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NEWS

2

Machine and Plant Diagnostics with ProDiag

TIA Portal, S7-1500 PLC

https://support.industry.siemens.com/cs/ww/en/view/109740151

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1 Introduction

Monitoring machines and plants plays an increasingly important role in automation technology. The ProDiag functionality integrated in TIA Portal allows you to configure custom monitoring for your machine or plant. This also allows you to diagnose faults in the process.

1.1 Overview

This application example shows a virtual conveyor system with two lifts. On the belt, cases are alternately transported to one of the lifts and then stacked upwards. The conveyor system is controlled using an operator panel (HMI) and monitored with ProDiag. The different supervisions can be simulated and displayed on the operator panel.



Figure 1-1: Plant overview

This application example describes the following aspects:

- Configuration of machine and plant monitoring with ProDiag.
- The different types of supervision.
- Diagnostics of supervision errors on the operator panel.

Advantage

With ProDiag, the supervisions are not programmed, but configured. This allows you to monitor your machine and plant without modifying the user program code. Without a programmer, you diagnose the machine and plant directly on the operator panel.

Automatic synchronization ensures that all operator panel displays are always up to date.

1.2 Principle of operation

User program

The sequence of the virtual conveyor system and its simulation are programmed in the user program. The program was created using the criteria that a maximum number of machine and plant diagnostics properties can be displayed. The user program is regarded as given in this example and therefore not described in greater detail.

Supervision with ProDiag

With ProDiag, you create global and local supervisions. You can configure global supervisions to Boolean tags within a tag table, a global data block or an ARRAY data block. Local supervisions are configured to Boolean parameters of a function block. In this way, the user program is not modified.

ProDiag provides different types of supervision. The following table lists these types with a use case.

Type of supervision	Use case in the example	Tag/parameter	
Operand Monitors the compressed air and the power supply when the conveyor system is on.		SeqData [DB15] "SeqData".compressedAir "SeqData".powerVoltage	
Interlock supervision	Monitors whether the interlock conditions (e.g., lift door closed) are met for the movements of the lift.	LiftCmd [FB190] #interlockAuto #interlockMan	
Action supervision	Monitors whether the lift has left its start position within a specified time.	LiftCmd [FB190] #sensorLiftUp #sensorLiftDown	
Reaction Monitors whether the lift has left its end position within a specified time.		LiftCmd [FB190] #sensorLiftUp #sensorLiftDown	
Position supervision Monitors whether a case is removed from a specific belt position when the conveyor system is off.		SeqData [DB15] "SeqData".newCase "SeqData".sensorStop1 "SeqData".sensorStop2 "SeqData".sensorStop3	

Table 1-1: Types of supervision with ProDiag

To run or enable supervisions, you must assign them to ProDiag FBs. The "Add new block" dialog allows you to create ProDiag function blocks in the "PRODIAG (incl. IDB)" language. The ProDiag function block is automatically called in the ProDiag organization block.

Note A maximum of 100 ProDiag FBs can be used in a project. You can assign a total of 1000 supervisions to one ProDiag FB (V2.0 or higher), which makes it even easier to design them based on technological aspects. For smaller plants without a plant hierarchy, you can combine all supervisions in a single ProDiag supervision block.

Supervision with GRAPH

For the GRAPH programming language, the supervisions have already been integrated into each single step. GRAPH provides two different types of supervision. The following table lists these types with a use case.

Type of supervision	Use case in the example
Interlock	Via an interlock, you program conditions on which the execution of the single actions depends. Actions of a step that are linked to the interlock are executed only when the interlock condition is met. If the interlock condition is not met, a fault has occurred. For this case, you can define alarms that will then be displayed. However, the fault has no influence on the transition to the next step. This example monitors whether the lift door is closed and the lift is free.
Supervision	Via a supervision, you program conditions that allow you to monitor an entire step. If the condition is met, a fault has occurred and the step remains active. This means that the sequencer does not transition to the next step.
	This example monitors only steps where lifts are moved. If the movement is not processed within a specified time (step duration exceeded), an alarm is output and the step remains active. Unlike the interlock, the supervision requires acknowledgment.

Display in Runtime

The occurring errors of the virtual conveyor system are displayed and diagnosed with the aid of Runtime. For this purpose, WinCC Professional provides different objects. The following table lists the objects:

Table 1-3: WinCC objects for displaying supervision errors

WinCC object	Use case in the example		
ProDiag overview	The "ProDiag overview" object shows the current state of the configured supervisions. If an error occurs, the error type and category will be displayed. The integrated button allows you to open the "Alarm view".		
GRAPH overview	The "GRAPH overview" object shows the following:		
	The current state.		
	The current step number.		
	The name of the step of the "LiftSeq" GRAPH sequencer.		
	Previous and next step.		
	If an error occurs in the sequence, the respective step will be displayed.		
	The buttons allow you to open the "Alarm view"/"PLC code view".		
Alarm view The ProDiag alarms are displayed in the "Alarm view". The allows you to open the "PLC code view" of the selected alarms			

WinCC object	Use case in the example			
PLC code view	 The "PLC code view" object shows the current program status of the selected ProDiag alarm or "LiftSeq" GRAPH sequencer. The object supports the LAD, FBD and GRAPH programming languages. The PLC code view is possible for the following supervision alarms: Global supervisions: interlocks only. Local supervisions: all basic supervisions at input parameters. Program modifications are automatically detected and updated. 			
Criteria analysis view	The "Criteria analysis view" object displays the invalid operands of the user program that have triggered a selected ProDiag or GRAPH alarm.			

1.3 Components used

This application example was created with the following hardware and software components:

Table 1-4

Component	No.	Article no.	Note	
CPU 1516F-3 PN/DP	1	6ES7516-3FN01-0AB0	Alternatively, any other CPU of the S7-1500 product family can be used.	
Memory card, 24 Mbytes	1	6ES7954-8LF02-0AA0	-	
STEP 7 Professional V15	1	6ES7822-105	-	
WinCC Professional /Advanced V15	1	6ES7822-105	-	
WinCC Runtime Professional V15	1	6ES7822-105	-	

This application example consists of the following components:

Table 1-5

Component	File name	Note
Documentation	109740151_ProDiag_DOC_V41_en.pdf	-
WinCC Advanced project	109740151_ProDiag_PROJ_Adv_V40.zip	-
WinCC Professional project	109740151_ProDiag_PROJ_Prof_V40.zip	-

2 Engineering

2.1 Hardware configuration

The following figure shows the hardware configuration of the application. Figure 2-1: Hardware configuration



Note Follow the installation guidelines of the devices.

2.2 Configuration

2.2.1 Creating ProDiag function blocks

A ProDiag FB is created in the PRODIAG programming language, e.g., using the "Add new block" dialog.

To do this, proceed as follows:

- 1. In the "Program blocks" folder, double-click the "Add new block" command. The "Add new block" dialog opens.
- 2. Click the "Function block" button.
- 3. Enter the name "LiftProDiagFB" for the new ProDiag FB.
- 4. In "Language", select "PRODIAG (incl. IDB)".
- 5. To add more properties of the new ProDiag function block, click "Additional information".

An area with more input fields is displayed.

- 6. Enter the desired properties.
- 7. Check the "Add new and open" check box if you want to open the ProDiag function block right away.
- 8. Click "OK" to confirm your entries.

-igure 2-2: "Add new block" dialog				
Add new block			×	
Name:				
LiftProDiagFB				
	Language:	PRODIAG (incl. IDB)		
OB	Number:	1		
Organization block		🔘 Manual		
DIOCK		 Automatic 		
	Description:			
Function block	Function blocks ar	e code blocks that store their value n available after the block has beer	s permanently in instance data blocks,	
=FC				
Function				
Data block				
	more			
> Additional information	ation			
🗹 Add new and open			OK Cancel	

Alternatively, you can create ProDiag FBs as follows:

- Creating a global supervision automatically creates the ProDiag FB. The user is not required to perform an action.
- When calling an FB with local supervision.
- At the instance data block of an FB.
- In the ProDiag overview table.
- **Note** You can structure your supervision according to the machine and plant units by creating one ProDiag FB per unit.

2.2.2 Defining supervision settings at the ProDiag FB

Global enable criterion

The global enable criterion allows you to control the call of the ProDiag FB in the ProDiag OB. The global enable criterion must be a global Boolean tag. The ProDiag FB is called only when the signal state of this tag is "TRUE". This allows you to specifically disable, for example, all supervisions of the ProDiag FB.

To define a global enable criterion, proceed as follows:

1. Right-click the "LiftProDiagFB" ProDiag FB and from the context menu, select "Properties...".

The ProDiag FB's properties dialog opens.

- 2. In the "General" tab, click "Supervision settings".
- 3. Select the global Boolean tag "SeqData".globalEnabler as the global enable criterion.

Figure 2-3: "Global enabler" dialog

LITTP	оріадня [FBIJ	۲ ۲	<u>~</u>
G	ieneral	Texts	FB supervision definitio	
_	ieneral Information		Supervision settings	
	ime stamps		Global enabler	
	ompilation rotection		Global enabler *SeqData*.globalEnabler	
	ttributes upervision s	ettings	Using the global enabler, you can define whether all supervisions of the ProDiag function block trigger supervision alarms. The prerequisite for this is that the global enable criterion has signal state *1* and the ProDiag function block is called in the ProDiag organization block OB250.	
			Categories	
<	1111	>	Select the category enable criterion and the display class for each category that is used in this ProDiag function block. Using the category enable criterion, you can define whether all supervisions of the ProDiag function block trigger supervision alarms. The prerequisite for this is that the category enable criterion has signal state *1*. Using the display class, you can define the display of the supervision alarms on a HMI device.	
			OK Cancel	

Note You can also use the global enable criterion to prevent, for example, a flood of alarms.

Category enable criterion

The category enable criterion allows you to enable and disable the supervisions for each single category of the ProDiag FB.

A category enable criterion is configured in the same way as the global enable criterion.

2.2.3 Creating global supervisions

In the application example, global supervisions are created at Boolean tags in the global data block "SeqData".

Operand supervisions

When the conveyor system is turned on, the compressed air supply must be ready. Otherwise, a supervision alarm of the "Error" category will be output. In the application example, the compressed air is monitored using the "SeqData".compressedAir tag.

To create the operand supervision, proceed as follows:

- 1. Open the global DB "SeqData".
- 2. Right-click the "SeqData".compressedAir tag and run "Add new supervision".
- 3. In "Type of supervision", select "Operand".
- 4. If an error has occurred, the state of the supervised tag is "False".
- 5. Set a "delay time", e.g. 0ms.
- 6. In "Condition 1", select the "SeqData".plantOn tag. Check the "True" check box for the condition trigger.

If necessary, you can add a maximum of three more conditions.

- 7. In "Category", select "Error".
- Select the ProDiag FB you have already created: "LiftProDiagFB". You can also create a new ProDiag FB. For the supervision, an "error flag" is automatically created in the instance data block of the ProDiag FB. The error flag indicates whether a fault has occurred. You can query this error flag in your program, for example, to shut off the machine in the event of certain faults.
- In "Specific text field", enter the text "Compressed air not OK". For another example of entering text, refer to "Example of the Error message supervision type".

Figure 2-4: Operand supervision

compressedAir			Roperties	Linfo Diagnostics
General Texts Supervision	ns			
Add new supervision	General			
 U Supervision_ID_1 (LiftProDiagFB) 	General			
General Specific text field		Operand		
Specific text field	Type of supervision:	Operand		
	Cupervised to a	"SeqData".compressedAir	Trigger: 🗌 True	False
	Supervised tag:		ingger: 🔄 inde	Paíse
	Delay time:	T#0ms	C1 trigger: 🗹 True	False
	Condition 1:			False
	Condition 2:		C2 trigger: V True	False
	Condition 3:		C3 trigger: 🗹 True	L Faise
	Category:			
	Subcategory 1:	·		
	Subcategory 2:	•		
	ProDiag FB:	LiftProDiagFB		
-	Error flag:	InstLiftProDiagFB."SeqData.comp	ressedAir_O_1".Err	
	Alarm text (see settings):	<category> : <type of="" supervision<="" td=""><td>> : <specific field="" text=""> : <plc name=""> : <prol< td=""><td>Diag FB name> : <supervision id=""> : 🛛 🗡</supervision></td></prol<></plc></specific></td></type></category>	> : <specific field="" text=""> : <plc name=""> : <prol< td=""><td>Diag FB name> : <supervision id=""> : 🛛 🗡</supervision></td></prol<></plc></specific>	Diag FB name> : <supervision id=""> : 🛛 🗡</supervision>
		<tag name=""></tag>		
	Specific text field			
	Enter a text and add the d	iesired associated values.		
	Specific text field:			
	Compressed air not OK			

The supervision of the "SeqData".powerVoltage power supply is created in the same way as the compressed air supervision.

