### **HMI GENERATION**

### **O**BJECTIVE

After working through this instruction module, students are able to design and implement a graphic interface for efficient process management. To this end, they are acquainted with the objectives of process management. They understand the basic concepts of representation and are acquainted with different representation techniques. This enables the students to generate an efficient graphic interface that is suitable for being applied in **PCS7**.

### **THEORY IN SHORT**

A modern process control system like the **PCS7** provides the operators with different display screen-supported windows to the process that can be used to handle all process management tasks. Because of the large volume of information from the technical process that the operator has to take in and attend to, it is advisable to structure the information. Also, certain rules have to be adhered to for navigation and representation in order to establish an interface to the technical process that can be conveniently operated and supports the operator to the greatest extent possible in his manifold process management tasks.

**PCS7** supports the design process of the process displays for control and monitoring in multiple ways. On the one hand, operator symbols and operator panels are defined for many of the elementary blocks and individual drive functions we use in basic automation -symbols and panels that allow for the project-wide uniform interaction with similar technical equipment. On the other hand, the plant hierarchy can be used to favorably structure the representation of the information.

Through this structure, very many elements of the operator communication system that have to be handled manually in other systems can be generated automatically and faultlessly through a generation run. The two remaining essential tasks when designing the process displays are, on the one hand, the representation of the static process structure (containers, piping, etc.) for better orientation, and on the other hand the insertion of elements for navigation along process streams on a plant hierarchy level.

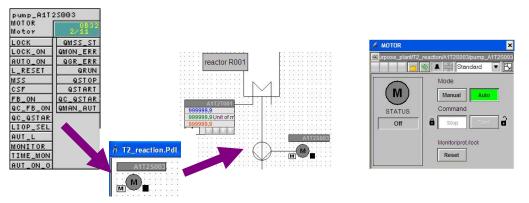


Figure 1: From individual drive function to operator controls and displays

By means of the generation run, icons are set up for all operator-controllable blocks of a hierarchical level. They subsequently only have to be moved and supplemented with static elements to get a complete operator display for the hierarchical level (refer to Figure 1).

### THEORY

### **OBJECTIVES OF PROCESS MANAGEMENT**

In a process engineering plants, it is the operator's task to carry out the intended operation of this plant economically and environmentally compatible. This task is called process management. The operator has to ensure a constant, high product quality and product volume (yield) and keep the amount of waste as low as possible. He also has to balance disturbance factors such as fluctuating properties of the raw materials used, plant disturbances or fluctuating throughput. He has to make sure that the availability and life of the plant is maximized. In addition, he has to make sure that emission values are adhered to and energy and material consumption are minimized [1].

To meet these objectives, the operator has to be continuously in a position to monitor the plant, to diagnose faults and intervene in the running process to eliminate the faults. The operator's workplace is the operator station of a control desk. This operator station is provided with all displays and intervention options that the operator needs to perform his job. The control system makes an operator interface available for this which he uses to carry out his tasks according to his capabilities, proficiencies and needs [1].

### **CONCEPTS OF REPRESENTATION**

The representation of data and information on the graphic user interface has a decisive influence in the operator's performance. For that reason, it has to be 'tuned' to his capabilities, proficiencies and needs. The following questions have to be answered in this regard:

- 1. For whom is the representation, and what purpose does it serve?
- 2. What is to be represented?
- 3. How is it to be represented?

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

#### Organizing what is to be represented

The information and data to be represented has to be organized in a way that is suitable for the representation. We have to specify how the existing elements are subdivided and arranged, how they relate and how the operator can navigate among the representations. To this end, it has to be determined how much information and data is to be represented overall (*quantitative aspect*), and it has to be specified which information and data is to be represented simultaneously and jointly (*qualitative aspect*).

The ratio has to be decided of what is new (information, dynamic part of the display) to what is known (data, static part of the display). The aim is to make the share of information as high as possible but with sufficient data to allow for the pertinent and purposeful interpretation of the information.

The result is the distribution of information and data to the different operator displays. We still have to define how the operator gets from one operator display to the next (*Navigation*).

### Filling Degree

Depending on the user interface, only a limited area is available to simultaneously represent data and information. To ensure that the information and data can be read and differentiated under all operating situations, only a certain part of this area is to be assigned characters. This part if called the *filling degree* of the representation.

The recommended filling degree depends on the type of characters and picture elements as well as on the necessary arrangement of these elements. It thus depends on the representation technique used. For example, the filling degree of a process engineering

flow chart should not amount to more than 50%; for an alarm page, on the other hand, it may amount to up to 80% [1].

#### Coding

**Coding** specifies how certain information is represented. Information can be coded by color, shape, form, expansion, direction (angle), position and dynamics (flashing). Uniform coding facilitates taking in the information and evaluating it.

Good coding is clear, distinguishable and does not contradict existing conventions. For example, the color green should never be used for STOP. If, instead, a red flashing signal is used as coding for STOP, this coding should be used consistently for the entire operator interface. Also, this coding should not be used for any other information, to rule out any confusion. In addition, good coding should be apparent, so that it is easily learned and remembered by the operator.

#### Conspicuousness

A central task of the user interface is calling the operator's attention to important information. Since usually different kinds of information are displayed in an operator display, it is advisable to design this information -depending on its relevance and priority-with different conspicuousness. The more conspicuous an item of information is represented, the sooner it is detected. In addition, based on its conspicuousness, the operator recognizes which informational item requires his primary attention at the moment. Based on some examples, Table 1 shows the stepped increase of conspicuousness of the representation for different information.

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

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Increasing conspicuousness of means	>

^		Combinat	ion of mea	ns	Application
	Contrast	Color	Flashing	Acoustical signal	
tion	high	Х	Х	х	Alarm
of visualization	high	х	х	-	Change of state (requiring acknowledgement)
	high	Х	-	-	Change of state (not requiring acknowledgement)
Isness	high	Х	-	-	Curves
icuor	low	Х	-	-	Material and energy flows
conspicuousness	high	-	-	-	Text of message line, explanatory texts
Increasing	medium	-	-	-	selctable and operator-controllable object (keys)
Incre	low	-	-	-	currently not selctable and operator- controllable object

### Consistency

Often, certain information occurs in several representations simultaneously. In this case, it is important that this information is represented *consistently* in the entire user interface. That means that the information looks identical in all representations, and behaves identically. Always the same terms and symbols are to be used. The operator input sequence should always be the same and the response by the system to the operator input sequence should be similar with respect to time as well as to content.

### **REPRESENTATION TECHNIQUES**

#### Basic Structure of the Display Fields

In principle, the display field should be structured the same for all types of representation. It makes orientation, information absorption, and thus process management easier for the operator.

The basic structure according to VDI 3699 [1] recommended for this is shown in Figure 2. In the upper area, the message line is located where the current messages are displayed as group messages. Below it, an overview area is located where the available representations (such as process displays in *PCS7*) are listed. From here, any representation can be opened. The work area occupies the largest part of the display area. Here, the representation that is currently selected is displayed. The bottom area contains the keys for activating general functions. In the working area, windows can be opened containing supplementary information (for example, different views of the *PCS7* blocks). All areas except for the working area are reserved and are permanently displayed.

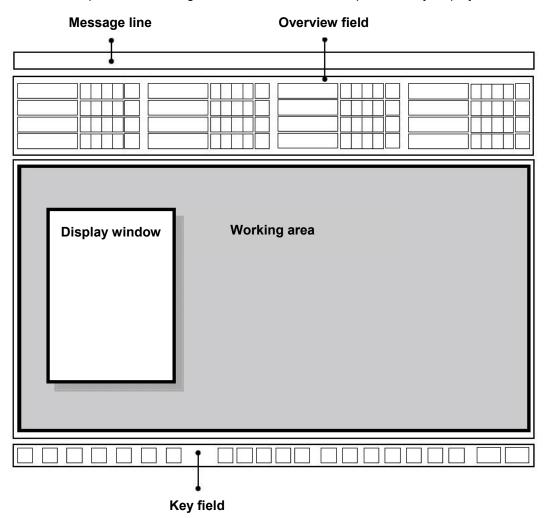


Figure 2: Basic structure of display fields

### Flow Diagrams

A flow diagram is the "schematic representation of components, including their connections, through (flow) lines to represent relationships in a process engineering plant and in control engineering" [1]. It renders the structure of the plant in a simplified manner and provides information regarding the paths of material, energy and signal streams between the different plant parts. With flow diagrams, process engineering and control engineering information is represented, and process intervention is made possible.

Flow diagrams consist of static and dynamic elements. The static display elements are represented by the **basic display**. This basic display contains the dynamic display elements that are continuously updated.

The static basic display provides the context for the dynamic display elements; i.e. it renders the meaning of the represented objects and their relationship to each other. The basic display represents all data that remains unchanged during the display. These are the display background, the headings and the labeling as well as the plant parts and the devices (inasmuch as their representation is not to change).

The dynamic display elements render the information for process management. **Display** elements represent the changes, characteristics and relationships of the process values. They render the state of the plant, of the control system or of the process. **Selection and** operator elements allow for operator intervention regarding process control. In addition, often additional information such as function charts or curves can be displayed as windows in the flow diagram.

Flow diagrams are classified as follows:

- Control system flow diagrams only represent components of control engineering such as controllers, actuators and open loop controls as symbols. They are connected by means of signal flow lines.
- Process system flow diagrams graphically represent, in a simplified manner, plant segments by means of symbols. Here also, three different types are distinguished:
  - A basic flow diagram represents plants, units or plant segments only in the form of rectangles. They are connected to each other by means of flow lines for materials, energy or energy carriers.
  - A *process flow diagram* represents a process using (simplified) graphic symbols. The symbols represent the corresponding plant segments and are connected to each other with flow lines.
  - A piping and instrument flow diagram (P&I flow diagram) represents the technical equipment of the plant using graphic symbols. In addition, measuring points, control system blocks and actuators are represented. The symbols are connected to each other with lines for piping and signal paths.

In the **PCS**, flow diagrams are referred to as **process displays**. Within the scope of the step by step instructions, different process displays are generated for the configured plant.

