Process automation with the SIMATIC PCS 7 CPU 410-5H controller

SIMATIC PCS 7 V9.0 – CPU 410-5H Firmware V8.2

https://support.industry.siemens.com/cs/ww/en/view/96839331

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Preface

Introduction

There are various automation systems available for the SIMATIC PCS 7 process control system which differ in performance, quantity structure, communications interfaces and scalability, among other things. These include:

- AS 410 automation system (AS 410-5H and AS 410E)

- Complementary S7-400 systems (AS 412 to AS 417)

Depending on the automation performance requirements, CPU 412 to CPU 417 may be used on the complementary S7-400 systems. If the performance limit of one of the CPUs being used is reached, e.g., as a result of necessary modifications to the user program, the hardware must be exchanged to increase the performance, or a higher performance S7-400 system used.

AS 410 automation systems are the preferred choice for all new plants with SIMATIC PCS 7. For applications with a small quantity structure the CPU 410E is appropriate, for all other applications there is the versatile CPU 410-5H.
The automation performance of the CPU 410-5H is scaled without having to change the CPU and is effected by means of the number of SIMATIC PCS 7 process objects. In this case the best performance is always available regardless of the area of application. The type reduction to a single CPU offers numerous advantages. It considerably simplifies the selection, configuration and planning of the automation system as well as spare parts inventory and plant expansion.

Document contents

In this document, scenarios are described which explain relevant functions of the CPU 410-5H Process Automation in the AS 410 and illustrate advantages compared to the complementary S7-400 systems. Additionally you will gain an overview of important configuration steps and hints. The CPU 410E behaves like a CPU 410-5H with limited quantity structures, so that the scenarios described in this application example apply to the CPU 410-5H as well as to the CPU 410E.

You will find information on the following topics in the document:

- General information on the CPUs of the AS 410

- Advantages of the CPU 410-5H

- Configuring the communications interface and establishing the connection between the ES and the AS

- Type Change in RUN (TCiR) and Configuration in Run (CiR/H-CiR)

- Configuration of the PN/Ethernet interfaces

- Upgrade with CPU 410 Expansion Packs (process objects and PN Red License)

Validity

This application example is valid for:

- CPU 410-5H Process Automation and CPU 410E Firmware version 8.2

- SIMATIC PCS 7 V9.0

Table of Contents

1 Overview of AS 410 automation system

The rugged AS 410 automation system is a modern, future-oriented, all-round system for the process industry. It forms the basis for future developments and can be deployed in all areas of application with versatility. AS 410 is thus the system of choice for all new plants with SIMATIC PCS 7.

The use of the AS 410 is particularly useful for PCS 7 systems with PROFINET as it is the only automation system that supports the following PROFINET functions in conjunction with PCS 7 V9.0:

- Redundant PROFINET R1 configuration

- Configuration in Run (CiR)

- High-precision time stamping (SoE – Sequence of Events))

Two versions of the CPU are available for the AS 410:

- CPU 410-5H – scalable performance for all applications

- CPU 410E – fixed quantity structure for applications with few process objects

An AS 410 with CPU 410-5H or CPU 410E can be configured as a standard high-availability or safety-oriented automation system, depending on your requirements. Technically speaking, the CPU 410E program and system behave like those of a CPU 410-5H with limited quantity structures. This means that the statements made in this application example concerning the CPU 410-5H also apply to the CPU 410E.

Benefits

- A hardware platform for all application uses, application sizes and performance ranges

- Specially developed for process automation

- Conformal coating

- Extended temperature range (0 °C to +70 °C)

- PROFINET functions (R1, CiR and SoE)

- Reduction of plant downtime thanks to the possibility of type updating of AS blocks in RUN mode (TCiR) and configuration modifications in Run for PROFINET and PROFIBUS (CiR/H-CiR).

- Integrated remaining load memory

1.1 CPU 410-5H – the "all-rounder" for process automation

In this chapter you will find general information on the CPU 410-5H, its functions and areas of application.

1.1.1 Introduction

The CPU 410-5H is a controller specially designed for process automation which is versatile in use. With its robust, high performance hardware, the CPU 410-5H covers the entire performance spectrum of the AS 412 to AS 417 complementary systems.

Scalable quantity structure

The quantity structure of the CPU 410-5H can be individually scaled according to the size and type of the PCS 7 applications. This is done by means of the PO volume, which is determined by the System Expansion Card (SEC). The volume extends from 100 PO (process objects) to 2k + PO (unlimited), at which point other performance data of the CPU act as the limiting factor.

The PO quantity structure of an SEC can be conveniently extended from the PCS 7 V8.1 by means of CPU 410 expansion packs. It is not necessary to uninstall the CPU or the SEC. There are CPU 410 expansion packs available for 100 POs and 500 POs. You have the following options when ordering CPU 410 expansion packs:

- Online via http://www.siemens.com/industrymall
- Through your Siemens contact person (www.siemens.com/automation/partner)

Communication

The CPU 410 has two PROFINET/Ethernet interfaces with an integrated 2-port switch. As a standard automation system, these enable the simple connection (S1) of PROFINET devices and, configured as an H system, the connection of devices via system redundancy S2. From FW V8.2, in its expansion as an H system the CPU 410 additionally supports the redundant connection (R1).
Per PROFINET interface a maximum of 250 devices can be connected. Consequently, per AS 410 as many as 500 devices can be operated via PROFINET. It is not possible to use the CP 443-1 for PROFINET.

The CPU 410-5H provides a peripheral address range of 8 kB per PROFINET interface.

In addition, the CPU has a PROFIBUS interface with 12 MBit/s and allows the connection of up to 96 PROFIBUS nodes.

The distributed process periphery can thus either be linked directly with PROFINET, PROFIBUS DP or via a subordinate bus system, such as PROFIBUS PA.

The connection to the plant bus can be made either via the communication module CP 443-1 or via the PROFINET/Ethernet interfaces integrated in the CPU. If an integrated interface is used to connect to the plant bus, it cannot be used for PROFINET.

PROFIBUS DP

2 Steckplätze für Sync-Module

PROFINET IO (2-Port-Switch)

PROFINET IO (2-Port-Switch)
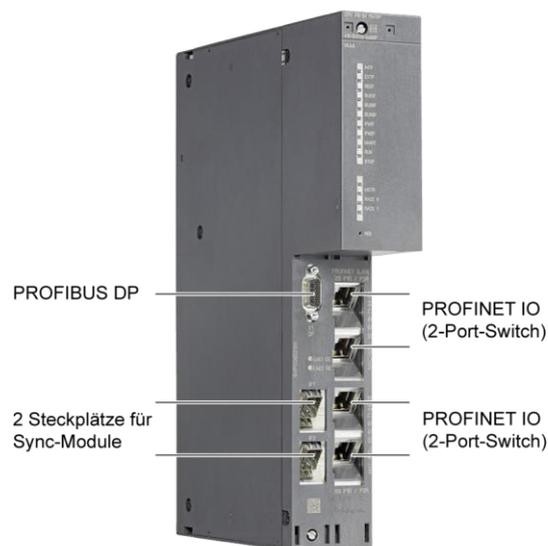
Note	For further information on the use of PROFINET in SIMATIC PCS 7, please refer to the application example: "PROFINET in SIMATIC PCS 7 – Guidelines and Blueprints" https://support.industry.siemens.com/cs/ww/en/view/72887082

Process safety functions

The CPU 410 is set up as standard for integrated process safety functions and offers all the functions required for safety-oriented applications. The controller is TÜV certified and meets all safety requirements up to SIL 3. The CPU is capable of multitasking, meaning that several programs can run simultaneously - both Basic Process Control Applications (BPCS) and safety-oriented applications. The programs are also reaction-free, with the result that potential errors in the BPCS applications have no effect on the safety-oriented applications and vice versa.

The PROFIsafe profile allows safety-related communication between the automation system (controller) and the process periphery via either PROFIBUS or PROFINET.

High availability

To reduce the risk of production downtime and ensure maximum availability, the AS 410 can be configured as a high-availability automation system. A highly available automation system AS 410 is constructed from two redundant, electrically isolated controllers (CPU 410). These can be mounted on a common rack or also operated synchronously at a distance of up to ten kilometers from one another. In this case, one of the two CPUs functions as the master and the other as the reserve. Synchronization modules can be connected in pairs by means of fiber-optic cables. The modules can be exchanged during operation.

1.1.2   Enhanced functions - Firmware V8.2

The CPU 410's Firmware V8.2 makes numerous new functions available. Firmware V8.2 can be used with all CPU 410-5Hs or CPU 410Es.

PROFINET extensions

- Support from PROFINET configurations (R1) as a complement to PROFINET system redundancy (S2).
  The CPU 410 Expansion Pack (PN Red) is necessary for the use of this configuration. The procedure for transferring the licenses of this expansion pack is identical to the procedure for expanding the PO volume of the CPU 410. See Chapter 2.6.

- Support from configuration changes in the operation of the CPU in the H system (H-CiR) and individual operation (CiR) See section 2.5.

- Support of the highly precise time stamp – Sequence of Events (SoE).

Security extensions

- New protective function for PROFIBUS and PROFINET interfaces (Field Interface Security), see Chapter 2.7.1.

- Support of SysLog in conjunction with SIEM (Security Incident Event Management) systems, see Chapter 2.7.2.

Other extensions

- The Load memory is maintained independent of a buffering by buffer batteries. The CPU can restart itself automatically after power failures even without buffer batteries. See Section 2.7.3.

- The possibility for firmware updates in two working steps for future firmware versions. See Section 2.7.4.

Note	You can download the firmware updates in the entry: "Operating system update: CPU410-5H Process Automation" https://support.industry.siemens.com/cs/ww/en/view/109476571
	For instructions on how to perform the update, please see: "Instructions for Updating the CPU 410 Operating System" https://support.industry.siemens.com/cs/ww/en/view/85196540

1.1.3 Advantages of the CPU 410-5H

General information

The CPU 410-5H offers, among others, the following advantages:

- A hardware platform for all application uses, application sizes and performance ranges.

  Consequently the selection, configuration and planning of the automation system are simplified.

- Lower costs for spare or replacement part inventories, as only one CPU type is used in the project.

- Flexible expansion of the automation performance without replacing hardware.

Plant planning

The advantages of the CPU 410-5H come into their own above all when planning a new plant:

- When planning the automation performance necessary for your plant, you will no longer have to consider different CPU variants, as the CPU 410-5H can be used for all purposes (e.g. as an H or an F system, as well as for all application sizes).

- The required automation performance (PO volumes) can be ordered according to the application size after the engineering phase is complete.

- The automation performance can be conveniently expanded as required at any time by means of the CPU System Expansion Card (SEC), without any exchange of hardware or plant downtime.

- The planning of the CPU spares is simplified considerably by the use of standardized hardware. In this case you will only need one CPU 410-5H without SEC as a replacement part, since the SEC can be transferred if the CPU is exchanged.

- Due to networking with PROFINET (PN), switchgear and drives can be reached by every CPU without expensive cabling. Should program relocations to another CPU arise in the course of the implementation, it will not be necessary to rewire the station or the device.

Note	The PN communication which spans the CPUs can influence the performance capability of all the CPUs in the PN network.

1.2 CPU 410E – for applications with up to 200 process objects

In this chapter you will find general information on the CPU 410E, its functions and areas of application.

1.2.1 Introduction

The AS 410 automation system with CPU 410E Process Automation is a cost-saving alternative to the use of the CPU 410-5H for small applications. Based on CPU 410-5H hardware, the CPU 410E offers the same benefits for applications with up to 200 PO.

Technically speaking, the CPU 410E program and system behave like those of a CPU 410-5H with limited quantity structures. This means that the statements made in this application example concerning the CPU 410-5H also apply to the CPU 410E.

1.2.2 Restrictions compared with the CPU 410-5H

The table below gives an overview of the most important differences between the CPU 410-5H and the CPU 410E:

Table 1-1

		CPU 410-5H	CPU 410E
PCS 7 process objects (PO)		100 up to c. 2600 scalable with SEC	200
Work memory (program/data)		32 MB	4 MB
Periphery address area	PROFIBUS	6 KB	1536 bytes
	PROFINET	8 KB	1536 bytes

Note	You will find further technical data on the CPU 410-5H and the CPU 410E in the following manual: "SIMATIC PCS 7 Process Control System CPU 410 Process Automation" https://support.industry.siemens.com/cs/ww/en/view/109748473

2 Application scenarios

2.1 Configuring the communications interface and Establishing the connection between the ES and the AS

In order to implement the application scenarios described in this chapter, a connection must be set up between the Engineering Station (ES) and the Automation System. The configuration procedure depends on the communications interface used.
A distinction is made between:

- AS with additional CP

- Internal PN/Ethernet interfaces of the CPU

2.1.1 Establishing a connection using an additional CP in the AS

The following will describe how to establish a connection between ES and AS using the CP 443-1.

Requirement

In order to establish a connection between the ES and the AS (via the CP), the modules must be fitted in the rack as shown in the operating manual.

Preliminary considerations

Before establishing communication, you must define whether you want to use TCP/IP or ISO. Addressing (IP address, MAC address) is carried out on the basis of the interface selection.

Note	Communication in the plant bus is normally based on the ISO protocol. Alternatively, TCP/IP can be used, e.g. when using a common (combined) terminal and plant bus for smaller systems without an OS server or when using the internal Ethernet interface of an automation system.
	You can find additional information on configuring the network connections in the manual: "SIMATIC Process Control System PCS 7 Compendium Part A - Configuration Guidelines" https://support.industry.siemens.com/cs/ww/en/view/109740190

Connection via ISO interface

The following points are a step-by-step description of how to establish the connection between the AS and the ES.

1. Configure the AS in the HW Config. and assign the address for the CP (MAC address) accordingly.
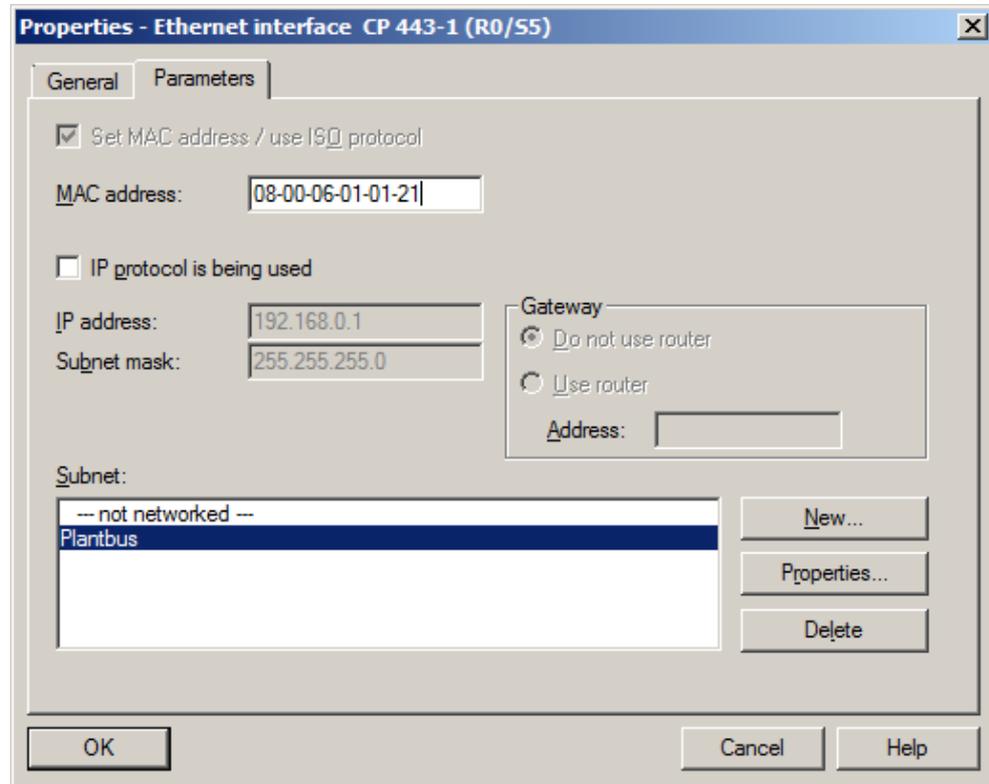

2. Save and compile the configuration.
3. In the SIMATIC Manager, use menu command "Tools > Set PG/PC interface..." to set the "Interface parameter setting used" to "ISO" (e.g., CP1623.ISO.1).
4. Switch back to the HW Config.
5. Execute the menu command "Target system > Load in module...".

6. In the "Select Target Module" dialog window, select the relevant module and click on "OK".
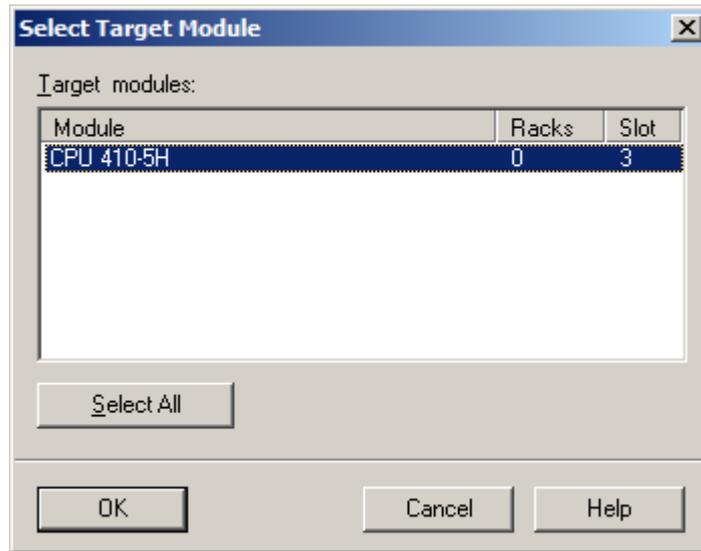
7. If you have not changed the MAC address for the CP (configured MAC address is the same as the factory-set MAC address), click on the "OK" button in the "Select Node Address" dialog window.
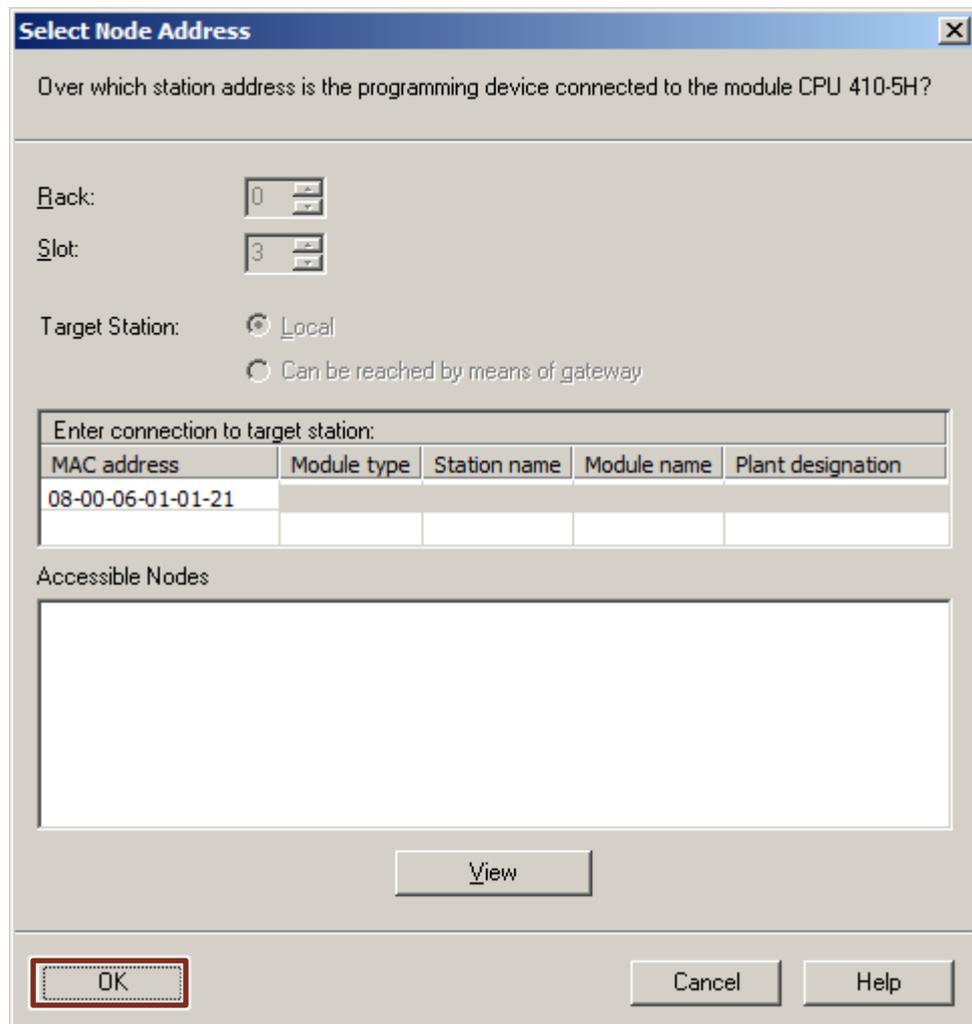
If you have configured a different MAC address, then click on the "View" button. Then in the "Accessible Nodes" box, select the CP from which you want to load the configuration. Then click on the "OK" button.

Select Node Address

Over which station address is the programming device connected to the module CPU 410-5H?

Rack: 0

Slot: 3

Target Station: ⦿ Local
○ Can be reached by means of gateway

Enter connection to target station:

MAC address	Module type	Station name	Module name
08-00-06-01-00-00	CP 443-1		

Accessible Nodes

00-1B-1B-7E-95-DD	SIMATIC-PC		
08-00-06-01-00-00	CP 443-1		
08-00-06-01-01-22	CP 443-1		
08-00-06-9E-73-AE	INC		

Update

OK   Cancel   Help

8. The configuration has now been loaded into the AS.

Note After an address change, always load the configuration via the HW Config or NetPro. The accessible nodes to which you can make assignments by loading a new address are only shown here. When loading from the SIMATIC Manager, an attempt will be made to load via the configured address. Since this cannot be accessed, the loading procedure will be aborted, accompanied by an appropriate message.

Connection via TCP/IP interface

The following points are a step-by-step description of how to establish the connection between the AS and the ES.

1. Configure the AS in the HW Config. and assign the IP parameters for the CP (IP address, subnet mask) accordingly.
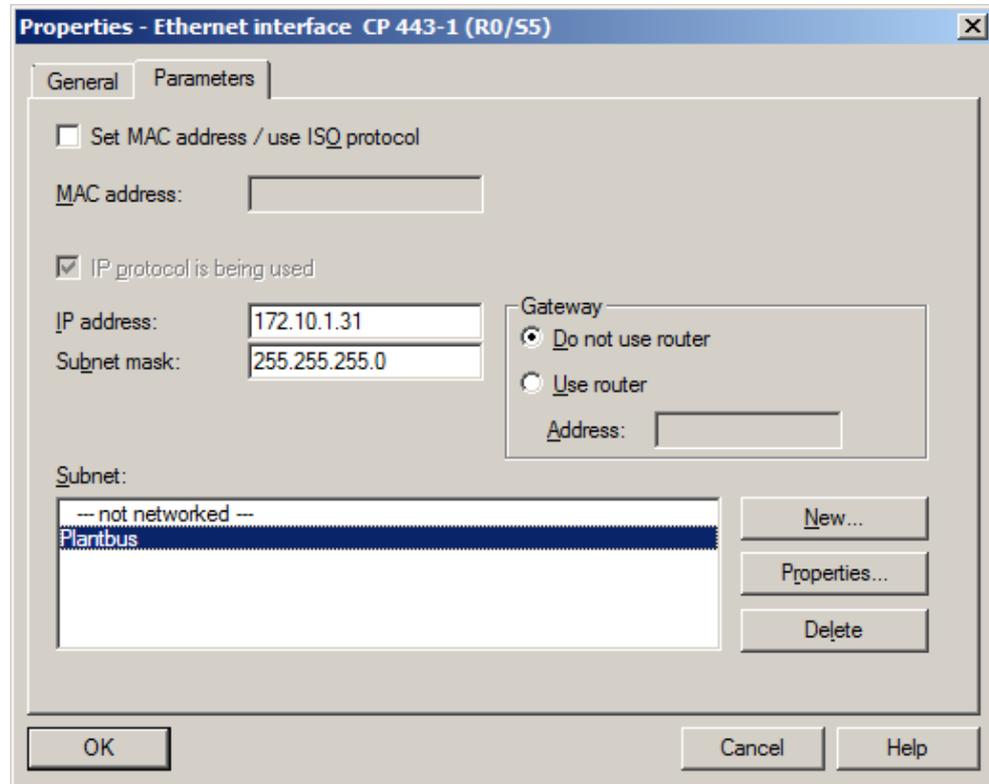
2. Save and compile the configuration.

