assignments.
This means that you can generally use the requirements when configuring the step chain.

You have already configured the requirements of the CMT "Vlv" accordingly.

Note

You define the concrete requirements for the individual control unit in the assigned individual control unit itself and not in EMT.
The requirements include, in particular, the required commands, but also the options for evaluating the status feedback.

13. Click the "Apply" button and "OK" to save the changes.

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The next step describes how to create characteristics of a step chain, a "batch" operation mode, a setpoint "SP_Amount" and a process value "PV_Level".

1. Open the node "Characteristics" in the column "Type structure".
   Here you define the characteristics of your step chain.

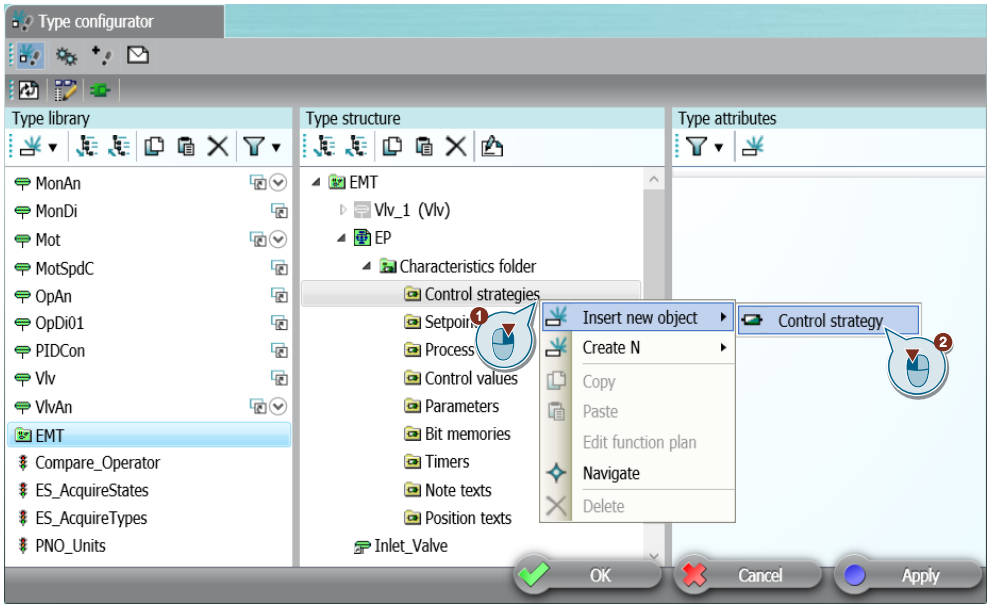
   A characteristic is the technology-oriented functionality of an SFC type, which is defined by a set of attributes (for example port name, data type, start value or upper limit).

Note

The definition of characteristics is not explained in this example.

Further information can be found in the following manual: SIMATIC process control system PCS 7 Compendium Part C - Technical functions with SFC types (V9.0)

2. Select the "Control strategies" folder and right-click on the folder to open the corresponding context menu.
3. Select "Insert new object > Control strategy" from the context menu.



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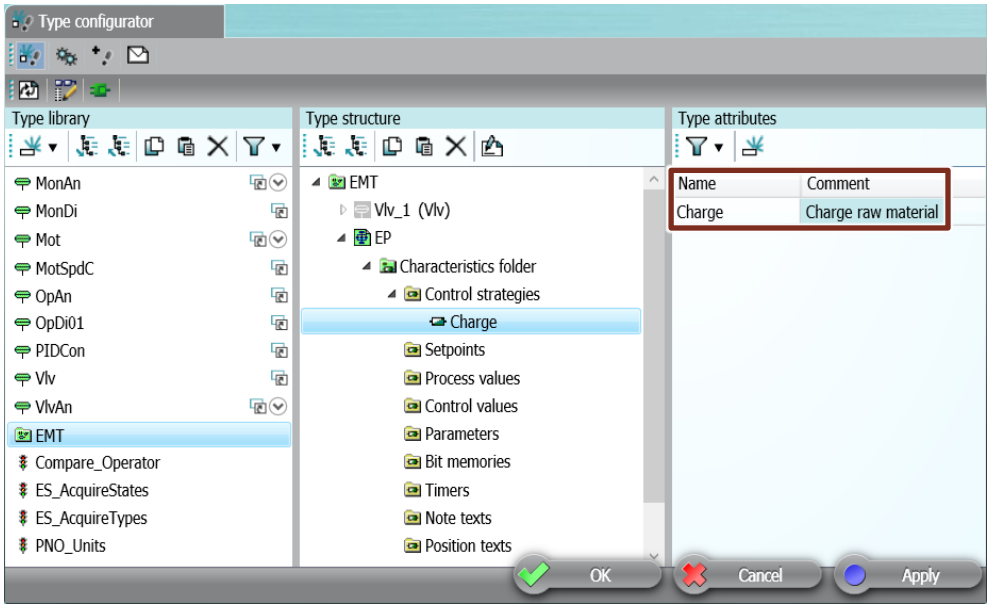
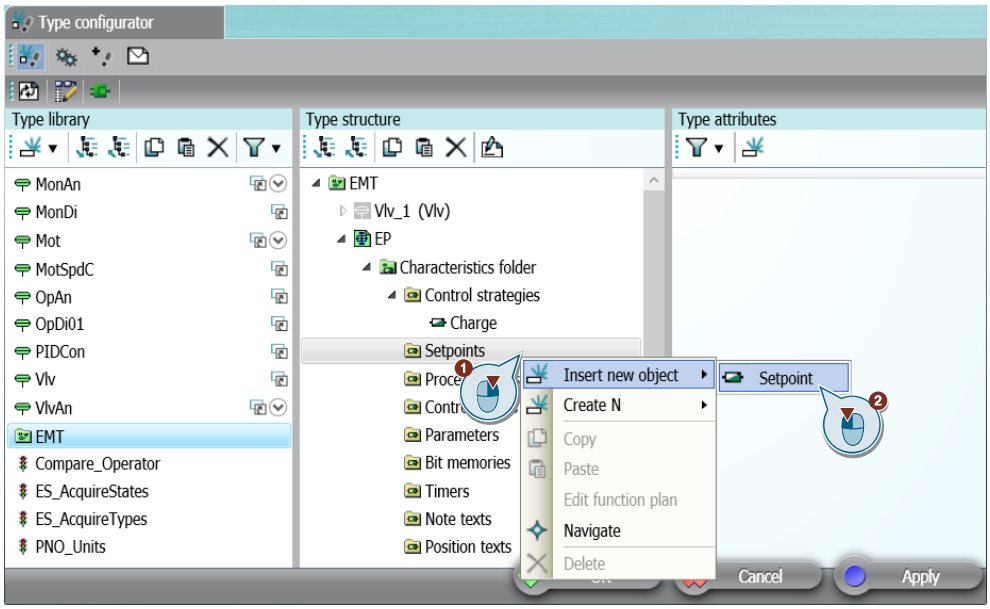
4. Rename the created operation mode to "Charge" and enter "Charge raw material" in the comment field.



5. Select the "Setpoints" folder and right-click the folder to open the corresponding context menu.
6. Select "Insert new object" > "Setpoint" from the context menu.



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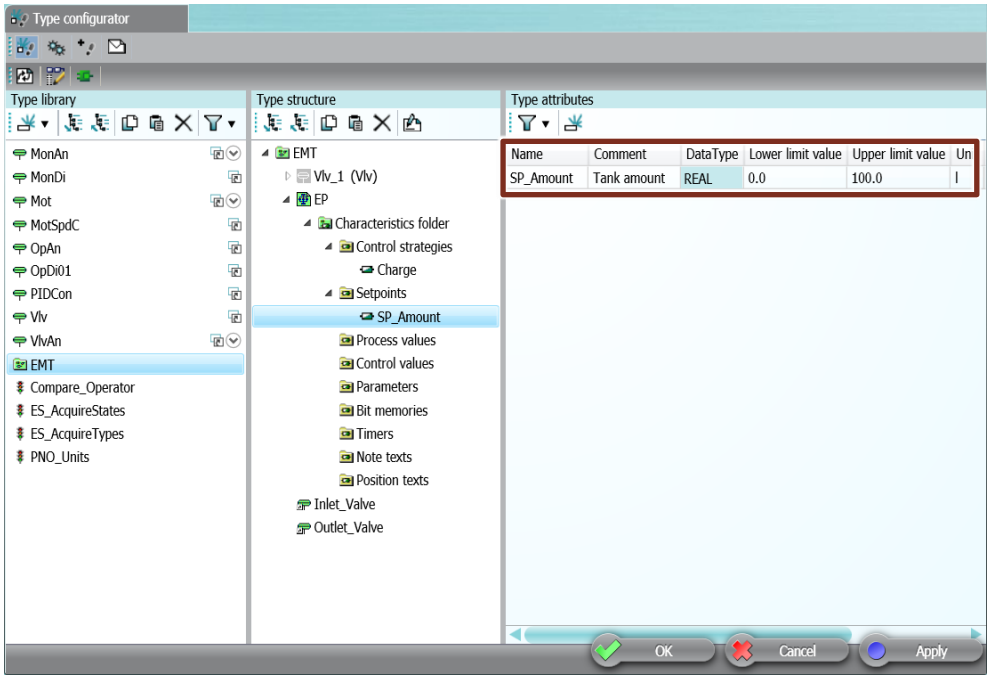
7. Define the associated attributes as follows:
   - "Name": "SP_Amount"
   - "Comment": "Tank amount
   - "DataType": "Real"
   - "Low Limit" "0"
   - "High Limit" "100"
   - "Unit": "l"



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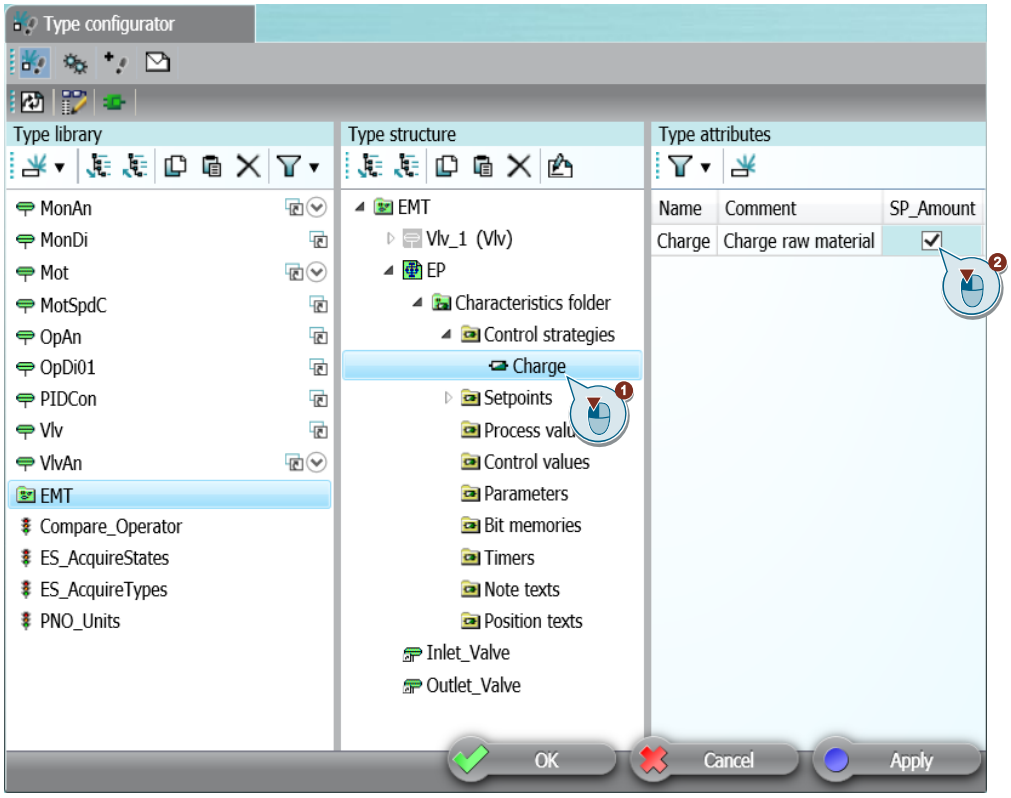
8. The setpoint "SP_Amount" is available for the operation mode "Charge". Open the attributes of the operation mode "Charge" and activate the option box in the column "SP_Amount".

Note This assignment is used to define which setpoint in SIMATIC WinCC / SIMATIC Batch is available to the respective control strategy.



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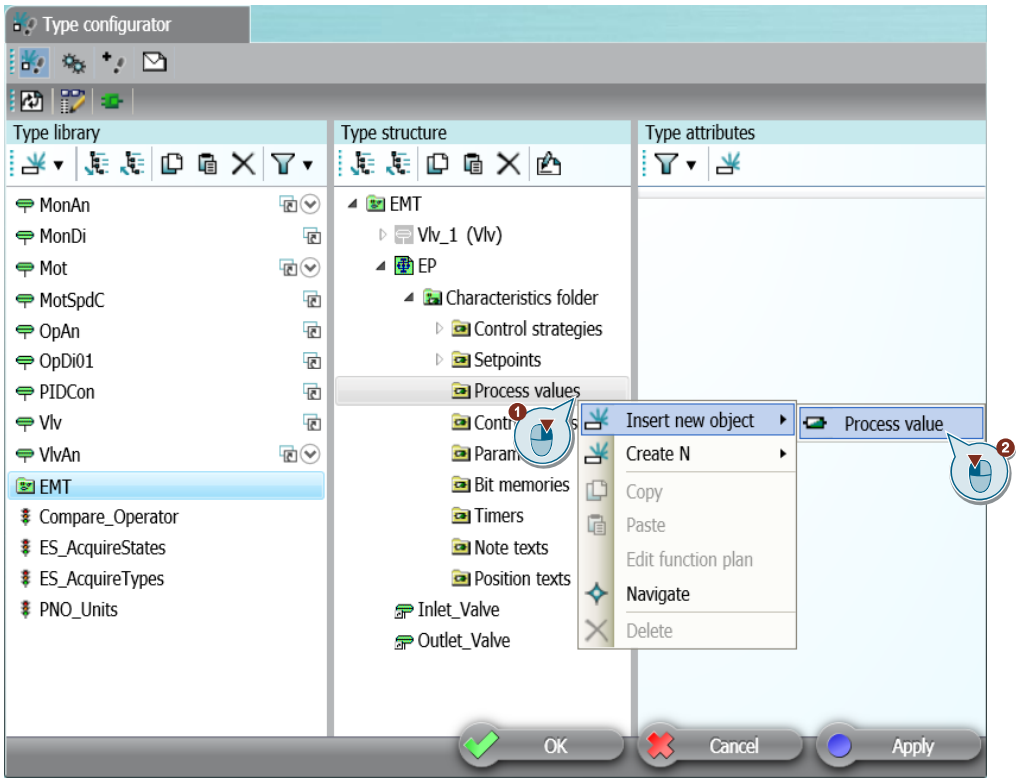
9. Select the "Process values" folder and right-click on the folder to open the corresponding context menu.
10. Select "Insert new object > Process value" from the context menu.



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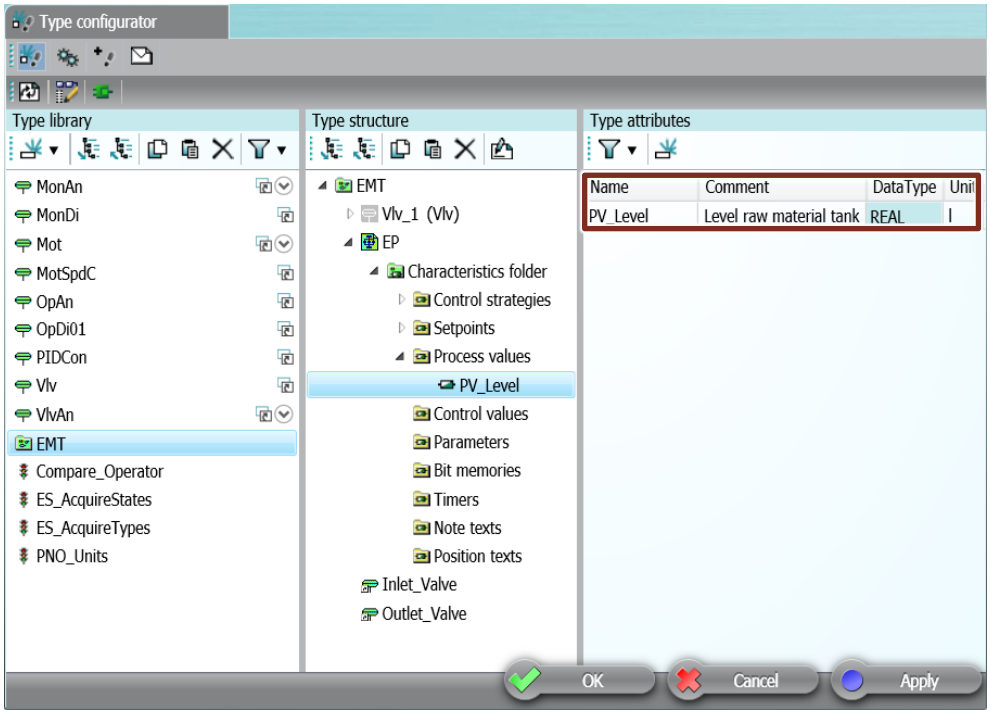
11. Define the associated attributes as follows:
    - "Name": "PV_Level"
    - "Comment": "Level raw material tank"
    - "DataType": "Real"
    - "Unit": "l".



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3.5 Create DCS structure with CMs and assign it to the AS

This section describes how to create a DCS structure in PAA and derive the respective CMs from the imported CMTs.

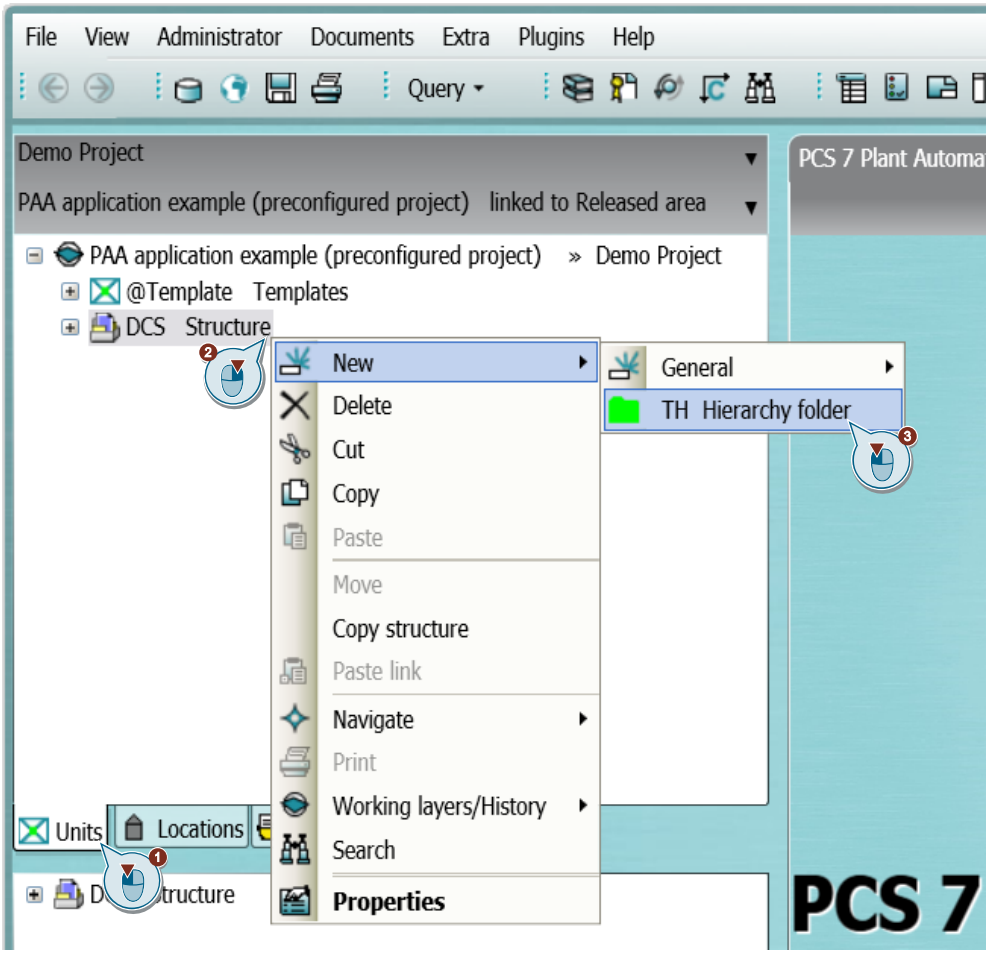
It also describes how to assign an AS to TH folders.

3.5.1 Create a DCS structure

This section describes how to create a DCS structure in PAA.

In the case of the sample project, create an example DCS structure in the "Units" view.

1. Open the view "Units".
2. Right-click on the "DCS Structure" folder to open the corresponding context menu.
3. Create a new hierarchy folder here.
   To do this, click on the entry "New > TH Hierarchy folder".



Change the name of the folder.

4. To do this, open the associated properties by double-clicking on them.
5. In the "Name" field, change the name to "Plant".

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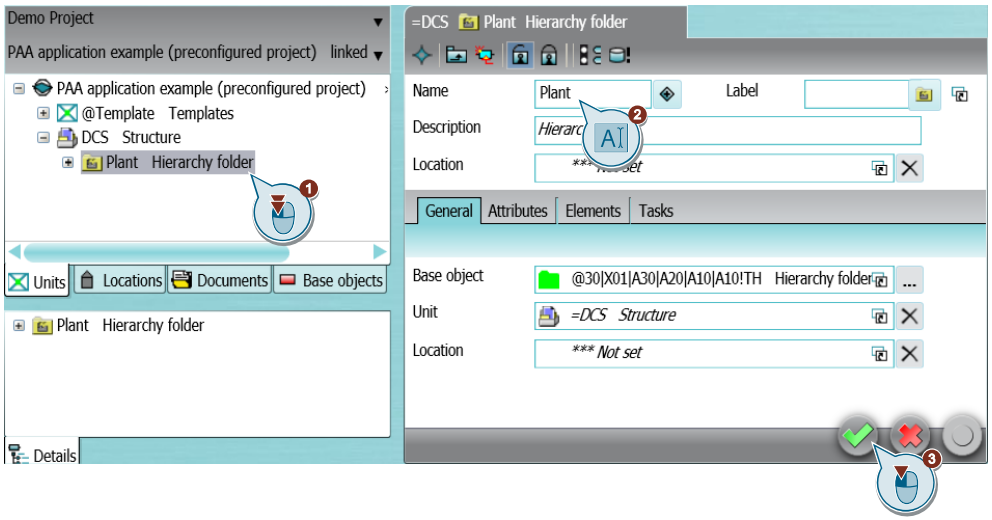
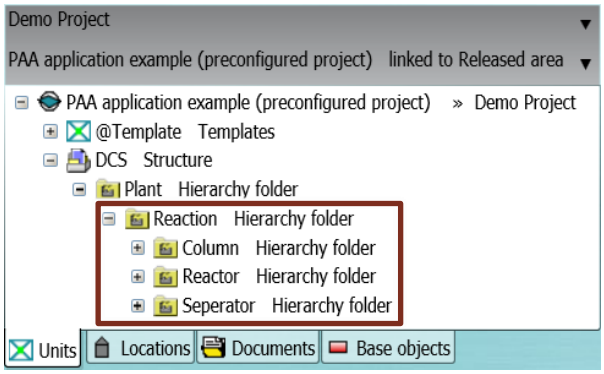
6. Then click on the "OK" button to adopt the changes.