### HMI GENERATION IN THE PCS7

The **PCS7** provides an extensive control and monitoring system that consists of the following subsystems [2]:

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

In this chapter, the **PCS7** graphics system is discussed. The message system will be discussed in detail in the next chapter 'Alarm Engineering'.

The graphic system represents the plant in a plant overview, displays process images in the working area of the service interface, provides operator process communication/ operator system communication and indicates alarm states. The corresponding service interface is generated on the system's operator station (OS). Thus, the OS is the central station for controlling and monitoring a *PCS7system* [2].

#### Configuring the Service Interface in PCS 7

The selected plant hierarchy of the project is the basis for organizing the service interface. The plants and units set up are mapped to the service interface through corresponding process displays. Display and directory names of the plant hierarchy are incorporated automatically. In the process mode, the available process displays are represented in the overview area corresponding to the plant hierarchy.

Initially, the process displays are set up at the corresponding location in the plant hierarchy and assigned to an OS. Then, the OS has to be compiled. After that, the process displays can be configured in the *Graphics Designer* of the *WinCC Explorer*. The *Graphics Designer* is an editor where static and dynamic display elements are inserted, arranged, wired and connected to each other.

### Configuring the Process Displays in PCS7

Technological blocks from the **PCS7** libraries that can be controlled and monitored are already provided with corresponding graphic representations, so-called **block icons**. They are inserted automatically in the corresponding display when the process displays are configured. In the process display, block icons represent -in a kind of overview- the most important information about the represented block.

By means of the block icons, different preconfigured *picture blocks* (*face plates*) can be called that open as windows in the working area. Picture blocks are dynamic display elements that are connected to the parameters of the represented block and are updated automatically. They make it possible for the operator to comprehensively monitor and operate the associated technological block. Depending on the block type, different *views* exist for the associated picture blocks. These views allow for accessing parameters for very specific tasks. For example, in addition to the standard view there often is also a parameter view to assign parameters, an alarm view for diagnosis or a limit view for setting operator limits of the setpoint. It depends on the represented technological block which views are offered.

The *Graphics Designer* makes additional dynamic standard objects available which can be inserted manually. These objects can be wired directly to the connections of the blocks in the CFCs and SFCs, and thus implement the desired dynamic behavior. Examples of standard objects are input and output fields for entering and displaying values, status displays to display the binary states of an object, as well as bars for the relative representation of values.

In addition, the *Graphics Designer* includes different libraries with preassembled graphics elements -such as piping or valves- that can be used to generate the static basic display. As an alternative, it is possible to generate and use one's own graphics.

In the step by step instructions below, additional features and capabilities of the *Graphics Designer* are discussed. Furthermore, some additional important *WinCC* tools are introduced.

### LITERATURE

- [1] VDI 3699 (Status 2005-05): Process Management with Screens.
- [2] SIEMENS (2009): Process Control System PCS 7: OS Process Management (V7.1).

### **STEP BY STEP INSTRUCTIONS**

### TASK

This task requires setting up the operator station (OS) after a few presettings in the *SIMATIC Manager*.

An overview display of the multi-purpose plant and a display respectively for educt tank B003, reactor R001 and product tank B001 are created.

### **O**BJECTIVE

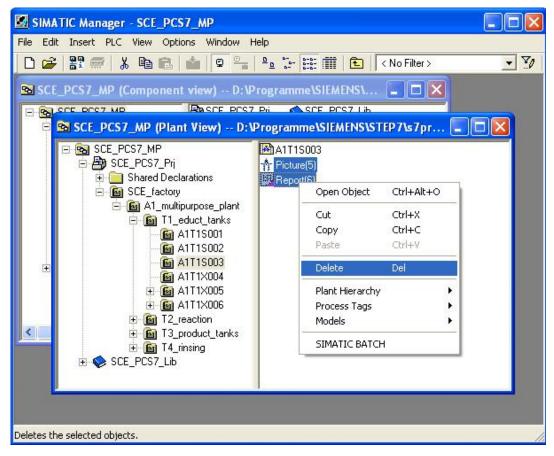
In this chapter, the student

- Learns to generate the operator station (OS) in the SIMATIC Manager
- Is acquainted with the configuration environment WinCC
- Learns to create displays with the Graphics Designer

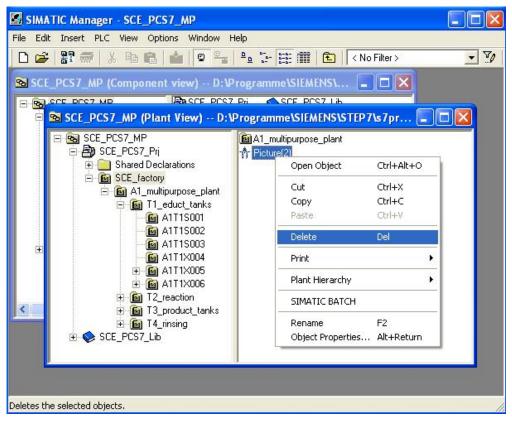
### PROGRAMMING

1. Before we start inserting displays, we remove from Level 4 in the plant view the displays inserted by the wizard at the very beginning of project generation. In our project, we only want to use displays in hierarchy level 2 and 3.

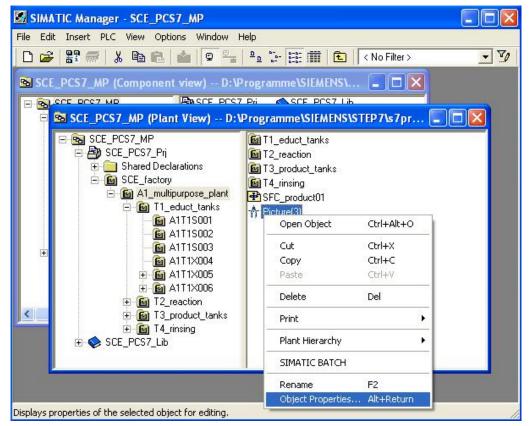
 $(\rightarrow \text{Display}(6) \rightarrow \text{Delete})$ 



2. Likewise, we delete the display in Level 1. ( $\rightarrow$  Display(3)  $\rightarrow$  Delete)



 Now we can edit 'Display(4)' in folder 'A1\_multipurpose\_plant'. (→ Display(4) → Object Properties)



4. At the general properties, we change the name of the display to the name of the folder. ( $\rightarrow$  General  $\rightarrow$  A1\_multipurpose\_plant)

Properties - WinCC	Picture: Picture(3)	X
General Block icons		
Name:	A1_multipurpose_plant	
Path:	SCE_PCS7_Pri\0S(1)\GraCS\Picture(3).Pdl	
Plant path:	SCE_PCS7_Prj\SCE_factory\A1_multipurpose_plant	_
Storage location of the project:	D:\Programme\SIEMENS\STEP7\s7proj\SCE_PCS7\SCE_Prj	
Author:		
Created:		
Last changed on:		
Comment:		
		×
OK Ar	pply Cancel	

5. In the displays, block icons can be generated automatically in the CFCs. By clicking on such a block icon in runtime, the face plate for this block can then be opened. Here, we set that the block icons are set up by taking the hierarchy into account.

 $(\rightarrow$  Block icons  $\rightarrow$  Derive the block icons from the plant hierarchy  $\rightarrow$  OK)

Properties - WinCC-Picture: Picture(3)	
General Block icons	
Derive the block icons from the plant hierarchy.	
OK Apply	Cancel

6. Now the missing pictures are inserted in Level 3, and then renamed accordingly. ( $\rightarrow$  T2\_reaction  $\rightarrow$  Insert New Object  $\rightarrow$  Picture)

SIMATIC Manager - SCE_PCS7_MP		
File Edit Insert PLC View Options Wir	ndow Help	
0 🛩 🔡 🐖 👗 🖻 🛍 🕍		< No Filter > 💽 🔀
SCE_PCS7_MP (Component view	Cut         Ctrl+X           Copy         Ctrl+C           Paste         Ctrl+V           Delete         Del	X P7\s7pr X
⊟ 🔂 SCE_PCS7_MP ⊟ 🎒 SCE_PCS7_Prj		T2×003
E B Shared Declaration -	Insert New Object	Hierarchy folder
SCE_factory	Print	▶ CFC
⊡ 💼 A1_multipurpos	Plant Hierarchy	▶ SFC
⊡ 🙆 T1_educt_( 🙆 A1T1S)	Process Tags	<ul> <li>Additional document</li> </ul>
	Models	Picture
	SIMATIC BATCH	Report
	Rename F2	Equipment Properties
	Object Properties Alt+Return	Equipment Property
Construction     Construction     Construction     Construction     Construction     Construction     Construction     Construction     Construction     Construction	anks (A1T25002 (A1T25003 (A1T25004 (A1T2T001	

 As a result we have -in the folders 'A1\_multipurpose\_plant', 'T1\_educt\_tanks', 'T2\_reaction', 'T3\_product\_tanks' and in 'T4\_rinsing'- one picture respectively with the name of the folder. Now, the block icons are generated in all these pictures.

 $(\rightarrow A1\_multipurpose\_plant \rightarrow Plant Hierarchy \rightarrow Create/Update Block Icons)$ 

SIMATIC Manag File Edit Insert PL	.C View Option:			
	እ 🖻 🖻 🕯		🔚 🧱 🗰 主 🛛 < No Filter >	- 70
				V
SCE_PCS7_MP	(Component v	riew) D:\Progra	mme\SIE 🖃 🗖 🔀	
E SCE PCS7	MP (Plant Vie	w) D:\Progran	Settings	
SCE_PCS7_M	IP	T1_educt_ta T2 reaction	Check Consistency Open Check Log	
😟 🔃 🧰 Share	d Declarations	T3_product_	Create/Update Block Icons	
	factory I multinumose pla	📕 🙆 T 4_rinsing 📘	Open Block Icons Log	
	Cut	Ctrl+X	Change AS Assignment	
	Сору	Ctrl+C	Change OS Assignment	
	Paste	Ctrl+V	Cancel Assignment	
	Delete	Del	Create/Update Diagnostic Screen	
	Insert New Obje	ct 🕨	Display Diagnostic Screens Log Configured Objects	
	Print	•	Update in the Multiproject	
	Plant Hierarchy	×	Clear Shortcut	_
	Process Tags	•		
	Models	•		
	SIMATIC BATCH			
	Rename	F2		
	Object Propertie	s Alt+Return		

8. In the following dialog, we leave all pictures checked and select the name parts of the plant designation for the object designation of the tags. Here, only the name of the chart is always entered.

