

SCE Training Curriculum

Siemens Automation Cooperates with Education (SCE) | 09/2015

PA Module P02-01 SIMATIC PCS 7 – HMI Generation



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Matching SCE Trainer Packages for these curriculum

- SIMATIC PCS 7 Software block of 3 packages Order No. 6ES7650-0XX18-0YS5
- SIMATIC PCS 7 Software block of 6 packages Order No. 6ES7650-0XX18-2YS5
- SIMATIC PCS 7 Software Upgrade block of 3 packages
 Order No. 6ES7650-0XX18-0YE5 (V8.0 → V8.1) or 6ES7650-0XX08-0YE5 (V7.1 → V8.0)
- SIMATIC PCS 7 Hardware Set including RTX Box Order No. 6ES7654-0UE13-0XS0

Please note that these trainer packages may be replaced with subsequent packages. An overview of the available SCE packages is provided at: <u>siemens.com/sce/tp</u>

Continuing education

For regional Siemens SCE continuing education, contact your regional SCE contact partner. <u>siemens.com/sce/contact</u>

Additional information relating to SIMATIC PCS 7 and SIMIT

In particular, Getting Started, videos, tutorials, manuals and programming guide. <u>siemens.com/sce/pcs7</u>

Additional information relating to SCE

siemens.com/sce

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HMI GENERATION

TRAINING OBJECTIVE

After working through this module, the students will be able to design and implement a graphic user interface for efficient process monitoring and control. To this end, they will be familiarized with the objective of process management. They understand the basic concepts of representation and are acquainted with different representation techniques. This enables the students to generate a graphic user interface in **PSC 7** that is useful and efficient.

THEORY IN BRIEF

A modern process control system such as **PCS 7** offers operating staff different screen based windows to the process; with it all process control tasks can be handled. Based on the large amount of information the operator has to take in and process from the technical process, structuring the information makes sense. In addition, certain rules have to be adhered to for navigation and representation in order to establish an interface to the technical process that can be operated well and that supports operators as well as possible in their manifold process control tasks.

PCS 7 supports the design process of process screens for operator control and monitoring in multiple ways. First, for many of the elementary blocks and individual control functions used in basic automation, operator icons and operator panels are defined that enable project-wide uniform interaction with similar technical equipment. Second, the plant hierarchy can be used to advantageously structure the represented information.

Based on this structure, very many elements of the operating system that have to be executed manually in other systems can be generated automatically and error-free by means of a generation run. The two essential remaining tasks when designing the process screens are the representation of the static process structure (containers, pipes, etc.) for better orientation, and inserting elements to navigate along process flows on a plant hierarchy level.

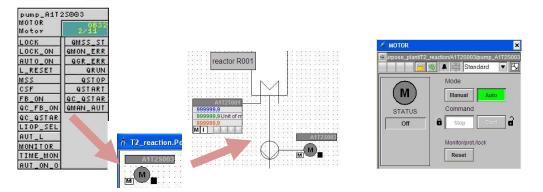


Figure 1: From individual drive function to the operating screen

By means of the generation run, icons are set up for all operable blocks of a hierarchical level. The icons then only have to be moved and enhanced with static elements in order to obtain a complete operating screen (see Figure 1).

THEORY

OBJECTIVES OF PROCESS CONTROL

The task of an operator in a process plant is to perform the intended operation of this plant economically and environmentally sustainable. This task is called process management. Operators have to ensure consistently high product quality and amount (yield) and keep the amount of rejects as low as possible; they also have to compensate for disturbance factors such as varying characteristics of the raw material used and for faults in the plant or fluctuating throughput. Operators have to ensure that the availability and life of the plant is maximized. Moreover, they have to ensure that the emission limits are observed and energy and material consumption is minimized [1].

To attain these goals, operators have to be constantly in a position to monitor the plant, to diagnose faults and to intervene in the running process to remove faults. The operator's workplace is the operator station at a control desk. This operator station has available all displays and intervention capabilities that operators need to perform their task. The control system provides them with a user interface that enables them to carry out their tasks according to ability, skills and requirements [1].

CONCEPTS OF VISUALIZATION

The visualization of data and information in the graphical user interface has a deciding influence on operators' performance. For this reason, it has to be in line with their abilities, skills and requirements. The following questions should therefore be answered:

- 1. For whom and for what are we visualizing?
- 2. What is to be visualized?
- 3. How is it supposed to be visualized?

These questions depend on the plant to be configured and, therefore, have to be answered for the respective project. However, the following aspects always have to be considered:

Organization of what we want to visualize

The information and data to be visualized has to be organized suitably for the visualization. We have to specify how the existing elements are structured and arranged, how they relate to each other and how it is possible to navigate among the visualizations. To this end, we have to specify how much data and information is to be visualized overall (*quantitative aspect*). We also have to specify which information and data is to be visualized simultaneously and jointly (*qualitative aspect*).

We have to decide in this case what the ratio is to be of what is new (information, dynamic display share) to what is known (data, static display share). The aim is to share information as much as possible but with sufficient data for a correct interpretation of the information suitable to the purpose.

The result is the distribution of information and data to the different operating screens. Now, we still have to define how the operator gets from one operating screen to another (*navigation*).

Print growth

Depending on the user interface, only a limited area is available for simultaneously displaying data and information. To ensure that the information and the data is legible and distinguishable in all operating situations, only a certain share of this area is to be assigned characters. This share is called *print growth* of the visualization.

The recommended print growth depends on the type of characters and the display elements as well as on the necessary arrangement of these elements. Thus, it depends on the visualization technique used. For example, the print growth of a process flow diagram should be no more than 50%; for a message page, on the other hand, it may be up to 80% [1].

Coding

Coding specifies how certain information is represented. Information can be coded through color, shape, form, extension, direction (angle), position and dynamics (flashing). Uniform coding facilitates the assimilation and evaluation of information for the operator.

Good coding is clear, distinguishable and does not contradict existing conventions. For example, the color green should never be used for a STOP signal. If instead a red flashing signal would be used as coding for STOP, this coding should be used consistently for the entire user interface. Also, this coding should not be used for any other information in order to rule out confusion. In addition, good coding should be plausible: the operator learns and remembers it easily.

Conspicuousness

A central task of the user interface is directing the operator's attention to important information. Because different information is usually displayed on an operating screen, it is advisable to design this information with varying conspicuousness corresponding to its relevance and priority. The more conspicuous the information, the sooner it is discovered. In addition, based on its conspicuousness, the operator recognizes the information that requires the most attention at the moment. Table 1 shows the stepped increase of conspicuousness of the visualization for different information, based on a few examples.

				alion of ste		Jousness according to [1]				
		Increasing conspicuousness of means								
			Combinat	ion of mea	Application					
/	\wedge	Contrast	Color	Flashing	Acoustical signal					
	L Ion	high	Х	х	Х	Alarm				
	sualizat	high	Х	х	-	Change of state (requiring acknowledgement)				
	Increasing conspicuousness of visualization	high	Х	-	-	Change of state (not requiring acknowledgement)				
	ousne	high	Х	-	-	Curves				
	onspicu	high	Х	-	-	Text of message line, explanatory texts				
	asing co	medium	-	-	-	selectable and operator-controllable object (keys)				
	Incre	low	-	-	-	currently not selctable and operator- controllable object				

Table 1: Application of stepped conspicuousness according to [1]

Consistency

Often, certain information occurs in several visualizations at the same time. In this case it is important that this information is visualized *consistently* in the entire user interface. This means the information looks identical in all visualizations, and behaves identically. The same terms and icons have to be used. The operation sequence should always be the same, and the system reaction to operations should be similar with respect to time and content.

VISUALIZATION TECHNIQUES

Basic Structure of the Display Area

The display area should always be structured the same for all types of visualization. For the operator, it facilities orientation, information assimilation and thus process management.

The recommended basic structure according to VDI 3699 [1] is shown in Figure 2. A message line is located in the upper area where the most current messages are displayed as group messages. Below it is an overview field where the available visualizations (for example, process pictures in **PCS 7**) are listed. From here, any visualization can be opened. The working area occupies the largest part of the display area. Here, the currently selected visualization is displayed. The lowest area contains the key field for activating general functions. In the working area, windows with supplementary information (such as different views of **PCS 7** blocks) can be opened in addition. All areas except the working area are reserved and are permanently displayed.

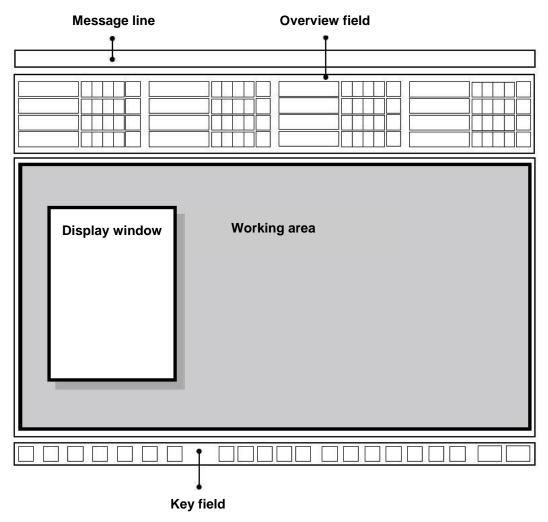


Figure 2: Basic structure of a display area

Flowcharts

A flowchart is the "schematic representation of components including their connection through (flow) lines to show relationships in a control plant and in control engineering" [1]. It represents a simplified plant structure and provides information about the paths of material, energy and signal flows between the different plant units. With the aid of flowcharts, process and control information is represented and interventions in the process are made possible.

Flowcharts consist of static and dynamic elements. The static display elements are represented by the *root screen*. This root screen contains the dynamic display elements that are continuously updated.

The static root screen provides the context for the dynamic picture elements, which means it indicates the meaning of the represented objects and their relationship among each other. The root screen represents all data that remains unchanged during the display. This data is the display background, the headings and labels as well as the plant units and the devices (if their representation is not to change).

The dynamic picture elements provide the information for process control. **Display elements** represent the changes, characteristics and relationships of the process values. They reflect the state of the plant, of the control system or of the process. **Selection and operator control elements** make it possible for the operator to intervene for process control. Furthermore, additional information such as function charts or curves can be inserted in the flowchart as a window.

Flowcharts are subdivided as follows:

- Control flowcharts represent only the components of control systems such as regulators, sensors and controllers as symbols. They are connected to each other with signal flow lines.
- Process flowcharts graphically represent plant units in a simplified way using symbols. Here, three different kinds are differentiated:
 - A basic flowchart represents plants, sub-plants or plant units in the form of rectangles. They are connected to each other with flow lines for materials, energy or energy sources.
 - A *process flowchart* represents processes using (simplified) graphic symbols. The symbols represent the corresponding plant units and are connected to each other with flow lines.
 - A *pipe and instrument diagram* (P&I diagram) represents the technical equipment of the plant using graphic symbols. In addition, process tags, control blocks and actuators are represented. The symbols are connected to each other by lines for pipes and signal paths.

In **PCS 7**, flowcharts are called **process pictures**. In the step by step instructions, different process pictures are generated for the configured plant.

HMI GENERATION IN PCS 7

PCS 7 has an extensive operator control and monitoring system that consists of the following subsystems [2]:

- A *graphic system* for displaying process information and for process operation.
- A *curve system* to represent and analyze time sequences of stored process values.
- A *message system* for diagnosing the process.
- A *log system* for documenting the process.
- An *archive system* for storing and maintaining process values, messages and logs

In this chapter, the **PCS 7** graphic systems is introduced. The message system will be described in the subsequent chapter 'Alarm Engineering'.