3. In the SIMATIC Manager, use menu command "Tools > Set PG/PC station..." to set the "Interface parameter setting used" to "RFC1006" or "TCPIP" (e.g., CP1623.RFC1006.1).

4. Switch back to the HW Config.

5. Execute the menu command "Target system > Edit Ethernet Node".

6. Click on the "Browse" button in the "Edit Ethernet Node" dialog window.

7. In the "Browse Network" dialog window, select the CP by means of the MAC address and click on the "OK" button.
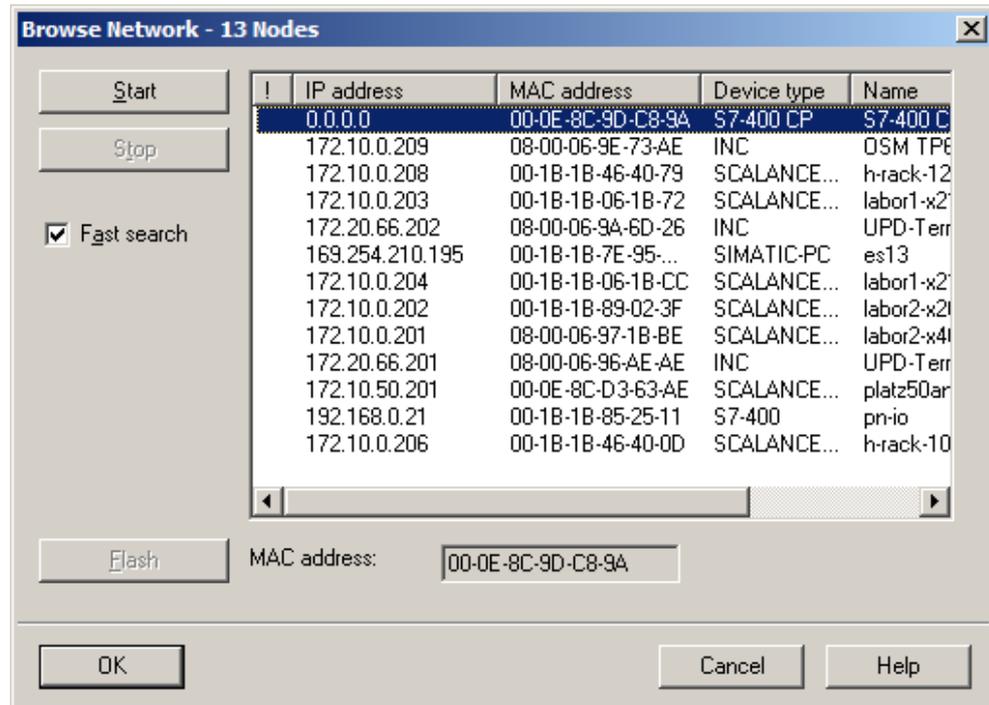
Note	If not all or none of the connected nodes are displayed, check the settings for the used network components (switches,...).

8. The MAC address and the IP parameters for the CP are entered in the "Edit Ethernet Node" dialog window. Adapt the IP parameters according to your configuration in HW Config (see Step 1). Next click on the "Assign IP Configuration" button and then on the "Close" button.

Note	If you start the search again, you can check to see if the parameters have been correctly accepted.

9. Execute the menu command "Target system > Load in module...".

10. In the "Select Target Module" dialog window, select the relevant module and click on "OK".

11. In the "Enter connection to target station" box in the "Select Node Address" dialog window, select the relevant IP address and click on the "OK" button.
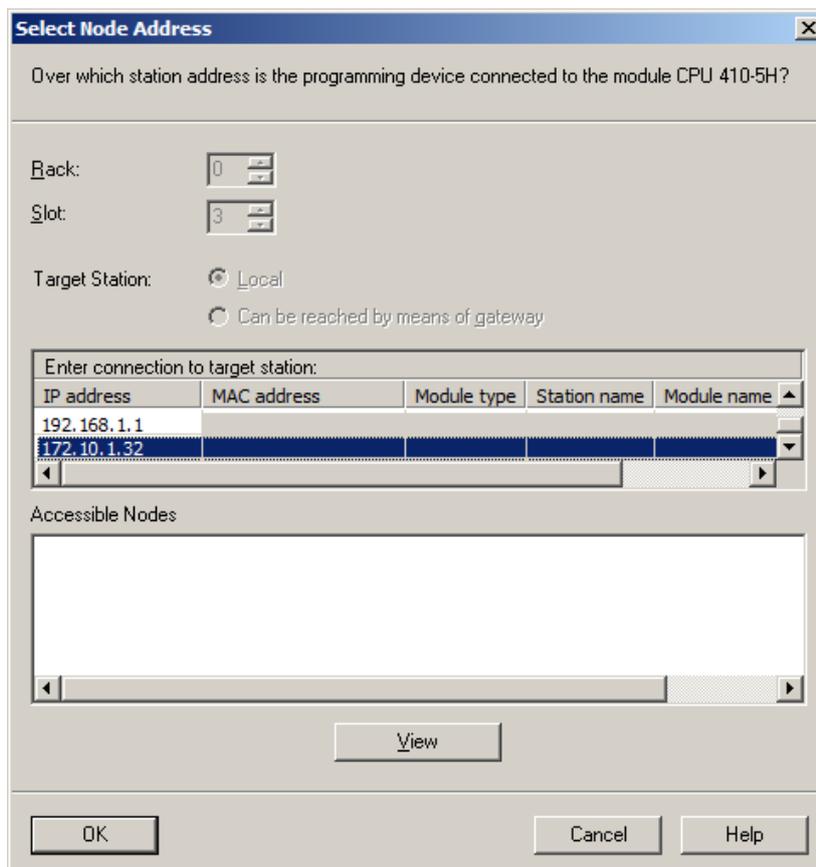
The configuration has now been loaded into the AS.

2.1.2 Establishing a connection via internal PN/Ethernet interfaces of the CPU

The following describes how to establish a connection between the ES and the AS using the internal PN/Ethernet interfaces of the CPU 410.

Requirement

In order to establish a connection between the ES and the AS using the internal interfaces of the CPU 410, the CPU 410 must be fitted in the rack as shown in the operating manual and be connected to the ES via the network (Ethernet).

Preliminary considerations

Before configuring, define which interface is to be used to connect the CPU to the plant bus. An IP address from the address range of the plant bus must be used for the interface.

Note	The ISO protocol is not supported by the internal PN/Ethernet interfaces.

Connection via PN/Ethernet interface

The following points are a step-by-step description of how to establish the initial connection between the CPU 410 and the ES.

1. Configure the AS in the HW Config. and assign the IP parameters (IP address, subnet mask) on the PN/Ethernet interface.
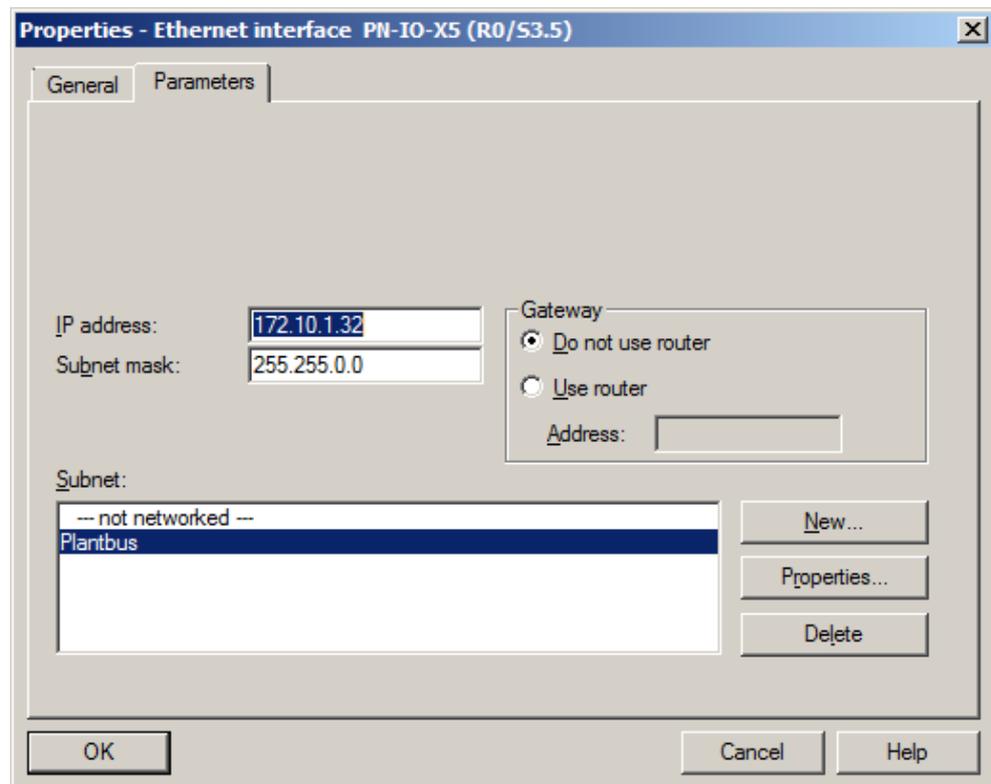
2. Save and compile the configuration.

3. In the SIMATIC Manager, use menu command "Tools > Set PG/PC interface... " to set the "Interface parameter setting used" to "RFC1006" or "TCPIP" (e.g., CP1623.RFC1006.1).

4. Switch to the HW Config.

5. Execute the menu command "Target system > Edit Ethernet Node".

6. Click on the "Browse" button in the "Edit Ethernet Node" dialog window.
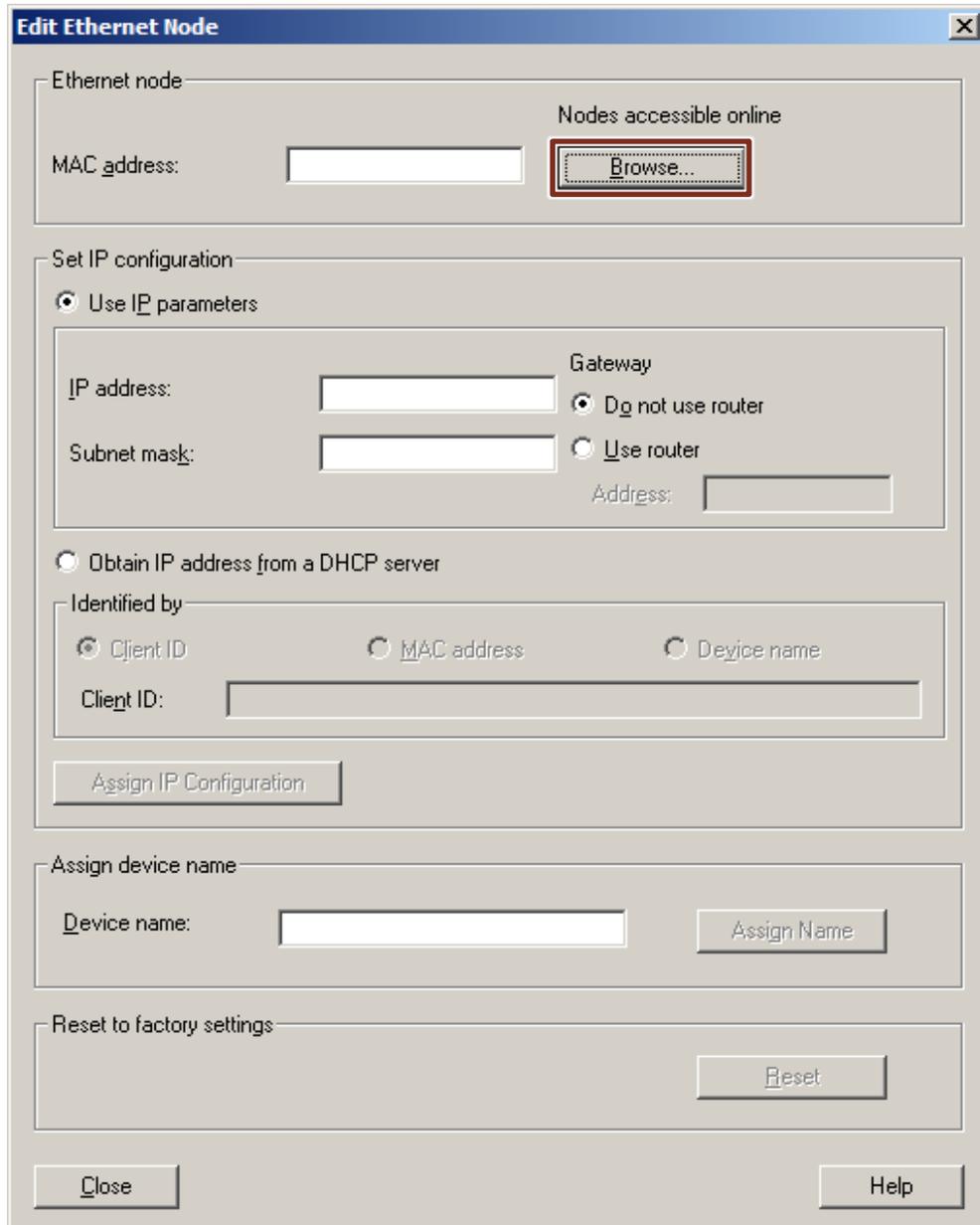
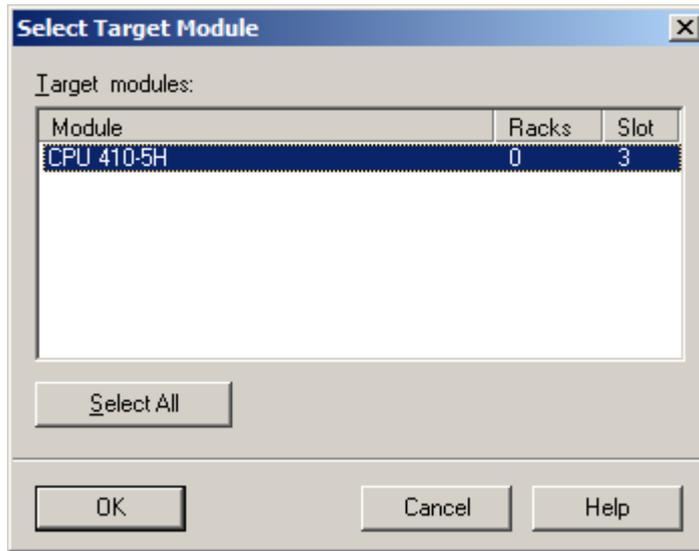7. In the "Browse Network" dialog window, select the CPU by means of the MAC address and click on the "OK" button.

!	IP address	MAC address	Device type	Name
	172.10.0.208	00-1B-1B-46-40-79	SCALANCE...	h-rack-12
	172.10.0.203	00-1B-1B-06-1B-72	SCALANCE...	labor1-x2
	172.20.66.202	08-00-06-9A-6D-26	INC	UPD-Terr
	169.254.210.195	00-1B-1B-7E-95-...	SIMATIC-PC	es13
	172.10.0.204	00-1B-1B-06-1B-CC	SCALANCE...	labor1-x2
	172.10.0.202	00-1B-1B-89-02-3F	SCALANCE...	labor2-x2
	172.10.0.201	08-00-06-97-1B-BE	SCALANCE...	labor2-x4
	172.20.66.201	08-00-06-96-AE-AE	INC	UPD-Terr
	172.10.50.201	00-0E-8C-D3-63-AE	SCALANCE...	platz50ar
	172.10.1.22	08-00-06-01-00-22	S7-PC	es22
	192.168.0.21	00-1B-1B-85-25-11	S7-400	pn-io
	172.10.0.206	00-1B-1B-46-40-0D	SCALANCE...	h-rack-10

MAC address: 00-1B-1B-85-25-11

Note If not all or none of the connected nodes are displayed, check the settings for the used network components (switches,...).

8. The MAC address and the IP parameters for the Ethernet interface are entered in the "Edit Ethernet Node" dialog window. Adapt the IP parameters according to your configuration in HW Config (see Step 1). Next click on the "Assign IP Configuration" button and then on the "Close" button.

Note	If you start the search again, you can check to see if the parameters have been correctly accepted.

9. Execute the menu command "Target system > Load in module...".

10. In the "Select Target Module" dialog window, select the relevant module and click on "OK".

11. In the "Enter connection to target station" box in the "Select Node Address" dialog window, select the relevant IP address and click on the "OK" button.
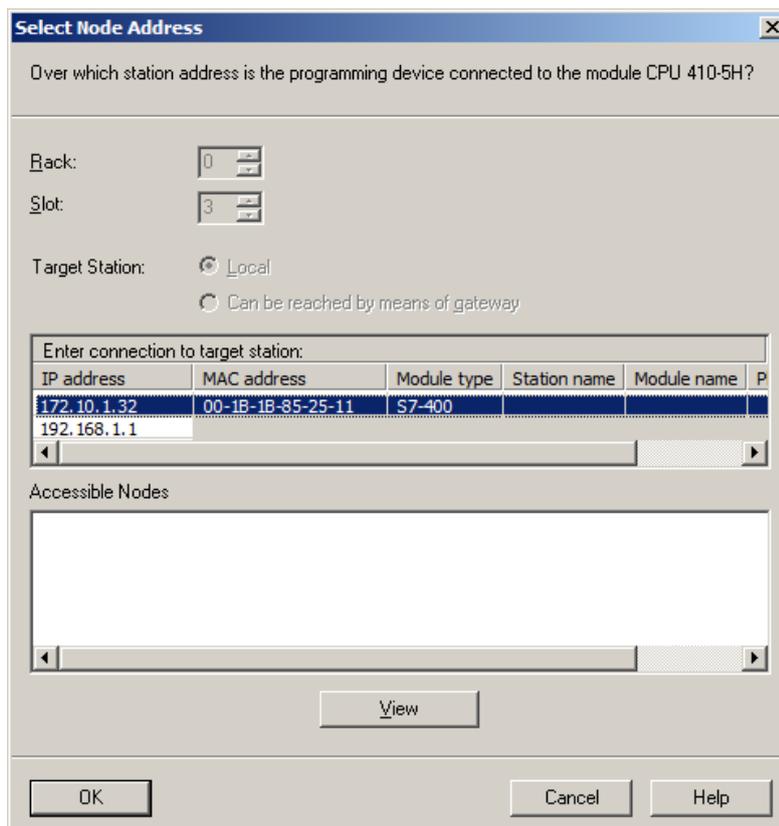
The configuration has now been loaded into the AS.

2.2 Loading interface changes from AS blocks in RUN mode (TCiR)

Introduction

From firmware V8.1 and in conjunction with SIMATIC PCS V8.1 or higher, the CPU 410 supports type updating with interface changes in RUN mode (Type Change in RUN (TCiR)). It is thus possible to update the instances after an interface change to block types and load them into the target system in RUN mode. With the TCiR function you can, for example, also update a library without having to put the CPU in the STOP state (see Chapter 2.3).

NOTICE	**Note that you must create new blocks (new number) for the instances of the changed block types that were loaded into the CPU by means of TCiR. The system deactivates the blocks in WinCC until the OS server has be been re-compiled and loaded.**
	In the case of a redundant OS server, you can do this before loading AS TCiR and loading one of the servers. This means that the plant can be operated before and after AS TCiR loading.
	Note, however, that when doing this data can be lost in the area of archiving.

NOTICE	**The following changes to the block can only be loaded in STOP mode:** • **Changed name of an input with configured message ("Message Event ID")**

Note	You can find a detailed description of TCiR in the CFC online help system and in the "SIMATIC Process Control System PCS 7 CFC for SIMATIC S7 (V9.0)" function manual. https://support.industry.siemens.com/cs/ww/en/view/109748700

This chapter will describe as an example how to add a new connection to the block and then load this change into the CPU 410 in RUN mode.

Requirements

The following requirements apply:

• A PCS 7 multiproject is open in the SIMATIC Manager.
• The automation program has been compiled and loaded into the CPU 410.
• Loading of the automation program was carried out with a CFC of Version V8.1 (or above)
• The firmware status of the CPU 410 is V8.1 (or above)
• There is enough storage space on the CPU for modified blocks
• There are enough reserve POs on the CPU

Making interface changes

Open the master data library for the project in component view.

1. Open the "Sources" folder.
2. Open the SCL source for the desired block type.
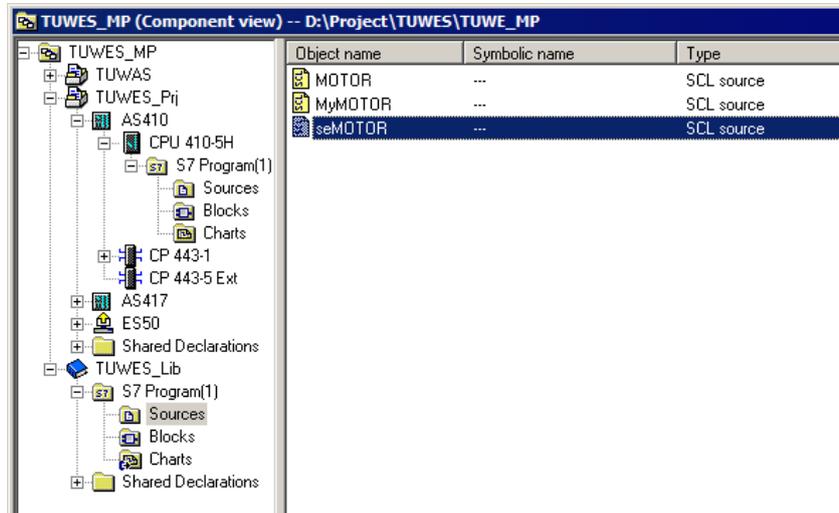
3. Carry out the desired changes.
In this example, the connection "LOCK_2" will be added for an additional interlock on the block.
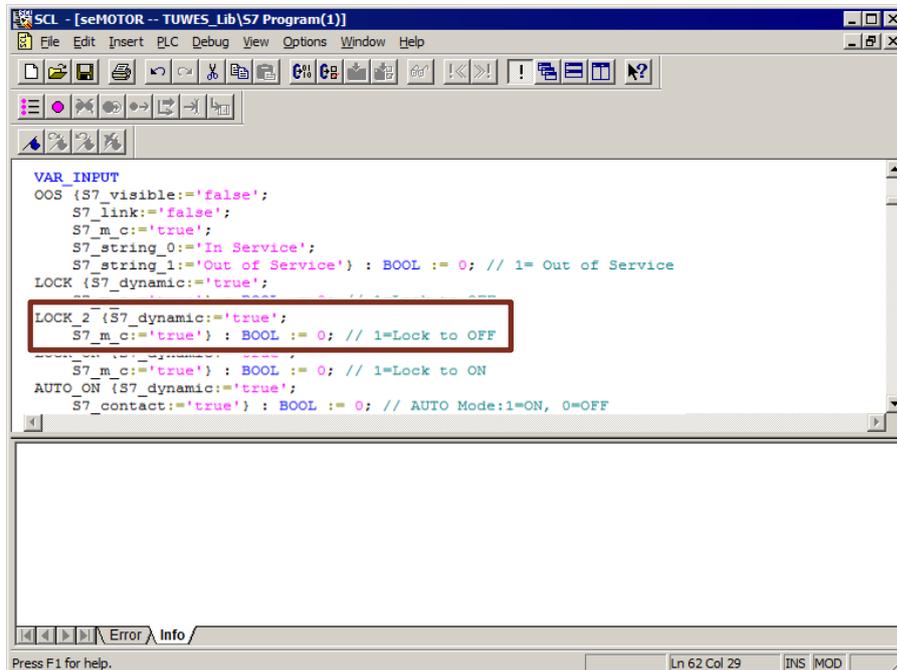