Position supervisions

When the conveyor system is at a standstill, the supervision monitors whether a case is removed from the first position. If a case is missing, a supervision alarm of the "Warning" category will be output. In the application example, the "SeqData".newCase tag (case exists sensor) is supervised for this purpose.

To create the position supervisions, proceed as follows:

- 1. Right-click the "SeqData".newCase tag and run "Add new supervision".
- 2. In "Type of supervision", select "Position".
- 3. If an error has occurred, the state of the supervised tag is "False".
- 4. Set a "delay time", e.g. 0ms.
- The conveyor system must be in stop. In "Condition", select the "SeqData".autoStarted tag (automatic started) and the "SeqData".autoStopped tag (automatic stopped). For both tags, check the "False" check box for the condition trigger. In addition, the "SeqData".stateCase[0] tag (case exists state) must be set. Check the "True" check box for the condition trigger.
- 6. In "Category", select "Warning".
- 7. Select the ProDiag FB you have already created: "LiftProDiagFB". You can also create a new ProDiag FB. For the supervision, an "error flag" is automatically created in the instance data block of the ProDiag FB. The error flag indicates whether a fault has occurred. You can query this error flag in your program, for example, to shut off the machine in the event of certain faults.
- 8. In "Specific text field", enter the text "Case at entrance missing".

Figure 2-5: Position supervision

newCase			🖾 Properti	es 🖪 Info 📱 Diagnostics
General Texts Supervisio	ns			
Add new supervision •	General			
	Type of supervision:	Position		
		"SeqData".newCase	Trigger: 🗌 True	🛃 False
	Delay time:	T#0ms	C1 trigger: 🔲 True	False
		"SeqData".autoStopped	C2 trigger: True	False
		"SeqData".stateCase[0]	C3 trigger: C3 True	False
		2: Warning		
	Subcategory 1: Subcategory 2:	▼		
fi fi	ProDiag FB:	LiftProDiagFB		
		InstLiftProDiagFB."SeqData.new@		
	Alarm text (see settings):	<category> : <type of="" supervision<br="">ID> : <tag name=""></tag></type></category>	ı> : ≪pecific text field> : <plc name=""> : <</plc>	ProDiag FB name> : <supervision td="" 🔪<=""></supervision>
	Specific text field			
	Enter a text and add the	desired associated values.		
	Specific text field:			
	Case at entrance missin	19		

According to the position supervision at "SeqData".newCase, the position supervision is implemented at the following stops:

- "SeqData".sensorStop1
- "SeqData".sensorStop2
- "SeqData".sensorStop3

2.2.4 Creating local supervisions

The local supervisions are created at the Boolean input parameters of the "LiftCmd" function block. The FB controls the outputs of a lift and is called twice in the program. Therefore, you have to configure the supervisions only once and can use them for both lifts.

Interlock supervisions

The lift outputs may be set only when the lift door is closed. The interlock supervision monitors whether the enables necessary for the "lift up" movement exist or whether the door is closed. The enables are transferred to the #interLockAuto FB parameter (automatic interlock) when the "LiftCmd" FB is called. If the enables are not provided, a supervision alarm of the "Error" category will be output. In the application example, the #interLockAuto FB parameter is supervised for this purpose.

To create the interlock supervision, proceed as follows:

- 1. Open the "LiftCmd" FB.
- 2. Right-click the #interLockAuto parameter and run "Add new supervision".
- 3. In "Type of supervision", select "Interlock".
- 4. If an error has occurred, the state of the supervised parameter is "False".
- 5. Set a "delay time", e.g. 0ms.
- 6. The #startLiftUp "actuator" and the #autoStarted "condition" (automatic started) must be set. For both, check the "True" check box for the condition trigger.
- 7. In "Category", select "Error".
- 8. In "Specific text field", enter the text "Door at lift not closed".

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Figure 2-	Figure 2-6. Interlock supervision							
interLockAuto								
General	Texts	Supervisions]					
📑 Add new	supervision							

	Interlock	

InterLockAuto			Properties	Info Diagnostics	
General Texts	Supervisions				
Add new supervision	General				
 ① Supervision_1 General 					
Specific text field	Type of supervision:	Interlock			
I Supervision_2					
	Supervised parameter:	#interLockAuto 🔳	Trigger: 🗌 True	🗹 False	
	Delay time:	T#Oms 🔳			
	Actuator (Condition 1):	#startLiftUp	C1 trigger: 🗹 True	E False	
	Condition 2:	#autoStarted	C2 trigger: 🗹 True	🗌 False	
	Condition 3:		C3 trigger: 🗹 True	E False	
	Category:	1: Error			
	Subcategory 1:	•			
	Subcategory 2:	•			
	-				
	Alarm text (see settings):	<pre><category> : <type name="" of="" superv=""> : <supervision id=""> : <</supervision></type></category></pre>			~
		L			-
	Specific text field				
	specific text field				
	Enter a text and add the de	sired associated values.			
	Specific text field:				
	Door at lift not closed or lift	blocked.			

the first of

.

The interlock supervision for the "lift down" movement and using the #interLockMan parameter are created in the same way as this interlock supervision.

For local supervisions, the "LiftProDiagFB" ProDiag FB is not assigned to the individual parameters but to the "InstMainFB" instance data block of the calling Note "MainFB".

See Chapter 2.2.5.

Action supervisions

The action supervision monitors whether the "lift up" movement has left the start position within a specified time. If the lift stops, a supervision alarm of the "Error" category will be output. In the application example, the #sensorLiftDown FB parameter is supervised for this purpose.

To create the action supervision, proceed as follows:

- 1. Right-click the #sensorLiftDown parameter and run "Add new supervision".
- 2. In "Type of supervision", select "Action".
- 3. If an error has occurred, the state of the supervised parameter is "True".
- 4. Set a "delay time", e.g. 200ms.
- 5. The #outLiftUp "action" (lift up output) must be set. Check the "True" check box for the condition trigger.
- 6. In "Category", select "Error".
- 7. In "Specific text field", enter the text "Lift has not left lower start position".

Figure 2-7: Action monitoring

sensorLiftDown			🖳 Properties 🚺 Info	Diagnostics
General Texts	Supervisions			
Add new supervision	General			
▶ ① Supervision_2	Type of supervision:	Action		
	Supervised parameter: Start-up time:	#sensorLiftDov III	Trigger: 🗹 True	E False
	Action (Condition 1): Condition 2:	#outLiftUp	C1 trigger: 🗹 True C2 trigger: 🗹 True	False
	Condition 3 :		C3 trigger: 🗹 True	E False
	Category: Subcategory 1: Subcategory 2:	1: Error		
	Alarm text (see settings):	<category> : <type of="" super<="" td=""><td>vision> : <specific field="" text=""> : < ervision ID> : <instance name=""> :</instance></specific></td><td></td></type></category>	vision> : <specific field="" text=""> : < ervision ID> : <instance name=""> :</instance></specific>	
	Specific text field			
		desired associated values.		
	Specific text field:			
	Lift has not left lower star	t position		

The action supervision for the "lift down" movement is created in the same way as this action supervision.

Reaction supervisions

The reaction supervision monitors whether the "lift up" movement has reached the end position within a specified time. If the lift stops before reaching this position, a supervision alarm of the "Error" category will be output. In the application example, the #sensorLiftUp FB parameter is supervised for this purpose.

To create the reaction supervision, proceed as follows:

- 1. Right-click the #sensorLiftUp parameter and run "Add new supervision".
- 2. In "Type of supervision", select "Reaction".
- 3. If an error has occurred, the state of the supervised parameter is "False".
- 4. Set a "delay time", e.g. 5000ms.
- 5. The #outLiftUp "action" (lift up output) must be set. Check the "True" check box for the condition trigger.
- 6. In "Category", select "Error".
- 7. In "Specific text field", enter the text "Lift has not reached upper end position".

sensorLiftUp		🖳 🖳 Properties 🔄 🛄 Info	追 🗓 Diagnostics
General Texts Su	pervisions		
Add new supervision	General		
General			
Specific text field Gupervision_2	Type of supervision: Reaction 💌		
	Supervised parameter: #sensorLiftUp	Trigger: 🗌 True	🗹 False
	Reaction time: T#5000ms		
	Action (Condition 1): #outLiftUp	C1 trigger: 🗹 True	False
	Condition 2:	C2 trigger: 🗹 True	False
	Condition 3:	C3 trigger: 🗹 True	False
	Category: 1: Error		
	Subcategory 1:		
	Subcategory 2:		
,		ipervision> : <specific field="" text=""> : ‹ upervision ID> : <instance name=""></instance></specific>	
	Specific text field		
	Enter a text and add the desired associated value Specific text field:	25.	
	Lift has not reached upper end position.		

Figure 2-8: Reaction supervision

The reaction supervision for the "lift down" movement is created in the same way as this reaction supervision.

2.2.5 Assigning the ProDiag FB to the instance data block of an FB

The parameters to be supervised in the interface of a block must be assigned to a ProDiag FB via the instance of the FB.

To do this, proceed as follows:

- 1. In the project tree, double-click the "PLC supervisions & alarms" folder. The supervisions and alarms editor opens.
- Click the "Supervisions > FB supervision instances" tab. It displays the instance data blocks with all local supervisions.
- 3. In the "ProDiag FB" column, click the selection field.
- 4. In the selection dialog, select the ProDiag FB you have already created: "LiftProDiagFB".

You can also create a new ProDiag FB.

Figure 2-9: Assigning the ProDiag FB

											🔍 Supervisions 🛛 Alarms
Та	ig si	upervisions FB su	pervision d	efinitio FB	supe	rvision instanc					
-	*										
		Supervised parameter	Trigger	ProDiag FB	D	Type of supervision	Condition 1	C1 Trigger	Condition 2	C2 Trigger	Specific text field
1		 InstMainFB [DB10] 		LiftProDiagFB		-					
2		 "InstMainFB".instLi 	. 🗆	LITTIODIAGED							
3	1	#interLockAuto	False	LiftProDiagFB	7	Interlock	#startLiftUp	True	#autoStarted	True	Door at lift not closed or lift blocked.
4	9	#interLockAuto	False	LiftProDiagFB	8	Interlock	#startLiftDown	True	#autoStarted	True	Door at lift not closed or lift blocked.
5	0	#interLockMan	False	LiftProDiagFB	9	Interlock	#startLiftUp	True	#autoStarted	False	Door at lift not closed or lift blocked.
6	Q	#interLockMan	False	LiftProDiagFB	10	Interlock	#startLiftDown	True	#autoStarted	False	Door at lift not closed or lift blocked.
7	Q	#sensorLiftUp	False	LiftProDiagFB	11	Reaction	#outLiftUp	True		✓ True	Lift has not reached upper end position
8	Q	#sensorLiftUp	False	LiftProDiagFB	12	Reaction	#outLiftUp	True		True	Lift has not reached upper end position
9	Q	#sensorLiftDo	🗹 True	LiftProDiagFB	13	Action	#outLiftUp	True		True	Lift has not left lower start position
10	0	#sensorLiftDo	False	LiftProDiagFB	14	Reaction	#outLiftDown	True		True	Lift has not reached lower end position
11		InstMainFB".instLi	. 🗆	LiftProDiagFB							

You can also assign the ProDiag FB in the instance data block properties.

To do this, proceed as follows:

- 1. Right-click the "InstMainFB" instance data block.
- 2. In the context menu, click Properties.
- 3. In the Properties dialog, click "Attributes".
- 4. In "Assign ProDiag FB", select the "LiftProDiagFB" ProDiag FB. You can also create a new ProDiag FB here.

InstMainFB [DB10] General Texts		
General Information Time stamps Compilation	Attributes	*
Protection Attributes Download without reinitialization	Optimized block access DB accessible from OPC UA Pro Diag	
	ProDiag Assigned ProDiag FB: LiftProDiagFB	
	User-defined attributes	
< <u> </u>	Block properties:	~
	OK Cancel	

2.2.6 Querying error bits in the program

Querying the group error bit of a ProDiag FB

For each ProDiag FB, different types of group error bits can be queried in the user program, for example, to stop the machine in the event of certain faults. The group error bits can also be accessed via the "InstLiftProDiagFB" instance data block of the ProDiag FB.

