

Learn-/Training Document

Siemens Automation Cooperates with Education (SCE) | As of Version V9 SP1

PA Module P01-02 SIMATIC PCS 7 – Hardware Configuration

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- Demo Version SIMIT Simulation Platform V10
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- SIMATIC PCS 7 AS RTX Box (PROFIBUS) only in combination with ET 200M for RTX Order No.: 6ES7654-0UE23-0XS1
- ET 200M for RTX Box (PROFIBUS) only in combination with PCS 7 AS RTX Box Order No.: 6ES7153-2BA10-4AB1

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Hardware configuration

1 Goal

In this chapter, students become familiar with the functionality of an automation system. They will be able to configure the selected hardware in the hardware configuration of *PCS* **7** and check it for consistency. Important settings will be made so that the *PCS* **7** process control system automatically sets up all the blocks necessary for communication between sensors, actuators and process management level in the automation stations.

2 Prerequisite

This chapter builds on chapter 'Process description', which describes the example plant. There are no further prerequisites for implementing this chapter.

3 Required hardware and software

- 1 Engineering station: Requirements include hardware and operating system (for further information, see Readme on the PCS 7 installation DVD)
- 2 SIMATIC PCS 7 software V9 or higher
 - Installed program packages (contained in SIMATIC PCS 7 Software Trainer Package):
 - Engineering \rightarrow PCS 7 Engineering
 - Engineering → BATCH Engineering
 - Runtime \rightarrow Single Station \rightarrow OS Single Station
 - Runtime \rightarrow Single Station \rightarrow BATCH Single Station
 - Options \rightarrow SIMATIC Logon
 - Options \rightarrow S7-PLCSIM V5.4 SP8



1 Engineering Station

2 SIMATIC PCS 7 V9 SP1 or higher

4 Theory

4.1 Theory in brief

During hardware configuration, the real components for acquisition of measured values and for output of signals for process control are inserted and arranged in a tabular representation of the configuration. As shown in Figure 1, this process describes at which slot or in which order each input/output module is placed. In addition, you assign the input and output signals to a defined memory location in the process image and assign the module parameters. If fieldbuses are used, unique device addresses are specified as well.



Figure 1: Mapping of the real configuration to the configuration table

When the settings are saved and compiled, an internal consistency check takes place (do all modules match, have addresses been assigned twice, etc.). As soon as the configuration is consistent within itself, the blocks necessary for the communication of the process data are set up without user assistance and can then be loaded to the **automation stations (AS)** of the control system. These now have all the information to initially determine whether the installed configuration corresponds to the one that was configured. Furthermore, they ensure that the process data is available for further processing at the automation systems at the desired sampling rate. The fact that extensive measures are also taken in case of errors, such as the automatic issuing of suitable messages and alarms, remains invisible for most users.

4.2 Distributed architecture of process control systems

Scalable process control systems such as *PCS* **7** cover a large range of processes. Applications include small laboratory plants with only a few sensors and actuators up to large plants with a hundred thousand process tags. To cover this broad spectrum, special structures are required. A typical component structure that can be easily expanded looks like this:

- On the process management level, an *operator system (OS)* consisting of one or more operator stations is used. Operators can control and monitor the plant via this OS.
- On the control level there are one or more *automation stations (AS)* that execute the open-loop and closed-loop control functions in real-time. These systems are to do their job regardless of OS failures. They consist at least of a power supply (PS) and a CPU and, if necessary, communication modules (CP).
- On the field level, sensors and actuators acquire the states of the technical processes and influence these processes, respectively.

While all components can run on a single computer system in the laboratory, as shown in Figure 2, it is advisable to distribute the components after a certain plant size (e.g. a pilot plant) is reached to better handle the complexity. For the data exchange between these components, various bus systems are used depending on requirements, e.g. bus systems with the real-time characteristics required for the process data communication.



Figure 2: Scalable structure of the PCS 7 process control system

4.3 Process image

The central processing unit (CPU) processes the automation programs on the automation stations (AS) the same way as other computers. The control programs are processed cyclically. When signals from the process are processed, the program does not access the connected input and output modules directly. Instead, a so-called process image is created in which all signals are read in at once and stored at the beginning of the cycle.

There are two reasons for this: First, accessing the process image requires considerably less time because it is stored in the internal memory of the CPU. Second, this approach ensures that the input information has all been collected within a defined time window – regardless of the execution time of the control program. This data consistency is attained by reading in the signals of the input modules in the process image input (PII) once per cycle. The program is then processed, and the results are written to the process image of the outputs (PIQ).

Once the entire program has been processed, the data is written from the PIQ to the output modules and thus output to the process. The process image of the inputs is then updated again, as shown in Figure 3.



Figure 3: Reading and writing of inputs and outputs during processing of the PLC cycle

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4.4 Connection to the process

The process signals acquired by the sensors, such as temperature, pressure, level and flow rate, are converted into an electrical signal with transducers. If the measuring device is not connected directly via a fieldbus, the signal is usually converted into a standardized electrical signal. This signal can then be acquired on the automation system side by a standardized signal module.

Because process industry plants are expected to acquire anywhere from a handful of measured values up to tens of thousands of measured values, it must be possible to select, clearly assign and parameterize the measuring module during the automation planning phase. For example, the user initially arranges the necessary signal modules in the hardware configuration virtually. In addition, the above-mentioned assignment of memory space in the process image is made for the signal modules. As soon as a signal module is inserted in the configuration, sufficient memory space is automatically assigned in the process image. There is the option to manually change the automatic assignment, but the size of the memory area in the CPU should always be taken into consideration.