4. Save the changes and compile the SCL program.
5. Close the SCL source.

Loading interface changes in RUN mode

1. Select the "Blocks" folder in the master data library.

2. Carry out command "Extras > Charts > Update block types".
   The "Update block types" dialog opens.

3. Select the check box in the "Download in RUN" column and click on the "Calculate" button in the "Resources" column.
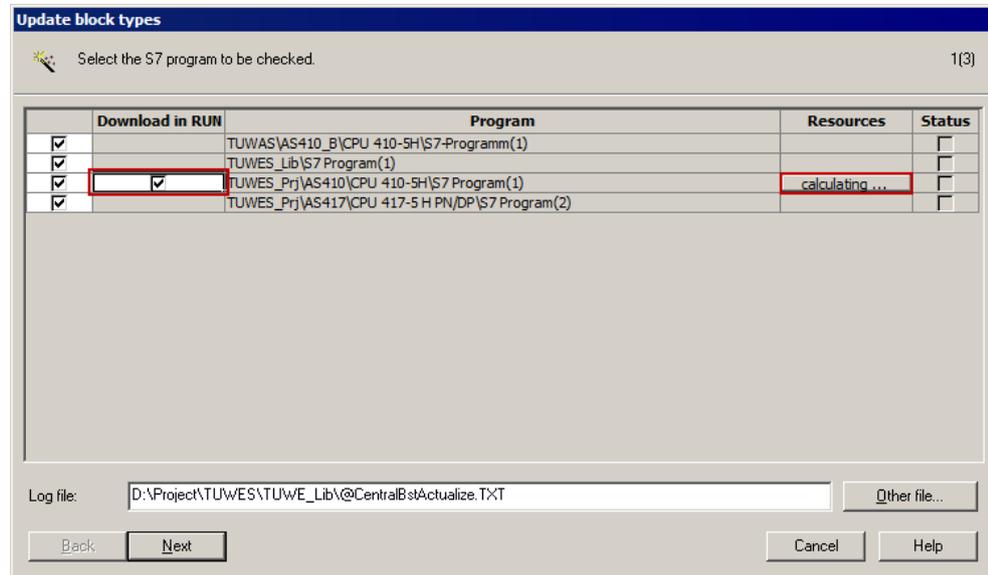
The "Resource information" dialog opens. This contains information about resource requirements for type changing in the automation system in which the type change is carried out.
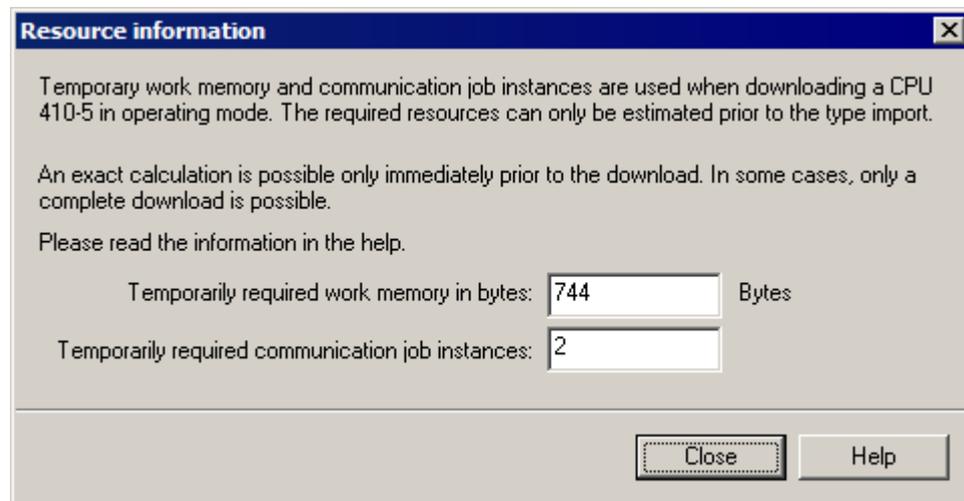
| **Note** | If not enough resources are available, loading is only possible via STOP. |

4. Close the "Resource information" dialog.

5. In the "Update block types" dialog, click on the "Next" button.
In this step, the display shows whether the type change can be carried out in the RUN state on the basis of the calculation in the "Consequence" field.
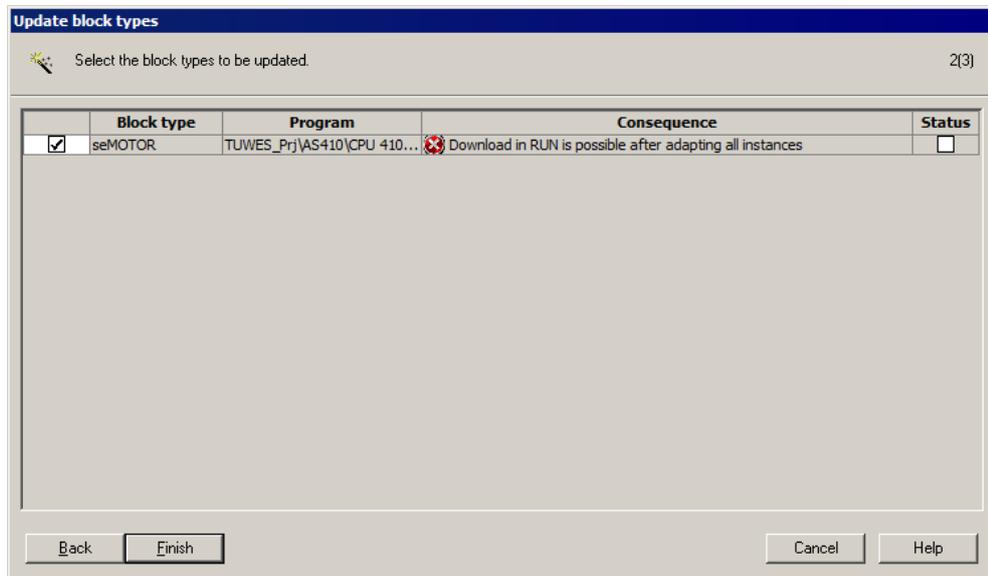
6. Click on the "Finish" button. Wait until the updating procedure has been completed successfully. A log file is displayed at the end of the procedure.

7. Select the "Charts" folder for the AS program and open a CFC chart.

The message "TCiR: Loading successful!" is displayed.
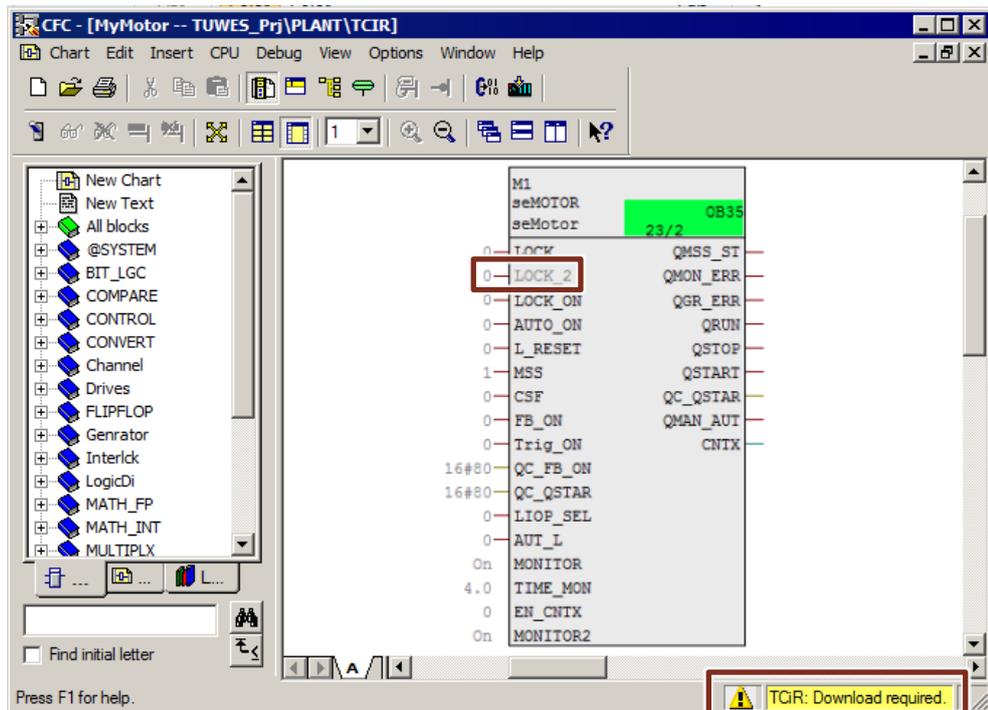
8. Click on the "Load" button on the toolbar.
   The "Compile program/Download to target system" dialog opens.

9. Select the "Entire program" option on the "Compile charts as program" tab.
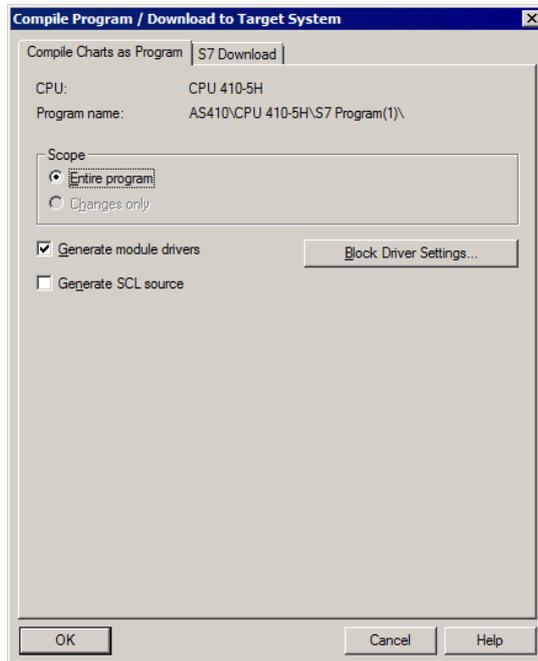
10. Open the "S7 download" tab and select the "Changes only" option.
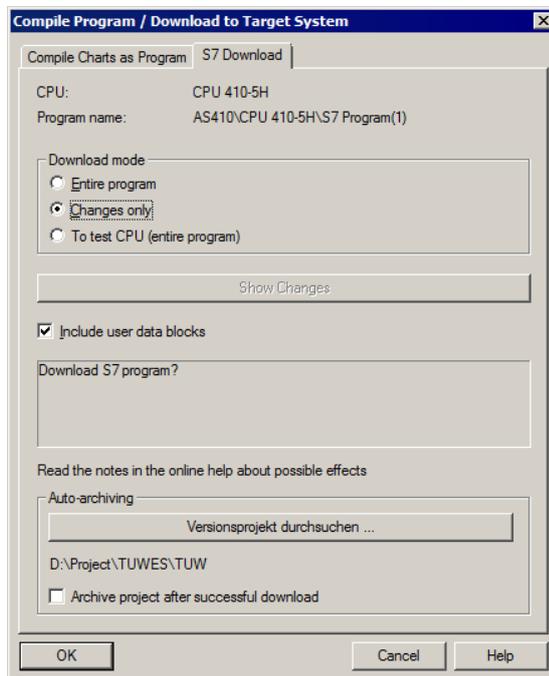
11. Click on the "OK" button.
    The interface changes are downloaded into the CPU 410 in RUN mode.

2.3 Using TCiR to update a library

Requirements

When updating an entire library, the same conditions and rules apply as to updating of an individual block.

Note	In general, upgrading using TCIR should have the aim of not stopping the AS but not demand migration of the project (the plant) to Run Time.

NOTICE	**Note that you must create new blocks (new number) for the instances of the changed block types that were loaded into the CPU by means of TCiR. The system deactivates the blocks in WinCC until the OS server has be been re-compiled and loaded.**
	In the case of a redundant OS server, you can do this before loading AS TCiR and loading one of the servers. This means that the plant can be operated before and after AS TCiR loading.
	Note, however, that when doing this data can be lost in the area of archiving.

Note	You can find a detailed description of TCiR in the CFC online help system and in the "SIMATIC Process Control System PCS 7 CFC for SIMATIC S7 (V9.0)" function manual. https://support.industry.siemens.com/cs/ww/en/view/109748700

The procedure for updating a library is described in the "Information and brief instructions for updating/upgrading PCS 7 software" manuals (https://support.industry.siemens.com/cs/ww/en/view/39980937).

License check

Note that at updating, more AS RT POs may be needed temporarily. This is the case if counting of AS RT PO is carried out in the CPU by the assigned memory.

To ensure that enough POs are available, proceed as described below.

1. Right-click the multiproject.
2. Select the "PCS 7 license information" menu item.
3. Make a note of the number of configured and booked POs and the maximum number of POs.
4. Check whether the AS RT counts the POs according to the assigned memory.

Note	You will find detailed information on the PO count in the following FAQs: "How are the licenses for the AS and OS counted in PCS 7 V7.0 onwards?" https://support.industry.siemens.com/cs/ww/en/view/38855207

If AS RT POs are not counted according to the assigned memory or if adequate spare POs are available, continue with "Resource Checking" in this chapter.

If the AS RT counts the POs according to the assigned memory, load the program via STOP.

| NOTICE	**If not enough AS RT POs are available on the CPU, downloading is not carried out. It is then only possible to update the user program by overall loading in STOP mode.**

Resource checking

After updating the blocks in the master data library, proceed as described below.

1. Select the "Blocks" folder in the master data library.

   Carry out command "Extras > Charts > Update block types".
   The "Update block types" dialog opens.

2. Select the check box in the "Download in RUN" column and click on the "Calculate" button in the "Resources" column.
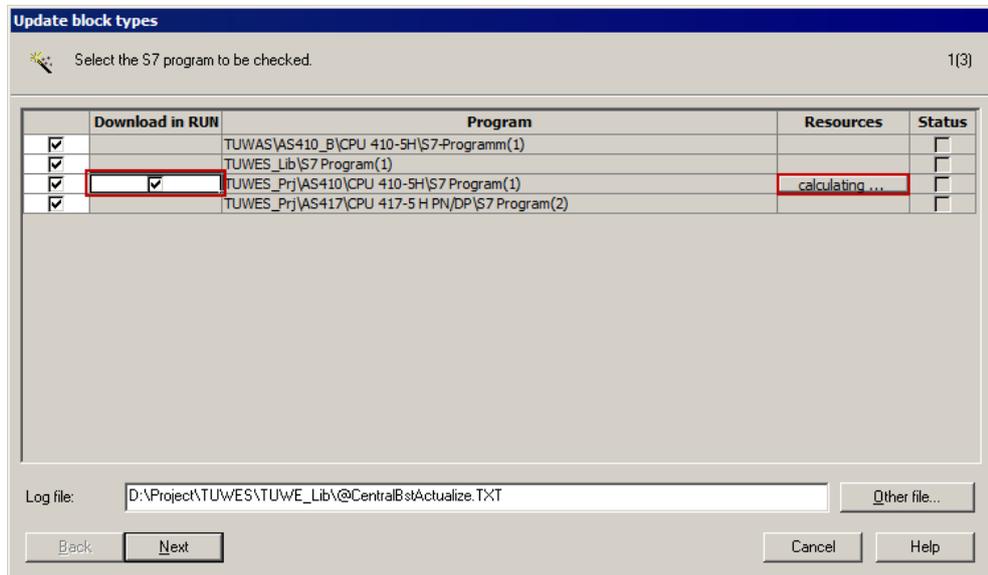
The "Resource information" dialog opens. This contains information about resource requirements for type changing in the automation system in which the type change is made.
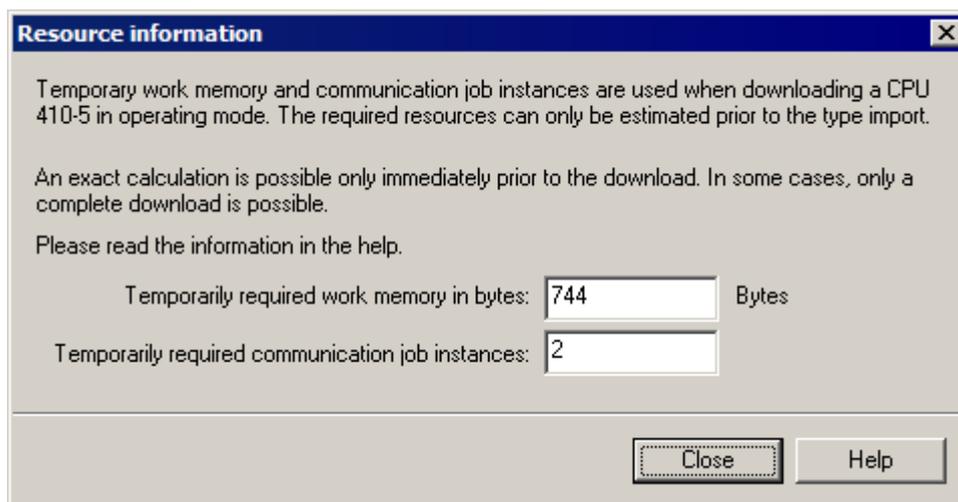
3. Check whether the there are adequate resources:
   If there are, proceed as described in chapter 2.2 from step 4 onward.

Note   If not enough resources are available, loading is only possible via STOP.

2.4 Configuring the PN/Ethernet interfaces of the CPU 410

In this chapter you will find information about configuration options for the PN/Ethernet interfaces of the CPU 410. The configurations are explained using the example of the CPU 410-5H and can be applied in the same way for the CPU 410E.

2.4.1 Standard Automation System – Configuring the interfaces for connection to the plant bus and the field bus without using an external CP

Due to its two PN/Ethernet interfaces, the CPU 410 can provide the option of implementing a connection to the plant bus and the field bus without using an external CP. This yields the following benefits:

- Reduction of hardware costs
- More space due to the use of compact mounting racks

The configuration procedure is carried out in the following steps:

- Adding a new AS station to the project
- Configure the interface for the plant bus
- Configure the interface for the field bus

The following figure shows the configuration schematically:

Fig. 2-1
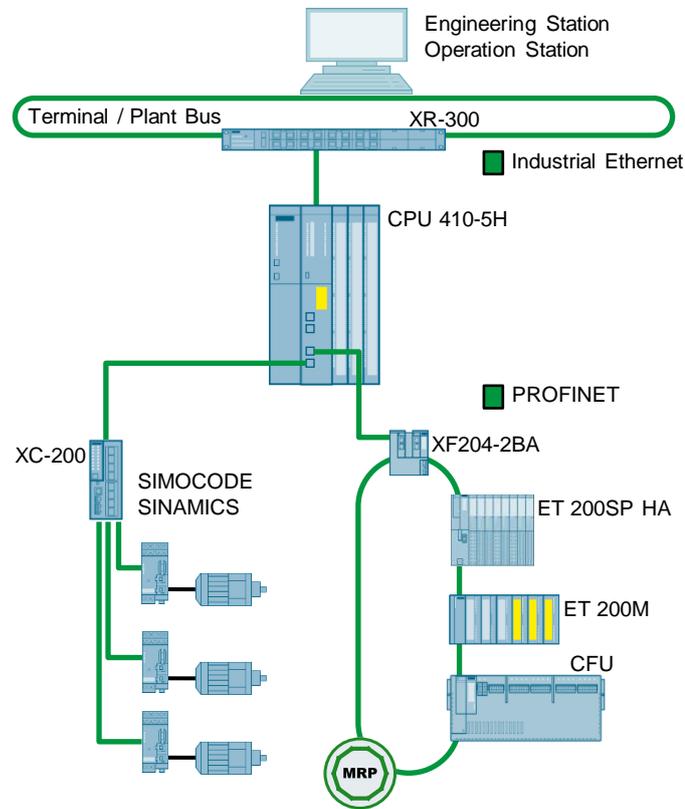
Requirements

The following requirements must be met:

- There is a PCS 7 multiproject present.
- A CPU 410-5H is connected.

Adding a new AS station to the project

1. Open a PCS 7 multiproject in the SIMATIC Manager.
2. Insert a new sub-project using the "File > New project" command.
3. Right-click on the sub-project and choose the "Insert new object > Preconfigured station" command from the context menu.
   The "PCS 7 Wizard: Expand project" dialog opens.
4. Select the CPU 410-5H without CP and insert the station. In this example, the procedure is explained using the example of a single station (AS410-Single (1H)).
5. Open the AS station with the CPU 410-5H in HW Config.

Configuring the interface for the plant bus

1. Open the properties for the "PN-IO-X5" interface of the CPU 410-5H in the HW Config.
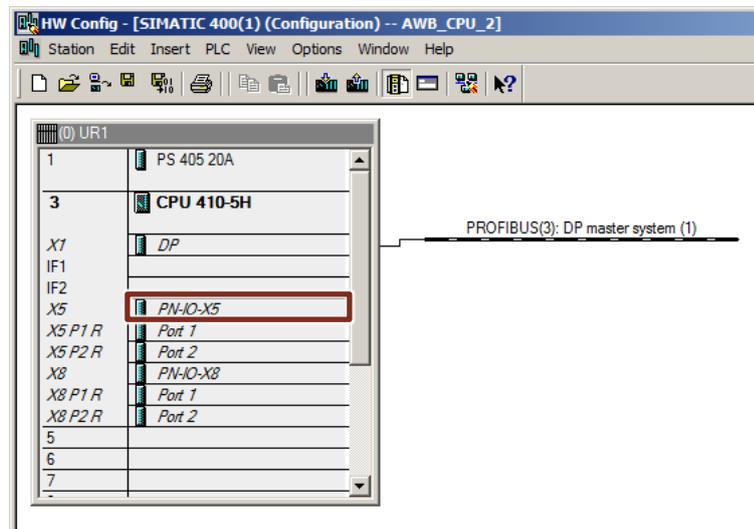

2. Enter an unequivocal device name in the "General" tab.
3. Click on the "Properties..." button
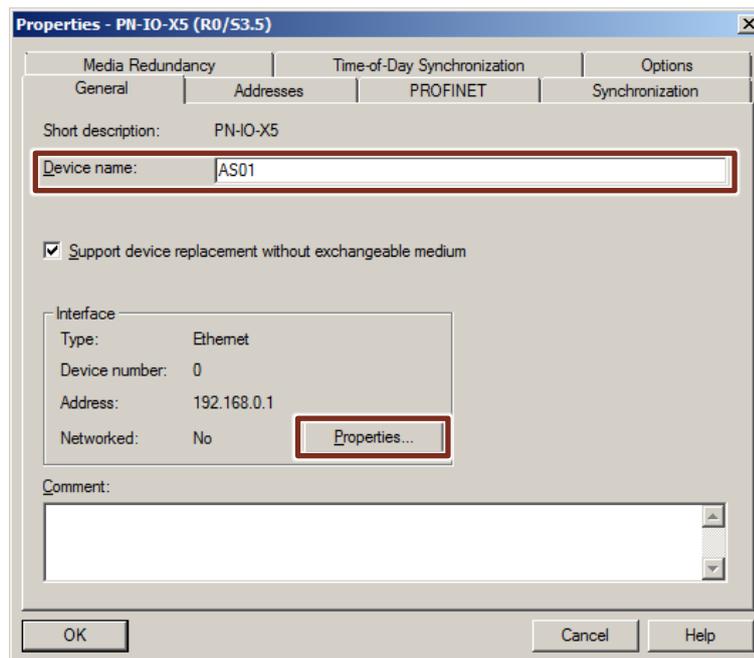
4. Enter a valid IP address and subnet mask for the plant bus.
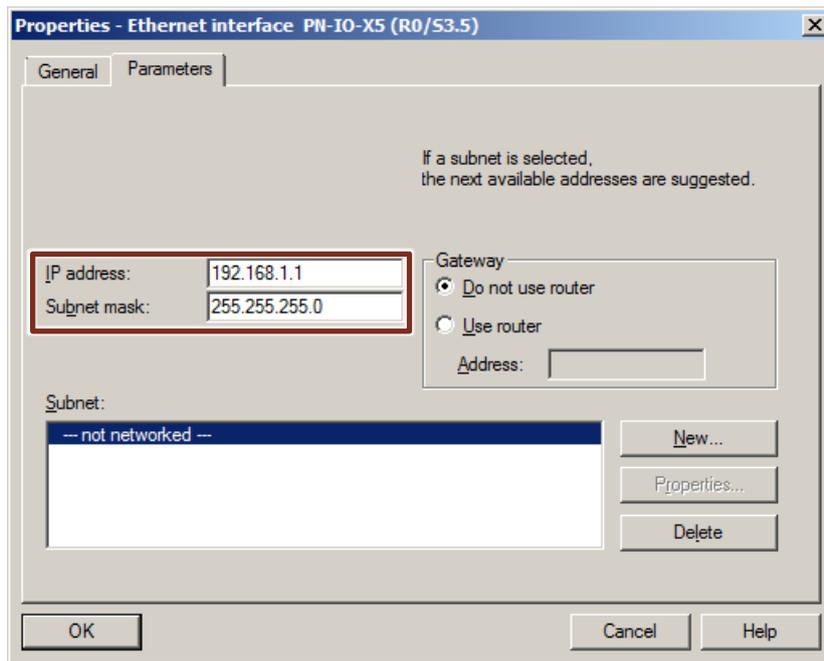
5. Assign an existing subnet to the interface or create a new subnet for it. In this example, a new subnet is created for the plant bus and assigned to the interface.
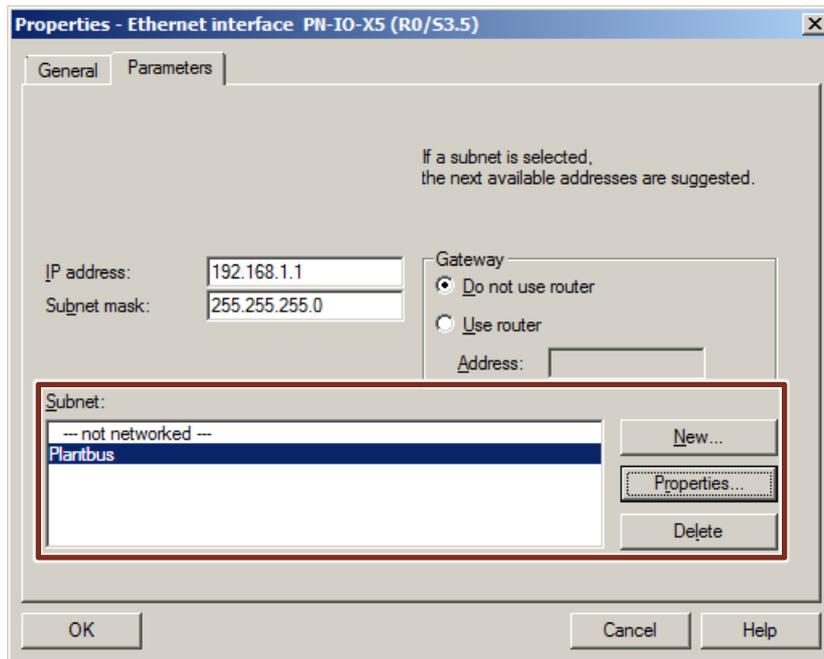
6. Confirm your settings with "OK".
   The interface is connected to the plant bus.
   From PCS V9.0 a PROFINET IO system is also created for connecting the PROFINET IO modules. This is not needed and can optionally be deleted using the short cut menu