The number of the included lower hierarchy levels is to be 1. The status for generating block icons is then displayed.

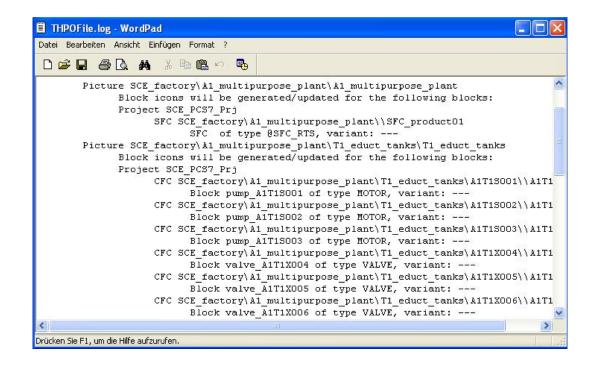
 $(\rightarrow$  Chart  $\rightarrow$  Lower hierarchy levels included 1  $\rightarrow$  OK)

Create/Update Block Icons
Block icons will be created or updated for the following pictures:
<ul> <li>SCE_factory\A1_multipurpose_plant\T1_educt_tanks\T1_educt_tanks</li> <li>SCE_factory\A1_multipurpose_plant\T2_reaction\T2_reaction</li> <li>SCE_factory\A1_multipurpose_plant\T3_product_tanks\T3_product_tanks</li> <li>SCE_factory\A1_multipurpose_plant\T4_rinsing\T4_rinsing</li> </ul>
The object name TAG is made up of the following components of the HID:
Chart
Lower hierarchy levels included:
OK Apply Cancel Help

Plant Hierarchy - Create/Update Block Icons	
Search CFC charts for blocks capable of operator control and mo SCE_factory\A1_multipurpose_plant\T1_educt_tanks\T1_educt	
	Cancel

9. After we did that, the operator station (OS) has to be recompiled. The log shows which picture block was set up in which picture. ( $\rightarrow$  Yes)

Create/L	Jpdate 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,). Do you want to view the function log now?
Ye	s No



10. After the pictures were set up in the plant view and the block icons were set up there, we can start compiling the operator station (OS) in the component view.

 $(\rightarrow \text{Component view} \rightarrow \text{SIMATIC PC Station}(1) \rightarrow \text{PLC} \rightarrow \text{Compile and Download Objects})$ 

SIMATIC Manager - SCE	_PCS7_MP				
File Edit Insert PLC View	Options Window	Help			
🗋 🗅 😅   🎛 🛲   X 🖻	R 🚵 👳 º		🗰 主 < No F	Filter >	- 7/ 🔡
SCE_PCS7_MP (Comp	onent view) D	: \Programme\S	IE 🔳 🗖 🔀		
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😟 📕 WinCC Al	Open Object	Ctrl+Alt+O			
⊞- 📄 Shared Decla ⊞- 🌪 SCE_PCS7_Lib	Cut Copy Paste	Ctrl+X Ctrl+C Ctrl+V			
	Delete	Del			
	PLC	•	Download	Ctrl	+L
	Print	•	Configure	Ctrl	+K
K III	SIMATIC BATCH		Compile and Dov	vnload Objects	
			Compare		
	Rename Object Properties	F2 Alt+Return			
Compiles/downloads the objects I	to be selected under	the highlighted ob	jects.		

11. Prior to the compilation run, we have to select the settings for the OS.

 $(\rightarrow OS(2) \rightarrow Edit)$ 

Selection table:					
Objects		Status	Operating Mode	Compile	Download
E-B SIMATIC PC Station(1)					
Configuration		undefined		<b>V</b>	
🖃 📕 WinCC Appl.					
Connections		undefined			
OS(1)			Not open	<b>V</b>	
Edit Test	Ipdate Operating Mode T Status during Open f compilation error is detected	View L	.og All Select	t Objects Select All	Deselect All

12. Regarding the assignment of areas to operator stations: we don't have to set anything in our case (with only 1 OS). ( $\rightarrow$  Next)

-lierarchy	Area	OS Assignment	Comment
SCE_factory\A1_multipurpose_plant	A1_multipurpose_plant	SIMATIC PC Station(1)\WinC	multipurpose plant for training of process control technolo

13. In the next window, we select the dialog in order to select a network connection. (→ Select Network Connections)

perator stations and areas:	S7 programs and r	network connection	IS:			
🖃 🗹 🍖 OS(1)	S7 program	Connection:	s Subnet	Subnet type	WinCC unit	Addres
🔤 🗹 📷 A1_multipurpose_plant	BT S7 Program(1	) :	Ethernet(1)	Ind. Eth.	Industrial Ethernet	08.00.06.01.0.
	<					

14. Here, we select as WinCC unit TCP/IP. The address is then correctly included automatically from the hardware configuration.

 $(\rightarrow \text{WinCC unit} \rightarrow \text{TCP/IP} \rightarrow \text{OK})$ 

Sel	ect Networ	k Connectio	n							
S7	program: S7 I	<sup>D</sup> rogram(1)								
	Subnet 🕢	Subnet type	WinCC unit		Address	Station no.	Segment no.	Rack no.	Slot no.	
9	Ethernet(1)	Ind. Eth.	TCP/IP	-	192.168.0.1			0	3	
			Industrial Ethe Industrial Ethe TCP/IP							
	ОК						C	ancel	Help	

15. After the area assignment, the OS assignment and the network connection were checked once more, we continue. ( $\rightarrow$  Next)

perator stations and areas:	S7 programs and netw	ork connections:		
- 🗹 🥐 OS(1)	S7 program 🔧	Connections Subnet	Subnet type WinC	C unit Addres
🔤 🗹 📷 A1_multipurpose_plant	S7 Program(1)	1 Ethernet(1)	Ind. Eth. TCP/	P 192.168.0.
	<		)	

16. In the selection that follows, we can select the scope of the compilation.

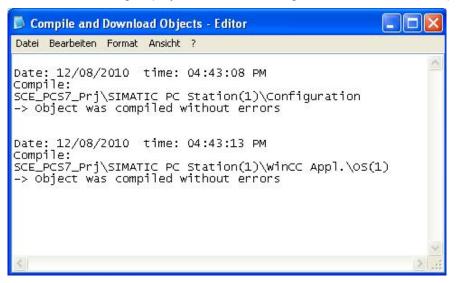
( $\rightarrow$  Tags and messages  $\rightarrow$  SFC Visualization  $\rightarrow$  Picture Tree  $\rightarrow$  Entire OS  $\rightarrow$  With memory reset  $\rightarrow$  Apply)

∂ata 7 Tags and message	8	Further options Minimum acquisition cycle of the archive tags: 1 second
SFC Visualization		☐ With interconnection partner ( SFC option )
Picture Tree		
cope		🔽 Create server data
<ul> <li>Entire OS</li> <li>Changes</li> </ul>	Vith memory r	eset

17. Since in our plant, the operator station (OS) is started on the engineering system (ES), we are selecting only Compile and not Download. After the compilation run is started, the prompt is confirmed with Yes. ( $\rightarrow$  Start $\rightarrow$  Yes)

📸 Compile and Download Objects					
Selection table:					
Objects		Status	Operating Mode	Compile	Download
□- 🖳 SIMATIC PC Station(1)					
Configuration		undefined			
🖃 - 🚺 WinCC Appl.					
Connections		undefined			
OS(1)			Not open		
	sure that the settings sele- the OS) A complete o in RUN. Do you want	prerequisites hav cted, no previous download is only p t to continue? No	jes online, please make s been met (e.g. current complete compilation from ossible if the PLCs are not		
Settings for Compilation/Download Update			v Log	Select Objects	
Edit Test Status	Operating Mode tus during Open		Single Object All	Select All	Deselect All
Compile only  Compile only	error is detected				
Start Close					Help

18. At the end, a log displays errors and warnings. We close the window. ( $\rightarrow$ 



- 19. We then open the OS from the component view for further editing.
- $(\rightarrow OS(2) \rightarrow Open Object)$ SIMATIC Manager - SCE\_PCS7\_MP File Edit Insert PLC View Options Window Help - 70 -🗋 🧀 🔡 🐖 👗 🛍 🕄 🧆 🗣 🏪 🏥 🏥 🔂 < No Filter > 🖻 SCE\_PCS7\_MP (Component view) -- D:\Programme\SIE... 📮 🗖 🔀 A1\_multipurpose\_plant E 🔂 SCE\_PCS7\_MP oj... 🗕 🗖 🗙 🖻 🎒 SCE\_PCS7\_Pri 1 SIMATIC 400(1) 🖻 🖳 SIMATIC PC Station(\* 🖻 📳 WinCC Appl. 💋 OS(1) Open Object Ctrl+Alt+O 🛨 🦳 Shared Decla 🕀 📚 SCE\_PCS7\_Lib Chrl+X Cut Ctrl+C CODV Paste Ctrl+V Delete Del ۲ Insert New Object PLC ۲ Compile Ctrl+B Display compilation log... Display load log... Generate server data Assian OS server... Start OS simulation Import WinCC objects Opens selected object.

20. The operator station (OS) is edited and represented In the *WinCC Explorer*. Here, you will see the editors and functions of the *WinCC* version installed here. In the next steps, we will become acquainted with some of these editors and functions. Additional information is provided in Help or the manuals.