The graphic system represents the plant in a plant overview, shows process pictures in the working area of the user interface, makes available elements for process and system operation and indicates alarm states. The corresponding user interface is generated on the system's operator station (OS). Thus, the OS is the central station for monitoring and operating a *PCS* **7** plant [2].

Configuring the User Interface in PCS 7

The selected plant hierarchy of the project is the basis for the organization of the user interface. The plants and subunits that were set up are represented in the user interface with corresponding process pictures. Picture names and directory names of the plant hierarchy are included automatically. In the process mode, the process pictures are represented in the overview area corresponding to the plant hierarchy.

First, the process pictures of a project are set up at the corresponding location in the plant hierarchy and assigned to an OS. The OS then has to be compiled. After that, the process pictures can be configured in the *Graphics Designer* of the *WinCC Explorer*. The *Graphics Designer* is an editor where static and dynamic picture elements can be inserted, arranged and interconnected.

Configuring the Process Pictures in PCS 7

Technological blocks from **PCS 7** libraries that can be operated and monitored include corresponding graphic representations, so-called **block icons**. When the process pictures are configured, they are inserted automatically in the corresponding screen. Overview-like, block icons provide the most important information about the represented block in the process picture.

By means of the block icons, different pre-configured **faceplates** can be called that open as a window in the working area. Faceplates are dynamic diagram elements that are connected to the parameters of the represented block and are updated automatically. They make it possible for the operator to extensively monitor and operate the associated technological block. Depending on the block type, different **views** exist for the associated faceplates. These views enable the access to parameters for very specific tasks. For example, in addition to the standard view there often also is a parameter view for assigning parameters, a message view for diagnostics, or a limit view for setting operational limits of the setpoint. It depends on the represented technological block which views are offered.

The *Graphics Designer* makes additional dynamic standard objects available that can be inserted manually. These objects can be interconnected directly with the I/Os of the blocks in the CFCs and SFCs and thus realize the desired dynamic behavior. Examples for standard objects are input and output fields for entering and displaying values, status indicators for displaying binary states of an object as well as bars for the relative representation of values.

In addition, the *Graphics Designer* provides different libraries with pre-assembled graphic elements such as piping or valves that can be used to generate the static root screen. You can also create and use our own graphics.

In the step by step instructions below, additional characteristics and capabilities of the *Graphics Designer* are presented. Moreover, important *WinCC* tools are introduced.

LITERATURE

- [1] VDI 3699 (Ausgabe 2005-05): Prozessführung mit Bildschirmen. (Process control using display screens)
- [2] SIEMENS (2013): Process Control System PCS7: OS Process Control (V8.0 SP1). A5E02779415-04 <u>https://support.industry.siemens.com/cs/ww/en/view/68157008</u>

STEP BY STEP INSTRUCTIONS

TASK

In this task, the operator station (OS) is created after a few presettings on the **SIMATIC Manager**.

We are creating the following: an overview screen of the multi-purpose plant, and one unit picture each for the educt tank, the reactor and the product tank. First, a solution for a tank is generated for each unit.

TRAINING OBJECTIVE

In this chapter, the student:

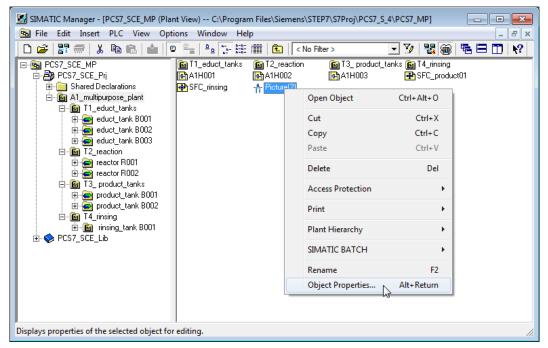
- Learns to generate the operator station (OS) in the SIMATIC Manager
- Is familiarized with the WinCC configuration environment
- Learns to build pictures in the Graphics Designer

These instructions are based on 'PCS7_SCE_0108_Ueb_R1305_en.zip'.

PROGRAMMING

1. First, change the object properties of your picture on level A1_multipurpose_plant.

 $(\rightarrow A1_multipurpose_plant \rightarrow Picture(2) \rightarrow Object Properties)$



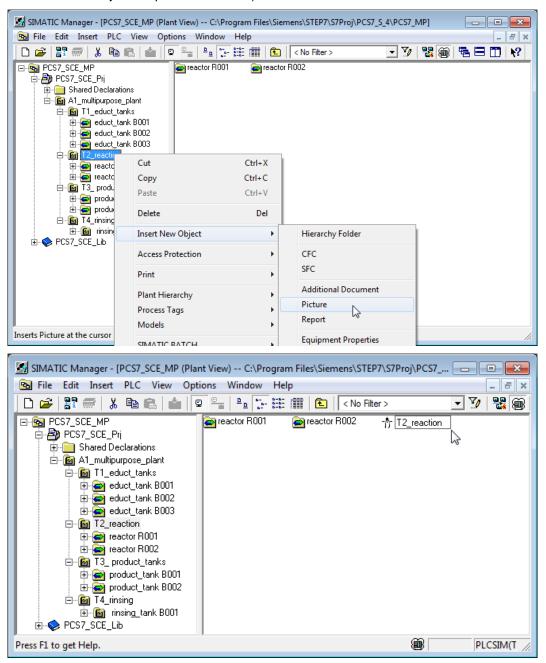
- 2. As the name, enter 'A1_multipurpose_plant'.
 - $(\rightarrow \text{General} \rightarrow \text{Name} \rightarrow \text{A1}_multipurpose_plant})$

General Block icons	
Name:	A1_multipurpose_plant
Path:	PCS7_SCE_Prj\OS(1)\GraCS\Picture(2).Pdl
Plant path:	PCS7_SCE_Prj\A1_multipurpose_plant
Storage location of the project:	C:\Program Files\Siemens\STEP7\S7Proj\PCS7_S_4\PCS7_Prj
Author:	
Created:	
Last changed on:	
Comment:	A
OK Ar	Cancel

3. Derive the block icons from the plant hierarchy. (\rightarrow Block icons \rightarrow Derive the block icons from the plant hierarchy)

Properties - WinCC-Picture: Picture(2)	×
General Block icons	
Derive the block icons from the plant hierarchy.	
OK Apply	Cancel

 In the levels T1 to T4, insert pictures with a right click and 'Insert New Object'. Assign names to them as shown in the example below for T2. (→ Insert New Object → Picture → Object Properties → Name)



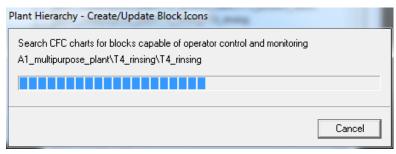
5. Then, the block icons have to be generated and updated. (\rightarrow A1_multipurpose_plant \rightarrow Plant Hierarchy \rightarrow Create/Update Block Icons)

SIMATIC Manager - [PCS7	7_SCE_MP (Plant View) C:\Progr	am Files\S	iemens\STEP7\S7Proj\PCS7_S_4\I	PCS7_MP]		
😼 File Edit Insert PLC	C View Options Window H	elp			_ & ×	
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🚊 📴 T1_ec	Cut Ct	rl+X				
🕀 🔁 ec	Copy Ctr	rl+C				
±€ ec	Paste Ct	rl+V				
⊡ 6 T2_re ⊕ ⊖ re	Delete	Del				
	Insert New Object					
±⊖ pr 	Access Protection					
⊡ím ⊡ím ⊡ím	Print	•				
DCS7_SCE_L	Plant Hierarchy	۰.	Settings			
	Process Tags	•	Check Consistency			
	Models	•	Open Check Log			
	SIMATIC BATCH	•	Create/Update Block Icons	N		
	Rename	F2	Open Block Icons Log	2		
Creates/updates block icons i	Object Properties Alt+Re in the selected pictures.	turn	Change AS Assignment Change OS Assignment			

In the window that opens, set 'Chart' under '...components of the HID' and the included lower level hierarchy levels to '1'. Confirm with 'OK'. (→ Chart → Lower hierarchy levels included → 1 → OK)

Create/Update Block Icons						
Block icons will be created or updated for the following pictures:						
 A1_multipurpose_plant\A1_multipurpose_plant A1_multipurpose_plant\T1_educt_tanks\T1_educt_tanks A1_multipurpose_plant\T2_reaction\T2_reaction A1_multipurpose_plant\T3_product_tanks\T3_product_tanks A1_multipurpose_plant\T4_rinsing\T4_rinsing 						
The object name TAG is made up of the following components of the HID:						
Chart						
Lower hierarchy levels included:						
Zoom block icons						
Zoom factor (50 - 500%): 100						
Position block icons automatically						
OK Apply Cancel Help						

7. Now the block icons are created and updated.



8. After Create/Update Block Icons, have the log displayed. (\rightarrow Yes)

Create/Update Block Icons (3283:5053)						
To ensure possible automatic corrections to the WinCC picture interconnections, you must subsequently compile the associated operator stations before making changes to the name components of the associated process variables (HID, chart names,).						
Ye	Do you want to view the function log now?					

9. The log shows that no errors occurred. (\rightarrow X)

🖉 🔜 🦻 🥙 🚽 THPOFile.log - WordPad	
Start Ansicht	0
Courier New 11 A A' Image: Strain and Strain	
-1	4・1・15人・16・1・17
********* Start of create / update block icons on 14.04.20 15:01:39 ********* Call from the OS Compile context Project PCS7_SCE_Prj, OS: OS\WinCC Appl.\OS(1) Picture A1 multipurpose plant\A1 multipurpose plant	15
Block icons will be generated/updated for the	E
following blocks: Project PCS7_SCE_Prj SFC AI_multipurpose_plant\\SFC_product01 SFC of type @SFC_RTS, variant: SFC AI_multipurpose_plant\SFC_rinsing SFC of type @SFC_RTS, variant:	
Picture A1_multipurpose_plant\T1_educt_tanks\T1 educt tanks	
Block icons will be generated/updated for the	
following blocks: Project PCS7_SCE_Prj CFC Al multipurpose_plant\T1_educt_tanks	
\educt_tank B001\\A1T1S001 Block pump A1T1S001 of type MotL, vari	ant:
	ano
CFC Al_multipurpose_plant\T1_educt_tanks \educt_tank B002\\AlT1S002 Block pump AlT1S002 of type MotL, vari	ant.
	une.
CFC A1_multipurpose_plant\T1_educt_tanks \educt_tank B003\\A1T1S003	
Block pump_A1T1S003 of type MotL, vari	ant:
CFC Al_multipurpose_plant\T1_educt_tanks \educt_tank B001\\AlTIX004	
Block Valve_A1T1X004 of type VlvL, variant: /2	
CFC A1_multipurpose_plant\T1_educt_tanks \educt_tank B002\\A1T1X005	
Block Valve_A1TIX005 of type VlvL, variant: CFC A1 multipurpose plant\T1 educt tanks	
\educt_tank B003\\AITIXOO6 Block Valve_AITIXO06 of type VlvL,	
variant:	
Picture A1_multipurpose_plant\T2_reaction\T2_reaction Block icons will be generated/updated for the	
100 % (=)	- (+)
100 % (=)	-)

10. We can now start compiling the OS from the Component view. (\rightarrow OS \rightarrow PLC \rightarrow Compile and Download Objects...)

			rogram Files\Siemens\STEP7\S7Proj\F	PCS7_S_4\PCS7 🗖 🗖 💌
😼 File Edit Ins	sert PLC View Options		þ	_ & ×
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	Сору	Ctrl+C		
	Paste	Ctrl+V		
	Delete	Del		
	PLC	•	Download	Ctrl+L
	Access Protection	•	Configure	Ctrl+K
	Print	•	Compile and Download Objects	A
	SIMATIC BATCH	•	Compare	
	Rename	F2		
	Object Properties	Alt+Return		
Compiles/download	Is the objects to be selected (under the highlig	hted objects.	li.