There are two different types of group error bits:

- Group error bit for types of supervision (All, O, I, R, A, P, Merr and Mtxt)
- Group error bit for categories (C1, C2, C3, C4, C5, C6, C7 and C8)

The following figure shows the "All" group error bit in the data structure of the status tags in the ProDiag IDB and its use in the user program.

Figure 2-11: Querying the group error bit in the program

6F-3 PN/DP] > Program	m blocks ▶ Pro	Diag 🕨 MainFB [F	B10]	_ ₽ ≡>	< @	·	_V15	_04 PLC_1	[CPU 1516F-3 PN/DF
ið ið ≇ ≝ 🖶 🖿	: 🗆 🖃 💬 冶 :	: 🖀 ± 🕼 ± 🔚 💓	¢° 6₀ e⊞ (H - 📑	10	9 ₹	۶ 🔍	🛃 🔁 🖏	Keep actual values 🛛
MainFB						Ins	tLift	ProDiagFB	
Name	Data type	Default value	Retain	Acces			Name		Data type
1 < Input					N 1		In	put	
2 📶 🏾 Initial_Call	Bool	🔳 false	Non-ret		, 2	-00	0	utput	
<				>	3	-00		Out	
		*			- 4			atic	
& >=1 ??? ⊣ −ol ⊢	+ -[=]				5			PC_Flags	PC_Flags_V2
					6		• •	State Total Numb	SV_FB_State_
								All	
Network 3: Lift 1					8			O	Bool
Comment					10	_	- 1	0	Bool
					11	_		R	Bool
	&				12			A	Bool
"SeqData".plantOn —			#inst	Lift1 Cmc	13			P	Bool
"SegData".			9	6FB11	14	-		Merr	Bool
doorClosed			"Li	ftCmd"	15	5 🕣		Mtxt	Bool
"InstLiftProDiagFB"		— EN	J		16	i 🕣		SV_Types	Byte
.State.All*			terLockAuto		17	/ 📶		C1	Bool
		ini	IETLOCKAUIO		18	3 🕣		C2	Bool

Querying the error bit of a supervision

For each supervision, an error bit can be queried in the user program, for example, to stop the machine in the event of certain faults. The error bits can also be accessed via the "InstLiftProDiagFB" instance data block of the ProDiag FB.

The following figure shows the "Err" error bit in the data structure of the operand supervision and its use in the user program.





2.2.7 Multi-selection for defining supervisions

You can create a large number of supervisions in the PLC tag table, in the interfaces of function blocks and in global data blocks with a single operator action. Only Boolean tags will be considered.

Select the tags in the global data block and select "Add new supervision" from the context menu.

	Name	Data type	Start valu	Retain	Accessible f	Setpoint	Supe	rvision	Comment	
8 📶		Bool	false				Q		Error on Sensor at stopper1	
9 -00	errSensorStop2	Bool	false			Ä	ŋ		Error on Sensor at stopper2	
0 🕣	 errSensorStop3 	Bool 🔳	false			Ē	Q		F	_
1 🕣	errSensorNewCase	Bool	false	Ä		Ä	Q	学 Inser		
2 🕣	sensorLift1Up	Bool	false	Ä		Ä	Q	📑 Add r	ow	
3 🕣	sensorLift1Down	Bool	false	Ā		Ā	ŋ	🗶 Cut	Ctrl+:	ĸ
4 🕣	sensorLift2Up	Bool	false	Ē			ŋ	🕕 Copy		-
5 🕣	sensorLift2Down	Bool	false				ŋ	💼 Paste	Ctrl+\	/
6 🕣	 toLift1 	Bool	false				ŋ	× Delet	te De	el l
7 🕣	 outLift1Up 	Bool	false				ŋ	Rena	me F2	2
8 🕣	 outLift1Down 	Bool	false				Q	D Add r	new supervision	7
9 🕣	 outLift2Up 	Bool	false				Q			
0 🕣	 outLift2Down 	Bool	false				D.	Upda	te interface	
1 📶	 manLift1Up 	Bool	false				ŋ	Go to	next point of use Ctrl+Shift+O	i i
2 🕣	manLift1Down	Bool	false				ŋ	Go to	definition Ctrl+Shift+I)
3 🕣	 manLift2Up 	Bool	false				D		-references F1	
4 🕣	manLift2Down	Bool	false				Q	Cross	-reference information Shift+F1	1
5 🛥	simOperandSupVis	Bool	false				Q [3]	Simulation supervision operand	
6 📶	simInterlockSupVis	Bool	false				Q [2]	Simulation supervision interlock	
7 🕣	simLiftFreeSupVis	Bool	false				ŋ		Simulation supervision lift free	
8 🕣	simActReactSupVis	Bool	false				Q		Simulation supervision action ar	d reaction
9 🕣	 simPositionSupVis 	Bool	false			📃 🔍 [4] Simulation supervisi		Simulation supervision position		
0 🕣	simActive	Bool	false			Simulation active		Simulation active		
1 📶	 releaseSimPlantOn 	Bool	false				Q [2]	Release simulation plant on	
2 📶	releaseSimAutoStarted	Bool	false				Q		Release simulation auto started	
3 🕣	releaseSimAutoStoppe	Bool	false				D		Release simulation auto stopped	

Figure 2-13: Multi-selection of supervisions

One supervision is created for each selected tag. In the "Properties" Inspector window, the "Supervisions" tab opens for the first tag. In this tab, you define the settings for every single supervision separately.

2.2.8 Creating supervisions in the GRAPH sequencer

For the GRAPH programming language, the supervisions have already been integrated into each single step. Alarms are generated automatically.

Interlock

With an interlock, you monitor whether an action can be executed. This example monitors whether the door at the lift entrance is closed and the lift is not blocked. If the interlock condition is not met, an alarm will be output.

To enter a specific alarm text, proceed as follows:

- 1. Open the step in the single step view.
- 2. Select "Interlock -(C)-".
- 3. Open the Inspector window and select the "Properties" tab.
- 4. In the "Alarm text" text field, enter the desired alarm text. This text is inserted into the interlock alarm with the "<step-specific text field>" alarm text field.

Navigation () () () () () () () () () (\$5: L	>=1 ?? .ift 1 up	- - •	0 -[w]	-ï►	CMP>T	CMP>U	CONV	NEG	NOT	SWAP	CMP> T_MAX	CMP > T_WARN			^
▼ 1: <new sequence=""> ∧ ← T6 ← T11</new>		nment I nterlock -((c)-:	8												
51 1nit Trans1 53 deact. Stop1		"Seq door0 "SeqData".li	Data". Ilosed <u>—</u> iftFree —	*		[rlock C								
+ T ³ + T ⁷ ran 54 57 act. Stop 2 desct. Stop 2 + T ⁴ Tran 54 + T ⁸ Tran 59 + Tran 59 + Tra	▶ 4	Supervision														
→ Permanent post-instructi	< 1	Comment		&												~
> Alarms						_	0	Proper	tios		100%	3	🞖 Diagr	•	Q	
General								төрег	ues		•	• II.	o blagi	1031103		
Interlock alarm		erlock alarn	n													_
		larm text	ot closed (or lift blo	cked											

Figure 2-14: GRAPH interlock

Supervision

With a supervision, you monitor an entire step. This example monitors the step duration. If the specified step duration is exceeded, an alarm will be output and the sequencer will not be transitioned to the next step.

To enter a specific alarm text, proceed as follows:

- 1. Open the step in the single step view.
- 2. Select "Supervision -(v)-".
- 3. Open the Inspector window and select the "Properties" tab.
- 4. In the "Alarm text" text field, enter the desired alarm text. This text is inserted into the supervision alarm with the "<step-specific text field>" alarm text field.





2.2.9 Configuring multilingual names in S7-GRAPH

You can configure the step and transition names in multiple languages and therefore output the names in the alarms, in the PLC code view and in the GRAPH overview in multiple languages.

- 1. In the "LiftSeq" S7-GRAPH FB [FB12], select the step to be edited and in the Inspector window, open the "Properties".
- 2. The "Texts" tab allows you to assign the names in multiple languages (enabled in the project).



Figure 2-16: Multilingual names in S7-GRAPH

2.2.10 Activating initial value acquisition of the GRAPH sequencer

To activate initial value acquisition, proceed as follows:

- 1. Open the properties of the "LiftSeq" GRAPH sequencer.
- 2. In "General > Block", update the version. (In this example: block version V5.0)
- 3. Go to the "Attributes" tab.
- 4. Check "Initial value acquisition".

Figure 2-17: Attributes of the GRAPH sequencer

eq [FB12]		
General	Texts FB supervision definitio	
General Information Time stamps Compilation Protection Attributes	Attributes	
	 Skip steps Acknowledgment required for supervision errors Permanent processing of all interlocks in manual mode Lock operating mode selection Set ENO automatically Initial value acquisition Multiple instance capability 	
	Extension block name:	
	User-defined attributes Enable tag readback Block properties:	

2.2.11 Resetting initial values on the GRAPH FB

With initial value acquisition, you analyze what triggered a supervision alarm. To this end, the initial values of those operands are recorded that are programmed before the supervised operand in your program. GRAPH FB V5.0 allows you, with the aid of the "RESET_CRIT" input parameter, to reset the signal state of the two static parameters, "H_IL_ERR" (Interlock) and "H_SV_FLT" (Transition), to FALSE after the criteria analysis. As a result, the HMI PLC code viewer no longer displays old values. This is useful when you change the programming of interlocks and transitions and no longer need the then obsolete initial values. Reprogramming does not automatically reset the signal states to FALSE.

To reset the signal states of the two system-internal static parameters and therefore the initial values, proceed as follows:

- 1. Make sure that the version of the GRAPH function block is 5.0.
- 2. Open the "LiftSeq" GRAPH FB, click the block interface and in the menu bar, select "Edit > Interface parameters > Maximum interface parameters".
- 3. Open the "MainFB" FB and right-click the GRAPH FB.
- 4. From the context menu, select "Update block call". After updating, the "LiftSeq" GRAPH FB is displayed with its maximum parameters.
- 5. When calling the GRAPH function block, interconnect the "RESET_CRIT" input parameter in your user program with a Boolean tag, e.g. "SeqData.resetCrit".

Figure 2-18: Resetting initial values at the "RESET_CRIT" parameter



2.2.12 Setting the parameters of the GRAPH sequencer

For the program status of the GRAPH sequencer to be displayed on the "GRAPH overview" HMI object, the parameters of the GRAPH sequencer must be visible in the HMI and accessible from the HMI.

To set this, proceed as follows:

- 1. Open the "LiftSeq" GRAPH sequencer.
- 2. Open the "Edit" menu.
- Check "Internal parameters visible/accessible from HMI". This selection can only be made if the GRAPH sequencer is open in the editor and the focus is on it.

Figure 2-19: Parameter	settings of the GRAPH sequencer
i iguio z i o. i ulumotor	

Edi	t View	Insert	Online	Options	Tools \
	Open obje	ct			
ß	Undo				Ctrl+Z
C	Redo				Ctrl+Y
Ж	Cut				Ctrl+X
	Сору				Ctrl+C
Ē	Paste				Ctrl+V
	Select all				Ctrl+A
.	Search in p	oroject			Ctrl+F
ab 4ac	Find and re	place			Ctrl+F
	Cross-refe	rence inf	ormation		Shift+F11
	Go to				•
	Renumber.				
	Interface p	aramete	rs		•
\checkmark	Internal pa	rameters	s visible/a	ccessible fr	rom HMI
~	Retentive i	nternal p	arameter	s	
	Compile				Ctrl+B
Q	Properties				Alt+Enter

2.2.13 Defining the ProDiag supervision settings

In the ProDiag supervision settings, you define the settings that apply to all supervisions in the entire TIA Portal project. You can find the ProDiag supervision settings in the project tree in "Common data".

Defining categories

The "categories" allow you to divide occurring faults into different priorities. The categories can

- either be output as part of a supervision alarm or displayed as a group error bit in the "ProDiag overview" object on an HMI device.
- You can customize them to your requirements. For example, you can assign a separate alarm class to each category.