Configuring the interface for the field bus

1. Open the properties for the "PN-IO-X8" interface of the CPU 410-5H in the HW Config.
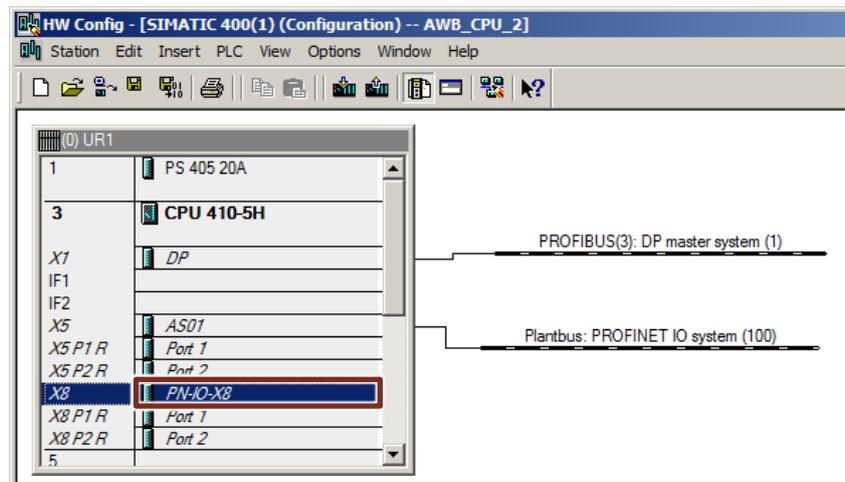
2. Enter an unequivocal device name in the "General" tab.
3. Click on the "Properties..." button
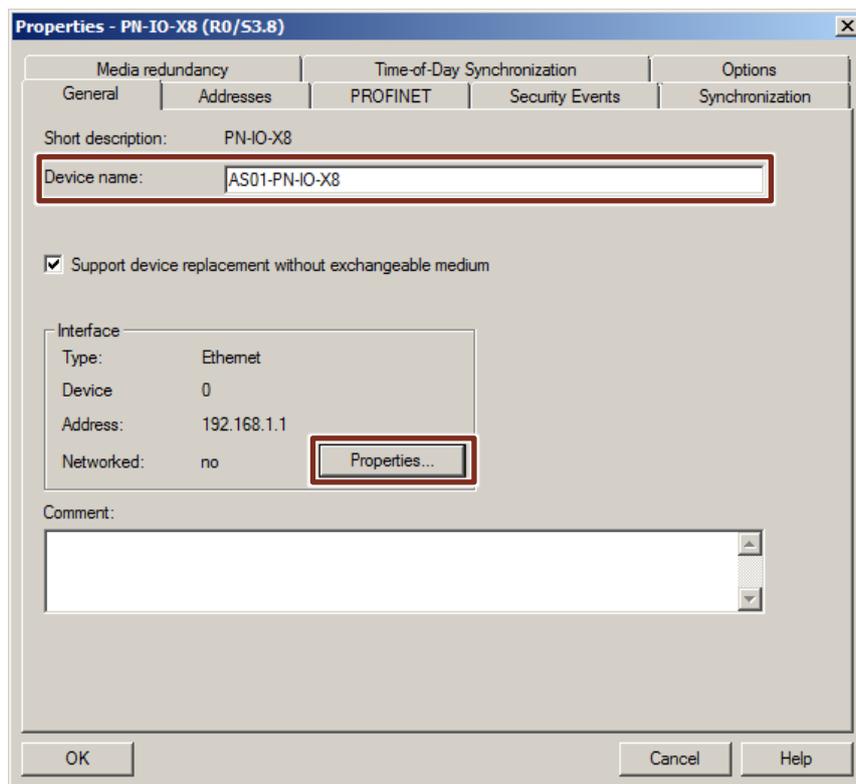
4. Enter a valid IP address and subnet mask for the field bus.

5. Assign an existing subnet to the interface or create a new subnet for it. In this example, a new subnet is created for the field bus and assigned to the interface.
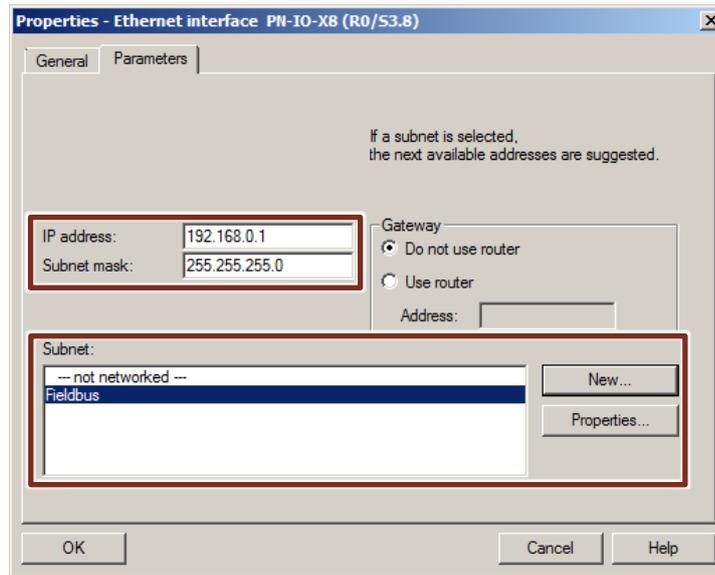
6. Confirm your settings with "OK".
   From PCS 7 V9.0 a PROFINET IO system is also created for connecting the PROFINET IO devices. With PCS 7 Version V8.2 and lower, right-click to select the interface and select the "Insert PROFINET IO system" command from the context menu.

Result

The interface X5 of the CPU is configured for connection to the plant bus and the interface X8 for the connection of PROFINET devices
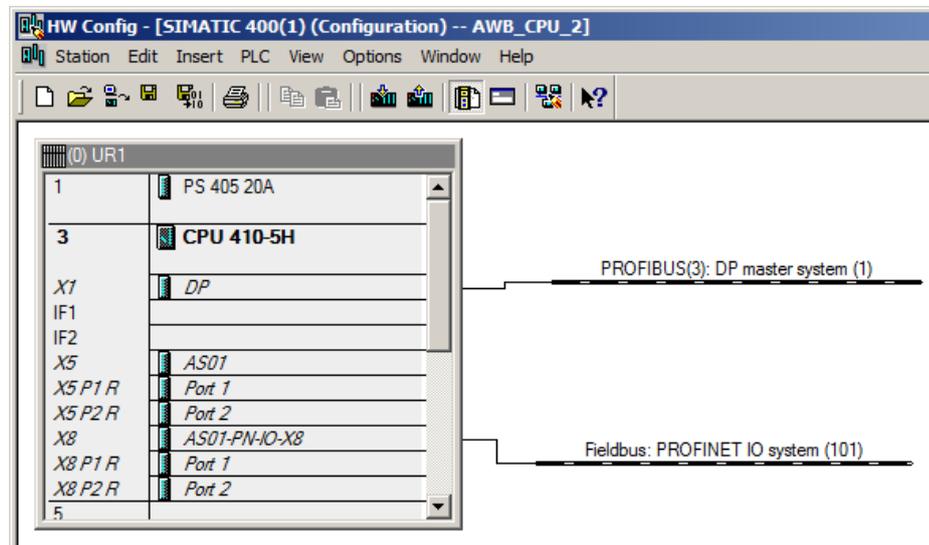
| Note | For further information on PROFINET in SIMATIC PCS 7, e.g. recommended PROFINET network configurations, see the application example: "PROFINET in SIMATIC PCS 7 – Guidelines and Blueprints" https://support.industry.siemens.com/cs/ww/en/view/72887082 |

2.4.2 Standard Automation System – Configuring two separate PROFINET interfaces for connection to the field bus

When there is a large number of devices, the CPU 410 offers the option of configuring two PROFINET interfaces for connection to the field bus. In this case, the connection to the plant bus is made via an external CP.

The configuration procedure is carried out in the following steps:

- Adding a new AS station to the project
- Configure the interface for the plant bus
- Configuring two PROFINET interfaces for the field bus

The following figure shows the configuration schematically:

Fig. 2-2

Requirements

The following requirements must be met:

- There is a PCS 7 multiproject present.
- A CPU 410-5H is connected.

Adding a new AS station to the project

Proceed as follows to configure two PROFINET interfaces for the field bus:

1. Open a PCS 7 multiproject in the SIMATIC Manager.

2. Insert a new sub-project using the "File > New project" command.

3. Right-click on the sub-project and choose the "Insert new object > Preconfigured station" command from the context menu.
   The "PCS 7 Wizard: Expand project" dialog opens.

4. Select the CPU 410-5H with a CP and insert the station. In this example, the procedure is explained using the example of a single station (AS410-Single (1H)) with a CP 443-1.

Configure the interface for the plant bus

1. Open the AS station with the CPU 410-5H in the HW Config.

2. Open the properties for the "PN-IO" interface of the CP 443-1.

3. Open the "General" tab and enter an unequivocal device name.

4. Click on the "Properties..." button.
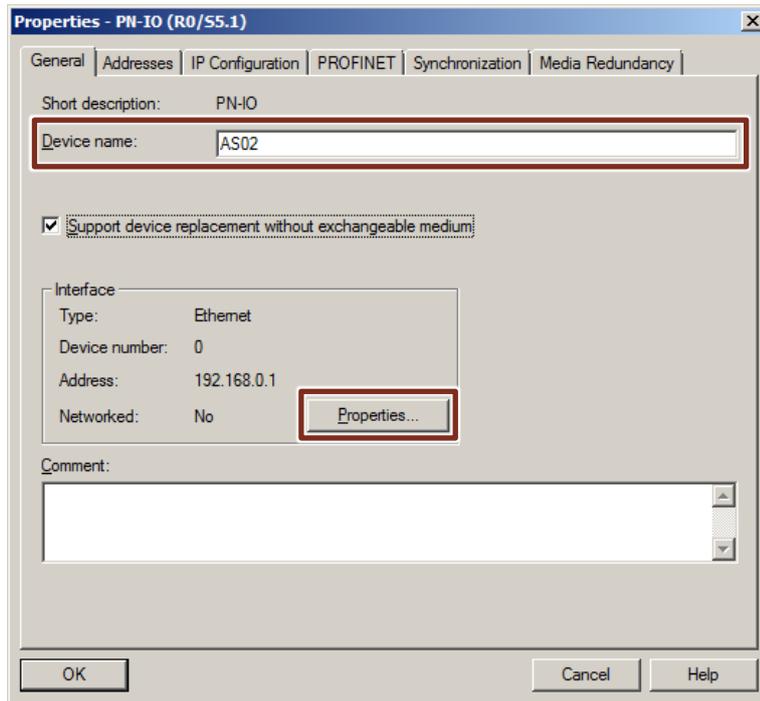
5. Activate the check box "Set MAC address/use ISO protocol" and assign the MAC addresses you wish.
   Enter a valid IP address and subnet mask for the plant bus or deactivate the option box "use IP protocol".

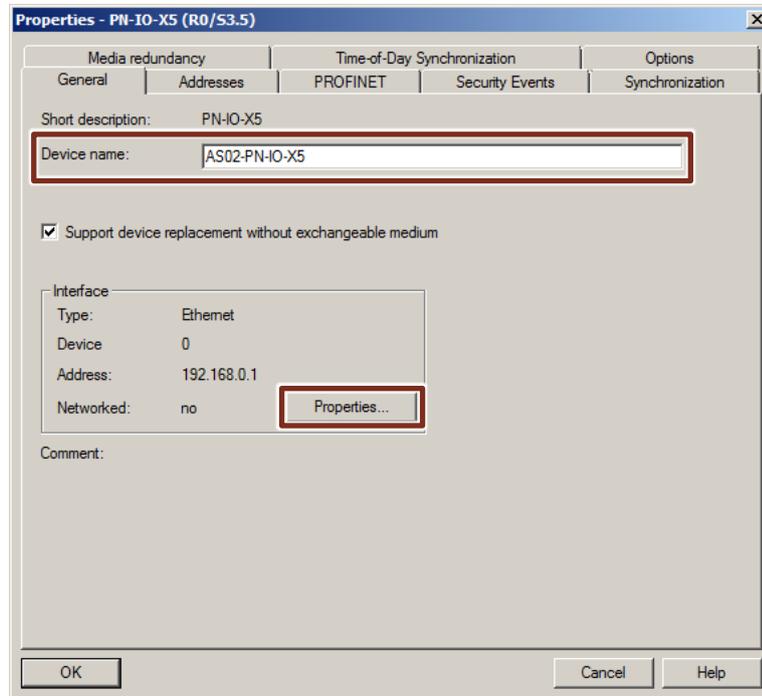6. Assign an existing subnet to the interface or create a new subnet for it.
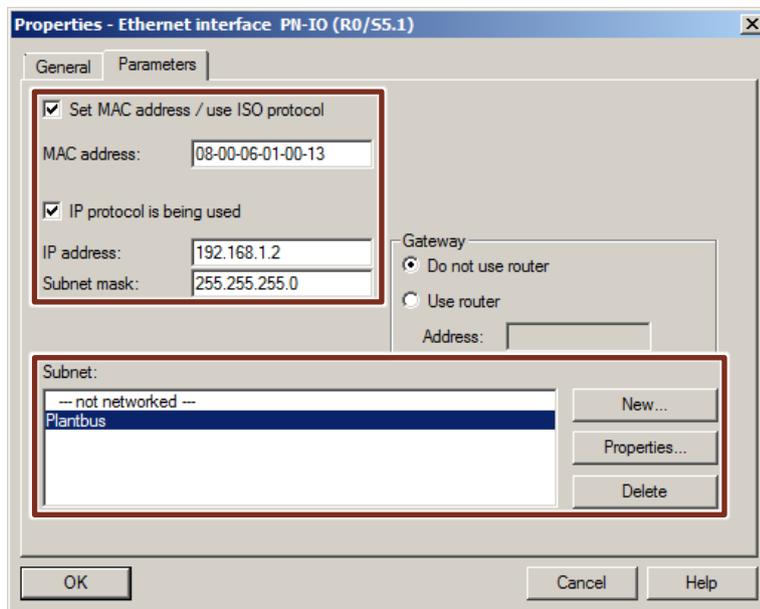
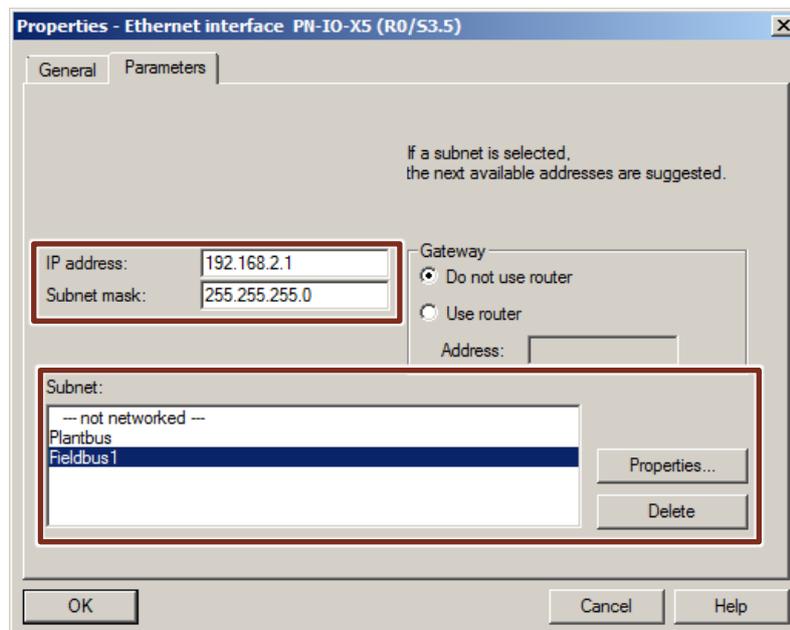7. Confirm your settings with "OK".
   The interface of the CP443-1 is connected to the plant bus.

Configuring the PROFINET interfaces for the field bus

When configuring interfaces X5 and X8, it must be borne in mind that the IP addresses of interfaces X5 and X8 must be located in different IP address areas.

1. Open the properties of the "PN-IO-X5" interface and enter an unequivocal device name in the "General" tab.

2. Click on the "Properties..." button.

3. Enter a valid IP address and subnet mask.

4. Assign an existing subnet to the interface or create a new subnet for it. In this example, a new subnet is created for the field bus and assigned to the interface.

Process automation with the SIMATIC PCS 7 CPU 410-5H controller
Entry ID: 96839331,   V3.2,   10/2019

5. Confirm your settings with "OK".
   From PCS 7 V9.0, a PROFINET IO system for connecting the PROFINET IO modules is created automatically. If a PCS 7 in version V8.2 and lower is being used, select the interface with the right mouse button and select the "Insert PROFINET IO system" command in the context menu.
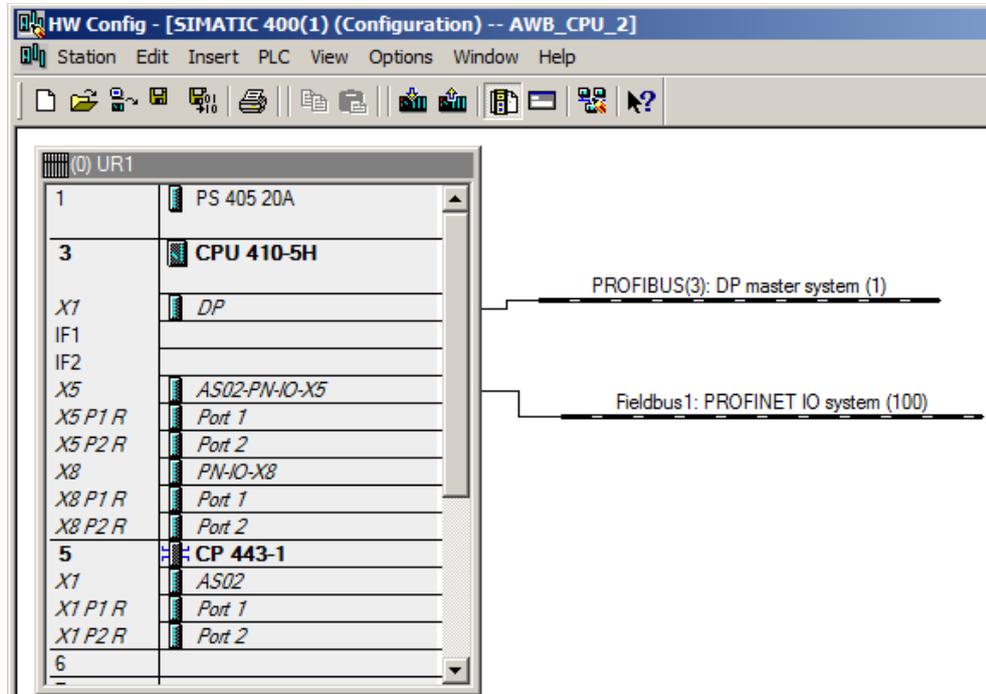
6. Repeat steps 1-5 for "PN-IO-X8" interface.
   In this example, the device name "AS02-PN-IO-X8", the IP address "192.168.3.1" (IP address range different from that of interface X5) and the new subnet "Fieldbus2" are used.

Result

The CP 443-1 is used for connecting to the plant bus. The internal interfaces of the CPU X5 and X8 are both configured for the connection of PROFINET devices.
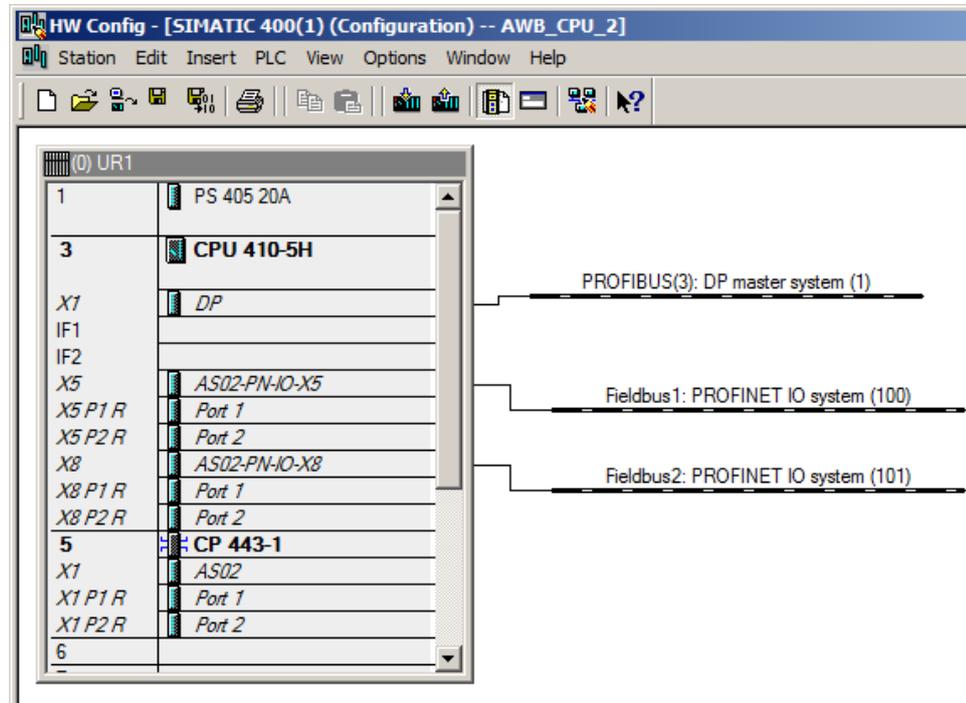
| Note | For further information on PROFINET in SIMATIC PCS 7, e.g. recommended PROFINET network configurations, see the application example: "PROFINET in SIMATIC PCS 7 – Guidelines and Blueprints" https://support.industry.siemens.com/cs/ww/en/view/72887082 |

2.4.3 High-availability automation system – Configuration of the interfaces

Highly available automation systems based on the CPU 410 enable the connection of PROFINET devices via simple S2 system redundancy as well as the configuration of redundant PROFINET configurations (R1).

For the segmentation of networks or when there is a large number of devices, the CPU 410 offers the option of configuring both PROFINET interfaces for connection to the field bus. In the following configuration the interface X5 is used for the connection of devices via simple system redundancy S2 and the interface X8 for the configuration of a redundant PROFINET configuration (R1). In the redundant PROFINET configuration (R1), the devices have two interface modules and are thus connected to the high-availability automation system via two separate PROFINET networks.

In this case, the connection to the plant bus is made via external CPs. Alternatively, the connection to the plant bus can also take place via the PROFINET/Ethernet interfaces integrated in the CPU. If internal interfaces are used to connect to the plant bus, these cannot be used for PROFINET.

