

SCE Training Curriculum

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

PA Module P03-01 SIMATIC PCS 7 – Advanced Layout of UIs

Cooperates with Education SIEMENS Automation

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>

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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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ADVANCED LAYOUT OF UIS

TRAINING OBJECTIVE

After working through this module, the students have additional knowledge regarding the design of the user interface of an operator station. They are able to make additional information available on the detail level. To this end, they use adapted message lists and trend curves. The students are able to combine created composites into a user defined object and redesign existing objects as user defined objects. These objects can then be made available for reuse.

THEORY IN BRIEF

In this chapter, some aspects of OS engineering are considered in greater depth. While in chapter P02-01 automatic generation of process pictures was primarily discussed, now supplementary techniques for designing process control are described.

The flowcharts (refer to P02-01) are usually arranged in the following hierarchical levels:

- Plant display
- Area display
- Plant section/group display
- Detail display

This classification can result from the plant hierarchy. While the upper levels aim for a good overview of the entire plant or corresponding areas, the plant section display and the detail display are to provide considerably more information about the area under consideration to make situation-conforming settings of parameters or fault diagnosis possible.

In addition to detailed information about the current state of the areas under consideration, the representation of process values in curves is particularly helpful to analyzing deviations. In curves, the time characteristics of a process value are represented. With one glance, the operator can immediately read off the following information:

- The time when striking changes occurred in the course
- Process values at the time mentioned above
- Gradients for certain points in time
- Dependencies between process values at simultaneous display
- Extreme values (when and how large)
- Fluctuation range
- Set point deviations
- Frequencies

Curve displays provide the operator with an expanded basis for decisions regarding control action. If a process value is outside the permissible range, based on the curve the user is informed of process value development in the most recent past and can detect whether the value continues to change for the worse or is improving.

THEORY

HIERARCHY OF FLOWCHARTS

In chapter P02-01 the objectives of process control as well as of basic design concepts and techniques for OCM interfaces (operator control and monitoring interfaces) were described.

Chapter P01-03 introduced the physical model of a system consisting of a plant, a plant section, equipment module and an individual control unit. Analogously, a hierarchy of flowcharts exists in process visualization that is arranged as follows, according to [1]:

- Plant diagram
- Area diagram
- Plant section/group diagram
- Detail display

The hierarchy of the flowchart facilitates orientation and specific display selection. The uppermost levels Plant display and Area display provide an overview and are usually represented schematically. In small plants, the plant display corresponds to the area display (refer to Figure 1). In the plant display, it has to be possible to select each area directly. In the area display, the plant sections are displayed in a manner that their state can be recognized and the plant section can be selected and operated. The plant section and group display reflect functional relationships; typical units, final control units and control systems can be operated. Detail displays are of great importance to parameter assignment, commissioning and error search if there are plant faults. In detail displays, individual devices and units are represented and by means of effective lines, the functional relationships can be visualized. For example, the signal flow of a control loop can be tracked. [1].



Figure 1: Hierarchy of flowcharts

CURVES

Curves are used for process control during intended operation, or for diagnosing faults [2]. They supplement the display with flow diagrams, particularly because they indicate the dependence of process values on time.

Related displays are: the display of a process value depending on the path, on other process variables, and even of several reference variables that are not described here, however.

The Purpose of Curves

Curves are displayed to show courses. By selecting different time horizons, different tasks can be implemented. Three variants exist in reference to the time the operator has the curve displayed.

The curve shows the past without the present. Such a curve is called history and is used for analysis. This can refer to a fault analysis but also to an analysis to optimize process control.

The curve shows the present with the recent past. This type is called pre-history. It can be used to display a trend. It is the most frequently used type of display regarding process control. From the course, the operator is able to read off qualitative values such as rising, falling, or steady and quantitative values such as the process value at a certain time, or the difference regarding a setpoint.

The curve shows the most recent past, the present and the future, and is called prediction display (refer to Figure 2). It is used to predict a process value and allows the user to intervene before the event occurs. To represent the future, the possible value course has to be calculated in advance.



Figure 2: Prediction display according to [2]

In general, the following values can be determined quite well through curves:

- Points in time where striking changes occurred in the course
- Process values at the points in time indicated before
- Gradients at certain points in time
- Dependencies between process values at simultaneous displays
- Extreme values (when and how large)
- Fluctuation ranges
- Deviations from the setpoint
- Frequencies

This variety of characteristics that can be read off shows the importance of curve displays. While the current process values and extreme values that occurred can be represented otherwise -for example, with analog or digital displays- the display of the other characteristics in such a compressed and immediately understandable form is difficult to conceive [3].

Acquisition and Storage of Curve Values

For the displayed course to reflect the actual course, the sampling rate of the process value has to correspond at least to twice the change frequency of the process value. In most cases, this requirement can be met with cyclical acquisition every 1s [2].

In PCS 7, the sampling rate corresponds to the acquisition cycle of a process value. As long as a process value is not archive, only the pre-history of the process value can be displayed. By archiving a process value (refer to chapter P02-03) the history can be displayed also, since archive variables are resorted to.

When curves are displayed, the pre-history differs from the history as shown in Table 1.

	Prehistory	History
Position of the time span shown in the curve field	Always relative to the present	Through an absolute point in time and a selected time span or through two absolute points in time
Labeling of the time axis	Relative time indications; if needed, can be switched to absolute time indication	Absolute time indications can be switched to time indications relative to a defined point in time of an event
Updates	Curve is updated during the display whereby all curve points are shifted	Curve does not change
Value axis	The value axis is usually located at the point in time of the present (at the right margin of the display)	The value axis is located on the left margin of the display

Table 1: Visible Differences between Prehistory and History [2]

Designing Curve Displays

In [2], guidelines for designing curve displays are provided. PCS 7 implements the basic design details by default; for that reason, they are described here only briefly. There are design rules, however, that you can implement yourself by means of the settings at OS engineering. To do this in a specific way, a few details are introduced here.