 $(\rightarrow F1)$ 

ile Edit View Tools Help		
) 🖂 🔳 🕨 🗶 🏥 📑 🕒 🐎	詳 🗰 省 ?	
a O5(1)	Name	Туре
	Computer	Computer
🗄 IIII Tag Management	Tag Management	Tag Management
E F: Structure tag	E Structure tag	Structures
A Graphics Designer	A Graphics Designer	Editor
	Alarm Logging	Editor
	Tag Logging	Editor
Tag Logging	E Report Designer	Editor
- 📕 Report Designer	Global Script	Editor
	Text Library	Editor
Text Library	Text Distributor	Editor
Text Distributor	W User Administrator	Editor Editor
User Administrator		Editor
	User Archive	Editor
	Time synchronization	Editor
Redundancy	Hine synchronizadon	Editor
User Archive	Picture Tree Manager	Editor
- 5 Time synchronization		Editor
	K OS Project Editor	Editor
- 🧙 Picture Tree Manager	Component List Editor	Editor
- 🛺 Lifebeat Monitoring	Faceplate Designer	Editor
* OS Project Editor	器sFC	Editor
Component List Editor		
Faceplate Designer		
上書 sFC	<	

21. We now have to specify the properties of the computer where the project is to be started later. In this case, it is the configuration computer. Right click on the computer and then select Properties.

<b>@</b> WinCCExplorer	- D:\Programme\SIEMENS\STEP7	\s7proj\SCE_PCS7\SCE_	_Prj\wincproj\0S(1)\0S(1).mcp	
File Edit View	Tools Help			
🗋 🍃 🔳 🕨	X 🗉 🗐 🕛 🌫 🗱 🛄	a ?		
🖃 📑 OS(1)		Name	Туре	
	12	PCS7V7	Serve	r
🗄 🛄 Tag Mana	New Computer			
🕀 📙 Structure	Find			
A Graphics	Cut			
🛛 🗹 Alarm Loç	Сору			
Tag Logg	Paste			
📲 Report Di	Delete			
- 🛛 🖓 Global Sci –	Properties			
Text Libra				
— 🚉 Text Distrib				
- 🎆 User Admin				
Cross-Refe				
Redundanc	40			
User Archiv				
- 🕒 Time synch	ronization			
- 🙀 Picture Tree				
- 🛺 Lifebeat Mo				
Faceplate [	Jesigner			
		<		>
OS(1)\Computer\		1 object(s)		1

 $(\rightarrow \text{Computer} \rightarrow \text{Properties})$ 

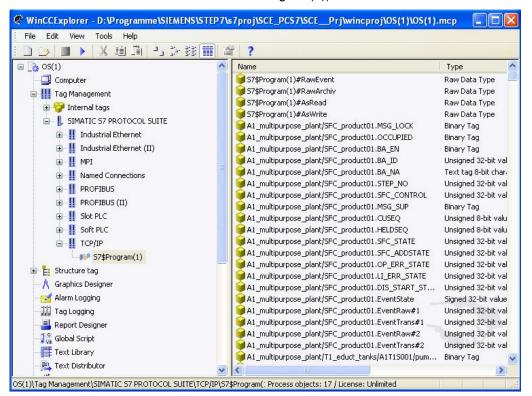
22. In the picture that follows, the name of the configuration computer is displayed that was specified previously in Windows. With the button 'Properties', we can specify the properties for the computer. (→ Properties)

omputer List: PCS7V7	
	Delete
	Properties
List of the computers in this project	

23. Now, a screen form is displayed where different parameters can be set. Here, the computer type of the computer on which WinCC runtime is to be started (in our case, with the local computer name 'PCS7V7') is specified as server. ( $\rightarrow$  PCS7V7  $\rightarrow$  Server  $\rightarrow$  OK  $\rightarrow$  OK)

eral Star	up Parameters Gra	phics Runtime	Runtime		
<b>F</b>	Computer Name	PCS7V7			
			Use Local Cor	mputer Name	
Compute	Туре				
💿 Serve					
() WinD	Client				
Server List					
	he computer in the ne	work			
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24. In Tag Management, under 'S7-Programm(1)', the tags for the corresponding CFC blocks and SFC step sequences that were automatically set up during the compilation run are located. They are used to visualize the face plates, but can also be utilized individually for visualization within the displays. (→ Tag Management → SIMATIC S7 PROTOCOL SUITE → TCP/IP → S7 Program(1))



25. To ensure that communication is working, we still have to select the system parameters of the TCP/IP connection.

WinCCExplorer - D:\Programme\SIEMENS\STEP7\s =ile Edit View Tools Help	s/proj\SCE_PCS/\S	CE_PrjwincprojWS(1)	WS(1).mcp
	7		
🔥 OS(1)	Name	Parameters	Last Change
- 🖵 Computer	₱₽ \$7\$Program(1)	IP,192.168.0.1,,0,3,02	12/8/2010 4:44:34 PM
🖃 🛄 Tag Management			
🗄 🎯 Internal tags			
🖃 📙 SIMATIC S7 PROTOCOL SUITE			
🗄 🔢 Industrial Ethernet			
🗈 👖 Industrial Ethernet (II)			
🗊 👖 MPI			
🕀 👖 Named Connections			
II PROFIBUS (II)			
🕀 👖 Slot PLC			
🗈 👖 Soft PLC			
New Driver Connection			
Structure tag			
Graphics Desig Find			0 0
Paste Paste			
Tag Logging Properties			
Report Designer			0 0
Global Script			6 6
Text Library			
Text Distributor	<		
I)\Tag Management\SIMATIC S7 PROTOCOL SUITE\TCP/IP\	land a	ects: 17 / License: Unlimited	

 $(\rightarrow \text{TCP/IP} \rightarrow \text{System Parameters})$ 

26. Here, we can now select any TCP/IP communication interface that was installed in STEP7 under PG-PC interface. We link this setting with the setting in the **SIMATIC Manager**. ( $\rightarrow$  Unit  $\rightarrow$  PLCSIM(TCP/IP)  $\rightarrow$  OK)

System Parameter - TCP/IP		×
SIMATIC S7 Unit		
Select logical device name		
CP-Type/Bus Profile:	TCP/IP	
Logical device name:	CP-TCPIP -	
I Set automatically	CP-TCPIP PLCSIM(RFC 1006) PLCSIM(TCP/IP) TCP/IP-> VMware Accelerated A TCP/IP(v tc) > VMware Accelerated A	44
Job processing	TCP/IP(Auto) -> VMware Accelera	
☐ Write with priority		
Enter a new device name or se	lect the requested device from the list.	
ОК АЬ	brechen Hilfe	

27. After system parameters are changed, **WinCC** has to be exited and restarted. ( $\rightarrow$  Yes  $\rightarrow$  OK)

Control	Center 🛛 🔣
?	The settings made will not be activated until the program is restarted! Exit the program?
	Ja Nein

Select one of the following options:	
Close project and exit WinCC Explorer	~

- 28. After we restarted WinCC, let's take a look at the *Picture Tree Manager*.
  - $(\rightarrow$  Picture Tree Manager  $\rightarrow$  Open)

WinCCExplorer - D:\Programme\SIEMENS\STEP7\s	7proj\SCE_PCS7\SCE_	_Prj\wincproj\(	)S(1)\0S(1).mcp	
File Edit View Tools Help				
🗋 🍃 📕 🕨 🕺 🏢 🏢 🖓 😸 🧱 🖀	7 ?			
🖃 📑 OS(1)	Name		Туре	
- 📴 Computer		No objects	evict	
🕀 🛄 Tag Management		NO ODJECIS	CXIST	
🗄 📙 Structure tag				
- 🖂 Alarm Logging				
Text Library				
🉀 User Administrator				
- 🙀 Cross-Reference				
- 📴 Redundancy				
- 🕒 Time synchronization				
() Horn				
Picture Tree Manager				
				alle alle
				-
Component List Editor				
Faceplate Designer				
	<			>
OS(1)\Picture Tree Manager\	0 object(s)			4



29. In the Picture Tree Manager we specify the sequence in which our pictures can be

called later. We keep the structure, make a save and exit the editor again. (  $\rightarrow$ 

📅 Picture Tree Manager - [OS(1).mcp]	
Project Edit View Options Help	
Hie <mark>Save</mark> of the containers and pictures	Picture preview:
<ul> <li>OS(1).mcp</li> <li>A1_multipurpose_plant - A1_multipurpose_plant.pdl</li> <li>A1_multipurpose_plant/T1_educt_tanks - T1_educt_tanks.pdl</li> <li>A1_multipurpose_plant/T2_reaction - T2_reaction.pdl</li> <li>A1_multipurpose_plant/T3_product_tanks - T3_product_tanks.pdl</li> <li>A1_multipurpose_plant/T4_rinsing - T4_rinsing.pdl</li> </ul>	
Unassigned containers and pictures	
Container	
I Saves the current picture hierarchy.	

### 30. Now let's look at the **OS Project Editor**. ( $\rightarrow$ OS Project editor $\rightarrow$ Open)

WinCCExplorer - D:\Programme\SIEMENS\STEP7\s	7proj\SCE_PCS7\SCE_	Prj\wincproj\OS(1)\OS(1	).mcp 💶 🗖 🔀
File Edit View Tools Help			
🗋 🖂 🔳 🕨 🕺 🏛 🚺 🕹 🌫 謎 🧱 🚞 🖀	7 ?		
🖃 📑 O5(1)	Name		Туре
		No objects exist	
🗄 🛄 Tag Management		NO ODJECIO EXIST	
🖭 🧮 Structure tag			
Graphics Designer			
- 🖂 Alarm Logging			
- 🛄 Tag Logging			
- ] 👷 Global Script			
Text Library			
- 🚉 Text Distributor			
🙀 User Administrator			
- 🞼 Cross-Reference			
- 📴 Redundancy			
User Archive			
- 9 Time synchronization			
			S. 14
- 🔄 Picture Tree Manager			28. Zet
Lifebeat Monitoring			1.21
ー・米 OS Project Editor			24
Component List Ec Open			
Faceplate Designe Properties			
品 sFC	<		>
OS(1)\OS Project Editor\	0 object(s)		

31. In the **OS Project Editor**, under 'Layout', we can select the monitor-configuration and the screen resolution.

In addition, there are settings for message display, the visible areas, the window arrangement in the runtime window and other general basic settings. We accept these

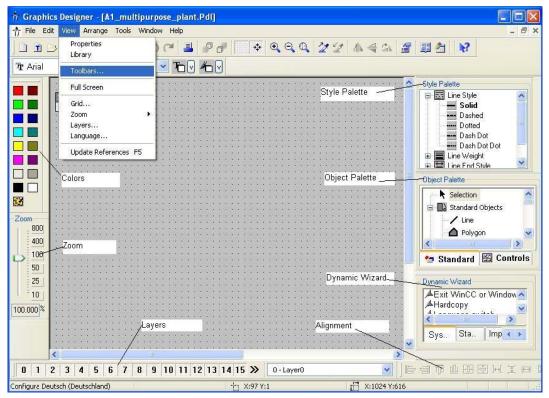
urrent layout: SIMATIC Standard 1024*768	
vailable layouts:	Layout Description:
Picture Name SIMATIC Standard 1024"768 SIMATIC Standard 1152"768	SIMATIC Standard-Layout for screen resolution of 1024*768
SIMATIC Standard 1280*1024	Number of area keys: 16
SIMATIC Standard 1680*1050 SIMATIC Standard 1920*1080	Number of server keys:
SIMATIC Standard 1920*1200	Overview extended configuration: Detail.
SIMATIC Standard 2560*1600	Runtime Help available
	Display
	User name O User ID
Monitor configuration	
• • • • •	

32. User friendly and clearly laid out operator displays are generated in the *Graphics Designer*. Barely any limits exist as to the programmer's creativity. In addition, it is possible to import graphics files or video sequences that were generated with other graphics programs. It is best to open individual pictures by double clicking on the names in the right window.