The configuration procedure is carried out in the following steps:

- Adding a new AS station to the project
- Configuring the interface of the CPs for the plant bus
- Configuring the PROFINET interfaces for the field bus

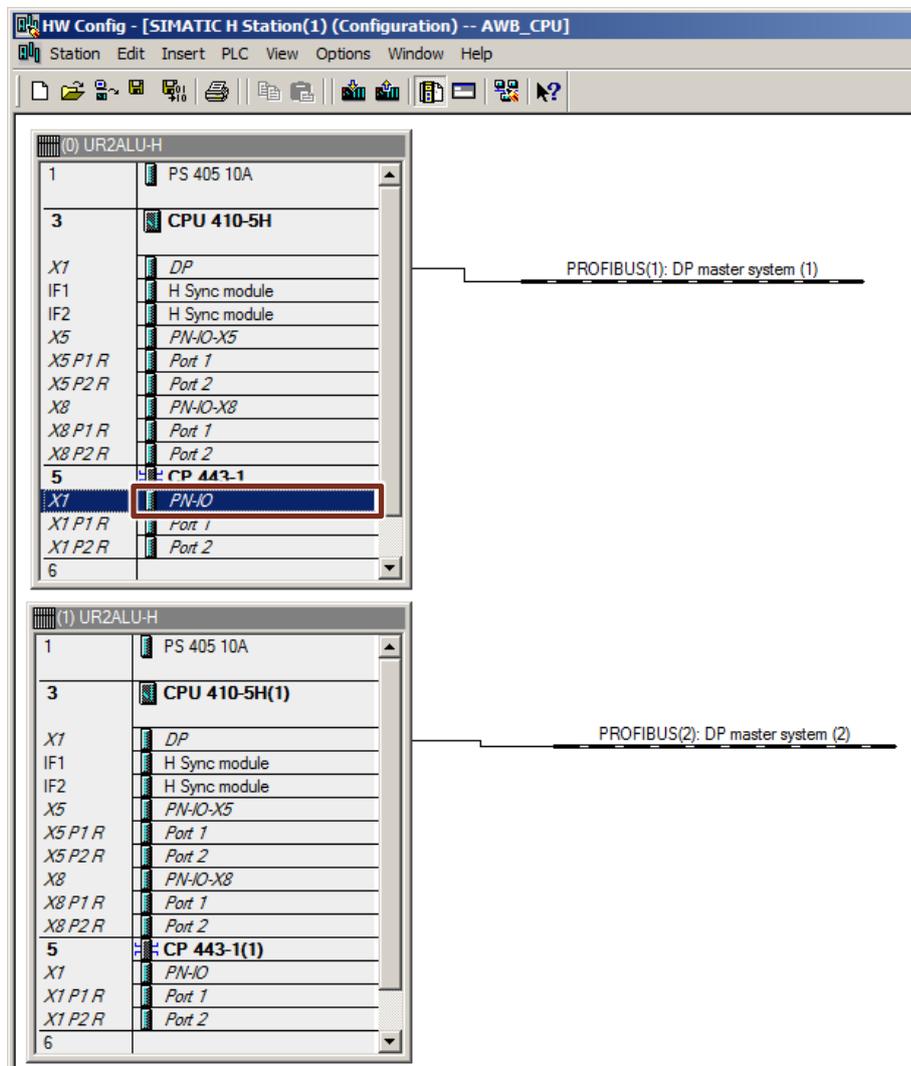The following figure shows the configuration schematically:

Fig. 2-3
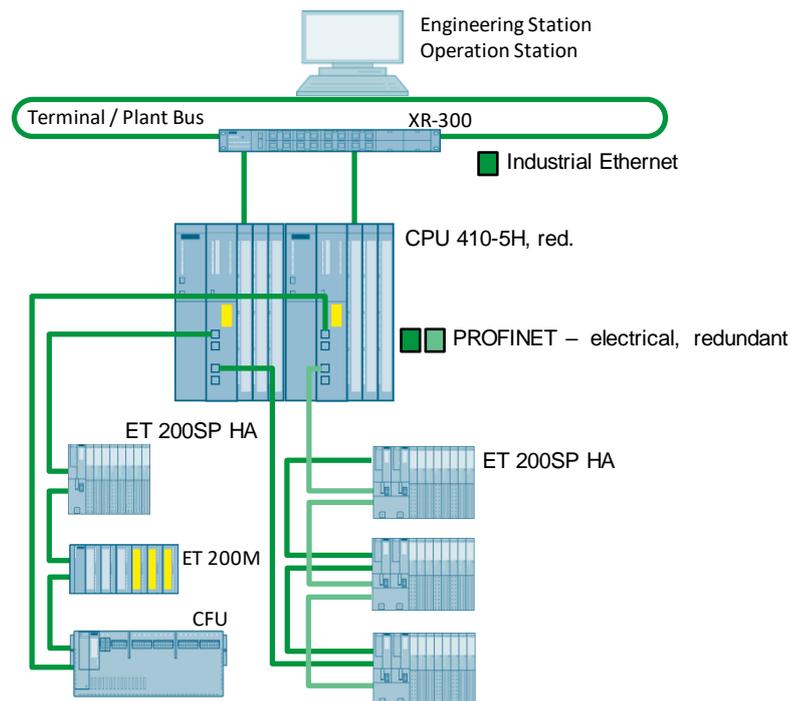
Adding a new AS station to the project

Proceed as follows to configure two PROFINET interfaces for the field bus:

1. Open a PCS 7 multiproject in the SIMATIC Manager.

2. Insert a new sub-project using the "File > New project" command.

3. Right-click on the sub-project and choose the "Insert new object > Preconfigured station" command from the context menu.
   The "PCS 7 Wizard: Expand project" dialog opens.

4. Select the CPU 410-5H with a CP and insert the station. In this example, the procedure is explained using the example of a redundancy station (AS410-2H) with a CP 443-1.

Configuring the interface of the CPs for the plant bus

1. Open the AS station with the CPU 410-5H in the HW Config.

2. Open the properties for the "PN-IO" interface of the CP 443-1 ion Rack 0.

3. Open the "General" tab and enter an unequivocal device name.

4. Click on the "Properties..." button.
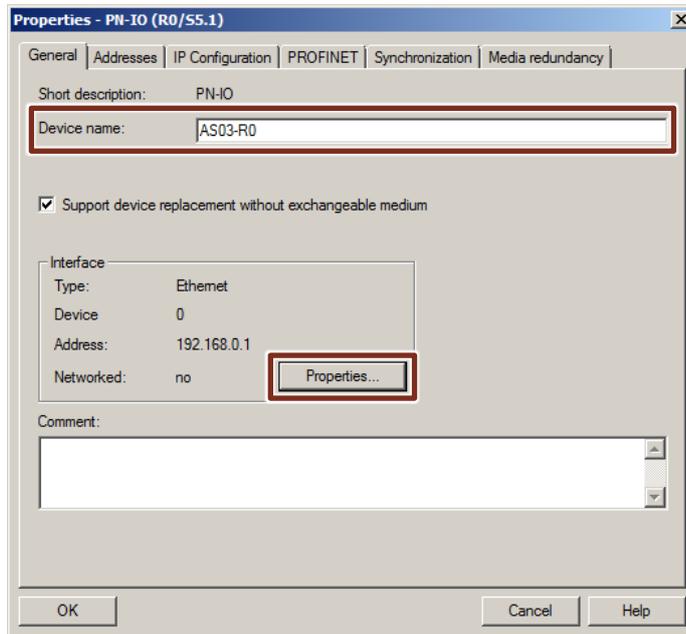
5. Activate the check box "Set MAC address/use ISO protocol" and assign the MAC addresses you wish.
   Enter a valid IP address and subnet mask for the plant bus or deactivate the option box "use IP protocol".

6. Assign an existing subnet to the interface or create a new subnet for it.
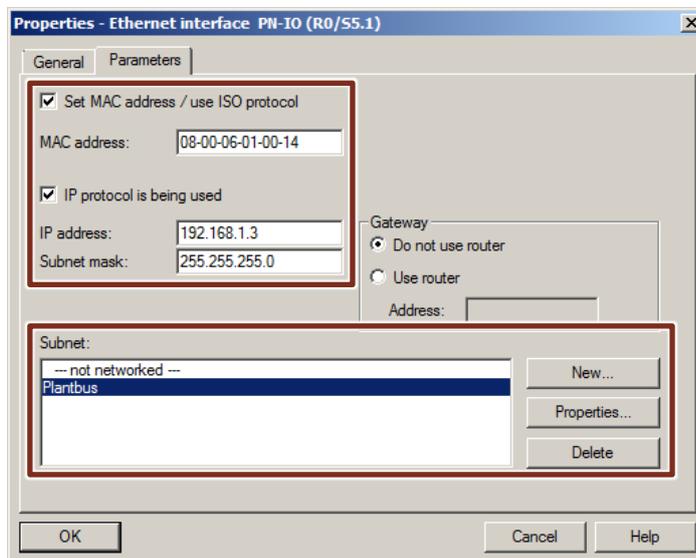
7. Confirm your settings with "OK".
   The interface of the CP443-1 is connected to the plant bus.

8. Repeat steps 1-7 for CP443-1 in Rack 1.
   In this example, the device name "AS03-R1", the IP address "192.168.1.4" (the same IP address range as the CP443-1 in rack 0) and the existing subnet "Plant bus" are used.

**Configuring the PROFINET interfaces for the field bus**

In the following, the interface X5 is configured for the connection of devices via simple system redundancy S2 and the interface X8 is used to create a redundant PROFINET configuration (R1). No provision has been made for the incorporation of S2 devices into the redundant R1 network.

For the connection of devices via simple system redundancy S2, IP addresses in the same IP address area must be used for the corresponding interfaces of the CPU.

When configuring the interfaces of R1 networks, the following must be borne in mind in respect of the IP addresses:

- In a purely R1 configuration without a Y switch and without embedded S2 devices, the two subnets can be in the same IP address ranges or in different ones.

- In a mixed configuration (R1 and S2 devices), the two subnets must be in the same IP address range.

- When using high-precision time stamps (SoE), the subnets must use different IP address ranges.

1. Open the properties of the "PN-IO-X5" interface in Rack 0 and enter an unequivocal device name in the "General" tab.
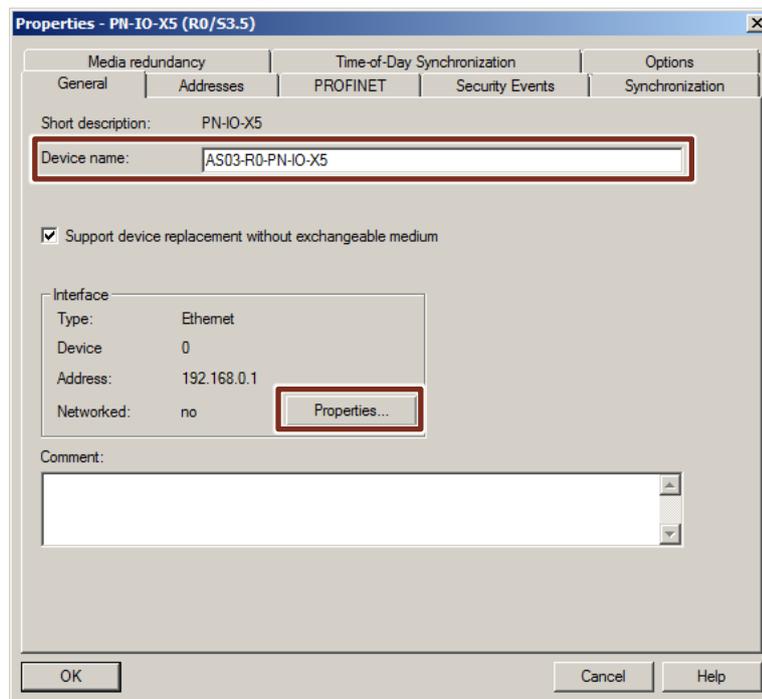
2. Click on the "Properties..." button.

3. Enter a valid IP address and subnet mask.

4. Assign an existing subnet to the interface or create a new subnet for it. In this example, a new subnet is created for the field bus and assigned to the interface.
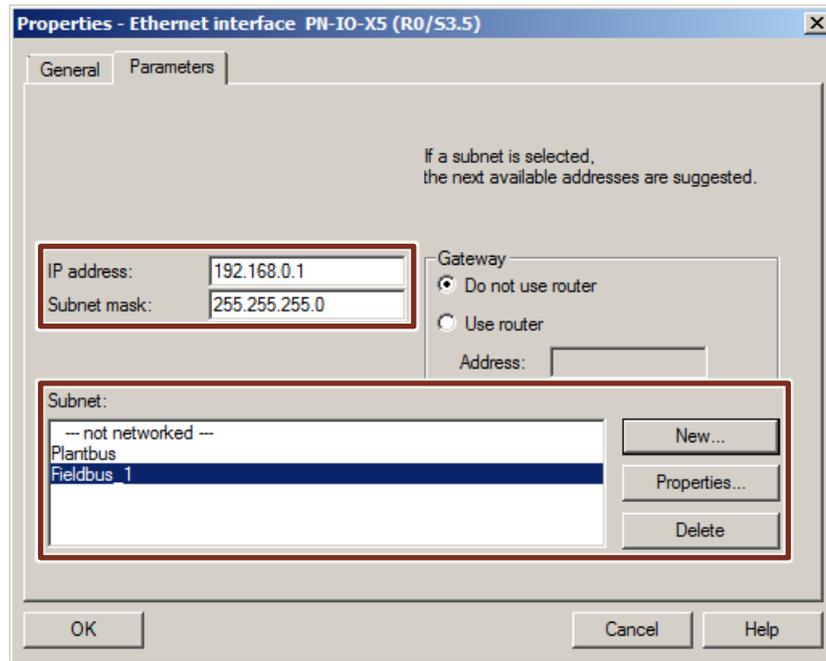
5. Confirm your settings with "OK".
   From PCS 7 V9.0 a PROFINET IO system is also created for connecting the PROFINET IO devices. If a PCS 7 in version V8.2 and lower is being used, select the interface with the right mouse button and select the "Insert PROFINET IO system" command in the context menu.
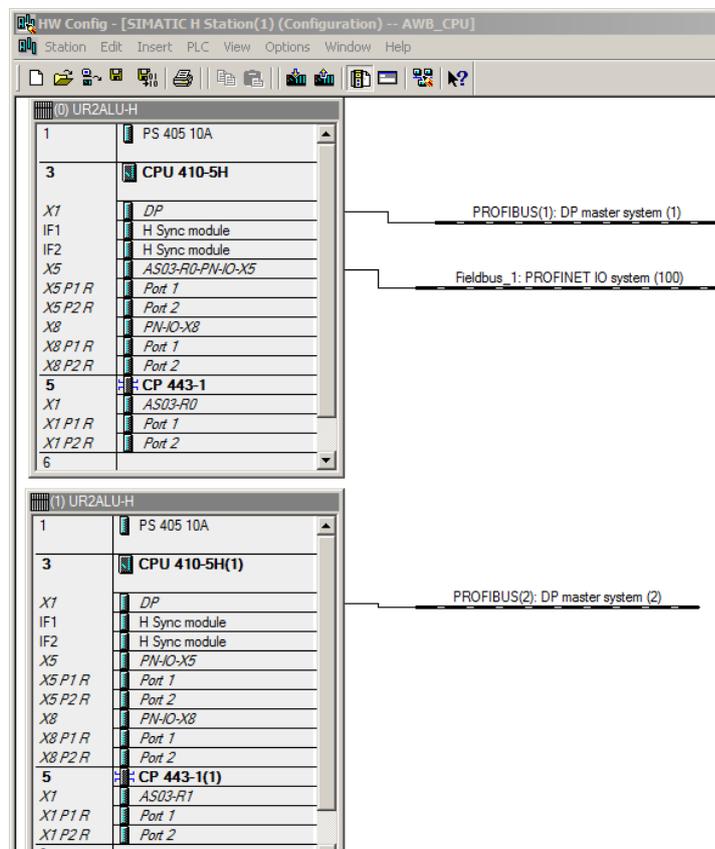
6. Repeat steps 1-5 for configuring the interfaces "PN-IO-X5" in Rack 1, "PN-IO-X8" in rack 0 and "PN-IO-X8" in Rack 1, with the data from the following Table.

	Rack 0: X5	Rack 1: X5	Rack 0: X8	Rack 1: X8
Device name	AS03-R0-PN-IO-X5	AS03-R1-PN-IO-X5	AS03-R0-PN-IO-X8	AS03-R1-PN-IO-X8
IP address	192.168.0.1	192.168.0.2	192.168.3.1	192.168.4.1
Subnet mask	255.255.255.0	255.255.255.0	255.255.255.0	255.255.255.0
Subnet	Fieldbus_1	Fieldbus_1	Fieldbus_R1_1	Fieldbus_R1_2
	Joint subnet		Different subnets	

Result

Both CP 443-1 units are configured for connection to the plant bus. The internal interfaces of the CPU are configured for the connection of PROFINET devices in the following manner:

- X5: Joint subnet for the connection of S2 devices
- X8: Separate subnet for the connection of R1 devices
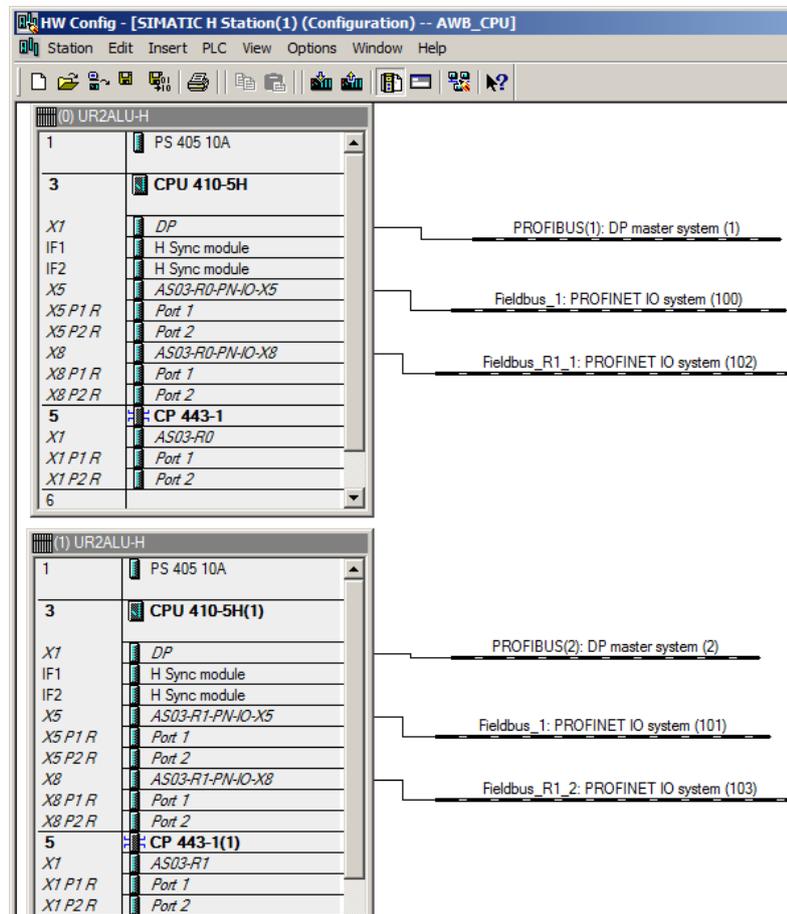
Note For further information on PROFINET in SIMATIC PCS 7, e.g. recommended PROFINET network configurations, see the application example:
"PROFINET in SIMATIC PCS 7 – Guidelines and Blueprints"
https://support.industry.siemens.com/cs/ww/en/view/72887082

2.5 Configuration modifications in operation – CiR/H-CiR

Configuration in Run (CiR) is a function that enables the system and configuration (e.g. the addition or modification of hardware) to be changed during operation without causing a plant standstill. This function is available to varying degrees for both standard automation systems and H-systems.

Configuration in Run in a standard automation system (CiR)

When CiR is used in a standard automation system, the process execution of the loading process is paused for a brief time interval (CiR synchronization time). The process inputs and outputs retain their last value during this time. When using the CPU 410-5H, the maximum CiR synchronization time is 60 ms.

Configuration in Run in a high-availability automation system (H-CiR)

Besides the modifications that are possible in a standard automation system, it is also possible to modify some CPU parameters in a high-availability automation system.

Sequence of an H-CiR process:

- Modify the hardware configuration offline
- When loading:
    - Stop standby CPU
    - Upload new hardware configuration to the standby CPU.
    - Switch over to the CPU with modified configuration
    - Update the second CPU
- The system works redundantly again

The changes that are possible as a CiR/H-CiR operation depend on whether the (changed) IO device has CiR functionality.

The following table gives an overview:

Table 2-1

CiR/H-CiR operation	Device without CiR	Device with CiR
Add IO device	✓	✓
Remove IO device	✓	✓
Add submodule	✗	✓
Remove submodule	✗	✓
Reassign submodule parameters	✗	✓
Interface configuration (e.g. enable/disable ports, topology configuration)	✗	✓

| **Note**	Additional information on Configuration in Run is available in the following documents: "PROFINET in SIMATIC PCS 7 – Guidelines and Blueprints" https://support.industry.siemens.com/cs/ww/en/view/72887082 "SIMATIC PCS 7 Process Control System CPU 410 Process Automation" https://support.industry.siemens.com/cs/ww/en/view/109748473

2.5.1 Change parameter assignment of a submodule

Scenario

In the PROFINET network of an AS 410 there is a distributed SIMATIC ET 200SP HA periphery with the configurable periphery module "AI-DI 16 / DQ 16x24VDC HART HA". The plan is in operation and channel 0, which has previously been used as a digital input, is to be made available as an analog input (0..24 mA HART) in the future. The procedure for changing parameterization and loading during operation is described below.

The following figure shows the configuration schematically:

Fig. 2-4
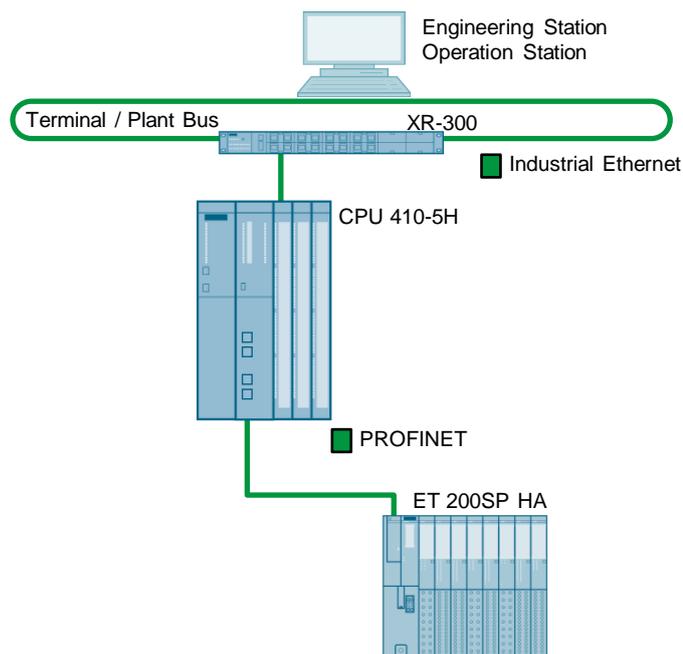
Procedure

Changing the parameterization is done as described in the following steps:

- Archiving the CiR load-capable project
- Changing parameterization
- Checking CiR capability
- Loading the hardware configuration during operation

Requirements

- The PCS 7 multiproject is open in SIMATIC Manager.
- The hardware configuration and the automation program have been compiled and loaded into the CPU 410.
- The firmware status of the CPU 410 is V8.2 (or above)
- The CPU 410 is in Run mode.
- The device whose submodule is to be re-parameterized, must be CiR-capable. ET 200SP HA supports CiR.

Changing parameter assignment of a periphery module

1. Archive the project before making any changes. This way, you may still be able to reject the changes, should CiR capability be lost.