To go to the dialog, select "Common data > Supervision settings > General > Categories".

By default, there are three categories: "Error", "Warning" and "Info". You can create and enable/disable five more categories.

The "Error" category cannot be disabled.

Figure 2-20 Category settings

▼ General	C . t .					
Categories	Categories					
Subcategories 1						
Subcategories 2	Activate the categories and associate them to alarm classes:					
Types of supervision		Category	Activation	Alarm class	Acknowledgement	Priority
Central time stamp	1	Error		No Acknowledgeme 💌		0
Alarm texts	2	Warning		No Acknowledgement		0
GRAPH supervisions	3	Info		No Acknowledgement		0
 Basic supervisions 	4	Category 4		<no alarm="" class=""></no>		0
Tags	5	Category 5	Ä	<no alarm="" class=""></no>		0
FB parameters	6	Category 5	Ä	<no alarm="" class=""></no>		0
 Supervisions with an error message 	7		Ä	<no alarm="" class=""></no>		0
Tags	8	Category 7	Ä	<no alarm="" class=""></no>		0
FB parameters	8	Category 8		<10 alarm class>		0
 Supervisions with a text message 						
Tags						
FB parameters						

Defining subcategories

The subcategories allow you to specify the information in a supervision alarm in greater detail.

Defining the default settings for the types of supervision

In the "Types of supervision" section, you can change the default settings of the different types of supervision. This is where you define the delay time and for which signal state an operand or condition supervision should be performed.

Figure 2-21: Default settings for the types of supervision

✓ General]							
Categories	Types	of supervision						
Subcategories 1								
Subcategories 2	Specify the default settings for each type of supervision within your project. These settings							
Types of supervision	lf v	ou select the check bo	x. the triad	pering status i	s TRUE.			
Central time stamp	-					vision Verme	hannes recentio	
 Alarm texts 	TO	u will be able to adapt	these dela	full values to	every super	vision, your c	nanges regardin	
GRAPH supervisions	_	Type of supervision	Trigger	C1 Trigger	C2 Trigger	C3 Trigger	Delay time	
 Basic supervisions 	1	Operand					T#0ms	
Tags	2	Interlock					T#0ms	
FB parameters	3	Reaction					T#5s	
 Supervisions with an error message 	4	Action	~				T#200ms	
Tags	5	Position					T#0ms	
FB parameters	6	Error message	~				T#0ms	
 Supervisions with a text message 	7	Text message	~				T#0ms	
Tags	8	GRAPH-Interlock					T#0ms	
FB parameters	9	GRAPH-Supervision					T#0ms	
	10	GRAPH-Warning					T#0ms	

Defining the ProDiag alarm texts

In the "Alarm texts" section, you can define the structure of the supervision alarms.

To create an alarm text, proceed as follows:

- 1. In the "Alarm texts" tab, select the desired area for which you want to create an alarm text, for example Basic supervisions > Tags.
- Use drag and drop to move the desired alarm text fields from the "Supported alarm text fields" field to the "Alarm text" text frame.
 You can change the order of the individual text fields at any time.
- 3. If you want to delete a text field, right-click the appropriate text field and from the context menu, select "Delete".
- 4. Select a desired delimiter for the text fields.

Figure 2-22: Alarm text structure

▼ General	_	
Categories	 Tags 	
Subcategories 1		
Subcategories 2	Configure the alarm text fields by drag	gging and dropping the required text frames and resort the text fields if necessa
Types of supervision	Supported alarm text fields:	Alarm text:
Central time stamp	Supported alarm text fields.	
 Alarm texts 	<category></category>	<category> : <type of="" supervision=""> : <specific field="" text=""> : <plc name=""> <prodiag fb="" name=""> : <supervision id=""> : <tag name=""></tag></supervision></prodiag></plc></specific></type></category>
GRAPH supervisions	<subcategory 1=""></subcategory>	strobing to names . Supervision by . stag names
 Basic supervisions 	<subcategory 2=""></subcategory>	
Tags	<type of="" supervision=""></type>	
FB parameters	<plc name=""> <prodiag fb="" name=""></prodiag></plc>	Information text:
 Supervisions with an error message 	<prodiag fb="" number=""></prodiag>	
Tags	 Supervision ID> 	
FB parameters	<tag address=""></tag>	
 Supervisions with a text message 	<tag name=""></tag>	
Tags	<tag comment=""></tag>	Additional alarm text 1:
FB parameters	<>pecific text field>	

Define the alarm text structures of the different supervisions based on the basic supervisions. For local supervisions, insert the "<Instance name>" and "<Parameter name>" alarm text fields instead of "<Tag name>".

2.2.14 Example of the Error message supervision type

For blocks that report errors and output a status, you can output error texts in a supervision alarm if an error has occurred.

In the following example, the "Frequency" FB checks the input frequency and outputs an error and the following status (error number):

- 16#8001 (32769 decimal): Input frequency less than 5.
- 16#8002 (32770 decimal): Input frequency greater than 10.

In a text list, the texts are assigned to the values of a tag. For the error texts to be output according to the status in a supervision alarm in the event of an error, proceed as follows:

- 1. In the "SeqData" DB, define the "freqError" tag (data type: Bool) and the "freqStatus" tag (data type: UInt).
- 2. Interconnect the "error" and "status" parameters of the "Frequency" FB with the defined DB tags.



Figure 2-23: Call and parameter assignment of the "Frequency" FB

- 3. For the "freqError" DB tag, configure a supervision with the following properties:
 - Type of supervision: Error message
 - Supervised tag: "SeqData".freqError
 - Delay time: T#0ms
 - Category: 1 : Error
 - ProDiag FB: e.g., LiftProDiagFB
- 4. In "Specific text field", enter the following associated values:
- 5. Error message @4%5X@: @4%t#TextListStatus@

In the event of an error, the error message is taken from the "TextListStatus" error text list.

6. In the "Tag 1 (SD_4)" input field, enter the "SeqData".freqStatus DB tag.

Figure 2-24. Demnition of the specific text field									
SeqDa	ita								
Nan	ne	Data type		Start value	Retain	Accessible f	Writa	Vi	
63 🕣 💻	frequency	Real		10.0		$\mathbf{\sim}$	\sim		^
64 📶 🗖	freqError	Bool		false	_				Ī
65 📶 🗖	freqStatus	UInt		0					Ī
									~
<								>	
freqError			🔍 Pr	operties	🗓 Info 🔒 🛽	Diagnostic	s		
Genera	I Texts Super	visions	1						
	new supervision	Π							
	rvision_ID_27 (LiftProDiag	(FB) S	specific t	ext field _					
Gene									
Spec	ific text field		Enter a t	ext and add t	he desired assoc	iated values.			
			Specific	text field:					
			Error me	ssage @4%5	X@:@4%t#TextLi	stStatus@			
				(AI)				
			Tag 1 (S	D_4):	5				
			"SeqDat	a".freqStatus					

Figure 2-24: Definition of the specific text field

- 7. In the project tree, select the "PLC1" folder and double-click "PLC alarm text lists" to open the text list editor.
- 8. Add a new text list and name it, for example, "TextListStatus". This name must match the name in the specific text field.
- 9. In the "Selection" column, select the "Decimal" setting for the text list.
- In "Text list entries", "Range from / Range to" columns, enter the status (error numbers) used in the "Frequency" FB. In "Entry", define the alarm texts.

Figure 2-25: Inserting the text list

Те	Text lists							
	Name			Selection	Comment			
٢	SYSTEMTag_Adr6	366732183812322	97_1	Decimal				
1-1	TextListStatus			Decimal 🔤				
Те	<add news<="" th=""><th>evtl istStatus</th><th></th><th></th><th></th></add>	evtl istStatus						
10	Range from	Range to	Entry					
1.				ency value less than 5				
1.	32770	32770	Freque	ency value greater tha	in 10			
L	. A al al an anna.							

As soon as the signal state of the "freqError" DB tag is TRUE, the supervision alarm is output with the text from the specific text field. The error number is displayed as a decimal number and the error text from the text list is output.

2.2.15 Configuring identical time stamp

With the ProDiag function block version 2.0 or higher, you can specify a central time stamp tag in the ProDiag supervision settings and then use it in the entire project in each CPU.

To this end, the central time stamp tag is defined as a global tag or as a global data block element in the respective CPU.

The same system time is assigned to all ProDiag supervision alarms within a program cycle that are sent by ProDiag function blocks with the "Use central time stamp" check box checked. Configuring the identical time stamp is only necessary if you are using multiple ProDiag function blocks.

To use a central time stamp, proceed as follows:

- 1. In the global data block "SeqData", define the two tags:
 - "identTimeStamp" (data type: LDT)
 - "retVal" (data type: Int)
- 2. In the project tree, open the "Common data" folder.
- 3. Open the "Supervision settings" dialog.
- 4. In the area navigation, go to "General > Central time stamp".
- 5. In the "Time stamp tag" field, enter the "SeqData.identTimeStamp" DB tag defined above.

Figure 2-26: Configuring identical time stamp

109740151_ProDiag_Example_V15_01 Common data Supervision settings						
₽						
✓ General	Control time atoms for ProDing and side along					
Categories	Central time stamp for ProDiag supervision alarms					
Subcategories 1						
Subcategories 2	Time stamp tag: SegData.identTimeStamp					
Types of supervision						
Central time stamp						
 Alarm texts 						

- 6. Right-click the "LiftProDiagFB" ProDiag FB and from the context menu, select "Properties".
- 7. Go to the "Attributes" tab and check the "Use central time stamp" check box.
- 8. Select "OK" to close the dialog.

Figure 2-27: Ac LiftProDiagFB	•	entral time stamp	×
General	Texts	FB supervision definitio	
General Information Time stamps Compilation Protection Attributes Supervision		Attributes Handle errors within block Optimized block access Initial value acquisition (for the c Use central time stamp Multiple instance capability	riteria analysis on HMI devices)
		User-defined attributes Enable tag readback Block properties:	
< III	> <		OK Cancel

- 9. Insert the "RD_SYS_T" instruction into the Main organization block and parameterize the "OUT" output with the "SeqData.identTimeStamp" DB tag.
- 10. Interconnect the "RET_VAL" parameter with the "SeqData".retVal DB tag.

Figure 2-28: Read instruction for time

	_ sys_ t Ldt	
- EN	ENO	
	RET_VAL	"SeqData".retVal
	OUT	— "SeqData"identTimeStamp

2.2.16 Exporting/importing supervision settings for ProDiag and S7-GRAPH

You can export the supervision settings for ProDiag and S7-GRAPH to a ".dat" file to import them into a new project.

To export/import the supervision settings, proceed as follows:

- 1. In the project tree, go to the "Common data" folder and open the "Supervision settings".
- 2. Click the
 - a. "Export supervision settings" icon to export the settings. Select a storage location.
 - b. "Import supervision settings" icon to import the settings. Select the file that you want to import.

Figure 2-29: Exporting and importing global settings

V15 V Common data V Supervision settings
Ψ_b
▼ General
Categories
Subcategories 1
Subcategories 2
Types of supervision
Central time stamp
✓ Alarm texts

Note The ProDiag supervision settings are based on alarm classes. You may have to export also the alarm classes as a ".dat" file.

2.2.17 Exporting and importing ProDiag supervisions and properties of a ProDiag FB

Aside from the created supervisions, you can also export/import the properties of one or more ProDiag FBs from the "Tag supervisions" and "FB supervision definitions" ProDiag overview tables.

To export the supervisions and properties of one or more ProDiag FBs, proceed as follows:

- 1. In the project tree, open the "PLC supervisions & alarms" editor.
- 2. Go to the "Supervisions" tab.
- 3. Click the
 - a. "Exports tag supervisions" icon to export the tag supervisions. Select a storage location.
 - b. "Imports tag supervisions" icon to import the settings. Select the file that you want to import.

Figure 2-30: PLC supervisions & alarms

ProDiag_V40 → PLC_1 [CPU 1516F-3 PN/DP] → PLC supervisions & alarms							
💭 Supervisions 🖂 Alarms							
Tag supervisions	Tag supervisions FB supervision definitions FB supervision instances						
▶ b (b)							_
Supervised tag		Trigger	ProDiag FB	ID	Type of supervision	Category	Delay time
(a) 🖳 "SeqData".comp	ressedAir	False	LiftProDiagFB	1	Operand	1: Fehler	T#0ms
2 II "SeqData".powe	rVoltage	False	LiftProDiagFB	2	Operand	1: Fehler	T#2000ms
3 🔍 "SeqData".newC	ase	False	LiftProDiagFB	з	Position	2: Warnung	T#0ms

When importing, you can choose what and how you want to import. In addition to the supervisions, the "Supervision settings" can be included in the import.