Create the following structure in the same way:

- "Plant"
  - "Reaction"
    - "Column"
    - "Reactor"
    - "Separator"



Note

The hierarchy can be built up to a maximum of eight levels.
After the eighth level the command in the context menu is grayed out.

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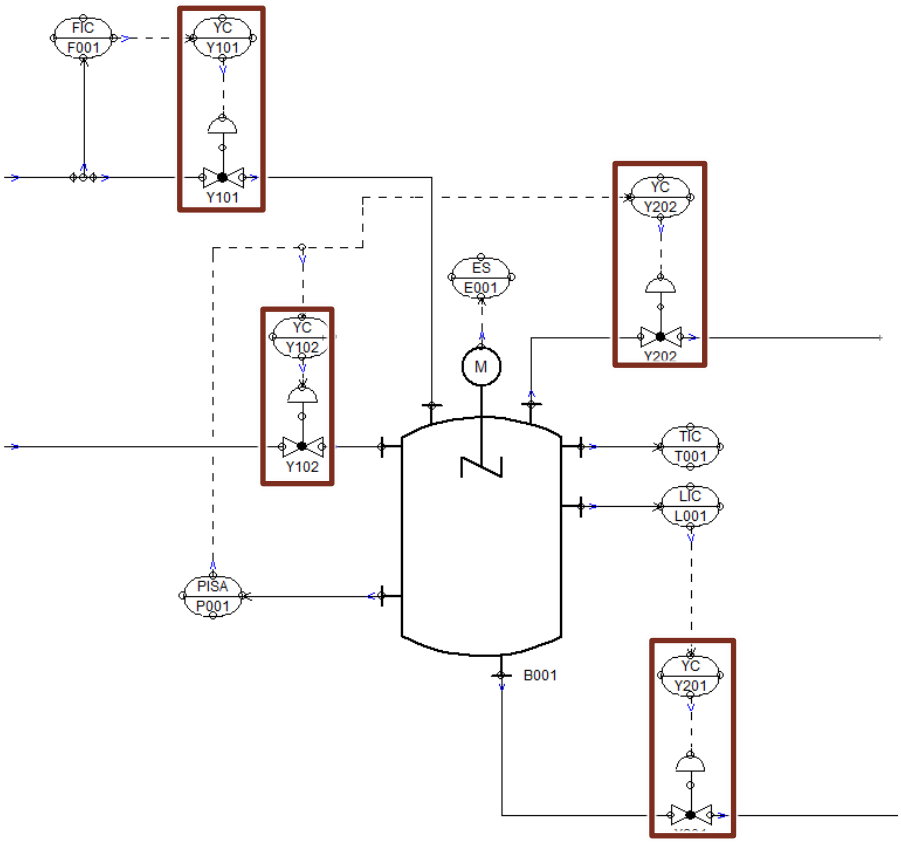
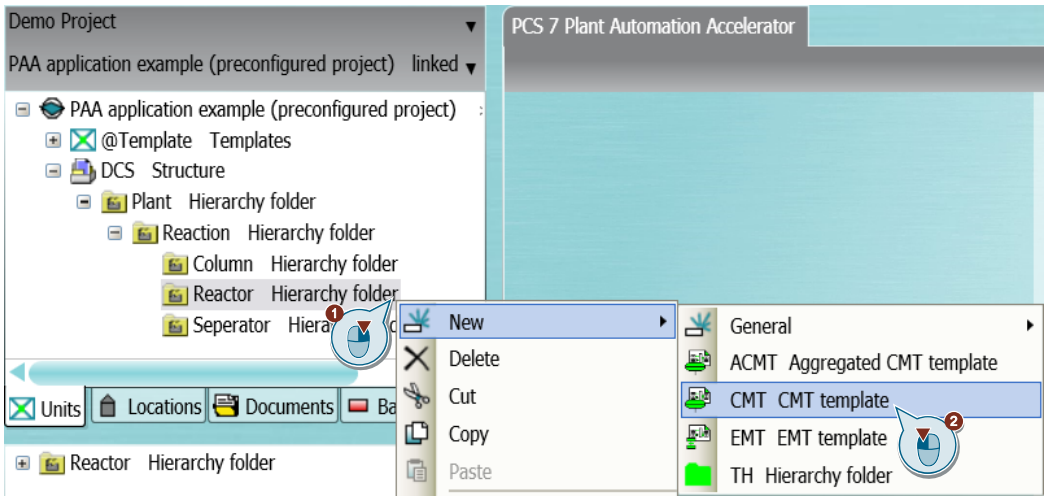
3.5.2 Creating CMs in the DCS structure

This section shows you how to create CMs in the DCS structure of PAA.

On the basis of the plant structure, create the following example CMs



1. Open the corresponding context menu by right-clicking on the "Reactor" hierarchy folder.
2. Click on the entry "New > CMT CMT template".



3. Double click on the created CM object to open its properties, and proceed to name the CM as follows.
   - "Name": "Y101"
   - "Description": "Analog inlet valve"

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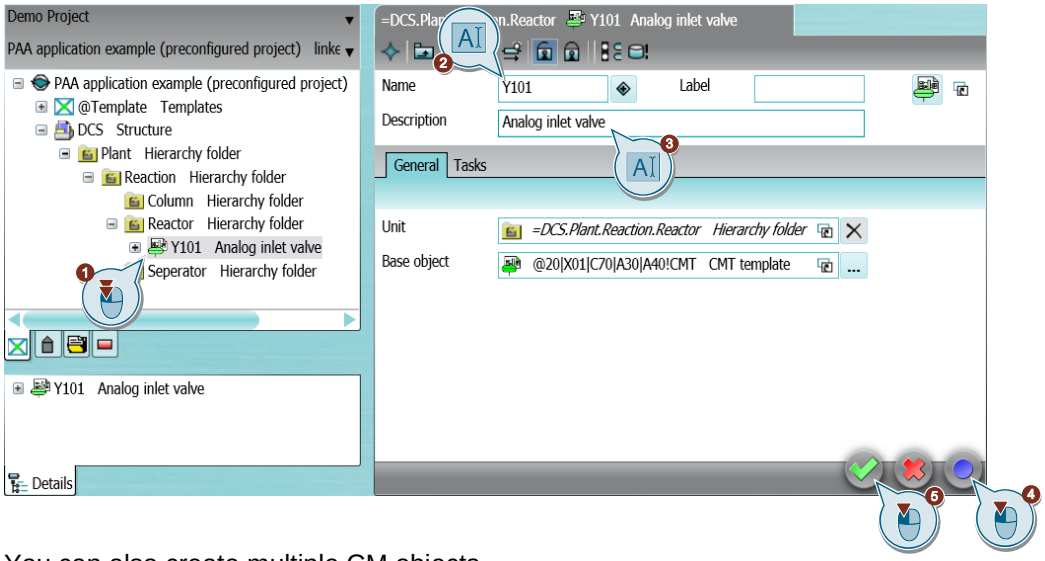
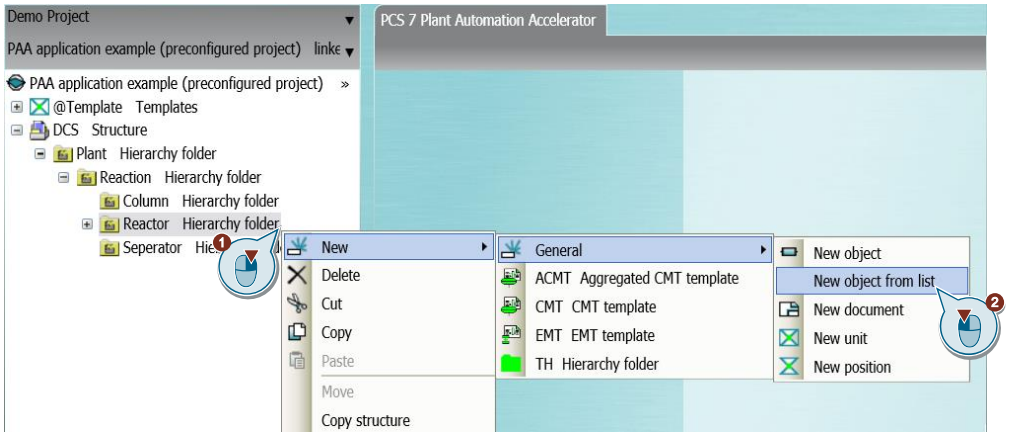
4. Click on the "Apply" and "OK" buttons to save the change and to close the properties dialog.



You can also create multiple CM objects.

In the example project, create three more CM objects under the "Reactor" folder.

5. Open the corresponding context menu by right-clicking on the "Reactor" hierarchy folder.
6. Click on the entry "New > General > New object from list".



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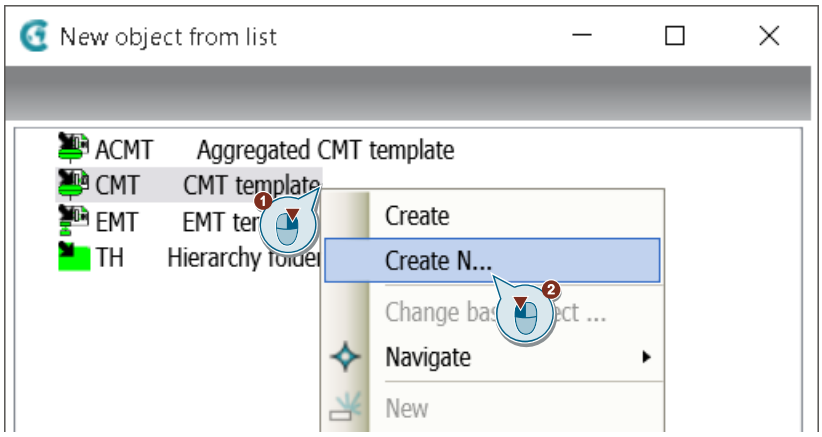
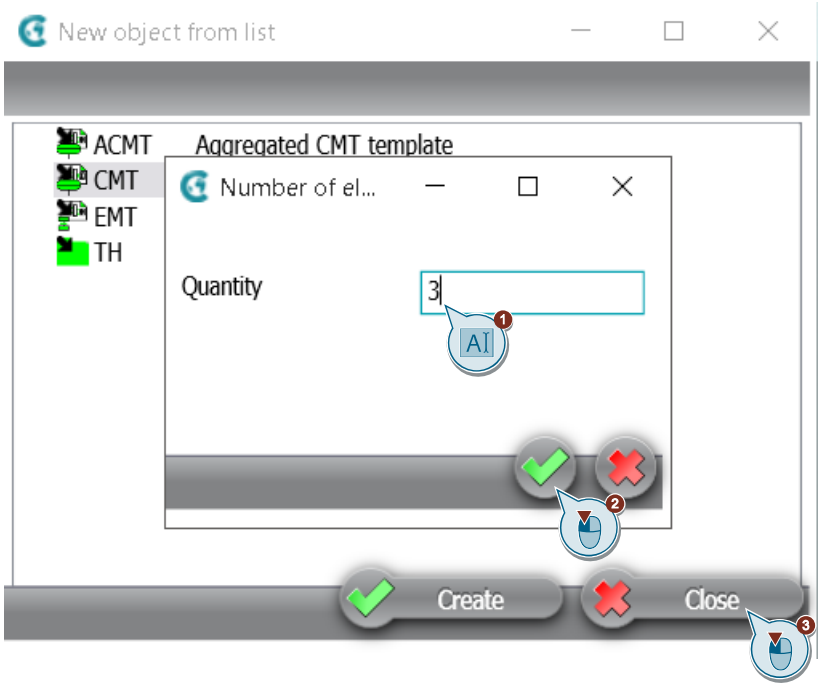
7. Right-click on the "CMT CMT template" object to open the corresponding context menu.
8. Click on the entry "Create N…"



9. In the "Quantity" field, enter the number of CM objects you wish to create under the TH folder "Reactor".

   In the case of the sample project, enter "3" here and then click on the "Create" button.
10. In the "New object from list" window, click "Close".



11. Change the name and description of the three CMs created as follows:
    - "Y102" - "Analog inlet valve"
    - "Y201" - "Analog outlet valve"
    - "Y202" - "Analog outlet valve"

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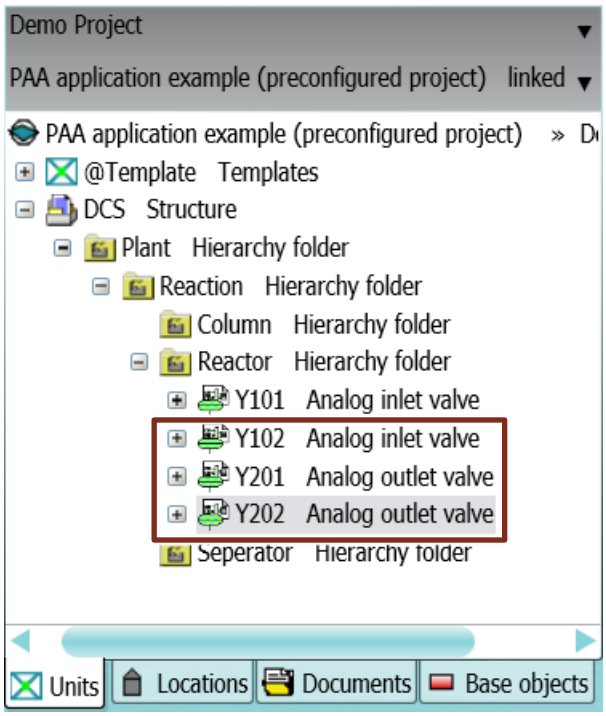

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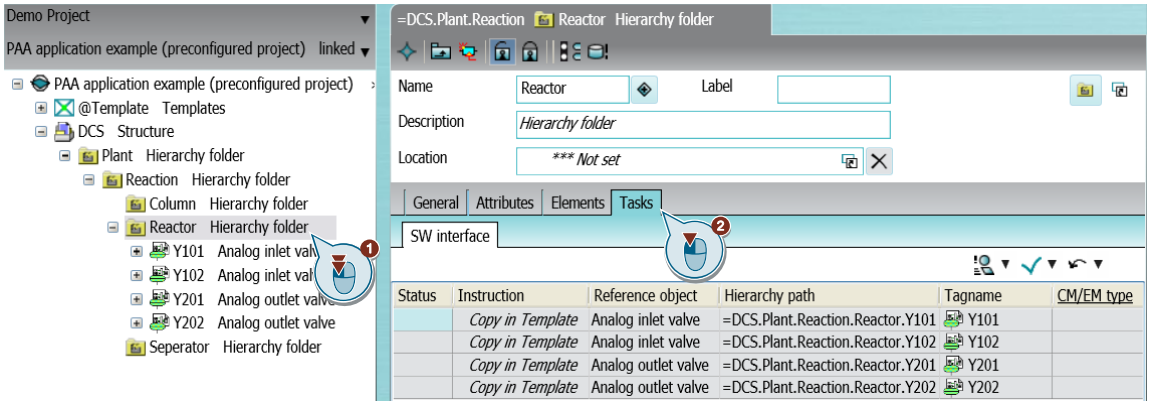
3.5.3 Assigning the appropriate CMTs to the CMs

This section shows you how to assign the associated CMTs to the CM templates you created earlier.

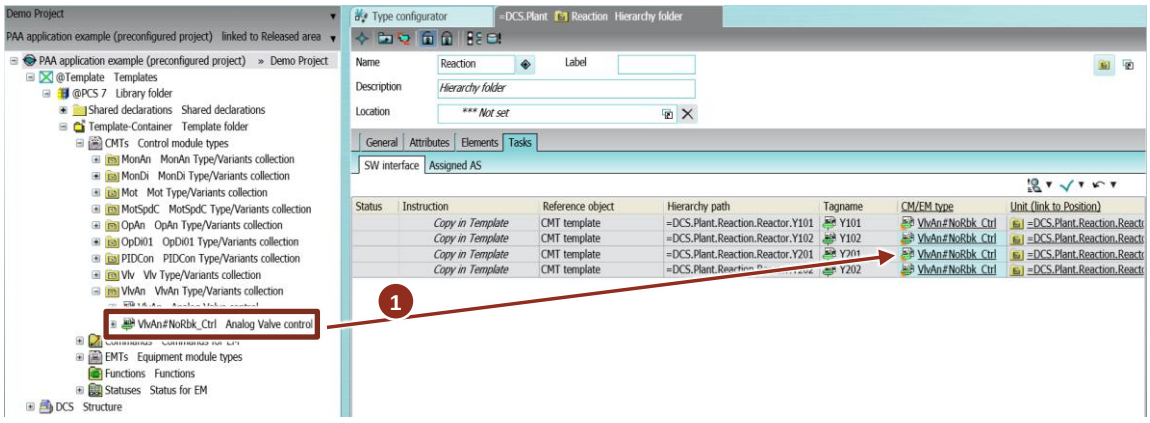
1. To do this, double-click on the "Reactor" folder to open the corresponding properties.
2. Open the "Tasks" tab.

   In the "SW interface" tab, all the CMs of the "Reactor" TH folder are displayed.



In the column "CM/EM type" you can now assign the corresponding CMTs to the CMs by Drag & Drop.
The CMs in the example project should be based on the CMT "VlvAn#FB_Ctrl".

3. To do this, navigate in the "Units" view to the CMT templates: "@Template > @PCS 7 > Template Container > CMTs".
4. Open the subordinate CMT objects of the folder "VlvAn".
   Under this you will find the CMT "VlvAn#FB_Ctrl".
5. Hold down <Shift> and in the SW interface tab, click in the first and then the last field of the CM/EM type column.
6. Drag and drop the CMT " VlvAn#FB_Ctrl" onto the marked fields.



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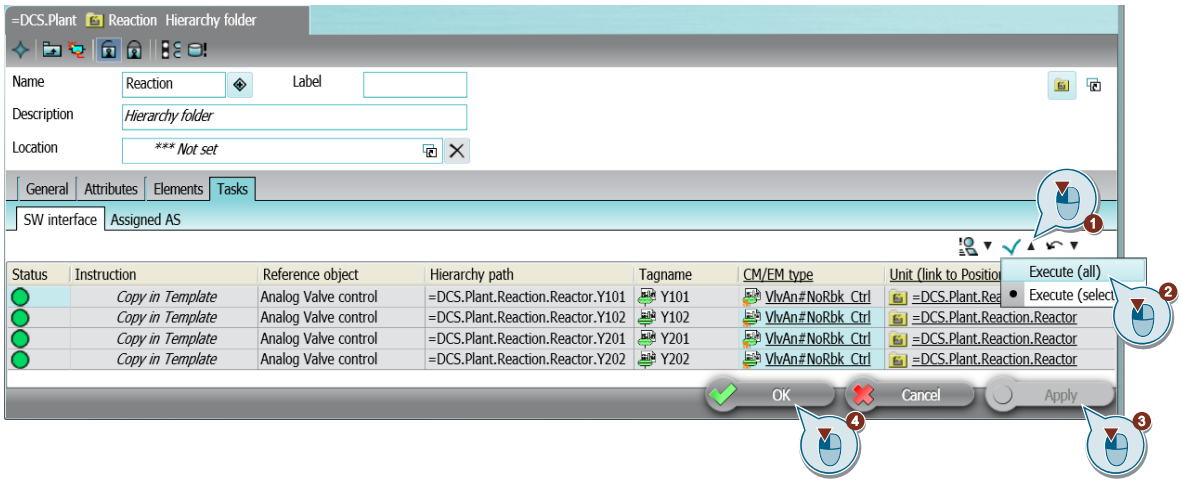
7. To activate the assignment, open the associated drop-down list by clicking on the button ▼ in the icon ✓ ▼ and click on the "Execute (all)" entry.

   The assignments are implemented and their status is checked.
   If the execution is error-free, the status color changes to green.

8. Then click on the "Apply" and "OK" buttons to apply the changes and to close the drop-down dialog.



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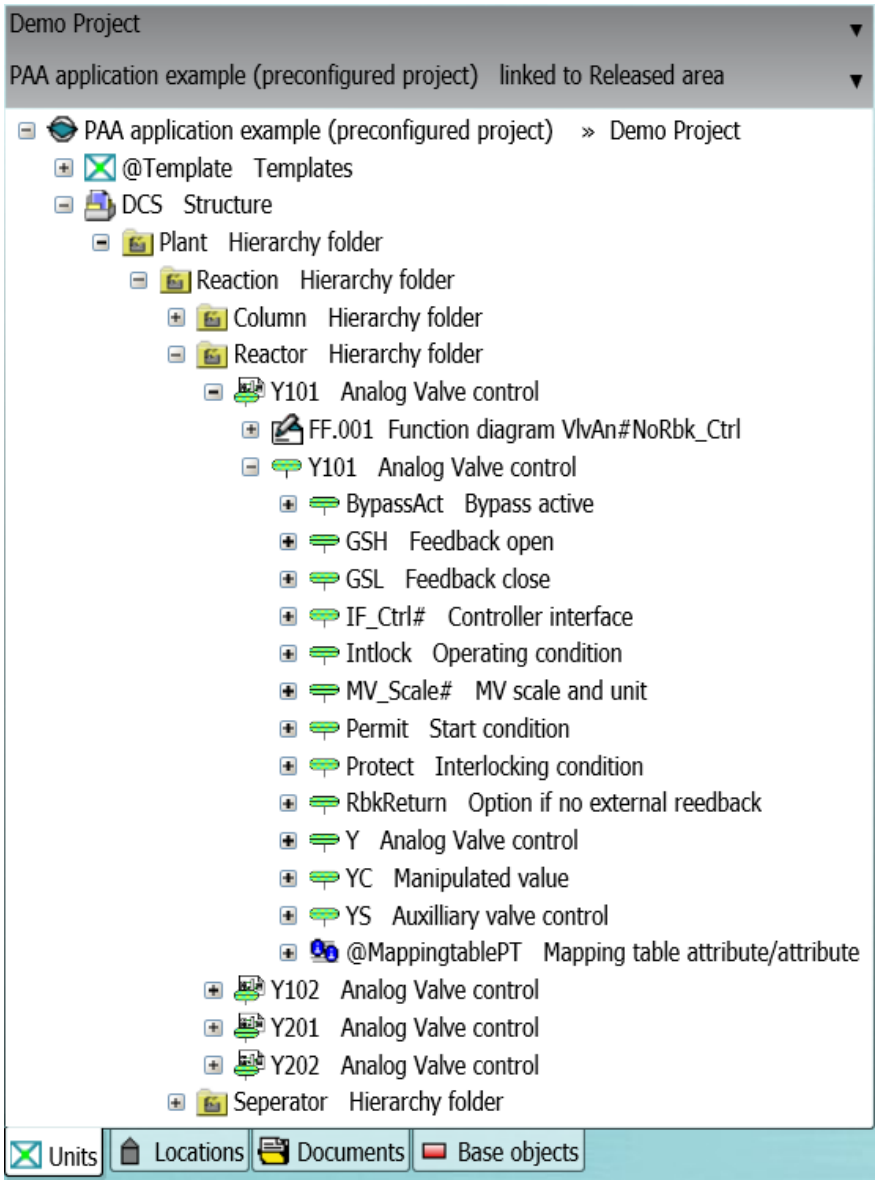
With the execution of the assignment, the signals, parameters and messages of the corresponding type were automatically created under the CMs.