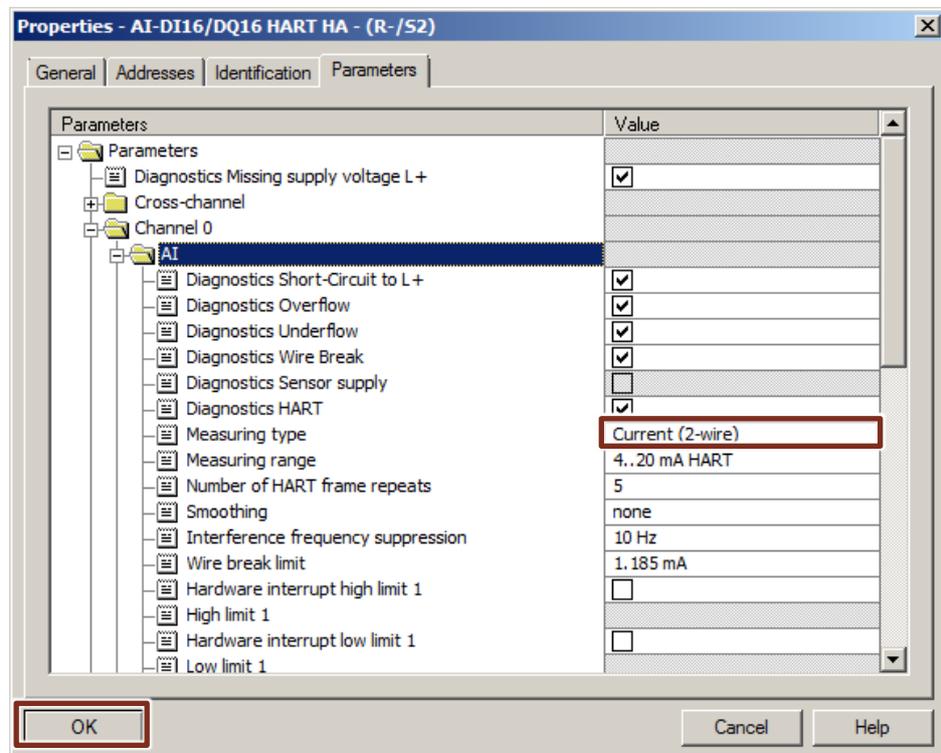2. Double-clicking on the periphery module to open "AI-DI16/DQ16 HART HA" the object properties.
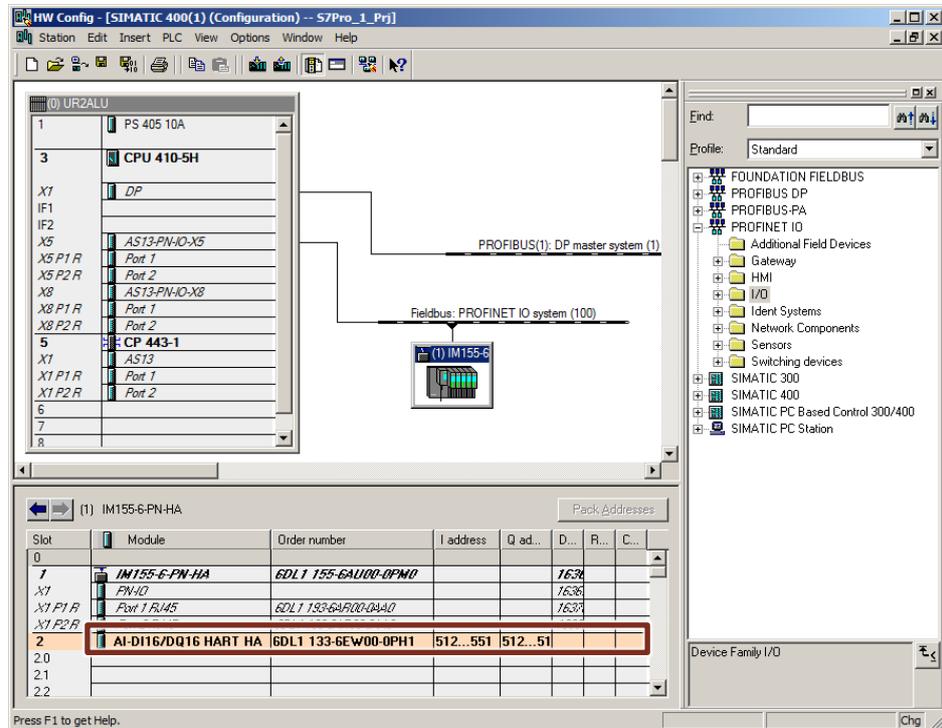
3. Switch to the "Parameters" tab and in the tree, open "channel 0 > AI".
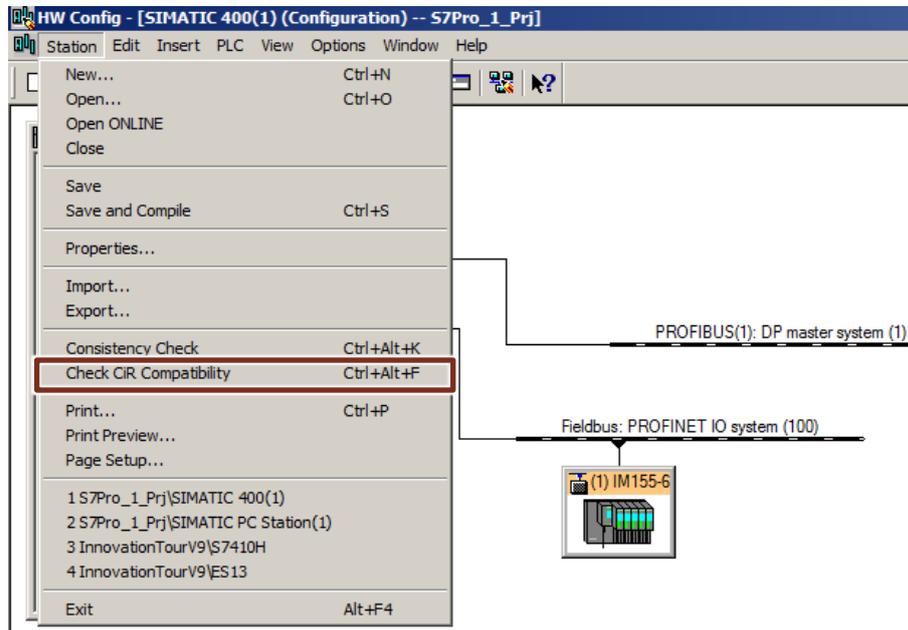   Until now, Channel 0 has been parameterized as a Digital Input, i.e. the Analog Input (AI) is deactivated.
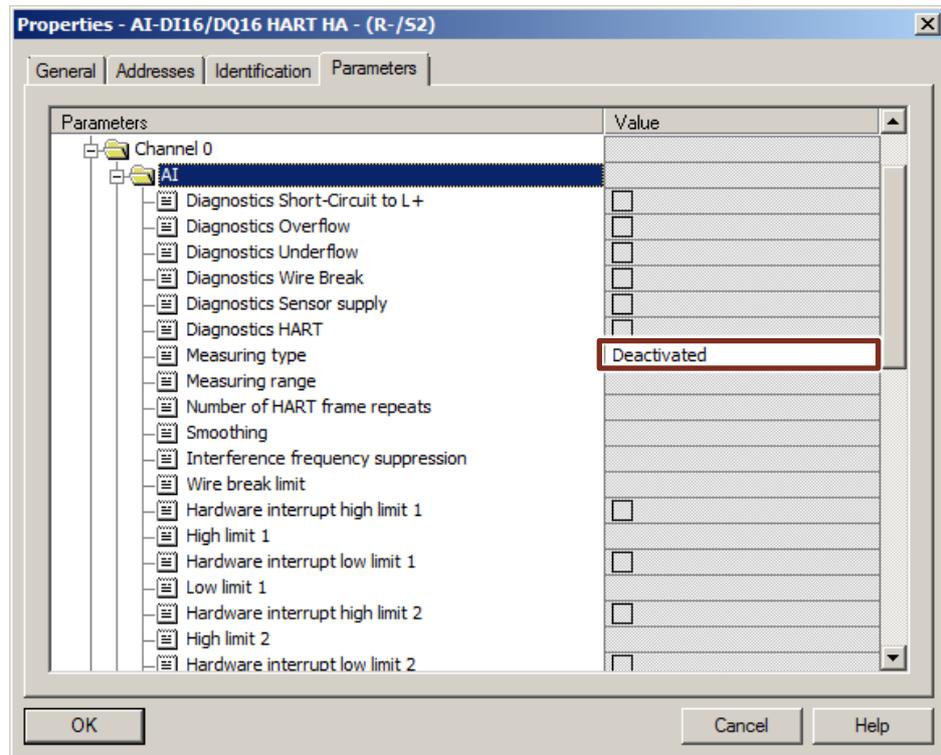
4. In the "Measurement type" drop-down list, select "Current (2wire)" and confirm the settings with OK.

Checking CiR capability

1. Select the menu command "Station > Check CiR capability" to check whether it is possible to load modifications during operation.

2. The CiR capability test returns the result that the station is consistent, i.e. the changes can be loaded during operation.
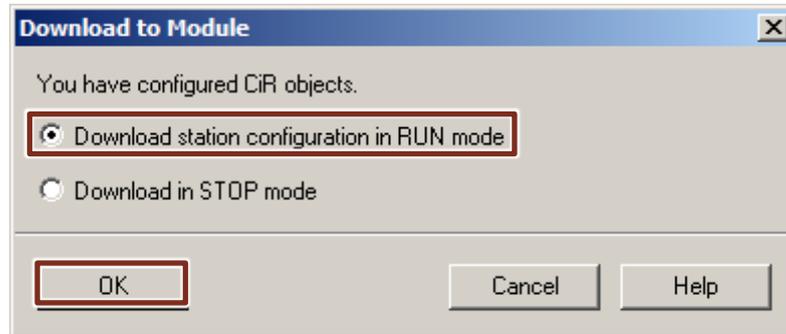   Confirm the dialog with "Close".
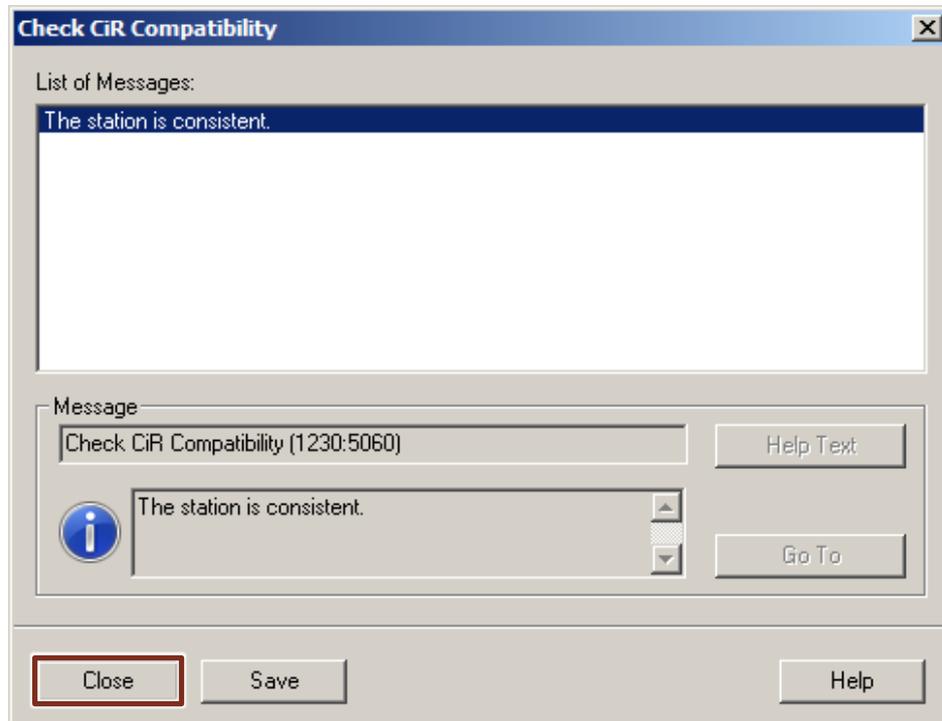
Loading the hardware configuration during operation

1. Save and compile your configuration, and then click on "load to module".

2. Select the "Load station configuration in operating mode RUN" and confirm with the "OK" button.

Result

Channel 0, which has previously been used as a digital input, is now available as an analog input (0..24 mA HART).

2.5.2 Adding a device

Scenario

As part of a function expansion, the periphery of a system is expanded by a Compact Field Unit (CFU). Since the process must not be interrupted, the CFU is to be integrated into the PROFINET network of the AS 410 during operation. The following figure shows the configuration schematically:

Fig. 2-5
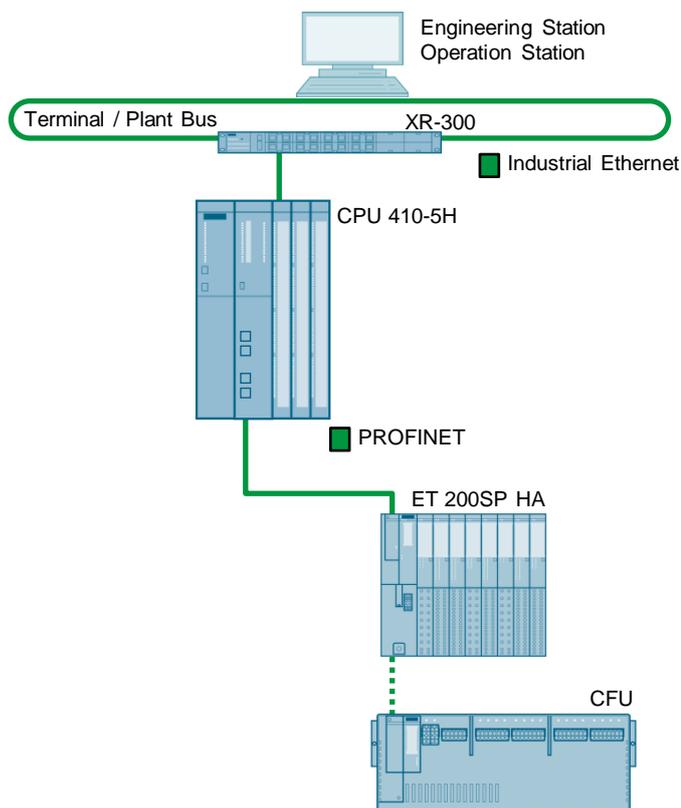
The connection of the CFU should be linear to the free port 2 of the ET 200SP HA. According to the recommendations for PCS 7, the topology is configured for the use of the device replacement function without removable media and unused ports are deactivated for security reasons This means that port 2 of the ET 200SP HA must be activated for the integration of the CFU and the topology configuration must be adapted.

Procedure

Adding a device during operation is carried out in the following steps:

- Archiving the CiR load-capable project
- Adding a device in the HW Config
- Adjusting the topology configuration and interface parameterization
- Checking CiR capability
- Loading the hardware configuration during operation
- Connection of the CFU (real plant)

Requirements

- The PCS 7 multiproject is open in SIMATIC Manager.
- The hardware configuration and the automation program have been compiled and loaded into the CPU 410.
- The firmware status of the CPU 410 is V8.2 (or above)
- The CPU 410 is in Run mode.
- All neighboring devices of the new device must support CiR (necessary for the adaptation of the topology configuration and the interface parameterization)

Adding a device

1. Archive the project before making any changes. This way, you may still be able to reject the changes, should CiR capability be lost.

2. Drag&drop the Compact Field Unit from the module catalog to the PROFINET IO system
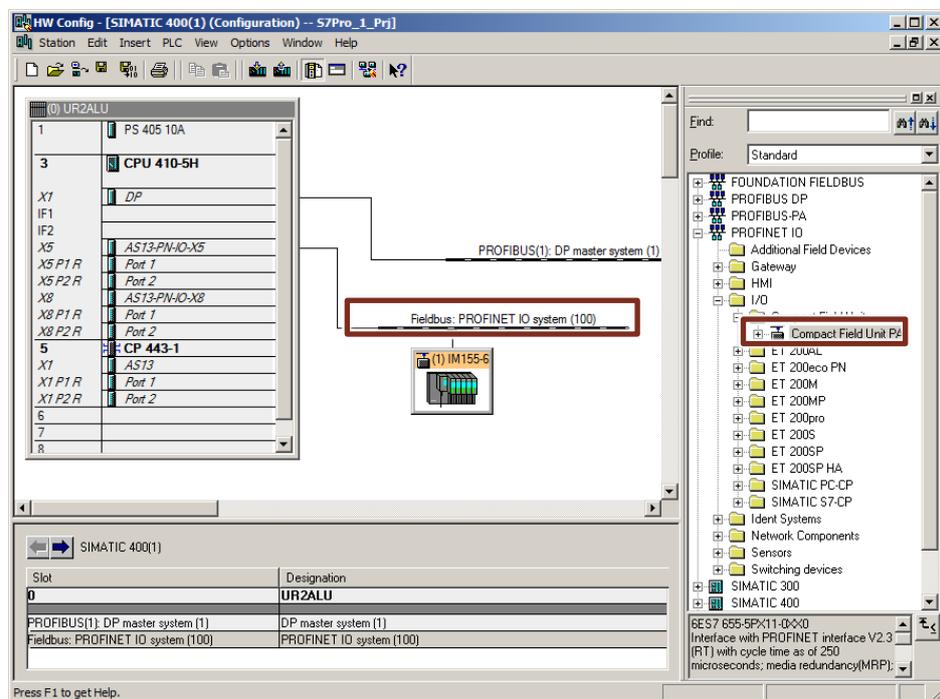

3. Open the "Object Properties..." via the context menu of the CFU and adapt the device name and the IP address according to the plant planning.

Activating Port 2 of the ET 200SP HA

For security reasons it is recommended that ports which are not needed be deactivated. In order to use them later, they have to be re-activated. This is only possible with CiR-capable devices. ET 200SP HA supports CiR.

1. Select the ET 200SP HA and open the properties of the port by double-clicking ON the port "X1 P2 R".
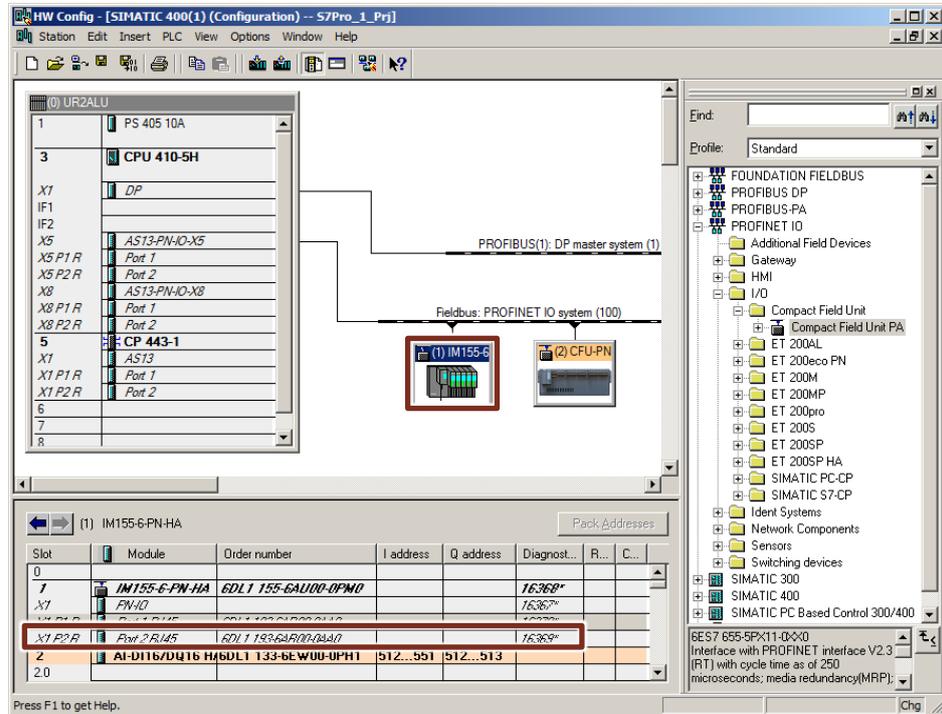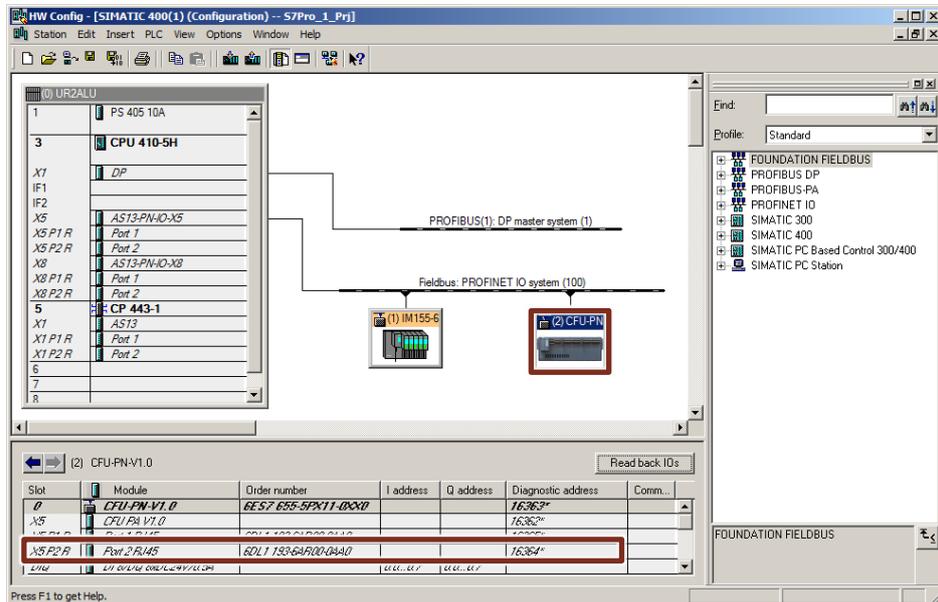

2. Switch to the "Options" tab and activate the port by selecting "Automatic settings" in the "Transfer media/duplex" drop-down list.

3. Confirm the properties by clicking on the "OK" button.
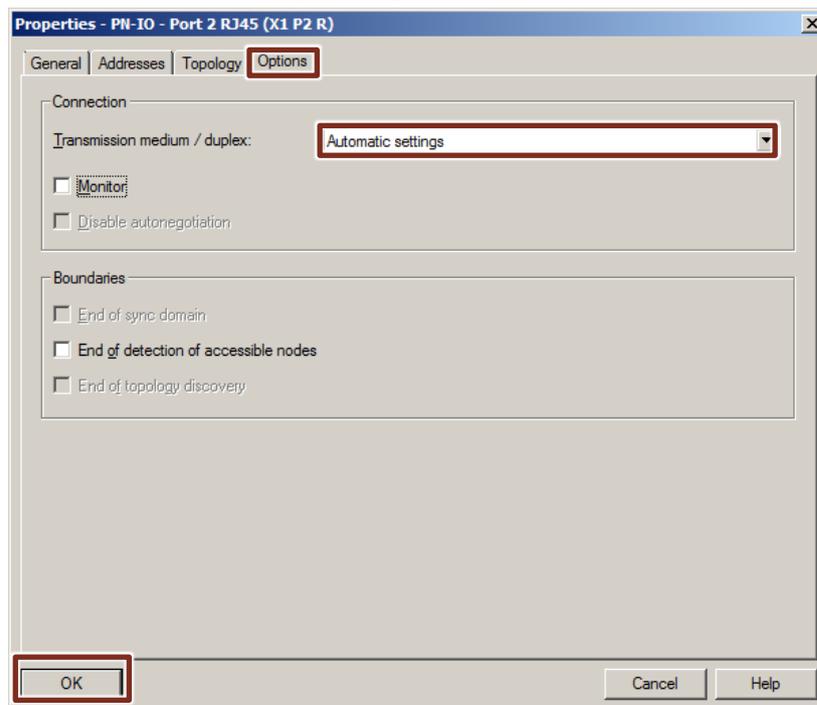
Deactivating the unrequired CFU port

For security reasons it is recommended that ports which are not required be deactivated.

1. Select the CFU and open the properties of the port by double-clicking on the port "X5 P2 R".


2. Change to the "Options" tab and deactivate the port by selecting "Disable" in the "Transfer media/duplex" drop-down list.