The curve display is displayed in the working area of the display area (refer to P02-01). It consists of the title field, the curve labeling field, and the curve field. The title field should contain the information for the unambiguous assignment to the process environment. In the curve labeling field, it should be possible to read off the relationship of displayed the curve and the process value. The curve display field is used to display the curve and should be as large as possible. To implement the curve display field, the following information is provided.

To facilitate reading off the values, grid lines have to be available. The value axis in this case should display several lines as an extension of the scale marks, and the time axis several lines according to the current time grid. The number of grid lines should be low and optically remain in the background. To this end, they should not be shown in color or blue. Reading rulers can provide additional support.

The curves should be displayed colored as continuous lines or as a series of dots. Color coding can be selected as required. The number of curves for each curve display field should be limited to six. The colors of the curves should be easily distinguishable from each other.

To implement the curve course, the following directions are recommended:

- From right to left: more recent values to the right, older values to the left
- From top to bottom: more recent values on top, older values on the bottom

The deciding factor in this case is whether a display time span that is as large as possible (from left to right) or a value resolution that is as high as possible (from top to bottom) is needed.

When curves with a prehistory are displayed, the curve course is updated; the entire curve shifts in the direction of the past (refer to Figure 2). If there is a shift with each new entry, the entire curve display field can be used to display the prehistory, and the operator can follow the display well since the curve is shifted only a little. If needed, it should be possible to stop the update.

For labeling the value axis, 1, 2 and 5 should be used for scale marks as well as their decade multiple. The value axis can be scaled in units or in percent. Table 1 shows where the value axis should be located. Also, a display with two value axes can be useful; in this case, the percent axis for all curves is displayed to the left, and the display of the values of a curve in units to the right. The time axis should always be labeled as shown in Table 1.

To display time spans, [2] offers the time spans and scale marks recommended in Table 2. It was taken into account here that if there is a change to another display time span, the same point in time can be located again.

Primary Task	Preassigned Display Time Spans	Updating Cycle (only for prehistory)	Scale Mark
Commissioning	5 min	1 s	1 min
Process Control	15 min	1 s	5 min
	30 min	2 s	5 min
	2 h	8 s	30 min
	8 h	32 s	1 h
	24 h	96 s	4 h
	4 days	384 s	12 h
Analysis	7 days	-	1 day
	30 days	-	7 days
	90 days	-	15 days
	360 days	-	90 days

Table 2. Recommended Display Time Spans [2	Table 2:	Recommended	Display	Time S	pans	[2]
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ACTIVEX CONTROLS

Curves are configured in OS engineering of PCS 7 either by setting up curve groups (Chapter P02-03) or by using configurable ActiveX Controls. PCS 7 provides ActiveX Controls for alarms, curves, and tables. Curves can be used to display time characteristics (Online Trend Control) and also to display dependencies between process values (Function Trend Control).

In the Online Trend Control, two different sources exist for displaying a curve. The first source is the process value that is buffered while the ActiveX Control is active. With this source, the trend can be displayed during monitoring. Here it is important that when ActiveX Control is closed, the values can no longer be called. If the second source is used, the data is taken from the archive (refer to P02-03). The process values taken from there can be displayed again and again. Depending on the time span selected, past data (history) can be called as well as the most recent data (prehistory). These values can be called again as long as they are in the short term archive. The size of the short term archive depends on the configuration as described in chapter P02-03.

Additional ActiveX Controls are the display of process values in tables (Online Table Control) or of the alarms in alarm lists (Alarm Control). Alarm Control receives its data always from the archive while the table, analogous to the Online Trend Control, has different sources.

ActiveX Controls are quite suitable for designing detail displays, since they provide additional information specifically for a detail area. To this end, specific process values for the corresponding detail display or filters for alarm lists can be selected and preconfigured; for example, by means of the attribute Origin. Figure 3 sketches a possibility for designing the detail display.



Figure 3: Layout of a detail display

USER DEFINED OBJECTS

A user defined object (UDO for short) is an object that can be dynamical and consists of individual objects. At OS Engineering, we identify the properties that can be changed and select them for the user defined object. Thus, only the most important properties of all individual objects are visible and provide a good overview of the properties. In addition, it is possible to specify some properties as unalterable for all instances, and combining each individual object for each instance is dispensed with also.

On the other hand, there is the increased effort for the careful selection of the properties; however, it amortizes quickly through multiple use. User defined objects that are to be used multiple times are stored in the library.

Also, alterability is facilitated since, for example, a block name or a CFC name has to be changed only at the user defined object and not at all individual objects.

The individual instances can be changed or supplemented with additional objects any time. If C-Actions are used for dynamical actions, this is done in the case of user defined objects in a script, and not in many individual objects. This increases the performance of visualization.

LITERATURE

- VDI/VDE 3699, sheet 3 (Ed. 2014-01): Process control using display screens Mimics.
- [2] VDI/VDE 3699, sheet 4 (Ed. 2014-01): Process control using display screens Curves.
- [3] Kindsmüller, M. C.: Trend-Literacy, Shaker Verlag 2006.
- [4] SIEMENS (2015): Configuration Manual Operator Station (V8.1). A5E32785103-AC. (http://support.automation.siemens.com/WW/view/en/90682677)

STEP BY STEP INSTRUCTIONS

TASK

In this task, the display structure will be expanded by another level in order to show more detail for the individual tanks and reactors.

In the example, create in the display for reactor R001 a detail view with a bar display for the reactor level, an online trend display and a message window for displaying the alarms associated with Reactor R001.

Then, for better reusability (for example, for Reactor 002) change the bar display into a user defined object.