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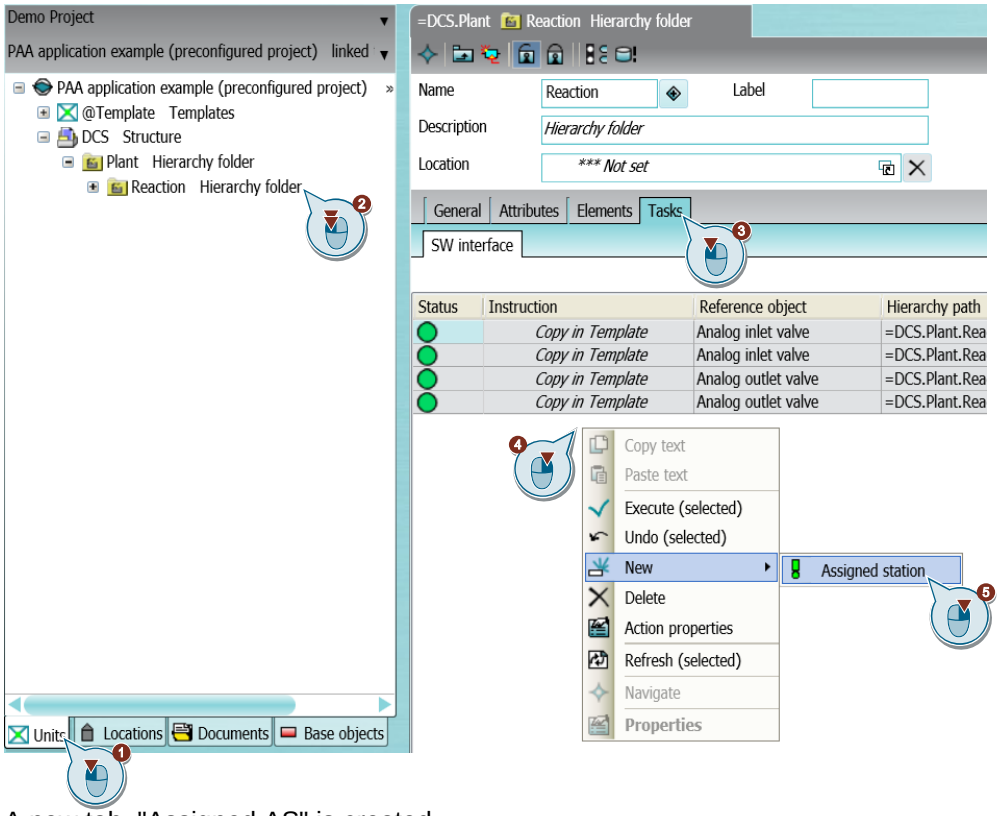
3.5.4 Assigning a DCS structure to an AS

This section shows you how to assign a TH folder to an AS. This is necessary so that PCS 7 can load the data into the correct AS target system after the data exchange.

In the example project you had previously created an AS Station ("A1 AS410-2H"). Assign it to the "Reaction" TH folder.

1. Open the view "Units".
2. Double-click on the TH folder "Reaction" to open the corresponding properties.
3. Open the tab:
   "Tasks > SW interface"
4. Right-click in the free area of the tab to open the corresponding context menu.
5. Create a new task here.
   Click on the entry: "New > Assigned station"



A new tab, "Assigned AS" is created.

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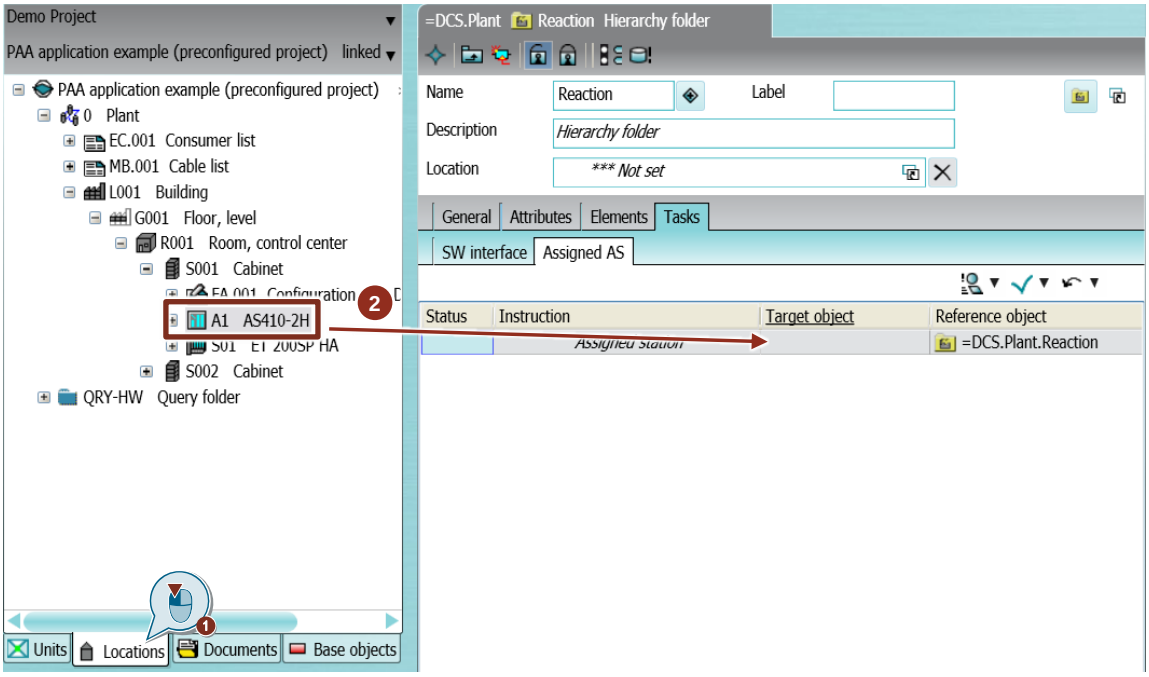
6. Open the "Locations" view.
7. Drag and drop the AS "A1 AS410-2H" into the "Target object" field.



Enable the assignment.

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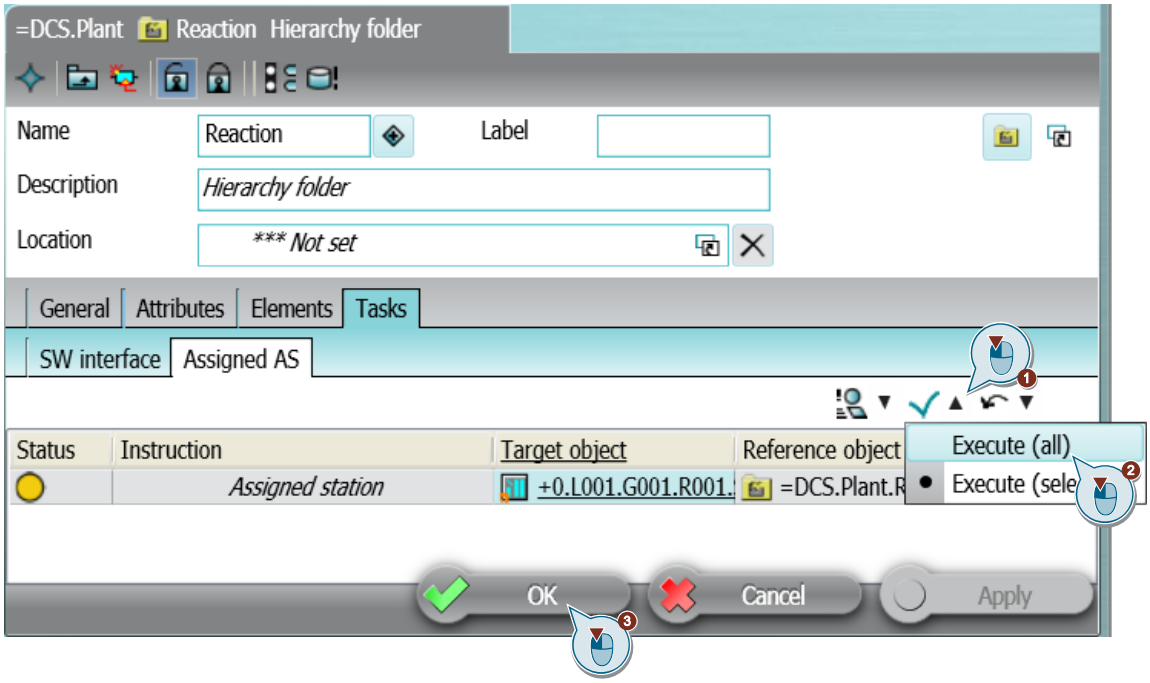
8. To activate the assignment, open the associated drop-down list by clicking on the button ▼ in the icon ✓ ▼ and click on the "Execute (all)" entry.
9. Then click on the "OK" button to apply the changes and to close the properties dialog.



Result

You have created a DCS structure in PAA, created CM templates in the DCS structure, and assigned them to the corresponding CMTs.

You have also defined that the AS "A1 AS410-2H" is assigned to the TH folder "Reaction".

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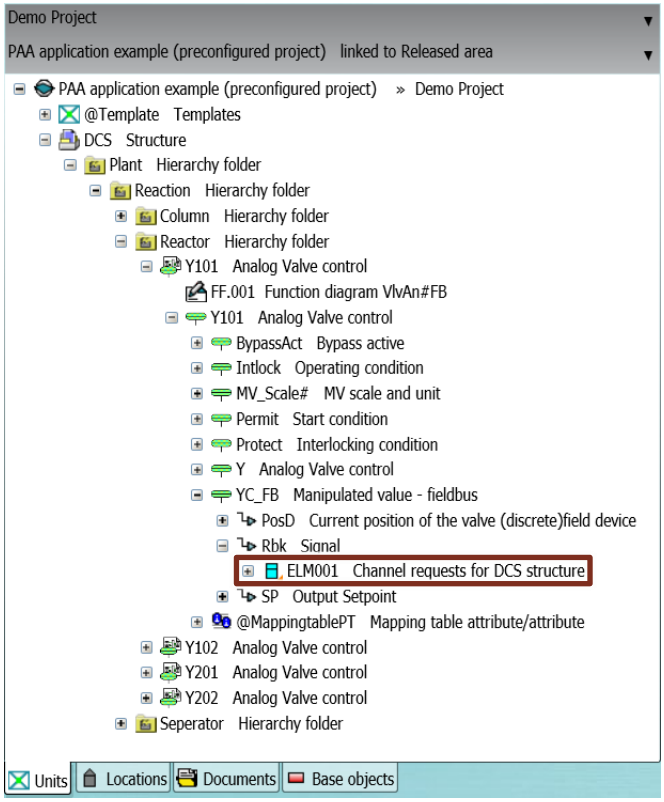
3.6 Assigning multiple signals to the hardware

By assigning the CMTs to the CMs, channel requirements were automatically created for the signal objects of the CMs.



Assign one channel (address) to each of these I/O modules.

This section describes in detail how to proceed and how to make the multiple assignments in the example project.

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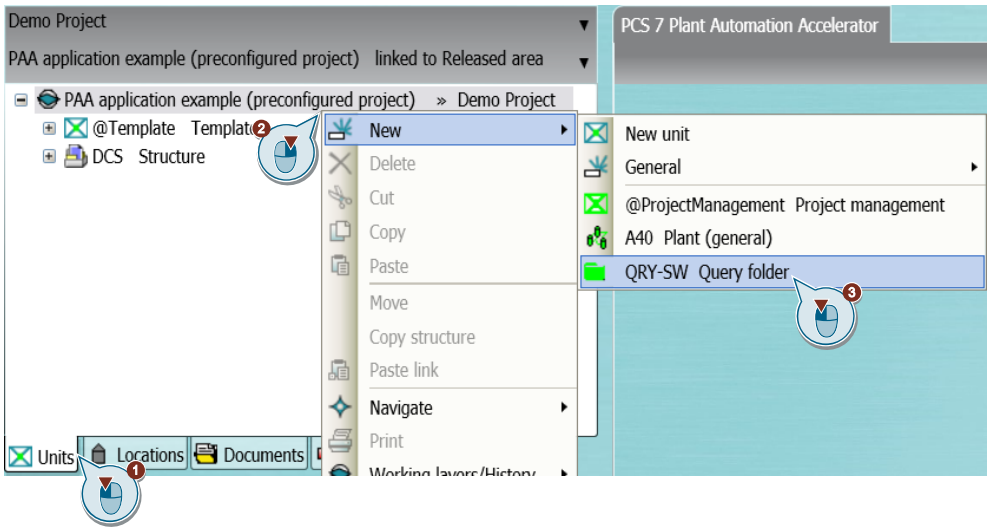
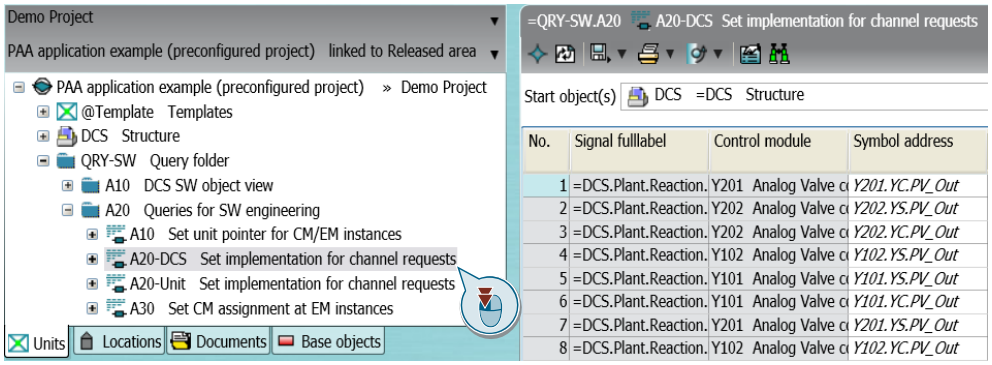
1. Open the "Units" view in PAA.
2. Right-click on the "PAA application example (preconfigured project)" project node to open the corresponding context menu.
3. Use this to create the folder "QRY-SW Query folder"
   "New > QRY-SW Query folder".



4. Open the query "A20-DCS Set implementation for channel requests" with a double click.

   The "DCS Structure" folder is stored by default in the "Start object(s)" field. This will display all the channel requests under the object.



With the query you can quickly and easily assign the corresponding inputs and outputs of the analog and digital components to the channel requirements from the "Locations" view.

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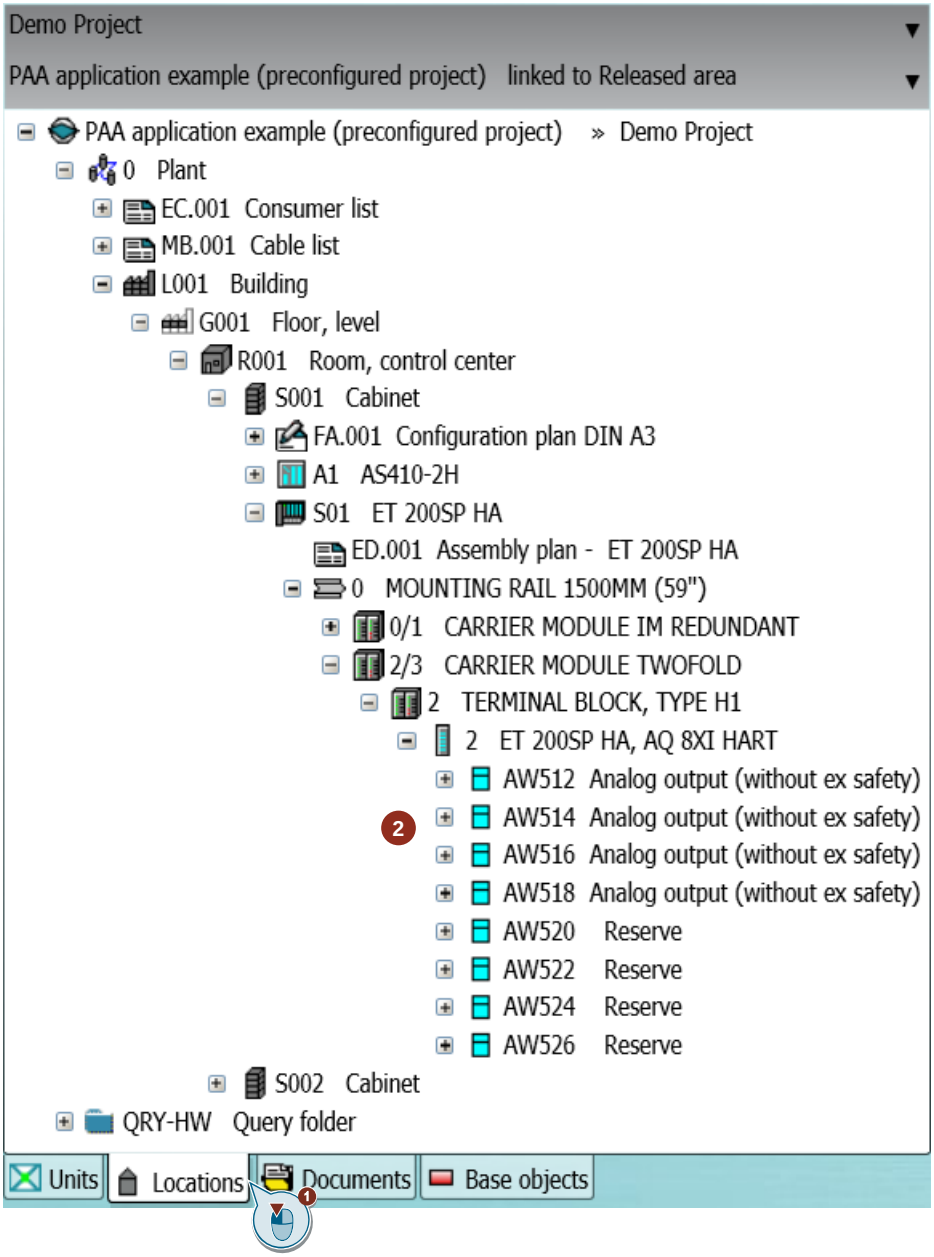
5. Open the "Locations" view.
6. Navigate to the "ET 200SP HA" and open the subordinate objects of the I/O module here.



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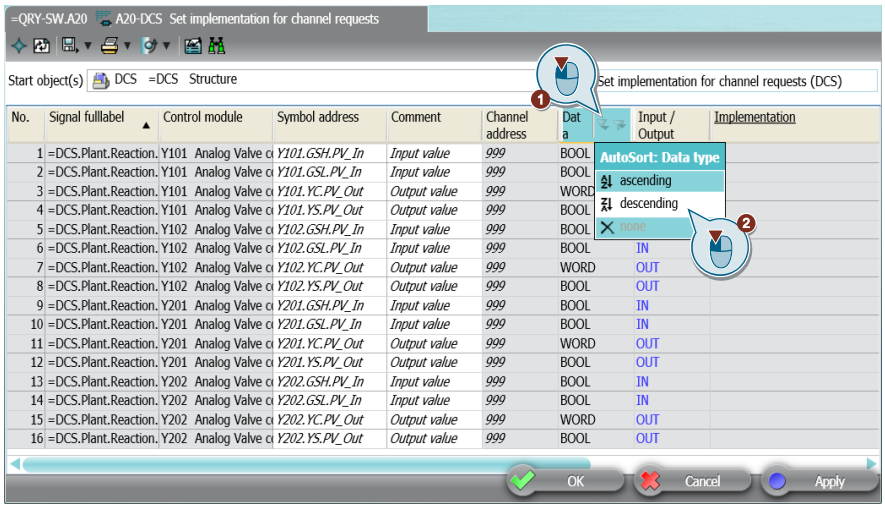
7. Sort the column "Data type" in "descending" order.



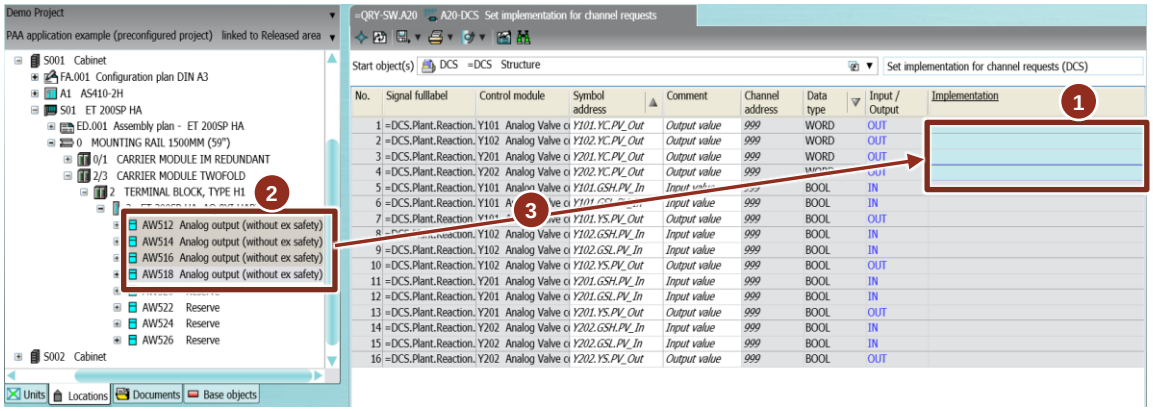
8. Sort the column "Input/ Output" "descending" and "symbol address" "ascending".
9. In the "Implementation" column, select the fields that have the value "OUT" in the "Input / Output" column.

Note

For fast selecting:

1. Click on the first field of the column.
2. Hold down <Shift> and click on another field in the column.
   This selects all the fields between the two.

10. Select four analog inputs of the analog output module and drag & drop them onto the selected fields in the "Implementation" column of the query.