Figure 2-31: PLC supervisions & alarms



Note

For more information about the export/import functions, refer to the online help or the STEP 7 and WinCC Engineering V15 system manual in chapter:

Exporting supervisions and properties of a ProDiag FB of a ProDiag FB

2.2.18 Visualizing supervisions on the HMI

To display the current supervision state, TIA Portal provides different objects that you can integrate into an HMI screen.

ProDiag overview

The ProDiag overview provides an overview of the current state of the configured supervision. The object shows the error category and type of supervision of a supervision. The object is assigned the status tag of a ProDiag IDB.

To configure a ProDiag overview, proceed as follows:

- 1. Drag the "ProDiag overview" object from "Taskcard > Toolbox > Controls" to the HMI screen.
- 2. In the Inspector window, click "Properties > Properties > General".
- 3. In "Tag", open the selection dialog.
- 4. Select the "State" status tag from the "InstLiftProDiagFB" ProDiag instance data block.
- 5. In "Output > Categories", you can define the names and colors of the supervision categories.
- 6. In "Output > Supervision types", you can define the names and colors of the supervision types.

Figure 2-32: ProDiag overview

	ProDiag overview	
	A i InstLiftProDiagFB Cat.: E W I C4 C5 C6 Type: O I R A P M Image: Category of the second s	 Controls 2 2 4 7 6 8 9 8 8 8 9 8 9 9 10 10
<		V 📀 📼 🗄 🔤 🖫 📟
ProDiag overvie	ew_1 [ProDiag overview] 🔤 Properties 🚺 Info 🗊 🗓 Diagnostics 👘 🗐 🔍	
Properties	Animations Events Texts	
Property list	General	
General		✓ Graphics
Appearance	Process	22 😥
Border	Tag: InstLiftProDiagFB_State	🕶 🔁 Navigate & operate
Layout	PLC tag: InstLiftProDiagFB.State	Button icons [PNG]
Text format		Main Strength Stre
 Output 	Address: SV_FB_State_V2	M Flag graphics [EMF]
Toolbar		State graphics [EMF]

GRAPH overview

The GRAPH overview provides an overview of the current state of a GRAPH sequencer. Assign the first PLC tag of the GRAPH instance data block to the object.

Block version V5.0 or higher allows you to view three-line mode with the additional lines for the previous and next step and the first invalid operand of the criteria analysis.

To configure a GRAPH overview, proceed as follows:

- 1. In the project tree, right-click the "LiftSeq" GRAPH FB and from the context menu, open "Properties...".
- 2. In the "General" tab, the block version must be at least V5.0.
- 3. Drag the "GRAPH overview" object from "Taskcard > Toolbox > Controls" to the HMI screen.
- 4. In the Inspector window, click "Properties > Properties > General".
- 5. In "Tag", open the selection dialog.
- 6. Select the first PLC tag, "OFF_SQ", from the "InstLiftSeq" GRAPH instance data block.

Figure 2-33: GRAPH overview

						> Ele	ements		 _	_	
					✓ Co	ntrols					
GRAPH overview						7	\sim	i? 📠			<mark>⊻∕</mark> x
🛕 InstLiftSeq 📮 📮					=	Ų,	\bigcirc	P			PDF
1 2 Step name	AUTO										
< III		> 100%	·		•						
GRAPH overview_1 [GRAPH overview]	Roperties	🗓 Info 🚺 🗓 Diag	nostics 🗖 🗖 🗏	•						
Properties Ani	mations Events	Texts									
Property list	General										
General Appearance	Process										
Border	Tag: In:	stLiftSeq_OFF_SQ									
Layout	PLC tag: In:	stLiftSeq.OFF_SQ			7						
Text format Output	Address:			Bool							
_

- 7. In "Properties" of the Inspector window, you can change the layout of the object.
- 8. Select the GRAPH overview, go to "Properties", "Layout" and check the following two check boxes:
 - "Show previous and next step" and
 - "Show first invalid operand".

Figure 2-34: GRAPH overview and extension

			GRAPH ove	erview
A Inst	Lift	Seq		무쿠
1	2	AUT		
S nnr	1 +	Predecess	or step name	
S nni	n	Step name	e	J
S nni	n ?	Successor	step name	
		T_B_Piece	Goods_FIXED;%M52.0; -	- b -
_				
<				
GRAPH overview_1 [GRAPH overview]				
Properties Animations Events	Т	exts		
Property pages		Crito -		
Name		Static value	Dynamization	
Layout		Static Value	Gynamization	
Height		190		
Number of steps		2		
Show first invalid operand				
Show initial step icon				
Show operating mode				
Show previous and next step				
Show simultaneous step icon				
Single-line mode				
Width		460		
X position		71		
Y position		591		
 Miscellaneous 				
Output				

- a. The "PLC code view" button takes you to the GRAPH program display. For more information, see the 'PLC code view' section on the next page.
- b. The criteria analysis can also be activated in the GRAPH overview. The last row in the GRAPH overview is the criteria analysis.

PLC code view

The PLC code view is used to display PLC program parts of your LAD, FBD and GRAPH programs. The PLC code view is activated using a button. The PLC code view does not need a connection to a PLC tag.

To configure a PLC code view, proceed as follows:

- 1. Drag the "PLC code view" object from "Taskcard > Toolbox > Controls" to the HMI screen.
- 2. In "Properties" of the Inspector window, you can change the layout of the object.

Figure 2-35: PLC code view



- **Note** You can open the PLC code view using the <u>"PLC code"</u> button or the "PLC code" button of the Graph overview.
- **Note** In the PLC code view, you can also display the program status of F-blocks. It is displayed in the same way as for standard blocks. A yellow header directly indicates that an F-block is being analyzed. F-operands are not marked.

Two-line display of step and transition names

Like TIA Portal, the PLC code view allows you to display the step and transition names in two lines.

- 1. Select the "PLC code view" and in the Inspector window, open the "Properties".
- 2. Select the "Properties" tab and in the area navigation, click "Layout".
- 3. In "GRAPH display", check the "Two-line display" check box.

Figure 2-36: Two-line display of step and transition names

PLC code view_1	[PLC code view]	Properties Info 🔒 🛽 Diagnostics
Properties	Animations Events Texts	
Property list	Layout	
General Appearance Border Lavout Text format	Position & size X: 37 ↓ ↓ ↓ 1173 Y: 217 ↓ ↓ 507	Symbol table lines Number of visible lines: 5
 Toolbar Symbol table Styles/Designs 	Display Show header (path)	GRAPH detail area width (%): 50
Miscellaneous Security	•	GRAPH display Image: Two-line display

- 4. In TIA Portal, open the "Options > Settings" dialog.
- 5. In the area navigation, navigate to "PLC programming > GRAPH".
- 6. In "View", check the "Show two lines" check box.

Alarm view

The alarm view displays the supervision alarms. The alarm view is assigned a control tag for the PLC code view. The control tag enables the "PLC code" button for the PLC code view.

To configure an alarm view, proceed as follows:

- 1. Drag the "Alarm view" object from "Taskcard > Toolbox > Controls" to the HMI screen.
- 2. In the Inspector window, click "Properties > Properties > General".
- 3. Select "Current alarm states".
- 4. Check the "Acknowledgement" and "No Acknowledgement" alarm classes.

Figure 2-37: Alarm view

J						_	Controls	
No.	Time	Date	Status	Text	Acknowledg	e g		20 ===
							71 🕮	1
							U 🕟	D
								_ <u>K</u>
						- 11		
						_		
		1		00%	•	- 1		
<			>		Y			
Alarm view_2	[Alarm view]		<u>s</u> P	roperties 🚺 Info 🔒	Diagnostics			
Properties	Animations	Events	Texts					
Property list	General							
General								
Appearance	Displ	ау						
Border	📀 Cur	rent alarm states		Alarm class	Enable	-		
Layout	I	Pending alarms		Errors				
Display		Unacknowledged	alarms	Warnings				
Text format		-	alarnis.	System				
Toolbar	U	rm buffer		Diagnosis events				
Button border				Acknowledgement				
Button fill p				No Acknowledgement				
Column he	F o i							
Columns	O Ala	rm log						
Table head								

- 5. In the Inspector window, click "Properties > Properties > Display".
- 6. In "Tag" of the "Control tag for PLC code view" section, open the selection dialog.
- 7. Select the internal tag "enablePLCCode".
- 8. In "Properties", you can change the layout of the object.

Figure 2-38: Control tag for ProDiag

Alarm view_1 [Alarr	n view]	🖳 Properties 🔛 Info 😩 🖳 Diagnostics 💷 🖃
Properties Ar	imations Events Texts	
📑 Property list	Display	
General Appearance	Display	Control tag for criteria analysis view
Border	Vertical scrolling: 🗹	Tag:
Layout	Horizontal scrolling	PLC taq:
Display		, actory.
Text format	Grid:	Address:
Toolbar	Focus width: 2	
Button border		Control tag for PLC code view
Button fill pattern	Control tag for display area	Tag: enablePLCCode
Column headers		Tag: enablePLCCode
Columns	Tag:	PLC tag:
Table header border	PLC tag:	Address: Bool
Table header fill	Address:	
Alarm filter		

Note Steps 6 through 8 are not required for WinCC Professional.

"PLC code" button for RT Advanced/Professional

The button activates the PLC code view.

To configure a PLC code view, proceed as follows:

- 1. Drag the "Button" object from "Taskcard > Toolbox > Elements" to the HMI screen.
- 2. In "Properties" of the Inspector window, you can change the layout of the object, for example the label.
- In the Inspector window, select "Properties > Animations" and open the "Display" section.
- 4. Use "Add new animation" to add the "Control enable" animation.
- 5. In "Tag" of the "Process" section, open the selection dialog.
- 6. Select the internal tag "enablePLCCode".

Figure 2-39: Control	enable of the	e "PLC code"	button fo	or RT Advanc	ed
[•] P1200 [TP1200 Comfort]	→ Screens → 00)1_Application >	Topic_001.	1_ProDiagAlarms	_∎≣×
Tahoma 🔳 19 💌	BI <u>U</u> SA1	: 🗄 ± <u>Å</u> ± <u>🖄</u> ±	<u>⊿</u> ± ≡±	—± 📑 ± 🕰 ±	≛± Ш±*
					^
		PLC co	de		
		<u> </u>			=
			> 100%		-8 0
<			> 100%		<u> </u>
Button_2 [Button]		🔍 Properties	🔁 Info (🗓 🗓 Diagnostics	
Properties Animatio	ns Events	Texts			
	Control enable				
Overview					
🕨 💷 Tag connections	Process			Control enable	
🔻 📆 Display	Tag:			Enabled	
💣 Add new animation	enablePLCCode		≣	 Disabled 	
Appearance	🔿 Range	From: 0	-		
Control enable		To: 100	\$		
▶ 2 movements	💿 Single bit	0			

- 7. Use "Add new animation" to add the "Appearance" animation.
- 8. In "Name" of the "Tag" section, open the selection dialog.
- 9. Select the internal tag "enablePLCCode".
- 10. In the "Range" column, enter the ranges "0" and "1".
- 11. Select the "foreground" and "background color" for the ranges "0" and "1".



Figure 2-40: Appearance of the "PLC code" button for RT Advanced

- 12. In the Inspector window, click "Properties > Events".
- 13. Select the "Click" event.
- 14. Insert the appropriate system function.
 - c. RT Advanced:
 "ActivatePLCCodeView" with the following parameters:
 - Screen name: "Topic_001.2_ProDiagPLCCodeView"
 - Screen object: "PLC code view_1"
 - d. RT Professional: "ShowPLCCodeViewFromAlarm" with the following parameters:
 - Alarm screen name: "ProDiag"
 - Alarm view name: "PLC code view_1"
 - Basic screen name: ProDiag
 - Screen Window Name: Bildfenster_1
 - Screen name of the PLC code view: "ProDiag_001_Graph"
 - Name of the PLC code view: "PLC code view_1"

Criteria analysis view

This function displays the invalid operands of the user program that have triggered a selected ProDiag or GRAPH alarm.