TRAINING OBJECTIVE

In this chapter, the student learns the following:

- To set up an ActiveX Control for displaying alarms
- To filter the display of alarms matching the hierarchy
- To insert and parameterize an ActiveX Control of the type 'Online Trend' to display archive variables
- To create from a group of objects a user defined object
- Parameterizing and using user defined objects

These instructions are based on the project 'PCS7_SCE_0203_Ueb_R1504_en.zip'.

PROGRAMMING

1. First, insert a picture in the folder 'Reactor R001' and name it 'Reactor R001'. (\rightarrow Reactor R001 \rightarrow Insert New Object \rightarrow Picture \rightarrow Reactor_R001)



2. Then, adapt the settings of the plant hierarchy to the expansion. (\rightarrow Options \rightarrow Plant Hierarchy \rightarrow Settings)

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3. The number of hierarchy levels is retained. However, at the third level a checkmark has to be placed at 'Included in HID'; otherwise, there may be problems during simulation. (\rightarrow Included in HID \rightarrow OK \rightarrow Yes)

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4. Then, the block icons have to be generated in the new picture.

 $(\rightarrow \text{Reactor R001} \rightarrow \text{Plant Hierarchy} \rightarrow \text{Create/Update Block Icons})$

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5. Have the object name created from the chart names and include, as previously, a lower level hierarchy level. (\rightarrow Object name: Chart \rightarrow Lower hierarchy levels included: $1 \rightarrow OK$)

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7. Now, once more activate in the 'Plant View' Compile and Download Objects.

 $(\rightarrow$ SCE_PCS7_Prj \rightarrow PLC \rightarrow Compile and Download Objects)

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 Prior to starting the compilation, make sure that S7-PLCSIM is started and the CPU is in the 'STOP' mode. Regarding the charts, everything is compiled and downloaded. Regarding the OS, compile the entire OS (a general reset is not necessary) as recommended in Step 3. (→ Start → Close)



9. Now, in the 'Component view', start WinCC by highlighting and opening 'OS(1)'. $(\rightarrow OS(1) \rightarrow Open Object)$

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Opens selected object.	Generate server data				1.

10. In the folder 'Graphics Designer' open the picture 'Reactor_R001.Pdl'. (→ Graphics Designer → Reactor_R001.Pdl)



11. Now, in the Object Properties, first change the geometry corresponding to your resolution (for example, 1024x616 at 1024X768) and the background colors to 'white'. For the color setting to be accepted, the static in the global color scheme has to be switched to 'No'. (→ Object Properties → Colors → Background Color → white → Effects → Global Color Scheme → No)



12. Next, from the project library, drag in the face plate for reactor R001. (\rightarrow View \rightarrow Library \rightarrow Project Library \rightarrow Reactor_V1_0)

Graphics Designer - reactor_R001.pdl				
File Edit View Arrange Tools Window	v Help			
E 🖸 😭 🚺 Toolbars	 Alignment Palette 	k? : • • • • • • •	• •	<u>_</u> • <u>></u> • <u>A</u> •
reactor R00 Full Screen	 Layer Palette 	비 ㅠ ㅛ 츠 아 迪 羊 曰 티 母 : ■ ■ ■		
reactor B(Color Palette 		▼ Standard	▼ ₽ X
Grid	 Object Palette 		Selec	tion
200m	✓ Font Palette		Stand	dard Objects
	Standard Palette	3 A1T2X001 A1T2X0		ine
: -12345,	✓ Status Bar		:: [] [] [] [] [] [] [] [] [] [] [] [] []	olygon
-12345, Update references F5	Zoom Palette		- <u>_</u> P	olyline
	Output Window			inpse
	🔓 Librany		E	llipse Segment
	 Controls 			ie Segment
	Dynamic Wizard			llipse Arc 📃
	Object properties			ectangle
	 Process Pictures 		R	ounded Rectangle
	Standard Library	-	×	tic Text
······································	Tage Children I I I I I I I I I I I I I I I I I I I			nnector
		3 ∨ -5 °a. \$\$5 1881 000.		Objects plication Window
	Rese Global Libra	ary Name Size	Last Change	ture Window
		ary 🔂 educt_tank_V1_0 16384	18.01.13 11:03	ntrol
		product_tank_V1_0 12739	18.01.13 11:05	Eobject
		reactor_V1_0 12540	18.01.13 10:53	Field
		13		•
				🔛 St 🕅 Pr
0 1 2 3 4 5 6 7 8 9 10 1	1 12 13			
Displays the library.				I X:1024 Y
	Dbject Prope	rties 🧠 Tags 📃 Output Window 🕒 Librar	y Wizard	

13. In the picture 'Reactor_R001.Pdl', ungroup the group with the reactor in the center. $(\rightarrow \text{Group} \rightarrow \text{Ungroup})$



14. Next, select in the object palette Smart objects and then 'Bar'. Then position the bar over the reactor tank.





15. Now, in the configuration dialog, open the tag selection and as data source the ES variables; then open the hierarchy 'A1_multipurpose_plant/T2_reaction/reactor R001/ A1T2L001/A1T2L001/Monitor...'. On the right side, select the tag 'PV#Value'.