11. Before starting, check the settings for compiling the OS. (OS(1) \rightarrow Edit...)

Compile and Download Objects Selection table:				_ 0 ×
Objects	Status	Operating Mode	Compile	Download
	Status	Operating mode	Compile	Download
Configuration	undefined			
□ WinCC Appl.	undonnod			
Connections	undefined			
OS(1)		Not open		
		•		
Settings for Compilation/Download Update	_ View Li	ng	lect Objects	
Edit Test Status Operating Mode	Sin	gle Object All	Select All	Deselect All
Status during Open				
Compile only 🔽 Do not load if compilation error is detected				
Start Close				Help

12. The assignment of areas to operator stations remains unchanged. (\rightarrow Next)

lierarchy	Area	OS Assignment	Comment	
A1_multipurpose_plant	A1_multipurpose_pl	OS\WinCC Appl.\OS(1)	multipurpose plant for training of prozess control technology wit	

13. In the next dialog step, the network connection is checked. (\rightarrow S7-Program(1) \rightarrow Select Network Connections...)

s	ettings: Compile OS		×			
	Select the network connections for the	S7 Programs associated with the areas.				
	Operator stations and areas:	S7 programs and network connections:				
	🖃 🖉 🥙 OS(1)	S7 pro / Connections Subnet Subnet type WinCC unit Addres	ss Station no. Segment			
	🖾 🗹 🔂 A1_multipurpose_plant	S7 Progr 1 Ethor lad Eth lad antiol 09.00.06.01.00.0	00			
		Select Network Connections				
		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~				
		<				
	1		P			
			Connection			
l	< Back Next >		Cancel Help			

14. As WinCC Unit, TCP/IP should be set. (WinCC unit  $\rightarrow$  TCP/IP  $\rightarrow$  OK)

elect Network C	Connection				
S7 program: S7 l	Program(1)				
Subnet 🛆	Subnet type	WinCC unit	Address	Station no.	Sej
Ethernet(1)	Ind. Eth.	Industrial Etheri 🔻	08.00.06.01.00.00		
		Industrial Ethernet Industrial Ethernet (II	]		
•		III			•
ОК			Cancel	Help	
	S7 program: S7	Ethernet(1) Ind. Eth.	S7 program: S7 Program(1)          Subnet       Subnet type       WinCC unit         State       Industrial Ethernet         Industrial Ethernet       Indus	S7 program: S7 Program(1)          Subnet       Subnet type       WinCC unit       Address         Ethernet(1)       Ind. Eth.       Industrial Ethernet       08.00.06.01.00.00         Industrial Ethernet(1)       Industrial Ethernet (1)       TCP/IP         Image: State of the state of	S7 program: S7 Program(1)          Subnet       Subnet type       WinCC unit       Address       Station no.         Ethernet(1)       Ind. Eth.       Industrial Ethernet       08.00.06.01.00.00         Industrial Ethernet (II)       Industrial Ethernet (II)       Industrial Ethernet (II)         ICP/IP       Station Industrial Ethernet (II)       ICP/IP

15. Now go to the next dialog step.( $\rightarrow$  Next)

Settings: Compile OS		×
Select the network connections for the	57 Programs associated with the areas.	
Operator stations and areas:	S7 programs and network connections:	
🖃 🖉 🥙 OS(1)	S7 pro 🛆 Connections Subnet Subnet type WinCC unit Address Stat	ion no. Segment
🗹 🖻 A1_multipurpose_plant	📴 S7 Progr 1 Ether Ind. Eth. TCP/IP 192.168.0.1	
	۲ اا	•
		Connection
< Back Next >	C	Cancel Help

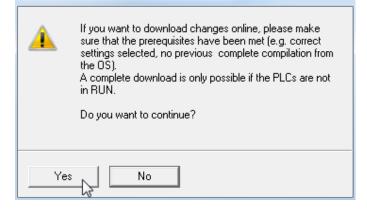
16. In the last setting window, apply the values shown below. ( $\rightarrow$  Apply)

Settings: Compile OS		×
Select the data you wa	vant to compile and the scope of the compilation.	
Data	Further options	
Tags and messages	Minimum acquisition cycle of the archive tags: 1 second	
SFC Visualization	With interconnection partner ( SFC option )	
Picture Tree	Compression Settings	
Scope	Create server data	
Entire OS	🔽 With memory reset	
C Changes		
< Back	Apply	icel Help

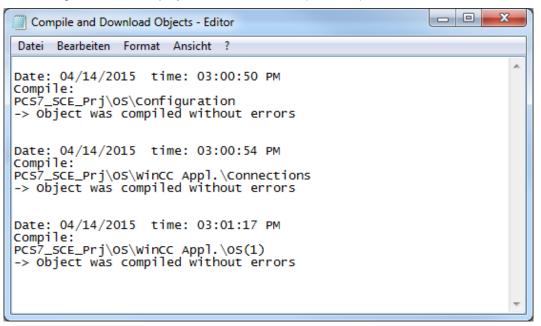
17. Because the operator station (OS) is started on the engineering system (ES) for this plant, we only select Compile here, not Download. After the compile run is started, the warning is confirmed with Yes. (→ Start → Yes)

Compile and Download Objects				- • • × •
Selection table:				
Objects	Status	Operating Mode	Compile	Download
<u>₽</u> _ 0S			×	
Configuration	undefined		✓	
□- WinCC Appl.			×	
Connections	undefined			
OS(1)		Not open		
Settings for Compilation/Download Edit Test Compile only Compile only Do not load if compilation error is detected	View Li Sin	9g gle Object All	Select Objects Select All	Deselect All
Start Close				Help

Compile and Download Objects (3280:822)



18. The log that is now displayed shows no errors. ( $\rightarrow$  EXE)



19. After the compilation, the operator station can be opened ( $\rightarrow$  OS(1)  $\rightarrow$  Open Object)

SIMATIC Manager - [PCS	7_SCE_MP (Component view)	C:\Program Files	Siemens\STEP7\S7F	Proj\PCS7_S	×
🔁 File Edit Insert PL	C View Options Windov	v Help		- 8	×
📘 🗅 😂   🏪 🛲   X 🖻	e 🗈   🏜   오 💁   ºo 🕻	5- 🟥 🏛   🔁   [	< No Filter >	💽 🏹 🔡 🗃	
PCS7_SCE_MP PCS7_SCE_Pri PCS7_SCE_Pri PCS7_SCE_Pri PCS7_SCE_Pri PCS7_SCE_Pri PCS7_SCE_Pri PCS7_SCE_Pri PCS7_SCE_MP PCS7_SCE_MP PCS7_SCE_MP PCS7_SCE_MP PCS7_SCE_MP PCS7_SCE_PRI PCS7_SCE_MP PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_PRI PCS7_SCE_	-ტ- A1_multipurpose_pla -ტ- T3_product_tanks - pl.		∱ T1_educt_tanks	-∱ T2_reaction	
🕀 📄 Shared D	Open Object	Ctrl+Alt+O			
⊡ 😵 PCS7_SCE_L	Cut	Ctrl+X			
	Сору	Ctrl+C			
	Paste	Ctrl+V			
	Delete	Del			
	Insert New Object	•			
	PLC	+			
Opens selected object.	Access Protection	+			1.

20. If the computer name in the WinCC project does not match the local computer name, you will receive the following message which you confirm with 'Yes'. Then you should change the name of the computer. ( $\rightarrow$  Computer  $\rightarrow$  Properties).

s7omwinx		X	
The configured server is no with the local computer as		want to open the project	
		Yes No	
WinCCExplorer - C:\Program Files\Siemens\STEP7\S7Proj\P	CS7_SCE\PCS7_Prj\winc	proj\OS(1)\OS(1).mcp	x
File Edit View Tools Help			
D D   I + X II II - 5 33 🎹 🖀	?		
	Name	Туре	
	PCS7OSCLIENT	Server Find	
Graphics Designer		Cut	
Alarm Logging		Сору	
		Paste	
		Delete	
Global Script		Properties	
Text Library		Hopenies v3	
Text Distributor			
Cross-Reference			
Redundancy			
User Archive			
Horn			
OS Project Editor			
Component List Editor			
一			
T Web Navigator			
OS(1)\Computer\		1 object(s) selected	Li

21. If the computer name is the same as the local computer name, no changes need be made. If the computer name does not match, it has to be set with the button 'Use local computer name'. Exit the window with 'OK'. ( $\rightarrow$  Use local computer name  $\rightarrow$  OK)

	General Startup Parameters Graphics Runtime Runtime	_
Computer Name PCS70SCLIENT	Language Setting at Runtime Disable Keys	
Use Local Computer Name	English (United States)	
iomputer Type	At+TAB	
Server	Default Language at Runtime	
WinCC-Client	English (United States)	
ver List	Start Information	
	Edit	
	PLC clock setting	
ame of the computer in the network	The PLC is is set to coordinated universal time (UTC) (preferred setting)	
	PLC is set to the local winter time all year (WinCC V5 compatibility mode)	
	Piecis serio trie local winter time ali year (wintee vio compatibility mode)	
	Time basis for time display in runtime	
	Local time zone	J
	Central time and date formatting	
	Configure individual components	
OK Cancel Help	ISO8601-Swap format to all components	
	C 199900 Fowah romac to al components	

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22. The change of the computer name is applied only after the restart. This means, you have to close WinCC if the computer name is changed.

	Chang	je computer	r name			×	
					CLIENT3' has changed fter you restart WinCO		
					Ok		
6	WinCC Explorer - C:\Program	Files\SIEMENS\	STEP7\S7Proj\PCS	7_S_4\PCS7_Prj\wincpro	j∖OS(1)∖OS(1).mcp		X
Ī	File Edit View Tools H	Help					
Ī	New	Ctrl+N	E 📰 🕋 📍				
d	🍃 Open	Ctrl+O			Name	Туре	
	Close				PCS7OSCLIENT	Server	
	Activate						
	Print Project Documentatio						
	Print Project Documentatio						
	Set Up Project Documentat						
	Recent File	•				9	
	Exit			Exit WinCC E	xplorer	8 ×	
	👖 User Administrator		-				
	🙀 Cross-Reference			This 🔬	closes the WinCC Expl	orer.	
	User Archive			C	lose project when exit	ting	
	······································						
	() Horn						
	Picture Tree Manager				E	xit Cancel	
	Lifebeat Monitoring						
	OS Project Editor     OS Project Editor						
	一品 SFC						

<.

1 object(s)

23. The WinCC project can be reopened from the SIMATIC Manager.

😵 Web Navigator

Exits the application; asks, if documents are to be saved.