Different signal modules are used, depending on the type of signals. For binary signals, DI (Digital Input) and DO (Digital Output) modules are used. The individual signals are organized in bits; this means each input/output signal occupies one bit of the process image. However, signal modules usually acquire 8, 16 or 32 signals at once.

For analog signals, AI (Analog Input) and AO (Analog Output) modules are used. Analog signals are usually organized in words (16 bits). Each analog input or output signal occupies 16 bits of memory, as shown in Figure 4. For this, the analog input module converts the analog process signal to a digital form. Depending on the resolution, only the higher order positions are occupied and '0' is written to the lower order positions. Analog output modules convert the digital output value to an analog signal. In the case of analog signals, modules are distinguished not only according to the number of signals but also according to their resolutions, for example, 2x12 bits, 8x13 bits or 8x16 bits.

Symbol Editor - [S7 Program(1) (Symbols) SCE_PC57_Prj\SIMATIC 400(1)\CPU 414-3 DP] Symbol Table Edit Insert View Options Window Help						
🖻 🔁	😂 🖬 🎒 🕺 🛍 🛍 🗠 📯 🛛 All Symbols 💽 🏹 📢					
	Status	Symbol 🛆	Address	Data type	Comment	
1		A1.T2.A1T2L001.LIS	EW 72	WORD	actual level value reactor R001	
2		A1.T2.A1T2L002.LIS	EW 74	WORD	actual level value reactor R002	
3		A1.T2.A1T2T001.TIC.M	EW 76	WORD	actual temperature value R001	
4		A1.T2.A1T2T002.TIC.M	EW 78	WORD	actual temperature value R002	
5						
Press F1 to	Press F1 to get Help.					

Figure 4: Symbol table of an AI module (Analog Input)

4.5 Distributed I/O

When sensors and signal sources are located far away from the automation system, wiring can become very extensive and complex. In addition, electromagnetic interference may impair reliability. The use of distributed I/O devices is suitable for these types of plants.

- The automation system is at a central location.
- One or more I/O devices (input and output modules) operate locally at a decentralized location.
- The data transfer between the I/O and the automation system [1] takes place via PROFIBUS
 DP (Distributed I/O). For this purpose, the AS and I/O must be equipped with corresponding communication modules.

A SIMATIC ET 200M was selected as the distributed I/O device for the plant described in the previous chapter. The I/O modules of the proven S7-400 automation system are connected to an interface module (IM 153-x) that ensures communication with the AS. Figure 5 shows a typical configuration. On the right, several digital and analog input and output modules are connected to the IM 153-1 interface module. The process signals coming from the field are connected directly to the routing level below the input and output modules; from there, short cables lead to the modules, thereby allowing errors in the wiring to the field to be quickly eliminated.



Figure 5: ET 200M Distributed I/O Device (source: Laboratory plant TU Dresden)

In the hardware configuration, the SIMATIC ET 200M is connected to a PROFIBUS DP line of the AS, as shown in Figure 6. The hardware configuration automatically suggests addresses that are not yet used in the selected subnet. The user assigns input and output modules to the slots of the ET 200M, as described below.

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ни с	🖳 HW Config - [SIMATIC 400(1) (Configuration) SCE_PCS7_Prj]							
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3	CPU 414-3 DP		T			Profile:	Standard	_
			11.450.4					
X2	DP	(3)	IM 153-2			E	ET 200iS	
X1	MPI/DP	1					ET 20015P ET 2001	
<u> F1</u>							ET 200L	
5	- CP 443-1						🛋 IM 153	
	P/V-IU P Part 1					· · · ·	📕 IM 153-1	
XIP2	Port 2					±	\overline IM 153-1	
6	1 10/12						🚡 IM 153-1	
<u> </u>						±	🚡 IM 153-1, Releas	e 1-5
							📺 IM 153-1, Releas	e 1-6
					_	÷	📺 IM 153-1, Releas	e6
						.	📺 IM 153-1, Releas	e7
						. E.	📺 IM 153-2	
	-					±	M 153-2	
	(3) IM 153-2, Redundancy	,					■ IM 153-2	
Slot	Module	Order Number	LAddress		Comm		■ IM 153-2 	
1	Module		T Address	4 Address			■ IM 153-2	
2 6	5 /M 153.2	6ES7 153-38410-0X80	8184×				TM 153-2	
$\frac{-}{3}$							🛱 🦳 Al-300	
4	DI32xDC24V	6ES7 321-1BL00-0AA0	03					
5	DI32xDC24V	6ES7 321-1BL00-0AA0	47				🗄 🦲 AO-300	
6	DI16xNAMUR	6ES7 321-7TH00-0AB0	811					
7	DI16xDC24V, Interrupt	6ES7 321-7BH01-0AB0	6465				🗄 🦲 CP-300	
8	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	6667				🗄 🧰 DI-300	
9	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	6869				🗄 🚊 DI/DO-300	
10	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	7071				🗄 🦲 DO-300	
$\frac{11}{10}$	D032xDC24V/0.5A	6ES7 322-18L00-0AA0		03				
$\frac{12}{12}$	DU16xDC24V70,5A	6ES7 322-88H10-0AB0		45			⊞ Special 300 T	
$\frac{13}{14}$		6E37 322-88H10-0480	72 07	b7			M 153-2FU	
14	AIOX14DIL AOOu12D3	6ES7 331-7HF01-04B0	1201	64 79			M 103-2 FO	_
		0237 33230000400		10473			M 103-2 FU	
						6ES7 153-2	BA10-0×B0	~ 비 테
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						4), Module r	eplacement during	T
J Draca E1 h	a aat Hala					D		
Press F1 t	o get Help.							icng //

Figure 6: Hardware configuration of an ET 200M [2]

4.6 References

- [1] Online help for SIMATIC PCS 7. Siemens.
- [2] SIEMENS (2010): Configuring Hardware and Communication Connections STEP 7. A5E02789739-01. (<u>support.automation.siemens.com/WW/view/en/45531110</u>)

5 Task

In this chapter, the PCS 7 project for the multipurpose plant is to be created using a wizard.