3. Confirm the properties by clicking on the "OK" button.
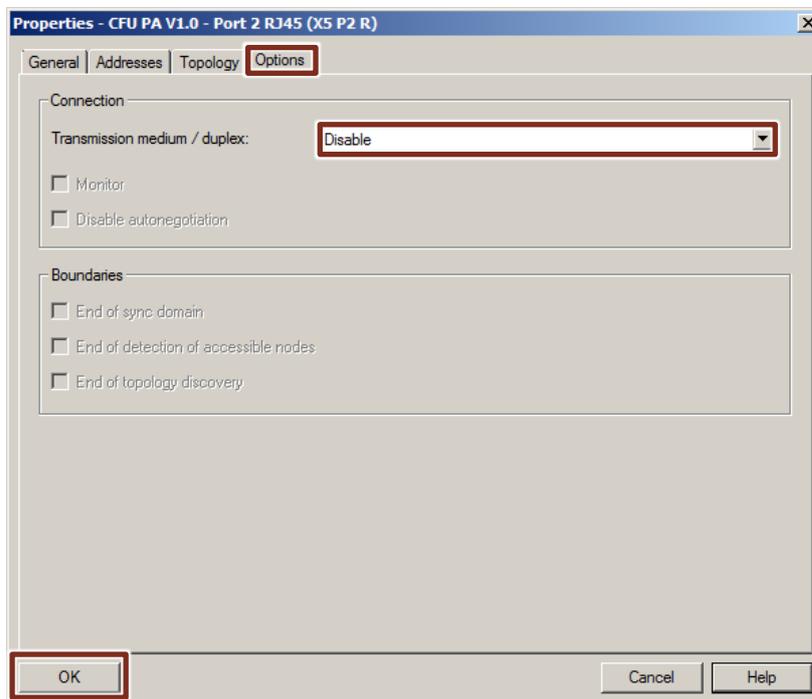
Adjusting the topology planning

Topology planning is a precondition for the device replacement function without removable media or automatic commissioning. If the function is active, the CPU can automatically assign to new, as yet unnamed devices, the name configured in HW Config.

1. Right-click on the PROFINET IO system and select the "PROFINET IO Topology..." command from the shortcut menu.
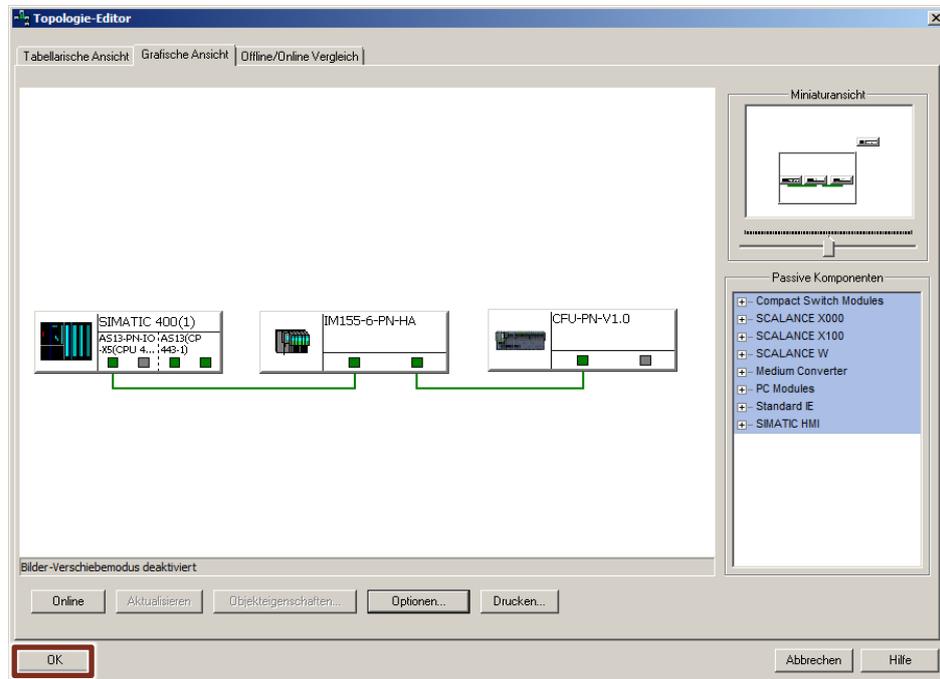
2. Switch to the "Graphic view" tab.
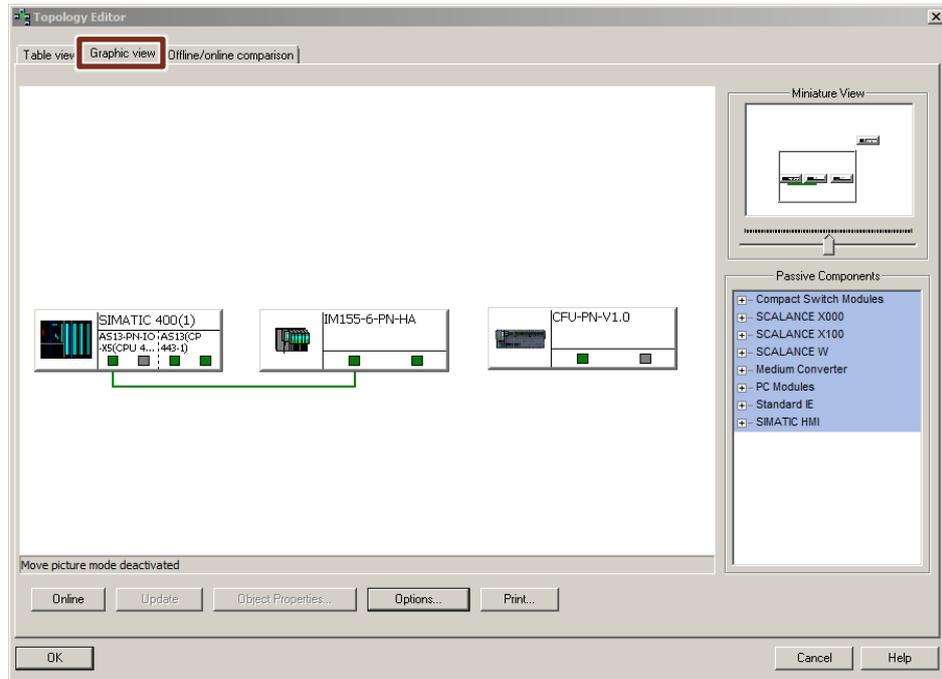
3. Drag&drop Port 2 of the ET 200SP HA to connect with Port 1 of the CFU.

4. Confirm the dialog "Interconnection properties" with the "OK" button to establish a connection.
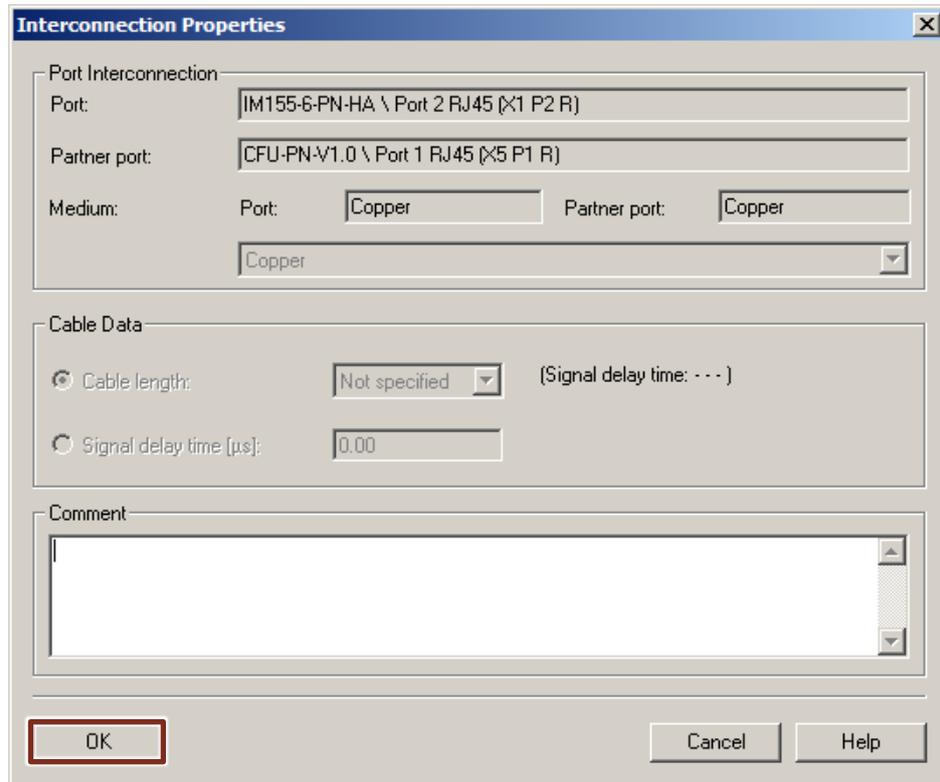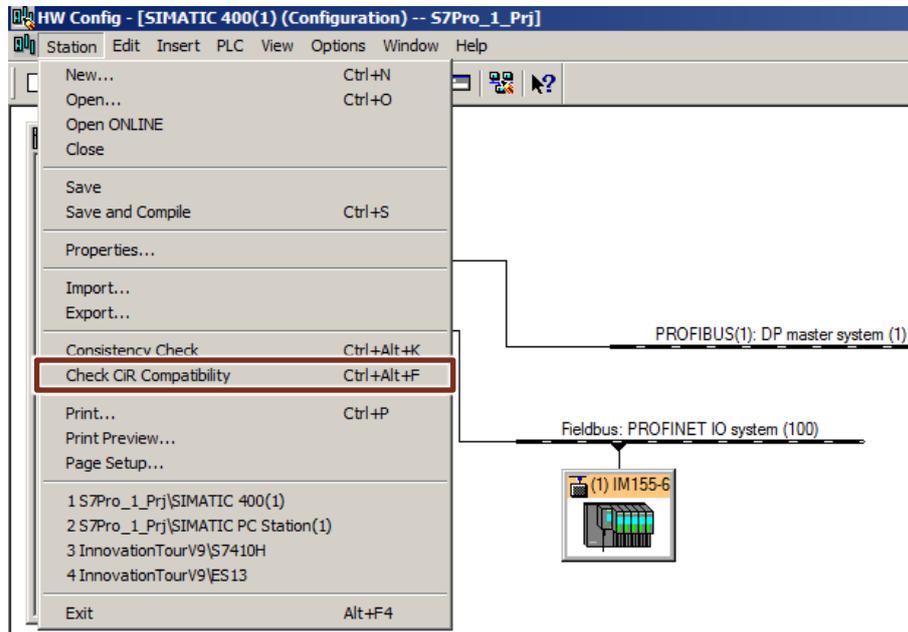

5. Confirm the adaptations in the topology editor by clicking on the "OK" button.
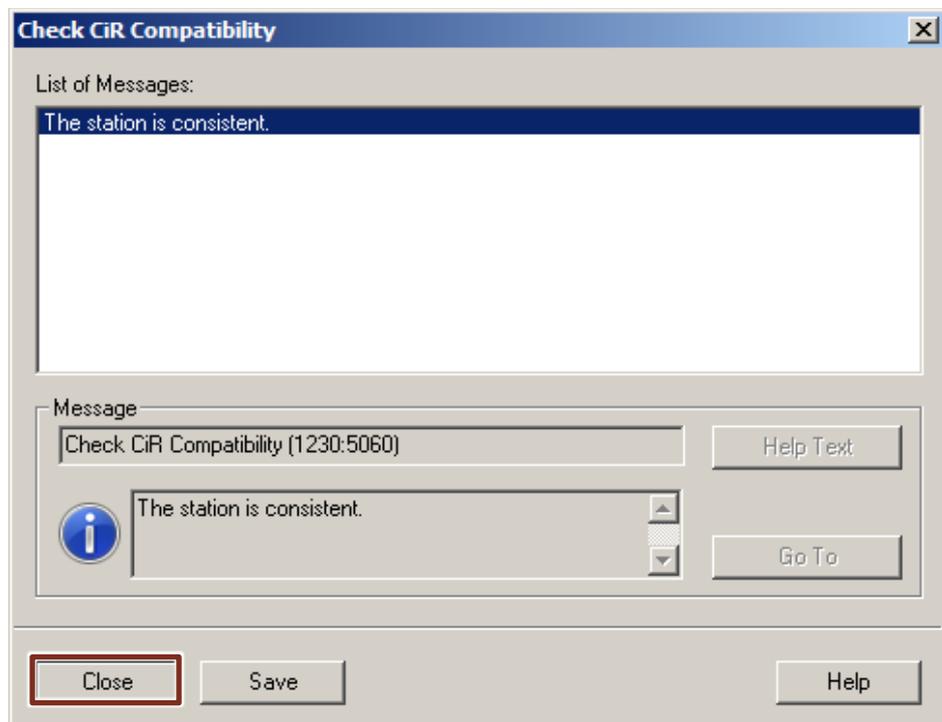
Checking CiR capability

1. Select the menu command "Station > Check CiR capability" to check whether it is possible to load modifications during operation.

2. The CiR capability test returns the result that the station is consistent, i.e. the changes can be loaded during operation.
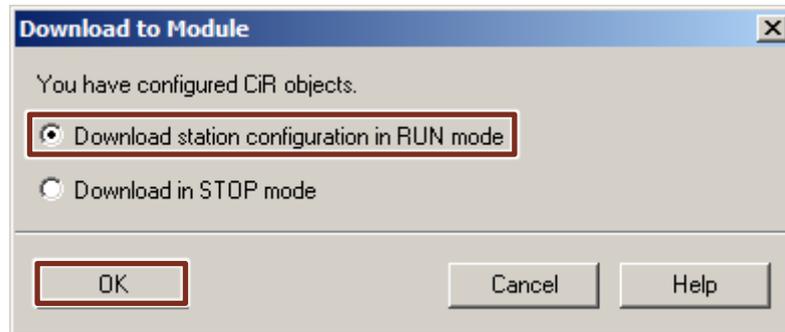   Confirm the dialog with "Close".

Loading the hardware configuration during operation

1. Save and compile your configuration, and then click on "load to module".

2. Select the "Load station configuration in operating mode RUN" and confirm with the "OK" button.

Connection of the CFU (real plant)

Thanks to the topology configuration, the automatic commissioning for the CFU can be made use of. As a prerequisite for automatic commissioning, the CFU used must be reset to factory settings and the actual topology (physical connection) must match the target topology (topology editor). If these requirements are met, the CFU is automatically addressed as soon as the hardware configuration has been loaded.

Connect Port 2 of the ET 200SP HA with Port 1 of the CFU.

Result

The Compact Field Unit has been integrated in the PROFINET network during operation and is now available as a periphery.

2.6 Upgrade with CPU 410 Expansion Packs

2.6.1 Introduction

There are two kinds of CPU 410 Expansion Packs:

- CPU 410 Expansion Pack (PO)
  Upgrade of the process objects of a CPU 410-5H

- CPU 410 Expansion Pack (PN Red)
  Activation of the function expansion for the
  support of redundant PROFINET subsystems (R1)

Enabling functional expansion to support redundant PROFINET subsystems (R1)

The "PCS 7 CPU 410 EXPANSION PACK (PN RED)" is required for the connection of PROFINET devices via redundant PROFINET R1 configurations. This is available in two variants:

- License on USB stick: 6ES7653-2CX01-0XE0

- License via Online software delivery (download): 6ES7653-2CX01-0XK0

A firmware version 8.2 or higher is a pre-requisite to be able to load CPU 410 Expansion Pack PN Red.

Online upgrade of CPU 410-5H process objects

When you load a PCS 7 project into the CPU, the system checks that the project can run with the current number of process objects (POs) in the CPU.

If the number is not sufficient, starting with PCS 7 V8.1 you have the option of increasing the PO volume by means of an online upgrade of the CPU 410-5H system expansion card (SEC).

CPU 410 Expansion Pack (PO)

You will need at least one CPU 410 expansion pack for the online upgrade of the process objects of a CPU 410-5H.

The CPU expansion packs for PO are available in the following sizes:

- 100 PO

- 500 PO

The expansion packs can be combined in any way up to the maximum size. Note, however, that with a redundant system (2 CPUs), the CPU 410 expansion packs must be distributed symmetrically between the CPUs.

The volume of a CPU expansion pack must always be assigned in its entirety to a CPU or SEC of the CPU. Distribution between several CPUs or SECs is not possible.

After a PO upgrade, the POs that are assigned to an SEC/CPU can no longer be relocated.

Example of a process object upgrade

If the number of POs in the CPU is not sufficient to load the engineering project, you can increase the PO volume of the CPU by means of an online upgrade.

Table 2-2

Expanding by 300 PO (from 400 PO to 700 PO)	
	With a single AS, to increase the number of POs by 300 you need 3 CPU 410 expansion packs with 100 POs each.
	With a redundant AS (2 CPUs), to increase the number of POs by 300 you need 6 CPU 410 expansion packs, with 100 POs each. This is necessary, since both CPUs must be expanded by 300 POs. In this case, you cannot combine expansion packs with 500 POs and 100 POs, since the PO volume of an expansion pack cannot be subdivided.

The table below contains further examples:

Table 2-3

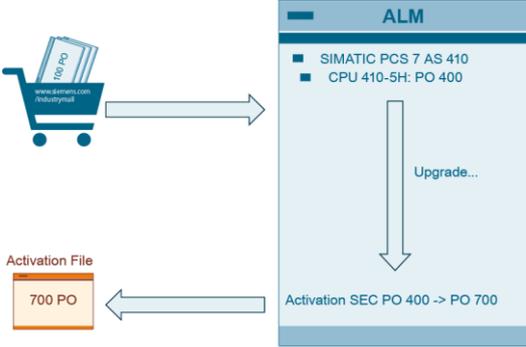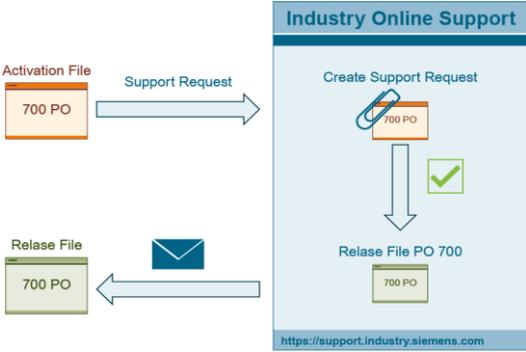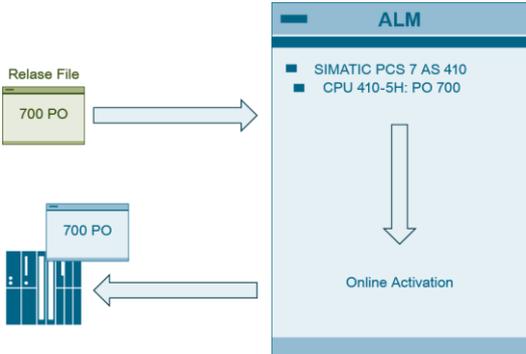| PO expansion by	CPU 410 expansion packs needed	
	Single AS	**Redundant AS**
400 POs	4 x 100 POs	8 x 100 POs
500 PO	1 x 500 POs or 5 x 100 POs	2 x 500 POs or 10 x 100 POs
600 POs	1 x 500 POs + 1 x 100 POs or 6 x 100 POs	2 x 500 POs + 2 x 100 POs or 12 x 100 POs
1000 POs	2 x 500 POs or 10 x 100 POs	4 x 500 POs or 20 x 100 POs

Unlimited PO volume

The PO volume can be increased to "Unlimited", i.e. to an unlimited volume of POs. Thereafter as many POs can be loaded as the physical storage will admit and until it is completely used up. There are two ways to increase the PO volume to "Unlimited":

- New purchase of CPU410-5H in bundle with PO 2K+.
  (Article number 6ES7654-5CQ00-0XF0)

- With the CPU Expansion Packs 100 and 500, the existing number of POs is extended to a total of 2600 POs. 2600 POs on a SEC of a CPU410-5H corresponds to an "Unlimited" PO volume.

2.6.2 Overview of work steps

The online upgrade for PO and PN Red is carried out in the following main steps (using the increase of 300 POs as an example):

Table 2-4

Schematic representation	Step
	1. Order the CPU 410 expansion packs.
	2. In the SIMATIC Automation License Manager (ALM), transfer the CPU 410 expansion packs to the CPU and create a PO activation file.
	3. Send the PO activation file for checking and activation by means of a support request. Within 48 hours, you will receive by e-mail a PO release file (for each PO activation file sent) as confirmation of checking.
	4. Transfer the PO release file to the SEC of the CPU using the ALM.

| Note | In a redundant AS only the CPU in Rack 0 is selected. The POs/PN Red license is automatically given to both CPUs. |

NOTICE	**When performing an online upgrade of the process objects, observe the information and notes in the manual:** "SIMATIC PCS 7 Service Support and Diagnostics (V9.0)" **https://support.industry.siemens.com/cs/ww/en/view/109746550**

2.6.3 Order the CPU 410 expansion packs

You have the following options when ordering CPU 410 expansion packs (PO and PN Red):

- Through your Siemens contact person (www.siemens.com/automation/partner)
- Online via www.siemens.com/industrymall

Fig. 2-6

After you have received the CPU 410 expansion packs (by e-mail or USB stick), transfer them to a disk drive that can be accessed by the Engineering Station.

2.6.4 Creating the activation file using the Automation License Manager (ALM)

Requirements

The CPU 410 must be accessible from the Engineering Station. A PCS 7 project (HW Config and program) must be loaded. Modifications in the project (e.g. name of CPU) are not allowed from creating the activation file until transferring the release file, since e.g. project name, name of the automation system and CPU are compared while transferring the release file.

Creating the activation file and transferring the release file must be carried out by the same user from the same ES, since the upgrade directory is only created for this user.

Procedure

1. Store the CPU 410 expansion packs on a drive that can be accessed in the Automation License Manager (ALM).
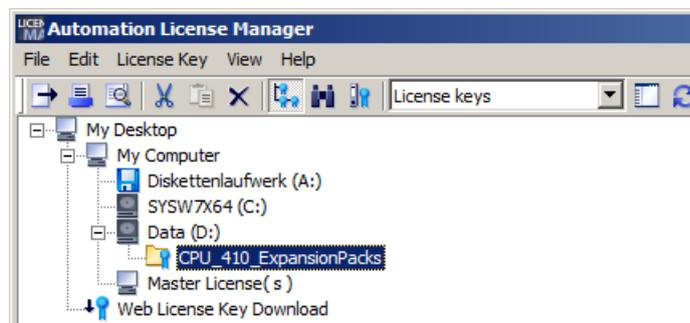
2. Select menu command "Edit > Connect target system > Connect/disconnect AS 410...".
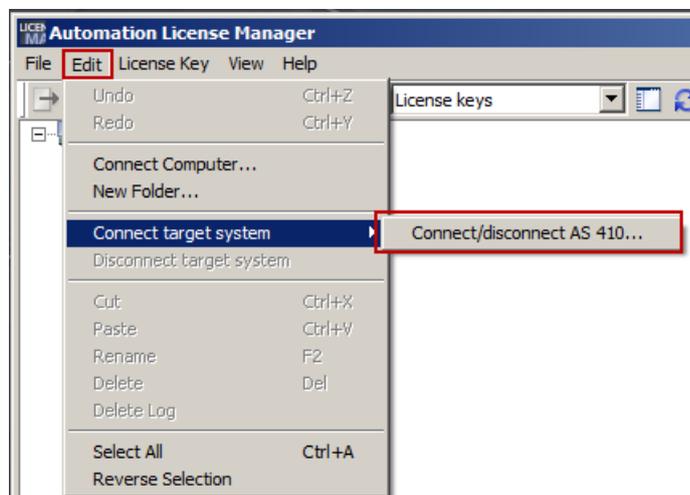
The "Connect Target System" dialog opens.

3. Click on the "Add" button to establish an on-line connection to a CPU 410-5H.
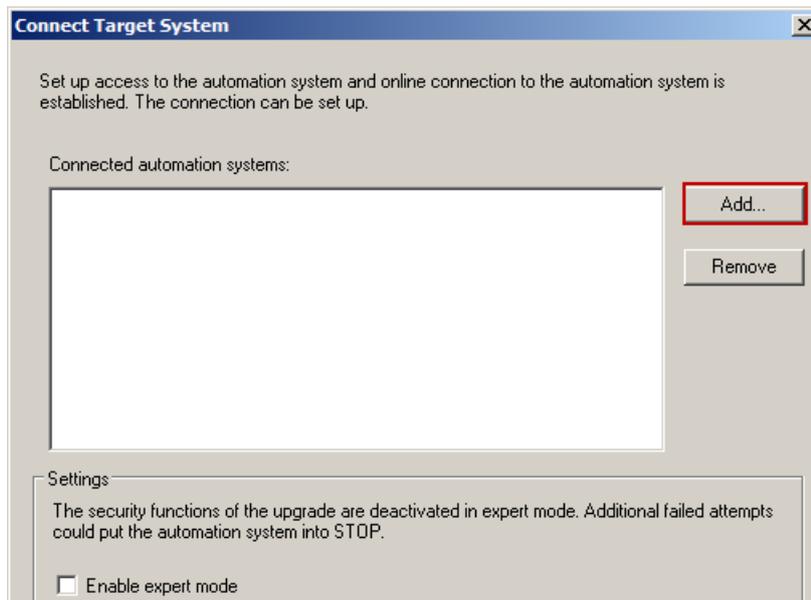
4. In the PCS 7 project, select the CPU to which you want to transfer the CPU 410 expansion packs. Then click on the "OK" button.