SIMATIC Manager - [PCS7_		-	Siemens\STEP	7\S7Proj\PCS7_SCE\P	PCS7_MP]			
🔂 File Edit Insert PLC								- 8 ×
📙 🗅 😂 📲 🛲 🖌 🖻	🖻 🏜 🔍 9 🐾 🕒	a 📴 🕮 🏢 🖻 🛛	< No Filter >	- Y !	器 🎯   ¹		<b></b> • <b>?</b>	
□         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •		라 A1_multipurpose_plani 라 T4_rinsing	t	- <u>†</u> T1_educt_tan	iks -∱-T2	2_reaction	-∱ T3_product_tanks	
🕀 💼 Shared Decl	Open Object	Ctrl+Alt+O						
🗄 🍫 PCS7_SCE_Lib	Cut	Ctrl+X						
	Сору	Ctrl+C						
	Paste	Ctrl+V						
	Delete	Del						
	Insert New Object	•						
	PLC	•						
	Access Protection	•						
	Compile	Ctrl+B						
	Display compilation	og						
	Display load log							
Opens selected object.	Generate server data							//
	Accian OS center							

Licensed mode

24. To set the network configuration, open Tag Management. ( $\rightarrow$  Tag Management  $\rightarrow$  Open)

MinCCExplorer - D:\SCE_Projekte_en\PCS7_SCE\PCS7_Prj\wincproj\OS(1)\OS(1).mcp [ #	Active ]	
File Edit View Tools Help		
□▷ ■ →   X 車 両  ℡ > 録 () 2   2   2   2   2   2   2   2   2   2		
□ OS(1)	Name Ty	/pe
Computer	No object	c evist
Tag Management	110 00ject	
Alarm Loggin Properties		
III Tag Logging		
Slobal Script		
- Text Library		
- Extributor		
User Administrator		
CrossReference		
Redundancy		
User Archive		
Time Synchronization		
Bausteinlisten Editor		
ー		
······································		
OS(1)\Tag Management\	Process objects: 30 / License: Unlimited	Licensed mode
Us(1)(Tay Management)	Process objects: 50 / License: Unimited	Licenseu mode

25. Here we can change the system parameters. To this end, select the system parameters in the SIMATIC S7 Protocol Suite under TCP/IP.

(SIMATIC S7 PROTOCOL SUITE  $\rightarrow$  TCP/IP  $\rightarrow$  System Parameter)

ag Management 🛛 🔍	( <b>]</b>	TCP/IP			Find		P
		Name	Data Type	Length	Format adaptation	Connection	
🗄 🍄 Internal tags	1	A1_multipurpose_plant/SFC_product01.BA_EN	Binary Tag	1		S7\$Program(1)	
SIMATIC S7 Protocol Suite	2	A1_multipurpose_plant/SFC_product01.BA_ID	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
	3	A1_multipurpose_plant/SFC_product01.BA_NA	Text tag 8-bit character set	32		S7\$Program(1)	
PROFIBUS	4	A1_multipurpose_plant/SFC_product01.CUSEQ	Unsigned 8-bit value	1	ByteToUnsignedByte	S7\$Program(1)	
Industrial Ethernet	5	A1_multipurpose_plant/SFC_product01.DIS_START_STATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
Slot PLC	6	A1_multipurpose_plant/SFC_product01.EventRaw#1	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
- TCP/IP	7	A1_multipurpose_plant/SFC_product01.EventRaw#2	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
S7 🚺 New Connection		A1_multipurpose_plant/SFC_product01.EventState	Signed 32-bit value	4	LongToSignedDword	S7\$Program(1)	
PROF	[	A1_multipurpose_plant/SFC_product01.EventTrans#1	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
Indus Paste	)	A1_multipurpose_plant/SFC_product01.EventTrans#2	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
		A1_multipurpose_plant/SFC_product01.HELDSEQ	Unsigned 8-bit value	1	ByteToUnsignedByte	S7\$Program(1)	
	· N2	A1_multipurpose_plant/SFC_product01.LI_ERR_STATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
Soft PLC	13	A1_multipurpose_plant/SFC_product01.MSG_LOCK	Binary Tag	1		S7\$Program(1)	
Structure tags	14	A1_multipurpose_plant/SFC_product01.MSG_SUP	Binary Tag	1		S7\$Program(1)	
@Maintenance	15	A1_multipurpose_plant/SFC_product01.OCCUPIED	Binary Tag	1		S7\$Program(1)	
🐵 🏤 @Enum_Operating State	16	A1_multipurpose_plant/SFC_product01.0P_ERR_STATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
🐵 🏤 @SFC_RTS	17	A1_multipurpose_plant/SFC_product01.SFC_ADDSTATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
🚋 🕂 Intlk02	18	A1_multipurpose_plant/SFC_product01.SFC_CONTROL	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
🐵 🔧 MotL	19	A1_multipurpose_plant/SFC_product01.SFC_STATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
🚋 🕂 🔧 VivL	20	A1_multipurpose_plant/SFC_product01.STEP_NO	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
PIDConL	21	A1_multipurpose_plant/SFC_rinsing.BA_EN	Binary Tag	1		S7\$Program(1)	
B	22	A1_multipurpose_plant/SFC_rinsing.BA_ID	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
CPU RT	23	A1_multipurpose_plant/SFC_rinsing.BA_NA	Text tag 8-bit character set	32		S7\$Program(1)	
	24	A1_multipurpose_plant/SFC_rinsing.CUSEQ	Unsigned 8-bit value	1	ByteToUnsignedByte	S7\$Program(1)	
	25	A1_multipurpose_plant/SFC_rinsing.DIS_START_STATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
Tag Management	26	A1_multipurpose_plant/SFC_rinsing.EventRaw#1	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
	27	A1_multipurpose_plant/SFC_rinsing.EventRaw#2	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	

26. In the 'Unit' tab, set PLCSIM(TCP/IP) as the logical device name.

$(\rightarrow \text{Unit} \rightarrow \text{Logical device name} \rightarrow$	PLCSIM(TCP/IP)	$\rightarrow$ OK)
-------------------------------------------------------------------------------	----------------	-------------------

SIMATIC S7 Unit	
Select logical device name	
CP type/bus profile:	TCP/IP
Logical device name:	PLCSIM(TCP/IP)
Set automatically	CP_H1_1: CP_L2_1: CP1623(RFC1006) MPI
Job processing	STONLINE
Write with priority	TCP/IP -> Realtek RTL8168C(P)/ TCP/IP(Auto) -> Realtek RTL8168 TS Adapter IE
Enter a new device name or s	elect the requested device from the list.

# 27. Now close Tag Management. ( $\rightarrow$ Close)

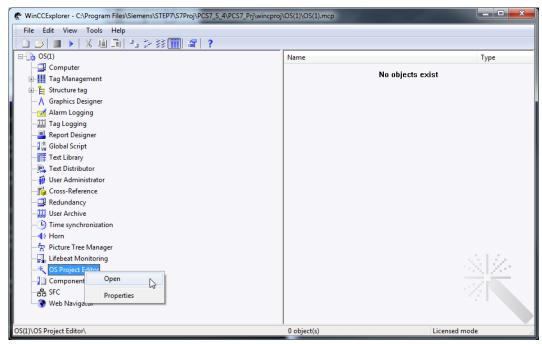
WinCC Configuration Studio			d in the second				×
File Edit View Help							
Exit jement «		TCP/IP			Find		P
		Name	Data Type	Length	Format adaptation	Connection	
🗄 🍄 Internal tags	1	A1_multipurpose_plant/SFC_product01.BA_EN	Binary Tag	1		S7\$Program(1)	
SIMATIC S7 Protocol Suite	2	A1_multipurpose_plant/SFC_product01.BA_ID	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
MPI	3	A1_multipurpose_plant/SFC_product01.BA_NA	Text tag 8-bit character set	32		S7\$Program(1)	
PROFIBUS	4	A1_multipurpose_plant/SFC_product01.CUSEQ	Unsigned 8-bit value	1	ByteToUnsignedByte	S7\$Program(1)	
Industrial Ethernet	5	A1_multipurpose_plant/SFC_product01.DIS_START_STATE	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
Slot PLC	6	A1_multipurpose_plant/SFC_product01.EventRaw#1	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
	7	A1_multipurpose_plant/SFC_product01.EventRaw#2	Unsigned 32-bit value	4	DwordToUnsignedDword	S7\$Program(1)	
S7\$Program(1)	8	A1_multipurpose_plant/SFC_product01.EventState	Signed 32-bit value	4	LongToSignedDword	S7\$Program(1)	
S/SProgram(1)	0	As an	managed and the rates		been attended and been a	C740/41	

28. Once you have opened WinCC again, open the Picture Tree Manager. ( $\rightarrow$  Picture Tree Manager  $\rightarrow$  Open)

WinCCExplorer - C:\Program Files\Siemens\STEP7\S7Proj\PCS7_S_4\PCS7_Prj\wincproj	\OS(1)\OS(1).mcp	
File Edit View Tools Help		
□ ▷   ■ ▶   X 埴 道  № 沙 録 🎆 🖀 ?		
- 🕞 OS(1)	Name	Type
- Computer		
🗄 📶 Tag Management	No objects exi	st
🗄 🖷 🧮 Structure tag		
Tag Logging		
Text Library		
🙀 User Administrator		
🔂 Cross-Reference		
Horn		
Picture Tree Manager		
Lifebeat Monitorin Open		
US Project Editor Properties		
Component List Ed.		
一		
🔤 🛜 Web Navigator		100 B
OS(1)\Picture Tree Manager\	0 object(s)	Licensed mode

29. In the Picture Tree Manager we specify the sequence in which the pictures are called later. Retain the structure, save and close the editor. ( $\rightarrow$  Save  $\rightarrow$  E^{CO} Close)

Picture Tree Manager - [OS(1).mcp]					
Project Edit View Options Help					
Hierarchy of the containers and pictures	Picture preview:				
OS(1).mcp     OS(1).mcp     OS(1).mcp     A1_multipurpose_plant - A1_multipurpose_plant.pdl     OS(1.mcp)     A1_multipurpose_plant/T1_educt_tanks - T1_educt_tanks.pdl     OS(1.mcp)     OS(1.mcp)     OS(1.mcp)     A1_multipurpose_plant/T2_reaction - T2_reaction.pdl     OS(1.mcp)     OS(1.mc					
Unassigned containers and pictures					
Container					
Saves the current picture hierarchy.					



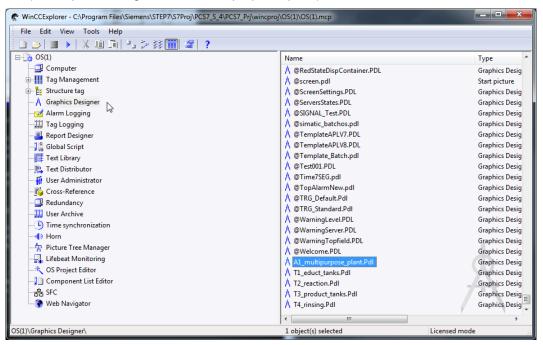
30. Then open the OS Project Editor. ( $\rightarrow$  OS Project Editor  $\rightarrow$  Open)

31. In the OS Project Editor, we can now select under 'Layout' the motor configuration and the screen resolution. In addition, settings are provided for message display, the visible areas, window arrangement in the Runtime window, and other basic settings. Set the desired layout, the number of area keys and the monitor configuration. Exit the dialog with 'OK'. (→ Select layout → OK)

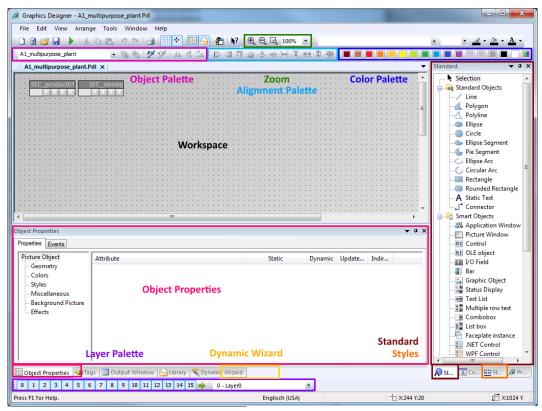
OS Project Editor	8	x
Eayout • Message configuration	sage display   🏧 Area   🖪 Runtime window   🎒 Basic data   🗃 General	
Current layout: SIMATIC Standard 1920*1	00	
Available layouts:	Layout Description:	
Picture Name SIMATIC Standard 1024*768 SIMATIC Standard 1152*864	SIMATIC Standard-Layout for screen resolution of 1024*768	
SIMATIC Standard 1280*1024 SIMATIC Standard 1600*1200 SIMATIC Standard 1680*1050 SIMATIC Standard 1920*1080	Number of area keys:     4       Number of server keys:     1       Overview extended configuration:     Detail	
SIMATIC Standard 1920*1200 SIMATIC Standard 2560*1600	Overview extended configuration: Detail	
	Configures the Project	
	Configuring the runtime system	
Monitor configuration		
•	Copies picture files	
	OK Cancel Ap	ply

32. The operating screens are generated in the Graphics Designer. Individual screens are opened best by double clicking on the name in the window to the right.