11. Click on the "Apply" and "OK" buttons to save the changes and to close the query.

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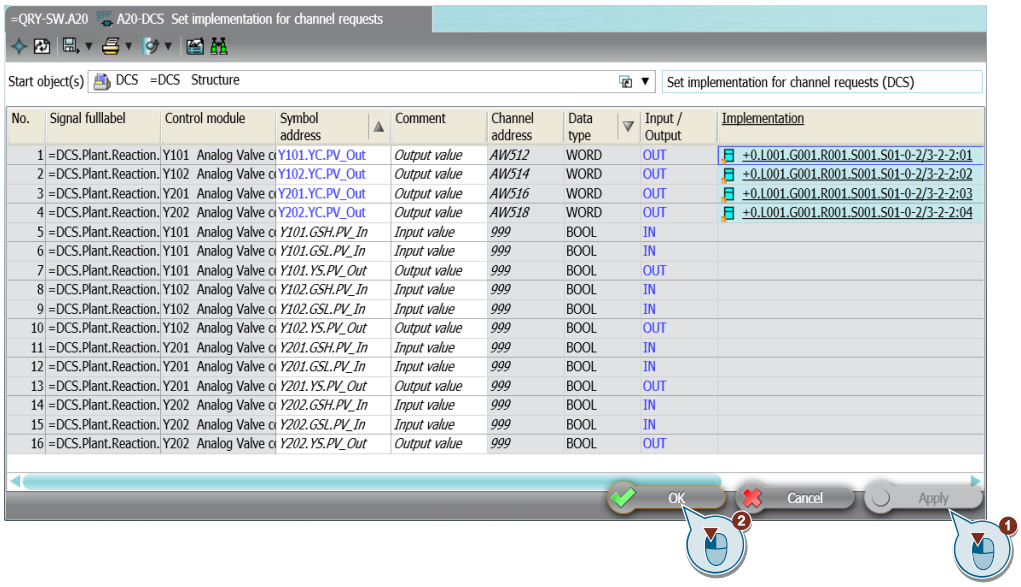

No.	Signal fulllabel	Control module	Symbol address	Comment	Channel address	Data type	Input / Output	Implementation
1	=DCS.Plant.Reaction.	Y101 Analog Valve c	Y101.YC.PV_Out	Output value	AW512	WORD	OUT	+0.L001.G001.R001.S001.S01-0-2/3-2-2:01
2	=DCS.Plant.Reaction.	Y102 Analog Valve c	Y102.YC.PV_Out	Output value	AW514	WORD	OUT	+0.L001.G001.R001.S001.S01-0-2/3-2-2:02
3	=DCS.Plant.Reaction.	Y201 Analog Valve c	Y201.YC.PV_Out	Output value	AW516	WORD	OUT	+0.L001.G001.R001.S001.S01-0-2/3-2-2:03
4	=DCS.Plant.Reaction.	Y202 Analog Valve c	Y202.YC.PV_Out	Output value	AW518	WORD	OUT	+0.L001.G001.R001.S001.S01-0-2/3-2-2:04
5	=DCS.Plant.Reaction.	Y101 Analog Valve c	Y101.GSH.PV_In	Input value	999	BOOL	IN	
6	=DCS.Plant.Reaction.	Y101 Analog Valve c	Y101.GSL.PV_In	Input value	999	BOOL	IN	
7	=DCS.Plant.Reaction.	Y101 Analog Valve c	Y101.YS.PV_Out	Output value	999	BOOL	OUT	
8	=DCS.Plant.Reaction.	Y102 Analog Valve c	Y102.GSH.PV_In	Input value	999	BOOL	IN	
9	=DCS.Plant.Reaction.	Y102 Analog Valve c	Y102.GSL.PV_In	Input value	999	BOOL	IN	
10	=DCS.Plant.Reaction.	Y102 Analog Valve c	Y102.YS.PV_Out	Output value	999	BOOL	OUT	
11	=DCS.Plant.Reaction.	Y201 Analog Valve c	Y201.GSH.PV_In	Input value	999	BOOL	IN	
12	=DCS.Plant.Reaction.	Y201 Analog Valve c	Y201.GSL.PV_In	Input value	999	BOOL	IN	
13	=DCS.Plant.Reaction.	Y201 Analog Valve c	Y201.YS.PV_Out	Output value	999	BOOL	OUT	
14	=DCS.Plant.Reaction.	Y202 Analog Valve c	Y202.GSH.PV_In	Input value	999	BOOL	IN	
15	=DCS.Plant.Reaction.	Y202 Analog Valve c	Y202.GSL.PV_In	Input value	999	BOOL	IN	
16	=DCS.Plant.Reaction.	Y202 Analog Valve c	Y202.YS.PV_Out	Output value	999	BOOL	OUT	

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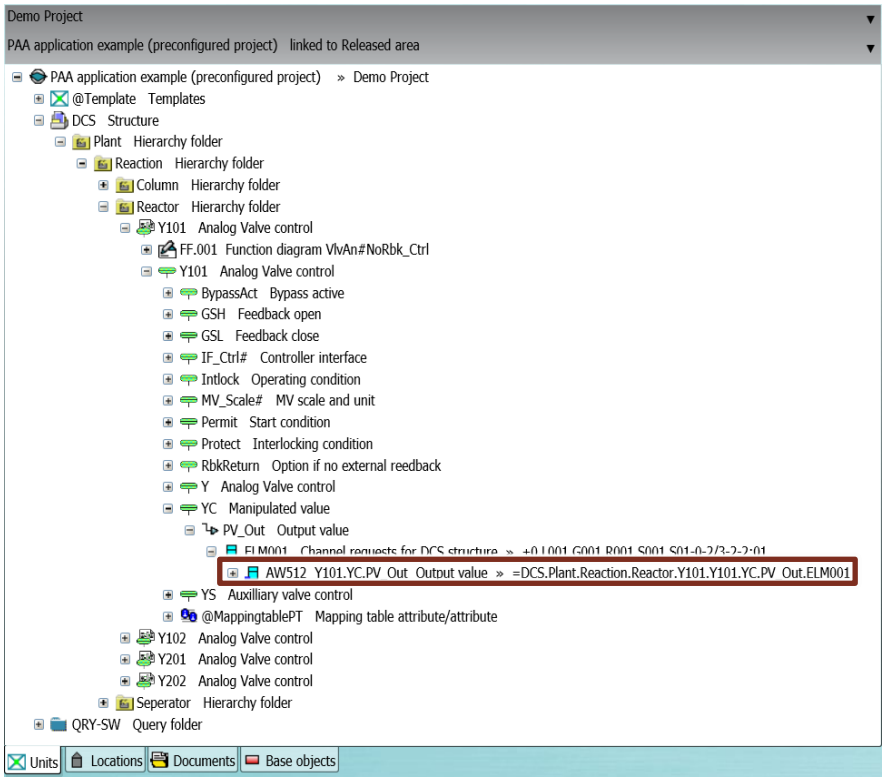
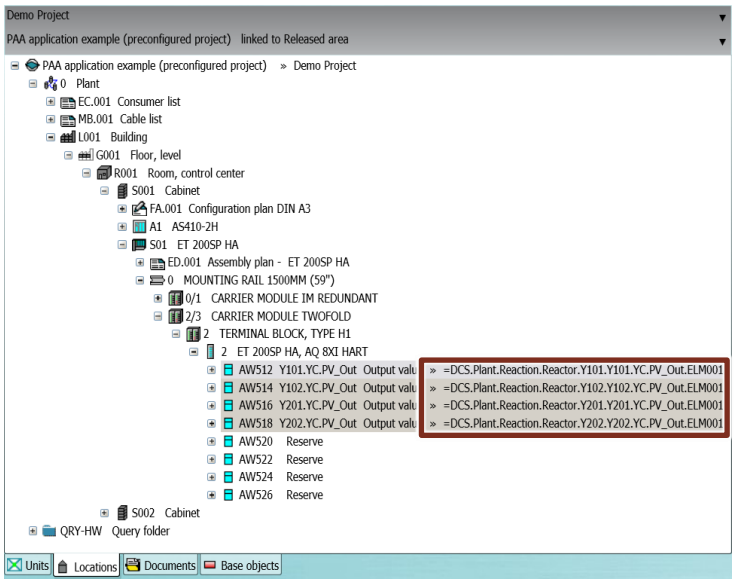
Result

You have thus assigned masses of channel requirements to the respective inputs and outputs of the IO components.

After you have implemented all the channel requests, a pointer is displayed in the signal planner next to the channel for each of the respective DP slaves.



After implementation, the channels for the components in the "Locations" view look like this:



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3.7 Use "Excel Import"

With the "Excel Import" function, data is imported into PAA and automatically created in large quantities.

The following data can be created *en masse* with the function:

- Plant hierarchy
- CMs
- Signals (connections)
- Hardware

Note A detailed description of the Excel import can be found in the FAQ. "How do you import the technological hierarchy, measuring points (CMs) and hardware into the SIMATIC PCS 7 Plant Automation Accelerator (PAA) using Excel Import?".

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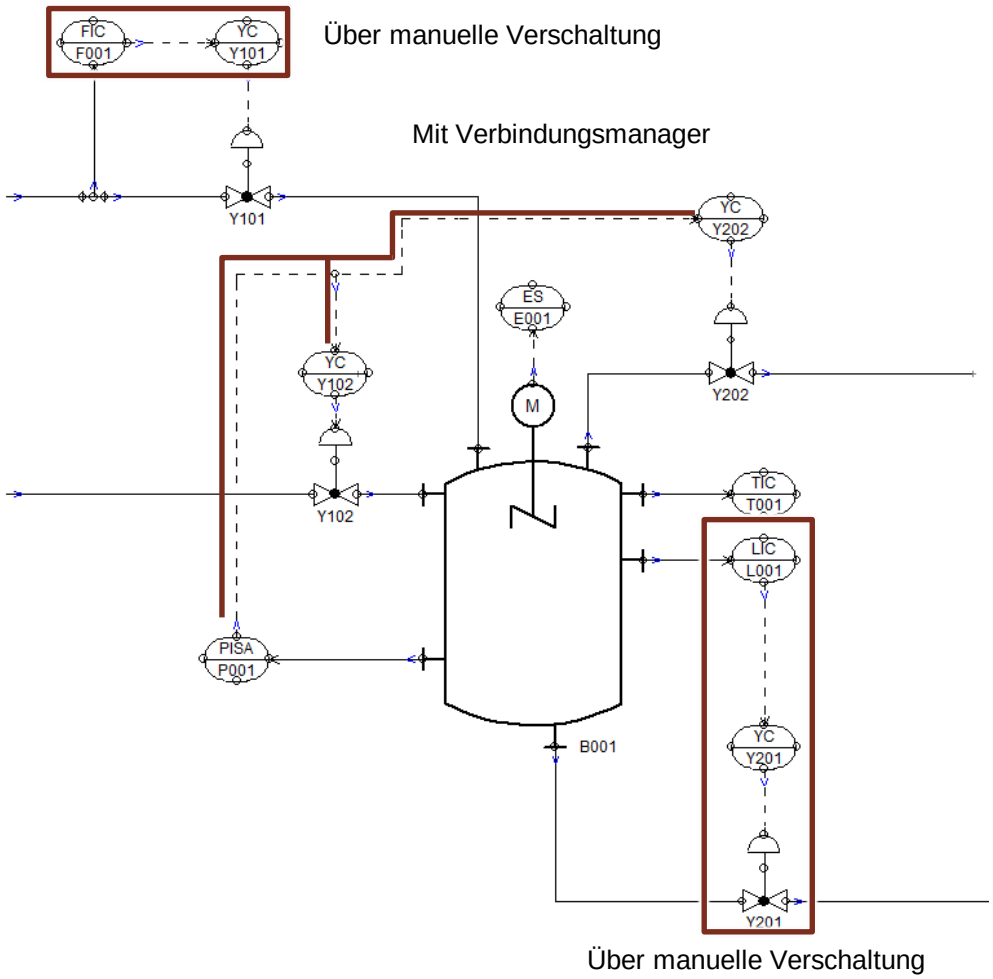
3.8 Interconnections between CMs (parameter interconnections)

This section describes how to create connections between CMs in PAA.

There are two options for this:

- Right-click for manual connection
- "Connection Manager".

In the case of the example project, create the following connections:



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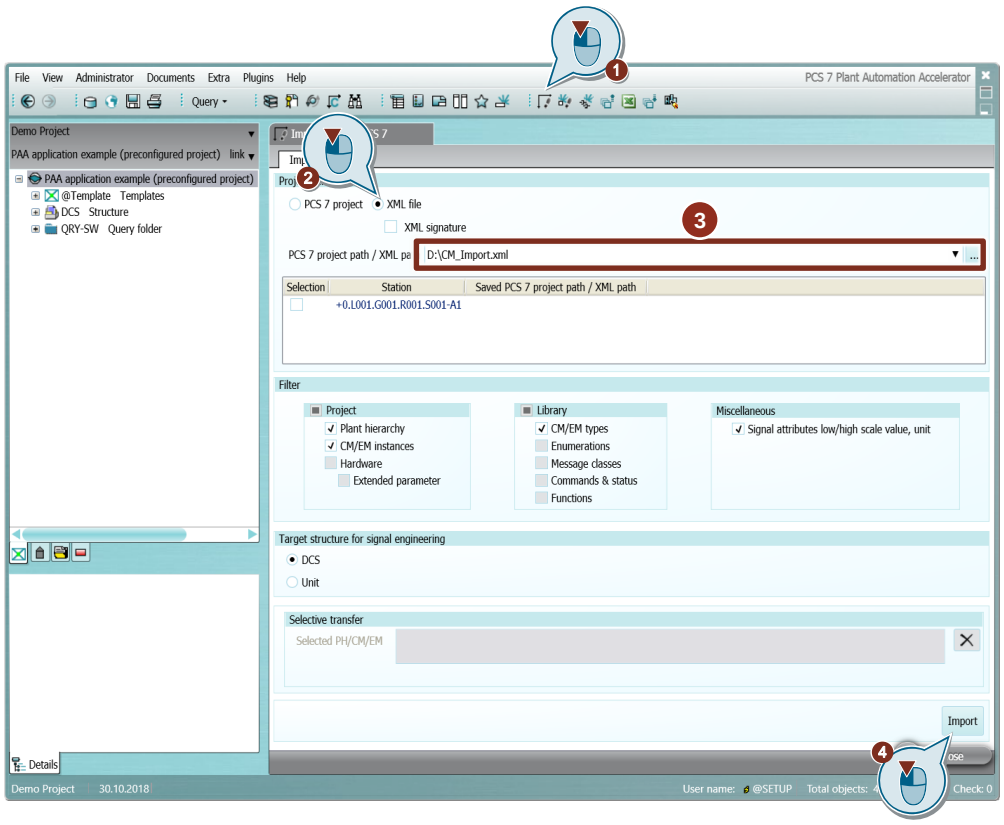
Import the CMs "F001", "P001" and "L001".

1. Open the "Import/Export PCS 7" dialog
2. Open the "Import" tab.
3. Select option "XML file"
4. Select the supplied XML file "CM_Import".
   The filters are then automatically selected.
5. Click on "Import".



6. In the "Data transfer - Generate/Import" window, click the button , to start the import from the XML file to PAA.

Note

For more information on importing data to PAA, refer to the section 3.2 Import PCS 7 to PAA

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3.8.1 Manual interconnection

This section describes how to create connections between CMs in PAA (via right mouse button) manually.

In the example project, the connections between the CM "F001" (flow measurement) and the valve "Y101" are to be created.

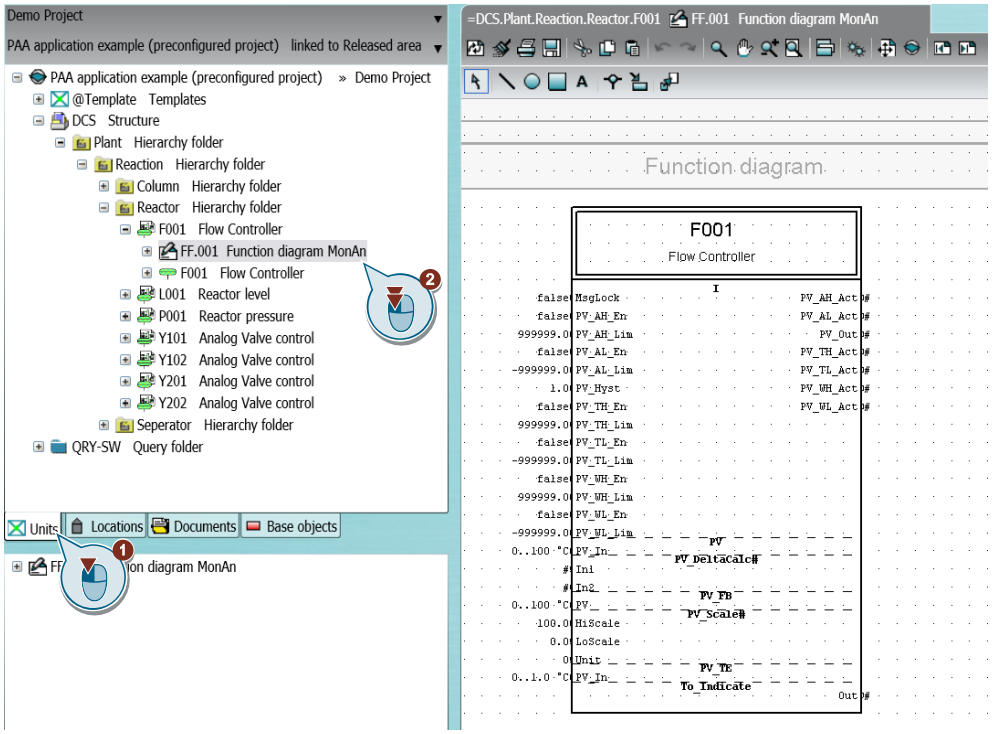
In addition, you should create connections between the CM "L001" (level measurement) and the valve "Y201".

1. To do this, open the "Units" view.
2. Navigate to the "F001" CM and open the subordinate objects.
3. Double-click to open the respective "Function diagram".

   This shows the logic of the CM.

   All the in- and outputs of the CM present in the technological connections are displayed here.

   Furthermore, the following are displayed on the connections to the hardware or other CMS.



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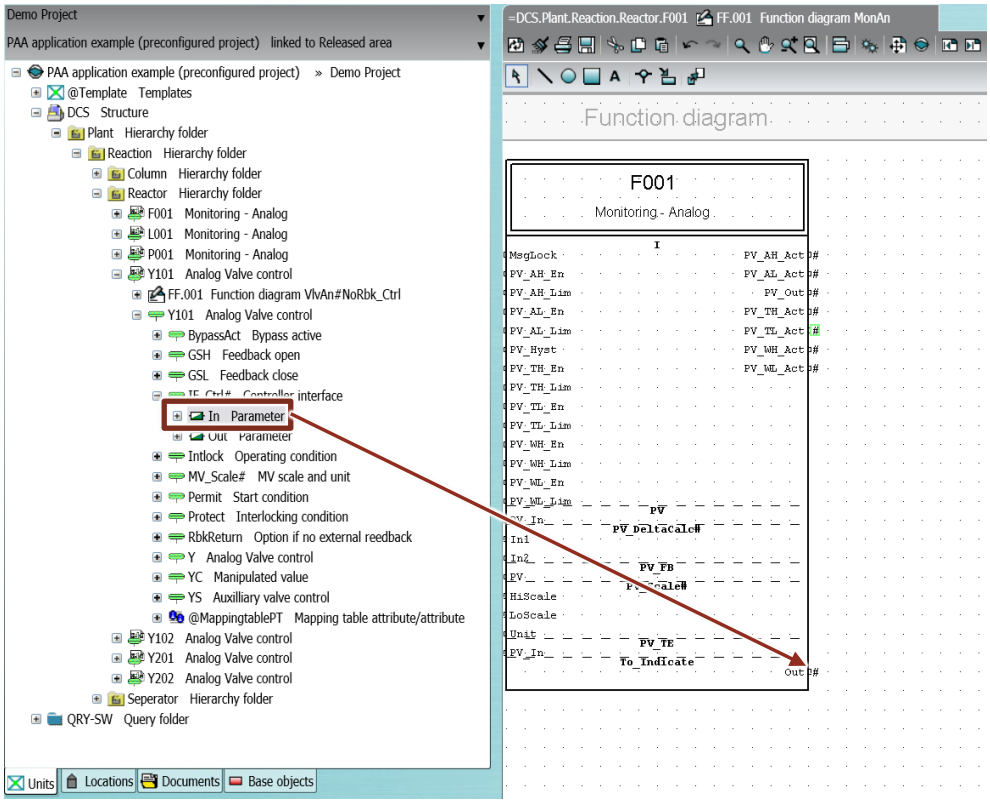
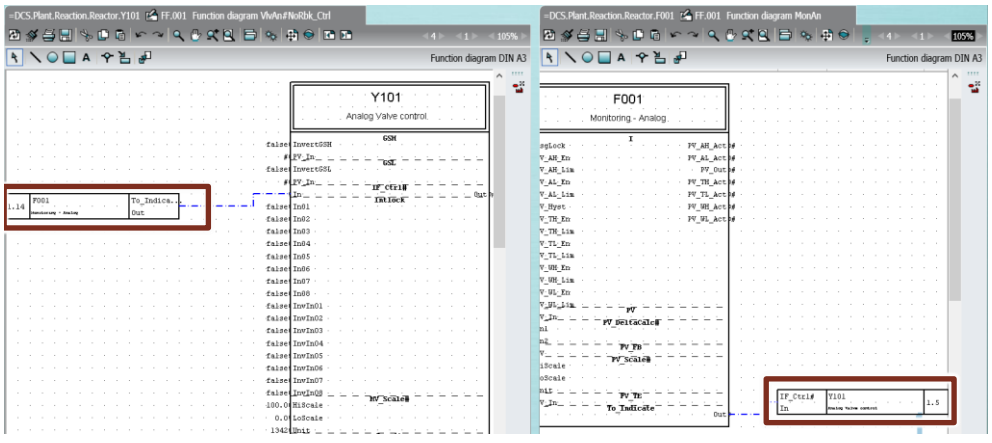
4. Navigate to CM "Y101" and open the subordinate objects.
5. Open the subordinate objects of the "IF_Ctrl#" module.
6. Drag and drop the "In" input onto the "Out" output of the "To_Indicate" block on the open "Function diagram".



You have now created a connection between the CMs.

This is represented by a connection flag.



7. Save the changes and close the function diagrams.

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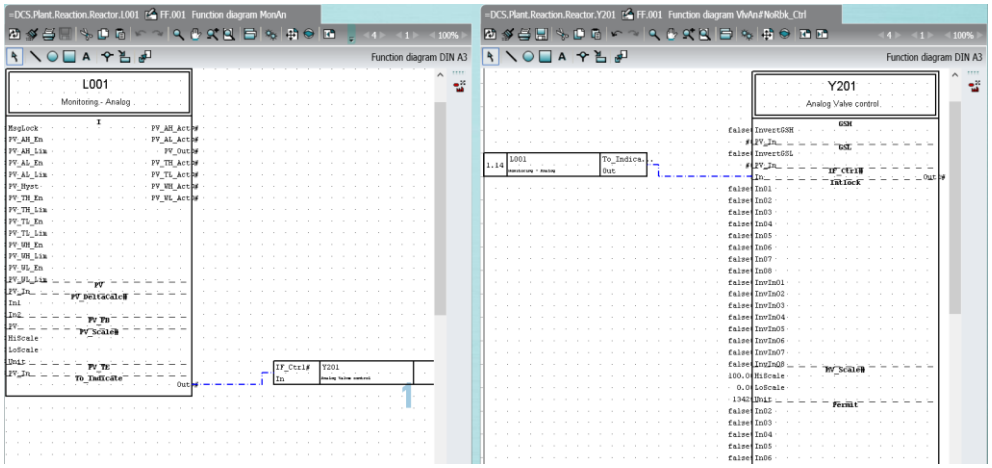
8. Connect the same connections of the "L001" and "Y201" CMs to each other.



9. Save the changes and close the function diagrams.

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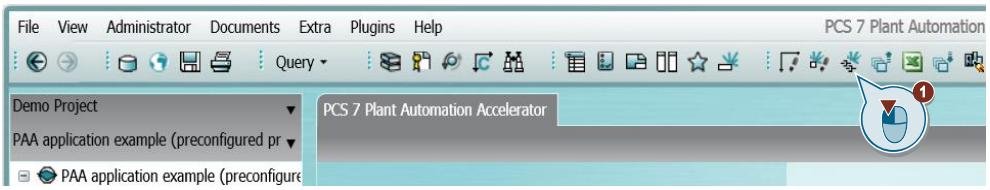
3.8.2 Interconnections via Connection Manager

This section shows how to use the plug-in "Connection Manager" to create your connections.

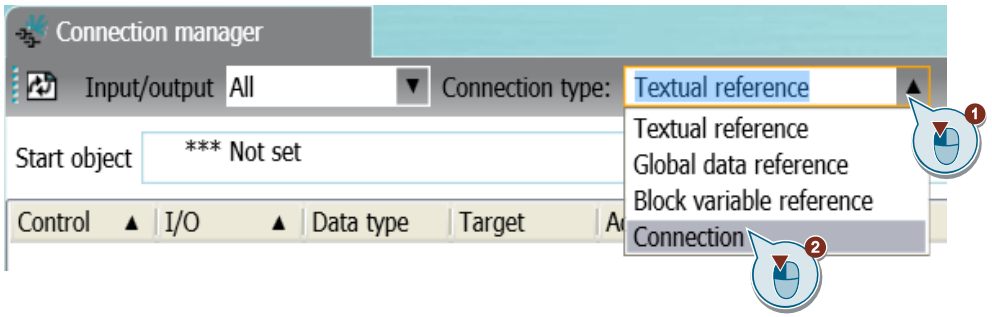
In the example project, use the "Connection Manager" to create connections between the CM "P001" (the pressure gauge) and the CMs "Y102" and "Y202".

1. To do this, open the plug-in "Connection Manager" via the PAA menu bar.
   Click on the "Connection Manager" button:



2. Change the "Connection Type" from "Textual reference" to "Connection".

This way, all input connections of the respective start object are displayed.