$(\rightarrow \text{ES Variables} \rightarrow \text{A1}_multipurpose)$	_plant/T2	_reaction/reactor	R001/A1T2L001/
Monitor_A1T2L001/PV#Value \rightarrow OK)			

Bar Configuration		४ <mark>×</mark>					
Tag Update Limits	2 s	Tags - Project: C:\Program Files\Siemens\S'	TEP7\S7Proj ≅ S V ₩	\PCS7_S_1\PCS7_Prj\wincp TEP 7 Symbol Server Vanables inCC Tags	roj\OS(1)\OS	i(1).mcp	<u>ि ×</u>
Maximum value Minimum value	-5	ES Variables G AI_multipurpose_plant G T1_educt_tanks G T2_expertise	Î	Name OS_PermOut OnOp	Type Uns Bin	Comment Operator Permissio 1=On Mode: On M	
Bar Graph Alignm	nent	internetion internetion R001 internetion A1T2H001 internetion A1T2H002	н	OosAct#ST OosAct#Value OosOp	Uns Bin Bin	Signal Status Value 1=Oos Mode: Oos	Ξ
lop (◯ left ◯ right	⊕ A1T2H003 ⊕-⊡ A1T2H007 ⊕-⊡ A1T2H007 ⊕-⊡ A1T2H008		OpSt_Out PV#ST PV#Value PV.AH_Lim	Uns Uns 32 32	Enabled operator st Signal Status Value PV - High Alarm Li	
	ОК	() () () () () () () () () () () () () (PV_AL_Lim PV_Hyst PV_OpScale#High PV_OpScale#Low	32 32 32 32	PV - Low Alarm Limit PV - Alarm Hysteres High Value Low Value	-
			•			OK Cancel	Help

- 16. Next, select the update, the maximum and the minimum value.
 - $(\rightarrow$ Update: Upon change \rightarrow Maximum value: 1000 \rightarrow Minimum value: 0 \rightarrow OK)

Bar Configuration	8 X
Tag	1T2L001.FV#Value
Update	Upon change 👻
Limits	
Maximum value	1000
Minimum value	0
Bar Graph Aligr	nment
top	🔘 left
🔘 bottom	🔘 right
	OK Cancel

 Now, the display is positioned exactly over the reactor and some levels are moved to the back (Arrange → Within the level → One to back) for the stirrer, the heater and the labeling to be visible again; then open the Properties for additional adaptations. (→ Properties)



18. In the 'Properties', change in 'Miscellaneous' the 'Tooltip Text' in 'A1T2L001'.

 $(\rightarrow \text{Properties} \rightarrow \text{Miscellaneous} \rightarrow \text{Tooltip Text} \rightarrow \text{A1T2L001})$

Object Properties								×
Properties Events								
Geometry	*	Attribute		Static	Dynamic	Update	Indir.	<u>^</u>
Colors		Operator-Control Enable		Yes	Q			
Styles		Authorization		<no access="" protection<="" td=""><td>Q</td><td></td><td></td><td>=</td></no>	Q			=
Font		Display		Yes	Q			
Flashing	Ξ	Tooltip Text		A1T2L001	Q			
Miscellaneous		Visualize Tag Status		Yes	Q			
Limits		Change Color		Total	Q			
Effects		Maximum Value		1000,000000	0			Ŧ
	Ŧ	·	_				•	
Dbject Properties	i Tag	gs 🔲 Output Window 🕒 Library 🤻 Dynamic Wizar	rd					

19. Then, select 'Axis'. Here, set the attribute 'Scale' to 'No'.

Object Properties							×
Properties Events							
Geometry	*	Attribute		Static	Dynamic	Update	Indir. 🔺
Colors		Scale		No	Q		
Styles		Alignment		Right	Q		
Font		Large Tick Marks		Normal	Q		
Flashing	Ξ	Label Each		1	-		
Miscellaneous		Only Large Tick Marks		No	Q		
Axis		Length of Large Tick Marks		7	ý.		
Effects		Exponent Display		No	Ū.		
Ellects	Ŧ	•	111				•
Cbject Properties	🛄 Ta	gs 📃 Output Window 💾 Library 🤻 Dynam	ic Wizard	-			

20. In 'Limits', specify the known low and high limit, their monitoring and the color of the bars if the limit is exceeded. (→ Properties → Bar → Limits → Low/high limit: refer to display/Monitoring: Yes → ○

ar	Attribute	Static	Dynamic	Update	Indir.
Geometry	Limit Marker	Display	Q		
Colors	Monitoring AL	Yes	Ŷ		
Styles	Limit AL	50,000000	Ŷ.		
Font	Bar Color AL		Ū.		
Flashing	Type AL	Absolute	ġ.		
Miscellaneous	Monitoring WL	Yes	Ŷ		
Limite	Limit WL	150,000000	ŷ		
Effects	Bar Color WL		Q		
Effects	Type WL	Absolute	- Q		
	Monitoring TL	No	Ŷ		
	Low limit TL	0,000000e+000	Q		
	Bar Color TL		Q		
	Type TL	Absolute	Q		
	Monitoring RL4	No	Q		
	Limit RL4	0,000000e+000	Ŷ		
	Bar Color RL4		ΠÔ		
	Type RL4	Absolute	Ū.		
	Monitoring RL5	No	Q		
	Limit RL5	0,000000e+000	Q		
	Bar Color RL5		¬ ₽		
	Type RL5	Absolute	ġ.		
	Monitoring AH	Yes	Ŷ		
	Limit AH	1000,000000	Ŷ		
	Bar Color AH		Q I		
	Type AH	Absolute	Q		
	Monitoring WH	Yes	Q		
	Limit WH	900,000000	Q		
	Bar Color WH		Q		
	Type WH	Absolute	Q		
	··· · · <u>-</u> ··				

21. In the object palette, under the tab 'Control' select the WinCC AlarmControl. Then draw a rectangle with the mouse.



 $(\rightarrow \text{Object palette} \rightarrow \text{Controls} \rightarrow \text{WinCC AlarmControl})$

22. Next, in the property dialog that is displayed automatically only change the text for Window title to 'Alarmlist reactor A1T2R001'.