 $(\rightarrow \text{Graphics Designer} \rightarrow A1_multipurpose_plant)$ 

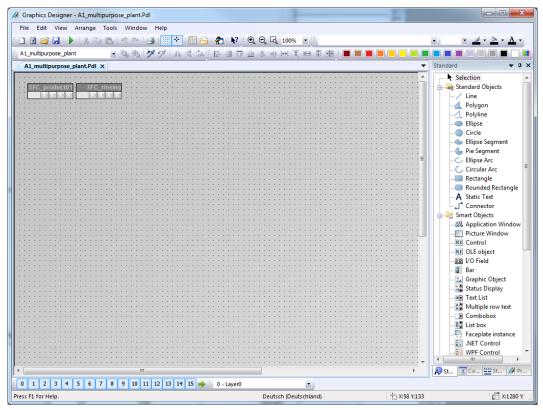


33. The Graphics Designer provides the most diverse functions for generating process pictures. They can be hidden or shown in the menu with View/Tools. ( $\rightarrow$  View  $\rightarrow$  Toolbars)



These toolbars have the following functions:

- Standard tools: contains icons and buttons to carry out frequent commands quickly.
- Color palette: used to assign colors to selected objects (one of 16 standard colors or a user defined color).
- Zoom palette: sets the zoom factor (in percent) for the active window.
- Style palette: changes the appearance of a selected object. Depending on the object, the line/border type, the line/border weight, the line end styles or the fill pattern can be changed.
- Object palette: contains the standard objects (polygon, ellipsis, rectangle, etc.), smart objects (OLE control, OLE element, EA field etc.) and Windows objects (button, check box etc.).
- Dynamic Wizard: provides a variety of frequently needed functions. They can be generated using a dialog that guides the operator and also lends support.
- Layer palette: selects which of the 32 levels (level 0 to 31) is visible. Level 0 is selected by default.
- Alignment palette: used to change the absolute position of one or several objects, to change the position of selected objects relative to each other, or unify the height and width of several objects.
- 34. Through creating the faceplates, the block icons are already included in the pictures. They can be positioned within the pictures as desired.



35. In the properties of the block icons, the displayed name can be specified. Otherwise, a very long name is displayed that includes the path. (→ Properties → Object name → A1_multipurpose_plant/SFC_Product01)

		- Layerð	· · · · · · · · · · · · · · · · · · ·				12     12     Standard     Selection
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36. Now, we change the background color of the picture to white. To this end, left click in the background of the picture with activated object properties toolbar. The properties of the picture object open.

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- 37. For each object as well as the picture, a variety of properties is provided that can be changed statically or dynamically (for example, interfaced with process variables). Here, the background color is edited.
  - $(\rightarrow$  Picture Object  $\rightarrow$  Colors  $\rightarrow$  Background Color  $\rightarrow$  Edit)

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Colors Styles Miscellaneous Background pictur Effects	Fill Pattern Color Grid Color	Edit

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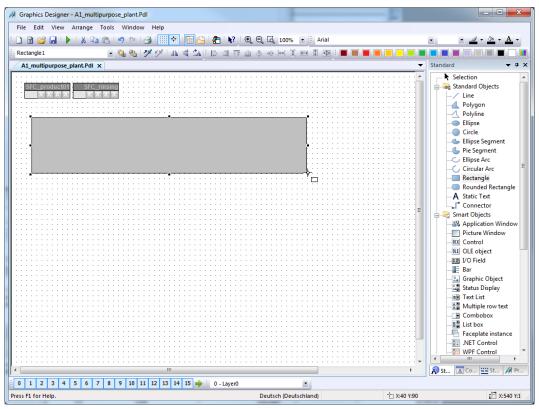
38. Now, select white as the color (255 255 255). (White  $\rightarrow$  OK)

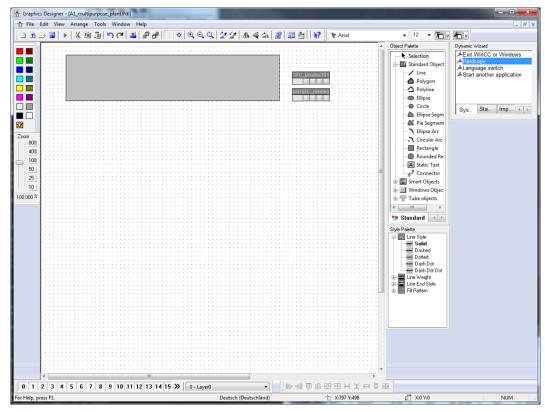
- 39. For the change of the background color to become effective, the global color scheme has to be deactivated.
  - $(\rightarrow$  Picture Object  $\rightarrow$  Effects  $\rightarrow$  Global color scheme  $\rightarrow$  No)

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- 40. Now, change the picture geometry for it to be shown completely at a resolution of 1024x768.

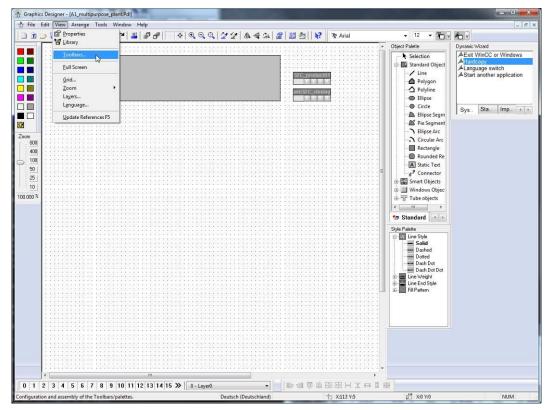
 Next, in the Standard palette, click on Rectangle and draw a large rectangle in the picture. (→ Standard palette → Rectangle)





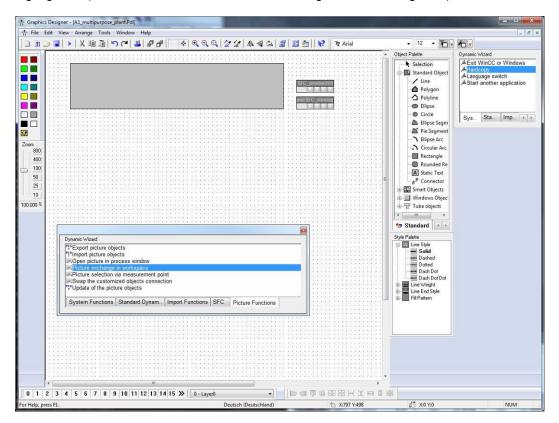
42. Arrange the icons for the SFCs as shown below next to the rectangle you just drew.

43. Open the selection for the toolbars if the Dynamic Wizard is not displayed yet. ( $\rightarrow$  View  $\rightarrow$  Toolbars  $\rightarrow$  Dynamic Wizard)



Toolbars	B
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45. If the toolbar for the dynamic wizard is displayed, select here from the 'Picture Functions' the 'Picture exchange in the working area'. Note that the rectangle is highlighted. (→ Picture functions → Picture exchange in the working area)



46. Read the explanation and go to 'Next'. ( $\rightarrow$  Next)

Welcome to the Dynamic Wizard	X
	This Wizard allows the selection of a frequently used dynamic for the selected object. This takes place in three steps: 1) Select the desired dynamic 2) Select a trigger for the dynamic 3) Set the options The Wizard then automatically generates the required dynamics and assigns them to the object.
	Do not show this page again
< Back	Next > Cancel Help

47. As trigger select 'Mouse click'. ( $\rightarrow$  Mouse click  $\rightarrow$  Next)

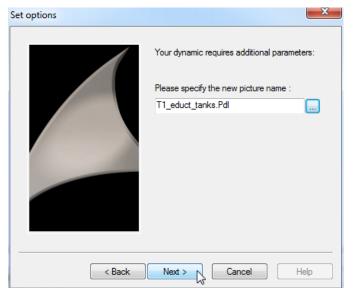
Select trigger	×
	You selected a dynamic that requires a trigger. Please select a trigger: Left mouse key Mouse click Right mouse key Trigger options
< Back	Next > Cancel Help

48. Now select the picture to which you want to change. ( $\rightarrow ...$ )

Please specify the picture name :
\\PCS70SCLIENT3\WinCC_Project_0S
Adapt process window to picture size
Process window sizeable

49. In the picture browser, select T1_educt_tanks.Pdl. ( $\rightarrow$  T1_educt_tanks.Pdl  $\rightarrow$  OK)

Picture Browser	2 ×
Hierarchy:	
PCS7OSCLIENT3	File Name
	-↑r @Welcome.PDL       -↑r A1_multipurpose_plant.Pdl       -↑r T1_educt_tanks.Pdl       -↑r T2_reaction.Pdl       -↑r T3_product_tanks.Pdl
	YF 15_product_tanks.Pdi -ŶF T4_rinsing.PdI ✓
	OK Cancel Help

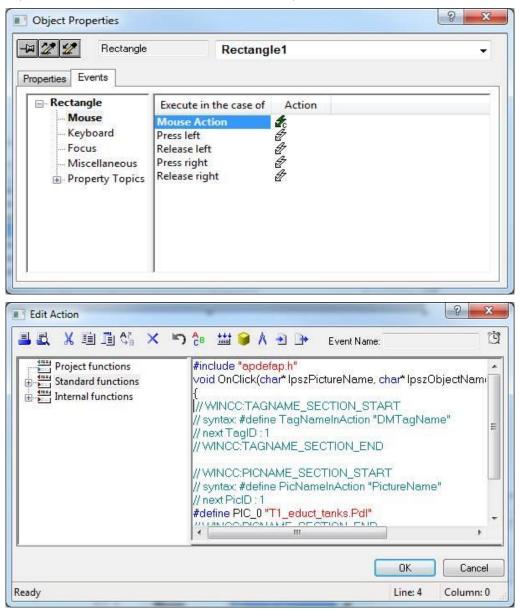


50. The name of the picture was accepted; continue. ( $\rightarrow$  Next)

51. The wizard is closed with 'Finish'. ( $\rightarrow$  Finish)

Finished!	×
	The Wizard will generate the following: The current picture: A1_multipurpose_plant.Pdl is exchanged with the picture T1_educt_tanks.Pdl by activating the trigger Mouse click on the object A1_multipurpose_plant
	Do not show this page again
< Back	Finish Cancel Help

52. If you would like to view the result, the mouse and the mouse action are located under 'Events'. With a double click on the icon *c* you can then view the C-script that was generated.