Next, the S7 station contained in project is configured. In the example, the S7 station is a SIMATIC S7-400 with a CPU 414-3 DP and a CP443-1 communications processor for linking to Ethernet via the TCP/IP protocol.

An ET 200M is used to connect the I/O signals for controlling the actuators in the plant and for acquiring the input signals. This modular field device is connected to the CPU via the PROFIBUS DP fieldbus.

The PC station, as the master computer with the *PCS* **7** software and *WinCC* for visualization, must also be configured. Any PC or laptop with a standard Ethernet interface is used for this.

The master computer, as operator station (OS), and the CPU, as automation station (AS), are interfaced via Ethernet and the TCP/IP protocol.

The project is also developed on the master computer. Consequently, the master computer operator station (OS) and the engineering station (ES) are combined.



Figure 7: Plant configuration for multipurpose plant

Notes:

- The abbreviations for engineering station (ES), operator station (OS) and automation station (AS) should be committed to memory, because these terms are used frequently in the PCS 7 software and in this document.
- The option is provided to replace the CPU414-3DP, depending on the available hardware, with another CPU, a PC based SIMATIC PCS 7 AS RTX or the SIMATIC PCS 7 Box PC.



Figure 8: Various plant configurations with SIMATIC PCS 7 Box, SIMATIC PCS 7 AS RTX and SIMATIC S7-400 CPU 414-3DP as controller (from left)

Note:

 In the following chapters, the S7-PLCSIM simulation software is used for testing the programs. This allows the user to basically configure any controller.

6 Planning

The devices to be used in the instructions can already be obtained from the task description. The following order numbers must be used for this:

Module	Order number	Firmware
PS 407 10A	6ES7 407-0KA02-0AA0	
CPU 414-3 DP	6ES7 414-3XM05-0AB0	V5.3
CP443-1	6GK7 443-1EX20-0XE0	V2.1

Table 1: S7 station (SIMATIC S7-400)

Module	Order number
IM 153-2	6ES7 153-2BA02-0XB0
DI32xDC24V	6ES7 321-1BL00-0AA0
DI16xNAMUR	6ES7 321-7TH00-0AB0
DI16xDC24V, Alarm	6ES7 321-7BH01-0AB0
DO32xDC24V/0.5A	6ES7 322-1BL00-0AA0
DO16xDC24V/0.5A	6ES7 322-8BH10-0AB0
Al8x14Bit	6ES7 332-7HF01-0AB0
AO8x12Bit	6ES7 332-5HF00-0AB0

Table 2: Distributed I/O (ET 200M)

7 Learning objective

In this chapter, students learn the following:

- Creation of a PCS 7 project
- Creation of the hardware configuration for an S7 station
- Creation of the hardware configuration for a PC station with WinCC
- Networking of an S7 station and a PC station

8 Structured step-by-step instructions

8.1 Creating a project

 The central tool in SIMATIC PCS 7 is SIMATIC Manager, which is opened here with a double-click. (→ SIMATIC Manager)



2. Use of the wizard for creating a PCS 7 project is recommended because it creates the S7 station and the PC station in one step (\rightarrow File \rightarrow 'New Project' Wizard)

SIMATIC Manager		_ _ _×
File PLC View Options Window Help		
New	Ctrl+N	
'New Project' Wizard		
Open	Ctrl+O	
S7 Memory Card	•	
Memory Card File	•	
Delete		
Reorganize		
Manage		
Archive		
Retrieve		
Page Setur		
rage setup		
1 SCE_PCS7_MP (Multiprojekt) C:\\S7Proj\SCE_PCS7\SCEMP		
2 SCE_PCS7_MP (Multiprojekt) C:\\SCE_PCS7_MP\SCEMP		
3 SCE_PCS7_MP (Multiprojekt) C:\\SCE_PCS7_MP\SCEMP		
4 SCE_PCS7_MP (Multiprojekt) C:\\S7Proj\SCE_PC_2\SCE_MP		
Exit	Alt+F4	
Creates a new project step-by-step with the help of a wizard.		1.