23. In the tab 'Message lists' select -as shown here- the 'Message blocks'. Make the >> > selection by adding message blocks with the buttons ; message blocks << < are removed with the buttons . To ensure that only the alarms that match the picture are displayed, select 'Fixed selection'. >> > < << $(\rightarrow Message lists \rightarrow$ \rightarrow Fixed selection: Edit) 2 X WinCC AlarmControl Properties

Hit list	Operator input	messages	Toolbar	Status Bar	Online configu	ration Export
General	Parameter	Effects	Selection	Font	Message blocks	Message lists
Availab Messa Ackno Numbe	e message bloo ge Duration wledged rr	:ks:	•	Selected me Date Time Status	ssage blocks:	
Class Type Comme Info Loop ir Priority Area Batch Operat Free 1	ent n Alarm name ion		Ш	Source Event		
Sortin	g Edit		Selections Edit		<< U Fixed select Ed	p Down ion it
				OK	Cancel	Apply

24. In the screen display below select as 'Criterion' the source, for Operand 'contains' and for Setting the text 'R001' as shown.

Criterion	Operand	Setting	
Source	contains	R001	

 $(\rightarrow$ Criterion: Source \rightarrow Operand: contains \rightarrow Setting: R001 \rightarrow OK)

- 25. Now, under 'Online configuration', select that the setting changes are not retained during runtime.
 - $(\rightarrow \text{Online configuration} \rightarrow \text{Online configuration}: \text{Do not retain} \rightarrow \text{OK})$

General	Parameter	Effects	Selection	Font	Message blocks	Messa	age list	
Hit list	Operator input	messages	Toolbar	Status Bar	Online configur	ration	Ехро	
_ Online	e configuration							
0	Do not retain		01	nline configu	rations are not retai	ned. Th	еу	
() F	Retain during ru	ntime	ar	e lost at the r	next picture change	э.		
O F	Retain permane	nently						
Opera	ator authorizatio	n for online	configuration	ı				
Kno	access protect	tion>						
Online	e configuration	at next pictu	ire change					
0	Discard		-					
- I - O F	Retain							
O F	Retain Reset							
F	Retain Reset							
F C	Retain Reset							
F	Retain Reset							
F	Retain Reset							
F	Retain Reset							
F	Retain Reset							
F O	Retain							
	Retain Reset							
F C	Reset							
F	Reset							
F F	Reset							

26. In runtime of the PCS7 project, the alarms are now displayed in the picture 'Reactor_R001'. Using the icon , the configuration can be changed; however, it is lost after a picture change.

📒 🛃	21/05/15 17:17:57.252 0	A1_multipurpose_plant/T2_react	ior Monitoring level A1T2L001 PV - Alarm empty 🔄 5/21/2015 3:20:41 PM
	A1_multipurpose_plant	Û	
		Reactor A1	T2R001



27. Next, select from the object palette, under the tab 'Control', the WinCC OnlineTrendControl. Then, draw a rectangle with the mouse to position the window for the curve view. (→ Object palette → Controls → WinCC OnlineTrendControl)



- 28. In the configuration dialog that is displayed automatically, in 'Trends' first change the object name of 'Trend 1' to 'PID Setpoint'.
 - $(\rightarrow \text{Trends} \rightarrow \text{Object name} \rightarrow \text{'PID} \text{Setpoint'})$

nCC Online	TrendCo	ontrol Properties		_		8 ×
Toolbar		Status Bar		Online conf	iguration	Export
Trends	Gener	ral Font	Tre	end window	Time axes	Value axes
Trends:				Object name		
V PID -	Setpoint			PID - Setpo	int	
				Trend windo	w:	
				Trend windo	ow 1	-
				Time axis:		
				Time axis 1		•
				Value axis:		
				Value axis 1	l	-
				Label:		
				SP		
New	Remo	ve Up D	lown			

29. Next, link the trend to an archive tag by clicking on the button and then select the setpoint SP#Value of A1T2T001.

$(\rightarrow Tag name \rightarrow {}^{\frown}\!$	\rightarrow SystemArchive \rightarrow ControlA1T2	2T001.SP#Value)
WinCC OnlineTrend	Control Properties	? X

	aalbar	Status Day		Opling ogsfir	unting		Event]	
Tren	ds Ge	neral Font	Tre	online coning	Time	axes	Value av	res	
_						0.00	10.00 0		
Iren	ds: PID - Setooi	int		PID - Setpoir	nt			- II	
	PID - Setpoi	inc.		Trand window				- 11	
				Trend window	. 1			.	
				Time avia	v 1			-	
				Time axis 1				.	
				Value axie					
				Value axis 1				-	
				Label:					
				SP				- II	
								- 11	
	lew Rei	move Up	Down						
Da	ta connectio	n		Tanana					
	ata source:			lag name:					
	L - Archive ta	ags	•						
Eff	ects						0	5	
D D	rend type:			Trend color:					
1	L - Connect o	dots linearly	•		2	Filled			
Li	ne style:			Line weight:					
) - Solid		•	1			\sim		
D	ot type:			Dot width:			×		
2	2 - Squares		•	3		ľ			
P	ot color:	Fill color:							
				Extended		Limit v	alues		
								-	
				UK	L	ancei	Арр	ny	
Archives/Tags		-			-	-		-	
			-		-	1997	and the second		
emArchive\									
SCLIENT3	Tag name					Comm	Tag type	Acquisi	Last ch
npressed_Archive	*				2	7 * 3	* T	* 5	7 *
temArchive	A1_multipu	rpose_plant/T2_reacti	on/A1T2L001	/Monitor_A1T2L001	.PV#Value	2	Analog	Cyclic	2013-1-
	A1_multipu	rpose_plant/T2_reacti rpose_plant/T2_reacti	on/A1T2L002 on/A1T2T001	'Monitor_A1T2L002 /Control_A1T2T001	.PV#Value .ER#Value	2	Analog Analog	Cyclic Cyclic	2013-1
	A1_multipu	rpose_plant/T2_reacti	on/A1T2T001	/Control_A1T2T001	.MV#Valu	e	Analog	Cyclic	2013-1-
	A1_multipu	rpose_plant/T2_reacti rpose_plant/T2_reacti	on/A1T2T001	/Control_A1T2T001.	.PV#Value		Analog Analog	Cyclic Cyclic-	2013-1
	A1_multipu	rpose_plant/T2_reacti	ion/A1T2T002	/Control_A1T2T002	.ER#Value		Analog	Cyclic	2013-1
	A1_multipu	rpose_plant/T2_reacti	on/A1T2T002	/Control_A1T2T002	MV#Valu	e	Analog	Cyclic	2013-1
	🖂 A1_multipu 🔀 A1_multipu	rpose_plant/12_reacti rpose_plant/T2_reacti	ion/A1T2T002	/Control_A1T2T002	.Fv#value .SP#Value		Analog	Cyclic	2013-1
		-							