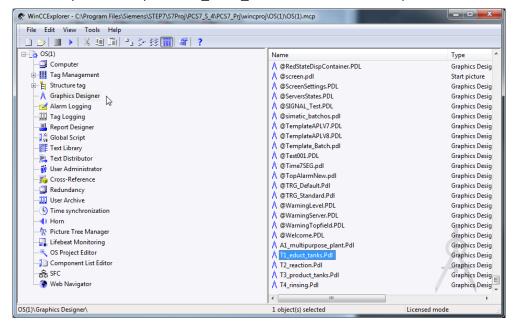


 $(\rightarrow \text{Events} \rightarrow \text{Mouse} \rightarrow \text{Mouse Click} \quad \stackrel{\bullet}{\checkmark} \rightarrow \text{OK})$ 

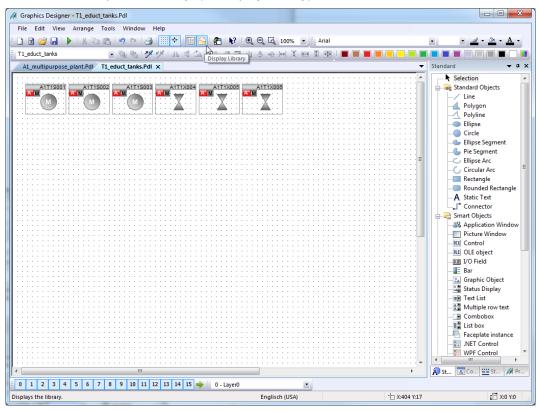
53. Using static texts, rectangles and the dynamic wizard, design your picture as shown here. It is absolutely necessary to ensure that the language 'View' menu corresponds to the desired target language. Here: English (United States).

Graphics Designer - A1_multipurpose_plant.Pdl	
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54. The next picture we open is 'T1_educt_tanks' from the WinCC Explorer.



55. After you have changed the background–as in the picture multi-purpose plant–to the color white, open the library. (→ Display Library)



56. From the library, first drag a symbol for the pump into the working field.

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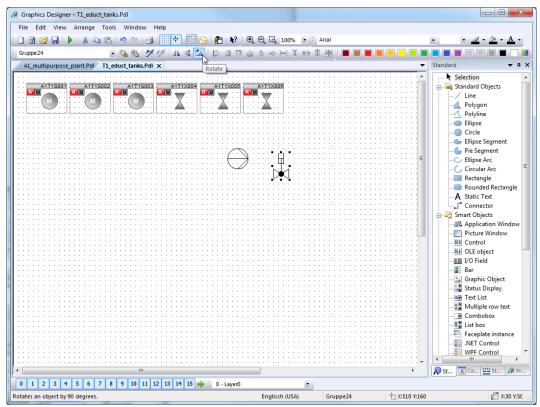
 $(\rightarrow \text{Global Library} \rightarrow \text{Symbols} \rightarrow \text{E-Symbols} \rightarrow 20_2)$ 

57. After the symbol for the pump, drag the valve symbol into the working field.

 $(\rightarrow$  Global Library  $\rightarrow$  Symbols  $\rightarrow$  Valves  $\rightarrow$  45)

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58. The static symbols can be changed in their orientation by using the button Rotate.  $(\rightarrow \text{Rotate})$ 



59. After you have inserted additional lines and text fields as shown here, draw a rectangle to represent the tank, and select its properties. ( $\rightarrow$  Rectangle  $\rightarrow$  Properties)

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Displays the properties dialog	Er	nglisch (USA)	Rectangle1	X:180 Y:210	1. ×:80 Y:14

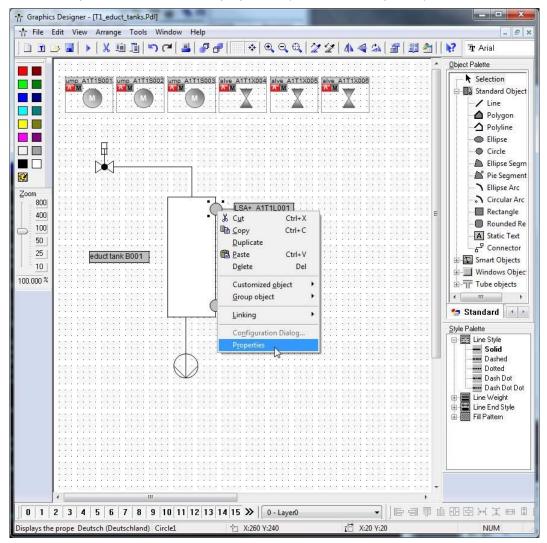
- 60. To change the color, deactivate the global color scheme once again.
  - $(\rightarrow \text{Properties} \rightarrow \text{Effects} \rightarrow \text{Global color scheme} \rightarrow \text{No})$

operties Events	1453 ¹¹				
<ul> <li>Rectangle</li> <li>Geometry</li> <li>Colors</li> <li>Styles</li> <li>Flashing</li> <li>Miscellaneous</li> <li>Filling</li> <li>Effects</li> </ul>	Attribute Global shadow Global color scheme Object transparency	Sta Yes No 0	Dyna	Up	

- 61. Now change the background color to white.
  - $(\rightarrow \text{Properties} \rightarrow \text{Colors} \rightarrow \text{Background Color})$

perties Events	Rectan	gle1	
Rectangle Geometry Colors Styles Flashing Miscellaneous Filling Effects	Attribute Border Color Border Background Background Color Fill Pattern Color	Sta Dyna	Up 1

62. Next, we configure a display of the digital level sensors. As shown here, draw a circle into the picture. Then, select its properties. (→ Circle → Properties)



- 63. To have the color displayed dynamically, deactivate the global color scheme.
  - $(\rightarrow \text{Properties} \rightarrow \text{Effects} \rightarrow \text{Global color scheme} \rightarrow \text{No})$

perties Events	Circle1				
<ul> <li>Circle</li> <li>Geometry</li> <li>Colors</li> <li>Styles</li> <li>Flashing</li> <li>Miscellaneous</li> <li>Filling</li> <li>Effects</li> </ul>	Attribute Global shadow Global color scheme Object transparency	Sta Yes No O	Dyna	Up	

- 64. To implement a dynamic display, select the background color with the right mouse button and then the dynamic dialog.
  - $(\rightarrow \text{Properties} \rightarrow \text{Colors} \rightarrow \text{Background Color} \rightarrow \text{Dynamic Dialog})$

roperties Events	Circle1		
<ul> <li>Circle</li> <li>Geometry</li> <li>Colors</li> <li>Styles</li> <li>Flashing</li> <li>Miscellaneous</li> <li>Filling</li> <li>Effects</li> </ul>	Attribute Border Color Border Background Background Color Fill Pattern Color	Dynamic Dialog C-Action VBS-Action Tag Delete	C

65. In the following dialog, first select Boolean as data type, then change the color at Yes/TRUE to green, finally select 'Tag' for the dynamic expression.

Event name		
Expression/Formula		Cance
Result of the Expres	sion/Formula	Tag Function
Valid range	Back	Operat
Yes / TRUE No / FALSE		<ul> <li>Bit</li> <li>Direct</li> </ul>
		Add
		Remove

66. At the variables, select as data source 'STEP 7 Symbol Server' and there, at the symbols, input I70.0 for the 'level monitoring educt_tank B001 operating point H'.

( $\rightarrow$  Data source  $\rightarrow$  STEP 7 Symbol Server  $\rightarrow$  A1.T1.A1T1L001.LSA+.SA+ / I18.0 / level monitoring educt_tank B001 operating point H  $\rightarrow$  OK)

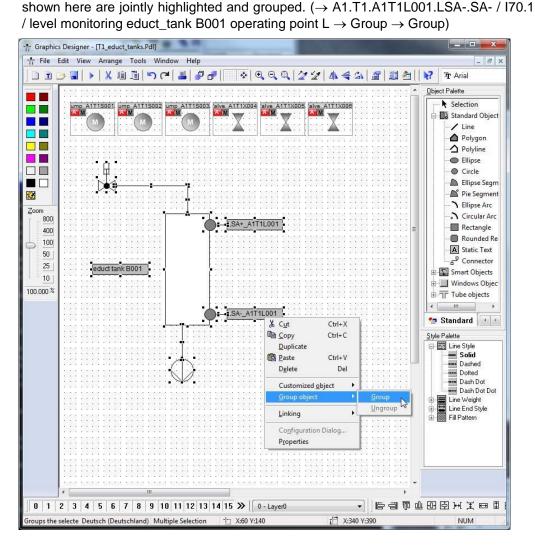
	S Variables /inCC Tags			
STEP 7 Symbol Server	Name	Data Type	Address	Comment
ST Program(1), PCS7_SCE_Prj//AS1//CPU 414	A1.A1H001.HS+START	BOOL	I 0.0	Main power s
⊕ - 🔂 Symbols	a1.A1H002.HS+OFF	BOOL	I 0.1	emergency sw
	a1.A1H003.HS+LOC	BOOL	I 0.2	local operation
	A1.T1.A1T1L001.LSA+.SA+	BOOL	I 18.0	level monitori.
	a1.T1.A1T1L001.LSASA-	BOOL	I 18.1	level monitori.
	1.T1.A1T1L002.LSA+.SA+	BOOL	I 18.2	level monitori.
	a1.T1.A1T1L002.LSASA-	BOOL	I 18.3	level monitori.
	a1.T1.A1T1L003.LSA+.SA+	BOOL	I 18.4	level monitori.
	a1.T1.A1T1L003.LSASA-	BOOL	I 18.5	level monitori.
	a1.T1.A1T1S001.SO+.O+	BOOL	I 1.0	pump outlet e.
	a1.T1.A1T1S001.SV.C	BOOL	Q 3.0	pump outlet e.
	A1.T1.A1T1S002.SO+.O+	BOOL	I 1.1	pump outlet e.
۰ (۱۳۵۵) الترکیز (۱۳			۰ ۲۰	
		OK ,	Cance	el Help

## $\triangle$

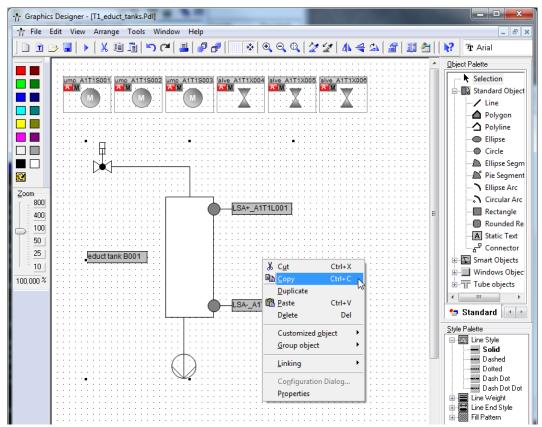
 $(\rightarrow$ 

**Note:** If you use AS1/S7-400, select the symbols under S7 Program(1). If you are using the AS2/RTX Box, however, then you have to select the symbols under S7 Program(2).