 The project is to be created here as a multiproject. This means a master library will be created in addition to the S7 station and PC station. The library ensures that the same version of blocks and chart templates (process tag types) is always used within a project. (→ Next)



4. Next, we select the configuration of the AS with the CPU used, the power supply and the communications processors for PROFIBUS and Ethernet. Because PCS 7 stations are usually ordered as an entire station (bundle), it is possible to select the bundles here based on their order numbers. We are using the bundle with description 'AS414-3 V5.3; AC10A; UR2; CP443-1EX20'. (→ CPU: AS414-3 → 6ES7*** → Number of communication modules CP443-5 → 0 → Next)

PCS 7 Wizard: 'New Project'					
🚺 Whic	ch CPU are you using in your	r project? 2	2 (4)		
CPU:	AS414-3	▼ Find Bundles: V1.37			
Bundle:	MLFB 6ES7654-**C*3-3BE* E-Stand:5 6ES7654-**C*3-3GE* E-Stand:5 6ES7654-**C*3-5DE* E-Stand:5 6ES7654-**C*3-5JE* E-Stand:5 6ES7654-**C*3-3BD* E-Stand:5	Description AS414-3 V5.3; AC10A; UR2; CP443-1EX20 AS414-3 V5.3; DC10A; UR2; CP443-1EX20 AS414-3 V5.3; AC20A; UR1; CP443-1EX20 AS414-3 V5.3; DC20A; UR1; CP443-1EX20 AS414-3 V5.3; AC10A; UR2; CP443-1EX20, optional CP443-5DX05			
	6ES7654-**C*3-3GD* E-Stand:5 6ES7654-**C*3-5DD* E-Stand:5 6ES7654-**C*3-5JD* E-Stand:5 6ES7654-**C*3-3BC* E-Stand:5 6ES7654-**C*3-3BC* E-Stand:5	AS414-3 V5.3; DC10A; UR2; CP443-1EX20, optional CP443-5DX05 AS414-3 V5.3; AC20A; UR1; CP443-1EX20, optional CP443-5DX05 AS414-3 V5.3; DC20A; UR1; CP443-1EX20, optional CP443-5DX05 AS414-3 V5.3; AC10A; UR2; CP443-1EX20	•		
Number of communication modules: 1 CP 443-5 V7.0 0 1 2 3 Back Next Finish 4 Cancel Help					

Notes:

- The number of additional communication modules for PROFIBUS is added here in an additional selection.
- Because the bundles listed here often do not correspond 100% to the existing S7 station, individual components may have to be added or exchanged later in the hardware configuration.

 We now select the number of hierarchy levels for the plant hierarchy (refer to chapter 'Plant Hierarchy') and an OS object. (→ Number of levels: 3 → AS objects: none → OS objects: PCS7 OS → Single station system → Next)

PCS 7 Wizard: 'New Proj	ect'	x
Which other ot	ojects do you want to use?	3 (4)
Plant hierarchy : AS objects :		AS objects :
Number of levels: 3		CFC chart
		SFC chart
OS objects :		
00000000	PCS7 OS	 Single station system
	🗖 OpenPCS 7	 Multiple station system
	SIMATIC BATCH	O Multiple station system redundant
	Route Control	
		Preview >>>
Back Next	Finish	Cancel Help

 The storage location and directory name (also project name) are specified and the project is finished in the following window (→ Storage location: any → Directory name: SCE_PCS7 → Finish)

S 7 Wizard: 'New Project'				
) Where do you want to	store the multiproject?		4 (4)	
Directory name:	The following objects	will be created:		
SCE_PCS7	Multiproject:	SCE_PCS7_MP		
	Project:	SCE_PCS7_Prj		
	Master data library:	SCE_PCS7_LIB		
U:\Program Files (x86)\SIEMENS\: Available directories and files:	o i EP /\s /proj		Browse	
_ONL0001 asasrv.ini projID.pro				
SCE_PCS7 SCE_PCS7_MP			Preview >>>	
Back Next	Finish		Cancel Help	

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7. Confirm the dialog that appears. $(\rightarrow OK)$



 After the project is finished, it is opened and displayed in the Component view as well as in the Plant view. You can switch between the views in the menu under View. (→ View)



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SIMATIC Manager - SC	E_PCS7_MP		
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E-® SCE_PCS7 E-₽ SCE_PC	Offline Online	Report(5)	
	Large Icons Small Icons List Details		
	Filter Define Columns		
	Show All Levels Num* Hide All Levels Num-		
	Toolbar Status Bar		
	Update F5		
Selecting different view sizes, a	zoom factors, views, and represent	tations.	1.

Note:

- Additional information on the Component view and Plant view is provided in chapter 'Plant Hierarchy'. In this chapter, only the Component view familiar from STEP 7 is used.
- To avoid future warnings due to a missing System ID, the SID '3007-00A0-1ABD' previously created for SCE projects is entered. (→ SCE_PCS7_MP → Object Properties → System ID: 3007-00A0-1ABD → OK)



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Properties - Multiproject 🗙					
General					
Name:	SCE_PCS7_MP				
Storage Location:	c:\program files (x86)\siemens\step7\s7proj\s7proj\sce_pcs7\sce_n				
Туре:	STEP 7 - Multiproject				
Project Language:	not yet set				
🔽 Can be opened und	der any Windows language settings (language neutral)				
🔲 Set project languag	je to 'Deutsch (Deutschland)'				
Author:					
Date Created:	03/04/2019 12:25:16 PM				
Last Modified:	03/04/2019 12:30:59 PM				
System ID:	3007-00A0-1ABD				
Commenti					
Comment.					
	v				
ОК	Cancel Help				

Note:

The System ID is used to register a project at Siemens in order to simplify support. It is optional and therefore does not have to be entered. If it is not entered, PCS 7 generates the message described in step 7 above each time a project is opened. This message can be ignored.