30. Now add another trend and apply the settings shown.

 $(\rightarrow \text{Trends} \rightarrow \text{New} \rightarrow \text{Object name: 'PID} - \text{Process value'} \rightarrow \text{Name: PV} \rightarrow \text{Tag name: Control_A1T2T001.PV#Value} \rightarrow \text{Limit values} \rightarrow \text{High limit values: 60} \rightarrow \text{Apply})$

T		Charless D		O-E-	the second s	
l oolbar Trondo		Status Bar		Online config	guration	Export
Trends	General	Font	In	end window	lime axes	Value axe
Trends:				Object name:		
V PID - Se	etpoint		_	PID - Proces	ss value	
📝 PID - Pr	ocess value	2		Trend window	v:	
				Trend windo	w 1	•
				Time axis:		
				Time axis 1		•
				Value axis:		
				Value axis 1		•
				Label:		
				PV		
New	Remove		own			
-Data conn	ection]			
Data sour	ce:			Tag name:		
1 - Archi	ve taos		-	SystemArch	ive\A1 multip	urpo 📴 🔗
Effects						
Trend typ)e:			Trend color:		
1 - Conn	ect dots line	early	•	Line unicht.	iii 🗆 F	llied
Line style	:			Line weight:		
U - Solid				1 Det widthe		\frown
Dot type:	rec		-	Dot width:	-	
Det color		Fill colory		-		
Duccolor:		Fill Color;		Evtended		imit values
	000			Extended		
				ОК	Cancel	Apply
	Limit	values			×	
		Low limit v	/alue			
		Color:		Value:		
			0	0		
		1	000	-		
		📝 High limit 🛛	value			
		Color:		Value:		
			2	60		
		Value with	n unce	tain status		
		Color:				

31. The next trend is the manipulated value; it has the following settings. (→ Trends → New → Object name: 'PID – Manipulated value' → Name: MV → Tag name: Control.MV#Value → Trend color: green → OK → Apply)

	WinCC OnlineTrendControl Properties	
	Toolbar Status Bar	Online configuration Export
	Trends General Font	Trend window Time axes Value axes
	Trends:	Object name:
	V PID - Setpoint	PID - Manipulated value
	V PID - Process value	Trend window:
	PID - Manipulated value	Trend window 1
		Time axis:
		Time axis 1
		Value axis:
		Value axis 1 💌
		Label:
		MV
	New Remove Up D	Down
	Data connection	Tag name:
	1 - Archive tags	 SystemArchive\A1_multipurpo
	Effecte	
	Trend type:	Trend color:
	1 - Connect dots linearly	- Filled
	Line style:	Line weight:
	0 - Solid	▼ 1
	Dot type:	Dot width:
	2 - Squares	▼ 3
lor Selection Colors		Extended Limit values
		OK Cancel Apply
Red	133 0 L code: 008500	
	OK Cancel	

32. The last trend we add is the level A1T2L001.

(\rightarrow New \rightarrow Object name: Level \rightarrow Tag name: A1T2L001.PV#Value \rightarrow Trend color: blue \rightarrow OK \rightarrow Apply)

WinCC OnlineTrendControl Properties		8 X	
Toolbar Status Bar	Online configuration	Export	
Trends General Font Tre	nd window Time axes \	/alue axes	
Trends:	Object name:		
V PID - Setpoint	Level - Process value		
PID - Process value	Trend window:		
PID - Manipulated value I evel - Process value	Trend window 1	•	
	Time axis:		
	Time axis 1	•	
	Value axis:		
	Value axis 1	-	
	Label:		
	LeverPv		
New Remove Up Down			
Data connection	-		
Data source:	Tag name:		
1 - Archive tags	SystemArchive (A1_multipurpo		
Effects			
Trend type:	Trend color:		
I - Connect dots linearly	Line weight:		
1 - Dash	2		
Dot type:	Dot width:		
3 - Circles 🔹	7 Color Selection		X
Dot color: Fill color:		The second se	These sectors in the local division of the l
	🔄 I 💙 Colors		
		_	~
	Red		0
	Green		0
	Blue	2	30
		HTML code: 0000E6	
			OK Cancel

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33. Now change to the tab Time Axes. There, set the parameters shown.

Toolbar Status Bar	Online Configuration Export
Frends General Font	Trend Window Time Axes Value Axe
lime axes:	Object name:
✓ Time axis	Time axis
	Trend window:
	Trend window 1
	Label:
	t
	Alignment:
	U - Bottom
New Remove Up Down	💷 📝 Refresh
Time range	Start fimal
0 - Time range	
	20.04.2015 • 19:10:05
	-
Number of measurement points:	Ime range:
110	
Effects	
Time format:	Color:
Date format:	
Automatic -	Use trend color
Chann data	
M Show date	

34. Then, in the tab Value axes, set up three value axes: one for the temperature values of 0 .. 100°C, one for the manipulated value 0 .. 100%, and one for the level of 0 .. 1000 ml.