File Edit View Tools Help		
🗅 🕞 🔳 🕨 🗶 🕮 🗐 🤚 🍉	建 📰 者 📍	
05(1)	Name	Туре
- 🗍 Computer	A @PTNO.PDL	Graphics Designer picture
Tag Management	🔥 @PTN_A1_multipurpose_plant.pdl	Graphics Designer picture
E F Structure tag	🔥 @R3i.pdl	Graphics Designer picture
	🔥 @RedStateDispContainer.PDL	Graphics Designer picture
	🔥 @screen.pdl	Start picture
- Marm Logging	A @ScreenSettings.PDL	Graphics Designer picture
- 🔝 Tag Logging	A @ServersStates.PDL	Graphics Designer picture
	A @SIGNAL_Test.PDL	Graphics Designer picture
- 🔐 Global Script	🔥 @template.pdl	Graphics Designer picture
Text Library	A @TemplateAPL.PDL	Graphics Designer picture
	👌 @Template_Batch.pdl	Graphics Designer picture
	A @Test001.PDL	Graphics Designer picture
🦳 🎆 User Administrator	A @Time75EG.pdl	Graphics Designer picture
- 👘 Cross-Reference	A @TopAlarmNew.pdl	Graphics Designer picture
- 🖵 Redundancy	A @TRG_Default.Pdl	Graphics Designer picture
User Archive	RG_Standard.Pdl	Graphics Designer picture
Time synchronization	R @WarningLevel.PDL	Graphics Designer picture
Horn	A @WarningServer.PDL	Graphics Designer picture
	A @WarningTopfield.PDL	Graphics Designer picture
- 🔄 Picture Tree Manager	A @Welcome.PDL	Graphics Designer picture
🚽 🚽 Lifebeat Monitoring	A1_multipurpose_plant.Pdl	Graphics Designer picture
	A T1_educt_tanks.Pdl	Graphics Designer picture
- [] Component List Editor	A T2_reaction.Pdl	Graphics Designer picture
Faceplate Designer	A T3_product_tanks.Pdl	Graphics Designer picture
品 SFC	A T4_rinsing.Pdl	Graphics Designer picture
00 ° °	<	>

 $(\rightarrow A1\_multipurpose\_plant)$ 

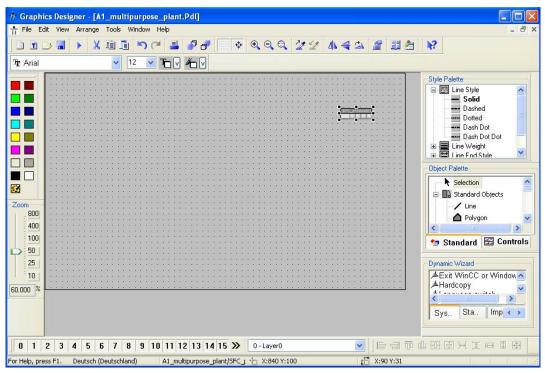
33. The **Graphics Designer** provides the most varied functions for generating process displays. They can be hidden or shown in the menu with View/Toolbars. ( $\rightarrow$  View  $\rightarrow$  Toolbars)



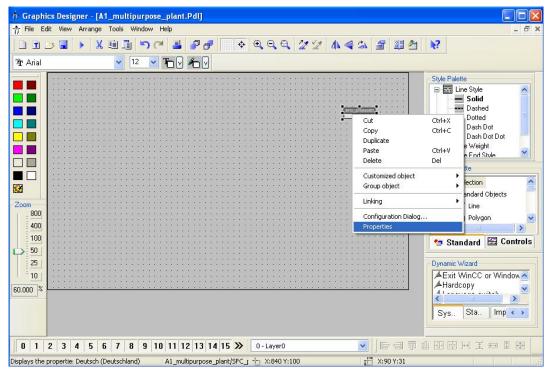
These toolbars have the following functions:

- **Standard Toolbar**: Contains symbols and buttons to execute frequent commands quickly.
- **Colors**: Provides for assigning colors to selected objects (one of 16 standard colors and one user defined color).
- **Zoom**: Sets the zoom factor (in percent) for the active window.
- Style Palette: Changes the look of a selected object. Depending on the object, we can change the line/frame style, the line/frame width, the line end style or the infill pattern.
- Object Palette: Contains the standard objects (polygon, ellipse, rectangle, etc), smart objects (OLE Control, OLE Element, IO field etc.) and Windows objects (button, check box etc.).
- Dynamic Wizard: Makes numerous frequently needed functions available. They can be generated using a dialog that guides the operator and also provides help.
- **Layers**: Selects which of the 32 layers (Layer 0 to 31) is visible. Layer 0 is selected as a matter of standard.
- Alignment: Lets you change the absolute position of one or several objects, change the position of objects relative to each other, or make the height and width of several objects uniform.

34. In our displays, the block icons are already included that can we can position as desired within the displays; as was done here for the SFC step sequence 'SFC\_product1'. (→ SFC\_product1)



- 35. In the properties of the block icons, we can also specify the displayed name. Otherwise, a very long name is displayed where the path is included also.
  - $(\rightarrow \text{Properties} \rightarrow \text{Properties} \rightarrow \text{General} \rightarrow \text{tag} \rightarrow \text{SFC}_{product01})$



Object Properties			? 🛛
Properties Events	bject A1_multipu	rrpose_plant/SFC_product01	*
Customized object Geometry Miscellaneous General Styles Links	Attribute tag type tagname Servername StructureType Version	Static Dyna Up SFC_product01 @@SFC_RTS/1 A1_multipurpose_pla @SFC_RTS Col % 05FC_RTS 7.0.1 SFC	

36. Next, we want to change the picture's background color to white. To do this, we right click on the picture's background and then select Properties. (→ Properties)

🛉 Graphics Designer - [A1_multipurpos				
↑ File Edit View Arrange Tools Window	Help			_ @ ×
		Q Q Q 2 2 4	4 24 🚰 🕮 😤 🗌	<u>k?</u>
Tr Arial 💙 12 🗸	₽₽₩₽			
Zoom 400 100 50 25 10 60.000 %	Cut Ctrl+X Copy Ctrl+C Duplicate Paste Ctrl+V Delete Del Customized object ► Group object ► Linking ► Configuration Dialog Properties			Style Palette  Line Style  Solid  Dash Dot Dash Dot Dash Dot Dash Dot Dot  Line Weight  Standard Objects  Standard Objects  Standard  Dynamic Wizard  Amount of the standard  Dynamic Wizard  Dynamic Wizard  Amount of the standard  Dynamic Wizard  Dynamic Wizard
0 1 2 3 4 5 6 7 8 9 1 Displays the propertie: Deutsch (Deutschland)		) - Layer0 1 X:277 Y:192	⊫ a Ţ d	

37. For each object as well as for the picture there are numerous properties that can be changed statically or dynamically (for example, interfaced with process variables). Here we are editing the background color.

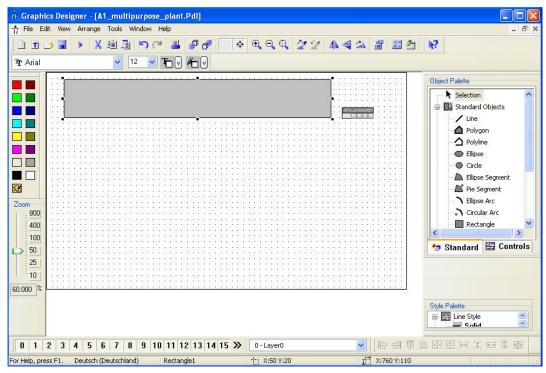
Object Properties				?
Properties Events	A1_multipurpose_	plant		•
<ul> <li>Picture Object</li> <li>Geometry</li> <li>Colors</li> <li>Styles</li> <li>Miscellaneous</li> <li>Background picture</li> <li>Effects</li> </ul>	Attribute Background Color Fill Pattern Color Grid Color	Static	Dyna Up I	

 $(\rightarrow \text{Properties} \rightarrow \text{Colors} \rightarrow \text{Background Color} \rightarrow \text{Edit})$ 

38. For our color we select white. ( $\rightarrow$  OK)

Color Selectio	n		
Colors	Palette		
			0
Red	-	255	
Green		255	
Blue		255	
	HTML code	: FFFFFF	
		ОК	Abbrechen

39. Next, we click in the Object Palette on Rectangle and then draw a large rectangle in our picture.



 $(\rightarrow \text{Object Palette} \rightarrow \text{Standard Objects} \rightarrow \text{Rectangle})$ 