The following prerequisites must be met for the Criteria analysis view:

- The operator panel is connected to the controller.
- The ProDiag FBs were created with V2.0.
- The GRAPH FBs were created with V4.0.
- Initial value acquisition is activated for function blocks and an alarm view has been configured.

In Runtime, you can see incoming alarms and invalid operands at a glance, provided that you configure the 'Criteria analysis view' and the connected 'Alarm view' in the same screen.

- 1. In "HMI tags", insert a new internal tag (e.g., "criteriaAnalysisViewer") with the "WString" data type. The string must be at least 50 characters long.
- 2. Drag the "Criteria analysis view" object from "Taskcard > Toolbox > Controls" to the "Alarms" HMI screen.

Figure 2-41: Inserting object for Criteria analysis view



- 3. In the "Alarms" HMI screen, select the "Criteria analysis view" object and in the Inspector window, click "Properties > General".
- 4. In "Tag", select the "criteriaAnalysisViewer" control tag.

Figure 2-42: Configuring control tag for Criteria analysis view

Symbol nan	ie	Value	Comment	
			<	• >
eria Analysis [C	riteria analysis v	view]		
operties A	nimations I	Events	Texts	
Property list	General			
eneral	Process			
pearance		Tax. India	eria Analysis Viewer	
opearance order		Tag: crit	enazinalysisviewer	I
opearance order yout	PL	.C tag:	enannarysis viewer	
opearance order yout ext format			enazinarysis viewer	
opearance order yout ext format mbol table		.C tag:	enannaiysis viewer	
opearance order yout ext format rmbol table yles/Designs		.C tag:	ena Antalysis viewer	
oppearance order yout ext format rmbol table yles/Designs iscellaneous	Ada Focus	.C tag:		

 To connect to the alarm, you must also configure the control tag on the "Alarm view" object.
 Select the "Alarm view" object and in the Inspector window, click "Properties >

Select the "Alarm view" object and in the Inspector window, click "Properties > Display".

- 6. In the "Control tag for criteria analysis view" window, click the selection button in "Tag".
- 7. Select the "criteriaAnalysisViewer" control tag.

Figure 2-43: Configuring control tag for alarm view

Alarm view_2 [Alar	arm view_2 [Alarm view]							Diagnostics	
Properties A	nimations	Events	Texts						
Property list	Display								
General	Display					Control tog f	or critoria	analysis view	
Appearance	Display					control tag i	or citteria	analysis view	
Border		Ver	tical scrolling	g: 🗹		Tag:	criteriaAna	alysisViewer	
Layout	Horizontal scrolling				PLC tag:				
Display		Honz		- <u>-</u>					
Text format			Grid	d: 📃		Address:		V	VString[60]
Toolbar			Focus width	n: 2 🗘					
Button border						Control tag f	or PLC cod	le view	
Button fill pattern	Control	tag for dis	play area			Tage	enablePLC	Code	
Column headers		_							
Columns	4	Tag:				PLC tag:			C
Table header bor	PL	.C tag:			P	Address:		B	ool
Table header fil	Ad	dress:							

2.2.19 Downloading the project

Now the configuration must be compiled and downloaded to the PLC or HMI.

Downloading to the PLC

To download the configuration to the PLC, proceed as follows:

- 1. In the project tree, select the "PLC_1" folder of the controller.
- 2. In the toolbar, click the "Download to device" button.

Figure 2-44: Download to PLC

Project Edit View Insert Online Options Tools Window
Project tree 🔲 🖣
Devices
I09740151_ProDiag_Example
Add new device A Devices & networks
ភ 📩 Devices & networks
Image: PLC_1 [CPU 1516F-3 PN/DP]
HMI_1 [TP1200 Comfort]
Ingrouped devices
Security settings
Common data
Documentation settings
Languages & resources
Image:
Card Reader/USB memory

Downloading to the HMI

To download the configuration to the HMI, proceed as follows:

- 1. In the project tree, select the "TP1200" folder of the operator panel.
- 2. In the toolbar, click the "Download to device" button.

Figure 2-45: Download to HMI

Project Edit View Insert Online Options T 📑 🎦 🗔 Save project 📑 🐰 🗐 🗊 🗙 🏷 🛨 🕻	
Project tree	
Devices	
Ēř	
109740151_ProDiag_Example	
te Add new device	
📅 📥 Devices & networks	
PLC_1 [CPU 1516F-3 PN/DP]	
▶ ☐ HMI_1 [TP1200 Comfort]	
Ungrouped devices	

2.3 Control and diagnostics with WinCC Runtime Advanced

You control the virtual conveyor system directly on the operator panel. A programmer for diagnostics is not required. The following three figures show the user interface of the operator panel.

2.3.1 Overview

The "Plant Overview" screen shows the conveyor belt with the two lifts and the buttons for controlling the plant and simulating errors. The ProDiag overview displays the current state of the configured supervisions and the GRAPH overview shows the current state of the GRAPH sequencer.



Figure 2-46: User interface overview

The "Alarms" screen shows the alarm view with the supervision alarms and the "PLC code" button takes you to the PLC code view.



arms		
	6/19/2018 11:30 AM	_
Time	Text	
10:50:08 AM	Error ; GRAPH-Supervision ; ; PLC1 ; LiftSeq ; Lift 1 up ; S5	
10:50:05 AM	Error : GRAPH-Interlock : : PLC1 : LiftSeq : Lift 1 up : S5	
10:50:05 AM	Error : Interlock : Door at lift not closed or lift blocked. : PLC1 : LiftProDiagFB : 7 : instLift1Cmd : interLockAuto	
	< • • > PLC code	

The HMI diagnostics, PLC overview, GRAPH overview and PLC code view objects allow you to diagnose supervision alarms.

Figure 2-48: "HMI PLC code view"



2.3.2 Controlling the conveyor system

Use the "Control" section to control the conveyor system. The buttons have the following functions.

- "Start" starts the conveyor system.
- "Stop" stops the conveyor system. The conveyor system does not stop immediately. It is not stopped until the lifts reach the lower position. In the meantime, the button flashes.
- "Ack" acknowledges errors.
- "Resc" allows you to manually delete the last recorded initial values.

2.3.3 Simulation and diagnostics of ProDiag supervisions

Simulation and diagnostics of a global operand supervision

You can trigger operand supervisions when the conveyor system is stopped or running. Proceed as follows:

- 1. Go to the "Plant Overview" screen.
- Click the "Operand" button to trigger the operand supervision of the compressed air and power supply. The button color changes to red and the two red symbols in the ProDiag overview, "E" and "O", indicate an error of the "Operand" type.

Figure 2-49: ProDiag overview

🚹 i InstLiftProDiagFB									
Cat.:	Е	W	Ι	C4	C5	C6			
Туре:	0	Ι	R	Α	Р	М			

 In the ProDiag overview, click the "Alarm view" button. The "Alarms" screen opens. The alarm view displays the supervision alarms of the operand errors.

Figure 2-50: Alarm view

 Time
 Text

 9:24:44 PM
 Error : Operand : Voltage power supply not OK : PLC_1 : LiftProDiagFB : 14 : SeqData.powerVoltage

 9:24:42 PM
 Error : Operand : Compressed air not OK : PLC_1 : LiftProDiagFB : 13 : SeqData.compressedAir

4. Select an alarm.

The "PLC code" button remains gray. A PLC code cannot be displayed for this operand error.

5. Click the "Operand" button again to disable the operand supervision.

Simulation and diagnostics of a global position supervision

To simulate a position supervision, the conveyor system must be stopped. The position is supervised where the case is on the belt.

To simulate and diagnose the position supervision, proceed as follows:

- 1. Go to the "Plant Overview" screen.
- 2. If the conveyor system is running, click the "Stop" button and wait until the conveyor system has stopped.
- 3. To trigger a position supervision, click the "Position" button.
 - The button color changes to red.
 - The sensor display behind the case changes its color from green to red.
 - The orange symbol, "W", and the red symbol, "P", in the ProDiag overview indicate a warning of the "Position" type.

Figure 2-51: ProDiag overview

🛕 i 🛛	Inst	:Lift	Prol	Diag	FB		
Cat.:	Е	W	Ι	C4	C5	C6	
Type:	0	Ι	R	Α	P	м	

 In the ProDiag overview, click the "Alarm view" button. The "Alarms" screen opens. The alarm view displays the supervision alarms of the position error.

Figure 2-52: Alarm view



- The "PLC code" button remains gray. A PLC code cannot be displayed for this position error.
- 6. Click the "Position" button again to disable the position supervision.
- 7. Restart the conveyor system.

Simulation and diagnostics of local interlock supervisions

To simulate the interlock supervisions, the conveyor system must be running. The supervision is not activated until a lift is started upwards or downwards. To simulate and diagnose an interlock supervision, proceed as follows:

- 1. Go to the "Plant Overview" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. To trigger an interlock supervision on the lifts, click the "Interlock" button.
 - The button color changes to red.
 - The door on the lift opens and the lift stops.
 - The two red symbols in the ProDiag overview, "E" and "I", indicate an error of the "Interlock" type.

Figure 2-53: ProDiag overview

🚹 i InstLiftProDiagFB											
Cat.:		w	Ι	C4	C5	C6					
Type:	0	I	R	Α	Р	М					

4. In the ProDiag overview, click the "Alarm view" button. The "Alarms" screen opens. The alarm view displays the supervision alarm of the interlock error.

Figure 2-54: Alarm view



5. Select this alarm.

The "PLC code" button turns light blue. This means that the associated PLC code can be displayed for this interlock error.

6. Click the "PLC code" button.

The "PLC code view" screen opens. The PLC code view displays the program part at the supervised "interLockAuto" input parameter of the "LiftCmd" function block.

The link indicates that the "SeqData".doorClosed signal (lift door closed) is not "TRUE".

Figure 2-55: PLC code view



7. Click the "Interlock" button again to disable the interlock supervision.

Simulation and diagnostics of local action supervisions

To simulate the action supervisions, the conveyor system must be running and both lifts must not yet be controlled. The supervision is not activated until a lift is controlled upwards or downwards by the program.

To simulate and diagnose the action supervision, proceed as follows:

- 1. Go to the "Plant Overview" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until both lifts have stopped and a case is provided for lift 2.
- 4. Click the "Action / Reaction" button to trigger an action supervision on a lift.
 - The button color changes to red.
 - If a lift is now controlled by the program, it will stop.
 - An action error will be triggered when a delay time has expired.
 - The two red symbols in the ProDiag overview, "E" and "A", indicate an error of the "Action" type.

Figure 2-56: ProDiag overview

🚹 i InstLiftProDiagFB												
Cat.:		w	Ι	C4	C5	C6						
Type:	0	Ι	R	A	Р	м						

5. In the ProDiag overview, click the "Alarm view" button. The "Alarms" screen opens. The alarm view displays the supervision alarm of the action error.

Figure 2-57: Alarm view

 Time
 Text

 11:14:56 PM
 Error : Action : Lift has not left lower start position : PLC_1 : LiftProDiagFB : 33 : instLift2Cmd : sensorLiftDown

6. Select this alarm.

The "PLC code" button turns light blue. This means that the associated PLC code can be displayed for this action error.

- 7. Click the "PLC code" button.
 - The "HMI PLC code view" screen opens.
 - The PLC code view displays the program part at the supervised "sensorLiftDown" input parameter of the "LiftCmd" function block.
 - The link indicates that the state of the "SeqData".sensorLift2Down signal remains "TRUE", i.e. that the unit has not left the lower end position.

Figure 2-58: PLC code view

```
PLC_1 | MainFB [FB10] | Network 4
```



8. Click the "Action / Reaction" button again to disable the action supervision.

Note In this application example, an action error, once a delay time has expired, always results in a reaction error.

Simulation and diagnostics of local reaction supervisions

To simulate the reaction supervisions, the conveyor system must be running. The supervision is not activated until a lift is controlled upwards or downwards by the program. If you activate the simulation before a lift is controlled, an action error will be triggered first, later followed by a reaction error. If you activate the simulation during the movement, only a reaction error will be triggered.

To simulate and diagnose the reaction supervision, proceed as follows:

- 1. Go to the "Plant Overview" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until a case is lifted by lift 2.
- 4. Click the "Action / Reaction" button to trigger a reaction supervision on the lifts.
 - The button color changes to red.
 - If a lift is now controlled, it will stop.
 - A lift that has already been controlled will be stopped.
 - A reaction error will not be triggered until a delay time has expired.
 - The two red symbols in the ProDiag overview, "E" and "R", indicate an error of the "Reaction" type.