3. Navigate to CM "Y102" in the "Units" view.
4. Drag and drop the CM "P001" into the field "Start object" of the "Connection manager".
   Now all the inputs of the "Y102" CM are shown.

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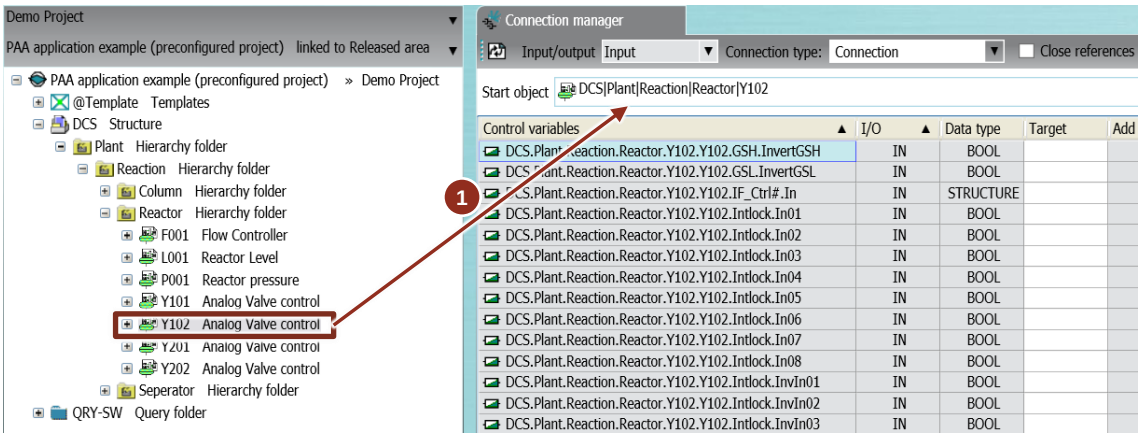
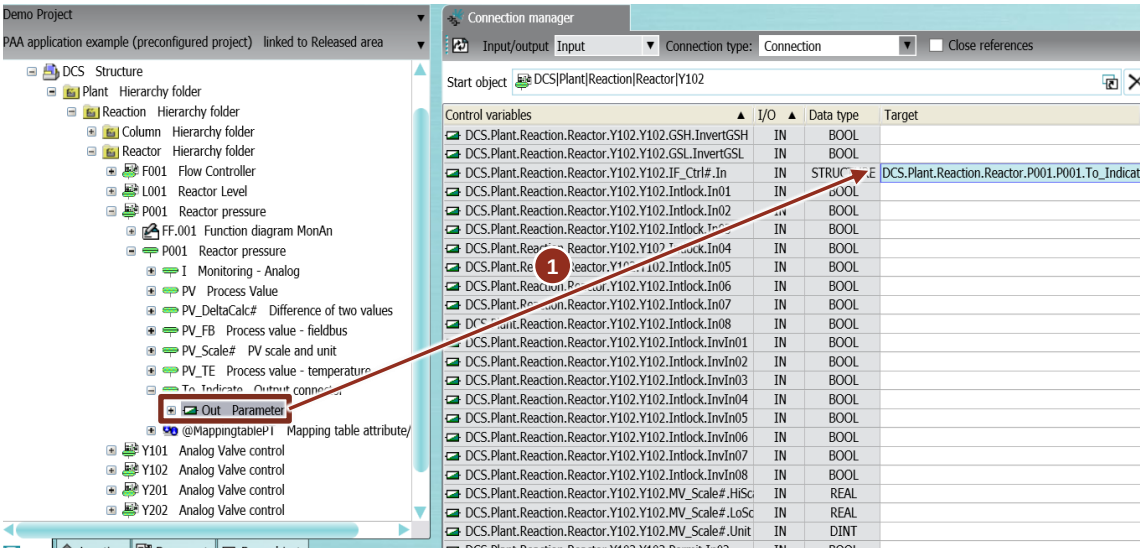


5. In the "Units" view, navigate to CM "P001" and open the subordinate objects.
6. Open the subordinate objects of the "To_Indicate" block.
7. Drag and drop the "Out" output into the "Target" field of input "Y102.IF_Ctrl#.In".



8. Navigate to the CM "Y202" and drag & drop it into the field "Start object" of the "Connection manager".
9. In the "Units" view, navigate to CM "P001" and open the subordinate objects.
10. Open the subordinate objects of the "To_Indicate" block.
11. Drag and drop the "Out" output into the "Target" field of input "Y202.IF_Ctrl#.In".

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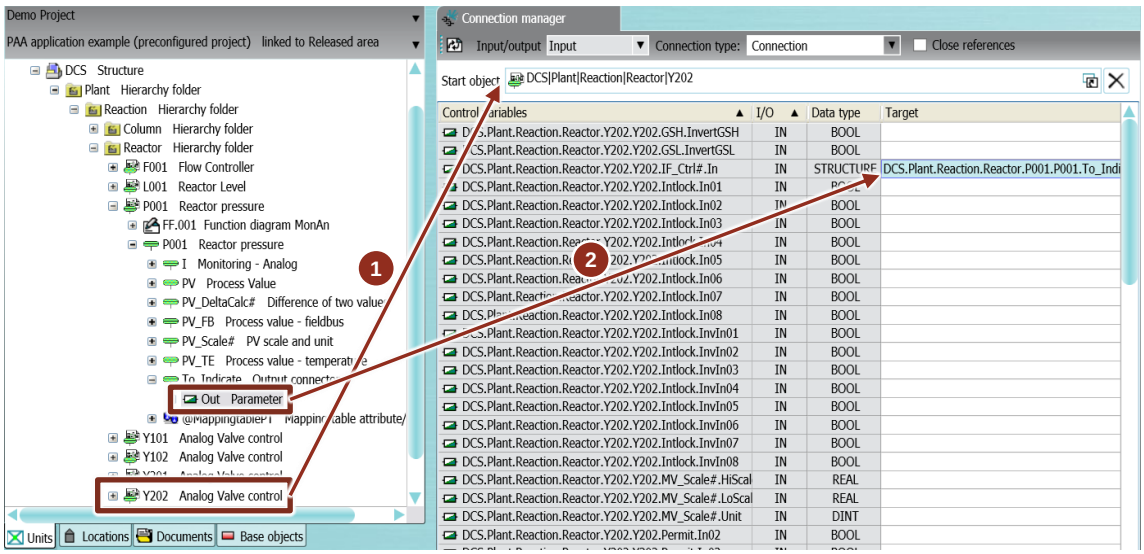
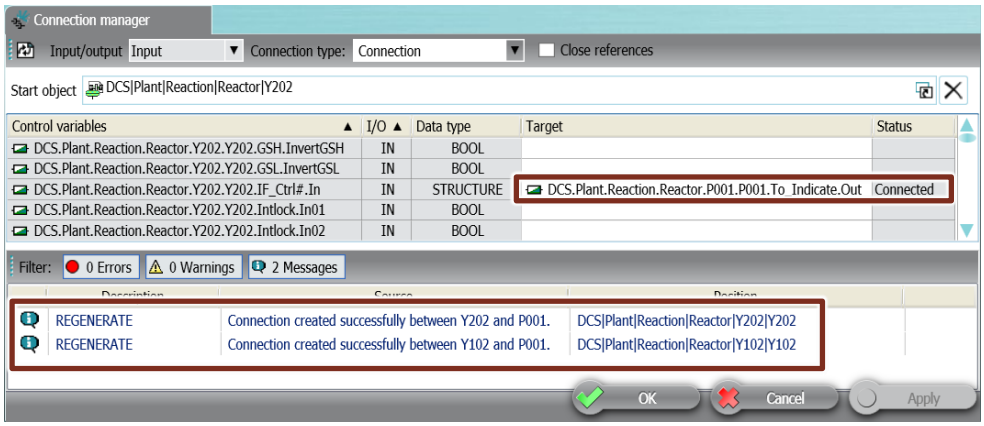


12. In the "Connection Manager", click on the "Apply" button in order to generate. During the process, a log is generated and displayed and the connections are created in the logic diagrams.

    Once the connections have been carried out, they are designated as connected.



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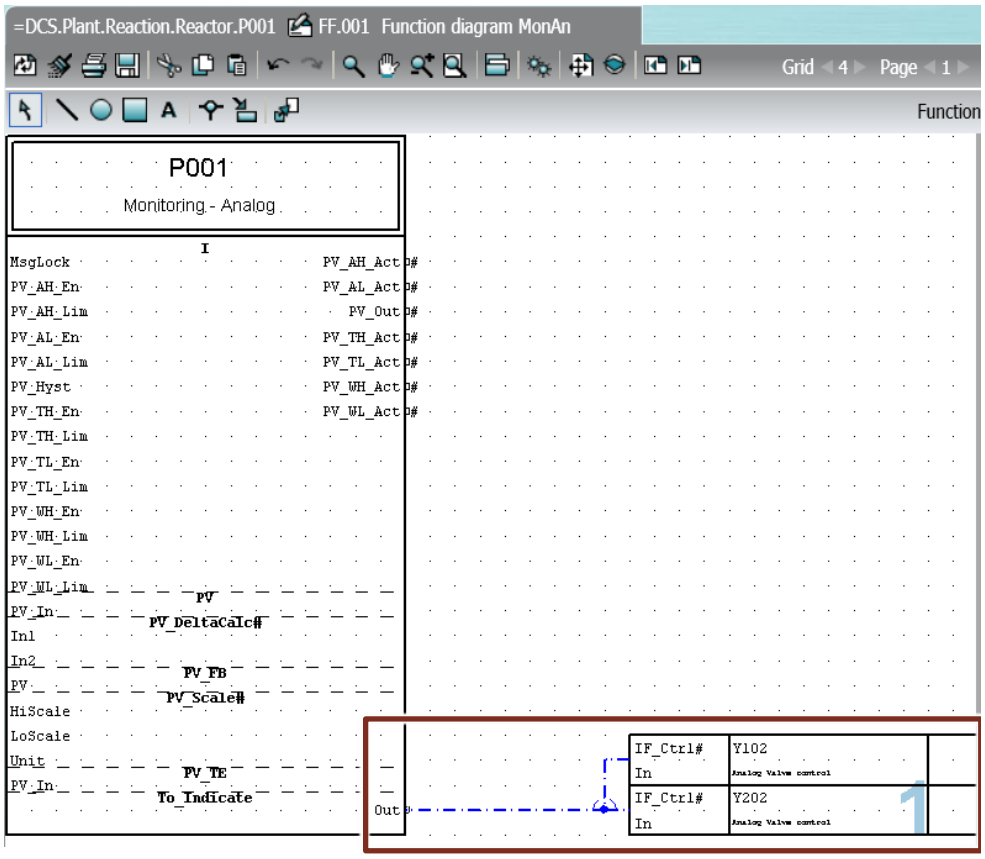
The connections are created automatically in the function diagrams and are correspondingly designated.



13. Click on the "Save" button in the PAA menu bar to save the changes.
14. Close the "Connection manager" and the logic diagrams.

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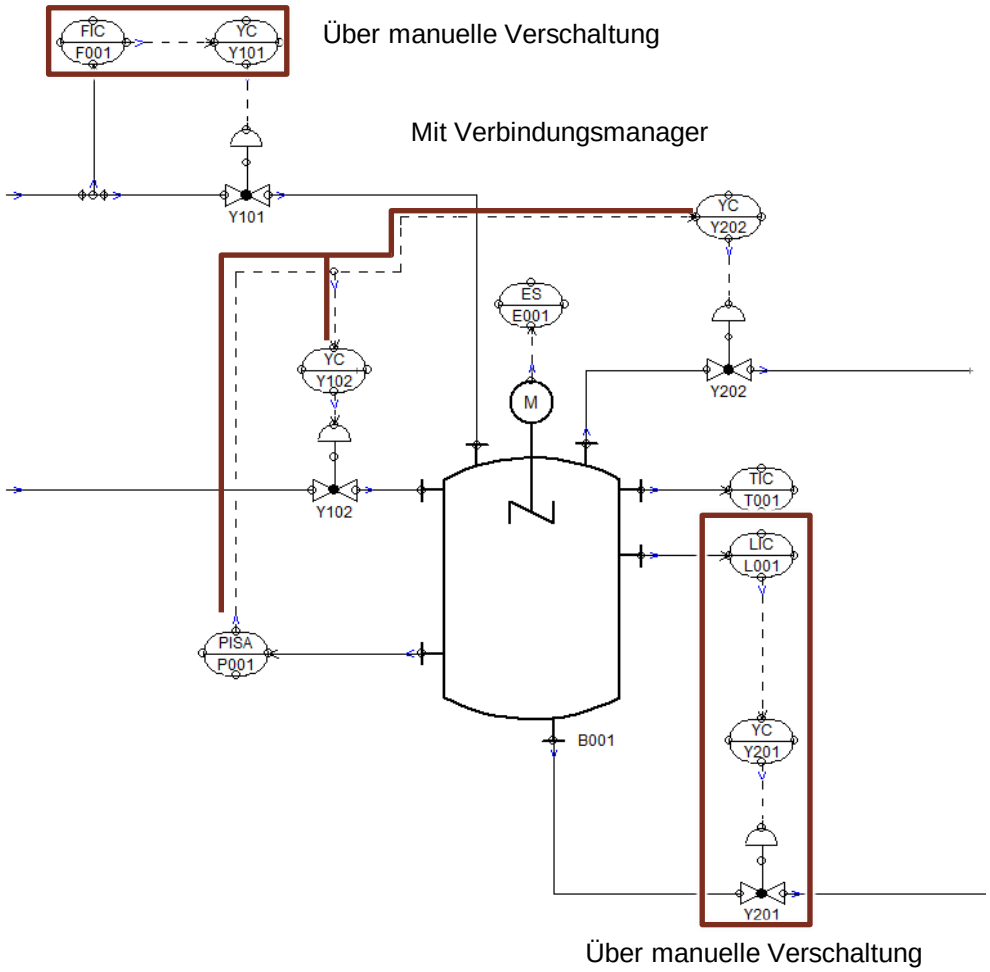
Result

You have become acquainted with different possibilities of connection creation in PAA and thus created the following connections between the CMs.



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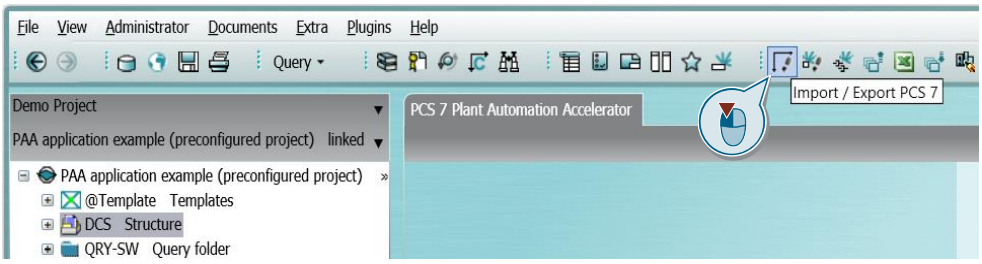
3.9 Exporting from PAA to PCS 7

This section describes how to export the PAA-project data to SIMATIC PCS 7 so that the following data is automatically generated in the PCS 7-project:

- Plant hierarchy
- Control modules
- Equipment modules
- Hardware components
- Interconnections

First transfer the library data from PAA to PCS 7.

1. To do this, in the PAA menu bar click on the "Import/Export PCS 7" .



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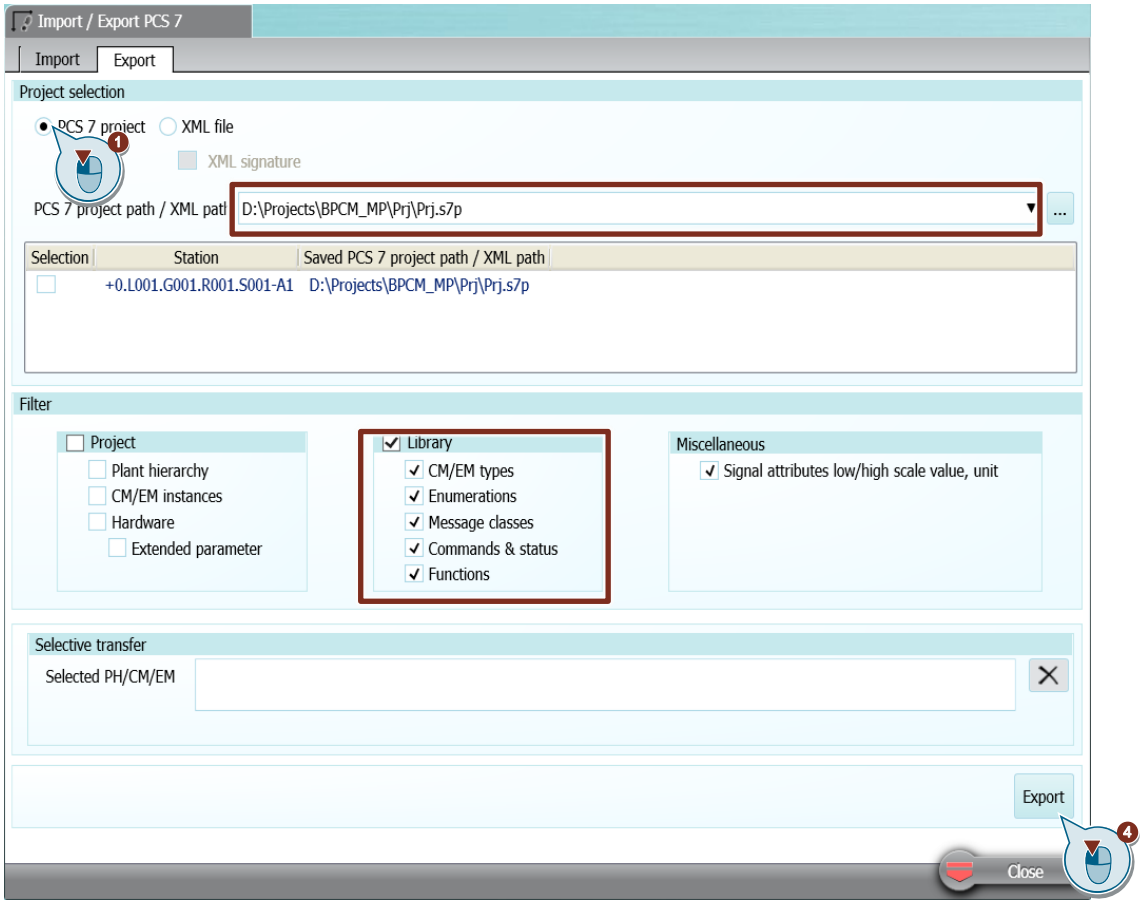
The "Import/Export PCS 7" dialog opens.

2. Open the "Export" tab.
3. Set the export window as follows:
   - Select the PCS 7-project
   - "PCS 7-project path": Select the supplied PCS 7-project
   - "Filter": Deactivate all selection boxes under "Project" and activate all selection boxes under "Library"
4. Click "Export".

PAA then automatically checks for differences between the PCS 7-project and the PAA-project and displays them clearly.



5. Transfer the data from PAA to PCS 7 as described in Importing from PCS 7 to PAA.

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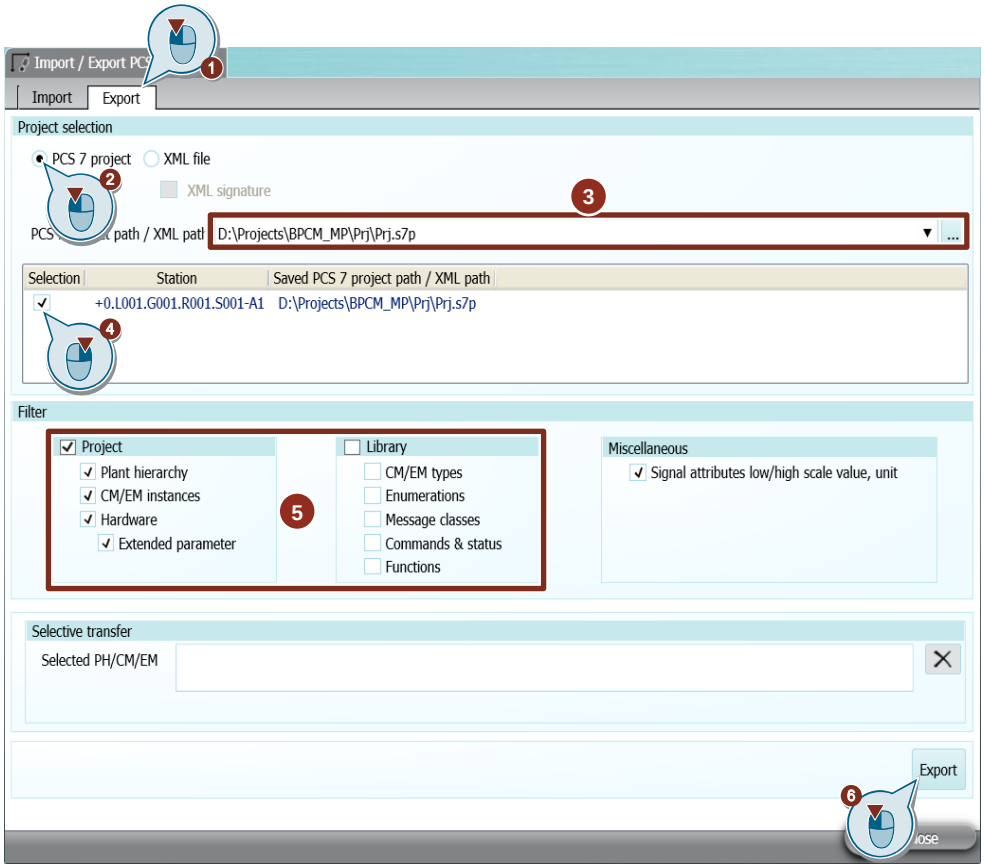
In the next step, transfer the remaining data from PAA to PCS 7.

6. Select the check box for Station "A1".
7. In the "Filter" directory you can state which data are to be exported and which are to be created.
   In the case of the sample project, activate all the option boxes under Project:
8. Click on the "Export" button.

   PAA then automatically checks for differences between the PCS 7-project and the PAA-project and displays them clearly.



Result

The data from the PAA-project have been successfully exported into, and automatically generated in the PCS 7-project.

The following data have been created:

- Plant hierarchy
- CMs
- Versions
- Hardware (AS, ET 200SP HA, I/O components)
- Interconnections

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3.10 Change management / Data comparison

This section describes how to compare changes between projects.

In the case of the application example, make changes in the PCS 7-project and compare the changed data with the PAA-project.

Also make exemplary changes in the PAA-project and compare them with the PCS 7-project.

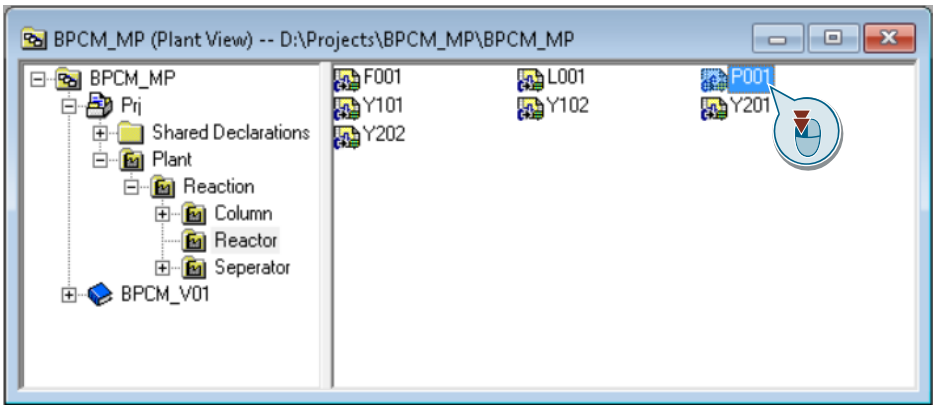
3.10.1 Changing PCS 7-project data and comparing them with PAA

This section describes how to synchronize the changes in the PCS 7-project with the PAA-project.