40. Now we open the selection for the toolbars if the *Dynamic Wizard* is not yet displayed. (→ View→ Toolbars)

🕆 Graphics Designer - [A1_multipurpose_plant.Pdl]	
🌴 File Edit View Arrange Tools Window Help	- 8 ×
	244388
Full Screen	Object Palette
Grid Zoom Layers Language	Selection     Selection     Selection     With the selection     With the selection     With the selection     Polygon     Polygon
Update References F5	Polyline     Ellipse     Orcle
	Crue     Crue     Liipse Segment     Pie Segment
Zoom 800	- Ellipse Arc - Circular Arc
400	Rectangle
50 25 10	Standard 🖾 Controls
10 80.000 %	
	Style Palette
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 » 0-Layer0	표 표 프 프 커 틴 팬 바 ㅠ ㅌ 레 🖉
Configuration and ass Deutsch (Deutschland) Rectangle1 1: X:50 Y:20	1 X:760 Y:110

41. In the selection, we click on 'Dynamic-Wizard'. ( $\rightarrow$  Dynamic Wizard  $\rightarrow$  OK)

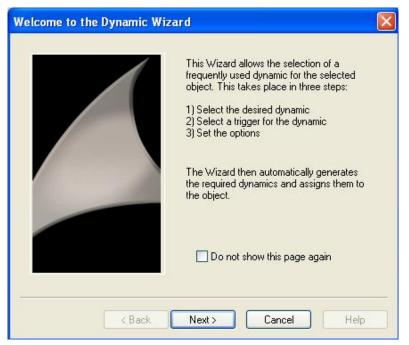
Toolbars	? 🛛
Toolbars:	ОК
Styles Standard	Cancel
<ul> <li>Alignment</li> <li>Colors</li> </ul>	Cancer
Font	
✓ Zoom ✓ Status	
✓ Layers ✓ Dynamic Wizard	Redo
Tags	

42. When the toolbar for the **Dynamic Wizard** is displayed, we select in 'Picture Functions' the 'Picture exchange in workspace'.

 $(\rightarrow$  Picture Functions  $\rightarrow$  Picture exchange in work space)

	×
Dynamic Wizard	
PosExport picture objects	
Poslmport picture objects	
BCOpen picture in process window	
Picture exchange in workspace	
Picture selection via measurement point Swap the customized objects connection "?"Update of the picture objects	
System Functions Standard Dynam Import Functions SFC Pict	ure Functions

43. We read the explanation and continue. ( $\rightarrow$  Next)



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

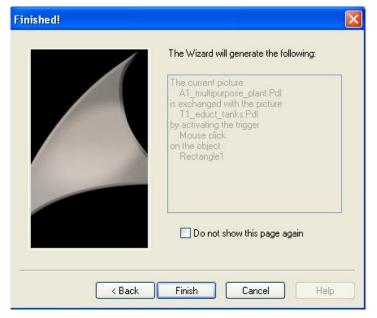
You selected a dynamic that requires a trigger.
Please select a trigger: Left mouse key Mouse click Right mouse key
Trigger options
Back Next > Cancel Help

45. Here we select the picture that is to be displayed after operating the button. ( $\rightarrow$   $\square$   $\rightarrow$  T1\_educt\_tanks.PdI  $\rightarrow$  OK  $\rightarrow$  Next)

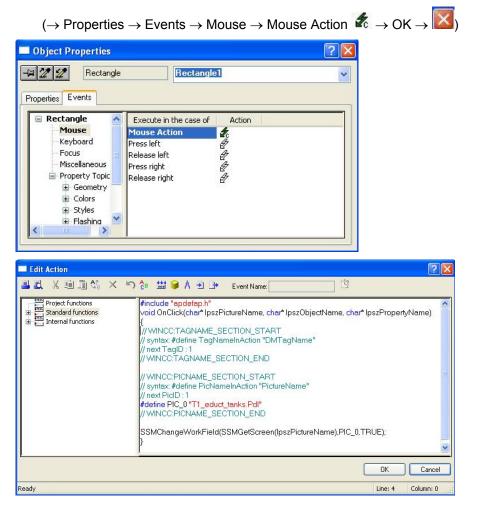
Set options	
	Your dynamic requires additional parameters: Please specify the new picture name :
	T1_educt_tanks.Pdl
2	
< Back	Next > Cancel Help

Picture Browser		? 🛛
Hierarchy:		
PC57V7	File Name	^
	*	7
	-%       @WarningTopfield.PDL         -%       @Welcome.PDL         -%       A1_multipurpose_plant.Pdl         -%       T1_educt_tanks.Pdl         -%       T2_reaction.Pdl         -%       T3_product_tanks.Pdl         -%       T4_insing.Pdl	
	OK Cancel	Help

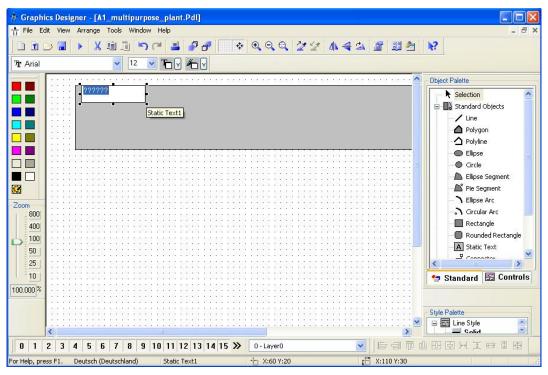
46. In the last window of the dialog, the complete selection is listed. ( $\rightarrow$  Finish)



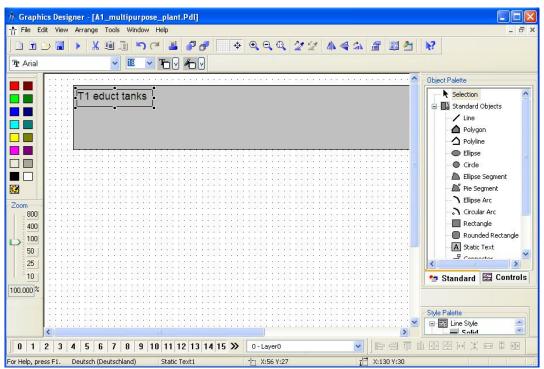
47. If you want to view the result, the mouse and the mouse action are located in Properties under 'Events'. By double clicking on the symbol 🐔, you can view the C-script that was generated.



48. Now we add the texts to the area for T1\_educt\_tanks. To this end, we select from the object palette the static text. (→ Static Text)



49. Enter the text and change the font and the color. Using the menu bar is the simplest way of doing this. (→ T1 educt\_tanks)

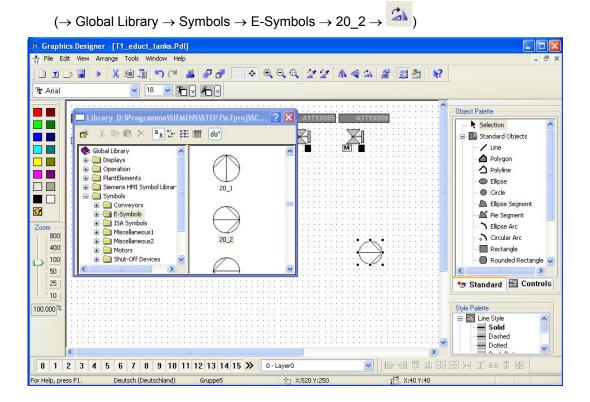


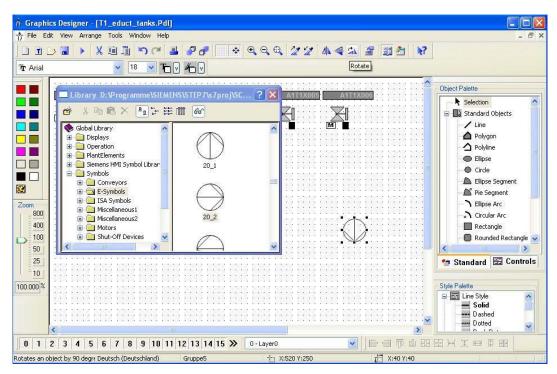
50. Now, complete the picture 'T1\_educt tanks' with the texts and buttons shown here for changing to T2, T3 and T4.

	esigner - [A1_multipurpose_plant.Pdl]	
of File Edit V	ew Arrange Tools Window Help	_ 8 ×
	▋ ▶ X ⅲ ⑲ ⌒ ■ ₽♂ 🕸 � ♀ ♀ ⁄ ⁄ ↓ ⊣ ☆ 🖀 ﷺ 🕺 😯	
∃nr Arial	18 ▼ 10 ダ 10 V	
	A1 multipurpose plant	· · · · · · · · · · · · · · · · · · ·
	T1 educt tanks         A1T1B001         A1T1B002         A1T1B003	
Zoom 800 400 100	T2 reaction A1T2R001 A1T2R002	
50 25 10 90.000 %	T3 product tanks A1T3B001 A1T3B002	
· · · · · · · · · · · · · · · · · · ·	T4 rinsing A1T4B001	
0 1 2	3 4 5 6 7 8 9 10 11 12 13 14 15 ≫ 0-Layer0 💌 📄 🖶 🗇 🕀 🚍 🖓	
For Help, press F1	. Deutsch (Deutschland) 17 X:914 Y:318 17 X:1024 Y:616	

🛉 Graph	ics Designer - [T1_educt_tanks.Pdl]			
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1				
Tr Arial			Display Library	
				Object Palette
	A1T1S001 A1T1S002 A1T1S003 A1T	1X004 A1T1X005 A1	T1X006	Selection
				Standard Objects
	······································			Polygon
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				Ellipse Segment
83	The Party series party party series party barry series	Reality Reality Statistic Reality Real		Pie Segment
Zoom				Ellipse Arc
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0 1	2 3 4 5 6 7 8 9 10 11 12 13 14 15 >>	0 - Layer0	<ul> <li>↓ ► ∃ 〒 ⊕ ⊞ [</li> </ul>	∃HI≡∎∎
Displays the	library. Deutsch (Deutschland)		I X:1024 Y:616	

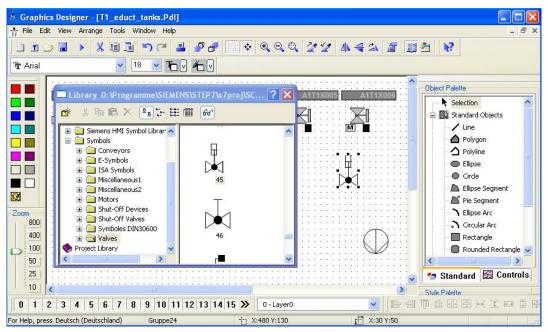
52. From the library, we now first drag a symbol for the pump into the work display and then rotate it in downward direction.