8.2 Configuring the S7 station

1. Next, we select the SIMATIC S7-400 station in the Component view and open the hardware configuration with a double click. (\rightarrow Component view \rightarrow SIMATIC 400(1) \rightarrow Hardware)

SIMATIC Manager - [SCE_PCS7_MP (Component View) C:\Program Files (x86)\SIEME	NS\STEP7\s7proj\SCE_PCS7\SCEMP]
B File Edit Insert PLC View Options Window Help	_ B ×
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SCE_PCS7_MP SCE_PCS7_Pri SIMATIC 400(1) SIMATIC 400(1) SOURCES SOURCES Blocks Call Charts SIMATIC PC Station(1) Shared Declarations SCE_PCS7_Lib	
Press F1 to get Help.	PLCSIM.TCPIP.1

2. To make the settings for Ethernet networking, we select the PN-IO interface with a double click in the CP 443-1. (\rightarrow PN-IO)

Image: HW Config - [SIMATIC 400(1) (Configuration) SCE_PC57_Prj] Image: SCE_PC57_Prj] Image: Station Edit Insert PLC View Options Window Help										
0 🖻 🔓	D 😅 🐎 🖩 🙀 🎒 🗈 🖻 in 🚵 🧰 🚯 📼 💥 📢									
(0) UR2AL	LU PS 407 10A CPU 414-3 DP		OFIBUS(1): E)P master syste	em (1)	_		<u>F</u> ind: <u>P</u> rofile:	Standard	
X2 X1 IF1 5 X1 X1 P1 R X1 P2 R 6 4	3 CP0 414-3 DP X2 DP X1 MP/DP IF1 5 5 CP 443-1 X1 PN-AO X1 P1R Post 1 X1 P2R Post 2 6 V								ROFIBUS DP ROFIBUS-PA ROFINET IO IMATIC 300 IMATIC 400 IMATIC PC Based Co IMATIC PC Station	ntrol 300/400
Slot	D) UR2ALU	Order number	Firmware	MPI addr	l a	Q (Co [
3	CPU 414-3 DP	6ES7 414-3XM05-0AB0	V5.3	2						
X2 X7 IF1	DF MFI/DF			2	8191* 8190*					
5 X1 X1F1R	FCP 443-1	6GK7 443-1EX20-0XE0	V2.1		8189* 8188* 8188*					
<u>x1<i>F2R</i></u> 6 7 8	Part 2				8186*			PROFIBU and C7 (d	IS-DP slaves for SIMA listributed rack)	TIC S7 E
Press F1 to ge	t Help.									

 Here, a device name can be assigned and the properties for the Ethernet interface can be selected. (→ Properties)

Properties - PN-IO (F	R0/55.1)	×
General Addresses	PROFINET Synchronization Media redundancy	
Short description:	PN-IO	
Device name:	PN-IO	
Support device r	eplacement without exchangeable medium	
- Interface		
Type:	Ethemet	
Device	0	
Address:	192.168.0.1	
Networked:	no Properties	
Comment:		
ОК	Cancel Help	

4. In the parameters, we enter an IP address and a subnet mask and create a new subnet. (\rightarrow Parameters \rightarrow IP address: 192.168.0.1 \rightarrow Subnet mask: 255.255.0 \rightarrow New)

Properties - Ethernet interface PN-IO (R0/55.1)							
General Parameters	,						
Set MAC address / use ISO protocol							
MAC address:	If a subnet is selected, the next available addresses are suggested.						
🔽 IP protocol is being used							
IP address: 192.168.0.1 Subnet mask: 255.255.255.0	Gateway © Do not use router © Use router						
	Address:						
Subnet:							
not networked	New						
	Properties						
	Delete						
ОК	Cancel Help						

5. Then we apply the subnet and the settings. (\rightarrow OK \rightarrow OK \rightarrow OK)

Properties - New sul	onet Industrial Ethernet	×
General		
Name: S7 subnet ID: Project path: Storage location of the project:	Ethemet(1) 004 - 0006 SCE_PCS7_Prj C:\Program Files (x86)\SIEMENS\STEP7\S7Proj\s7proj\SCE_PCS7\SCE	
Date created: Last modified:	03/04/2019 12:42:55 PM 03/04/2019 12:42:55 PM	
comment:		
ОК	Cancel Help	

8.3 Connection of the I/O signals

 Next, we configure an ET 200M as a field device on PROFIBUS. In doing so, we have to set the appropriate profile first. Then we select the appropriate interface module from the catalog in folder PROFIBUS DP/ET200M and move it onto the master system of the CPU using dragand-drop. (→ PROFIBUS DP → ET 200M → IM 153-2 HF → PROFIBUS(1): DP master system(1))

HW Config - [SIMATIC 400(1) (Configuration) SCE_PC57_Prj]		
ung station Edit Insert PLC view Options window Help		_ 먼 스
	Eind:	nt ni
PROFIBUS(1): DP master system		
3 CPU 414-3 DP	Profile: JPCS7_V90	_
	FOUNDATION FIELDBUS	
X2 DP X1 MPI/DP		
	Elin-Object	
5 EP 443-1	DP/PA Link	
X1 PN-10	🗄 💼 ET 200iS	
X1 P1R Port 1	ET 200iSP	
	EI 200M	
	im 153-1	
	🖶 🖷 IM 153-2	
	⊡ 📑 IM 153-2 FO	
	IM 153-2 HF	
Slot Designation		
0 UR2ALU		
PROFIBUS(1): DP master sustam (1) DP master sustam (1)	🖶 📲 IM 153-2 HF OD	
	🗈 🚡 IM 153-2 HF OD	
	IM 153-2 HF 0D	
	ET 200pro	
	🗄 🧰 ET 2005	-
	6ES7 153-2BA02-0XB0	.▲ ₹<
	IM 153-2 Bus interface for up to 12 S7-300 SM	\$
	during operation. Used redundantly with active	-
Press F1 to get Help.		Chg //

Notes:

- To select the correct interface module, you must pay attention to the order numbers. They
 are printed on the interface module and in the footer of the hardware catalog as soon as you
 have selected a component.
- If you do not have your own hardware available, it is best to adhere to what is shown here.