On the one hand, you must change CM "P001" parameter values, and on the other hand you should create a standard function in PCS 7, which you can then use in PAA to create locking logic.

Changing parameter values

1. Open the CM "P001" in the PCS 7-project with a double click.



2. Change the following parameter values in block "I":

Parameter input	New value
"PV_AH_Li"	15
"PV_WH_Li"	12
"PV_AL_Li"	3
"PV_AL_Li"	1

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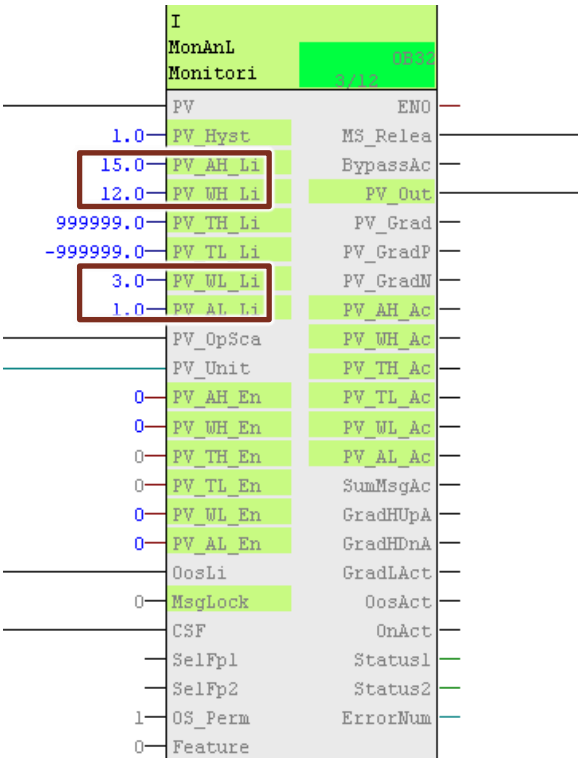

Close the CM.

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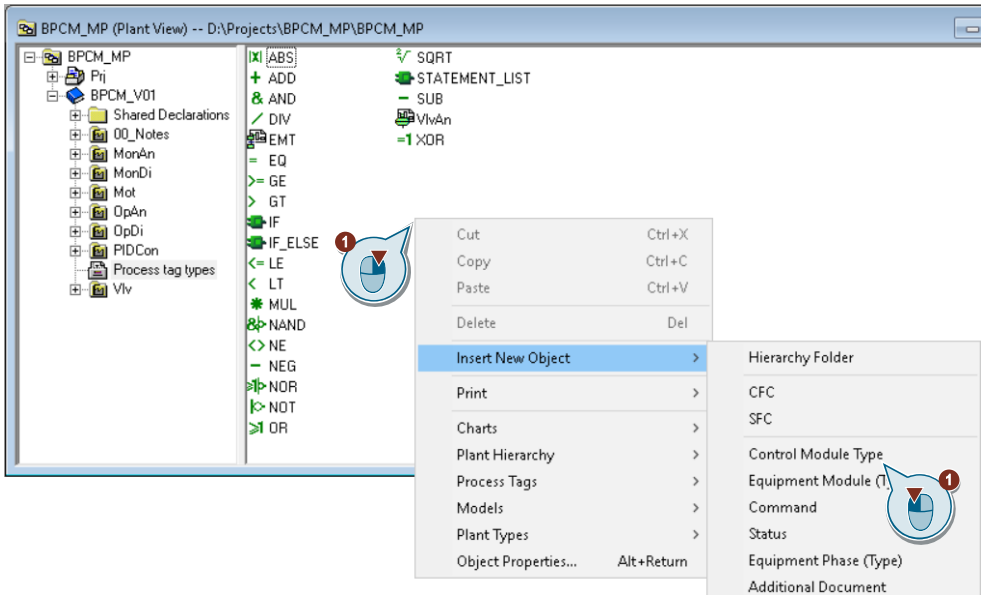
Creating Standard function

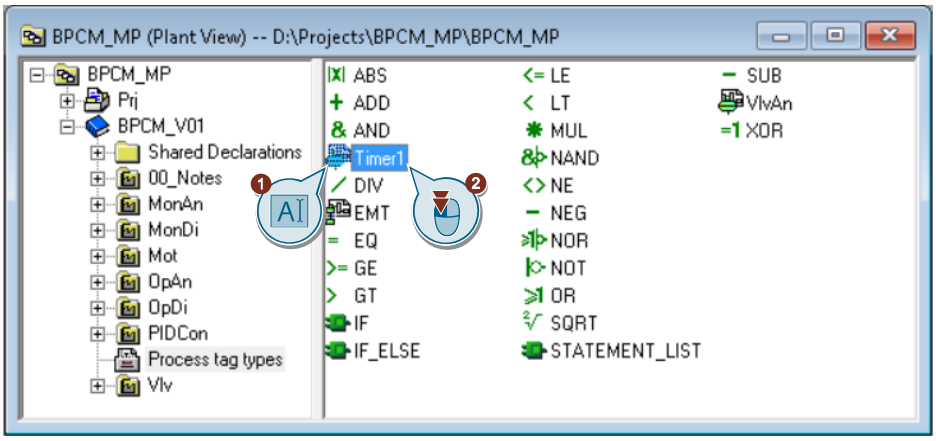
1. In the "Plant View" of the PCS 7-project, navigate to the "Process tag types" folder.

   Create a new CMT in the "Process tag types" folder.

2. To do this, right-click in the folder to open the corresponding context menu and click on the entry: "Insert New object > Control Module Type".



3. Rename the CMT to "Timer1".
4. Open the "Timer1" CMT with a double click.



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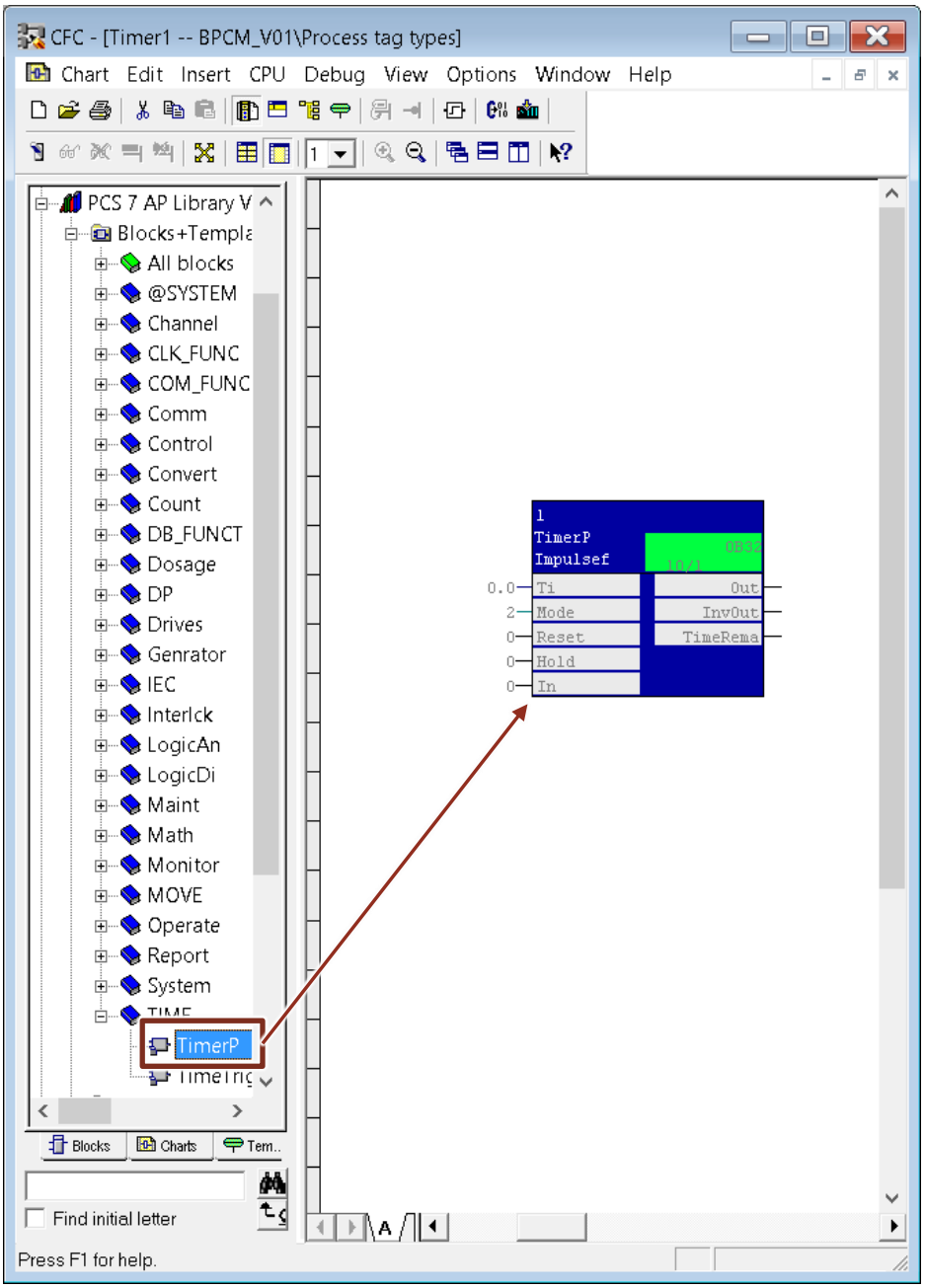
5. Drag and drop the "TimeP" block from the "PCS 7 AP Library V90" onto the plan.



6. Click on the "Technological Connections" button in the menu bar of the CFC Editor.

   The "Technological Connections" window opens.
   Here you can define and configure the CMT connections.

   In the chart the module has the name "1". Change the name in accordance with the name of the CMT.

7. To do this, select the "Timer1" object in the "Technological connections".

   The associated attributes (with their attribute values and assignments) of the object are displayed in the attributes area of the technological connections.

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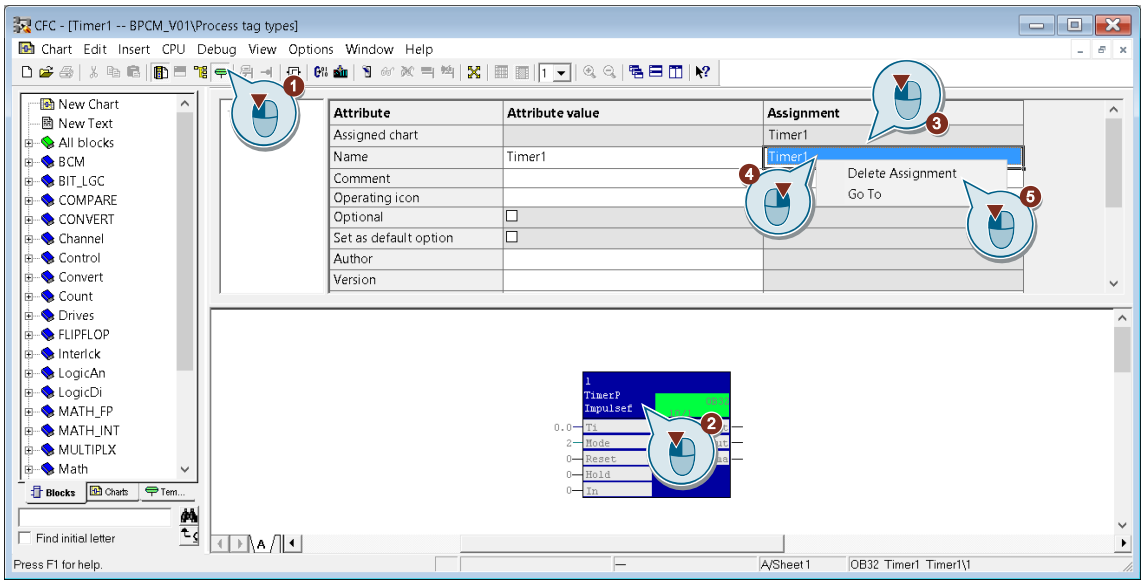
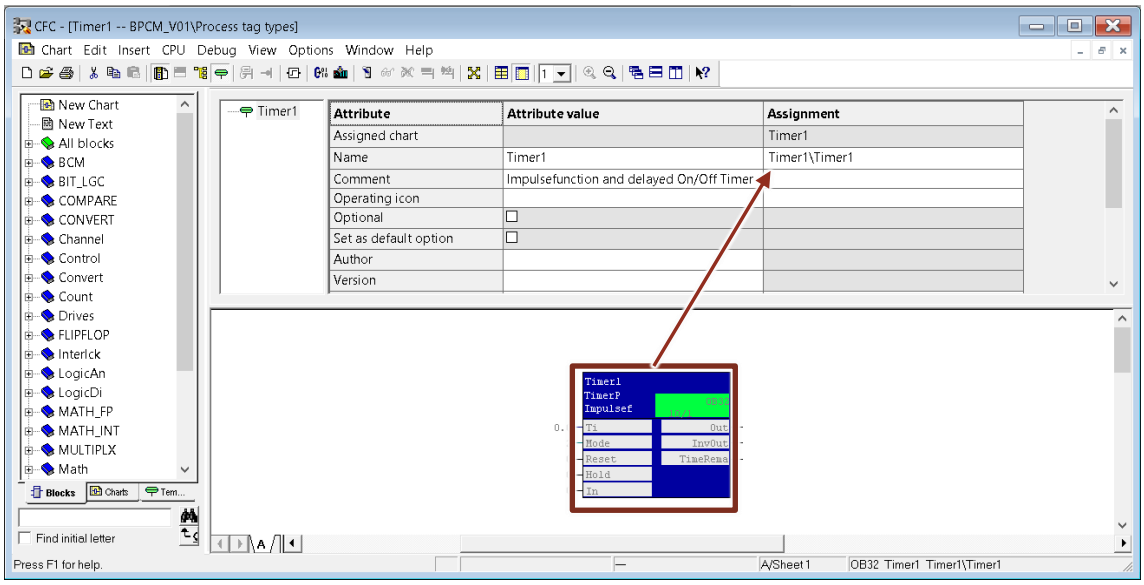
8. Delete the preset entry from the field for name assignment.
9. To do this select the field with a click.
10. Right-click on the associated context menu to open it and then click on the entry "Delete Assignment".



11. Select the module in the chart and drag & drop it into the field for the name assignment of the object "Timer1".

    This way you have defined that the module name depends on the name of the CMT.
12. Press<F5> to update the data in the chart.



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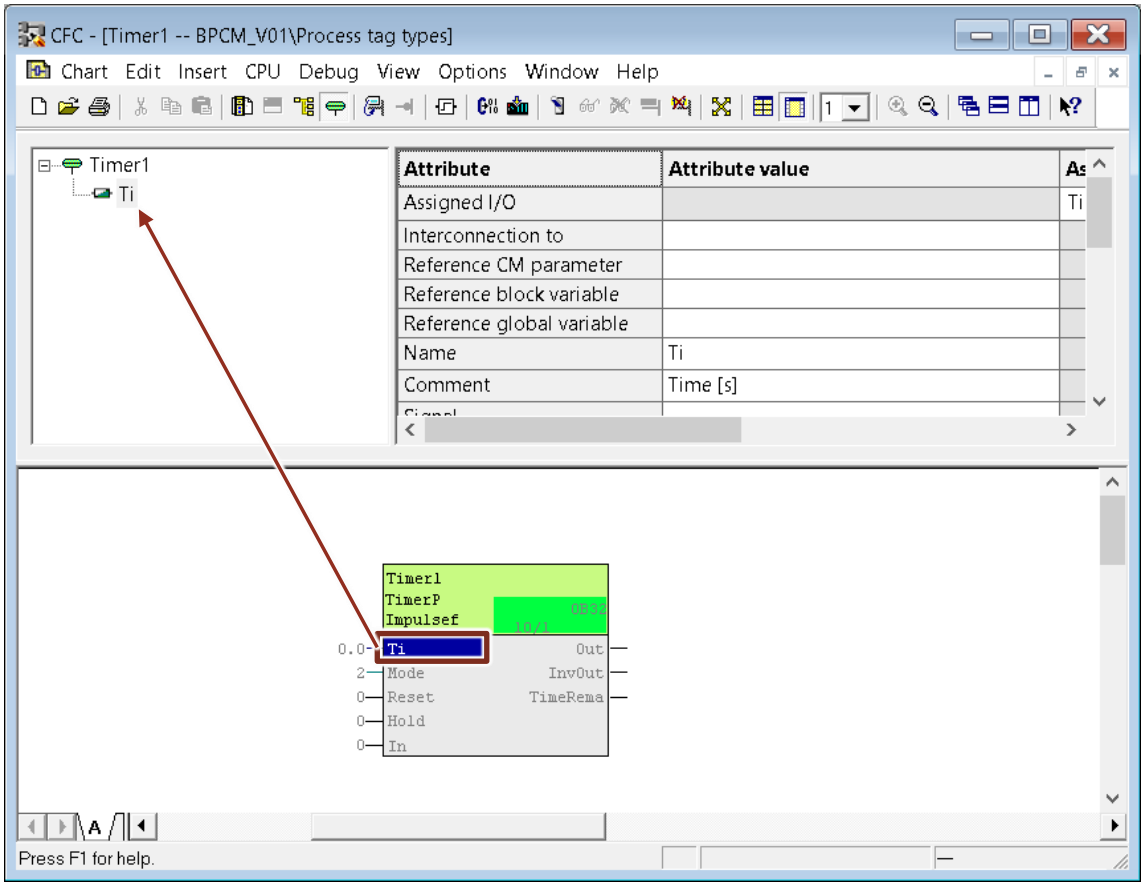
13. Select the "Ti" input of the "Timer1" module and drag and drop it to the "Timer1" object in the "Technical Connections".

    This way a new input/control element is created.



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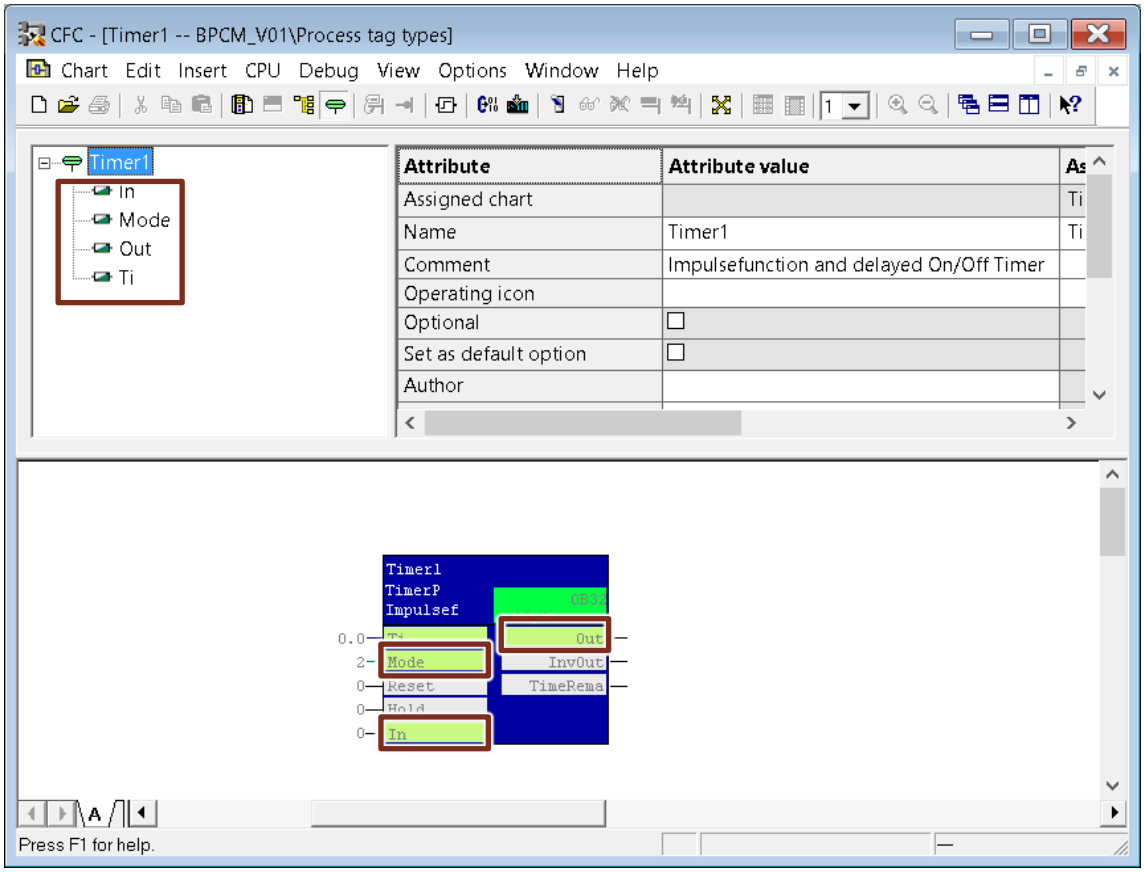
14. Create further connections for the CMT in the same way in the "Technological connections" under the block object "Timer1":
    - "Mode"
    - "In"
    - "Out"



If the in- and outputs are saved in the technological connections, these in and outputs are highlighted in green at the module.

Now define the CMT as standard function.

15. To do this, select the "Timer1" object in the technological connections.
16. Click on the attribute "Function" to activate it.
    You have thus defined the CMT as standard function
17. Press <F5> on your keyboard to update the data.

The Single Controller Type (CMT) icon changes to allow you to distinguish single controller types from standard functions.