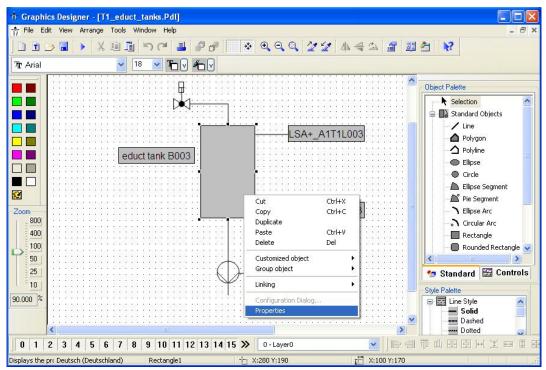


53. Then, we drag a symbol for the valve from the library into the work display.

 $(\rightarrow \text{Global Library} \rightarrow \text{Symbols} \rightarrow \text{Valves} \rightarrow 45)$ 



54. After we have inserted -as shown here- additional lines and text fields, we are positioning a rectangle to represent the tank, and select its properties. (→ Rectangle → Properties)



- 55. To change the color we deactivate the global color scheme.
  - $(\rightarrow \text{Properties} \rightarrow \text{Representation} \rightarrow \text{Global color scheme} \rightarrow \text{no})$

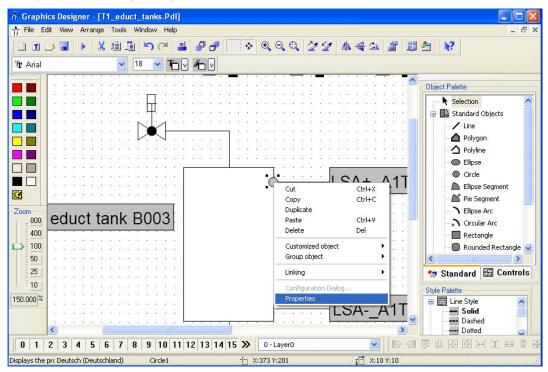
Object Properties			?
Properties Events	Rectangle1		*
<ul> <li>Rectangle</li> <li>Geometry</li> <li>Colors</li> <li>Styles</li> <li>Flashing</li> <li>Miscellaneous</li> <li>Filling</li> <li>Effects</li> </ul>	Attribute Global shadow Global color scheme Object transparency	St Dyna Yes XX No XX 0 XX	. Up   [ [ [
	<	IIII	

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

Attribute Border Color Border Background Color Background Color Fill Pattern Color	St Dyna	Up
	Border Color Border Background Color Background Color	Border Color

57. Now we are configuring a display of the level encoders. To this end, we are drawing -as shown here- a circle into our display. Then we select its properties.

 $(\rightarrow Circle \rightarrow Properties)$ 



58. To have the color displayed dynamically, we deactivate the global color scheme. ( $\rightarrow$  Properties  $\rightarrow$  Representation  $\rightarrow$  Global Color Scheme  $\rightarrow$  no)

Object Properties			? 🛛
Properties 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	St Dyna Yes T No T O T	.   Up   C C C
	<	.000	>

59. To implement a dynamic display, we select the background color with the right mouse key, and then the dynamic dialog.

 $(\rightarrow \text{Properties} \rightarrow \text{Colors} \rightarrow \text{Background Color} \rightarrow \text{Dynamic Dialog})$ 

Object Properties			? 🔀
Properties 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 Color Background Color Fill Pattern Color	St Dyna Up I	

60. In the following dialog, we first select the data type Bool, and then we change the color at Yes/TRUE to green. Finally, we select 'Tag' to make it dynamic. 

-

$(\rightarrow \text{Bool} \rightarrow \text{Yes/TRUE} \rightarrow$	$\rightarrow \square \rightarrow Tag)$
Dynamic value ranges	? 🛛
Event name Expression/Formula	Apply Cancel Check
Result of the Expression/Formula         Valid range       Bac         Yes / TRUE       Image (Marcology of the second sec	Tag Function Operator Operator Analog Boolean Bit Direct
<ul> <li>Do not evaluate tag status</li> <li>Tag status</li> <li>Quality I</li> </ul>	Code

61. At Tags, we select as data source 'STEP 7 Symbol Server' and there, at the symbols, Input I3.0 for 'level monitoring educt tank B003 Operating Point H'.

 $(\rightarrow \text{Data source} \rightarrow \text{STEP 7 Symbol Server} \rightarrow \text{A1.T1.A1T1L003.LSA+.SA+} / \text{I3.0} / \text{level}$ monitoring educt tank B003 Operating Point  $H \rightarrow OK$ )

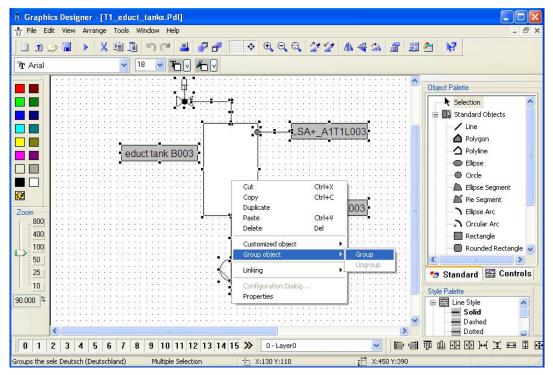
도 과 部 🎟 🕹 iter: 🚺 🔍	Data source: V STEP 7 Symbol ES Variables WinCC Tags	Server		
🖃 🞒 STEP 7 Symbol Server	Name	Data Type	Address	Comment
🖻 🛐 S7 Program(1), SCE_PCS7_F	A1.A1H001.HS+START	BOOL	I 0.0	Main power switch multipurp
🗉 👌 Symbols	a1.A1H002.HS+OFF	BOOL	I 0.1	emergency switch OFF
庄 📲 DB	a1.A1H003.HS+LOC	BOOL	I 0.2	local operation mode switch
	a1.T1.A1T1L001.LSA+.SA+	BOOL	I 1.0	level monitoring educt tank
	a1.T1.A1T1L001.LSASA-	BOOL	I 1.1	level monitoring educt tank
	A1.T1.A1T1L002.LSA+.SA+	BOOL	I 2.0	level monitoring educt tank
	a1.T1.A1T1L002.LSASA-	BOOL	I 2.1	level monitoring educt tank
	a1.T1.A1T1L003.LSA+.SA+	BOOL	I 3.0	level monitoring educt tank
	a1.T1.A1T1L003.LSASA-	BOOL	I 3.1	level monitoring educt tank
	A1.T1.A1T15001.SO+.O+	BOOL	I 1.2	pump outlet educt tank BOO
	A1.T1.A1T1S001.SV.C	BOOL	O 0.1	numn outlet educt tank BOD
<	<			

62. Then, we accept the settings in the dynamic dialog.

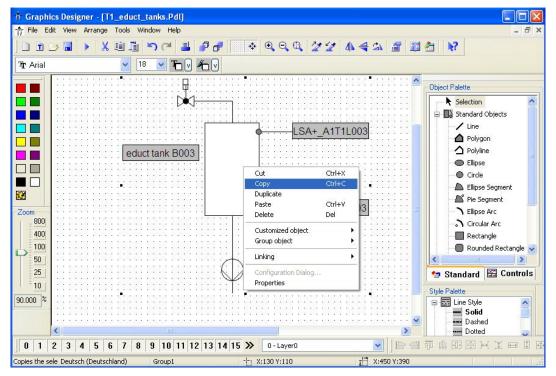
namic value ranges	?
Event name	Apply
Tag	Cance
Expression/Formula	Check
'S7\$Program(1)/A1\$T1\$A1T1L003\$LS/	
Valid range Bac Yes / TRUE No / FALSE	O Analog O Boolean O Bit O Direct
	Add
	Remove

63. The steps shown above are also performed for encoder 'A1.T1.A1T1L003.LSA+.SA- / I3.1 / level monitoring educt tank B003 Operating Point L'. Then, the elements shown here are highlighted together and grouped.

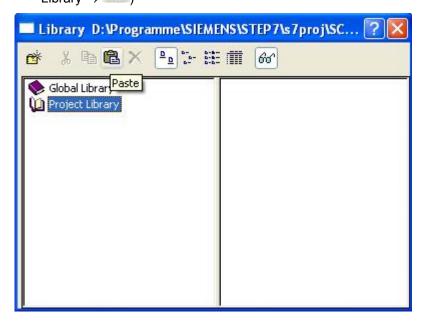
( $\rightarrow$  A1.T1.A1T1L003.LSA+.SA- / E3.1 / level monitoring educt tank B003 Operating Point L  $\rightarrow$  Group Object  $\rightarrow$  group)



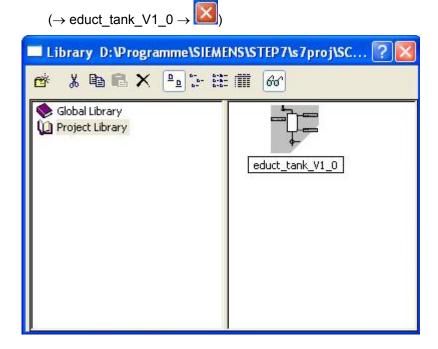
64. Then, we copy the group. ( $\rightarrow$  Copy)



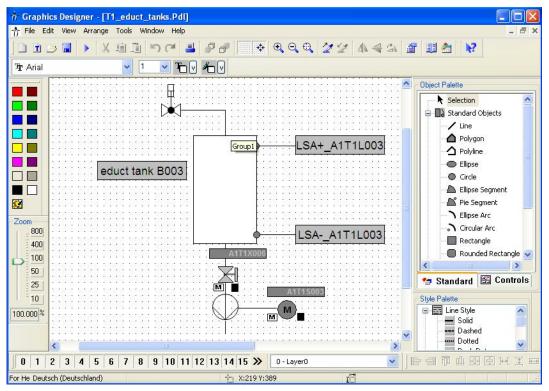
65. Next, we open the library and enter the group in the project library. ( $\rightarrow$   $\xrightarrow{\textcircled{}}$   $\rightarrow$  Project Library  $\rightarrow$   $\xrightarrow{\textcircled{}}$ )



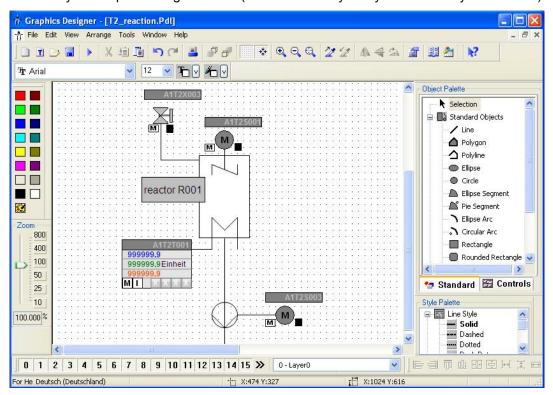
66. Our group in the library is then renamed 'educt\_tank\_V1\_0'.