2. In the following selection, you assign the PROFIBUS address for the interface module. (\rightarrow Address: 3 \rightarrow OK)

Properties - PROFIBUS interface IM 153-2	×
General Parameters	
Address:	
Subnet:	New
PROFIBUS(1) 1.5 Mbps	INGW
	Properties
	Delete
ОК	ancel Help

Note:

 The address set here must also be set on the interface module in binary code using a switch block. The user can obtain additional information on this in the manual of the interface module. Now, you enter the I/O modules from the folders below the interface module used. This is done by dragging these modules to the respective slot within the ET 200M. The I/O addresses of the individual modules should be set in their properties as shown here.

When your configuration is complete, apply it with the '+Iu' button for saving and compiling.

Set addresses \rightarrow $40 \rightarrow \times$

(→PROFIBUS DP →ET 200M →IM 153-2 HF →DI-300 →DO-300 →AI-300 → AO-300 →

			_					
H HW	Image HW Contrig - [SIMATIC 400(1) (Contiguration) SCE_PC37_Pr]							
un Sta	ition Edit Insert PLC View	Options Window Help					_ 8 ×	
0 🖬								
Ĺ								
(0)) UR2ALU							
1	PS 407 10A					Eind:	<u></u>	
				PROFI	BUS(1): DP master system	Profile:	PCS7 V90	
3	CPU 414-3 DP					Tromo.	1.637_930	
	8		(3)	IM 153-2		÷) ET 200iSP 📃	
X2	DP		F				ET 200M	
	MPI/DP		e 📕				- 📠 IM 153-1	
	18 CD 442 1					. E	- M 153-1	
5						+	- M 153-2	
	01 D D D d 1					+	- M 153-2 FU	
						+	- M 153-2 HF	
	FZA FOILZ				-		- M 153-2 HF	
I I Î					•		- 💼 IM 153-2 HF	
							± AI-300	
	(3) IM 153-2 Bedundancu							
	(o) In ros 2, riedandancy						5M 332 AU2812Bit	
Slot	Module	Order Number	I Address	Q Address	Comment		SM 332 A02X12DI	
1	_						SM 332 A044120k	
2	🚡 /M 153-2	6ES7 153-2BA02-0xB0	8184×				SM 332 A04/120k	
3							SM 332 ΔΠΔv16Bit	
4	DI32xDC24V	6ES7 321-1BL00-0AA0	03				SM 332 A04x16Bit	
5	DI32xDC24V	6ES7 321-1BL00-0AA0	47				- SM 332 A04x16Bit	
6	DI16xNAMUR	6ES7 321-7TH00-0AB0	811					
7	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	6465				. SM 332 A02x0/4.,20mA HAR	
8	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	6667					
9	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	6869				🗄 📲 SM 332 A08x16Bit HART	
10	DI16xDC24V, Interrupt	6ES7 321-78H01-0AB0	7071				🗄 📲 🚺 SM 332 A08x16Bit HART 🛛 🜉	
11	D032xDC24V/0.5A	6ES7 322-1BL00-0AA0		03				
12	D016xDC24V/0,5A	6ES7 322-8BH10-0AB0		45				
13	DU16xDC24V/0,5A	6ES7 322-8BH10-0AB0		67		6ES7 332	-SHFUU-UABO	
$\frac{14}{15}$	Al8x14Bit	6ES7 331-7HF01-0AB0	/287	04.70		redundance	cy only possible for PROFIBUS DP	
15	AU8x12Bit	16ES7 332-5HF00-0AB0		6479			,, <u></u> ,	
1						p		
Press F1	L to get Help.							

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Slot	Module	Order Number	I Address	Q Address	Comment
1	-				
2	IN 153-2	6ES7 153-2BA02-0XB0	8184*		
3					
4	DI32xDC24V	6ES7 321-1BL00-0AA0	03		
5	DI32xDC24V	6ES7 321-1BL00-0AA0	47		
6	DI16xNAMUR	6ES7 321-7TH00-0AB0	811		
7	DI16xDC24V, Interrupt	6ES7 321-7BH01-0AB0	6465		
8	DI16xDC24V, Interrupt	6ES7 321-7BH01-0AB0	6667		
9	DI16xDC24V, Interrupt	6ES7 321-7BH01-0AB0	6869		
10	DI16xDC24V, Interrupt	6ES7 321-7BH01-0AB0	7071		
11	D032xDC24V/0.5A	6ES7 322-1BL00-0AA0		03	
12	D016xDC24V/0,5A	6ES7 322-8BH10-0AB0		45	
13	D016xDC24V/0,5A	6ES7 322-8BH10-0AB0		67	
14	Al8x14Bit	6ES7 331-7HF01-0AB0	7287		
15	AO8x12Bit	6ES7 332-5HF00-0AB0		6479	

Notes:

- To select the correct module, you must pay attention to the order numbers. They are printed on the modules and in the footer of the hardware catalog as soon as you have selected a component. If you do not have your own hardware available, it is best to adhere to what is shown here.
- You can facilitate the search for the correct modules by utilizing the search dialog at the very top of the catalog. There, you simply enter the order number you are looking for and you can search the entire catalog up or down.
- Slot 3 remains free. It is reserved for the expansion module with a multi-tier configuration.
- In order to use the specified symbol table, it is important to set the specified I/O addresses.