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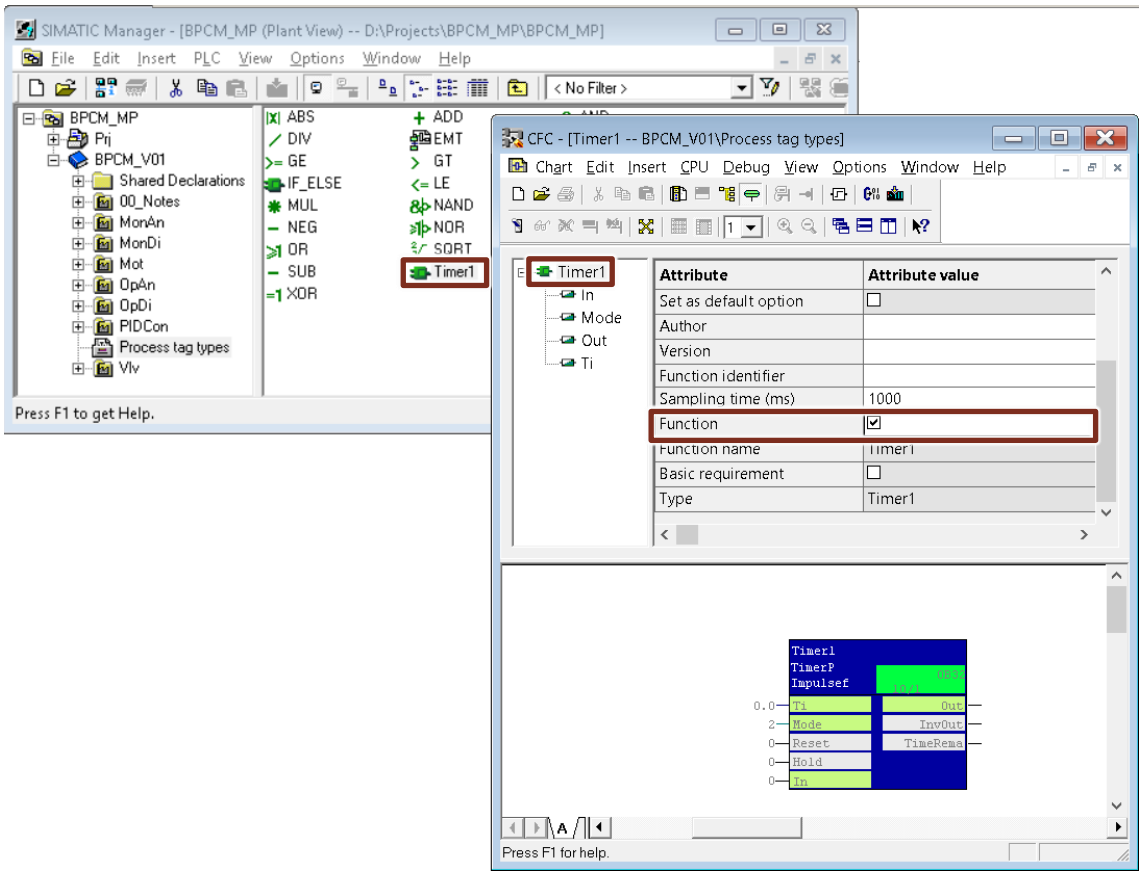

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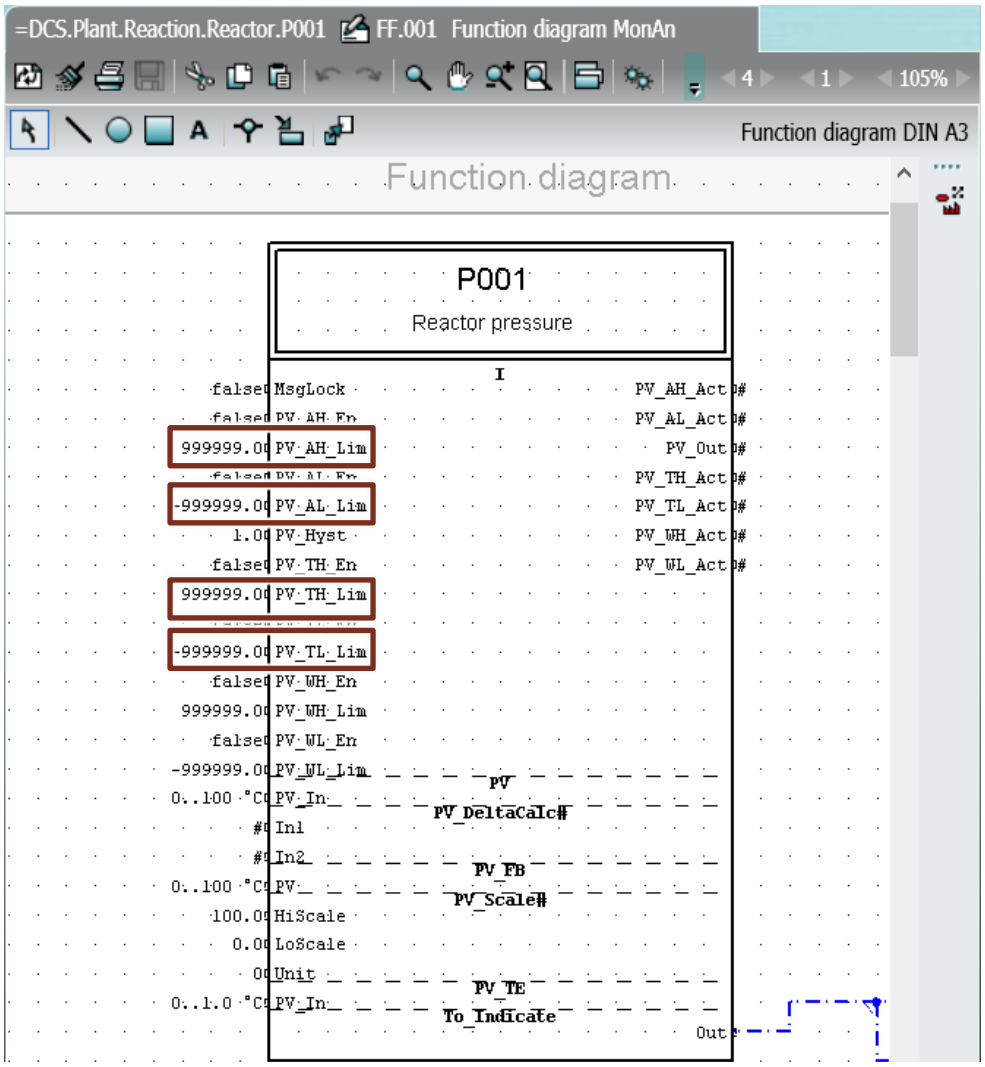
Comparison with PAA

1. Open the view "Units"in the PAA-project.
2. Navigate to "P001" CM.
3. Open the corresponding logic diagram with a double click ("Function diagram").

   Here you can see that the block's old parameter values are still present at the inputs. You should now synchronize and accept these with the PCS 7-project.



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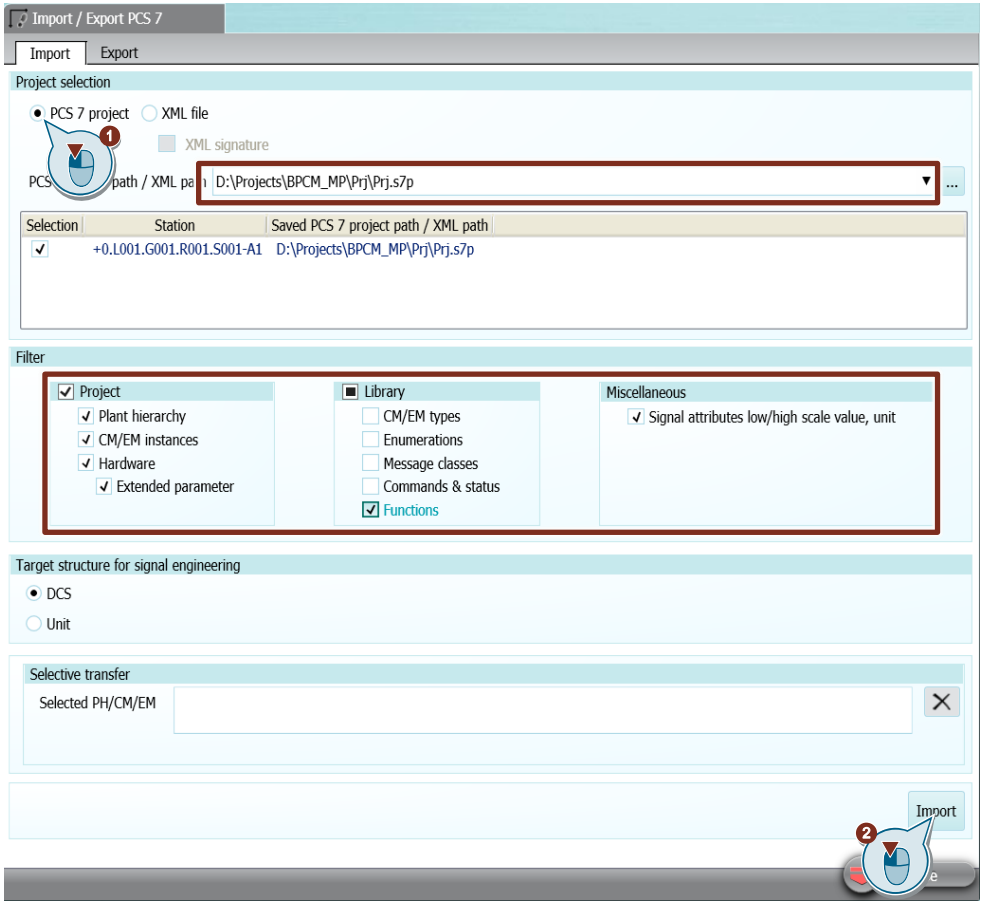
4. Close the logic diagram ("Function diagram").
5. For the matching, open the "Import / Export PCS 7" dialog.
   Click on the button "Import / Export PCS 7" in the PAA menu bar .
6. Open the "Import" tab.
7. Select the "PCS 7-project" option.
8. Select the PCS 7 sample project.
9. In the "Filter" directory, activate the following check boxes
   - "Plant hierarchy"
   - "CM instances"
   - "Hardware"
   - "Extended parameter"
   - "Functions"
   - "Signal attributes low/high scale value, unit"
10. Click on "Import".



11. Click on the button to start the data matching.

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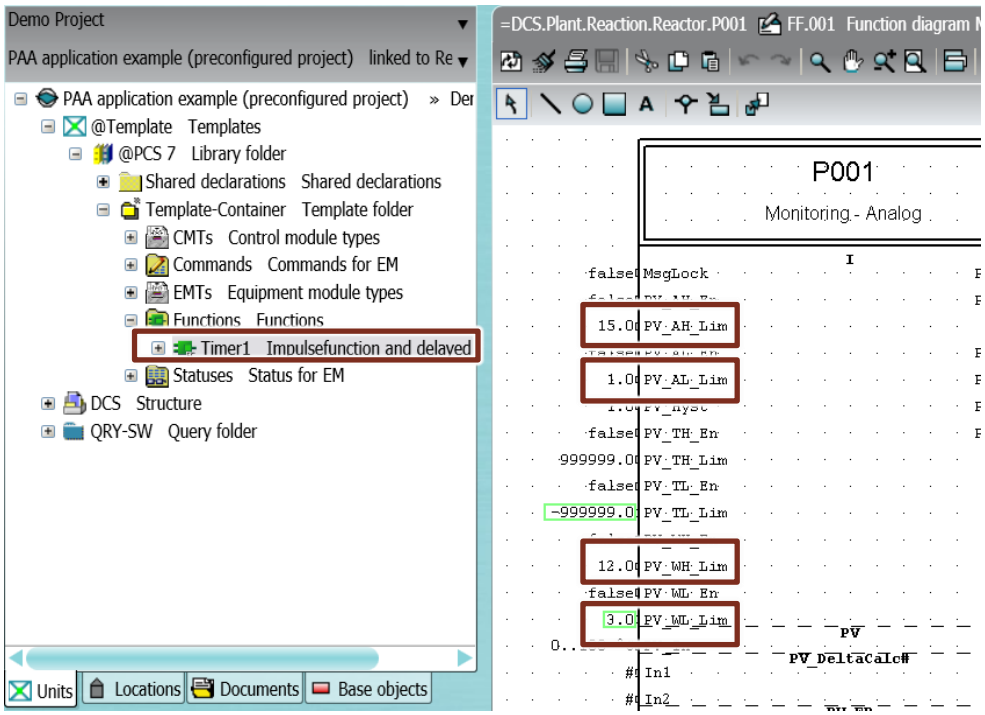
Result

The imported standard function was stored in the PAA-project in the "Units" view under the "@Template > @PCS 7 > Template Container > Functions" node.

In addition, the changed parameter values of the CM "P001" were transferred to the PAA-project and automatically updated at the corresponding point.



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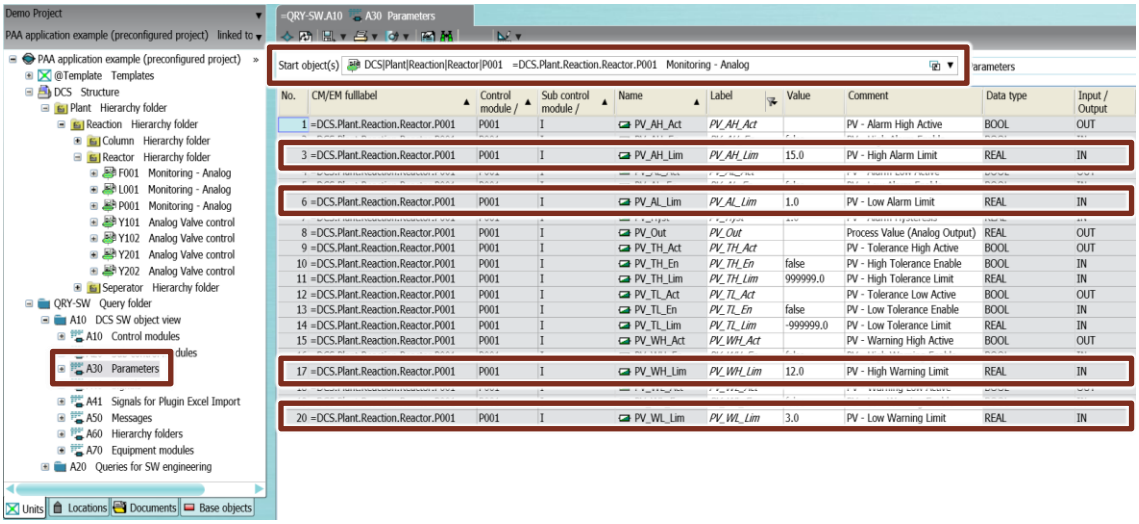
You can also display and change the parameters by parameter in a list. The PAA query "A30 Parameter" is available for this purpose. This displays all parameters below the start object, and can be filtered and adjusted.



So you have learned how to synchronize changes from the PCS 7-project with the PAA-project so that both projects are identical again.

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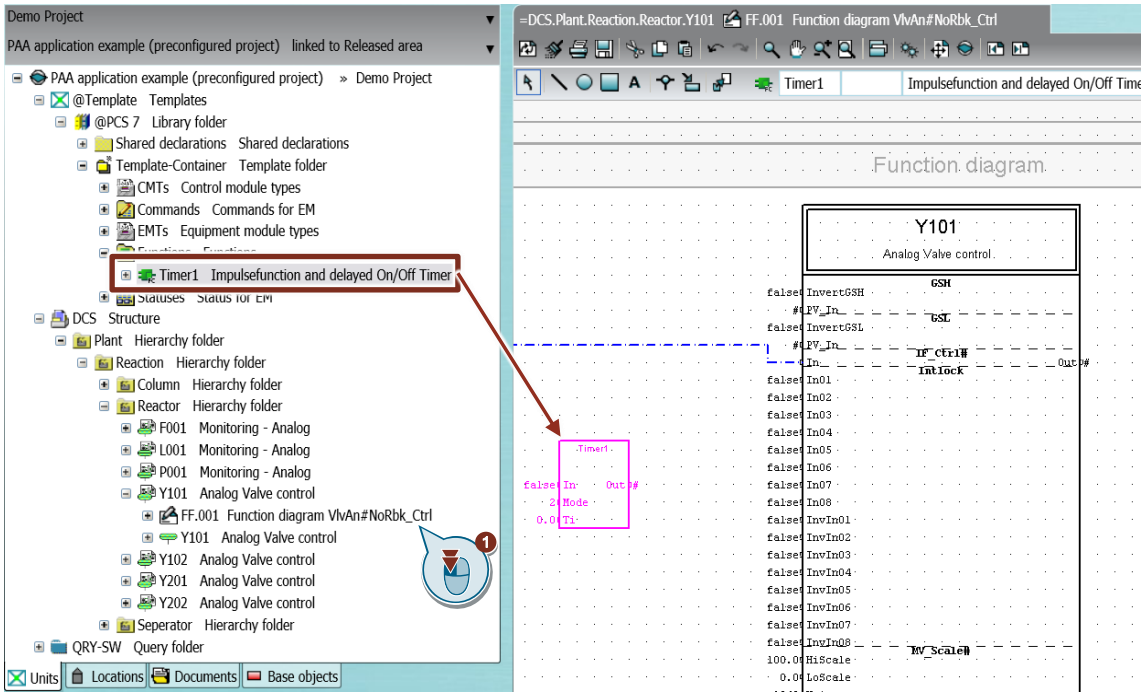
3.10.2 Creating an interlock system in PAA and matching with PCS 7

This section describes how to synchronize/accept changes in the PAA-project with the PCS 7-project.

In the PAA sample project, create a locking logic in the logic diagram ("Function diagram") of the CM "Y101" and then transfer it to the PCS 7-project so that both projects are identical again.

Creating an interlock system in PAA

1. Open the view "Units" in the PAA-project.
2. Navigate to the "Y101" CM.
3. Open the corresponding logic diagram ("Function diagram") with a double click.
4. In the function diagram create an example interlock system that does the following:
   - If the pressure gauge "P001" gives an alarm that the pressure in the reactor is too high, the valve "Y101" should be closed.
   - To ensure that the signal was not just a short peak, the previously created standard function "Timer1" is used.
     Only when the signal is present for a while is it passed on to the input of the interlock module of the CM "Y101" and the valve "Y101" is closed.
5. To do this, drag and drop the standard function "Timer1" onto the function diagram of the "Y101" CM.



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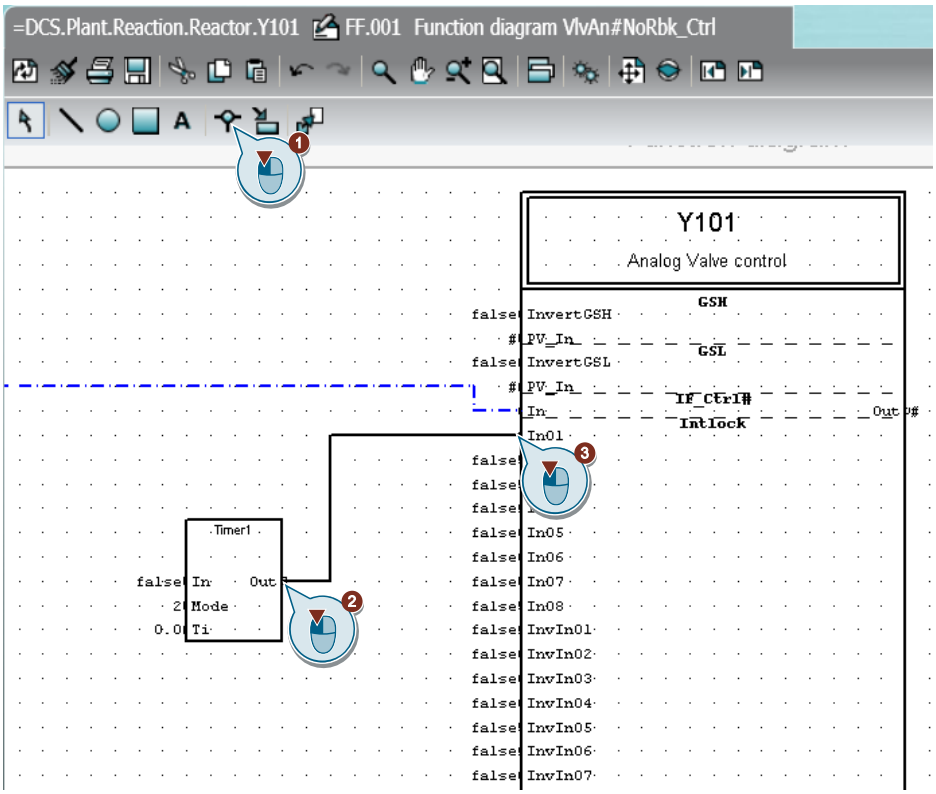
6. Connect the "Out" output of the "Timer1" module to the "In01" input of the "Y101" module's "Interlock" block field.



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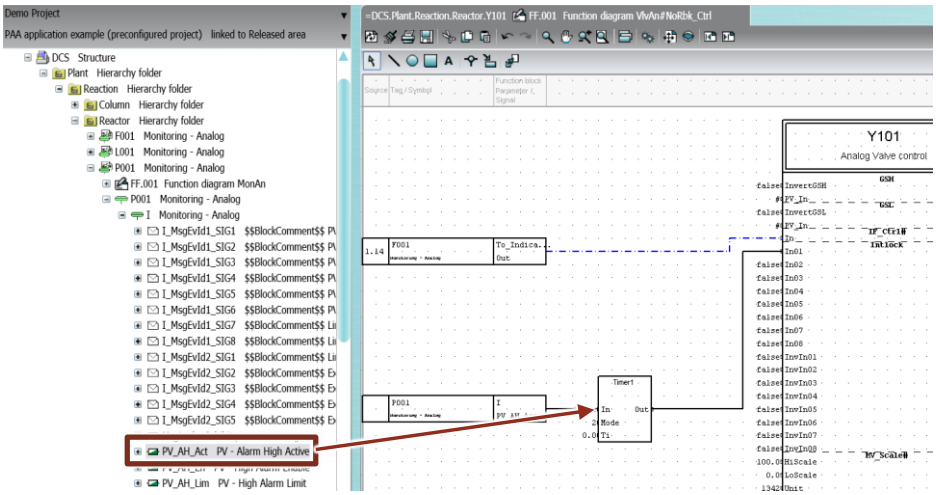
7. Now create the following connection:

Output				Input		
CM	Block	Connection		CM	Block	Connection
P001	I	PV_AH_Act	→	Y101	Timer1	In

Setting the connections is described in the section 3.8.1 in detail.



8. Click on the "Save" button in the PAA menu bar to save the changes.
9. Close the function diagrams.

Matching with SIMATIC PCS 7

Transfer the changed project data to the PCS 7-project.

1. Click on the "Import/Export PCS 7" button in the PAA menu bar .
2. Open the "Export" tab.
3. Select the "PCS 7-project" option.
4. Select the PCS 7 sample project.
5. In the "Filter" directory you can state which data are to be exported and which are to be created. In the case of the example project, activate the following check boxes:

   Activate all option boxes under "Project",

   Deactivate all option boxes under "Library".
6. Click on the "Export" button, to transfer the modified data to PCS 7.

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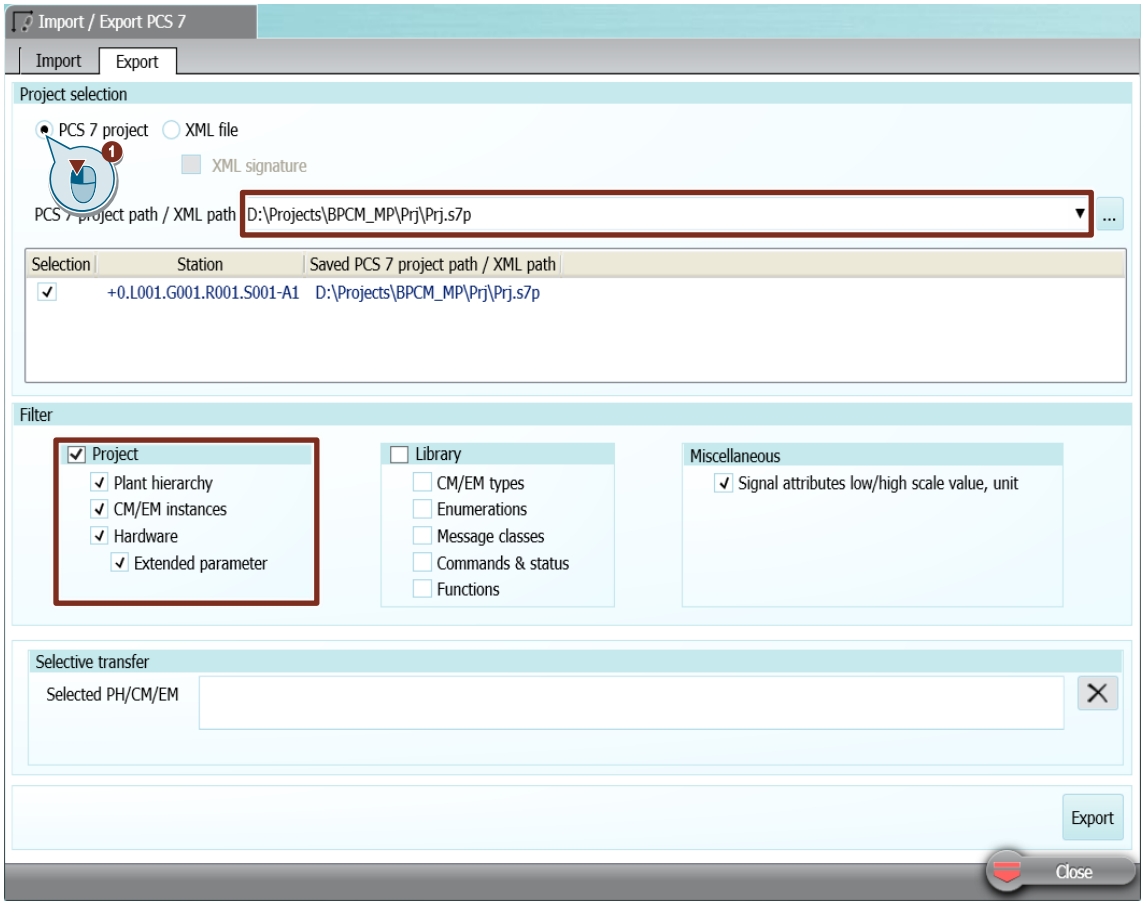

7. Click on the button, to start the export to PCS 7.
8. Click on the "Save" button in the PAA menu bar and close the "Import / Export PCS 7" dialog.