Figure 2-59: ProDiag overview

🚹 i InstLiftProDiagFB											
Cat.:		w	Ι	C4	C5	C6					
Type:	0	Ι	R	Α	Р	М					

 In the ProDiag overview, click the "Alarm view" button. The "Alarms" screen opens. The alarm view displays the supervision alarm of the reaction error.

Figure 2-60: Alarm view

 Time
 Text

 11:15:01 PM
 Error : Reaction : Lift has not reached upper end position : PLC_1 : LiftProDiagFB : 32 : instLift2Cmd : sensorLiftUp

6. Select this alarm.

The "PLC code" button turns light blue. This means that the associated PLC code can be displayed for this reaction error.

7. Click the "PLC code" button.

The "HMI PLC code view" screen opens. The PLC code view displays the program part at the supervised "sensorLiftUp" input parameter of the "LiftCmd" function block.

The link indicates that the state of the "SeqData".sensorLift2Up signal remains "FALSE", i.e. that the unit has not reached the upper end position.

Figure 2-61: PLC code view

PLC_1 | MainFB [FB10] | Network 4

FALSE ""SeqData". sensorLift2Up"------ sensorLiftUp

8. Click the "Action / Reaction" button again to disable the reaction supervision.

Simulation of the Error message supervision type with the text from the specific text field

- 1. In the project tree, navigate to "PLC1 > Watch and force tables" and open the "WatchTableFreq" watch table.
- 2. Click the glasses icon to change the watch table to the Online view.
- 3. In "Modify value", enter a value greater than 10.0, e.g. 11.0.
- 4. In the toolbar, click the "Modify now" function. This action simulates 'exceed upper limit'.

Figure 2-62: Watch table



5. Go to WinCC Runtime Advanced. In the ProDiag overview, the two symbols "E" and "M" are displayed in red.

Figure 2-63: ProDiag overview

🚹 i InstLiftProDiagFB											
Cat.:		W	Ι	C4	C5	C6					
Type:	0	Ι	R	Α	Ρ	М					

6. In the ProDiag overview, click the "Alarm view" button. The "Alarms" screen opens. The error message is displayed as shown in the below figure.

Figure 2-64: "Frequency value greater than" error message

 Time
 Text

 5:12:26 AM
 Error : Error message : LiftProDiagFB : 27 : SeqData.freqError : Error message 08002: Frequency value greater than 10

- 7. Return to the watch table and in "Modify value", enter a value less than 5.0, e.g. 4.0.
- 8. In the toolbar, click the "Modify now" function. This action simulates 'fall below lower limit'.
- 9. Go to the "Alarms" screen. The error message is displayed as shown in the below figure.

Figure 2-65: "Frequency value less than" error message



10. To stop the simulation, change the "SeqData".frequency DB tag in the watch table back to the value 10.0.

2.3.4 Simulation and diagnostics of GRAPH supervisions

Simulation and diagnostics of a supervision (step supervision)

Technologically, the GRAPH supervision can be compared to a reaction supervision.

To simulate a supervision of the "LiftSeq" GRAPH sequencer, the conveyor system must be running. The supervision is only configured in those steps where a lift is controlled upwards or downwards. The respective end position of the movement is configured as a transition (step enabling condition for the next step). The specified step duration of a step is supervised in the supervision. If the movement within a step takes too long, the supervision will be activated and an alarm will be output. The supervision is triggered by simulating an interlock error or an action/reaction error.

To simulate and diagnose the supervision, proceed as follows:

- 1. Go to the "Plant Overview" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until a case is lifted on lift 2.
- 4. Click the "Interlock" or "Action / Reaction" button to trigger a supervision in a step.
 - The color of the respective button changes to red.
 - If a lift is now controlled, it will stop.
 - A lift that has already been controlled will be stopped.
 - When the specified step duration has expired, an alarm will be output.
 - The red step number in the GRAPH overview indicates an error in the GRAPH sequencer.

Figure 2-66: GRAPH overview

🚹 InstLi	iftSeq	무쿠						
9	AUTO							
S 007	Deactivate Stop 2							
S 009	Lift 2 moves up							
S 010	Lift 2 moves down							
	"SeqData".sensorLi	"SeqData".sensorLift2Up; 0; Sensor lift2 up						

5. In the GRAPH overview, click the "Alarm view" button. The "Alarms" screen opens. The alarm view displays the error alarm of the supervision.

Figure 2-67: Alarm view



- 6. Click the right arrow at the bottom edge of the screen. The "HMI PLC code view" screen opens.
- 7. Click the "PLC code" button of the GRAPH overview. The PLC code view shows a part of the "LiftSeq" GRAPH sequencer. The interrupted step is displayed in red. The below transition network shows that the state of the "SeqData".sensorLift2Up signal remains "FALSE", i.e. that the unit has not reached the upper end position.





8. Click the "Interlock" or "Action / Reaction" button again to disable the supervision.

The error that the GRAPH sequencer displays is automatically acknowledged in the program.

Simulation and diagnostics of an interlock with initial value acquisition (criteria analysis)

To simulate an interlock of the "LiftSeq" GRAPH sequencer, the conveyor system must be running. The interlock is only configured in those steps where a lift is controlled upwards or downwards. The "SeqData".doorClosed signal (lift door closed) ANDed with the "SeqData".liftFree signal (lift not blocked) is programmed as a condition for the interlock. The action in the step will be executed only if the interlock condition is met. If the interlock condition is not met, an alarm will be output. The interlock is triggered by simulating an interlock error. You can additionally display the initial values and directly view the invalid operands (criteria analysis). You can also toggle between the Actual values view and the Initial values view.

To simulate and diagnose an interlock, proceed as follows:

- 1. Go to the "Plant Overview" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until a case is lifted by lift 1.
- 4. Click the "Interlock" button to trigger an interlock in a step.
 - The color of the respective button changes to red.
 - In a step with a configured interlock, the lift is no longer controlled and stops.
 - An interlock alarm is output.
 - The red step number in the GRAPH overview indicates an error in the GRAPH sequencer.

Figure 2-69: GRAPH overview

🔒 InstLi	ftSeq 🖵 📮
5	AUTO
S 004	Activate Stop 2
S 005	Lift 1 moves up
S 006	Lift 1 moves down
	"SeqData".doorClosed; 0; Safety door clos

- 5. Click the "Lift blocked" button to simulate the initial value analysis.
- 6. In the GRAPH overview, click the "Alarm view" button. The "Alarms" screen opens.
- 7. Select the following alarm: "Error: Interlock: Door at lift not closed or lift blocked."
 - The alarm view displays the interlock alarm indicating that the door is not closed or blocked.
 - The Criteria analysis view displays the "SeqData.doorClosed" tag with the value 0. The safety door is not closed.

Figure 2-70: Alarm and Criteria analysis view

larms		7/2/2018 12:03 PM	
Time	Text		
11:52:20 AM	Error : GRAPH-Supervision : PLC1 : LiftSeq : Lift2 up : S9		
11:52:17 AM	Error: GRAPH-Interlock: : PLC1: LiftSeq: Lift2 up: S9		
11:52:17 AM	Error : Interlock : Door at lift not closed or lift blocked. : PLC1 : LiftProDiagFB : 15 : instLift2Cmd : interLockAuto		
Criteria analy	is		
Symbol name	Value Comment		
"SeqData".d	oorClosed 0 Safety door closed		
	< · · · >	PLC code	

- 8. Click the "PLC code" button and the "HMI PLC code view" screen opens. The PLC code view shows a part of the "LiftSeq" GRAPH sequencer. The step with the interlock alarm is displayed in red.
- 9. Click the "Transition/Interlock" button to go to the interlock network.

The "Initial values view" of the interlock network shows that the "SeqData".doorClosed condition is not met, i.e. that the lift door is not closed. The first error is displayed in red.



Figure 2-71: PLC code Initial values view

10. Click the "Actual values/Initial values" button to go to the Actual values view.

The "Actual values view" of the interlock network shows that the two conditions "SeqData".doorClosed and "SeqData".liftFree are not met, i.e. that the lift door is not closed and the lift is not free.

11. Clicking the "Lift blocked" button and the "Interlock" button again disables the interlock.

The error in the GRAPH sequencer is automatically acknowledged in the program.

2.4 Control and diagnostics with WinCC Runtime Professional

The application example was extended for WinCC Runtime Professional. The extension of this application example was implemented with the configuration from Chapter <u>Configuration 2.2</u>.

Note For ProDiag with WinCC Runtime Professional, the GRAPH block must have been configured in V5.

2.4.1 Overview

The figure shows the Runtime user interface.





The "ProDiag" screen shows the conveyor belt with the two lifts and the buttons for controlling the plant and simulating errors. In addition, the screen shows

- the current state of the configured supervisions and the GRAPH overview with the current state of the GRAPH sequencer.
- the alarm view with the supervision alarms and the "PLC code" button with which the PLC code view is activated.
- the following HMI diagnostic objects: ProDiag overview, GRAPH overview and Criteria analysis view. The objects allow you to diagnose the supervision alarms.

2.4.2 Controlling the conveyor system

Use the "Control" section to control the conveyor system. The buttons have the following functions.

- "Start" starts the conveyor system.
- "Stop" stops the conveyor system. The conveyor system does not stop immediately. It is not stopped until the lifts reach the lower position. In the meantime, the button flashes.
- "Resc" allows you to manually delete the last recorded initial values.

2.4.3 Simulation and diagnostics of ProDiag supervisions

Simulation and diagnostics of a global operand supervision

You can trigger operand supervisions when the conveyor system is stopped or running.

To simulate and diagnose the operand supervision, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. Click the "Operand" button to trigger the operand supervision of the compressed air and power supply.
 - The color of the "Operand" button changes to red.

The two red symbols in the ProDiag overview, "E" and "O", indicate an error of the "Operand" type.

Figure 2-73: ProDiag overview

i InstLiftProDiagFB										
Cat.:	Е	W	Ι							
Ту	0	Ι	R	Α	Ρ	Μ				

3. In the ProDiag overview, click the "Alarm view" button. The alarm view displays the supervision alarms of the operand errors and the 'exceed upper limit' simulation.

Figure 2-74: Alarm view

) 🍦 🖀 👱		
	Date	Time	Alarm text
1	06/08/18	10:04:31	Error : Operand : LiftProDiagFB : 2 : : SeqData.powerVoltage : Power voltage OK
2	06/08/18	10:04:29	Error : Operand : LiftProDiagFB : 1 : : SeqData.compressedAir : Compressed air OK

4. Click the "Operand" button again to disable the operand supervision.

Simulation and diagnostics of a global position supervision

To simulate a position supervision, the conveyor system must be stopped. The position is supervised where the case is on the belt.

To simulate and diagnose the position supervision, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. If the conveyor system is running, click the "Stop" button and wait until the conveyor system has stopped.
- 3. To trigger a position supervision, click the "Position" button.
 - The button color changes to red.
 - The sensor display behind the case changes its color from green to red.
 - The orange symbol, "W", and the red symbol, "P", in the ProDiag overview indicate a warning of the "Position" type.

Figure 2-75: ProDiag overview

🛕 i		I	nstL	iftPr	oDia	зgFB	
Cat.:	Ε	W	Ι				
Type:	0	Ι	R	Α	Р	М	

4. In the ProDiag overview, click the "Alarm view" button. The alarm view displays the supervision alarms of the position error.

Figure 2-76: Alarm view

	Date	Time	Alarm text
1	06/08/18	10:26:24	Warning : Position : LiftProDiagFB : 4 : : SegData.sensorStop1 : Sensor at stopper1

5. Click the "Position" button again to disable the position supervision.

Simulation and diagnostics of local interlock supervisions

To simulate the interlock supervisions, the conveyor system must be running. The supervision is not activated until a lift is started upwards or downwards.

To simulate and diagnose an interlock supervision, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. If the conveyor system is not running, click the "Start" button.

 To trigger an interlock supervision on the lifts, click the "Interlock" button. The button color changes to red. The door on the lift opens and the lift stops.

The two red symbols in the ProDiag overview, "E" and "I", indicate an error of the "Interlock" type.