 $(\rightarrow$ Value axes \rightarrow Object name: Value axis temperature \rightarrow Label: °C \rightarrow Value range: automatic \rightarrow New \rightarrow ...)

Toolbar		Status Bar		Online confi	guration	Export
Trends	General	Font	Tre	end window	Time axes	Value axes
Value axes	:			Object name	:	
🔽 Value	axis tempera	ture		Value axis te	emperature	
🔽 Value	axis MV			Trend windo	w:	
Value	axis level			Trend windo	ow 1	-
				Label:		
				°C		
				Alignment:		
				0 - Left 👻		
New N	Remove		wn) Scaling:		
4	3			0 - Linear		•
-Value rar	ige					
from:		to:				
0		100		📃 Automatio		

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Toolbar	Sta	itus Bar	Online co	nfiguration	Export		
Trends Ge	eneral	Font	Trend window	Time axes	Value axes		
Value axes:			Object nar	ne:			
🔽 Value axis	temperature	;	Value axis	: MV			
🚺 Value axis	MV		Trend wind	dow:			
📝 Value axis	level		Trend win	idow 1	-		
			Label:				
			%				
			Alignment				
			0 - Left		•		
New	emove	Up Dow	n Scaling:				
2			0 - Linear		•		
-Value range-							
from:	to		T 10 1 17				6
0	N	/inCC Online	I rendControl F	roperties			
				roperties			
		Toolbar	Sta	atus Bar	Online confi	guration	Export
		Toolbar Trends	General	atus Bar	Online confi Trend window	guration	Export Value axe
		Toolbar Trends Value axe:	r Sta General	atus Bar	Online confi Trend window	guration Time axes	Export Value axe
		Toolbar Trends Value axes	r Sta General s: e axis temperature	atus Bar	Online confi Trend window Object name: Value axis le	guration Time axes	Export Value axe
		Toolbar Trends Value axes Value Value	r Sta General s: e axis temperature e axis MV	atus Bar Font ·	Online confi Trend window Object name: Value axis le Trend window	guration , Time axes . 	Export Value axe
		Toolbar Trends Value axes Value Value Value	r Sta General s: e axis temperature e axis MV e axis level	atus Bar Font	Online confi Trend window Object name: Value axis le Trend window Trend window	guration Time axes : : : : : : : : : : : : : : : : : : :	Export Value axe
		Toolbar Trends Value axe: Value Value Value	r Sta General S: e axis temperature e axis MV e axis level	atus Bar	Online confi Trend window Object name: Value axis le Trend window Trend window Label:	guration Time axes : : : : : : : : : : : : : : : : : : :	Export Value axe
		Toolbar Trends Value axe: Value Value Value	r Sta General s: e axis temperature e axis MV e axis level	atus Bar Font :	Online confi Trend window Object name: Value axis le Trend windov Trend windov Label: ml	guration , Time axes vvel .vvel .vw 1	Export Value axe
		Toolbar Trends Value axes Value Value Value	r Sta General s: e axis temperature e axis MV e axis level	atus Bar	Online confi Trend window Object name: Value axis le Trend windov Trend windov Label: ml Alignment:	guration Time axes : wel w: ww 1	Export Value axe
		Toolbar Trends Value axes Value Value Value	r Sta General s: e axis temperature e axis MV e axis level	atus Bar	Online confi Trend window Object name: Value axis le Trend window Trend window Label: ml Alignment: 0 - Left	guration Time axes wel w: ww 1	Export Value axe
		Toolbar Trends Value axe: Value Value Value	r Sta General S: e axis temperature e axis MV e axis level	atus Bar	Online config Trend window Object name: Value axis le Trend window Trend window Label: ml Alignment: 0 - Left Scaling:	guration Time axes 	Export Value axe
		Toolbar Trends Value axe: Value Value Value Value	r Sta General s: e axis temperature e axis MV e axis level Remove	atus Bar Font	Online config Trend window Object name: Value axis le Trend windov Trend windov Label: ml Alignment: 0 - Latet Scaling: 0 - Linear	guration Time axes vvel w: ww 1	Export Value axe
		Toolbar Trends Value axes Value Value Value New Value rai	r Sta General s: e axis temperature e axis MV e axis level Remove	up Down	Online config Trend window Value axis le Trend window Trend window Label: ml Alignment: 0 - Left Scaling: 0 - Linear	guration Time axes : : vvel 	Export Value axe

35. Now we assign the value axes to the trends.

 $(\rightarrow \text{Trends} \rightarrow \text{PID} - \text{Setpoint: Value axis Temperature} \rightarrow \text{PID} - \text{Process value: Value axis temperature} \rightarrow \text{PID Manipulated value: Value axis MV} \rightarrow \text{Level: Value axis level} \rightarrow \text{OK})$

Toolbar		Status Bar	Online cor	nfiguration	Export		
Trends	General	Font Trend window		end window Time axes Value axes			
Trends:			Object nam	e:			
V PID - Se	etpoint		PID - Man	ipulated value			
V PID - Pr	rocess value		Trend wind	ow:			
V PID - M	anipulated v	alue	Trend wind	dow 1	•		
🔽 Level -	Process valu	e	Time axis:				
			Time axis				
			Value axis:				
			Value axis	temperature	•		
			Value unio	temperature			
			Value axis	temperature			
			Value axis	MV			
			Value axis	level	1/2		
New	Remove	Up D	endControl Proper	level ties	15		y .
New	Remove WinC	Up D C OnlineTre Toolbar	endControl Proper	ties r On	ine configuration		Export
New	Remove WinC	Up D C OnlineTre Toolbar Trends	endControl Proper Status Ba General Font	level ties r On Trend wir	ine configuration adow Time	axes	Export Value axe
New	Remove WinC	Up D C OnlineTre Toolbar Trends	endControl Proper Status Ba General Font	ties r On Trend wir Obje	ine configuration adow Time	axes	Export Value axe
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36. During the runtime of the PCS 7 project, the following trend is displayed in the picture 'Reactor_R001'.