Result

The data from the PAA-project have been successfully exported into, and automatically generated in the PCS 7-project.

The following data have been created:

- Updated CM "P001" and "Y101" with standard function
- connection between CM "P001" and "Y101".

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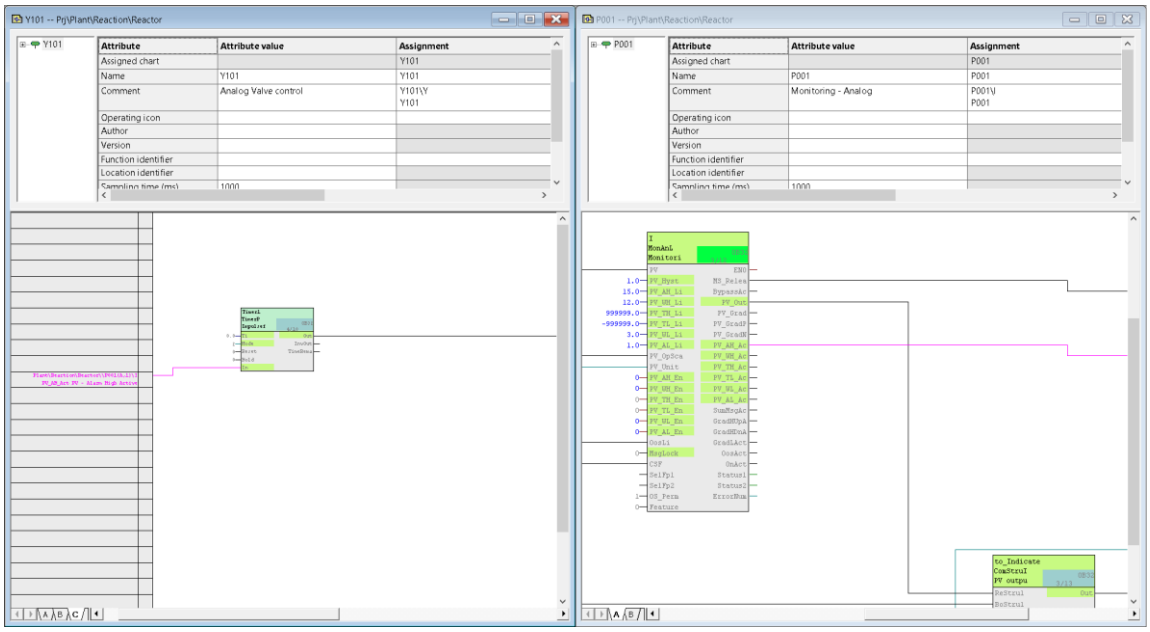

You have learned how to synchronize changes from the PAA-project with the PCS 7-project so that both projects are identical again.

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3.11 Integration of the PAA database in COMOS

You have the option of expanding PAA with COMOS modules, such as: FEED; P&ID, MRO, etc.

Likewise, you can expand COMOS, by installing and integrating PAA, thus adding the PAA functionalities.

If you wish to carry out one of these application cases, please refer to COMOS Customer Support.

Link: www.siemens.com/gtac

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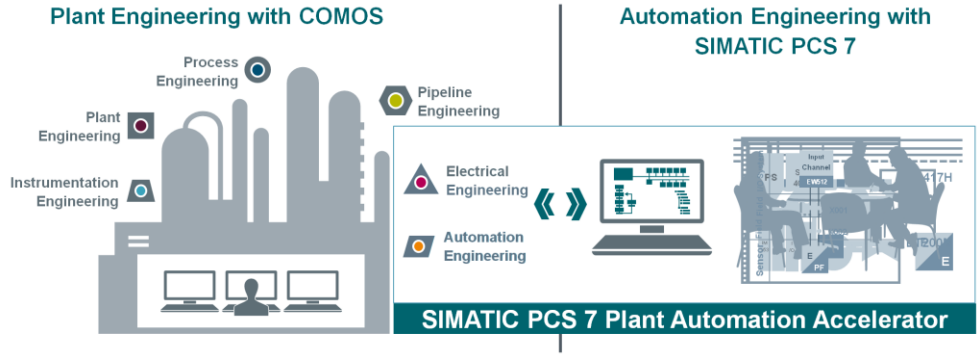
4 Useful information

4.1 Details on the principle of operation of PAA

4.1.1 Differentiation of PAA from COMOS workflow with the "Integration Layer"

The SIMATIC PCS 7 Plant Automation Accelerator also provides advantages for existing COMOS users: COMOS customers with an existing or planned COMOS installation can purchase the PAA as a COMOS module with the so-called "Integration Layer", thereby acquiring the option of using all available functionalities for fully integrated engineering with COMOS and SIMATIC PCS 7 by using the SIMATIC standard objects supplied. With the corresponding COMOS licenses, data can be transferred from process design as well as from basic and detail engineering to the control system and vice versa. A combination with other COMOS modules is possible. The Integration Layer can also be used in multi-user mode in an existing COMOS installation.



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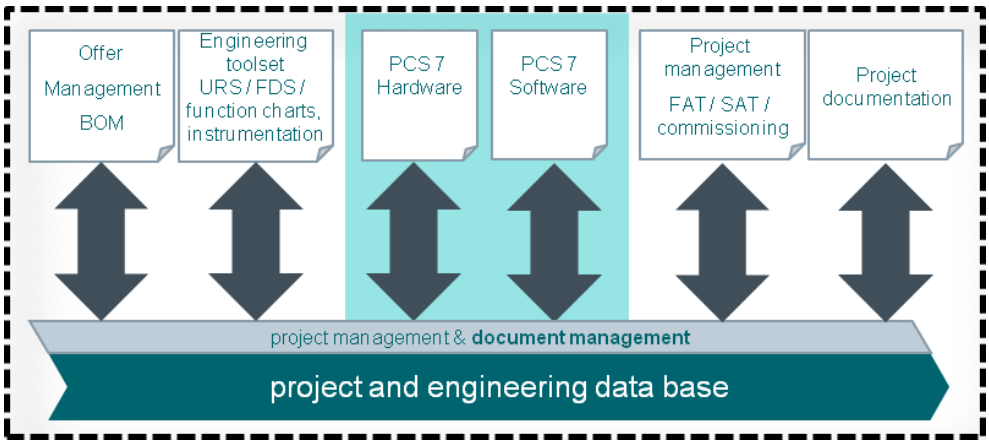
4.1.2 Advantages of PAA over Advanced Engineering (AdvES)

With AdvES, you have the possibility to create engineering data (e.g. hardware, TH, CMs, etc.), based on measurement point and signal list operators, *en masse* in a SIMATIC PCS 7-project.

The Plant Automation Accelerator (PAA) is fully based on a COMOS platform and offers the following advantages over Advanced ES (AdvES):

- graphical editors for planning electrical engineering, control strategies, as well as back-documentation of existing PCS 7 data
- COMOS user administration with multi-user engineering in work layers
- a central and system-independent data storage. This ensures a fully integrated planning from plant engineering to automation, based on an electronic workflow.
- Variable and flexible system architectures allow collaborative work on data storage at different locations.
- Standardized data interfaces for further processing of data in various formats such as MS Excel, MS Access and XML.
- Freely configurable data queries enable maximum efficient mass data engineering in tables.
- Data communication with the SIMIT simulation tool

You can import your PCS 7-projects into PAA data storage and save them digitally.



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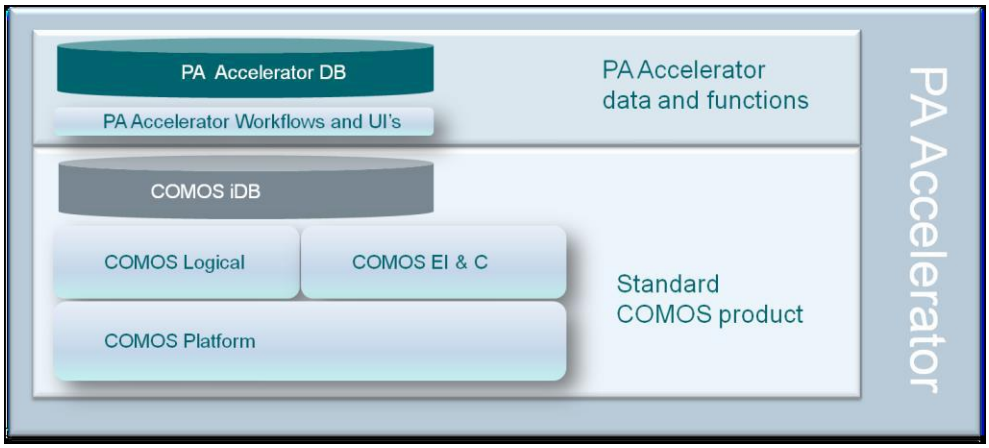
4.1.3 General information on the underlying systems

Overview

PAA is based on COMOS.

For this reason, this section contains general information on COMOS and SIMATIC PCS 7.



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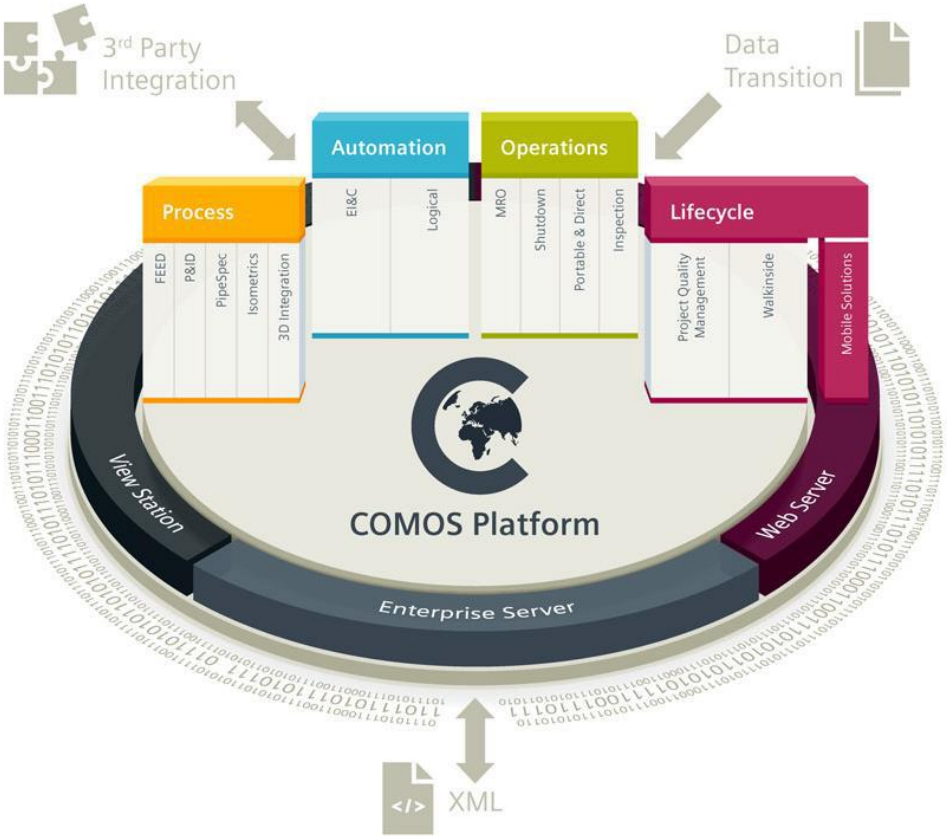
COMOS Overview

The uniform data platform of the COMOS integrated software solution enables plant planners, operators and installers to achieve a seamless flow of information from project-relevant data across all company levels and project phases.

A prerequisite for effective plant management is the optimal networking and coordination of all trades involved in the planning and operation of a plant. COMOS software solutions provide the basis for worldwide, cross-location cooperation between the various trades over the entire life cycle of a plant.

The object orientation of the COMOS software concept ensures consistent application networking. In COMOS, we describe the graphical and data technical representation of a component in a plant as an object. Related data sheets, lists and other documents are directly linked to the corresponding objects and thus form a unit.



The complete plant information is stored in a central database. As a result, COMOS allows all disciplines and departments involved in the engineering and operating phases to always access the same object data. Objects can be processed in COMOS bidirectionally on data sheets as well as in technical drawings. This means that changes to objects or documents are available to every user worldwide at all times, whatever the time zone – providing up-to-dateness and consistency. The entire plant, right down to the individual components, can be examined and further developed from a functional and interdisciplinary perspective.

Common data management enables COMOS to pool data in parallel working processes and workflows.

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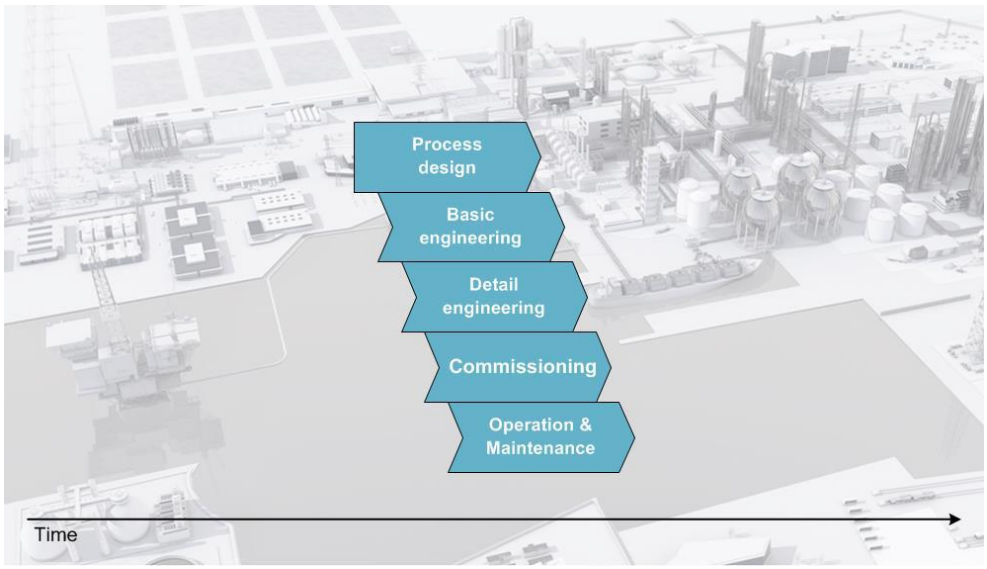

The open system architecture of COMOS can be adapted to exactly meet company-specific requirements, allows links to third-party systems, and can be integrated into existing Electronic Data Processing (EDP) scenarios.

You will find additional information about COMOS on the COMOS - product page.

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SIMATIC PCS 7 Overview

Uninterrupted operation and consistent product quality with a simultaneous reduction of plant costs are only a few of the challenges faced by the process industry today. The control system plays a decisive role in tackling these many tasks. The SIMATIC PCS 7 process control system makes it possible to react quickly to changing market conditions. It stands for user-friendliness, high system availability, future-proof technology and reduced total cost of ownership.

Processing plants in the process industry have to meet increasingly stringent requirements in terms of flexibility, scalability, availability and security – and maximum future and investment security. In this tension field, digitization opens up completely new perspectives.

Through plant lifecycle times of up to 30 years, lifecycle management is a key issue in the process industry. But how can plants from the past millennium be made economically fit for the digital future? Shorter product development times, continuous efficiency improvements, more flexible production approaches, increased availability, optimized system maintenance or informed decisions based on real-time data: The list of benefits through digitization is long. In order for real and virtual production to blend over the entire life cycle, data integration across all process steps and levels is imperative. The physical basis is formed by flexible and powerful communication networks from the field to the control level.

SIMATIC PCS 7 is based on proven and innovative standard automation components and thus offers perfectly matched products, systems and solutions for a comprehensive customer-specific automation in all branches of the manufacturing, process and hybrid industries.

Seamlessly harmonized – Programmed for success:

Central system-wide uniform hardware and software configuration with an engineering system with integrated configuration for field devices and safety-related applications. The core component for every SIMATIC PCS 7-project is the SIMATIC Manager. It is an integration platform for the engineering tools and

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configuration base for the central and system-wide engineering: The SIMATIC PCS 7-project is created, managed, archived and documented here.

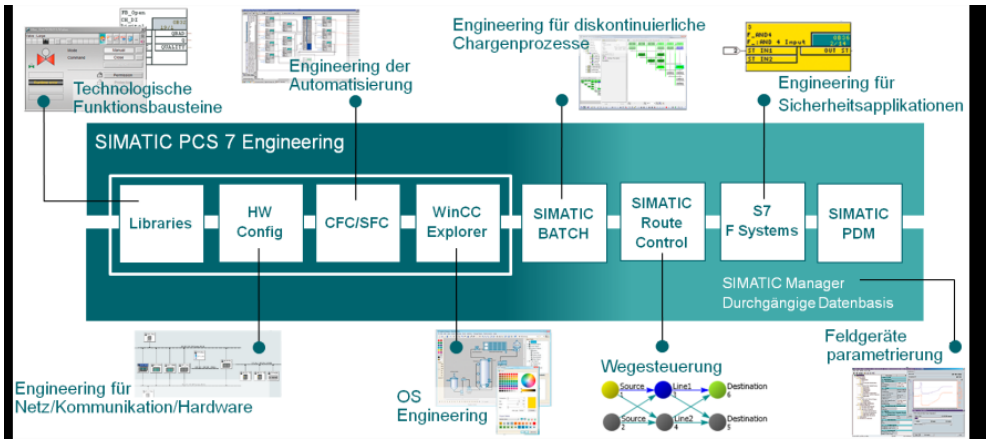
The PCS 7 Engineering System provides an SFC and CFC editor for configuring the logic functions. The out of the box function blocks of the APL Library support this.

Simple hardware configuration and the universal, manufacturer-neutral PDM tool for configuring, parameterizing, commissioning, diagnostics and service of intelligent field devices (sensors and actuators) and field components enable rapid commissioning and maintenance during operation. The Maintenance Station is focused on "Plant Asset Management" and contributes to preventive and predictive diagnostics, upkeep and maintenance of the plant.

The operator system of the SIMATIC PCS 7 process control system is created in WinCC Explorer. It enables a comfortable and safe management of production processes so that the operator can observe the process sequence and, if necessary, intervene.

SIMATIC PCS 7 Process Historian provides high-performance long-term archiving functionality for perfect integration into the control system: Process data, tags, alarms and batch data from SIMATIC BATCH can be archived centrally in real-time.

The flexibility of the process control system results from scalability according to customer-specific requirements. SIMATIC PCS 7 also offers the right solution for discontinuous production: With SIMATIC BATCH complex batch processes can be flexibly automated. The route control system, an industry-neutral system for project planning, control, monitoring and diagnosis of material transport, dominates extensive route/pipeline networks. Critical states in systems in which any malfunction of the system itself or or of the automation systems could have serious consequences, are detected by SIMATIC PCS 7 with Safety Integrated, a reliable safety system (SIS) at an early stage, so that the system can be returned to a safe state when necessary. This minimizes risks to man, the environment and the plant.



Innovative hardware components are also a significant part of the SIMATIC PCS 7 portfolio.

The SIMATIC PCS 7 automation systems are scalable for all plant sizes and are available in various safety and availability levels. Our modular systems are remarkable not only for their ruggedness, but also for their flexibility. Embedded systems are a combination of hardware and software, ready-to-connect preconfigured for the respective automation tasks.

Whether compact or modular, purely digital I/O interfaces or complete decentralized systems, including integrated drive technology, installed in the

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control cabinet or directly in harsh industrial environments: the compact peripheral systems are perfectly adapted to the requirements of the process industry - today and in the digital plants of tomorrow! The possibility of plugging and pulling components during operation particularly benefits high system availability. Station expansion is possible without having to stop the plant.

A change of perspective in the field device connection is also enabled by decentralized peripherals for the efficient transfer of familiar plant concepts into the digital world

The particularly compact and high-availability hardware components support PROFINET - and provide considerably more space for plant planning and operation. PROFINET enables flexible and easily scalable network structures and enormous costs savings throughout the life cycle thanks to a huge reduction in cabling required.

Thanks to the seamless integration of SIMATIC PCS 7 into Totally Integrated Automation (TIA), you benefit from a complete spectrum of perfectly coordinated system components for the complete automation of the complete production process

You will find additional information about SIMATIC PCS 7 on the PCS 7 - product page.

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5 Appendix

5.1 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

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5.2 Links and Literature

Subject area	Link / description
Siemens Industry Online Support	https://support.industry.siemens.com
Article download page	https://support.industry.siemens.com/cs/ww/en/view/109742154
COMOS Product page	https://w3.siemens.com/mcms/plant-engineering-software/en/Pages/Default.aspx
PCS 7 Product page	http://w3.siemens.com/mcms/process-control-systems/en/simatic-pcs-7/pages/simatic-pcs-7.aspx
PCS 7 Topic page	www.siemens.com/onlinesupport/pcs7
COMOS topic page	http://www.siemens.com/onlinesupport/comos
Application example: Controlled plant engineering from the outset with COMOS FEED	https://support.industry.siemens.com/cs/ww/en/view/109480737 Get to know the basic functions and benefits of COMOS FEED and go through a complete standard workflow to generate all of the relevant data for the bidding phase and to create the foundations for the basic and detailed engineering phases.
Application example: Fast and easy generation of Piping and Instrumentation Diagrams with COMOS P&ID using a practical example	https://support.industry.siemens.com/cs/ww/en/view/109480739 Get to know the basic functions and benefits of COMOS P&ID. This application example guides you through a standard workflow to map process engineering, pipe engineering and measurement and control engineering (MSR) procedures.
Application example: Integrated Engineering with COMOS and SIMATIC PCS 7 using a practical example	https://support.industry.siemens.com/cs/ww/en/view/70922226 Get to know the basic functions and benefits of COMOS in connection with SIMATIC PCS 7. The application example takes you through a standard workflow. The example shows you how you can exchange data between the two systems.
Control Module (CM) Technology - Efficient Engineering in SIMATIC PCS 7	https://support.industry.siemens.com/cs/ww/en/view/109475748 Control Module (CM) technology is not just used to optimize engineering efforts, but also to make a standardized structure of the automation program possible while quickly adapting to future demands.
Automated creation of the SIMIT simulation model with COMOS planning and engineering data	https://support.industry.siemens.com/cs/ww/en/view/109740344 This application example is a "best practice" example and shows you how to import COMOS planning data into SIMIT and automatically create your simulation model.

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5.3 Change documentation

Table 5-1

Version	Date	Modifications
V1.0	08/2017	First version
V2.0	12/2018	Second version

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