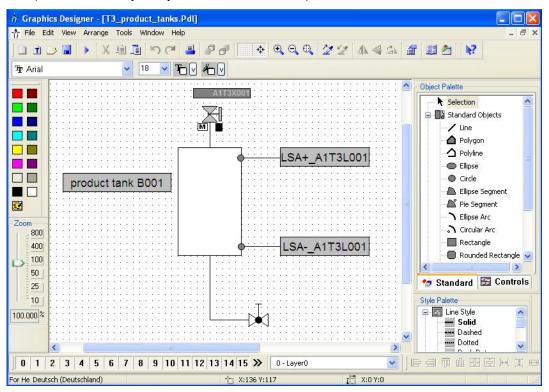
67. Now, in picture 'T1\_educt\_tanks.Pdl', the picture blocks (face plates) for valve 'A1T1X006' and pump 'A1T1S003' are positioned as shown here.



68. Picture 'T2\_reaction.Pdl' is set up just as picture 'T1\_educt\_tanks\_Pdl'. Here also, a group 'reaction\_V1\_0' is stored in the project library. The stirrer can be taken from the library as the picture is generated. (→ Global Library → Symbols → E-Symbols → 11)

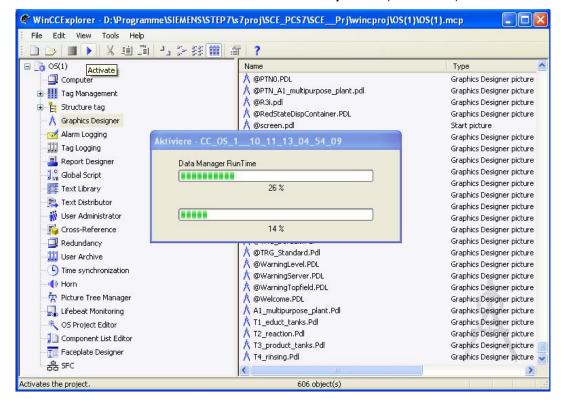


69. The picture 'T3\_product\_tanks.Pdl' is set up just as the picture'T1\_educt\_tanks.Pdl'. Here, the product tank is stored in the project library as the group 'product\_tanks\_V1\_0'. The valve can be taken from the library as the picture is generated.



 $(\rightarrow$  Global Library  $\rightarrow$  Symbols  $\rightarrow$  Valves  $\rightarrow$  46)

70. We now start the OS in runtime in the **WinCC Explorer**. ( $\rightarrow$  Activate)



71. To open a certain picture, we click on 'A1\_multipurpose\_plant' in the overview area, for example. A window appears with the pictures listed. (→ A1\_multipurpose\_plant)

11/12/10	23:58:45.995 0	A1_multipurpose_plant/T2_re	action Runtime error	2/12/11/2010 10:59:05 PM
11_multipurpose_plan	0 0 0 0		0 0 0	SIEMENS COST
SIEMENS	1_multipurpose_p 1_multipurpose_ T2_reaction T3_product_ta T4_rinsing	ar har har har har har har har har har h		
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72. In our picture 'A1 multipurpose\_plant', an overview of all areas and the block icon for the step sequence are displayed. By clicking on the block icon, we can open and operate the SFC\_Product01.

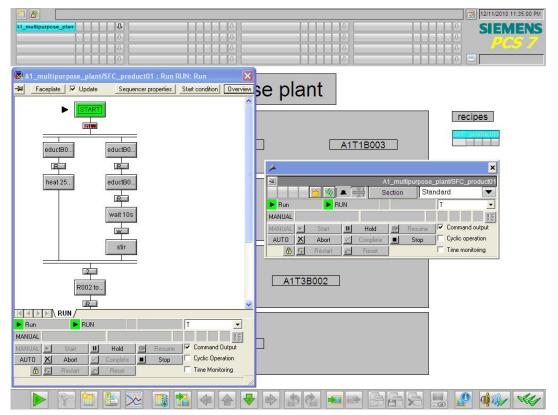
 $(\rightarrow SFC\_Product01)$ 

2 2 11/12/10	23:32:37.515 0	A1_multipurpose_plant/T2_r	eactior Runtime error	12/11/2010	11:33:34 PM
A1_multipurpose_plan	Û	0	0		IENS
	0	0	0		18 7
	Ð.	0	0		
	Û.	D	0		

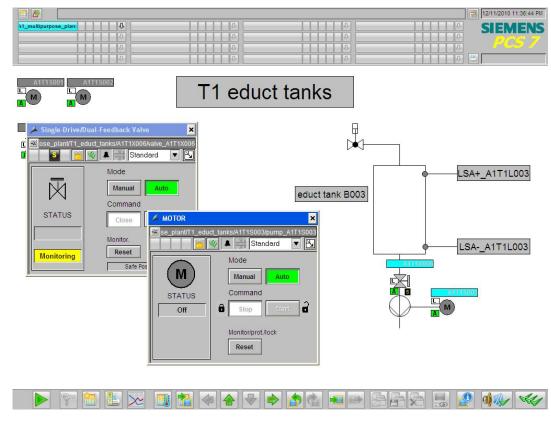
#### A1 multipurpose plant

				-		
T1 educt tanks					recip	es
A1T1B00	01	A1T1B002	1	A1T1B003	SFC_pro	oduct01
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					]	
T2 reaction						
	A1T2R001		A1T2R002	2		
T3 product tanks					]	
	A1T3B001	٦	A1T2D000			
	ATTSBOUT		A1T3B002			
					1	
T4 rinsing						
		A1T4B001	]			
	5 🖂 🔟 🛣				-	al 🐝 🦋

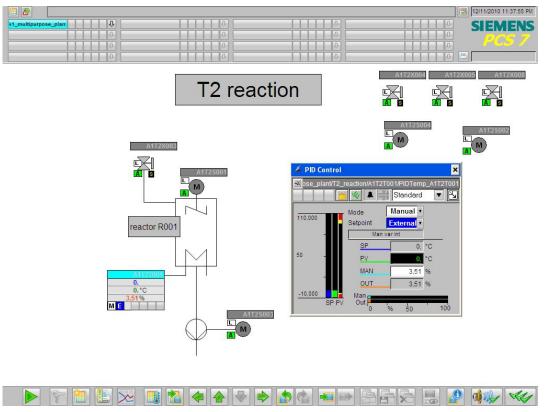
73. Here, the step sequence can be started, watched and operated, just as directly as in the SFC Editor.



74. Here, we can see the operating screen for 'T1\_educt tanks', with the face plates for 'Valve\_A1T1X006' and 'Pump\_A1T1S003'. Within the face plates, their operating modes can be selected and then operated in that mode.



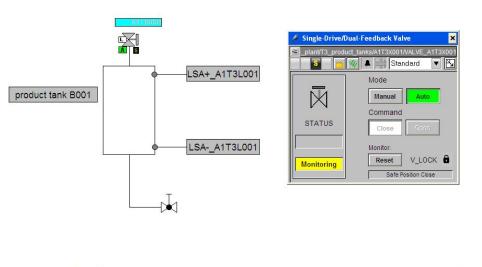
75. Here, the operating screen for 'T2\_Reaction' is displayed with the faceplate for 'PIDTemp\_A1T2T001', the PID controller for the temperature in the reactor. The controller parameters can be changed in this faceplate.



76. Here, the operating screen for 'T3\_product\_tanks' is displayed with the faceplate for 'Valve\_A1T3X001'.

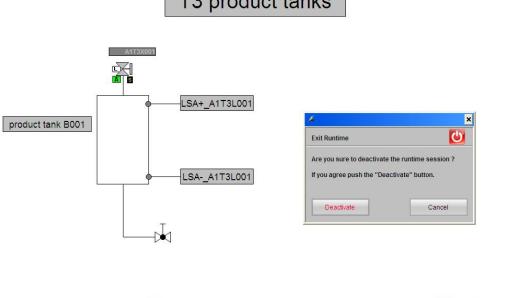
			2/11/2010 11:39:06 PM
1_multipurpose_plan		D.	8 SIEMENS
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0	0	0	
D. D	0	0	

T3 product tanks



77. To exit runtime, press the button

$(\rightarrow \textcircled{0} \rightarrow \text{Deactivate})$						
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		0	Q I	0.23 7		
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T3 product tanks

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#### **EXERCISES**

We are going to apply to the exercises what we learned in the theory chapters and the step by step instructions. To this end, we are utilizing the already existing multi-project in the step by step instructions (PCS7\_SCE\_0201\_R1009.zip) and expand it.

In the step by step instructions, again only one plant line was implemented. For that reason, the objective of the exercise is to implement the missing line. The tasks are designed to be an aid for generating all needed plant parts in the configuring tool *WinCC*.

#### TASKS

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

- Educt containers A1T1B001 and A1T1B002 are to be implemented in addition to container A1T1B003 in the picture 'T1\_educt\_tanks.pdl'. The pumps and valves needed for this are already available and can be used directly for the new plant parts. The containers should be taken from the library so that their representation does not differ from the container generated initially.
- 2. Reactor R002 is to be implemented in addition to Reactor R001 that already exists in the picture 'T2\_Reaction.pdl'. Also, the connection from the outlet of Reactor R002 to the inlet of Reactor R001 is to be displayed.