37. The steps below show how a number of objects can be grouped into a single 'User defined object'. First, however, it is important that none of the included objects has been grouped. If such groups exist, they have to be ungrouped.





38. Then, highlight all objects and right click on the selection. Now, select 'Create' 'Customized object'. (\rightarrow Customized Object \rightarrow Create)



39. In the configuration dialog, in the left window click on 'User defined' and select the first property of one of the customized objects that can be parameterized later in the finished user defined object. Drag this property to the left window to UserDefined2. (→ User defined → Bar1 → Process Driver Connection → User defined)

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40. In this manner, select from the object Bar1 the properties 'Process Driver Connection', 'Maximum value', 'Minimum value', 'LimitAL', 'LimitWL', 'LimitAH' and 'LimitWH'.
(→ Bar1: Maximum value → Bar1: Minimum value → Bar1: LimitAL → Bar1: LimitWL → Bar1: LimitAH → Bar1: LimitWH)

Properties Events Object Customized object	Language English (United States)	
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41. For the text window 'Static Text2' that describes the reactor, have the 'Text' displayed. Then, accept the user defined object with OK.

 $(\rightarrow \text{StaticText2: Text} \rightarrow \text{OK})$

Configura Properties	ition Dialog Customized obj	ject	111.27		45.2.5.5	? ×
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42. Now, copy the finished user defined object to store it in the project library for later use. $(\rightarrow \text{Copy})$

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43. Next, select the icon $\stackrel{(\Box)}{\longrightarrow}$ to display the library. ($\rightarrow^{\Box} \rightarrow$ Project Library \rightarrow Insert)

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44. Next, change the name of the user defined object in the library to 'customObject_reactor_V1_0'. (→ customObjekt_reactor_V1_0)

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	reactor_V1_0	12540	18.01.13 10:53	
	customObject_reactor_	V1_0 39	20.04.15 19:25	
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45. Now return to the user defined object in the picture 'Reactor_R001.Pdl' and select its properties (→ Properties)

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46. In the Properties under 'Customized object', the selected properties for the sub-objects are displayed. For the 'Process Driver Connection' click on' \bigcirc ' for 'Dynamic' and then select the tag. ($\rightarrow \heartsuit \rightarrow Tag$)

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	Text	Reactor\r\nA1T2R001	Ŷ	
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47. From the ES Variables, select 'A1_multipurpose_plant/T2_reaction/reactor_R001 /A1T2L001/A1T2L001/Monitor_A1T2L001/PV#Value'.

 $(\rightarrow$ ES Variables \rightarrow A1_multipurpose_plant/ T2_reaction/reactor_R001/ A1T2L001/ A1T2L001/ Monitor_A1T2L001/PV#Value \rightarrow OK)

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A1T2T001	-			•
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- 48. Now, for 'Dynamic', select an 'Update Cycle' of '1s'. Next, set the other properties as shown here. Then close the window.
 - $(\rightarrow \text{Update: } 1s \rightarrow \text{Text: Reactor\r\nA1T2R001} \rightarrow \bigotimes)$

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49. Finally, we should position the faceplates correctly, label and save them.

50. Now, we want to use the customized object in the picture 'Reactor_R002.Pdl'. To this end, set up a new picture in the plant view of the SIMATC Manager in the folder Reactor R002, and compile the changes of the OS(1).

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51. Now open the picture 'Reaktor_R002' in the Graphics Designer.

 $(\rightarrow \text{Graphics Designer} \rightarrow \text{Reactor}_R002.\text{Pdl} \rightarrow \text{Open picture})$



52. Start by setting the same properties as in step 11. Then click the icon ', to display the libraries; from the 'Project Library' drag the 'customObjekt_reactor_V1_0' into the picture.



 $(\rightarrow \stackrel{\text{led}}{\longrightarrow} \rightarrow \text{Project Library} \rightarrow \text{customObject_reactor_V1_0})$

53. In the properties you can now access, under 'UserDefined', the selected properties of the customObject. Thus, you have created an object with a specific selection of properties that can be used again and again quickly and effectively. (→ Properties → Customized object → UserDefined)



54. Finally, arrange the faceplates and insert a picture title.



Exercises

In the exercises, we apply what we learned in the Theory section and the Step by Step Instructions. To this end, we use and expand the existing multi-project from the step by step instructions (PCS7_SCE_0301_R1504_en.zip).

We are creating a new user defined object for the tanks with an upper and lower sensor. It can also be used to generate detail displays for the other plant sections.

In addition, the detail displays are to be accessible from the overview page by clicking on the corresponding text.

To the existing detail display of reactor R002, additional ActiveX Controls are added.

TASKS

- 1. Create a new picture on the level of educt_tank B001. Get the template for the tank from the library and ungroup the group.
- 2. Now, create from the tank a customized object. Select the modifiable parameters. The names of the new parameters are possibly not unique. They should be adapted.

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Properties					
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Edit the Selected Prop	perty				
	OK Cancel				

- 3. In the overview display, generate links to the newly created displays by expanding the existing static texts by a dynamic. Use the Dynamic Wizard Display functions Picture change in the working area, as in chapter P02-01.
- 4. In the detail display 'Reactor_R002' insert an alarm list and then configure the list in a way that only alarms for Reactor R002 are displayed.
- Last, instead of an OnlineTrendControl configure an OnlineTableControl and have the level, the actual value, the setpoint and the manipulated value of the control system displayed.



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