8.4 Configuration of the PC station

 Next, we select the SIMATIC PC station in the Component view of SIMATIC Manager and open the configuration with a double click. (→ Component view → SIMATIC PC Station(1) → Configuration)

SIMATIC Manager - [SCE_PC57_MP (Component View) C:\Program Files (x86)\SIEMENS	5\STEP7\s7proj\SCE_PCS7\SCEMP]
🔂 File Edit Insert PLC View Options Window Help	_ _ _ _ _ _
🔄 🗅 😂 🔡 🐖 X 🗈 🛍 📩 😰 🏪 🕒 🗽 🔛 🎆 🛍 🖊 < No Filter >	🗹 🎶 💥 🕮 🖷 🗖 📢
SCE_PCS7_MP SCE_PCS7_Pri SIMATIC 400(1) Shared Declarations SCE_PCS7_Lib SCE_PCS7_Lib	
Press F1 to get Help.	PLCSIM.TCPIP.1

2. Within the PC station, the Ethernet interface must be entered first. To do this, we drag the CP-Industrial Ethernet in version V8.2 from IE General to the first free slot in the PC station.

In the window that is displayed next, we connect this interface with the Ethernet network already set up in the S7 station and enter the IP address and the subnet mask. (\rightarrow SIMATIC PC Station \rightarrow CP-Industrial Ethernet \rightarrow IE General \rightarrow SW V8.2 \rightarrow IP address: 192.168.0.2 \rightarrow Subnet mask: 255.255.255.0 \rightarrow Subnet: Ethernet(1) \rightarrow OK)

Big HW Config - SIMATIC PC Station(1) Station Edit Insert PLC View Options Window Help			<u>_ </u>					
SIMATIC PC Station(1) (Configuration) SCE_PCS7_Prj								
ar (0) PC	<u>F</u> ind:		m‡ mi					
	Profile:	PCS7_V90	•					
2 WinCC Appl. 3 Properties - Ethernet interface IE General (R0/51)	E-	OUNDATION FIELDBUS						
General Parameters	III THE P III THE P	ROFIBUS DP ROFIBUS-PA						
6 Set MAC address / use ISO protocol	E ∰ P	ROFINET IO						
T If a subnet is selected.	⊡- <u>₽</u> S	IMATIC 400 IMATIC PC Station						
the next available addresses are suggested.		Archive BATCH						
IP protocol is being used	Ē	Controller						
IP address: 192.168.0.2 Gateway		CP-Industrial Ethernet						
Subnet mask: 255.255.255.0 C Her mater	E	CP 1612						
Leden B Madda Courseway								
Index Module Order number								
2 WinCC Appl Ethemet(1)								
		-+ SW V8.2						
Delete		CP-PROFIBUS						
	D	PDM						
OK Cancel Help		Route Control User Application						
13	Proxy for	any Industrial Ethernet modul	·귀즈					
	communic	cation (via ISOonTCP), PG	-					
Insertion possible								

3. An Ethernet interface and the WinCC application are now entered in the PC station. We apply this configuration be clicking on the ' $\mathbf{P}_{\mathbf{P}}$ ' button for saving and compiling. (\rightarrow + \mathbf{P} \rightarrow **X**

H	W Co	nfig - SIMATIC PC Statio	on(1)								
Stat	Station Eait Insert PLC view Options Window Help										
	<u></u>			N?							
04	SIMA	TIC PC Station(1) (Conf	iguration) SCE_PCS7_Prj							-	므느
	V) (0) [DC.							Eind:		mt mi
ll î	1	IE General							Profile:	PCS7_V90	-
	2	WinCC Appl.							E E	DUNDATION FIELDBUS	
	3								— <mark>ж</mark> Р	ROFIBUS DP	
	5								■驚躍日	ROFIBUS-PA	
	6								I⊞ man r ⊞ man s	IMATIC 400	
	0								🛛 🗄 🖳 S	IMATIC PC Station	
11 -									Ē	Archive	
										BATCH Controller	
										CP-Industrial Ethernet	
						_				- CP 1512	
띜											
		M PC							Ē	- 🗀 CP 1623	
11 -			- (- CP 1628	
	Index	Module	Order number	Firmware	MPI address	I address	Comment		E	Beneral	
	2	WinCC Appl		V8.2		16383"				SW V7.1	
	3										
	4										
	5			_						CP-PROFIBUS	
	5										
	/ 8			-						Route Control	
	9								i i i	User Application	
	10										
	11			_							
	12			_					IE_CP	and had a state of the second as a de-	. <u>≜</u> ₹ <u>≺</u>
	14								ISO, TCP	/IP, S7 and S7·H	
	15								communic	ation (via ISOonTCP), PG	-
									<i>v</i>		

8.5 Networking

 To check and compile the networking in our project, we now open the Ethernet network in the Component view of SIMATIC Manager with a double-click. (→ Component view → SCE_PCS7_Prj → Ethernet (1))

SIMATIC Manager - [SCE PCS7	MP (Component View) C:\Program Files (x86)\SIEMENS\	STEP7\s7proj\SCE PCS7\SCE MP]
🔂 File Edit Insert PLC View (Options Window Help	_ B ×
	🛔 💼 😨 🗣 🕒 📴 🛗 💼 🔁 < No Filter >	▼ ½ 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
CE_PCS7_MP CE_PCS7_Pri CE_PCS7_PFI CE_PC	SIMATIC 400(1) SIMATIC PC Station(1)	Shared Declarations
Press F1 to get Help.	Γ	PLCSIM.TCPIP.1