Figure 2-77: ProDiag overview

A	🛕 i InstLiftProDiagFB										
Cat.:	Е	W	Ι								
Ту	0	Ι	R	Α	Ρ	Μ					

4. In the ProDiag overview, click the "Alarm view" button. The alarm view displays the supervision alarm of the interlock error and the 'fall below lower limit' simulation.



2								
	Date	Time	Alarm text					
1	06/08/18	10:46:44	Error : GRAPH-Supervision : PLC_1 : LiftSeq : Lift 1 moves up : S005 :					
2	06/08/18	10:46:40	Error : Interlock : LiftProDiagFB : 15 : instLift1Cmd : interLockAuto : Door at lift not closed					
3	06/08/18	10:46:39	Error : GRAPH-Interlock : PLC_1 : LiftSeq : Lift 1 moves up : S005 :					

- 5. Disable "auto scroll" and select the Interlock alarm.
- 6. Click the "PLC code" button. The PLC code view displays the block error.

Figure 2-79: PLC code view



7. Click the "Interlock" button again to disable the interlock supervision.

Simulation and diagnostics of local action supervisions

To simulate the action supervisions, the conveyor system must be running and both lifts must not yet be controlled. The supervision is not activated until a lift is controlled upwards or downwards by the program.

To simulate and diagnose the action supervision, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until both lifts have stopped and a case is provided for lift 2.
- 4. Click the "Action / Reaction" button to trigger an action supervision on a lift.
 - The button color changes to red.
 - If a lift is now controlled by the program, it will stop.
 - An action error will be triggered when a delay time has expired.
 - The two red symbols in the ProDiag overview, "E" and "A", indicate an error of the "Action" type.

Figure 2-80: ProDiag overview

🛕 i		I	nstL	iftPr	oDia	agFB	
Cat.:	Е	W	Ι				
Type:	0	Ι	R	А	Ρ	М	

5. In the ProDiag overview, click the "Alarm view" button. The alarm view displays the supervision alarm of the action error.

Figure 2-81: Alarm view

1									
	Date	Time	Alarm text						
1	06/08/18	10:56:52	Error : Reaction : LiftProDiagFB : 12 : instLift2Cmd : sensorLiftUp : Lift has not reached upper end position						
2	06/08/18	10:56:51	Error : GRAPH-Supervision : PLC_1 : LiftSeq : Lift 2 moves up : S009 :						
3	06/08/18	10.56.47	Error · Action · LiftProDiagEB · 13 · instLift2Cmd · sensorLiftDown · Lift has not left lower start position						

Click the "PLC code" button.

The PLC code view displays the program part at the supervised "sensorLiftDown" input parameter of the "LiftCmd" function block. The link indicates that the state of the "SeqData".sensorLift2Down signal remains "TRUE", i.e. that the unit has not left the lower end position.

Figure 2-82: PLC code view





6. Click the "Action / Reaction" button again to disable the action supervision.

Note In this application example, an action error, once a delay time has expired, always results in a reaction error.

Simulation and diagnostics of local reaction supervisions

To simulate the reaction supervisions, the conveyor system must be running. The supervision is not activated until a lift is controlled upwards or downwards by the program. If you activate the simulation before a lift is controlled, an action error will be triggered first, later followed by a reaction error. If you activate the simulation during the movement, only a reaction error will be triggered.

To simulate and diagnose the reaction supervision, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until a case is lifted by lift 2.
- 4. Click the "Action / Reaction" button to trigger a reaction supervision on the lifts.
 - The button color changes to red.
 - If a lift is now controlled, it will stop. A lift that has already been controlled will be stopped.
 - A reaction error will not be triggered until a delay time has expired.
 - The two red symbols in the ProDiag overview, "E" and "R", indicate an error of the "Reaction" type.

Figure 2-83: ProDiag overview

🛕 i		I	nstL	iftPr	oDia	igFB	
Cat.:	Е	W	Ι				
Type:	0	Ι	R	Α	Ρ	М	

5. In the ProDiag overview, click the "Alarm view" button. The alarm view displays the supervision alarm of the reaction error.

Figure 2-84: Alarm view



- 6. Disable "auto scroll" and select the alarm.
- 7. Click the "PLC code" button.
 - The PLC code view displays the program part at the supervised "sensorLiftUp" input parameter of the "LiftCmd" function block.
 - The link indicates that the state of the "SeqData".sensorLift2Up signal remains "FALSE", i.e. that the unit has not reached the upper end position.

Figure 2-85: PLC code view

```
PLC_1 | MainFB [FB10] | Network 4
```

FALSE ""SeqData". sensorLift2Up"------sensorLiftUp

8. Click the "Action / Reaction" button again to disable the reaction supervision.

2.4.4 Simulation and diagnostics of GRAPH supervisions

Simulation and diagnostics of a supervision (step supervision)

Technologically, the GRAPH supervision can be compared to a reaction supervision.

To simulate a supervision of the "LiftSeq" GRAPH sequencer, the conveyor system must be running. The supervision is only configured in those steps where a lift is controlled upwards or downwards. The respective end position of the movement is configured as a transition (step enabling condition for the next step). The specified step duration of a step is supervised in the supervision. If the movement within a step takes too long, the supervision will be activated and an alarm will be output. The supervision is triggered by simulating an interlock error or an action/reaction error.

To simulate and diagnose the supervision, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until a case is lifted by lift 2.
- 4. Click the "Interlock" or "Action / Reaction" button to trigger a supervision in a step.
 - The color of the respective button changes to red.
 - If a lift is now controlled, it will stop.
 - A lift that has already been controlled will be stopped.
 - When the specified step duration has expired, an alarm will be output.
 - The red step number in the GRAPH overview indicates an error in the GRAPH sequencer.

Figure 2-86: GRAPH overview

👖 InstLiftSeq 🛛 🖵 🕂							
9	AUTO						
S 007	Deactivate Stop 2						
S 009	"Lift 2 moves up"						
S 010	"Lift 2 moves down"						
	"SeqData".doorClosed; ; 0; Safety do						

5. In the GRAPH overview, click the "Alarm view" button. The alarm view displays the error alarm of the supervision.

Figure 2-87: Alarm view

	Date	Time	Alarm text					
1	06/08/18	11:30:56	Error : GRAPH-Supervision : PLC_1 : LiftSeq : Lift 2 moves up : S009 :					
2	06/08/18	11:30:52	Error : Interlock : LiftProDiagFB : 7 : instLift2Cmd : interLockAuto : Door at lift not closed					
3	06/08/18	11:30:52	Error : GRAPH-Interlock : PLC_1 : LiftSeq : Lift 2 moves up : S009 :					

6. Select the following alarm: "Error: GRAPH-Supervision: PLC_1: LiftSeq: Lift 2 moves up: S009".

- 7. Click the "PLC code" button of the GRAPH overview.
 - The PLC code view shows a part of the "LiftSeq" GRAPH sequencer. The interrupted step is displayed in red. The below transition network shows that the state of the "SeqData".sensorLift2Up signal remains "FALSE", i.e. that the unit has not reached the upper end position.



Figure 2-88: PLC code view

8. This information is also displayed in the Criteria analysis view. Figure 2-89: Criteria analysis view

\$	Symbol name	Value	Comment
'	SeqData".sensorLift2Up	0	Sensor lift2 up
	(III		F

9. Click the "Interlock" or "Action / Reaction" button again to disable the supervision.

The error that the GRAPH sequencer displays is automatically acknowledged in the program.

Simulation and diagnostics of an interlock with initial value acquisition (criteria analysis)

To simulate an interlock of the "LiftSeq" GRAPH sequencer, the conveyor system must be running. The interlock is only configured in those steps where a lift is controlled upwards or downwards. The "SeqData".doorClosed signal (lift door closed) ANDed with the "SeqData".liftFree signal (lift not blocked) is programmed as a condition for the interlock. The action in the step will be executed only if the interlock condition is met. If the interlock condition is not met, an alarm will be output. The interlock is triggered by simulating an interlock error. You can additionally display the initial values and directly view the invalid operands (criteria analysis). You can toggle between the Actual values view and the Initial values view.

To simulate and diagnose an interlock, proceed as follows:

- 1. Open the "ProDiag" screen.
- 2. If the conveyor system is not running, click the "Start" button.
- 3. Wait until a case is lifted by lift 1.
- 4. Click the "Interlock" button to trigger an interlock in a step.
- 5. Click the "Lift blocked" button.
 - The color of the respective button changes to red.
 - In a step with a configured interlock, the lift is no longer controlled and stops.
 - An interlock alarm is output.
 - The red step number in the GRAPH overview indicates an error in the GRAPH sequencer.

Figure 2-90: GRAPH overview

📕 Inst	LiftSeq 🖵 🖵
9	AUTO
S 007	Deactivate Stop 2
S 009	"Lift 2 moves up"
S 010	"Lift 2 moves down"
	"SeqData".doorClosed; ; 0; Safety do

6. In the GRAPH overview, click the "Alarm view" button. The alarm view displays the interlock alarm.

Figure 2-91: Alarm view

C									
	Date	Time	Alarm text						
1	06/08/18	12:05:49	Error : GRAPH-Supervision : PLC_1 : LiftSeq : Lift 2 moves up : S009 :						
2	06/08/18	12:05:45	Error : Interlock : LiftProDiagFB : 7 : instLift2Cmd : interLockAuto : Door at lift not closed						
3	06/08/18	12:05:44	Error : GRAPH-Interlock : PLC_1 : LiftSeq : Lift 2 moves up : S009 :						

Select the following alarm: "Error: GRAPH-Supervision: PLC_1: LiftSeq: Lift 2 moves up: S009".

 Click the "PLC code view" button of the GRAPH overview or the "PLC code" button. The PLC code view shows a part of the "LiftSeq" GRAPH sequencer. The step with the interlock alarm is displayed in red.

The "Initial values view" of the interlock network shows that the "SeqData".doorClosed condition is not met, i.e. that the lift door is not closed. The first error is displayed in red.



Figure 2-92: PLC code Initial values view

- 8. Clicking the "Actual values/Initial values" button allows you to go to the Actual values view.
- 9. The "Actual values view" of the interlock network shows that the two conditions "SeqData".doorClosed and "SeqData".liftFree are not met, i.e. that the lift door is not closed and the lift is not free.



Figure 2-93 PLC code Actual values view

10. The "Lift blocked" button and the "Interlock" button disable the interlock. The error in the GRAPH sequencer is automatically acknowledged in the program.

Simulation of the Error message supervision type with the text from the specific text field

- 1. In the project tree, navigate to "PLC1 > Watch and force tables" and open the "WatchTableFreq" watch table.
- 2. Click the glasses icon to change the watch table to the Online view.
- 3. In "Modify value", enter a value greater than 10.0, e.g. 11.0.
- 4. In the toolbar, click the "Modify now" function. This action simulates 'exceed upper limit'.

Figure 2-94: Watch table



5. Go to WinCC Professional. In the ProDiag overview, the two symbols "E" and "M" are displayed in red.



A	i	In	stL	iftP	roD	iag	FB
Cat.:	Е	W	Ι				
Ту	0	Ι	R	Α	Ρ	Μ	2

6. In the ProDiag overview, click the "Alarm view" button. The error message is displayed as shown in the below figure.

Figure 2-96: "Frequency value greater than" error message



- 7. Return to the watch table and in "Modify value", enter a value less than 5.0, e.g. 4.0.
- 8. In the toolbar, click the "Modify now" function. This action simulates 'fall below lower limit'.
- 9. Return to WinCC Professional. The error message is displayed as shown in the below figure.

Figure 2-97: "Frequency value less than" error message



10. To stop the simulation, change the "SeqData".frequency DB tag in the watch table to the value 10.0.

3 Appendix

3.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos - all information is accessible with just a few mouse clicks: support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical gueries with numerous tailor-made offers - ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

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We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

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- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:

support.industry.siemens.com/cs/ww/en/sc/2067

3.2 Links and literature

Table 3-1

No.	Торіс
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/109740151
\3\	STEP 7 and WinCC Engineering V15 system manual: https://support.industry.siemens.com/cs/ww/en/view/109755202

3.3 Change documentation

Table 3-2

Version	Date	Modifications			
V1.0	10/2016	First version			
V2.0	12/2016	WinCC Runtime Professional added			
V3.0	09/2017	Initial value acquisition (criteria analysis) added			
V4.0	07/2018	Updated and new functions added with TIA Portal V15			
V4.1	03/2019	Text changed in chapter 2.2.7			