- 8 X Dynamic value ranges Event name Apply Tag 30 Cancel Expression/Formula Check 'S7\$Program(1)/A1\$T1\$A1T1L001\$LSA+\$SA+' ... Result of the Expression/Formula Data Type O Analog Valid range Back Boolean es / TRUE O Bit No / FALSE O Direct Add. Remove O not evaluate tag status Tag status Quality Code
- 68. The steps shown above are also performed for the sensor 'A1.T1.A1T1L001.LSA-.SA-/ I70.1 / level monitoring educt_tank B001 operating point L'. Then, the elements

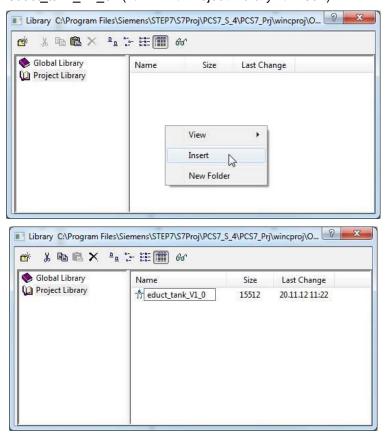


67. We now apply the settings in the Dynamic Dialog. ( $\rightarrow$  Apply)

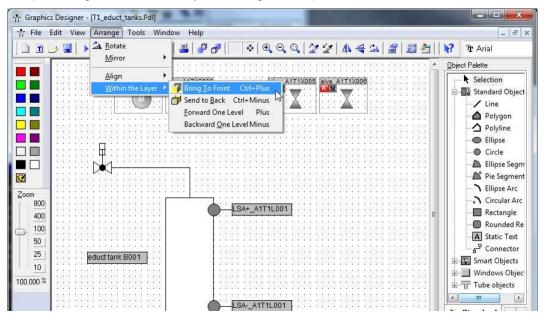


69. The group is then copied. ( $\rightarrow$  Copy)

70. Now we open the library and the group is inserted in the project library. Name the template 'educt_tank_V1_0'. (→ Project Library → Insert)

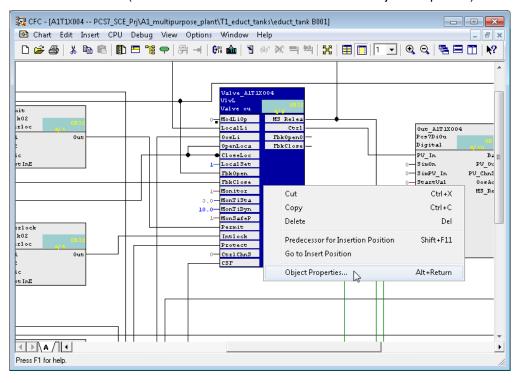


71. Next, in the picture 'T1_educt_tank.Pdl' we position the faceplates for the valve 'A1T1X004' and for the pump 'A1T1S001' as shown here. It is advisable to bring the symbols within the layer to the very front so they can't be covered up by other drawing elements.



 $(\rightarrow \text{Arrange} \rightarrow \text{Within the Layer} \rightarrow \text{Bring to Front}).$ 

72. The orientation of the dynamic valve faceplates is not yet correct. At runtime, the faceplates are animated in a way that in the closed state, they are situated transversely to the position of the pipe and rotate when opened in the position direction. However, this orientation can be changed only via the CFC of the respective valve. To rotate a valve, first open the associated CFC and then the object properties of the valve block. ( $\rightarrow$  Plant view  $\rightarrow$  A1T1X004  $\rightarrow$  Valve  $\rightarrow$  Object Properties)



73. Now, in the field Create block icon, enter a '2'. This rotates the icons by 90 degrees.

$(\rightarrow Create$	block	icon $\rightarrow$	$2 \rightarrow$	OK)
-----------------------	-------	--------------------	-----------------	-----

Type:	<b>VivL</b>	Block group:
Name:	Valve_A1T1X004	
Comment:	Valve outlet educt tank B001	-
Inputs:	75	_ I OCM possible
Internal identifier:	FB1899	OCM
Instance DB:	DB195	
Name (header):	MvL.	Create block icon:
Family:	Drives	
Author:	AdvLib80	MES-relevant
To be inserted in OB		Special properties
✓ OB100 [Warm re	estart]	Messages
		Readback enabled

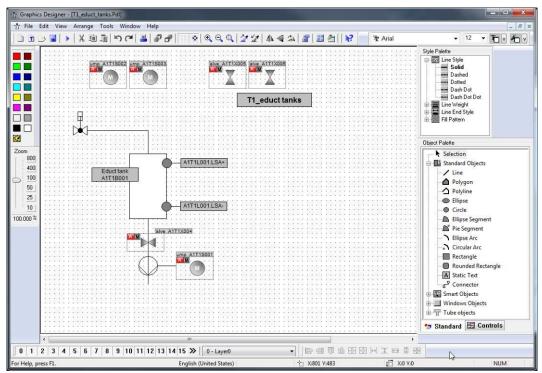
74. After you have made the changes for all valves that are located in a vertical pipe compile the changes.

				Status	Operating Mode	Compile
PCS7_SC	CE_Prj					
E-M AS1						
🛄 н рОд	lardware			undefined		
E- 🚺 C	CPU 414-3 DP				STOP	V
0	Blocks					
B				undefined		V
¢	) Connections			undefined		
🛨 🖳 AS2						
E-B OS						
	Configuration			undefined		
	VinCC Appl.					
¢				undefined		
	OS(1)				Deactivated	Image: Second
ettings for Comp	silation/Download —	Update		_ Viet	v Log	⊂Select Objects
-			Operating Mode			
iettings for Compi Edit	silation/Download	Status	Operating Mode		v Log Single Object AlL	Select Objects
-						
Edit	Test	Status	uring Open			
-	Test	Status	uring Open			

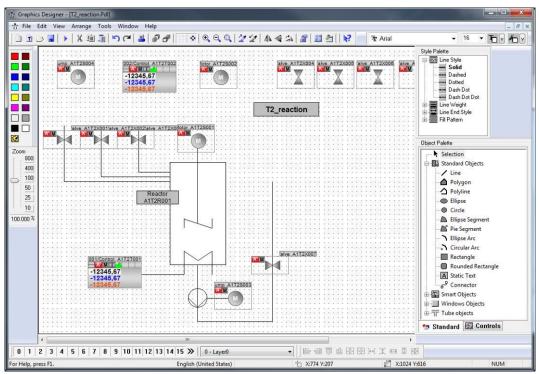
75. In the last dialog for settings, enter the changes at Scope and then start compiling the OS. ( $\rightarrow$  Scope  $\rightarrow$  Changes $\rightarrow$  Apply  $\rightarrow$  Start)

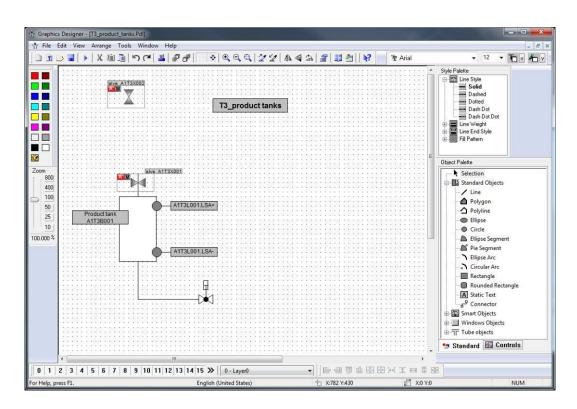
Settings: Compile OS	ant to compile and the scope of the compilation.	X
—Data     Tags and message	Further options Minimum acquisition cycle of the archive tags:	
SFC Visualization	With interconnection partner (SFC option )         Compression	
Scope	Create server data	
C Entire OS	With memory reset	
< Back	Apply Cancel	Help

76. In WinCC, the symbol of the valve–for which you made the change shown–is now rotated according to standard. Next, insert a static text 'T1 educt_tank'; it facilitates orientation during operation. The result is shown below.



77. Just as for the picture T1_educt_tank, a tank/reactor is set up in the pictures Product Tank and Reactors, The two figures below can be used as examples. In addition, generate a template for the library from the one reactor as well as from the product tank.



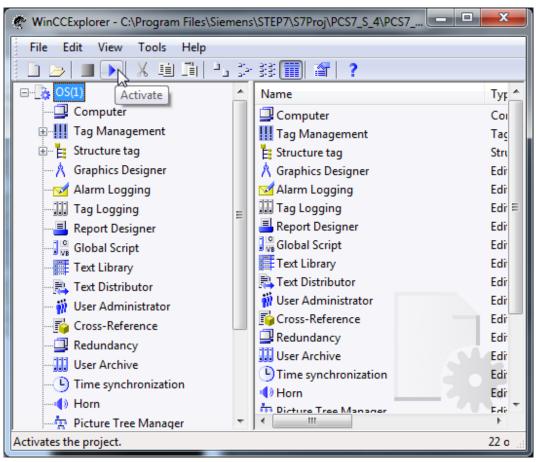


78. To test the HMI with SIMIT and PCLSIM, the charts have to be downloaded to PLCSIM. The plant simulation in SIMIT also has to be started. Set the CPU to the RUN-P mode.

S7-PLCSIM1	
File Edit View Insert PLC Execute Tools Window Help	
🗋 🗅 😂 🖬 🖨 (Plcsim(tcp/ip)) 💽 🕹 🖷 🖷 🖷 🖶 –🚧 🕅	
· · · · · · · · · · · · · · · · · · ·	
<b>\$</b>	
Image: CPU       Image: CPU <td></td>	
Press F1 to get Help.	Default: //

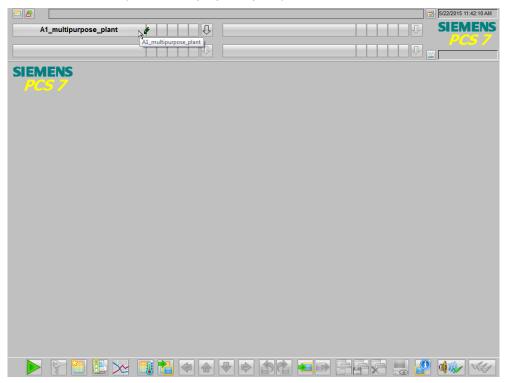
79. In the WinCC Explorer, activation on the ES has to be allowed in the properties of the OS. ( $\rightarrow$  Properties  $\rightarrow$  Allow activation on ES)

A WinCC Explorer - D:\SCE_Projekte_en\PCS7_S_1\PCS7_Prj\wincproj\OS	(1)\OS(1).mcp				• ×
File Edit View Tools Help					
□ ≥ ■ > X = 1 = 5 ≥ 33 🗐 🖀 ?					
Properties     Properties     Tag Management     Araphics Designer     Graphics Loging     International Loging	A Graphi Marmi III Toolo Project Properties	anagement cs Designer Logging	Type Computer Tag Manag Editor Editor Editor User Interface and Shortcuts	×	
- Gross-Reference - Reference - Reference	Allow activation     Help available in     Color conversion     Vector text files	on ES I Runtime	ages		
	C scripts with langu	age setting "Dynami	c" in Runtime:		10.00
	Operating system la	anguage for non-Uni	code programs	•	
Press F1 for Help.	This option disable	s the project activat	on interlock on the E	ES.	
		ОК	Cancel		



80. Then, OS Runtime is activated ( $\rightarrow$  Activate)

81. First, open the plant overview by clicking on the area key 'A1_multipurpose_plant' in the overview area. (→ A1_multipurpose_plant)



82. Picture A1_multipurpose_plant with an overview of all areas of the plant and the sequential function charts (SFC) is shown.