The CPU is displayed in the ALM.

5. Drag the license keys for the CPU 410 expansion packs and drop them on to the automation system for which you want to perform the upgrade.

Note	If you have selected the wrong automation system, you can move the license keys for the CPU 410 expansion packs by dragging and dropping.

6. Open the "Online" folder in tree view for the automation system.
7. Select the license and then select the "License Key > Upgrade" menu command.

NOTICE	When you initiate the upgrade, the selected CPU 410 expansion packs are assigned to the SEC. Moving to another AS is no longer possible. The SEC must not be changed between both CPUs (rack 0 and rack 1) until transferring the release file.

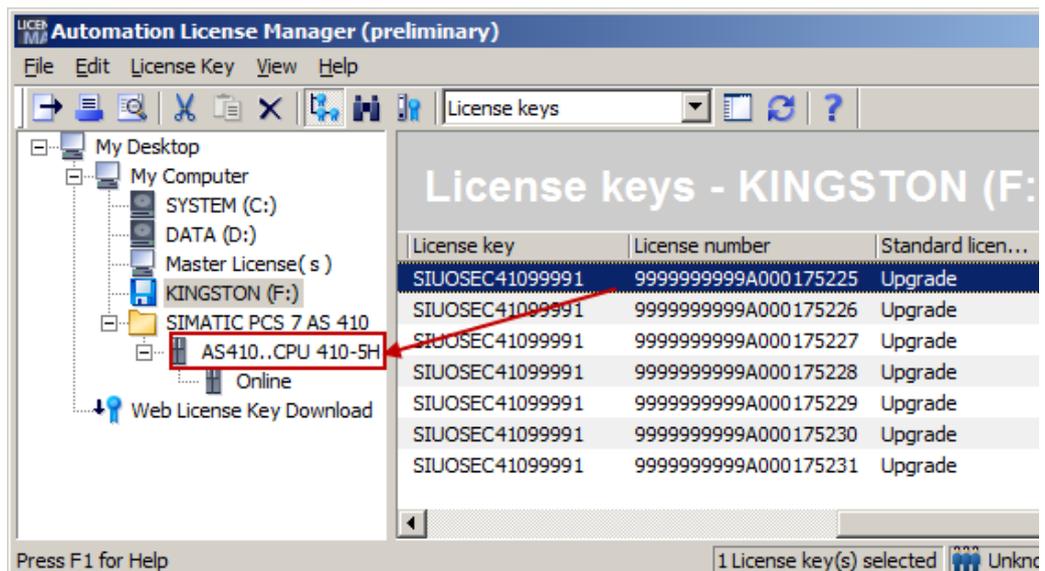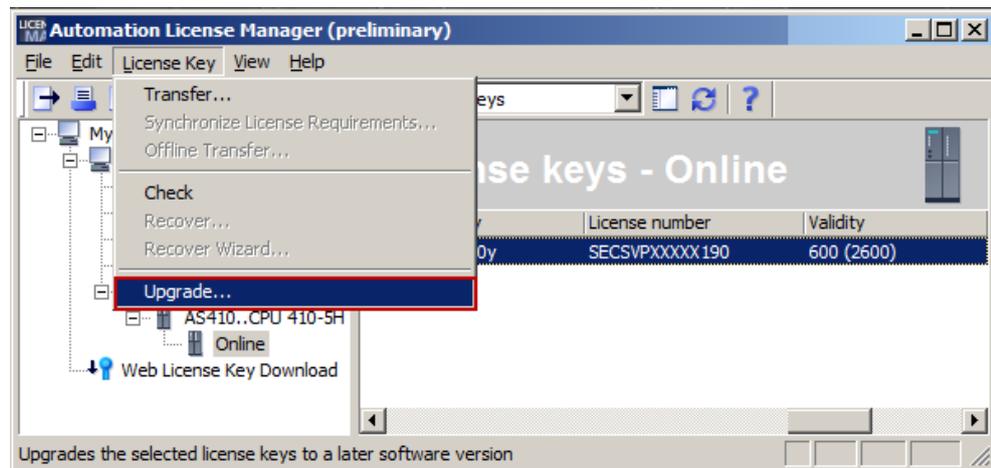The license keys for the selected CPU 410 expansion packs are deleted and an activation file is created in the folder: "Documents > Siemens > Automation > PCS 7 > Activations"
("C:\Users\<USER>\Documents\Siemens\Automation\PCS 7\Activations"), with <USER> for your Windows username.

The ALM displays which expansions are involved in the activation files. In this example of an activation file for a volume expansion from 600 to 700.
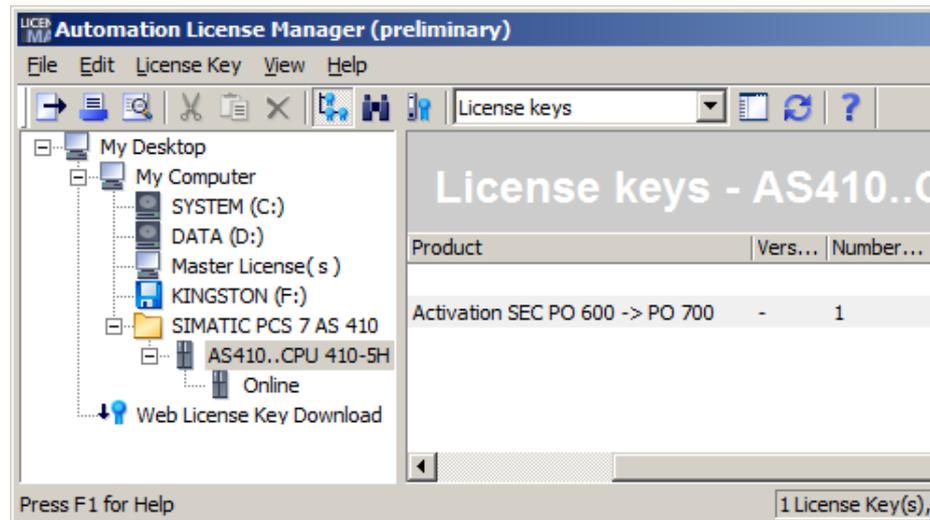
2.6.5 Sending the activation file via a Support Request

The Activation File is now sent to the Technical Support via Support Request in order to receive a Release File:

1. First start a Support Request via the website
https://support.industry.siemens.com/cs/my/src?lc=en-WW.

Abbildung 2-7
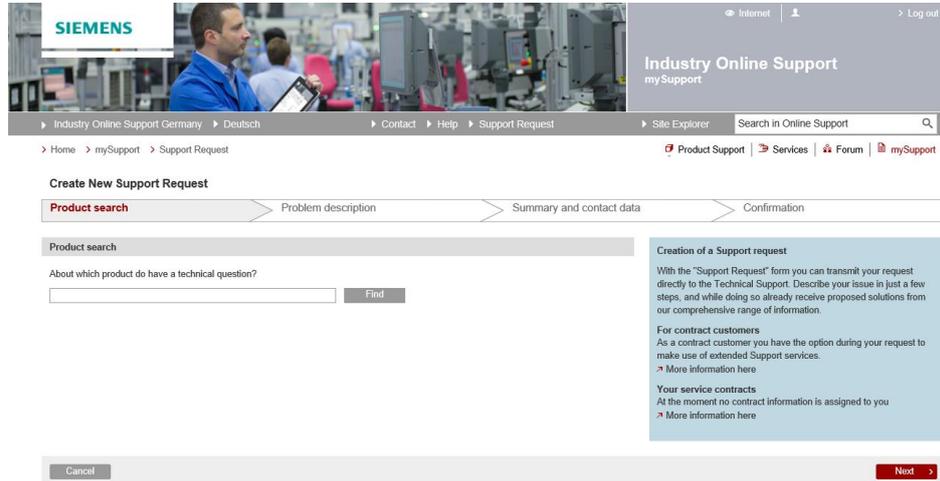
2. Step "Search product":
   - Enter "CPU 410" in the entry field "Product/Order number" and click on the button "Find" (1).
   - Click on the "Next" button (2).

3. In the register "Problem description", in the area "First help for the selected product", you will find contributions which can help you with your problem (1).

4. Describe the problem.
   - Make the entries in the mandatory fields (2).
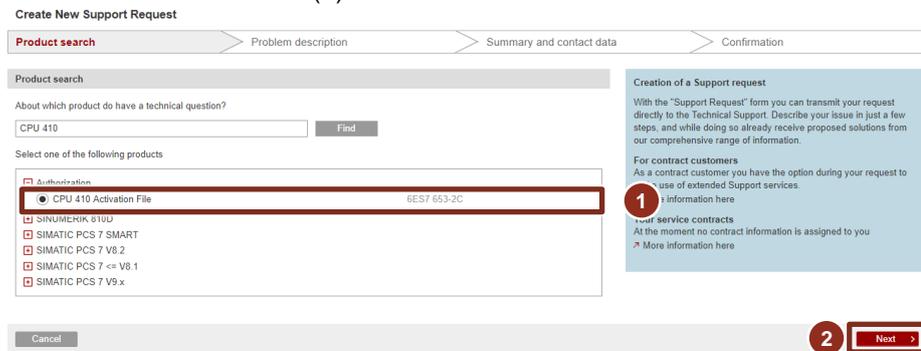   - Enter the text "Request Release-File" in the entry field "Details of the Request" (3).
   - - Insert the activation file as a zip file by clicking or by dragging & dropping the activation file on the area "Move your files ("Drag and drop") into this field or click to select files" (4).
   - Click on the "Next" button (5).

Note	Activation files are automatically created in the following Upgrade directory in the Engineering Station: "Documents > Siemens > Automation > PCS7 > Activations" ("C:\Users\\Documents\Siemens\Automation\PCS 7\Activations") stands for your Windows username

Note	You can send several activation files with one support request.

5. "Specify contact data" step: Specify your contact data, then click on the "Next" button.

6. "Summary and send" step: Check your details, then click on the "Send" button. Within 48 hours you will receive an e-mail containing a release file for each activation file sent.

2.6.6 Transferring the release file to the SEC of the CPU

Requirements

The CPU 410 must be accessible from the Engineering Station. The same PCS 7 project (HW Config and program) must be loaded which was loaded when creating the activation file. The reason is while transferring the release file some names are compared e.g. project name, name of the automation system and CPU.
The transferring of the release file must be carried out by the same user from the same ES as creating the activation file, since the upgrade directory is only created for this user.

Procedure

1. Transfer the received release files to the Upgrade directory in the Engineering Station: "Documents > Siemens > Automation > PCS 7 > Activations" ("C:\Users\<USER>\Documents\Siemens\Automation\PCS 7\Activations"), with <USER> for your Windows username.

2. Open the Automation License Manager (ALM).
The automation systems that are connected to the Automation License Manager are shown in the list in the "Connect AS 410" dialog box.

3. Click on the "Add" button to connect a further automation system. In the PCS 7 project, select the CPU to which you want to transfer the release file. Then click on the "OK" button.

The CPU is displayed in the ALM.

4. Drag&drop the release file to the "Online" folder of the desired automation system.
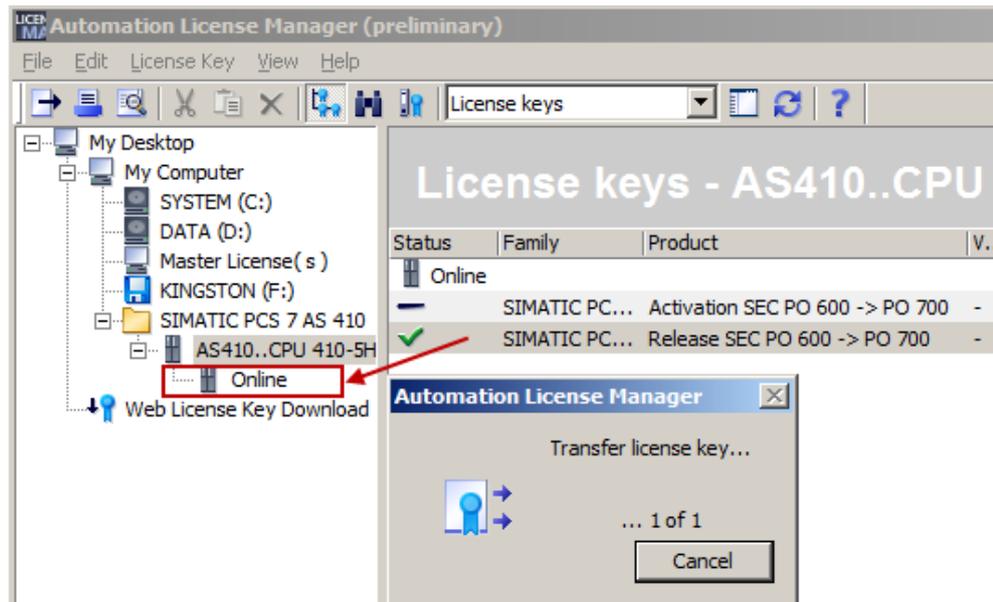
The upgrade is carried out. The time that is taken depends on the loading of the automation system.

After an upgrade is completed, the files (release file and activation file) that are used in the Upgrade directory are deleted.

The Automation License Manager shows the new number of POs for the updated SEC as well as any PN Red license that may be available (in this example there is no PN Red).

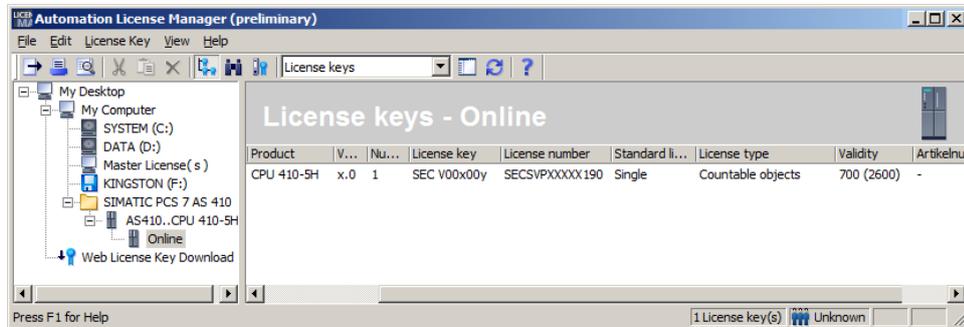| Note	You can also call up the volume of the SEC, as well as the process objects that are subject to license, in the SIMATIC Manager under "Extras > PCS 7 license information".

2.7 Further functions of the CPU 410

2.7.1 Field Interface Security

Field Interface Security is a function for additional protection of the automation system and which is supported from Firmware V8.2 upwards. It can be activated if a CPU interface is used only for the connection of field devices.
Activating Field Interface Security blocks access to the CPU through the interface concerned by impeding build-up of a communication incoming from external nodes. This means that all queries are rejected and that only the communications outgoing from the CPU, e.g. for IO operation, continue to be permitted.

Benefits

- For protection against unauthorized access from the field bus
- Separate activation for each interface
- No restrictions of performance for field bus communication

Configuration

The Field Interface Security function is supported for the PROFINET as well as for the PROFIBUS interface and can be activated or deactivated in the HW Config in the settings of the interface via a check box. For the PROFINET interfaces, the checkbox "Enable additional protection on the interface (Field Interface Security)" is located in the PROFINET tab.

Fig. 2-8
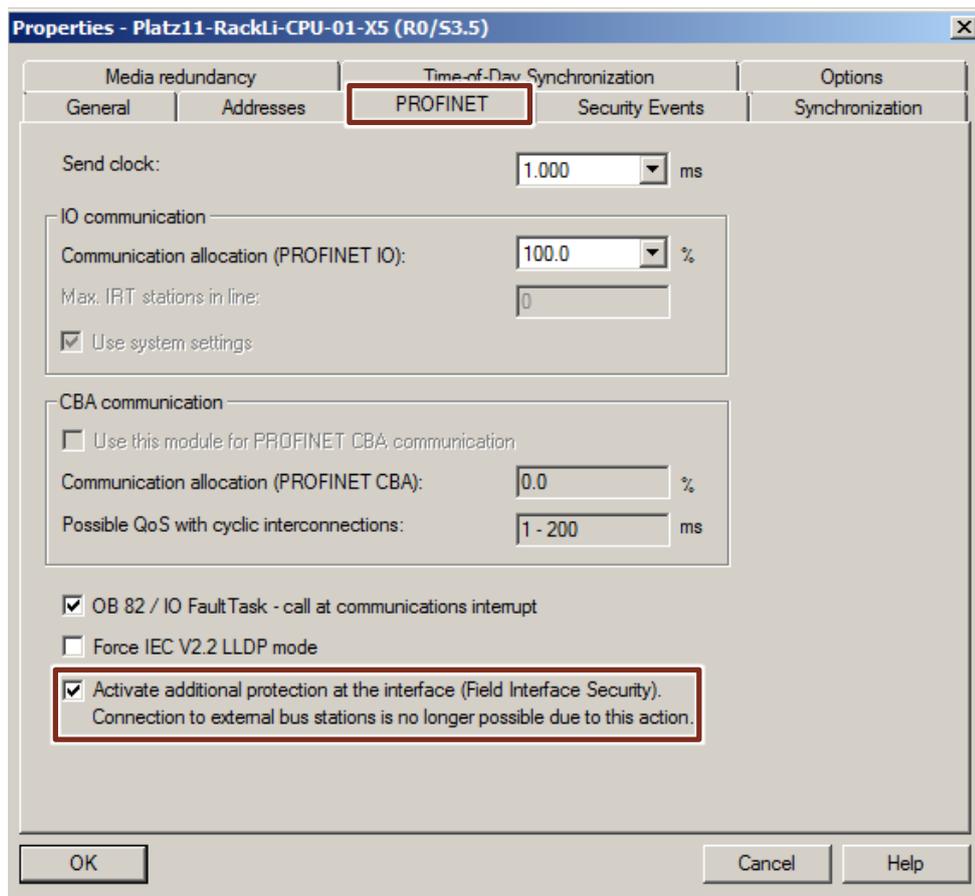
Note | For further information on the protection of the automation system and the characteristics of the block (Field Interface Security) please refer to the manual: "SIMATIC PCS 7 Process Control System CPU 410 Process Automation" https://support.industry.siemens.com/cs/ww/en/view/109748473

2.7.2 Security Event Logging

Security Event Logging is a function to register user activity on a CPU. Security-relevant changes to the CPU are sent as SysLogEvents to one or more SIEM (Security Incident Event Management) systems, where they are interpreted and processed further. When using the CPU 410 Security Event Logging is supported from Firmware V8.2 and newer.

The following actions, for instance, are registered as SysLogEvents:

- Connection setup with correct legitimation

- Error in the legitimation (incorrect password)

- A configuration change has been made

- A PCS 7 user program change has been transmitted

Benefits

- Acquisition of safety-relevant changes on the CPU

- Detection of forbidden access and deviations from normal behavior

- Applicative assignment of user name by SIEM

Configuration

Further information on security event logging with SysLogEvents, including instructions for configuration and planning can be found in the application example: "Recording User Activity on a SIMATIC Controller Using a SIEM System" https://support.industry.siemens.com/cs/ww/en/view/109748211

2.7.3   Remaining load memory

From Firmware V8.2 the memory concept of the CPU 410 changes. With the new memory concept, the program is automatically stored in the remanent memory (FLASH) after every download and not in the battery-buffered RAM as before. This means that the program is preserved even in the absence of a buffer battery. This function is independent of the hardware version of the CPU, i.e. each CPU 410-5H is already prepared for the remanent memory.

It is to be noted that each CPU 410 which has already been used can contain a program that starts when the CPU is started. If the program does not start, the CPU must be reset to factory defaults.

The new memory concept does not affect dynamic data, e.g. diagnostics buffers, counters, process images and current process values. These continue to be stored in a non-remanent manner and are retained as before only when a buffer battery is used across the network.

If the current process values from selected blocks are to be transferred from the unbuffered memory to the remanent memory, this is possible with the "Read back program ..." function.

Note	If you begin to use a CPU that has already been used elsewhere, make sure that the content stored in the load memory does not cause dangerous system conditions at the new location.
	If the previous use of the CPU is unknown to you, reset it to its default settings.
	The CPU 410 can be reset to factory settings by pressing the reset button when the power supply is switched on and then held until the STOP LED flashes.

2.7.4   Firmware update in two steps

With CPU 410 firmware V8.2 and newer it is possible to update the firmware update in two working steps. This allows the firmware update of the CPU to be prepared in a first operating step (loaded into the CPU) during operation and to be activated in a later step in a second step.
Especially in the case of H systems, a significantly faster firmware update with less time is achieved in solo operation, since the firmware can be loaded first into both CPUs and the H system can then operate exclusively to activate the firmware in solo operation.

Benefits

- A Firmware update can be prepared during normal operation

- Optimized self-test after the Firmware update

- Reduced overall time required for firmware updates

Procedure

The firmware update in two steps can be started as until now via HW Config. In HW Config select the "Target system > Update firmware" menu command.
A dialog for updating the firmware appears. In this dialog there are three options available from firmware V8.2 and upwards:

(1) "Load and activate firmware"

(2) "Load firmware only"

(3) "Activate loaded firmware"

When a firmware is loaded via option (2), the files for the firmware update are transferred to the CPU. The loaded firmware can then be activated with option (3), updating the CPU to the new firmware.

Fig. 2-9

| Note | For further information on updating firmware, please refer to the manual: "SIMATIC PCS 7 Process Control System CPU 410 Process Automation" https://support.industry.siemens.com/cs/ww/en/view/109748473 |

2.8 Additional information

2.8.1 Replacing an existing CPU with the CPU 410-5H

An existing CPU in the S7-400 series can be replaced by the CPU 410-5H with little effort. In addition to the replacing the hardware, some adaptations must also be made to the hardware configuration of the PCS 7 project. You will find extensive information about this at https://support.industry.siemens.com/cs/ww/en/view/85014617.

2.8.2 Extending availability

With the standard SIMATIC PCS 7 AS 410 automation system, you already have the option of selectively increasing the availability by means of redundant configuration of the Industrial Ethernet communications module.

With its redundant CPUs, the Type AS 410H redundancy station offers considerably greater availability. It works on the 1 −of−2 principle, where the reserve system is switched in if there is a failure of the active subsystem. Starting from here, you can double the power supply or the Industrial Ethernet communications module for each subsystem and combine these measures.

You can find extensive information about the procedure for expanding a Single Station to a Redundancy Station at
https://support.industry.siemens.com/cs/ww/en/view/82523363.

3 Appendix

3.1 References

Table 3-1

	Topic area	Title
\1\	Siemens Industry Online Support	http://support.industry.siemens.com
\2\	Download page for this entry	https://support.industry.siemens.com/cs/ww/en/view/96839331
\3\	SIMATIC PCS 7 Process Control System CPU 410 Process Automation	https://support.industry.siemens.com/cs/ww/en/view/109748473
\4\	SIMATIC PCS 7 Service Support and Diagnostics (V9.0)	https://support.industry.siemens.com/cs/ww/en/view/109746550
\5\	Security guidelines for PROFIBUS & PROFINET International (PI):	http://www.profibus.com/nc/download/specifications-standards/downloads/profinet-security-guideline/display/

3.2 Change documentation

Table 3-2

Version	Date	Change
V1.0	10/2014	First edition
V1.1	12/2014	Revision of Chapter 2.2 Loading interface changes from AS blocks in RUN mode (TCiR)
V1.2	03/2015	• New Chapter 2.1 Configuring the communications interface and Establishing the connection between the ES and the AS • Revision of Chapter 2.4 Configuring the PN/Ethernet interfaces of the CPU 410
V1.3	02/2016	• New Chapter 2.3 Using TCiR to update a library • Revision of Chapter 2.2 Loading interface changes from AS blocks in RUN mode (TCiR)
V2.0	03/2016	Update for PCS 7 V8.2
V2.1	11/2016	Description for the PO expansion to "Unlimited" added (Section 2.5.1).
V3.0	08/2017	Update for PCS 7 V9.0
V3.1	09/2017	Chapter 2.6 directory path updated and notes added
V3.2	10/2019	Chapter 2.6.5 Updated procedure