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2. The NetPro tool provides a good overview of the components and networks in our project. We see that both stations are connected to each other via Ethernet and that ET 200M is interfaced with the SIMATIC S7-400 via PROFIBUS. We apply these network settings by clicking on the '+19' button for saving and compiling. (→ +19)

RetPro - SCE_PCS7_Prj			
Network Edit Insert PLC View Options Window Help			
SCE_PC57_Prj (Network) C:\Program Files (x86)\\SCE_Prj	x		
Ethernet(1) 1	Eind: <u>mt mi</u>		
Industrial Ethernet	Selection of the network of		
MPI(1) MPI	PROFIBUS DP		
PROFIBUS(1) PROFIBUS	Eran PHOFINE TO Eran Stations Eran Subnets		
SIMATIC PC Station(1) Benera WinCC Genera Appl. 3 3 2 2 2 2 3	I.		
To display the connection table, please select a module capable of a connection (CPU, FM module, OPC server or application). To display the network address overview, please select a subnet.			
Ready PC internal.local.1 X 0 Y 3 Inse	S7 and C7		

3. In the next window, we select 'Compile and check everything'. (\rightarrow Compile and check everything \rightarrow OK)

Sa	ave and Compile	x
	Compile Compile and check everything Compile changes only	
[OK Cancel Help	

4. The result of the compilation is displayed in a window. $(\rightarrow \checkmark)$

🚹 Outputs for consistency check for C:\Program Files (x86)\SIEMENS\STEP 💶 🗖 🗙					
File Edit					
Messag	Message	Туре	Project	Project path	
	No errors.				
<u> </u>				<u> </u>	
l i					

8.6 Checklist – step-by-step instruction

The following checklist helps students to independently check whether all steps of the step-bystep instruction have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	Multiproject present	
2	S7-400 configured	
3	CP: Ethernet address set	
4	ET 200M configured	
5	PROFIBUS and I/O addresses set	
6	PC station configured	
7	Networking performed	
8	Project successfully archived	

Table 3: Checklist for step-by-step instructions

9 Exercises

In the exercises, we apply what we learned in the theory section and in the step-by-step instructions. The existing multiproject from the step-by-step instructions is to be used and expanded for this.

Note:

The exercises can be carried out without having to first work through the step-by-step instructions completely and correctly. To get to the stage of the project needed for the exercises, the project archive provided can be unzipped and opened using the 'Retrieve' function. (→ File → Retrieve...).

The name of the project archive for the step-by-step instructions is: p01-02-project-r1905-en.zip. The download of the project is stored as zip file "Projects" on the SCE Internet for the respective module.

The following exercises are recommended especially for users of the PCS 7 Trainer Package because an AS RTX Box will be integrated in these exercises. The AS RTX Box is also an automation station and can handle the same tasks as the previously configured S7-400.

For that reason, this exercise is not mandatory for execution of the overall project.

9.1 Tasks

- Insert the new AS by right-clicking the project and selecting "Add new object" and then "Preconfigured Station ...". In the dialog box that opens, select the "PCS7 BOX" as CPU and then the "AS RTX" with order number 6ES7654-0UE13-0XX0. Continue along with the dialog without making any other settings.
- Because the AS RTX Box is a PC based automation station, you should now have a second SIMATIC PC station in the project. You should now assign your stations meaningful names; for example, SIMATIC 400(1) is named AS1, SIMATIC PC Station (1) is named OS and SIMATIC PC Station (2) is named AS2.
- 3. Next, network the AS RTX Box (=AS2) with the Ethernet (1) and with a new PROFIBUS master system PROFIBUS (2). You must open the configuration of the AS2 for this. So far, your AS has only one interface to PROFIBUS, "CP5611-CP5621". For this reason, add an IE General. Assign the Ethernet interface parameters exactly as described in the step-by-step instructions. For parameter assignment of the PROFIBUS interface, you need to open the properties and add a new PROFIBUS network.

4. So that the new AS can actually undertake the tasks of the AS1, you need the identical ET 200M. You have two options for adding the ET 200M including the I/O cards. The first option corresponds to the configuration as provided in the step-by-step instructions. The second option is to copy the previously created ET 200M and insert it with a right-click on the PROFIBUS (2) line.

9.2 Checklist – exercise

The following checklist helps students to independently check whether all steps of the exercise have been carefully completed and enables them to successfully complete the module on their own.

No.	Description	Checked
1	PCS 7 BOX / AS RTX inserted in the multiproject	
2	AS1, AS2 and OS present in the project	
3	Networking performed	
4	New ET 200M configured	
5	Project successfully archived	

Table 4: Checklist for exercises

10 Additional information

More information for further practice and consolidation is available as orientation, for example: Getting Started, videos, tutorials, apps, manuals, programming guidelines and trial software/ firmware, under the following link:

siemens.com/sce/pcs7

Preview "Additional information"

Getting Started, Videos, Tutorials, Apps, Manuals, Trial-SW/Firmware

- SIMATIC PCS 7 Overview
- SIMATIC PCS 7 Videos
- > Getting Started
- > Application Examples
- > Download Software/Firmware
- SIMATIC PCS 7 Website
- SIMATIC S7-400 Website

Further Information

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Siemens SIMATIC PCS 7 siemens.com/pcs7

SCE Learn-/Training Documents siemens.com/sce/documents

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TIA Portal siemens.com/tia-portal

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