18/01/13 10:10:27.001 0	A1_multipurpose_plant/T2_	reaction Valve inlet reactor R002 from reactor R001 Fe 😽 1/18/2013 10:12:40 AM
A1_multipurpose_plant	Ū I I I I I I I I I I I I I I I I I I I	

A1_multipurpose_plant

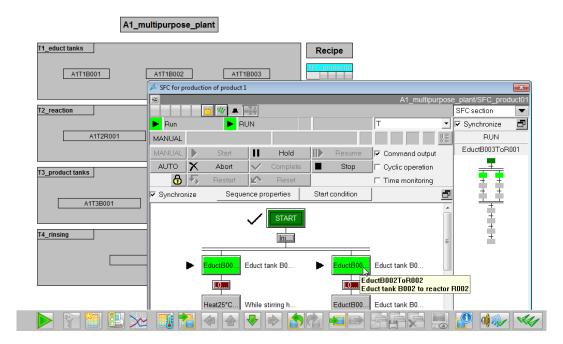
T1_educt tanks A1T1B001 A1T1B002 A1T1B003	Recipe SFC_product01 mt/SFC_rinsing
T2_reaction	
T3_product tanks A1T3B001 A1T3B002	
T4_rinsing	

83. By clicking on the block icon of the sequential function chart, an SFC can be opened and operated. ( $\rightarrow$  SFC_Product01  $\rightarrow$  Start  $\rightarrow$  OK)

		5/22/2015 11:42:55 AM
A1_multipurpose_plant	x Q	

A1_mu	ltipurpose_plant					
T1_educt tanks		1	Recipe			
A1T1B001	ATTIBOO1 ATTIBOO2 ATTIBOO3					
	🔺 SFC for production of produc	t 1			<b>—</b> ×	
<b>TO</b>				A1_multipurpo	ose_plant/SFC_product0	
2_reaction					SFC section 🔹	
A1T2R001	Idle				🛛 🔽 Synchronize	
ATTZRUUT	MANUAL			8		
	MANUAL 🕨 Start	II Hold	Resume	Command output	Active step	
3_product tanks	AUTO X Abort	Complete	Stop	Cyclic operation	_ <del></del>	
	🔒 坃 Restart	Reset		Time monitoring	+ +	
A1T3B001	Synchronize Seq	uence properties	Start condition			
A113B001		START	]			
T4_rinsing		SFC Command	-			
	At SFC: A1_multipurpose_plant/SFC_product01					
		Executing 'S	tart' command			
	Heat25°C					
		ОК	2		Cancel	

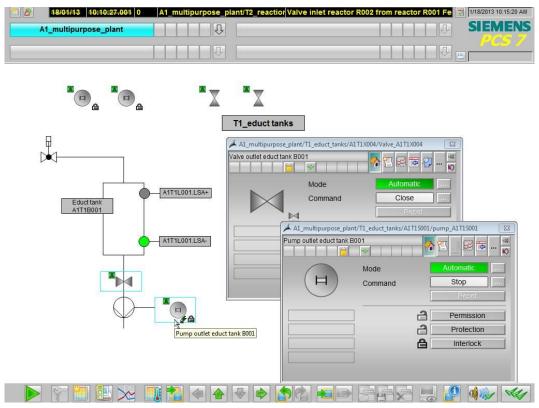
📒 🖉	22/05/15 13:45:51.039 0	A1_multipurpose_plant/T2_reactic Valve in	et reactor R002 from reactor R001 Feedback error 🛛 😾 5/22/2015 11:46:17 AM
	A1_multipurpose_plant		



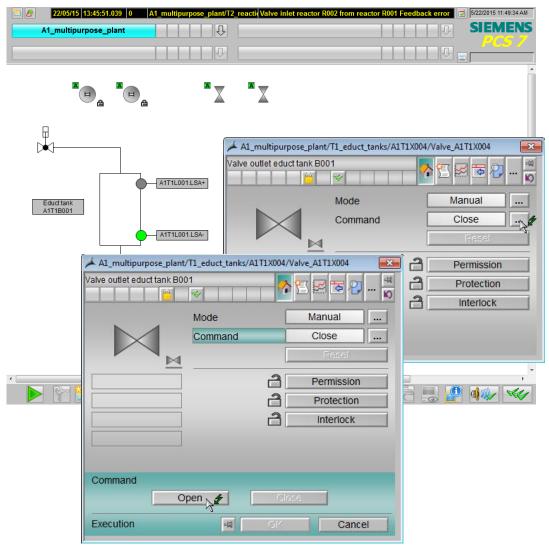
84. You get to the lower level layers either by opening the Picture Tree Navigator or by selecting the picture exchanges you generated. (→ Arrow to the right of the A1_multipurpose_plant → T1_educt_tank)

🛅 🕭 🛛 22/05/15 13:45:51.039 0 🛛 A1_mul	tipurpose_plant/T2_reactic Valve inlet reactor R002	from reactor R001 Feedback error 😨 5/22/2015 11:46:39 AM
A1_multipurpose_plant	$\Box = \Box = \Box$	
	ATTIBOO3	
T2_reaction	A1T2R002	
T3_product tanks A1T3B001	A1T3B002	
T4_rinsing		
	] =	

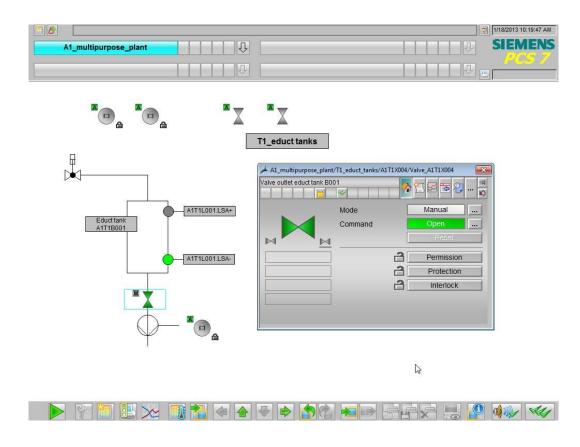
85. In the operating screen of the educt tank, the faceplates for the valves and the pumps of this level are shown. The faceplates permit the operating mode change and operating the valves and pumps.



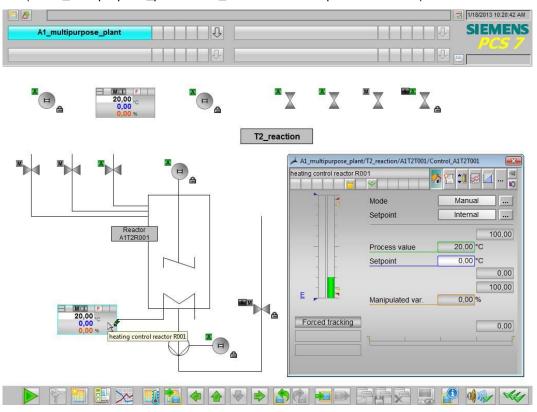
86. To operate a valve (here: open; click on the command button '…' next to Close, select Open and confirm your selection with OK. ( $\rightarrow ... \rightarrow$ Open  $\rightarrow$ OK)



87. The open valve position is signaled through the rotation and the green coloring of the faceplate. Pumps can be controlled the same way.

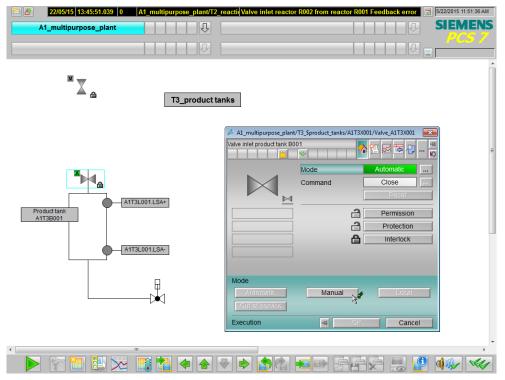


88. The operator screen 'T2_Reaction' has a faceplate for the PID controller, in addition to the faceplates for valves and pumps, which can be operated and monitored through it. (→ A1_multipurpose_plant → T2_Reaction → Temperature control)



89. The operating screen 'T3_product_tank' is represented with the faceplate for a valve whose operating mode is just being switched.

 $(\rightarrow A1_multipurpose_plant \rightarrow T3_product_tank \rightarrow Valve \rightarrow ... \rightarrow Manual \rightarrow OK)$ 



- 22/05/15 13:45:51.039 0 A1_multipurpose_plant/T2_reactive Valve inlet reactor R002 from reactor R001 Feedback error 🗟 5/22/2015 11:51:58 AM 2 SIEMENS A1 multipurpose plant Û  $\mathbf{X}$ T3_product tanks A A1T3L001.LSA+ Product tan A1T3B001 A1T3L001.LSA->~ keyset change 91. Then, select 'Exit runtime' and return to the WinCC Manager. 22/05/15 12:07:34.327 0 A1_mu T2_reactic Valve inlet reactor R002 from m reactor ß l Fe ack err 5/22/2015 12:08:52 P SIEMENS Û A1_multipurpose_plant М X T3_product tanks ₽ A1T3L001.LSA+ Product tan A1T3B001 A1T3L001.LSA-흃 9
- 90. Runtime is terminated by first operating the button 'keyset change' in the lower control bar.

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exit runtime

## **E**XERCISES

In the exercises, we apply what we learned in the Theory section and in the Step by Step Instructions. To this end, we are using and expanding the existing multi-project from the step by step instructions (PCS7_SCE_0201_R1305_en.zip).

In the step by step instructions, only one element of the levels T1_educt_tank, T2_Reaction and T3_product_tank of the plant hierarchy was implemented. The objective of the exercise is to complete the pictures of the individual levels, or to generate the pictures of the missing levels.

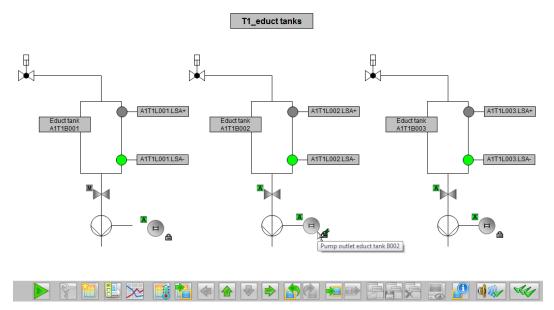
Then, generate a picture for the level T4_Rinse.

## TASKS

The tasks below are based on the step by step instructions. For each task, the corresponding steps of the instructions can be used as an aid. Regarding the arrangement, the rules of the VDI3699 [1] have to be noted.

 Complete the picture of the levels T1_educt_tanks by adding the missing tanks A1T1B002 and A1T1B003. Use the template from the library for this so the representations will be consistent. Adapt the labeling of the tank and of the binary sensors. Do not forget to adapt the variables for visualizing the binary sensors. The valves and motors are already set up, they only have to be positioned. Note, however, that the valves may have to be rotated once more.

🛅 🖉 🛛 <mark>22/05/15</mark> 1	1:55:34.787 0 <i>4</i>	1_multipurpose_plant/T2_rea	action Valve inlet reactor R002 from reactor R001 Fe 🛃 5/22/2015 11:56:33 AM
A1_multipurp	ose_plant	Û	



- Now, also complete the pictures of levels T2_Reaction and T3_product_tank with the missing elements (tanks or reactors). Use the P&I diagram as a guide so that all valves, motors and controllers are positioned correctly. Take note of the correct rotation of the valves.
- 3. Finally, design the operating screen for the level T4_rinse. To this end, adapt the background analogous to the step by step instructions. Generate a picture title and a tank based on the educt and product tanks. Connect the variables of the binary sensors and arrange the valves and the motor using the P&I diagram as a guide.